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URANIUM AND ITS COMPOUNDS

A BIBLIOGRAPHY OF UNCLASSIFIED LITERATURE

AUTHOR:

Fred E. Croxton

K-25 PLANT
CARBIDE AND CARBON CHEMICALS COMPANY
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Oak Ridge, Tennessee

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ABSTRACT

References included in this bibliography cover the period 1789 to 1950 and were obtained from many sources. Several hundred of the 3970 references were obtained from the separates published by the U. S. Atomic Energy Commission. Author, subject, and numerical indexes are supplied as is a list of over 500 abbreviations used for the periodicals to which references are made.

Martin Heinrich Klaproth
1743-1817
Discoverer of Uranium

Photograph courtesy of the Edgar Fahs Smith Memorial
Collection on the History of Chemistry, University of Pennsylvania

INTRODUCTION

This bibliography has been prepared to furnish an inclusive listing of the world's literature on uranium.

From the discovery of the element in 1789 by M. H. Klaproth until the discovery of fission in 1937 by Hahn and Strassmann, uranium was little more than a laboratory curiosity, with only small amounts being used in steelmaking, ceramics, laboratory analysis, and catalysis. It is noteworthy that for 50 years after the discovery of uranium, UO_2 , the metallic-appearing dioxide, was considered to be the element. Hence, papers published prior to 1842, when Péligot pointed out this error, must be reworded in order to obtain accurately the results of the early research.

The history of uranium research is the story of the development of modern chemistry and physics. The workers of the pre-fission era included a great number of those now generally famous for work in other fields. Bucholz, Péligot, Crookes, Lord Rutherford, B. B. Boltwood, J. L. C. Zimmermann, Alibegoff, Remelé, Feigl, and the Becquerel, Fresenius, and Curie families contributed.

It may be thought that because of the lack of commercial uses for uranium, very little research was reported on the chemical and physical characteristics of the element and its compounds. This would be in error. As early as the middle of the nineteenth century, much research of consequence had been published, and between the middle of the nineteenth century and 1920, much of the chemical and physical data on the element and its compounds were collected. The names of Aloy, Oechsner de Coninck, Colani, and Rammelsberg are noteworthy in "pre-fission" uranium research as are those of E. Baur and Biltz and his coworkers who, with those who studied the photolytic reactions of uranium salts, contributed greatly to the knowledge of uranium and uranyl complex compounds. The later work on complexes by R. Rascanu and Mazzucchelli is also very important and should not be overlooked. These men approached the problems of complex formation from a chemical standpoint. In the early part of this century the still excellent data on absorption spec-

tra began to appear from the laboratories of H. C. Jones, W. W. Strong, E. L. Nichols, and H. L. Howes. They, with Dieke and Duncan and others of the "postfission" era have contributed the bulk of the data on optical solution-chemistry and physics of uranium.

In the study of the pharmacological aspects of uranium, prior to the intensive studies carried on by the University of Rochester and other Manhattan District and Atomic Energy Commission contractors, the work of MacNider, Garnier, and Marek stands out brilliantly. These men had studied carefully the renal function and hematologic activity of uranium long before it became important as a hazard.

The early work on uranium metallurgy was also well done, but because of the lack of pure metal before Marden, Rentschler, Lilliendahl, and the Westinghouse process, the data cannot be considered to be very accurate. This, combined with the unavailability of large pieces of metal, required careful and exhaustive work on the whole field. The research on metallurgy carried out at Iowa State College, the University of Chicago, and other places after 1940 is, therefore, doubly important.

The mineralogy of uranium has been under study since 1789. However, regrettable as it may be, a change in purpose of this bibliography during its preparation made it impractical to include as extensive references to these studies as were included on chemistry, physics, biology, and physical metallurgy.

The bibliography itself is arranged chronologically by date of publication, i.e., by date of availability to the scientific community. In this arrangement, certain arbitrary decisions have been made for convenience in listing. The date of completion of a published volume, rather than the actual day of publication of the paper, is considered to represent the date a paper is available, and, in the case of papers once covered by security restrictions, the date these restrictions were lifted is used as the date of availability.

Within each year the papers have been arranged alphabetically by author with very few exceptions. These exceptions were made so that a slightly more logical order or research might be presented.

By far the major portion of the references are accompanied by annotations or abstracts, many of which were copied in part or total from such standard sources as Chemical Abstracts, Science Abstracts, Nuclear Science Abstracts, etc. Other annotations were obtained from other secondary sources or from the papers themselves.

Indexes are provided for easy use of this bibliography which otherwise would be far too cumbersome for practical purposes. The author index follows the list of references, and it is in turn followed by a subject index, a numerical index, and a list of the abbreviations used for the titles of periodicals. Each index is preceded by a brief introduction which describes its arrangement. The compiler considers the subject index to be the heart of the bibliography, and great care has been taken to include index reference even to minute amounts of data presented in the annotations and abstracts.

It is anticipated that a revision of this bibliography will be prepared in the future. In connection with this revision, the compiler would greatly appreciate receiving information on errors of omission or commission which have occurred in this compilation. Care has been taken to insure accuracy, but, because of the limited library resources available, all references could not be directly verified.

Grateful acknowledgment is herewith tendered to Mr. R. R. Lowery, Mr. G. E. Randall, and Dr. I. A. Warheit for their advice and encouragement; to Dr. Simone B. Schwind; to the staffs of the libraries of the Oak Ridge Institute of Nuclear Studies, the Oak Ridge National Laboratory, and the K-25 Plant, in particular to Miss Louise Markel, Miss Evelyn Levine, and Miss Marion Garber, for their valuable assistance in identifying publications, borrowing materials, and verifying many questionable references; and last, to Mr. S. K. Ford, Mr. K. L. Frame, Mr. C. D. Dunnebacke, Jr., Mrs. Elise McAlister, Mrs. Christine Beaven, and Miss Betty Smallen for performing the tremendous quantities of clerical work occasioned by this compilation.

REFERENCES

PUBLICATIONS LOCATED IN 1789

- 1 Klaproth, M. H. "The Chemical Investigation of Uranite, a Newly Discovered Metallic Substance." Chem. Ann. (Crell) II, 387-403(1789).
This paper reports the first prepn. of UO_2 although at that time it was believed to be the element rather than the oxide. The UO_2 was prepd. by reduction of UO_3 in a C crucible. A method of analysis (for UO_2) is given.
- 2 Klaproth, M. H. "Chemical and Mineralogic Studies on Uranium." Mem. Akad. Wiss. Berlin, 273(1789).

PUBLICATIONS LOCATED IN 1790

- 3 Klaproth, M. H. "Note Sent to M. Schurer." Ann. chim. (1), 6, 175-6(1790).
This is a correction to an earlier article by de la Métherie.
- 4 Klaproth, M. H. "Pure Mineralogical-Chemical Communication." Chem. Ann. (Crell) I, 291-8(1790).

PUBLICATION LOCATED IN 1791

- 5 Richter, J. B. Ueber die Neuern Gegenstande der Chemie. Breslau, 1791.
Vol. 1, p. 1-15. This section reports the first prepn. of $\text{UO}_2(\text{OAc})_2 \cdot 2\text{H}_2\text{O}$. It was obtained by dissolving U oxide in HOAc and was pptd. in the form of small yellow crystals. Vol. 9, p. 36. The prepn. of UO_2 by the reduction of higher U oxides with C at high temp. is discussed.

PUBLICATION LOCATED IN 1792

- 6 Hermbstädt, S. F. "Experiments and Remarks on Various Things." Chem. Ann. (Crell) II, 311-17(1792).

PUBLICATION LOCATED IN 1793

- 7 Klaproth, M. G. "Klaproth's Remarks on Uranium Ore." Chem. Ann. (Crell) II, 151-2(1793).
This is a correction to an earlier article.

NO PUBLICATIONS LOCATED IN 1794

PUBLICATION LOCATED IN 1795

- 8 Saussure, H. B. "New Investigations on the Use of the Blowpipe in Mineralogy." Chem. Ann. (Crell) I, 198-227(1795).

Page 210 shows blowpipe reactions for minerals contg. U.

NO PUBLICATIONS LOCATED IN 1796

PUBLICATIONS LOCATED IN 1797

- 9 Kirwan, R. "On the Decomposition and Assay of Metal-Rich Ores." Chem. Ann. (Crell) II, 503-18(1797).

The first section of this paper contains methods for the decomp. of U-bearing minerals.

- 10 Klaproth, M. H. Beiträge zur Chemischen Kenntnis der Mineralkörper. Berlin, 1797. Vol. 2. Page 197 contains a report of an attempt to prep. U metal by reduction of UO_3 in a C crucible. This method resulted in the prepn. of UO_2 which, because of its metallic appearance, was considered to be the metal.

NO PUBLICATIONS LOCATED IN 1798

PUBLICATION LOCATED IN 1799

- 11 Bucholz, C. F. Beiträge zur Erweiterung und Berichtigung der Chemie. Erfurt, 1799. Vol. 1. Page 62 contains some information on U.

PUBLICATION LOCATED IN 1800

- 12 Ritter, J. W. "Some Remarks on Cohesion and on the Composition of the Same with Magnetism." Ann. Physik (Gilbert) 4, 1-33(1800).
Magnetic properties of $\text{U}[\text{UO}_2]$ are discussed.

PUBLICATIONS LOCATED IN 1801

- 13 Champeaux, —. "Exact Story of the Discovery of Uranium Oxide in France, and the Position of That Substance." J. mines (France) 10, 529-42(1801).
- 14 Klaproth, M. H. Beiträge zur Chemischen Kenntnis der Mineralkörper. London, 1801. Page 477 contains some information on U.

PUBLICATIONS LOCATED IN 1802

- 15 Sage, B. G. "Analysis of an Uranium Ore or Herschel's Sulfurous [Mineral]." J. Roy. Inst. Gt. Brit. 1, 276-7(1802).

- 16 Sage, B. G. "Analysis of an Uranium or Herschel's Sulfurous [Mineral]." J. phys. chim. histoire nat. 55, 314-17(1802).

NO PUBLICATIONS LOCATED IN 1803

PUBLICATION LOCATED IN 1804

- 17 Gehlen, A. F. "On the Changed Color of Metal Salts Occurring in Ether-Hydrochloric Acid under Sunlight." Neues allgem. J. Chem. 3, 566-74(1804).

This paper reports obtaining UOCl_2 or $\text{UCl}_4 \cdot \text{UO}_2$ (the formula is not completely detd.) by photochem. reduction of a soln. of anhyd. UO_2Cl_2 in ether.

PUBLICATIONS LOCATED IN 1805

- 18 Bucholz, F. "Communication on the Knowledge of the Chemical Ratio of Uranium to Other Substances. First Part: On Uranium in Reguline and Calcined States." Neues allgem. J. Chem. 4, 17-49(1805).

$\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ can be prepd. by the soln. of U oxides in HNO_3 . When the soln. is evapd., the crystals will be deposited and can be recrystd. from water. Data on the solubility of $\text{UO}_2(\text{NO}_3)_2$ in H_2O and EtOH are reported. The prepn. of UO_2 by reduction of higher U oxides is discussed.

- 19 Bucholz, F. "Communication on the Knowledge of the Chemical Ratio of Uranium in Other Substances. Second Part: On the Combining Ability of Uranium Oxide with Acids." Neues allgem. J. Chem. 4, 134-60(1805).

$\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$ forms small lemon-yellow crystals. The prepn. is discussed and it is stated that when UO_2 or U_3O_8 is used to prep. the sulfate by way of concd. H_2SO_4 , oxidation with KNO_3 , evapn. to dryness, and self-crystn. from a water soln., the material has 3.5 moles water/mole. This, however, was later proved to be incorrect (see Pélignot). Information is given on the soly. of $\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$ in water and alc. $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ can be prepd. by the soln. of U oxides in HNO_3 . This paper also contains a discussion of the soly. of uranyl nitrate in H_2O and EtOH. When the soln. is evapd., the crystals will be deposited and can be recrystd. from H_2O . Uranyl salts are reduced to U^{+4} by Et_2O in the presence of light.

- 20 Gregor, W. "Experiments on a Mineral Substance Formerly Supposed to Be Zeolite, with Some Remarks on Two Species of Uran-Glimmer." Trans. Roy. Soc.(London) 95, 331-48(1805).

- 21 Gregor, W. "Experiments upon Green Uran Mica with a View to Its Chemical Analysis." Ann. Phil. (1), 5, 281-4(1805).

The analysis for U is discussed.

- 22 Richter, J. B. "On the Certain Purification of Uranium-Chalk from Iron, Copper, Lead, Calcium Oxide, and Clays, Including Some Other Remarks on Herr Bucholz's Contribution to the Collection of Knowledge on the Chemical Situation of Uranium and Other Substances." Neues allgem. J. Chem. 4, 402-10(1805).

PUBLICATION LOCATED IN 1806

- 23 Proust, J. L. "Contributions on Cyanides." Ann. chim. (1), 60, 225-52(1806).

A yellow ppt. was observed when uranyl salt solutions were treated with KCN solutions. This material was contaminated with uranyl hydroxide.

PUBLICATION LOCATED IN 1807

- 24 Proust, J. L. "Contributions on Cyanides." J. Chem. Physik (Gehlen) 3, 549-97(1807).

This paper is similar to that published in Ann. chim. (1), 60, 225-52(1806).

NO PUBLICATIONS LOCATED IN 1808, 1809, 1810

PUBLICATIONS LOCATED IN 1811

- 25 Gay-Lussac, T. Recherches Physico-Chimique. Paris, 1811. Vol. 1.

Page 262 indicates that U_3O_8 can be reduced to UO_2 by K at about 150° . A dull glow is produced during the reduction.

- 26 John, J. F. "On Some Heretofore Unknown Compounds of Chromic Acid with Various Bases." J. Chem. Physik (Schweigger) 3, 378-82(1811).

It is claimed that uranyl chromate is formed from a solution of uranyl carbonate with CrO_3 .

NO PUBLICATIONS LOCATED IN 1812 AND 1813

PUBLICATION LOCATED IN 1814

- 27 Porrett, R. "On the Nature of the Salts Termed Triple Prussiates, and on Acids Formed by the Union of Certain Bodies with the Elements of Prussic Acid." Trans. Roy. Soc. (London) 527-56(1814).

It is reported that uranyl thiocyanate octahydrate is easily sol. in H_2O and dissocs. strongly.

NO PUBLICATIONS LOCATED IN 1815

PUBLICATIONS LOCATED IN 1816

- 28 Phillips, W. "On the Oxide of Uranium, the Production of Cornwall." Trans. Geol. Soc. (1), 3, 112-20(1816).

- 29 Porrett, R. "On the Combination of Sulfur with Cyanogen." Ann. Physik (Gilbert) 53, 184-97 (1816).

It is reported that uranyl thiocyanate octahydrate is easily sol. in H_2O and dissocs. strongly.

- 30 Porrett, R. "On the Nature of Salts Termed Triple Prussiates, and on Acids Formed by the Union of Certain Bodies with the Elements of Prussic Acid." J. Chem. Physik (Schweigger) 17, 258-301(1816).

This paper is similar to that published in Trans. Roy. Soc. (London) 527-56(1814).

NO PUBLICATIONS LOCATED IN 1817

PUBLICATION LOCATED IN 1818

- 31 Chevreul, M. E. "On the Acidity of Tungsten and Uranium when Saturated with Oxygen." Ann. Phil. (1), 12, 144-5(1818).

This paper contains a discussion of the prepn. of K uranyl carbonate and the acid characteristics of UO_4 .

PUBLICATIONS LOCATED IN 1819

32 Berzelius, J. J. "Analysis of Several Minerals." Ann. chim. phys. (2), 12, 12-37(1819).
Some information on U minerals is included.

33 Clarke, E. D. "Further Observations Respecting the Decomposition of the Earths, and Other Experiments Made by Burning a Highly Compressed Mixture of the Gaseous Constituents of Water." Ann. Physik (Gilbert) 62, 337-98(1819).
The reduction of U oxide is discussed.

PUBLICATION LOCATED IN 1820

34 Gahn, J. G. "On the Blowpipe." J. Chem. Physik (Schweigger) 29, 295-313(1820).
Blowpipe reactions of U are reported.

NO PUBLICATIONS LOCATED IN 1821

PUBLICATIONS LOCATED IN 1822

35 Arfvedson, J. A. "Contribution toward a Closer Knowledge of Uranium." Handl. Svenska Vetenskapsakad. 404-26(1822).

The information contd. in this paper is similar to that reported by the author in Ann. Physik Chem. (Pogg.) 1, 245-70(1824).

36 Pfaff, C. H. "On the Analysis of Uranium Ores." J. Chem. Physik (Schweigger) 35, 326-8 (1822).

37 Phillips, R. "Analysis of Uranite of Cornwall." Ann. chim. phys. (2), 22, 211-16(1822).

38 Phillips, R. "Analysis of Uranite of Cornwall." J. Chem. Physik (Schweigger) 44, 42-6(1822).

PUBLICATIONS LOCATED IN 1823

39 Berzelius, J. J. "Some Experiments with Uranium Oxide and Its Compounds." Handl. Svenska Vetenskapsakad. 152-76(1823).

40 Brande, W. T. "Experiments on the Oxides and Salts of Uranium." Quart. J. Sci. 14, 86-91 (1823).

It is reported that mixed salts are obtained when the prepn. of uranyl carbonate is attempted using $(\text{NH}_4)_2\text{CO}_3$ and uranyl nitrate. When CO_2 is introduced to a suspension of freshly prepd. uranic acid in H_2O a uniform product does not result.

41 Lecanu, L. R. "Procedure for Obtaining Pure Uranium Oxide." J. pharm. sci. accessoires (2) 9, 141-5(1823).

42 Phillips, R. "Analysis of Uranite of Cornwall." Ann. Phil. (2), 5, 57-61(1823).

43 Phillips, R. "Analysis of Uranite of Cornwall." Quart. J. Sci. 15, 168(1823).

- 44 Phillips, R. "Phosphate of Uranium." Ann. Phil. (2), 5, 470(1823).

PUBLICATIONS LOCATED IN 1824

- 45 Arfvedson, J. A. "Contribution toward a Closer Knowledge of Uranium." Ann. Physik Chem. (Pogg.) 1, 245-70(1824).

This article contains a discussion of the reduction of higher oxides of U to UO_2 using H_2 as opposed to the earlier method which used C. The crystals obtained are ordinarily micro. octahedra; however, the form will vary considerably with the method of prepn. UO_2 can also be obtained by reduction of KUO_2Cl_3 with dry H_2 as long as HCl is evolved. The residue is then leached with H_2O and dried. The UO_2 obtained is stable in air, goes to U_3O_8 when heated (with swelling) and is insol. in HCl and H_2SO_4 . A study on at. wt. of U is reported. $(\text{NH}_4)_2\text{U}(\text{CO}_3)_3$ prepn. is reported as is $\text{U}(\text{CO}_3)_2$. It is reported that mixed salts are obtained when the prepn. of uranyl carbonate is attempted using $(\text{NH}_4)_2\text{CO}_3$ and uranyl nitrate. It is also reported that $\text{UO}_2\text{Cl}_2 \cdot x\text{H}_2\text{O}$ may be obtained from aq. soln. of UO_2Cl_2 which may itself be obtained by oxidizing a soln. of UCl_4 with HNO_3 . $\text{BaO} \cdot 2\text{UO}_3$ can be obtained by pptn. from boiling solns. of UO_2Cl_2 to which BaCl_2 has been added while NH_3 is passed through the soln. The filtered ppt., which should be washed quickly with boiling H_2O to prevent BaCO_3 contamination, is a relatively pure product. $(\text{NH}_4)_2 \cdot 2\text{UO}_3 \cdot x\text{H}_2\text{O}$ or $(\text{NH}_4)_2\text{U}_2\text{O}_7 \cdot x\text{H}_2\text{O}$ is obtained by pptn. of uranyl salts with excess $(\text{NH}_4)^+$; it is yellow. $\text{PbO} \cdot 2\text{UO}_3$ can also be prepd. from solns. of $\text{UO}_2(\text{NO}_3)_2$ and $\text{Pb}(\text{NO}_3)_2$ by pptn. with NH_3 . In the discussion the conclusion is reached that uranyl nitrate is not completely decompd. until the entire mass has been converted to U_3O_8 . $\text{K}_2\text{UO}_2\text{Cl}_4 \cdot 2\text{H}_2\text{O}$ was prepd. in the form of small prismatic or granular yellow crystals from a soln. of UO_2Cl_2 and excess KCl . In prepg. $\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$, if UO_2 or U_3O_8 is used in place of UO_3 , the H_2SO_4 soln. must first be oxidized with HNO_3 then the entire material evapd. to dryness, taken up in water and the syrupy soln. which remains left to crystallize. Wartlike crystals of $(\text{NH}_4)_2\text{UO}_2(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$ are obtained by evapn. of the soln. containing the individual sulfates. $\text{K}_2\text{SO}_4 \cdot \text{UO}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$ or $\text{K}_2\text{UO}_2(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$ crystals are obtained by evapn. of a soln. of $(\text{UO}_2)^{+2}$ and K^+ sulfate.

- 46 Arfvedson, J. A. "Contribution toward a Closer Knowledge of Uranium." Ann. Phil. (2), 7, 253-67(1824).

This paper contains information similar to that reported in Ann. Physik Chem. (Pogg.) 1, 245-70(1824).

- 47 Berzelius, J. J. "Analysis of Uranite from Autun." Ann. sci. nat. (1), 1, 446-7(1824).

- 48 Berzelius, J. J. "Investigation of Hydrofluoric Acid and Its Most Remarkable Compounds." Ann. Physik Chem. (Pogg.) 1, 1-48(1824).

UO_2F_2 was first prepd. as a white amorph. mass by evapg. a soln. of UO_3 in aq. HF . This paper reports that in combination with other metallic fluorides UF_4 and UO_2F_2 will give cryst. double salts.

- 49 Berzelius, J. J. "Investigation of Hydrofluoric Acid and Its Most Remarkable Compounds." Ann. Physik Chem. (Pogg.) 2, 113-50(1824).

- 50 Berzelius, J. J. "Some Experiments with Uranium Oxide and Its Compounds." Ann. Physik Chem. (Pogg.) 1, 359-86(1824).

Analysis for U and studies of uranic cpds. are included. $\text{UO}_2\text{C}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$ was first prepd. and analyzed as reported in this paper. It was pptd. from concd. uranyl solns. with $\text{H}_2\text{C}_2\text{O}_4$. The prepn. of $2(\text{NH}_4)_2\text{CO}_3 \cdot \text{UO}_2\text{CO}_3$ is reported when the prepn. of uranyl carbonate is attempted using $(\text{NH}_4)_2\text{CO}_3$ and uranyl nitrate. It is reported that 3 different K uranyl sulfates are obtained from solns. of UO_2SO_4 and K_2SO_4 in various proportions. The paper contains a discussion of the phases of the system. $2\text{KCl} \cdot \text{UO}_2\text{Cl}_2 \cdot 2\text{H}_2\text{O}$ or $\text{K}_2\text{UO}_2\text{Cl}_4 \cdot 2\text{H}_2\text{O}$ will crystallize in greenish-yellow prisms from a soln. of KCl and UO_2Cl_2 . When K uranyl carbonate is ignited and the melt leached with H_2O , an insol. brick-red

powder of $K_2U_2O_7$ is left behind. $K_2U_2O_7$ is only partially reduced by ignition in a stream of H_2 . $K_4UO_2(CO_3)_3$ is obtained from a soln. of uranyl hydroxide in $KHCO_3$. A basic uranyl oxalate is reported in this paper although its compn. is not accurately given. It is argued that the method of prepg. $BaO \cdot 2UO_3$ used by Arfvedson will always contain $(NH_4)_2O \cdot UO_3$ as an impurity. A substitute method using the pptn. of uranyl nitrate with $Ba(OH)_2$ and washing of the ppt. until no Ba is found is reported to yield a pure product. This paper also reports the prepn. of impure UO_2S_2 by the pptn. of the material from $(UO_2)^{+2}$ solns. with $(NH_4)_2S$.

- 51 Lecanu, L. R. and Serbat, M. "Procedure for Obtaining Pure Uranium Oxide." Quart. J. Sci. 17, 139-40(1824).

PUBLICATIONS LOCATED IN 1825

- 52 Arfvedson, J. A. "Contribution toward a Closer Knowledge of Uranium." Ann. chim. phys. (2), 29, 148-75(1825).

*This paper contains information similar to that reported in Ann. Physik Chem. (Pogg.) 1, 245-70(1824).

- 53 Arfvedson, J. A. "Contribution toward a Closer Knowledge of Uranium." J. Chem. Physik (Schweigger) 44, 8-19(1825).

This paper contains information similar to that reported in Ann. Physik Chem. (Pogg.) 1, 245-70(1824).

- 54 Berzelius, J. J. "Some Experiments with Uranium Oxide and Its Compounds." Ann. Phil. 9, 266-81(1825).

This paper contains information similar to that reported in Ann. Physik Chem. (Pogg.) 1, 359-86(1824).

- 55 Berzelius, J. J. "Some Experiments with Uranium Oxide and Its Compounds." J. Chem. Physik (Schweigger) 44, 19-35(1825).

This paper contains information similar to that reported in Ann. Physik Chem. (Pogg.) 1, 359-86(1824).

- 56 Brande, W. T. "Experiments on the Oxides and Salts of Uranium." J. Chem. Physik (Schweigger) 44, 1-7(1825).

It is reported that mixed salts are obtained when the prepn. of uranyl carbonate is attempted using $(NH_4)_2CO_3$ and uranyl nitrate. When CO_2 is introduced to a suspension of freshly prepd. uranic acid in H_2O a uniform product does not result.

- 57 Gmelin, C. G. "Experiments on the Action of Barium, Strontium, Chromium, Molybdenum, Wolfram, Rhodium, Paladium, Nickel, Cobalt, Uranium, Cerium, Iron and Manganese on Animal Organisms." J. Chem. Physik (Schweigger) 43, 110-15(1825).

This paper contains the first reference to the toxicity of U cpds.

- 58 Lecanu, L. R. "Contributions toward the History of Uranium." J. pharm. sci. accessoires (2), 11, 279-85(1825).

This article contains a discussion of the reduction of higher oxides of U to UO_2 using H_2 as opposed to earlier methods using C. There is also a discussion of the heating of $UO_2(NO_3)_2 \cdot 6H_2O$. A soln. of UO_2SO_4 is reported to be acid toward litmus. In contrast to the earlier reports of Bucholz, this paper describes cryst. $UO_2SO_4 \cdot 3H_2O$ as being partly yellow and partly green without any definite cryst. form. The prepn. of $2(NH_4)_2CO_3 \cdot UO_2CO_3$ is reported. The evapn. of a UO_2Cl_2 soln. gives small deliq. needle-like crystals. The prepn. of UO_2CO_3 from mixts. of uranates or double uranyl salts is also reported, e.g., if an excess of a satd. soln. of $KHCO_3$ or NH_4HCO_3 is added dropwise to a soln. of $UO_2(NO_3)_2$; the yellow ppt. obtained contains K_2UO_4 or $(NH_4)_2UO_4$, as well as uranyl carbonate.

- 59 Lecanu, L. R. and Serbat, M. "Procedure for Obtaining Pure Uranium Oxide." J. Chem. Physik (Schweigger) 44, 35-42(1825).
- 60 Pleischl, A. "On Iodous Acid; Comparison of Its Properties with the Properties of Hydriodic and Iodic Acid." J. Chem. Physik (Schweigger) 45, 1-25(1825).
Uranium iodate is mentioned.

PUBLICATIONS LOCATED IN 1826

- 61 Berzelius, J. J. "On Sulfates." Ann. Physik Chem. (Pogg.) 6, 425-58(1826).
U sulfocarbonate is mentioned.
- 62 Berzelius, J. J. "On Sulfates." Ann. Physik Chem. (Pogg.) 7, 1-32(1826).
U sulfoarsenate is mentioned.
- 63 Berzelius, J. J. "On Sulfates." Ann. Physik Chem. (Pogg.) 7, 137-58(1826).
U sulfoarsenate is mentioned.
- 64 Berzelius, J. J. "On Sulfates." Ann. Physik Chem. (Pogg.) 7, 261-88(1826).
U sulfomolybdate is mentioned. When uranyl salts are mixed with K_2MoS_4 , a dark brown stable ppt. is obtained. When mixed with K_2MoS_5 , a dark red ppt. is found.

PUBLICATIONS LOCATED IN 1827

- 65 Fischer, N. W. "On Metal Reduction Using Other Metals in the Wet Way." Ann. Physik Chem. (Pogg.) 9, 255-66(1827).
The reduction of U oxides to U is reported on p. 264.
- 66 Gmelin, C. G. "Experiments on the Action of Barium, Strontium, Chromium, Molybdenum, Wolfram, Rhodium, Palladium, Nickel, Cobalt, Uranium, Cerium, Iron and Manganese on Animal Organisms." Edinburgh J. Med. Sci. 3, 324(1827).
This paper includes early references concerning the toxic effect of U cpds.

NO PUBLICATIONS LOCATED IN 1828

PUBLICATIONS LOCATED IN 1829

- 67 Fischer, N. W. "On Metal Reduction Using Other Metals in the Wet Way." Ann. Physik. Chem. (Pogg.) 16, 124-8(1829).
The reduction of U oxides to U is mentioned on p. 126.
- 68 Quesneville, —. "On the Preparation of Uranium Oxide without the Direct Use of Ammonium Carbonate." J. pharm. chim. (2), 15, 494-5(1829).
- 69 Quesneville, —. "On the Preparation of Uranium Oxide without the Direct Use of Ammonium Carbonate." J. prakt. Chem. (1), 6, 451-2(1829).

PUBLICATIONS LOCATED IN 1830

- 70 Berthemot, J. B. "Memorandum on Bromides." Ann. chim. phys. (2), 44, 382-96(1830).
It is reported that UO_2Br_2 will lose all Br_2 in the molecule when heated in air. It will give off HBr and yield a red modification of UO_2 which is stable toward further ignition.
- 71 Haidinger, W. "On Johannite, a New Mineral Species." Edinburgh J. Sci. 3, 306-10(1830).
- 72 Haidinger, W. "On Johannite, a New Mineral Species." Ann. Physik Chem. (Pogg.) 20, 472-6 (1830).
- 73 Stromeyer, F. "On the Phosphoric Acid and Pyrophosphoric Acid Salts." J. Chem. Physik (Schweigger) 58, 123-40(1830).
U pyrophosphate is mentioned.

PUBLICATION LOCATED IN 1831

- 74 Berzelius, J. J. "On Vanadium and Its Properties." Ann. Physik Chem. (Pogg.) 22, 1-67(1831).
Uranyl vanadate can be prepd. with a uranyl salt in the presence of potassium vanadate or potassium hydrogen vanadate. No formula is given.

PUBLICATIONS LOCATED IN 1832

- 75 Herschel, J. F. W. "Letter to the Editors on the Separation of Iron Oxide and on a New Method for the Complete Purification of Uranium Oxide." Ann. chim. phys. (2), 49, 306-11(1832).
The sepn. of U from Fe using $\text{K}_2\text{Fe}(\text{CN})_3$ is discussed.
- 76 Herschel, J. F. W. "Letter to the Editors on the Separation of Iron Oxide and on a New Method for the Complete Purification of Uranium Oxide." Ann. Physik Chem. (Pogg.) 25, 627-8(1832).
The sepn. of U from Fe using $\text{K}_2\text{Fe}(\text{CN})_3$ is discussed.

NO PUBLICATIONS LOCATED IN 1833

PUBLICATIONS LOCATED IN 1834

- 77 Berzelius, J. J. "Investigations on the Properties of Tellurium." Ann. Physik Chem. (Pogg.) 32, 577-627(1834).
U tellurate is reported to be a pale lemon-yellow ppt.
- 78 Persoz, J. "Separation of Several Metal Oxides." Ann. chim. phys. (2), 56, 333-5(1834).
The prepn. of $\text{PbO} \cdot 2\text{UO}_3$ from solns. of $\text{UO}_2(\text{OAc})_2$ and basic lead acetate is reported.

PUBLICATIONS LOCATED IN 1835

- 79 Berzelius, J. J. "On Distillation Products of Racemic Acid (Acidum Paratartaricum)." Ann. Physik Chem. (Pogg.) 36, 1-28(1835).

U tartrate is mentioned.

- 80 Berzelius, J. J. "Investigations on the Properties of Tellurium." Ann. chim. phys. (2), 58, 225-81(1835).

This paper is similar to that published in Ann. Physik Chem. (Pogg.) 32, 577-627(1834).

- 81 Persoz, J. "On the Order of Reactivity of Oxides for Acids, and the Applications which Follow." Ann. chim. phys. (2), 58, 180-203(1835).

The sepn. of U from other materials using CuO and HgO is discussed.

PUBLICATION LOCATED IN 1836

- 82 Regnault, V. "Relative Studies on the Action of Water Vapor at a High Temperature on Metals and Metallic Sulfides. Trial of a New Classification of Metals According to Their Degree of Oxidizability." Ann. chim. phys. (2), 62, 337-88(1836).

This paper reports that H₂O (vapor) will oxidize UO₂. U₃O₈ is said to be formed in the reaction.

PUBLICATIONS LOCATED IN 1837

- 83 Marchand, R. F. "On the Salts of Ethylsulfuric Acid." Ann. Physik Chem. (Pogg.) 41, 596-634(1837).

U sulfoethylate is reported.

- 84 Marchand, R. F. "On the Salts of Ethylsulfuric Acid." J. prakt. Chem. (1), 12, 257-65(1837).

This paper is similar to that published in Ann. Physik Chem. (Pogg.) 41, 596-634(1837).

- 85 Werner, A. "Uranium Oxide from Pitchblende." J. prakt. Chem. (1), 12, 381-3(1837).

PUBLICATION LOCATED IN 1838

- 86 Werner, A. "Uranium Oxide from Pitchblende." Polytech. J. (Dingler) 68, 465-6(1838).

NO PUBLICATIONS LOCATED IN 1839

PUBLICATIONS LOCATED IN 1840

- 87 Regnault, V. "Research on the Specific Heat of Elements and Compounds. 1st Memorandum: Elements." Ann. chim. phys. (2), 73, 5-72(1840).

The average specific heat for (UO₂) for the temp. interval 10 to 98° was found to be 0.06190.

- 88 Regnault, V. "Research on the Specific Heat of Elements and Compounds. 1st Memorandum: Elements." Ann. 36, 103-10(1840).

This paper is the summary of one published in Ann. chim. phys. (2), 73, 5-72(1840).

- 89 Regnault, V. "Research on the Specific Heat of Elements and Compounds. 1st Memorandum: Elements." Ann. Physik Chem. (Pogg.) 51, 213-44(1840).

This paper contains information similar to that reported in Ann. chim. phys. (2), 73, 5-72(1840).

PUBLICATIONS LOCATED IN 1841

- 90 Pélégot, E. "On the Atomic Weight of Uranium." Compt. rend. 12, 735-6(1841).

This paper contains a report of the detn. of the compn. of $\text{UO}_2(\text{OAc})_2 \cdot 2\text{H}_2\text{O}$.

- 91 Pélégot, E. "On the Atomic Weight of Uranium." J. prakt. Chem. (1), 23, 494-8(1841).

- 92 Pélégot, E. "Research on Uranium." Compt. rend. 13, 417-26(1841).

- 93 Pélégot, E. "Research on Uranium." J. pharm. chim. (2), 27, 525-35(1841).

- 94 Pélégot, E. "Research on Uranium." Ann. Physik Chem. (Pogg.) 54, 122-5(1841).

- 95 Pélégot, E. "Research on Uranium." J. prakt. Chem. (1), 24, 442-51(1841).

Identification of UO_2 (as prepared by Klaproth) as an oxide and not the metal as assumed.

- 96 Rammelsberg, C. "On the Thioantimonate and Thioarsenate." Ann. Physik Chem. (Pogg.) 52, 193-242(1841).

A yellowish-brown ppt. of uranyl thioantimonate can be obtained by adding Na_3SbS_4 to a soln. of ammonium uranyl chloride.

PUBLICATIONS LOCATED IN 1842

- 97 Bonaparte, L. L. "Note on Valeric Acid, the Valerates, Quinine Lactate, and Several Other Salts of That Base." J. chim. med. (2), 8, 676-86(1842).

U valerianate can be obtained from the action of light on valeric acid in the presence of $(\text{UO}_2)^{+2}$ salts.

- 98 de La Provostaye, F. H. "Crystallographic Research on Uranium and Uranyl Salts." Ann. chim. phys. (3), 5, 47-51(1842).

Crystals of $(\text{NH}_4)_2\text{UO}_2(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$ are reported to be stable in air, strongly fluorescent, greenish and probably of a monoclinic prismatic shape; an axial ratio of 1.428:1:1.226 for a:b:c is proposed. The β angle is reported to be 102° . It is reported that $(\text{NH}_4)_2\text{UO}_2(\text{C}_2\text{O}_4)_2$ can be obtained from $\text{UO}_2\text{C}_2\text{O}_4$ and $(\text{NH}_4)_2\text{C}_2\text{O}_4$ solns. A material is reported which was prepd., investigated, and supposed to be $\text{U}(\text{SO}_4)_2 \cdot 8\text{H}_2\text{O}$. However, later expts. showed it to be the 9-hydrated material. This paper also contains a discussion of the crystal form of $\text{UO}_2(\text{NO}_3)_2$. $\text{U}(\text{SO}_4)_2$ is reported to belong to the rhombic crystal system on the basis of these early measurements. (Later measurements show that this is incorrect.) $(\text{NH}_4)_2\text{UO}_2(\text{CO}_3)_2$ and $(\text{NH}_4)_3\text{UO}_2\text{F}_5$ were prepd. $(\text{NH}_4)_4\text{UO}_2(\text{CO}_3)_3$ appears upon pptn. in the form of yellow transparent crystals which are monoclinic and prismatic. The axial ratio is given.

- 99 de La Provostaye, F. H. "Addition to the Note on Uranium and Uranyl Salts." Ann. chim. phys. (3), 6, 165-6(1842).

It is reported that $2\text{KCl} \cdot \text{UO}_2\text{Cl}_2 \cdot 2\text{H}_2\text{O}$ or $\text{K}_2\text{UO}_2\text{Cl}_4 \cdot 2\text{H}_2\text{O}$ cryst. as triclinic pyramids with an axial ratio, a:b:c, of 0.607:1:0.560 with the angles $\alpha = 80^\circ 41'$, $\beta = 77^\circ 42'$, and $\gamma = 91^\circ 18'$.

- 100 Delffs, W. "Contribution to the Chemistry of Uranium." Ann. 55, 229-36(1842).

It is reported that ammonium uranyl carbonate can be obtained from concd. $(\text{NH}_4)_2\text{CO}_3$ solns. when mixed with $(\text{NH}_4)_2\text{UO}_4$.

101 Ebelmen, J. J. "Research on Several Compounds of Uranium." Ann. 43, 286-318(1842).
 The reaction product obtained in the prepn. of UO_2 by igniting uranyl oxalate in dry H_2 is said to be first black and then cinnamon-brown. It is pyrophoric and oxidizes rapidly when heated in air. It has a d. = 10.15. Very pure UO_2 in a cryst. form can be obtained by using five parts Na_2UO_4 with 20 parts of anhyd. MgCl_2 in a covered crucible. Brilliant black cubes are obtained, which can easily be isolated because of their great d. and their stability in the presence of dil. acid. When the mixed $\text{U}^{+4,+6}$ hydroxide is dried in vacuum, a black mass is obtained. This material exhibits a cryst. fracture. If the material is rubbed, the residue is a green powder which maintains a const. wt. upon heating in air. The d. of U_3O_8 = 7.31 (probably at room temp.). A brick-red product obtained by the dehydration of $\text{UO}_3 \cdot \text{H}_2\text{O}$ at 300° was identified as U_2O_7 which goes to U_3O_8 at red heat. A question is raised re the actual existence of U_2O_5 proposed by other investigators. This paper contains a discussion of the soly. of U_3O_8 in acids. $(\text{NH}_4)_4\text{UO}_2(\text{CO}_3)_3$ can be obtained by digestion of $(\text{NH}_4)_2\text{UO}_4$ in excess $(\text{NH}_4)_2\text{CO}_3$ at approx. 65° . It is reported that it is 5% sol. at 15° (H_2O). When $(\text{NH}_4)_2\text{UO}_2(\text{CO}_3)_3$ is given a prolonged heating at 300° , it will be converted entirely to UO_3 . This paper contains the early identification of $\text{K}_2\text{UO}_2(\text{C}_2\text{O}_4)_2 \cdot 3\text{H}_2\text{O}$. $\text{K}_6(\text{UO}_2)_2(\text{C}_2\text{O}_4)_5 \cdot 10\text{H}_2\text{O}$ is reported to be obtainable from dil. aq. soln. of K and uranyl oxalates in which the K salt is in excess. The pptd. material which forms in the shape of gypsum crystals is said to lose over $\frac{1}{2}$ of its water at 100° . It is stable in air. $\text{K}_2\text{SO}_4 \cdot \text{UO}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$ or $\text{K}_2\text{UO}_2(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$ is obtained as crystals by evapn. of a soln. of UO_2SO_4 and K_2SO_4 . It is purified by repeated recrystn. $\text{K}_4\text{UO}_2(\text{CO}_3)_3$ can be obtained by evapn. of a soln. of K_2UO_4 in KHCO_3 soln. Information is included on the photolytic properties of $(\text{UO}_2)^{+2}$. It is reported that $\text{U}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ can be obtained by photochem. reduction of a U^{+6} soln. with excess U_3O_8 in concd. H_2SO_4 when this soln. is treated with alc., placed in a closed vessel and exposed to sunlight. The prepn. and dehydration of the trihydrate to monohydrate is discussed. Anhyd. UO_2SO_4 can be obtained by the dehydration of the tetra- or trihydrate at approx. 300° . It is reported that $\text{UOSO}_4 \cdot 2\text{H}_2\text{O}$ can be obtained by treating $\text{U}(\text{SO}_4)_2 \cdot x\text{H}_2\text{O}$ with a large amt. of cold water. When the material is treated with boiling water, H_2SO_4 is extrd. from the material leaving a black coloration. No U is extrd. by this hot water. When mixed hydroxide, $\text{U}_3\text{O}_8 \cdot x\text{H}_2\text{O}$, is dried in air, it converts to $\text{UO}_3 \cdot 2\text{H}_2\text{O}$ which is a light-yellow homogeneous powder, stable in air, which will not absorb CO_2 . Although $\text{U}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ is sol. in dil. H_2SO_4 and HCl and sparingly sol. in the concd., it is said to be insol. in water with decompn. $\text{UO}_2\text{C}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$ is prepd. by pptn. from a concd. soln. of $\text{UO}_2(\text{NO}_3)_2$ using oxalic acid. The resulting cpd. is obtained as a yellow powder or small, difficultly sol. crystals. A d. of 2.98 is reported for the crystals. It is reported that $2\text{Na}_2\text{CO}_3 \cdot \text{UO}_2\text{CO}_3$ or $\text{Na}_4\text{UO}_2(\text{CO}_3)_3$ can be prepd. by dissolving Na_2UO_4 in a NaHCO_3 soln., and that $\text{UO}_2\text{C}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$ is sol. to the extent of 0.8/100 parts H_2O at 14° , and 3.4/100 parts H_2O at 100° . One part of $\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$ dissolved in about 0.47 part of H_2O at 22° . One part of the salt is said to dissolve in about 0.28 part of H_2O at boiling. An incorrect compn. for $\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$ is reported. 3.5 moles H_2O are said to be present. See Pélégot for correct information. It is reported that when solns. of K_2CO_3 are added dropwise to a soln. of $\text{UO}_2(\text{NO}_3)_2$, mixts. of KHCO_3 and uranyl hydroxide are obtained.

102 Ebelmen, J. J. "Research on Several Compounds of Uranium." Ann. chim. phys. (3), 5, 189-223(1842).

This paper contains information similar to that reported in Ann. 43, 286-318(1842).

103 Ebelmen, J. J. "Research on Several Compounds of Uranium." J. prakt. Chem. (1), 27, 385-421(1842).

This paper contains information similar to that reported in Ann. chim. phys. (3), 5, 189-223(1842) and Ann. 43, 286-318(1842).

104 Haidlen, J. and Fresenius, R. H. "On the Use of Potassium Cyanide in Chemical Analysis." Ann. 43, 129-49(1842).

When KCN is added to a soln. of U salt, a yellow ppt. contaminated with uranyl hydroxide is formed; however, this ppt. was not fully investigated.

105 Kuhn, O. B. "Remarks on Uranium." Ann. 41, 337-44(1842).

The prepn. of BaU_2O_7 by heating uranyl nitrate with a great excess of $\text{Ba}(\text{OH})_2$ is reported.

106 Pélégot, E. "Investigations on Uranium." Ann. 41, 141-50(1842).

This paper contains a report of the detn. of the compn. of $\text{UO}_2(\text{OAc})_2 \cdot 2\text{H}_2\text{O}$.

107 Pélégot, E. "Research on Uranium." Ann. 43, 255-86(1842).

$\text{UO}_2\text{C}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$ is prepd. by pptn. from a concd. soln. of $\text{UO}_2(\text{NO}_3)_2$ and oxalic acid. The resulting cpd. is obtained as a yellow powder of small, difficultly sol. crystals. It was also formed by pptn. from UCl_4 soln. $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ can be prepd. by the soln. of U oxides in HNO_3 . When the soln. is evapd., the crystals will be deposited and can be recrystd. from water. This paper reports that UCl_4 forms dark-green regular octahedra with a metallic luster. The crystals are said to subl. as a red vapor at red heat. UCl_4 is prepd. by the chlorination of U oxide and C. The mixt. is placed in a hard-glass tube and dried completely while a stream of Cl_2 is passed through the tube. It is then heated to red heat in a more rapid Cl_2 stream. Red vapors of UCl_4 are formed and condense near the place where the heat is applied. It is very hygr., fumes in air, and readily gives an emerald-green liq. It will dissolve in water and is apparently hydrolyzed, since the green soln. is quite acid and gives no double cpd. with alk. chlorides. When UCl_4 soln. is evapd., it decomps. giving off copious fumes of HCl and depositing black $\text{U}(\text{OH})_4$. This paper also describes the prepn. of UCl_3 by the chlorination of U oxide to UCl_4 and the reduction of this material with H_2 in the same tube at a relatively low temp. until the exhaust gases no longer contain HCl . When uranyl oxalate is ignited in dry H_2 , followed by cooling in H_2 , UO_2 is obtained in pure form. The colors which are obtained are attributed to differences in the size of aggregates. The cryst. shape is said to be dependent upon the prepn. method; scales with metallic luster were obtained by this method. It is not attacked by dil. HCl and H_2SO_4 , even when the acids are warm. UO_2 is reported not to be attacked by gaseous HCl , even at high temps. It will, however, dissolve in concd. H_2SO_4 . It is also reported that, when uranyl salts are ignited with volatile acids, the U_3O_8 , which is formed, is usually accompanied by black U_2O_5 . Investigations of the hydroxides of U (probably U^{+4} hydroxides, reported as U^{+2} and U^{+3} hydroxides) showed that the hydroxide was a flocculent reddish-brown ppt. which became denser and darker when boiled. It was concluded that water of hydration was lost upon boiling. $\text{U}(\text{OH})_4$ is said to be easily sol. in dil. acid. The prepn. and properties of a material identified as $\text{U}(\text{SO}_4)_2 \cdot 8\text{H}_2\text{O}$ are given. It is prepd. by treating a soln. of UCl_4 with H_2SO_4 and freeing the crystals obtained from water by heating. The gel which remained is then dissolved in water and evapd., yielding prismatic crystals of the normal sulfate, some of which are accompanied by crystals of the basic salt. It is reported that $\text{UOSO}_4 \cdot 2\text{H}_2\text{O}$ can be obtained by treating $\text{U}(\text{SO}_4)_2 \cdot x\text{H}_2\text{O}$ with a large amt. of cold water. This material is said to be a light-green powder which is very slightly sol. in H_2O . It is reported that UO_2Cl_2 can be prepd. by the action of dry Cl_2 on UO_2 at red heat. It is a yellow, cryst., very deliq. material. Double salts with UO_2Cl_2 were obtained by combining it with KCl and NH_4Cl . $2\text{KCl} \cdot \text{UO}_2\text{Cl}_2 \cdot 2\text{H}_2\text{O}$ or $\text{K}_2\text{UO}_2\text{Cl}_4 \cdot 2\text{H}_2\text{O}$ will cryst. from $\text{K}_2\text{U}_2\text{O}_7$ soln. (excess HCl) as large greenish-yellow rhombic plates. $(\text{NH}_4)_2\text{UO}_2\text{Cl}_4 \cdot 2\text{H}_2\text{O}$ can be cryst. from very concd., almost syrupy, solns. of $(\text{NH}_4)_2\text{U}_2\text{O}_7$ in the presence of excess HCl as deliq., well-formed rhombohedrons. $(\text{NH}_4)_2\text{UO}_2(\text{C}_2\text{O}_4)_2$ can be obtained from $\text{UO}_2\text{C}_2\text{O}_4$ and $(\text{NH}_4)_2\text{C}_2\text{O}_4$ solns. $\text{K}_2\text{SO}_4 \cdot \text{UO}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$ or $\text{K}_2\text{UO}_2(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$ is obtained in similar fashion. It is purified by repeated recrystn. This paper also reports the dehydration of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ to the trihydrate. $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ is dilq. in air even at ordinary temp., liquefying in moist air. $(\text{NH}_4)_2\text{O} \cdot 2\text{UO}_3 \cdot x\text{H}_2\text{O}$ or $(\text{NH}_4)_2\text{U}_2\text{O}_7 \cdot x\text{H}_2\text{O}$ is obtained as a yellow ppt. of uranyl salts with excess NH_4 . $2\text{Na}_2\text{CO}_3 \cdot \text{UO}_2\text{CO}_3$ or $\text{Na}_4\text{UO}_2(\text{CO}_3)_3$ can be prepd. by dissolving Na_2UO_4 in Na_2CO_3 soln. $(\text{NH}_4)_4\text{UO}_2(\text{CO}_3)_3$ can be obtained by digestion of $(\text{NH}_4)_2\text{UO}_4$ in excess $(\text{NH}_4)_2\text{CO}_3$ soln. at approx. 65° . It is reported that, when a soln. of $(\text{NH}_4)_2\text{UO}_2(\text{CO}_3)_2$ is heated, a yellow flocculent ppt. is obtained which is probably at mixt. of uranyl carbonate, UO_3 , and uranate.

108 Pélégot, E. "Research on Uranium." Ann. chim. phys. (3), 5, 5-47(1842).

This paper contains information similar to that reported in Ann. 43, 255-86(1842).

- 109 Rammelsberg, C. "On Bromate Salts and the Combining of Metal Bromides with Ammonia." Ann. Physik Chem. (Pogg.) 55, 63-88(1842).

It is reported that, when $\text{Ba}(\text{BrO}_3)_2$ was added to an aq. soln. of UO_2SO_4 and the yellow filtrate evapd. over H_2SO_4 , a powdery yellow salt was isolated which contained $\text{UO}_2(\text{BrO}_3)_2$ and H_2O .

- 110 Rammelsberg, C. "On the Atomic Weight of Uranium and the Composition of Its Oxides and Salts." Ann. Physik Chem. (Pogg.) 55, 318-28(1842).

This paper contains a discussion of the prepn. of U_3N_4 which was first obtained by passing NH_3 over UCl_4 at red heat. When UCl_4 is heated in H_2 or NH_3 gas, it goes over to a brownish lower chloride which is probably UCl_3 . When it is placed in a stream of NH_3 at ordinary temp. heat is given off and part of the gas is absorbed without visible change in the UCl_4 . UCl_3 can be prepd. by heating UCl_4 in a stream of NH_3 . The existence of $\text{U}^{+4,+6}$ hydroxide ($\text{U}_3\text{O}_8 \cdot x\text{H}_2\text{O}$) is reported in this paper. It is said to be violet. Proof of compn. is not given.

- 111 Rammelsberg, C. "On the Atomic Weight of Uranium and the Composition of Its Oxides and Salts." Ann. Physik Chem. (Pogg.) 56, 125-34(1842).

The prepn. and properties of a cpd. identified as $\text{U}(\text{SO}_4)_2 \cdot 8\text{H}_2\text{O}$ are given. The prepn. method used was to dissolve UO_2 in concd. H_2SO_4 and evap. or to evap. a soln. of UCl_4 which had been treated with H_2SO_4 . Dark-green 8-sided prisms were obtained. It is reported that $\text{U}(\text{SO}_4)_2$ is a member of the rhombic crystal system. This is based on early measurements but was corrected by later experimenters. It is reported that, when $\text{UOSO}_4 \cdot 3\text{H}_2\text{O}$ is obtained by treating $\text{U}(\text{SO}_4)_2 \cdot x\text{H}_2\text{O}$ with a large amt. of cold water, the resultant product is not a dihydrate as reported by other authors but rather a trihydrate. It is also reported that $\text{UOSO}_4 \cdot 2\text{H}_2\text{O}$ can be obtained by the addn. of NH_3 to an acid soln. of the $\text{U}(\text{SO}_4)_2$; excess alk. is said to cause pptn. of $\text{UO}_2 \cdot 2\text{H}_2\text{O}$. It is said that UOSO_4 in either of its hydrated forms is easily sol. in acid.

- 112 Wöhler, F. "The Preparation of Uranium." Ann. 41, 345(1842).

When a soln. of $(\text{NH}_4)_2\text{UO}_4$ in HCl is treated with excess NH_4Cl , evapd. to dryness and fused, the leaching of the melt with water will leave a residue of black cryst. UO_2 .

PUBLICATIONS LOCATED IN 1843

- 113 Berthier, P. "On Several Separations Using Sulfurous Acid or Alkaline Sulfites." Ann. chim. phys. (3), 7, 74-87(1843).

This paper reports that uranyl sulfite can be prepd. by introducing SO_2 into a soln. of $(\text{NH}_4)_2\text{UO}_4$. The cpd. will crystallize in a mixt. which contains basic uranyl sulfite. It is reported that a soln. of $(\text{NH}_4)_2\text{UO}_2(\text{CO}_3)_2$ in aq. SO_2 prepd. in the cold will produce a yellow granular ppt. of basic uranyl sulfite when boiled.

- 114 Berthier, P. "On Several Separations Using Sulfurous Acid or Alkaline Sulfites." Ann. 46, 182-95(1843).

This paper contains information similar to that reported in Ann. chim. phys. (3), 7, 74-87(1843).

- 115 Berthier, P. "On Several Separations Using Sulfurous Acid or Alkaline Sulfites." J. prakt. Chem. (1), 29, 68-79(1843).

This paper contains information similar to that reported in Ann. chim. phys. (3), 7, 74-87(1843).

- 116 Bonaparte, L. L. "Note on Valeric Acid, the Valerates, Quinine Lactate, and Several Other New Salts of That Base." J. prakt. Chem. (1), 30, 302-12(1843).

This paper contains a discussion of the reduction of valeric acid in the presence of uranyl salts and light.

- 117 Ebelmen, J. J. "Note on the Chemical Composition of Pitchblende." Ann. chim. phys. (3), 5, 498-503(1843).

- 118 Ebelmen, J. J. "Note on the Chemical Composition of Pitchblende." Ann. mines (France) (4), 4, 397-404(1843).

The analysis for U is discussed.

- 119 Ebelmen, J. J. "Note on the Chemical Composition of Pitchblende." J. prakt. Chem. 30, 414-21(1843).

The analysis for U is discussed.

- 120 Malaguti, F. J. "On the Preparation of Uranium Peroxide." Ann. chim. phys. (3), 9, 463-5 (1843).

$\text{UO}_3 \cdot \text{H}_2\text{O}$ is reported to be an orange-yellow apparently amorph. powder which possibly is of rhombic crystals. The d. of the amorph. material at 15° is 5.926. This paper reports the oldest method of prepg. $\text{UO}_4 \cdot \text{H}_2\text{O}$, based on the decompn. of uranyl nitrate followed by digestion of the residue with H_2O . The soln. of $\text{UO}_2(\text{NO}_3)_2$ is evapd. off below boiling. This gives rise to a violent reaction in some cases.

- 121 Malaguti, F. J. "On the Preparation of Uranium Peroxide." Compt. rend. 16, 851-3(1843). This paper contains information similar to that reported in Ann. chim. phys. (3), 9, 463-5(1843).

- 122 Malaguti, F. J. "On the Preparation of Uranium Peroxide." J. prakt. Chem. (1), 29, 231-4(1843). This paper contains information similar to that reported in Ann. chim. phys. (3), 9, 463-5(1843).

- 123 Rammelsberg, C. "On the Atomic Weight of Uranium and the Composition of Its Oxides and Salts." Ann. 48, 234-7(1843).

- 124 Rammelsberg, C. "On the Atomic Weight of Uranium and the Composition of Its Oxides and Salts." J. prakt. Chem. (1), 29, 234-8(1843).

- 125 Rammelsberg, C. "On the Atomic Weight of Uranium and the Composition of Its Oxides and Salts." Ber. preuss. Akad. Wiss. 79-83(1843).

- 126 Rammelsberg, C. "Investigation of Uranium Pitchblende." Ann. Physik Chem. (Pogg.) 59, 35-6(1843).

The analysis for U is discussed.

- 127 Rammelsberg, C. "On the Uranous Salts, Including Remarks on the Atomic Weight of Uranium." Ann. Physik Chem. (Pogg.) 59, 1-34(1843).

This is a comprehensive article on uranous cpds., and should be consulted for early study on these materials. A large number of cpds. are considered. The colors of many, particularly halides, are reported. The uranous cpds. of a number of common org. acids are prepd. and described.

- 128 Wertheim, I. "On Uranium and Some of Its Double Acetates." J. prakt. chem. (1), 29, 209-31 (1843).

It is reported that $\text{UO}_2(\text{OAc})_2 \cdot 3\text{H}_2\text{O}$ crystallizes below 10° from moderately concd. aq. soln. The material is said to lose 1 mole of H_2O upon heating to 100° and to become anhyd. and yellowish-red, as opposed to the clear yellow of the hydrated material, when heated to 275° . $\text{NH}_4\text{UO}_2(\text{OAc})_3 \cdot 3\text{H}_2\text{O}$ can be obtained from heated solns. of $\text{UO}_2(\text{OAc})_2$ with $(\text{NH}_4)_2\text{CO}_3$ and dissolving the ppt. in HOAc or from solns. of the individual acetates. Heating is said to yield the water-free salt. This is the first report of the prepn. of $\text{Na}(\text{CH}_3\text{CO}_2) \cdot \text{UO}_2(\text{CH}_3\text{CO}_2)_2$ or $\text{NaUO}_2(\text{CH}_3\text{CO}_2)_3$. $\text{KUO}_2(\text{CH}_3\text{CO}_2)_3 \cdot \text{H}_2\text{O}$ is obtained by treating a soln. of $\text{UO}_2(\text{OAc})_2$ with K_2CO_3 in a small excess of HOAc. It is in the form of yellow

tetragonal prisms with an axial ratio $a:c = 1:1.2832$. When $K_2U_2O_7$ is reduced in H_2 , the material becomes violet-black but shows no change in cryst. form. It will decomp. when ignited with oxalic acid in the absence of air. When oxalic acid is not present the ignition of the hydrated $K_2U_2O_7$ will produce the anhyd. salt. $MgUO_2(OAc)_4 \cdot 7H_2O$ is reported to be an octahydrate. The material is formed from $UO_2(OAc)_2$ in the presence of $MgCO_3$ upon the addn. of $HOAc$. It is reported that the heating of magnesium uranyl acetate leaves a yellow-brown residue of magnesium uranate for which no formula is given. Ca uranyl acetate is reported to exist in an analogous series with the alk. and alk. earth uranyl acetates. $Zn(UO_2)_2(OAc)_6 \cdot 3H_2O$ exists in the form of pale-yellow crystals. The prepn. of $ZnUO_2(OAc)_4$ by pptn. is reported. Sr uranyl acetate is an analog in the alk. and alk. earth uranyl acetate series. It is formed as nontransparent crystals. $Ba(UO_2)_2(CH_3CO_2)_6 \cdot 6(3)H_2O$ can be obtained from $UO_2(OAc)_2$ by the addn. of $BaCO_3$ and $HOAc$. It is formed as shiny yellow platelets. When $BaO \cdot 2UO_3$ is prepd. from uranyl acetate with $Ba(OH)_2$, a carbonate-free product is obtained. $PbO \cdot 2UO_3$ can be prepd. from solns. of $UO_2(NO_3)_2$ and $Pb(NO_3)_2$ by pptn. with NH_3 . $PbUO_2(CH_3CO_2)_4 \cdot 6H_2O$ is obtained from $HOAc$ soln. of the monohydrate as a pale-yellow needlelike material group in clusters.

- 129 Wertheim, I. "On Uranium and Some of Its Double Acetates." Ber. Vers. deut. Naturf. Aerzte 193-6(1843).

This paper contains information similar to that reported in J. prakt. Chem. (1), 29, 209-31(1843).

PUBLICATIONS LOCATED IN 1844

- 130 Bottinger, H. "On the von Berthier Method of Using Sulfurous Acid in Chemical Analysis." Ann. 51, 397-413(1844).

The sepn. of U is mentioned on p. 407.

- 131 Muspratt, J. S. "On the Sulfurous Acid Salts." Ann. 50, 259-92(1844).

On p. 290 it is reported that $UO_2SO_3 \cdot 4H_2O$ will decomp. upon heating, giving off SO_2 . This paper also reports the prepn. of UO_2SO_3 by mixing of $UO_2(NO_3)_2$ and $(NH_4)_2SO_3$ solns. It also reports that UO_2SO_3 is normally obtained with 3 moles of water as $UO_2SO_3 \cdot 3H_2O$.

- 132 Péligot, E. "Research on Uranium." Ann. chim. phys. (3), 12, 549-74(1844).

It is reported that $UO_2(C_4H_4O_6) \cdot H_2O$ or $H_2[UO_3(C_4H_4O_6)]$ can be obtained by drying the higher hydrated material at 150° or in vacuum. It is also said to deposit from warm aq. soln. of uranic and tartaric acid in the form of yellow crystals and to be stable up to 200° . The tetrahydrate is also reported to be in the form of yellow crystals and to deposit at ordinary temp. from an aq. soln. of uranic and tartaric acid. This paper reports attempts to confirm information reported by Berzelius on acid uranyl sulfates. No confirmation was reported. The only uranyl acid sulfate reported in the older literature was found to be $UO_2SO_4 \cdot H_2SO_4$. It is very deliq., anhyd., and prepd. from warm concd. H_2SO_4 soln. of UO_2SO_4 . When a hot aq. soln. of $UO_2(NO_3)_2$ and potassium antimonyl tartrate is cooled slowly, bundles of silky crystals of the double tartrate, $(SbO)_2[UO_2(C_4H_4O_6)_2] \cdot 9H_2O$, are deposited. Seven of the 9 moles of H_2O are lost in vacuum and the last 2 moles at 200° . U_3O_8 can be prepd. from uranyl nitrate by carefully drying the nitrate over an open flame and heating the pulverized residue in an oil bath to 250° until acid vapors are no longer evolved. The trihydrate of uranyl sulfate is properly identified in this paper as having 3 moles rather than 3.5 moles of H_2O . This is a correction to information presented by Bucholz and Ebelmen. It is reported that no acid salts are formed by the evapn. of a HNO_3 soln. of $UO_2(NO_3)_2$.

- 133 Péligot, E. "Research on Uranium." Compt. rend. 18, 682-7(1844).

- 134 Wertheim, I. "On Uranium and Some of Its Double Acetates." Ann. chim. phys. (3), 11, 49-71 (1844).

This paper contains information similar to that reported in J. prakt. chem. (1), 29, 209-31(1843).

PUBLICATIONS LOCATED IN 1845

- 135 Péligré, E. "Research on Uranium." J. prakt. Chem. (1), 35, 146-64(1845).
The information contd. in this paper is similar to that reported in Ann. chim. phys. (3), 12, 549-74(1844).
- 136 Rammelsberg, C. "On the Atomic Weight of Uranium and the Composition of Its Oxides and Salts." J. pharm. chim. (3), 8, 479(1845).
- 137 Rammelsberg, C. "On the Atomic Weight of Uranium and the Composition of Its Oxides and Salts." Ann. Physik Chem. (Pogg.) 66, 91-5(1845).
- 138 Wöhler, F. "Purification of Uranium Oxide from Nickel, Cobalt, and Zinc." Ann. 56, 127(1845).

PUBLICATIONS LOCATED IN 1846

- 139 Faraday, M. "Experimental Researches in Electricity. Twentieth and Twenty-First Series. 27. On New Magnetic Actions, and on the Magnetic Condition of All Matter." Trans. Roy. Soc. (London) 41-62(1846).
U is reported to be slightly paramagnetic.

140 Péligré, E. "On the Atomic Weight of Uranium." Compt. rend. 22, 487-94(1846).
Method of determination and results are given.

141 Péligré, E. "On the Atomic Weight of Uranium." J. pharm. chim. (3), 10, 80(1846).

142 Péligré, E. "On the Atomic Weight of Uranium." J. prakt. Chem. (1), 38, 153-9(1846).

PUBLICATIONS LOCATED IN 1847

143 Arppe, A. E. De acido pyrotartarico. Inaugural Dissertation, Univ. of Helsingfors, 1847. 94p.
U tartrate is mentioned.

144 Engelhardt, H. and Maddrell, R. "On Lactic Acid and Its Salts." Ann. 63, 83-120(1847).
U lactate is mentioned on p. 99.

145 Faraday, M. "Experimental Researches in Electricity. Twentieth and Twenty-First Series. 27. On New Magnetic Actions, and on the Magnetic Condition of All Matter." Ann. Physik Chem. (Pogg.) 70, 24-59(1847).

This paper is similar to that published in Trans. Roy. Soc. (London) 41-62(1846).

146 Le Conte, J. L. "On Coracite, a New Ore of Uranium." Am. J. Sci. (2), 3, 173-5(1847).

147 Péligré, E. "On the Atomic Weight of Uranium." Ann. chim. phys. (3), 20, 329-44(1847).
The method of detn. and results are given.

148 Péligré, E. "On the Atomic Weight of Uranium." J. prakt. Chem. (1), 41, 398-410(1847).

149 Persoz, J. "Note on the Double Pyrophosphates." Ann. chim. phys. (3), 20, 315-29(1847). The gummy substance obtained upon deviation from the accepted concn. of sodium pyrophosphate and uranyl pyrophosphate in the prepn. of $\text{Na}_2\text{UO}_2\text{P}_2\text{O}_7 \cdot \text{H}_2\text{O}$ will not produce a ppt. with H_2S or $(\text{NH}_4)_2\text{S}$.

150 Scheerer, T. "Investigation of Some Minerals Containing Metal Acids Which Resemble Tantallic Acid." Ann. Physik Chem. (Pogg.) 72, 561-71(1847).
A method of analyzing for U is included.

PUBLICATIONS LOCATED IN 1848

151 Arppe, A. E. "On Pyrotartaric Acid." Ann. 66, 73-80(1848).
U pyrotartrate is mentioned.

152 Haidinger, W. "Proposal of an Investigation in the Work of H. Patera on Uranium." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse 628-9(1848).

153 Persoz, J. "Note on the Double Pyrophosphates." Ann. 65, 163-77(1848).
U pyrophosphate is discussed.

154 Playfair, L. and Joule, J. P. "Researches on Atomic Volume and Specific Gravity. Ser. 2. On the Relation of Volumes between Simple Bodies, Their Oxides and Sulphurets, and on Differences Exhibited by Polymorphous and Allotropic Substances." Mem. Proc. Chem. Soc. 3, 57-103(1848).

Values for the sp. gr. and at. vol. of U oxides are given.

155 Rose, H. "On the Application of Ammonium Chloride in Analytical Chemistry." Ann. Physik Chem. (Pogg.) 74, 562-80(1848).

It is reported that $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ can be converted to U_3O_8 by ignition with NH_4Cl .

156 Smith, J. L. "Two New Minerals, Medjidite (Sulphate of Uranium and Lime), Liebigite (Carbonate of Uranium and Lime)." Am. J. Sci. (2), 5, 336-8(1848).

157 Werther, G. "On the Compounds of Phosphoric Acid and Arsenic Acid with Uranium Oxide. Investigation of Chalcolith and Uranite. Proposal of a New Determination Method for Arsenic Acid." J. prakt. Chem. (1), 43, 321-49(1848).

A sodium uranyl phosphate was obtained when excess Na_3PO_4 soln. was added to a $\text{UO}_2(\text{NO}_3)_2$ soln. When M quantities were used, however, only uranyl phosphate was obtained. It is stated that sodium uranyl arsenate can be obtained by mixing solns. of $\text{UO}_2(\text{NO}_3)_2$ and sodium arsenate. $\text{UO}_2\text{HAsO}_4 \cdot 4\text{H}_2\text{O}$ is obtained when H_3AsO_4 is added to a cold soln. of uranyl acetate or to a boiling soln. of $\text{UO}_2(\text{NO}_3)_2$ dild. with H_2O . The uranyl arsenate is insol. in H_2O and HOAc and will lose all its water of hydration upon heating to 120° at which point it starts to decomp. leaving a green residue and evolving thick white vapors. $\text{UO}_2\text{H}_4(\text{AsO}_4)_2 \cdot 3\text{H}_2\text{O}$ can be obtained by evapg. a soln. of arsenic acid with U oxide, $\text{UO}_2(\text{NO}_3)_2$ or $\text{UO}_2(\text{OAc})_2$ and allowing the product to stand over H_2SO_4 . The trihydrate appears as groups of small yellow crystals which lose their water of hydration at 150° giving a white sublimate of As_2O_3 at bright-red heat. Yellow microcryst. $\text{UO}_2\text{HPO}_4 \cdot 4\text{H}_2\text{O}$ is obtained when $\text{UO}_2(\text{OAc})_2$ is treated with H_3PO_4 . When a HNO_3 soln. of NaH_2PO_4 was treated with $\text{UO}_2(\text{NO}_3)_2$, the resulting sulfur-yellow cpd. of uranyl hydrogen phosphate is reported to be of nonuniform compn. A bright-yellow amorph. cpd. of approx. $\text{UO}_2\text{HPO}_4 \cdot 1\frac{1}{2}\text{H}_2\text{O}$ is obtained upon treatment of UO_3 with dilute H_3PO_4 . This material will become dark yellow upon heating but will regain its original color when cooled. It is insol. in water and HOAc but sol. in mineral acids and excess $(\text{NH}_4)_2\text{CO}_3$ solns. The prepn. of crystals of the compn. $\text{UO}_2\text{H}_4(\text{PO}_4)_2 \cdot 3\text{H}_2\text{O}$ is also reported. These are obtained by heating small amt. of H_3PO_4 with UO_3 to b. and allowing

to stand over H_2SO_4 . Part of the H_2O in this material is lost upon heating, and a lusterless light-yellow powder is obtained. At red heat the crystals puff up and lose the rest of their H_2O but do not m. or give off H_3PO_4 . Alk. soln. does not affect the material but alk. fusion will decomp. it. It is reduced to UO_2 when fused with carbonized potassium sodium tartrate.

- 158 Werther, G. "On the Compounds of Phosphoric Acid and Arsenic Acid with Uranium Oxide. Investigation of Chalcolith and Uranite. Proposal of a New Determination Method for Arsenic Acid." J. pharm. chim. (3), 14, 57-63(1848).

This paper contains information similar to that reported in J. prakt. Chem. (1), 43, 321-49(1848).

- 159 Werther, G. "On the Compounds of Phosphoric Acid and Arsenic Acid with Uranium Oxide. Investigation of Chalcolith and Uranite. Proposal of a New Determination Method for Arsenic Acid." Ber. preuss. Akad. Wiss. 230-3(1848).

This paper contains information similar to that reported in J. prakt. Chem. (1), 43, 321-49(1848).

PUBLICATIONS LOCATED IN 1849

- 160 Leconte, C. "Research on the Qualitative and Quantitative Analysis of Phosphoric Acid." Compt. rend. 29, 55-6(1849).

The use of alk. phosphate to ppt. U from soln. is said to produce unreliable results because of the inclusion of alk. in the ppt.

- 161 Patera, A. "On a New Production Method for Pure Uranium Compounds in Bulk." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse 353-7(1849).

162 Patera, A. "Red Uranium Compounds." Ber. Mitt. Freund. Naturw. Wien 5, 45-50(1849). It is reported that ammonium uranium red can be obtained as a blood-red ppt. from uranyl soln. when they are treated with $(\text{NH}_4)_2\text{S}$, and the reaction mixt. allowed to stand in the presence of air for from one to two days. It is reported that the substance can be dissolved in acids, evolving H_2S and free S. The NH_3 can be displaced by other bases upon boiling with alk. or alk. earth hydroxide. Sodium uranium red can be pptd. from uranyl soln. using H_2S and NaOH ; no further investigation was made. The potassium uranium red is obtained from ammonium uranium red by boiling with KOH soln.

PUBLICATIONS LOCATED IN 1850

- 163 Muspratt, J. S. "On the Salts of Selenious Acid." J. Chem. Soc. 72, 52-70(1850). U selenites are among those discussed.

- 164 Patera, A. "Red Uranium Compounds." J. prakt. Chem. (1), 51, 122-7(1850). This paper contains information similar to that reported in Ber. Mitt. Freund. Naturw. Wien 5, 45-50(1849).

PUBLICATION LOCATED IN 1851

- 165 Smith, J. L. "Liebigite." Am. J. Sci. (2), 11, 259(1851).

PUBLICATIONS LOCATED IN 1852

166 Girard, A. "On the Compounds of Uranium Sesquioxide with Acids." Ann. 81, 366-8(1852). Aq. SO_2 solns. have no effect on $\text{UO}_3 \cdot \text{H}_2\text{O}$; however, gaseous SO_2 will convert an aq. suspension of $\text{UO}_3 \cdot \text{H}_2\text{O}$ to $\text{UO}_2\text{SO}_3 \cdot \text{H}_2\text{O}$. It is reported that $\text{UO}_2\text{SO}_3 \cdot 4\text{H}_2\text{O}$ is formed as a yellow ppt. which is stable in air and consists of small prismatic crystals. $(\text{UO}_2)_2\text{P}_2\text{O}_7 \cdot 5\text{H}_2\text{O}$ is obtained when the calcd. quantity $\text{Na}_4\text{P}_2\text{O}_7$ is added to a $\text{UO}_2(\text{NO}_3)_2$ soln. The pentahydrate is obtained as a voluminous yellow ppt. which eventually crystallizes, especially if warmed. The material is insol. in water, alc., and ether, but sol. in excess ppt. and HNO_3 . The crystals are reported to effloresce in air and become pale yellow. Heating of this material at 100° will yield the amorph. pyrophosphate.

167 Girard, A. "On the Compounds of Uranium Sesquioxide with Acids." Compt. rend. 34, 22-4 (1852).

This paper contains information similar to that reported in Ann. 81, 366-8(1852).

168 Girard, A. "On the Compounds of Uranium Sesquioxide with Acids." J. pharm. chim. (3), 21, 183-5(1852).

This paper contains information similar to that reported in Ann. 81, 366-8(1852).

169 Girard, A. "On the Compounds of Uranium Sesquioxide with Acids." J. prakt. Chem. (1), 55, 285-7(1852).

This paper contains information similar to that reported in Ann. 81, 366-8(1852).

170 Stokes, G. G. "On the Change of Refrangibility of Light." Trans. Roy. Soc. (London) 142, 463-562(1852).

Discussions are included on the phosphorescence of numerous uranyl compounds as solids and in solution.

PUBLICATIONS LOCATED IN 1853

171 Leconte, C. De l'emploi de l'azotate d'uranium dans la recherche et le dosage de l'acide phosphorique et des phosphates. Thesis, Univ. of Paris, 1853. (No. 96)

172 Leconte, C. "Summary of Experiments on Uranium Nitrate." Compt. rend. soc. biol. 5, 171-3(1853).

This paper reports early clinical studies on the effects of U nitrate on animals.

173 Stokes, G. G. "On the Change of Refrangibility of Light." Trans. Roy. Soc. (London) 143, 385-96(1853).

Discussions are included on the phosphorescence of numerous uranyl compounds.

174 Vogl, J. F. "Three New Mineral Discoveries in Joachimsthal." Jahrb. geol. Reich. 4, 220-3 (1853).

175 von Hauer, K. "Chemical Investigations of Uranium Ores from Pribram in Bohemia." Jahrb. geol. Reich. 4, 105-09(1853).

176 von Hauer, K. "Some Observations on the Preparation of Urano-Uranic Oxide." Jahrb. geol. Reich. 4, 557-9(1853).

PUBLICATIONS LOCATED IN 1854

- 177 Dauber, H. "Investigation of the Minerals in the Collection of Dr. Kranz in Bonn." Ann. Physik Chem. (Pogg.) 92, 237-51(1854).

Basic U sulfate crystals were examined.

- 178 Patera, A. "On the Industrial Production of Uranium Yellow." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse 11, 842-4(1854).

The formula $\text{Na}_2\text{O} \cdot 2\text{UO}_3 \cdot 6\text{H}_2\text{O}$ is proposed for the light-yellow commercial sodium uranate pptd. from solns. of sodium uranyl carbonate with H_2SO_4 .

- 179 Patera, A. "On the Industrial Production of Uranium Yellow." J. prakt. Chem. (1), 61, 397-8(1854).

- 180 Stokes, G. G. "On the Change in Refrangibility of Light." Ann. Physik Chem. (Pogg.) 4 (Erganizungsbd.), 177-345(1854).

Discussions are included on the phosphorescence of numerous uranyl cpds.

- 181 von Hauer, K. "Chemical Investigation of Uranium Ores from Pribram in Bohemia." J. prakt. Chem. (1), 61, 391-7(1854).

The results of analysis of U ores are given.

PUBLICATIONS LOCATED IN 1855

- 182 Marbach, H. "Discovery of the Existence of Rotatory Power in Many Crystalline Compounds in the Cubic or Regular System." Compt. rend. 40, 793-800(1855).

Sodium uranyl acetate was examined and a 4° rotation found.

- 183 Marbach, H. "Discovery of the Existence of Rotatory Power in Many Crystalline Compounds in the Cubic or Regular System." Ann. chim. phys. (3), 44, 41-50(1855).

This paper contains information similar to that reported in Compt. rend. 40, 793-800(1855).

- 184 Marbach, H. "On the Optical Properties of Some Crystals in the Isometric System." Ann. Physik Chem. (Pogg.) 94, 412-26(1855).

This paper contains information similar to that reported in Compt. rend. 40, 793-800(1855).

- 185 Schabus, J. Bestimmung der Krystallgestalten. Wien. 1855.

Page 40 reports that $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ exhibits a light-greenish-yellow or deep-yellow fluorescence. A discussion of the crystal structure of the cpd. is included.

- 186 Werther, G. "Contribution to the Knowledge of Fluorescent Substances." J. prakt. Chem. (1), 65, 349-51(1855).

Discussions are included on the phosphorescence of numerous uranyl cpds.

- 187 Williams, C. G. "Note on the Double Salts Formed by the Chlorides of Cadmium, Bismuth, and Uranium with the Organic Alkaloids." Chem. Gaz. 13, 450-1(1855).

PUBLICATIONS LOCATED IN 1856

- 188 Arendt, R. and Knop, W. "On the Determination of Phosphoric Acid in the Presence of Iron." Chem. Centr. 27, 803-04(1856).

The use of U salts in H_3PO_4 detn. is discussed.

- 189 Keferstein, W. "On the Crystal Form of Some Chemical Compounds." Ann. Physik Chem. (Pogg.) 99, 275-99(1856).

$(\text{NH}_4)_4\text{UO}_2(\text{CO}_3)_3$ appears upon pptn. in the form of yellow transparent crystals which are monoclinic and prismatic. An axial ratio is given. The crystal form of other U carbonates is also discussed.

- 190 Knop, W. "New Method for the Analysis of Phosphoric Acid." J. prakt. Chem. (1), 69, 401-15 (1856).

The use of U in the estimation of H_3PO_4 is discussed.

- 191 Knop, W. "New Method of Phosphoric Acid Determination." Chem. Centr. 27, 769-79(1856).

When uranyl salts are present, sodium phosphate ppts. yellow-white UO_2HPO_4 ; in the presence of NH_4OAc , $\text{UO}_2\text{NH}_4\text{PO}_4$ is pptd. Both ppts. are insol. in HOAc .

- 192 Pélégot, E. "Note on the Preparation of Uranium." Compt. rend. 42, 73-4(1856).

This paper contains a discussion of expts. in which UCl_4 was reduced to metallic uranium using the alk. metals, K and Na. Al was also used successfully. The d. of U was detd. to be 18.4. It is reported that when K is substituted for the Na and the reaction carried out in a Pt crucible, the resulting U will be contaminated with Pt.

- 193 Pélégot, E. "Note on the Preparation of Uranium." J. pharm. chim. (3), 29, 203-05(1856).

- 194 Scheibler, C. "Contribution to Knowledge of the Lithium Salts." J. prakt. Chem. (1), 67, 485-9(1856).

Large crystals of $\text{LiUO}_2(\text{CH}_3\text{CO}_2)_3 \cdot 3\text{H}_2\text{O}$ are first reported in this paper. They were prepd. from solns. of stoichiometric quantities of the simple acetates.

- 195 Williams, C. G. "Researches on Quinoline and Its Homologues." J. prakt. Chem. (1), 69, 355(1856).

Quinolinium uranyl chloride, $2\text{C}_9\text{H}_8\text{NCl} \cdot \text{UO}_2\text{Cl}_2$, can be prepd. from dil. solns. of ammonium uranyl chloride and quinoline chloride. The product is obtained as yellow prisms.

PUBLICATIONS LOCATED IN 1857

- 196 Arendt, R. and Knop, W. "On the Determination of Phosphoric Acid Using Uranium Oxide." Chem. Centr. 28, 177-85(1857).

It is reported that, when iron phosphate is boiled with UCl_4 in very dil. solns., a bluish-green flocculent ppt. of U^{+4} phosphate is obtained. This ppt. does not have a const. compn. and is insol. in HCl .

- 197 Arendt, R. and Knop, W. "On the Determination of Phosphoric Acid Using Uranium Oxide." J. prakt. Chem. (1), 70, 385-97(1857).

- 198 Arendt, R. and Knop, W. "On the Properties of Some Uranium Salts." Chem. Centr. 28, 162-6 (1857).

Various oxides (with and without NH_3) and chloride soln. are discussed. UCl_4 solns. can be obtained by boiling the HCl soln. of $(\text{NH}_4)_2\text{UO}_2(\text{CO}_3)_2$ with an excess of Cu turnings and Pt chloride. When the soln. is dild. and cooled, most of the Cu present is pptd. as copper chloride. The rest is removed with H_2S and the latter driven off by vigorous boiling. In order to eliminate NH_4Cl , the U is pptd. from the soln. as $\text{U}(\text{OH})_4$ and this is then dissolved in HCl to form the soln. of UCl_4 . It is reported that, when UCl_4

soln. is added dropwise to boiling water, a black ppt. of $\text{U}(\text{OH})_4$ is formed and copious fumes of HCl are emitted. The soln. is said to be stable in air at ordinary temps. and to be a very good reducing agent.

199 Arendt, R. and Knop, W. "On the Properties of Some Uranium Salts." J. prakt. Chem. (1), 71, 68-73(1857).

200 Descloizeaux, A. "Memorandum on the Use of Optical Bifringement Properties for the Identification and Classification of Mineral Crystals." Compt. rend. 44, 322-5(1857).
Autunite and chalcilite are among the minerals examined.

201 Genth, F. A. "Contribution on Mineralogy." Am. J. Sci. (2), 23, 415-27(1857).
An analysis of a U ore is reported on p. 421.

202 Grailich, J. and von Lang, V. "Investigations on the Physical Properties of Crystalline Substances." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse 27, 3-77(1857).
Cadmium uranyl acetate supposed by these investigators to be $\text{CdUO}_2(\text{CH}_3\text{CO}_2)_4 \cdot 5\text{H}_2\text{O}$, exists as yellow crystals in the form of rhombohedral pyramids giving negative double refraction and a great dispersion of green fluorescence. The crystal structure and fluorescence of zinc uranyl acetate is discussed. $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ is reported to exhibit pos. double refraction.

203 Kessler, L. "Procedure for the Preparation and Analysis of Uranium Oxide." J. pharm. chim. (3), 31, 182-3(1857).
The extraction of U from uraninite is described.

204 Niépce de Saint-Victor, A. "Memorandum on a New Action of Light." Compt. rend. 45, 811-15 (1857).
Photographic color of yellow-green is reported when U oxide is used on paper.

205 Rammelsberg, C. Die neusten Forschungen in der krystallographischen Chemie. Leipzig, 1857.
Page 58 of this book contains a discussion of the crystal structure of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$.

206 von Lang, V., Handl, A., and Murmann, A. "Crystallographic Investigations." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse 27, 171-81(1857).
It is reported that crystals of lithium uranyl acetate trihydrate have an axial ratio of $a:b:c = 1.2647:1:1.5849$ with $\beta = 99^\circ 53'$, and no obvious cleavage plane.

PUBLICATIONS LOCATED IN 1858

207 Arendt, R. and Knop, W. "On the Analysis of Phosphoric Acid Using Uranium Oxide." J. pharm. chim. (3), 33, 158(1858).

208 Descloizeaux, A. "Memorandum on the Use of Optical Bifringement Properties for the Identification and Classification of Mineral Properties." Ann. mines (France) (5), 14, 339-420 (1858).
 $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ is reported to exhibit positive double refraction.

209 Genth, F. A. "Contribution on Mineralogy." J. prakt. Chem. (1), 73, 203-09(1858).
An analysis of a U-bearing ore is given.

210 Gladstone, J. H. "On the Use of the Prism in Qualitative Analysis." J. Chem. Soc. 10, 79-92 (1858).
Research on the absorption spectra of U^{+4} salts is reported.

- 211 Grailich, J. Krystallographisch-Optische Untersuchungen. Wien, Olmuz, 1858.
Page 151 contains crystallographic data on sodium uranyl acetate.
- 212 Hallwachs, W. and Schafarik, A. "On Compounds of Earth Metals with Organic Radicals." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse **33**, 569-71(1858).
The action of U salts on EtI is discussed.
- 213 Kessler, L. "Process for the Preparation and Analyses of Uranium Oxide." Compt. rend. **46**, 530-1(1858).
The extraction of U from pitchblende and various other common analytical procedures are noted.
- 214 Niépce de Saint-Victor, A. "Memorandum on a New Action of Light." J. prakt. Chem. **74**, 233-44(1858).
The absorption of light and use of U in photography are discussed.
- 215 Niépce de Saint-Victor, A. "Second Memorandum on a New Action of Light." Compt. rend. **46**, 448-52(1858).
The absorption of light and use of U in photography are discussed.
- 216 Niépce de Saint-Victor, A. "Second Memorandum on a New Action of Light." Compt. rend. **46**, 489-91(1858).
The influence of light on photographic paper impregnated with U nitrate is described.
- 217 Niépce de Saint-Victor, A. "Third Memorandum on an Action of Light Unknown until Now." Compt. rend. **47**, 866-9(1858).
The absorption of light and use of U in photography are discussed.
- 218 Niépce de Saint-Victor, A. "Fourth Memorandum on an Action of Light Unknown until Now." Compt. rend. **47**, 1002-06(1858).
The absorption of light and use of U in photography are discussed.
- 219 Ordway, J. M. "Examination of the Soluble Basic Sesquisalts." Am. J. Sci. (2), **26**, 197-209 (1858).
It is reported that NH_3 in a UO_2Cl_2 soln. will prod. a ppt. which dissolves again until half the acid is neutralized. When UO_2SO_4 soln. is treated with NH_3 the ppt. also dissolves until half the acid is neutralized. Excess BaCO_3 will remove two-thirds of the acid in a cold soln. of the sulfate. This paper reports that a basic salt is pptd. when a large amt. of HN_3 is added to an aq. soln. of $\text{UO}_2(\text{NO}_3)_2$.
- 220 von Lang, V. "Investigations on the Physical Structure of Crystalline Materials." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse **31**, 85-130(1858).
The formula for magnesium uranyl acetate is reported as $\text{Mg}(\text{UO}_2)_2(\text{CH}_3\text{CO}_2)_6 \cdot 12\text{H}_2\text{O}$. The previously reported heptahydrate is said to be an octahydrate. The material is formed from $\text{UO}_2(\text{OAc})_2$ in the presence of magnesium carbonate upon the addn. of HOAc . The existence of cadmium uranyl acetate with 5 moles of H_2O is reported. $\text{Ca}(\text{UO}_2)_2(\text{CH}_3\text{CO}_2)_6 \cdot x\text{H}_2\text{O}$ is reported to crystallize as bipyramidal rhomboids having many facets. No distinct cleavage planes are reported and pos. double refraction was noted. A greenish-blue fluorescence was found. The refractive indices for $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ are reported to be: $n_\beta = 1.4950$ (red); $n_\beta = 1.4967$ (yellow); $n_\beta = 1.4991$ (green); $n_\beta = 1.5023$ (blue).
- 221 von Lang, V. and Grailich, W. J. "Investigations on the Physical Structure of Crystalline Materials." Sitzber. Akad. Wiss. Wien, Math.-naturw. **32**, 3-77(1858).
This paper contains a discussion of the magnetic prop. of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$. It is reported to be weakly diamagnetic and the magnetic props. are said to be strongest in the direction of the a axis and weakest parallel to the b axis.

- 222 Weselsky, P. "Contribution to the Knowledge of Double Uranium Acetates." J. prakt. Chem. (1), 75, 55-62(1858).

It is reported that $\text{Zn}(\text{UO}_2)_2(\text{CH}_3\text{CO}_2)_6 \cdot 7\text{H}_2\text{O}$ can be prepd. in aq. soln. from the monoacetate and crystallized from HOAc soln. $\text{Mg}(\text{UO}_2)_2(\text{CH}_3\text{CO}_2)_6 \cdot 12\text{H}_2\text{O}$ can be obtained from equiv. amt. of the monoacetate between 0 and 18° and crystd. from HOAc. $\text{Sr}(\text{UO}_2)_2(\text{CH}_3\text{CO}_2)_6 \cdot 6\text{H}_2\text{O}$ is formed from soln. of the corresponding amt. of the monoacetates and crystn. of the ppt. is obtained from HOAc. Color and prop. are similar to the calcium salts. $\text{Ca}(\text{UO}_2)_2(\text{CH}_3\text{CO}_2)_6 \cdot 6(8)\text{H}_2\text{O}$ is said to be prepd. from the formula amt. of the monoacetate crystd. from HOAc as a sulfur-yellow, air-stable material. The existence of cadmium uranyl acetate with 5 moles of H_2O is reported.

- 223 Weselsky, P. "Contribution to the Knowledge of Double Uranium Acetates." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse 30, 205-11(1858).

This paper contains information similar to that reported in J. prakt. Chem. (1), 75, 55-62(1858).

PUBLICATIONS LOCATED IN 1859

- 224 Becquerel, E. "Studies on Luminous Effects Caused by the Action of Light on Substances. I." Ann. chim. phys. (3), 55, 5-119(1859).

The phosphorescence of uranyl salts is discussed; see following paper for continuation.

- 225 Becquerel, E. "Studies on Luminous Effects Caused by the Action of Light on Substances. II." Ann. chim. phys. (3), 56, 99-102(1859).

This is a continuation of the previous paper.

- 226 Becquerel, E. "Studies on Luminous Effects Caused by the Action of Light on Substances. III." Ann. chim. phys. (3), 57, 40-124(1859).

This is a continuation of the previous paper. It includes data on the characteristics of the fluorescence spectrum of uranyl compounds.

- 227 Becquerel, E. "Studies on Luminous Effects Caused by the Action of Light on Substances. IV." Ann. chim. phys. (3), 62, 5-100(1859).

This is a continuation of the previous paper.

- 228 Hallwachs, W. and Schafarik, A. "On the Compounds of Earth Metals and Organic Radicals." Ann. 109, 206-09(1859).

A brief discussion of substituted uranyl chlorides and U oxides is included.

- 229 Hermann, R. "On the Composition of a Group of Uranium Silicate Minerals." J. prakt. Chem. (1), 76, 320-9(1859).

- 230 Hermann, R. "On the Composition of a Group of Uranium Silicate Minerals." Bull. soc. imp. naturalistes Moscou (2), 32, 107-20(1859).

- 231 Hittorf, W. "On the Migration of Ions during Electrolysis." Ann. Physik Chem. (Pogg.) 106, 337-411(1859).

It is reported that UO_2Cl_2 will conduct electricity in the fused state. Also, that electrolysis of UO_2Cl_2 solutions causes the decompn. of the material and the formation of UO_2 and chlorine. See next paper for continuation.

- 232 Hittorf, W. "On the Migration of Ions during Electrolysis." Ann. Physik Chem. (Pogg.) 106, 513-86(1859).

This is a continuation of the previous article.

- 233 Niépce de Saint-Victor, A. and Corvisart, L. "Of Vegetable and Animal Starch with Respect to the Transforming Influence Which Sunlight Exercises upon It; of Dextrine, of Cane Sugar, of Oxalic Acid with Respect to the Same; of Several Substances Which Destroy or Increase This Solar Action." Compt. rend. 49, 368-71(1859).

This paper contains a discussion of the decompn. of oxalic acid in the presence of uranyl salts when exposed to light. This is strictly a photochem. reaction as it does not appear to take place at higher temps. in the dark. Uranyl oxalate is discussed briefly.

- 234 Ordway, J. M. "Examination of the Soluble Basic Sesquisalts." J. prakt. Chem. (1), 76, 19-23(1859).

Information on basic U salts is included.

- 235 Ordway, J. M. "Some Facts Respecting the Nitrates." Am. J. Sci. (2), 14-19(1859).

This paper reports the m. p. of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ as 59° and its b. p. as 118° . Heating effects in general are also discussed.

- 236 Pincus, (Dr.)—. "Volumetric Determination of Phosphoric Acid Using Uranium Acetate." J. prakt. Chem. (1), 76, 104-13(1859).

- 237 Pincus, (Dr.)—. "Volumetric Determination of Phosphoric Acid Using Uranium Acetate." Arch. path. Anat. Physiol. klin. Med. 16, 137-46(1859).

- 238 Uhrlaub, E. Ueber die Verbindungen einiger Metalle mit Stickstoff. Dissertation, Univ. of Göttingen, 1859.

The method described by Wöhler for prepg. UO_2 using NH_4UO_4 and NH_4Cl is said to yield an oxynitride of U rather than UO_2 . Expts. on the method fail to confirm the results. UCl_2 prepd. by heating UCl_4 in a stream of NH_3 contains N_2 as well as Cl_2 . The prepn. and compn. of U_3N_4 by passing NH_3 over UCl_4 at red heat is reported. When a U soln. contg. HCl and NH_4Cl and NaCl is evapd. to dryness, the residue heated until the NaCl melts, and the entire mass extd. with water, one can obtain a gray iridescent cryst. powder, corresponding approx. to the formula $\text{U}_3\text{N}_4 \cdot \text{UO}_2 \cdot 2\text{U}_3\text{O}_8$.

- 239 Weselsky, P. "Contribution to the Knowledge of Double Uranium Acetates." J. pharm. chim. (3), 35, 147(1859).

This paper contains information similar to that reported in J. prakt. Chem. (1), 75, 55-62(1858).

PUBLICATIONS LOCATED IN 1860

- 240 Anthon, E. F. "On the Combined Uranium-Sodium Carbonates." Polytech. J. (Dingler) 156, 288-9(1860).

It is reported that sodium uranyl carbonate is obtained when pitchblende is treated with aqua regia, the soln. evapd. to dryness, the residue leached with water, and then treated with Na_2CO_3 . The material crystd. as a yellow powder. When the crystals are heated above 400° , they turn brick-red and lose CO_2 ; they are difficultly sol. in water and the d. of a satd. soln. at 15° is reported to be 1.161. Pure ammonium uranyl carbonate can be obtained from commercial potassium uranyl carbonate by converting the material to the nitrate and then pptg. with excess NH_4OH , NH_3 , and CO_2 .

- 241 Anthon, E. F. "On Uranium Oxide and Its Industrial Preparation." Polytech. J. (Dingler) 156, 207-12(1860).

- 242 Boedeker, C. Die Beziehungen zwischen Dichte und Zusammensetzung. Leipzig, 1860. It is indicated on p. 8 that the density of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ at 13° is 2.807 and on p. 9 that the d. of sodium uranyl acetate is 2.55.
- 243 Burnett, C. J. "On Uranium." J. Phot. Soc. (London) 6, 134-5(1860).
- 244 Hermann, R. "On the Composition of a Group of Uranium Silicate Minerals." Arch. wiss. Kunde Russ. 19, 265-77(1860).
- 245 Niépce de Saint-Victor, A. and Corvisart, L. "Of Vegetable and Animal Starch with Respect to the Transforming Influence Which Sunlight Exercises upon It; of Dextrine, of Cane Sugar, of Oxalic Acid with Respect to the Same; of Several Substances Which Destroy or Increase This Action." Ann. 113, 112-15(1860).
This paper contains information similar to that reported in Compt. rend. 49, 368-71(1859).
- 246 Rose, H. "Analytical Chemistry Contribution. On the Determination of the Amount of Metal in Sulfur Compounds." Ann. Physik Chem. (Pogg.) 110, 120-42(1860).
The estn. of U is discussed.
- 247 Schrauf, A. "Determination of the Optical Constants of Crystalline Compounds." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse 41, 769-806(1860).
The crystal structure of hydrated uranyl ammonium acetate is reported to be the same as that of the anhyd. salt.
- 248 Sutton, F. "On the Estimation of Phosphoric Acid in Manures, Coprolites, Bone-Ash, and Similar Commercial Substances." Chem. News 1, 97-8(1860).
The H_3PO_4 present is ested. using U salts.
- 249 Sutton, F. "On the Estimation of Phosphoric Acid in Manures, Coprolites, Bone-Ash, and Similar Commercial Substances." Chem. News 1, 122-3(1860).
The H_3PO_4 present is analyzed using U salts.
- 250 Vysocky, A. "On Uranium, Uranium Containing Metal and Uranium Yellow." Ziva 8, 25-30(1860).

PUBLICATIONS LOCATED IN 1861

- 251 Debray, H. "Memorandum on the Preparation of Certain Crystalline Phosphates and Arsenates." Ann. chim. phys. (3), 61, 419-55(1861).
 $\text{CaUO}_2\text{H}_2(\text{PO}_4)_2 \cdot 4\text{H}_2\text{O}$ can be obtained in the form of lemon-yellow crystals by mixing concd. calcium hydrogen phosphate soln. with excess $\text{UO}_2(\text{NO}_3)_2$ soln. at 50 to 60° . When heated to 100° it becomes the trihydrate, and when heated to 250° in a closed tube the dihydrate is obtained.
- 252 Drenckmann, B. "On the Chemical Nature of Uranium and Some of Its New Compounds." Z. ges. Naturw. 17, 113-53(1861).
 $\text{UO}_3 \cdot 2\text{H}_2\text{O}$ has been prepd. by heating a finely powd. mixt. of U_3O_8 with excess KClO_3 in a Pt crucible and repeatedly leaching the melt with water. When $\text{UO}_3 \cdot 2\text{H}_2\text{O}$ is heated for two or three hrs in dry air at 80° , it goes to the monohydrate; however, the reaction will not go in stagnant air under 160° . The prepn. and properties of a material which is said to be U_2O_5 is discussed in this paper. The attempts to prep. UO_4 by strong oxidation of acid, neutral or alk. soln. of uranic acids, and uranates are reported. All these attempts were unsuccessful. It is also reported that, when a soln. of ammonium uranyl carbonate is heated, a yellow flocculent ppt. is obtained which is probably a mixture of uranyl carbonate,

UO₃, and uranate. No acid salts are formed by the evapn. of HNO₃ soln. of UO₂(NO₃)₂. It is reported that UO₂(NO₃)₂·6H₂O can be prepd. by the soln. of U oxides in HNO₃. When the soln. is evapd., crystals will be deposited which can be recrystd. from water. Uranyl nitrate is said to cryst. out of strong nitric acid in the form of elongated prisms which often contain some of the mother liquor. Attempts to prep. the uranyl hydrosulfate in uniform product were unsuccessful. It is reported that K₂SO₄·UO₂SO₄·2H₂O is obtained from strong H₂SO₄ soln. of the component sulfates. Na₂UO₄ is prepd. by the fusion of amorph. Na₂O·2UO₃ with excess NaCl in order to yield a black powd. oxide and a residue contg. 6-sided micro. yellow flakes of the uranate. When a mixt. of uranyl sulfate and excess NaCl is placed in a Pt crucible covered with a layer of NaCl and heated with a blast lamp until most of the NaCl has volatilized, a sodium triuranate, Na₂O·3UO₃, is obtained. Bronze-colored micalike flakes having a golden sheen are obtained from the cooled melt after extn. with H₂O. Drying of these flakes at 120° will completely free them of H₂O. They have the appearance of rhombic tablets and a d. of 6.9123. They are not affected by moderate heating, turn silvery gray when heated to white heat losing 2.6% of the oxygen but with no change in cryst. structure. They are insol. in water but easily sol. in dil. acids. When KCl is mixed with uranyl sulfate contg. excess H₂SO₄ and the mixt. covered with KCl and heated over a blast lamp until fumes of KCl are evolved, the melt cooled, boiled with H₂O and the residue dried in vacuum, a fine yellow powder of K₂O·6UO₃·6H₂O is obtained. It is very hygr. and becomes anhyd. at 300 to 400°, turning brick red. It will turn silver gray losing oxygen when ignited at white heat.

- 253 Fresenius, C. R. "On the Introduction of Free Ammonia and Ammonium Salts in the Precipitation of Nickel, Cobalt, Zinc, Manganese, Iron and Uranium with Ammonium Sulfide." J. prakt. Chem. (1), 82, 257-75(1861).

The estn. of U is discussed.

- 254 Hermann, H. Concerning Several Uranium Compounds. Dissertation, Univ. of Göttingen, 1861. Igniting UO₂ in the presence of CS₂ (gas) produces UO₂·US₂. A mixt. of CO₂ and CS₂, however, has no effect on UO₂ under the same conditions. UO₃ reacts with a gaseous mixt. of CO₂ and CS₂ at red heat and will form UO₂. Freshly prepd. UO₂·US₂ can be obtained by igniting U₃O₈, UO₃, or (NH₄)₂UO₄ in CS₂ vapor. It is reported that both Cl₂ and fuming HNO₃ will decomp. this cpd. with the evolution of heat and light. Freshly prepd. chlorine water will oxidize it slowly. It is said to dissolve easily in concd. HCl. Very pure UO₂, in cryst. form, can be obtained by heating five parts of Na₂UO₄ with 20 parts of anhyd. MgCl₂ in a covered crucible. Brilliant black cubes are obtained which can be isolated easily because of their great d. and their stability in the presence of dil. acid. It is also reported that UO₂ can be obtained by ignition of U₃O₈ or Na₂UO₄ with S or NH₄Cl followed by H₂O leaching. UO₂S₂ can be pptd. from uranyl salt soln. with (NH₄)₂S. UCl₄ will react with H₂S at red heat forming US₂ and evolving HCl. UCl₄ vapor does not attack Al even at red heat. Ammonium uranium red can be obtained as a blood-red ppt. from uranyl salt solns. when they are treated with (NH₄)₂S, and the reaction mixt. allowed to stand in the presence of air for one to two days. When Br₂ vapor is led over a glowing mixt. of UO₂ and C, UBr₄ is obtained. In this paper the prepn. consists in mixing 5 to 6 g of cryst. UO₂ with 30 to 36 g of starch and igniting. Place the material in a porcelain tube and expose it to the action of a stream of CO₂ contg. Br₂. The brown powd. mass which condenses in the cooler parts of the tubes shows a definite cryst. character. It apparently consists of small needles. UBr₄ fumes in air and deliq. very quickly to a dark-green liq. UO₂Br₂ was observed as a by-product in the prepn. of UBr₄. U(OH)₄ will dissolve in aq. HI and give a green soln. This dissertation outlines the first prepn. of UF₄; however, the formula is incorrectly reported as UF₆. UF₄ is reported to be attacked slowly by dil. acids and dissolved with difficulty by concd. acids. It is also reported that UF₄ does not lose all of the water which may be present until it has reached approx. 200°.

- 255 Kunheim, H. On the Action of Water Vapor on Metal Chlorides at High Temperature. Dissertation, Univ. of Göttingen, 1861.

When UCl₄ is ignited in the presence of water vapor U₃O₈ is obtained.

- 256 Pisani, F. "Analysis of Uranite from Autun and of Chalcocite from Cornwall." Compt. rend. 52, 817-19(1861).
- 257 Pisani, F. "Note on the Determination of Uranium and Phosphoric Acid." Chem. News 3, 211-12(1861).
- 258 Pisani, F. "Note on the Determination of Uranium and of Phosphoric Acid." Compt. rend. 52, 72-3(1861).
- The use of alk. phosphate to ppt. U from soln. is said to produce unreliable results because of the inclusion of alk. in the ppt.
- 259 Pisani, F. "Note on Several Reactions of the Salts of Iron, Uranium and Aluminum. Separation of Uranium and Iron." Chem. News 3, 257(1861).
- 260 Pisani, F. "Note on Several Reactions of the Salts of Iron, Uranium and Aluminum. Separation of Uranium and Iron." Compt. rend. 52, 106-37(1861).
- A method is given for the sepn. of Fe from U in soln. using $(\text{NH}_4)_2\text{CO}_3$. The Fe is pptd. completely only when some $(\text{NH}_4)_2\text{S}$ is added. U can be pptd. from the filtrate using the std. NH_3 method. A sharp sepn. is claimed.
- 261 Schrauf, A. "Determination of the Optical Constants of Crystalline Compounds. Ann. Physik Chem. (Pogg.) 112, 588-95(1861).
- An optical examination of U acetate is reported on p. 593.

PUBLICATIONS LOCATED IN 1862

- 262 Parkman, T. "On the Carbonates of Alumina, Glucina, and the Sesquioxides of Iron, Chromium, and Uranium." Am. J. Sci. (2), 34, 320-30(1862).
- Upon mixing soln. of Na_2CO_3 and $\text{UO}_2(\text{NO}_3)_2$, a vigorous reaction was obtained and the product was reported to be a mixt. of sodium uranate and uranyl carbonate. However, later work indicates that this is probably a mixed uranium carbonate-hydroxide.
- 263 Rose, H. "On the Quantitative Determination of Uranium Oxide." Ann. Physik Chem. (Pogg.) 116, 352-4(1862).
- This paper contains a discussion of the NH_3 method for pptg. U as the uranate and igniting it to U_3O_8 . The $(\text{NH}_4)_2\text{S}$ pptn. in which carbonate-free $(\text{NH}_4)_2\text{S}$ is used in place of ordinary NH_4OH is also discussed. This method is illustrated for the sepn. of U from other elements of the $(\text{NH}_4)_2\text{S}$ group; however, in this case large excesses of $(\text{NH}_4)_2\text{CO}_3$ are used. U is said to remain in soln.
- 264 Rose, H. "On the Quantitative Determination of Uranium Oxide." Z. anal. Chem. 1, 411-13 (1862).
- 265 Seekamp, W. "On the Decomposition of Oxalic Acid by Sunlight." Ann. 122, 113-18(1862).
- It is reported that $\text{U}(\text{C}_2\text{O}_4)_2 \cdot 6\text{H}_2\text{O}$ is formed by the reduction of $\text{UO}_2(\text{NO}_3)_2$ soln. by oxalic acid with prolonged exposure to sunlight. $\text{U}(\text{C}_2\text{O}_4)_2 \cdot 6\text{H}_2\text{O}$ is reported to be insol. in water and dil. acids and to be decompd. by alk. A discussion of the photolysis of org. acids in uranyl salt soln. is included.

PUBLICATIONS LOCATED IN 1863

- 266 Guyard, A. "On the Direct Estimation of Manganese, Antimony, and Uranium, by the Volumetric Method; and on Some Compounds of the Three Metals." Chem. News 8, 292-3(1863).
- 267 Guyard, A. "Of the Direct Determination of Manganese, of Antimony and of Uranium by the Volumetric Method and of Some Compounds of These Metals." Bull. soc. chim. France (2), 1, 89-95(1863).

The sepn. of Mn and U may be carried out by pptn. of Mn in a weak sulfuric acid soln. using KMnO_4 . The U will remain in soln.

- 268 Parkman, T. "On the Carbonates of Alumina, Glucina, and the Sesquioxides of Iron, Chromium, and Uranium." Chem. News 7, 112-15, 122-3(1863).
- 269 Stokes, G. G. "On the Long Spectrum of Electric Light." Chem. News 7, 147-9(1863). Discussions are included on the phosphorescence of numerous uranyl compounds.

PUBLICATIONS LOCATED IN 1864

- 270 Gibbs, W. "Communication on Chemistry from the Laboratory of the Lawrence Scientific School. V. On the Quantitative Separation of Cerium from Yttrium, Aluminium, Glucinum, Manganese, Iron, and Uranium." Z. anal. Chem. 3, 397-8(1864).
- 271 Gibbs, W. "Communication on Chemistry from the Laboratory of the Lawrence Scientific School. V. Separation of Uranium from Zinc, Cobalt, and Nickel." Z. anal. Chem. 3, 334(1864).
- A brief note indicates that the use of a method similar to that used for Mn sepn. is successful.
- 272 Gibbs, W. "On the Quantitative Separation of Cerium from Yttrium, Aluminium, Glucinum, Manganese, Iron, and Uranium." Am. J. Sci. (2), 37, 354-4(1864).
- 273 Grothe, H. "On Behavior of Metal Oxide Solutions Toward Alkalis in the Presence of Non-volatile Organic Substances and on the Detection of Metal Oxides in Such Solutions." J. prakt. Chem. (1), 92, 175-90(1864).

Page 177 contains information on the action of alk. on U ions.

- 274 Guyard, A. "Of the Direct Determination of Manganese, Antimony and Uranium by the Volumetric Method and of Several Compounds of These Metals." Chem. News 9, 13-14(1864).

This paper contains a discussion of the analysis for U using the manganous phosphate pptn. The reaction is said to be complete when the bright ppt. becomes rose-colored.

- 275 Guyard, A. "Of the Direct Determination of Manganese, Antimony and Uranium by the Volumetric Method and of Several Compounds of These Metals." Bull. soc. chim. France (2), 1, 89-96(1864).

Some investigations on the hydroxides of U are reported. These hydroxides are identified as the di- and trivalent hydroxides, but probably are actually tetravalent materials.

- 276 Guyard, A. "Of the Direct Determination of Manganese, Antimony and Uranium by the Volumetric Method and of Several Compounds of These Metals." J. pharm. chim. (3), 45, 409-12(1864).

- 277 Phipson, T. L. "On Magnesium." Proc. Roy. Soc. (London) **13**, 217-18(1864).
The action of Mg on soln. contg. U is briefly discussed.
- 278 Remelé, A. "Research on the Sulfur Compounds of Uranium." Compt. rend. **58**, 716-19(1864).
- 279 Remelé, A. "Research on the Sulfur Compounds of Uranium." Mon. sci. Docteur Quesneville **6**, 469-74(1864).
- 280 Remelé, A. "Research on the Sulfur Compounds of Uranium." J. prakt. Chem. (1), **93**, 316-18(1864).
- 281 Remelé, A. "On Uranium Oxysulfide, $\text{U}_2\text{O}_2\text{S}$, and Its Decomposition Product." Ber. Vers. deut. Naturf. Aerzte **39**, 96-8(1864).
- 282 Remele, A. "On Uranium Red." Mondes **6**, 459-60(1864).
- 283 Stolba, F. "On Analysis of Alkali Uranates." Z. anal. Chem. **3**, 71-6(1864).
In the sepn. of U from alk., the residue contg. the U and alk. uranium salts from the evapd. soln. is dissolved in 5% fluorosilic acid and the soln. combined with 3 or 4 times its vol. of alc. in which the uranium silicofluoride is sol. but in which the alk. salts are not. This soln. of uranyl silicofluoride must not be exposed to a direct light or the U will ppt. When $(\text{NH}_4)_2\text{U}_2\text{O}_7$ is heated with NH_4Cl , part of the U present subl. as UCl_4 . When an excess of NaOH is added to UO_2SO_4 soln. during the pptn. of sodium pentaauranate, the product obtained is light yellow and has the compn. $\text{Na}_2\text{O} \cdot 5\text{UO}_3 \cdot 12\text{H}_2\text{O}$ when dried in air, as opposed to the pentahydrate obtained using a neutral soln. It is reported that an orange-yellow ppt. of $\text{Na}_2\text{O} \cdot 2\text{UO}_3$ is obtained by treating UO_2SO_4 with excess NaOH . After drying in air this material has the compn. $\text{Na}_2\text{O} \cdot 2\text{UO}_3 \cdot 6\text{H}_2\text{O}$. Ignition of this hexahydrate produces the anhyd. salt. $\text{K}_2\text{U}_2\text{O}_7$ can be pptd. from uranyl salt soln. with excess KOH . This orange-yellow ppt. when dried in air is reported to have the compn. $\text{K}_2\text{O} \cdot 2\text{UO}_3 \cdot 6\text{H}_2\text{O}$.

PUBLICATIONS LOCATED IN 1865

- 284 Breithaupt, A. "Mineralogical Studies. 1. Fauserite. 2. Fritzscheit and Uranite in General." Berg-hüttenmänn. Ztg. **24**, 301-03(1865).
- 285 Church, A. H. "Revision of the Mineral Phosphates." Chem. News **12**, 183(1865).
The analysis of some minerals containing U is included.
- 286 Gibbs, W. "Separation of Uranium from Zinc, Cobalt, and Nickel." Am. J. Sci. (2), **39**, 64(1865).
- 287 Gore, G. "On the Properties of Liquified Hydrochloric Acid Gas." Phil. Mag. (4), **29**, 541-50(1865).
It is reported that UO_3 is colored a bright yellow when heated in gaseous HCl but will not dissolve upon standing for several days in liq. HCl . The residue is sol. in H_2O .
- 288 Knop, W. "Method for the Purification of Uranium Oxide." Chem. Centr. **10**, 161-4(1865).
- 289 Remelé, A. "On the Determination and Separation of Uranium Oxide with the Application of Ammonium Sulfide." Z. anal. Chem. **4**, 371-86(1865).
This paper contains a discussion of work on the NH_4^+ pptn. of U and the detection and detn. of U by this method. In the sepn. of U from alk. earths and alk., the NH_4Cl soln. is carefully mixed with carbonate-free $(\text{NH}_4)_2\text{S}$ or NH_4OH and allowed to stand overnight without contact with air. The ppt. is washed with dil. pptg. media and repptd.

- 290 Remelé, A. "Research on the Sulfur Compounds of Uranium." Ann. Physik Chem. (Pogg.) **124**, 114-62(1865).

This paper reports the detailed investigation of the easily decompd. UO_2S which can be pptd. from aq. or alc. soln. of uranyl salt using $(\text{NH}_4)_2\text{S}$. The pptn. beaker must be kept at the b.p. of water until the soln. is clear. The same results are obtained by using NH_4OH . It is reported that barium uranyl sulfide can be obtained from an alc. soln. of $\text{UO}_2(\text{NO}_3)_2$ by the addn. of a barium sulfide soln. It also can be obtained from a soln. of uranium oxysulfide in excess upon the addn. of $(\text{NH}_4)_2\text{S}$ with $\text{Ba}(\text{NO}_3)_2$. In the former method a brown ppt. is obtained and the latter shows a green material. Some question is formed re the actual existence of the cpd. earlier reported as U_2O_5 . A description is included of the phys. appearance of U_3O_8 . It is described as dark green to olive green or black. The color is influenced by the d. and ignition temp.

- 291 Remelé, A. "Research on the Sulfur Compounds of Uranium." Ann. Physik Chem. (Pogg.) **125**, 209-46(1865).

U red consists of a mixt. of uranyl hydroxide with a red modification of UO_2S . It is reported that ammonium U red can be obtained as a blood-red ppt. from uranyl salt soln. when it is treated with $(\text{NH}_4)_2\text{S}$ and the reaction mixt. allowed to stand in the presence of air for from one to two days. It is also reported that UO_2SO_3 is normally obtained contg. 2 moles of H_2O . This result is in disagreement with earlier reports by Muspratt. UO_2SO_3 is prepd. by mixing uranyl nitrate with ammonium sulfite. The sulfite prepd. in this way is always contaminated with ammonium uranate.

- 292 Seekamp, W. "On the Decomposition of Succinic Acid and Pyrotartaric Acid in Sunlight." Ann. **133**, 253-5(1865).

The action of light on U succinate is discussed. It is reported that, when uranyl salts are mixed with succinic acid and the mixt. exposed to light, propionic acid and CO_2 result.

- 293 von Hauer, K. "Note on the Crystal Form of Sodium Uranium Acetates." Ann. Physik Chem. (Pogg.) **125**, 149-50(1865).

Sodium uranyl acetate exists as yellow crystals with a greenish fluorescence. The crystals are cubic, principally tetrahedra and pentagon-dodecahedra often twinned. According to this author, rhombic dodecahedra often occur.

PUBLICATIONS LOCATED IN 1866

- 294 Belohoubek, A. "Volumetric Determination of Uranium Using Potassium Permanganate." J. prakt. Chem. (1), **99**, 231-5(1866).

The U-contg. soln. in H_2SO_4 is heated with Zn to reduce the U to U^{+4} . A definite time is required for this reduction as a change of color is no criterion of complete reaction. KMnO_4 is then used as the titrant to oxidize the U^{+4} to U^{+6} again.

- 295 Bolton, H. C. On the Fluorine Compounds of Uranium. Dissertation, Univ. of Göttingen, 1866. U_3O_8 will react with aq. HF to form the insol. UF_4 and the sol. UO_2F_2 . An earlier indication that the formula of the material was UF_6 is corrected. UF_4 is reported to be a green hydr. powder contg. no moisture at 100° . When heated strongly in air, the material is said to go to U_3O_8 without melting and, when heated in dry H_2 , it will decomp. to a reddish-brown mass giving off HF. This residue is insol. in H_2O and attacked only very slightly by acids with the exception of concd. HNO_3 . It is also reported that boiling NaOH will cause decompn. into insol. $\text{U}(\text{OH})_4$ and sol. NaF. When an aq. soln. of UO_2F_2 is heated with tin and HCl, UF_4 is obtained. It is reported that the α and β (cryst. and amorph.) modifications of UO_2F_2 show the same chem. properties. UO_2F_2 cannot be completely freed from water and the yellow soln. of UO_2F_2 which is produced along with UF_4 when U_3O_8 is treated with HF cannot be made

to cryst. UO_2F_2 can be obtained from alc. soln. as a transparent yellow amorph., very deliq. mass. $\text{K}_3\text{UO}_2\text{F}_5$ can be obtained as a lemon-yellow cryst. ppt. by treating a soln. of $\text{UO}_2(\text{NO}_3)_2$ with a slight excess of pure KF, washing with cold water and recrystg. from hot water. It is also stated that it can be obtained by crystg. a K_2UO_4 soln. in HF which has been treated with KF or by adding KF to a soln. of UO_2F_2 . No success was obtained in attempting to prep. the material in the dry way by melting potassium uranyl sulfate with NaF and Na_2SO_4 as a flux. Crystals of $\text{K}_3\text{UO}_2\text{F}_5$ occur in two modifications: the first monoclinic and the second tetragonal. Crystal measurements were made on both forms. Upon heating, this cpd. will decomp. into K_2UO_4 , UF_4 , UO_2 , KF, and other materials. When fused with Na_2CO_3 , it will decomp. to the uranate and NaF. It is completely decompd. when warmed with concd. H_2SO_4 . 12.5 parts salt is said to be sol. in 100 parts water at 21° . The aq. soln. turns litmus red, is not decompd. by boiling or by the addn. of Na_2CO_3 or NH_4CO_3 . NH_3 , BaCl_2 , $\text{Ba}(\text{OAc})_2$, and CaCl_2 yield ppts. Oxalic and formic acids in direct sunlight cause reduction to green KUF_5 which is said to be insol. in alc. and ether and can be pptd. from aq. soln. in finely divided form by the addn. of alc. It is insol. in water and dil. acids and difficultly sol. in boiling HCl. When dissolved in H_2SO_4 , it is decompd. by NH_3 with the deposition of $\text{U}(\text{OH})_4$. The material will liquefy in air giving off HF (the air must be moist) leaving a residue of K_2UO_4 . When the material is heated in a closed tube, the residue consists of UO_2 in which KF is suspended. Treatment with dry H_2 reduces the material only slowly. UO_2 is obtained when the material is fused with NaOH. $(\text{NH}_4)_3\text{UO}_2\text{F}_5$ can be obtained by dissolving $(\text{NH}_4)_2\text{UO}_4$ in HF and evapg. the soln. over H_2SO_4 . Yellowish, clear cryst. masses are obtained. $\text{Ba}_3(\text{UO}_2)_2\text{F}_{10} \cdot 2\text{H}_2\text{O}$, is obtained as a ppt. from pure potassium uranyl fluoride soln. when treated with BaCl_2 . The ppt. is a voluminous lemon-yellow which gradually yields cryst. powder when dried at about 100° . It decomp. upon heating in a closed tube without melting, first losing its water of hydration. Sodium uranium fluoride is prepd. in a manner analogous to the K salt; it shows almost the same properties, and is said to lose F_2 upon heating in air going over to $\text{Na}_2\text{U}_2\text{O}_7$ without melting. It is sol. in water forming a green soln. The formula $\text{NaF} \cdot \text{UF}_4$ is proposed. It occasionally crystallizes out when a mixt. of $\text{UO}_2(\text{NO}_3)_2$ and NaF or a soln. of Na_2UO_4 in HF is evapd. over H_2SO_4 . Fairly large tubular crystals are obtained. The material is said to melt upon heating forming Na_2UO_4 and when recrystd. will lose water going over into nonefflorescent cryst. with the compn. $\text{NaUO}_2\text{F}_3 \cdot 2\text{H}_2\text{O}$.

- 296 Bolton, H. C. "On the Fluorine Compounds of Uranium." Bull. soc. chim. France (2), 6, 450-2(1866).

This paper contains a condensation of the dissertation written at the University of Göttingen in 1866.

- 297 Bolton, H. C. "On the Knowledge of Fluorine Compounds of Uranium." J. prakt. Chem. (1), 99, 269-74(1866).

This paper is a condensation of the dissertation written at the University of Göttingen in 1866.

- 298 Bolton, H. C. "On the Knowledge of Fluorine Compounds of Uranium." Monatsber. preuss. Akad. Wiss. 299-305(1866).

This paper is a condensation of the dissertation written at the University of Göttingen in 1866.

- 299 Bolton, H. C. "On the Knowledge of Fluorine Compounds of Uranium." Z. Chem. 9, 353-6(1866).

This paper is a condensation of the dissertation written at the University of Göttingen in 1866.

- 300 Bunsen, R. W. "Flame Reactions." Phil. Mag. (4), 32, 81-107(1866).
Information on the flame reactions of U is included.

- 301 Bunsen, R. W. "Flame Reactions." Ann. 138, 257-96(1866).
Information on the flame reactions of U is included.

- 302 Commaille, A. "On the Action of Magnesium on Metal Salts in Neutral Solution." Compt. rend. 63, 556-9(1866).

The action of Mg on solutions containing U is described.

- 303 Commaille, A. "On the Action of Magnesium on Metal Salts in Neutral Solution." Bull. soc. chim. France (2), 6, 257-62(1866).

The action of Mg on solutions containing U is described.

- 304 Elsner, L. "On the Sublimation of Some Compounds at White Heat." J. prakt. Chem. (1), 99, 257-61(1866).

This paper states that yellow U oxide is volatile at approx. 2500 to 3000°. This statement probably refers to a decompn. product of UO_3 rather than to UO_3 itself.

- 305 Fresenius, R. H. "II. Chemical Analysis of Inorganic Compounds." Z. anal. chem. 5, 351-406(1866).

A short section on the flame reactions for U compounds is included.

- 306 Frisch, K. "On the Basicity of Tartaric Acid." J. prakt. Chem. (1), 97, 278-89(1866).

U tartrate is mentioned.

- 307 Gibbs, W. "Separation of Uranium from Zinc, Cobalt, and Nickel." Rev. universelle mines 19, 212(1866).

- 308 Oeffinger, H. Ueber die Lichtabsorption der Uransalze. Dissertation, Univ. of Tübingen, 1866. Research on the absorption spectra of U^{+4} is reported. Information also is included on the absorption spectra of uranyl salt solutions.

- 309 Remelé, A. "Research on the Sulfur Compounds of Uranium." J. prakt. Chem. (1), 97, 193-216(1866).

This paper contains information similar to that reported in 1865.

PUBLICATIONS LOCATED IN 1867

- 310 Becquerel, E. La Lumière, ses Causes et ses Effets. Paris, 1867.

It is indicated (p. 38) that crystals of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ show a light-greenish-yellow triboluminescence.

- 311 Merz, G. "A Communication on Experimental Chemistry." J. prakt. Chem. (1), 101, 261-73 (1867).

The fluorescence of U compounds is discussed briefly.

- 312 Pinner, A. De uranylio cyanato et rhodanato. Dissertation, Univ. of Berlin, 1867.

The yellow ppt. produced in uranyl salt soln. by KCN contains no cyanide. Uranyl thiocyanate can be prepd. by dissolving uranyl hydroxide in HCNS. $8\text{KCNS} \cdot 3\text{UO}_2(\text{CNS})_2$ can be obtained by mixing alc. solns. of KCNS and $\text{UO}_2(\text{NO}_3)_2$. The resulting double thiocyanate is stable. $(\text{NH}_4)_2\text{UO}_2(\text{CNS})_4$ can be obtained from a mixt. of uranyl nitrate and NH_4CNS in alc. The material is reported to form deliq. crystals.

- 313 Rabuteau, A. Éléments de Toxicologie et de Médecine Légale. (2nd ed.) Paris, 1867.

It is reported on p. 849 that U in the body is excreted in the bile.

- 314 Rammelsberg, C. "On the Phosphorous Acid Salts." Ann. Physik Chem. (Pogg.) 132, 481-516 (1867).

$(\text{UO}_2)_3\text{H}_2(\text{HPO}_3)_4 \cdot 12\text{H}_2\text{O}$ is obtained as a yellow ppt. by adding freshly pptd. ammonium uranate to a soln. of PCl_3 . Upon drying in air hard translucent pieces are obtained. The salt will lose part of its water content when stored over H_2SO_4 and give off its water slowly upon heating. At about 300° it will lose all water of hydration forming the anhyd. salt which is green.

- 315 Scheller, L. "On Some Double Salts of Uranium Sulfite." Ann. 144, 238-41(1867).
Using a soln. of potassium hydrosulfite and uranic acid in the presence of excess SO_2 , the cpd. $\text{KUO}_2(\text{OH})\text{SO}_3 \cdot x\text{H}_2\text{O} \cdot 2\text{UO}_3 \cdot 2\text{SO}_2 \cdot (x+1)\text{H}_2\text{O}$ was obtained. (The same method was used later by Kohlshutter to obtain the material $\text{K}_2\text{O} \cdot 2\text{UO}_3 \cdot 3\text{SO}_4$.) It is claimed that $\text{NaUO}_2(\text{OH})\text{SO}_3 \cdot x\text{H}_2\text{O}$ was prepd. in the same manner and that the hard lumps which were formed after drying in vacuum were cryst. Later experimentation could not confirm these results. An attempt to duplicate the method for the prepn. of ammonium uranyl sulfite reported in this paper was also unsuccessful.
- 316 Scheller, L. "On Some Double Salts of Uranium Sulfite." Z. Chem. 3, 522(1867)
- 317 Skey, W. "On the Production of Some New Metallic Sulphocyanides, and the Separation of Certain Bases from Each Other by the Method Therein Employed." Chem. News 16, 201(1867).
Uranyl thiocyanate can be obtained by adding KCNS to an ethereal soln. of UO_2Cl_2 .
- 318 Souchy, A. "Analysis of Precipitate Which is Formed by Boiling Uranyl Salts in a Supersaturated Solution of Ammonium Carbonate." Z. anal. Chem. 6, 400-03(1867).
The composition of ammoniacal uranyl carbonate is reported.

PUBLICATIONS LOCATED IN 1868

- 319 Pélilot, E. "On the Preparation of Uranium." Compt. rend. 67, 507-08(1868).
- 320 Thalén, R. "On the Determination of the Wavelength of Metallic Rays." Nova Acta Regiae Soc. Sci. Upsaliensis (3), 6, no. 9(1868).
Early expts. on the detn. of the spark spectrum of U are reported.

PUBLICATIONS LOCATED IN 1869

- 321 Bolton, H. C. "On the Action of Light on Uranium." Am. J. Sci. (2), 48, 206-14(1869).
It is reported that UO_2SO_4 is not reduced when mixed with glycerine and exposed to light. This paper also summarizes information on the photochem. of U.
- 322 Gore, G. "On Hydrofluoric Acid." J. Chem. Soc. 7, 368-406(1869).
 UF_4 is reported to dissolve in anhyd. HF simultaneously reacting with it. The reaction product, however, is not identified. It is reported that U oxide (UO_3 ?) is sol. in pure and anhyd. HF.
- 323 Heintz, W. "Note on the Repreparation of Uranyl Nitrates from Phosphoric Acid Salts and on Uranyl Nitrate Phosphates." Ann. 151, 216-22(1869).
This paper contains a discussion of previous work on the sepn. of U from P using tin. It gives some refinements of the earlier method of Girard and Raynoso. The existence and properties of $\text{UO}_2\text{HPO}_4 \cdot 4\frac{1}{2}\text{H}_2\text{O}$ are discussed. This material will lose $3\text{H}_2\text{O}$ at 110° but will retain the remainder until ignited. Uranyl nitrate phosphate of the compn. $2\text{UO}_3 \cdot \text{N}_2\text{O}_5 \cdot \text{P}_2\text{O}_5 \cdot 16\text{H}_2\text{O}$ is eventually obtained as a micro. greenish-yellow prismatic cryst. material from concd. soln. of uranyl phosphate in HNO_3 which is allowed to stand. The crystals m. easily when heated giving off H_2O and HNO_3 . When the mass is cooled, a uranyl phosphate results. The nitrate phosphate compound is sol. in HCl , HNO_3 , and H_2SO_4 and, if the soln. is treated with NH_3 , uranyl phosphate is pptd. HOAc will dissolve it only slightly and from this or an aq. soln. $\text{UO}_2\text{HPO}_4 \cdot 1\frac{1}{2}\text{H}_2\text{O}$ is deposited after long standing.

- 324 Kissel, E. "Comparative Investigation on the Precipitation and Volumetric Determination Methods for Phosphoric Acid with Special Consideration for the Determination Using the Precipitation of Ammonium Magnesium Phosphate." Z. anal. Chem. **8**, 164-73(1869).
The volumetric method using U solution is described in detail, as are other methods.
- 325 Peligot, E. "On the Preparation of Uranium." Ann. chim. phys. (4), **17**, 368-9(1869).
A description of the reduction of UCl_4 with KCl and fresh-cut Na in a porcelain crucible is given. The material is heated to a red heat and the metal is smelted by rapidly heating at a high temp. It can be sepd. from the black slag by washing with H_2O . O_2 must be excluded.
- 326 Pélégot, E. "On the Preparation of Uranium." Ann. **149**, 128(1869).
- 327 Reichardt, E. "On the Separation of Uranium Oxide from Phosphoric Acid." Z. anal. Chem. **8**, 116-17(1869).
U can be sepd. from P when a soln. with $(\text{CO}_3)^{-2}$ in dil. HOAc is treated with FeCl_3 . This can also be accomplished by the use of Na_2CO_3 in any acidified Fe^{+3} soln. The CO_2 evolved completely retains the U in soln.
- 328 Thudichum, J. L. W. "Results of Researches on Lutein and the Spectra of Yellow Organic Substances Contained in Animals and Plants." Chem. Centr. **40**, 65-8(1869).
The absorption spectra of U salts are described.
- 329 Winkler, C. "On the Determination of Uranium." Z. anal. Chem. **8**, 387-8(1869).

PUBLICATIONS LOCATED IN 1870

- 330 Bolton, H. C. "Index to the Literature of Uranium." Ann. N. Y. Lyceum **9**, 362-76(1870)
- 331 Huggins, W. "Note on the Spectra of Erbium and Some Other Earths." Phil. Mag. (4), **40**, 302(1870)
U oxide is said not to emit any lines or bands in an oxygen-hydrogen flame but only the continuous spectrum which is emitted by all incandescent solid bodies.
- 332 Huggins, W. "Note on the Spectra of Erbium and Some Other Earths." Proc. Roy. Soc. (London) **18**, 546-53(1870).
 U_3O_8 in an oxygen-hydrogen flame slowly emits a continuous spectrum.
- 333 Meyer, L. "The Nature of the Chemical Elements as a Function of Their Atomic Weight." Ann. **8**, (Supp.), 354-64(1870).
An early determination of the sp. ht. of U is reported.
- 334 Schultz-Sellack, C. "Hydrate of Uranyl Nitrate." Z. Chem. (2), **6**, 646(1870).
 $\text{UO}_2(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$ is reported to be found in the form of fluorescent well-formed needles. It will crystallize out of strong HNO_3 soln. of the hexahydrate when such soln. is evapd. in vacuum over H_2SO_4 and KOH.
- 335 Sorby, H. C. "On Some Remarkable Spectra of Compounds of Zirconia and the Oxides of Uranium." Nature **1**, 588-9(1870).
Brief early information on the absorption spectrum of solid uranyl compounds is given.

- 336 Sorby, H. C. "On Some Remarkable Spectra of Compounds of Zirconia and the Oxides of Uranium." Phil. Mag. (4), 39, 450-60(1870).

Early information on the absorption spectrum of solid uranyl compounds is given.

- 337 Sorby, H. C. "Of Some Remarkable Spectra of Compounds of Zirconia and the Oxides of Uranium." Proc. Roy. Soc. (London) 18, 197-207(1870).

Early information on the absorption spectrum of solid uranyl compounds is given.

PUBLICATIONS LOCATED IN 1871

- 338 Bolton, H. C. "Extraction of Uranium." Am. Chemist 1, 50-2(1871).

The extn. of U from ores is discussed.

- 339 Jani, W. "Contribution on Phosphoric Acid Titration Using Uranium Solution." Chem. Centr. II, 329-33(1871).

- 340 Jani, W. "Method for the Working-up of Uranium Residues." Chem. Centr. II, 219-20(1871). Sodium uranyl carbonate may be prepd. by warming a uranyl phosphate soln. with Na_2CO_3 . Yellow crystals, which split into Na_2UO_4 and Na_2CO_3 when heated to 400° , are obtained.

- 341 Puller, R. E. O. "On the More Important Methods for Estimating Arsenic Gravimetrically." J. Chem. Soc. 24, 586-93(1871).

A section on uranic pyroarsenate is included.

- 342 Puller, R. E. O. "On the More Important Methods for Estimating Arsenic Gravimetrically." Z. anal. Chem. 10, 41-75(1871).

When an $(\text{NH}_4)^+$ soln. is added to a soln. of $\text{UO}_2\text{HAsO}_4 \cdot 4\text{H}_2\text{O}$, the double arsenate $\text{NH}_4\text{UO}_2\text{AsO}_4 \cdot x\text{H}_2\text{O}$ is obtained. $(\text{UO}_2)_2\text{As}_2\text{O}_7$ is obtained when this ammonium uranyl arsenate is heated. The double arsenate is reported to be yellowish-green and slimy. It is insol. in H_2O or HOAc and sol. in mineral acids.

- 343 Rheineck, H. "On the Separation of the Oxide of Iron from Oxide of Uranium, and the Estimation of Phosphoric Acid by Means of Uranium." Chem. News 24, 233-4(1871).

The std. sodium uranyl acetate reagent for H_3PO_4 is employed.

- 344 Rose, H. Handbuch der analytischen Chemie. (6th ed.) Leipzig, 1871.

Vol. 2, p. 171, contains a description of the sepn. for Mn from U using $(\text{NH}_4)_2\text{S}$. The sepn. is said to be best carried out in a carbonate-free soln. MnS pptn. leaves all U in the filtrate. The HCl method for U-Fe sepn. is also discussed in which the soln. is pptd. with NH_4OH and the ppt. ignited in H_2 . Metallic Fe then dissolved out with HCl . The sepn. of U from alk. and alk. earths is also reviewed.

- 345 Schultz-Sellack, C. "On the Basicity of Uranium Oxide, Molybdic Acid, Boric Acid and Nitrous Acid." Ber. 4, 12-15(1871).

UO_2SO_4 is reported as amber-yellow nonfluorescent crystals when evapd. from a concd. H_2SO_4 soln. of UO_2SO_4 . It is said to take up moisture gradually from the atm. and not to be decompd. by mild ignition. It is freely but slowly sol. in H_2O . It is reported that in a hot soln. of UO_2SO_4 in concd. H_2SO_4 the anhyd. $\text{UO}_2\text{SO}_4 \cdot \text{H}_2\text{SO}_4$ will crystallize out as fairly large greenish-yellow fluorescent crystals which quickly take up moisture. Uranyl pyrosulfate, $\text{UO}_2\text{S}_2\text{O}_7$, is also discussed and is reported to crystallize slowly in the form of small yellow pieces when a soln. of UO_2SO_4 in excess concd. H_2SO_4 is treated with liquid SO_3 . The crystals pick up water avidly from the atm. and sputter when water is poured over them.

- 346 Weisbach, A. "Preliminary Note on a New Mineral from Schneeberg: Trögerite and Walpur-gite." Neues Jahrb. Mineral. Geol. 869-70(1871).

PUBLICATIONS LOCATED IN 1872

- 347 Becquerel, E. "Memorandum on the Analysis of the Light Emitted by Phosphorescent Uranium Compounds." Ann. chim. phys. (4), 27, 539-79(1872).

Measurements of the fluorescent spectra are reported for a large number of uranyl salts. It is reported that only the uranyl compounds of U are phosphorescent and that the phosphorescence is bright but generally of short duration.

- 348 Becquerel, E. "Memorandum on the Analysis of the Light Emitted by Phosphorescent Uranium Compounds." Compt. rend. 75, 296-303(1872).

This paper contains information similar to that reported in Ann. chim. phys. (4), 27, 539-79(1872).

- 349 Follenius, O. "Contribution on the Volumetric Determination of Uranium." Z. anal. Chem. 11, 179-81(1872).

When the KMnO_4 method for the detn. of U is used, it is necessary to titrate suitable aliquot amts. of the soln., one after another, in the same vessel until the permanganate amount is constant. This is particularly important if large concn. of HCl is present.

- 350 Hagenbach, E. "Experiment on Fluorescence." Ann. Physik Chem. (Pogg.) 146, 375-405(1872).

The use of fluorescence as a qual. analytical method for U salts is reported. The phosphorescence of solns. of uranyl salts is investigated. Discussions are included on the phosphorescence of numerous uranyl cpds. There is also early information on the absorption spectra of solid uranyl cpds.

- 351 Mendelejeff, D. I. "The Periodic System of the Chemical Elements." Ann. 8, (Supp.), 133-229 (1872).

The at. wt. of U is reported.

- 352 Rammelsberg, C. F. "On the Atomic Weight of Uranium." Ber. 5, 1003-06(1872).

$(\text{NH}_4)_2\text{UO}_2(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$ appears to be isomorphous with the dihydrates of sodium and magnesium sulfates and sodium manganese sulfate.

- 353 Rammelsberg, C. F. "On the Hypophosphorous Acid Salts." Monatsber. preuss. Akad. Wiss. 409-53(1872).

$\text{UO}_2(\text{H}_2\text{PO}_2)_2 \cdot \text{H}_2\text{O}$ may be obtained by dissolving fresh $(\text{NH}_4)_2\text{UO}_4$ in warm dil. hypophosphorous acid. The material is obtained first as a mass which becomes hard and cryst. upon cooling. Evapn. of the soln. yields the hypophosphite as small yellow crystals which lose their water of hydration between 100 and 200°. $\text{UO}_2(\text{H}_2\text{PO}_2)_2 \cdot \text{H}_2\text{O}$ is difficultly sol. in water and easily sol. in HCl and HNO_3 . Evapn. with HNO_3 and ignition will produce a uranyl metaphosphate. Upon being heated to high temp. the cpd. decomps. with a flash and the evolution of H_2 giving a loose gray-green powder which is presumably UP_2O_7 or $\text{U}(\text{PO}_3)_4$ and UP.

- 354 Rammelsberg, C. "On the Hypophosphorous Acid Salts." Ber. 5, 492-7(1872).

This paper is a condensation of that published in Monatsber. preuss. Akad. Wiss. 409-53(1872).

- 355 Rammelsberg, C. "On Some Double Uranium Acetates." Ann. Physik Chem. (Pogg.) 145, 158-62(1872).

Uranous acetates with Cu and Co are described. $\text{Mg}(\text{UO}_2)_2(\text{CH}_3\text{CO}_2)_6 \cdot 12\text{H}_2\text{O}$ and $\text{Zn}(\text{UO}_2)_2(\text{CH}_3\text{CO}_2)_6 \cdot 7\text{H}_2\text{O}$ are erroneously reported in this paper as hexahydrates.

- 356 Schrauf, A. "Chalcolith and Zeunerite, Including Remarks on Walpurgin and Trögerite." Mineralog. Mitt. (1), 2, 181-6(1872).
- 357 Schumann, C. "On the Determination of Phosphoric Acid." Z. anal. Chem. 11, 382-95(1872). One method discussed is that of titrating with $\text{UO}_2(\text{NO}_3)_2$ soln.
- 358 Sorby, H. C. "On Some Remarkable Spectra of Compounds of Zirconia and the Oxides of Uranium." Ann. chim. phys. (4), 20, 215-16(1872).
- 359 Weisbach, A. "[Zeunerite, a New Mineral.]" Neues Jahrb. Mineral. Geol. 206-08(1872).

PUBLICATIONS LOCATED IN 1873

- 360 Abesser, O., Jani, W., and Marcker, M. "On the Methods of Phosphoric Acid Determination." Z. anal. Chem. 12, 239-81(1873).
The use of U soln. in H_3PO_4 analysis is discussed.
- 361 Cronander, A. W. "On Several Combinations with Phosphorus Perchloride." Bull. soc. chim. France (2), 19, 499-501(1873).
This paper reports the formation of $\text{UCl}_5 \cdot \text{PCl}_5$. The material is said to be formed along with POCl_3 and a little Cl_2 when UO_3 is heated with an excess of PCl_5 for several days in a closed tube. The double pentachloride can be sep'd. from the by-products by heating the reacted material to 180 to 190° in dry CO_2 . It occurs pure as a yellow-red amorph. mass and m. without decompn. giving a slightly volatile sublimate. When heated in a stream of hydrogen, it gives off a mixt. of HCl and PH_3 . It will react with HCl when heated, forming UCl_4 , Cl_2 , and PCl_5 . It is decompd. by water to give a gelatinous ppt. of uranous phosphate and sol. UO_2Cl_2 .
- 362 Gibbs, W. "Analytical Notices. 1. On the Quantitative Estimation of Chromium and the Separation of Chromium from Uranium. 2. On the Estimation of Magnesium as Pyrophosphate." Am. J. Sci. (3), 5, 110-17(1873).
The sepn. of U and Cr was carried out using HgNO_3 . The Cr was oxidized to chromate with HNO_3 and pptd. from boiling neutral soln. Cl^- and $(\text{SO}_4)^{-2}$ are said to interfere.
- 363 Gibbs, W. "Analytical Notices. 1. On the Quantitative Estimation of Chromium and the Separation of Chromium from Uranium. 2. On the Estimation of Magnesium as Pyrophosphate." Chem. News 28, 51(1873).
- 364 Gore, G. "On Some Properties of Anhydrous Liquified Ammonia." Proc. Roy. Soc. (London) 21, 140-7(1873).
It is reported that UO_3 and $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ are attacked only slightly by liq. NH_3 . UF_4 is reported to be somewhat sol. in liq. NH_3 yielding a yellow-colored soln.
- 365 Kitchin, A. "Note on the Estimation of Phosphoric Acid as Uranic Phosphate." Chem. News 27, 199(1873).
- 366 Mendelejeff, D. I. "On the Applicability of the Periodic Rule to the Cerite Metals." Ann. 168, 45-63(1873).
This paper contains the first reference to the existence of potassium uranyl nitrate.

- 367 Morton, H. and Bolton, H. C. "Preliminary Note of an Investigation of the Fluorescent and Absorption Spectra of Uranium Salts." Chem. News **28**, 47-50(1873).
Investigation of the phosphorescence of solns. of uranyl salts is reported. Measurements of the fluorescent spectra are reported for a large number of uranyl salts. Heating of $(\text{NH}_4)_2\text{UO}_2(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$ will yield the anhyd. salt.
- 368 Morton, H. and Bolton, H. C. "Preliminary Note of an Investigation of the Fluorescent and Absorption Spectra of Uranium Salts." Chem. News **28**, 113-16(1873).
The influence of temp. on the absorption spectra of uranyl solutions is investigated and the changes of rising temp. are recorded.
- 369 Morton, H. and Bolton, H. C. "Preliminary Note of an Investigation of the Fluorescent and Absorption Spectra of Uranium Salts." Chem. News **28**, 164-7(1873).
Measurements of phosphorescence and fluorescence of uranyl salts and solutions are given.
- 370 Morton, H. and Bolton, H. C. "Preliminary Note of an Investigation of the Fluorescent and Absorption Spectra of Uranium Salts." Chem. News **28**, 233-4(1873).
It is reported that ammonium uranyl carbonate can be obtained from concd. $(\text{NH}_4)_2\text{CO}_3$ soln. when mixed with $(\text{NH}_4)_2\text{UO}_4$. It is reported that sodium uranyl carbonate can be prepd. by the combination of the uranyl phosphate soln. and a warm concd. soln. of Na_2CO_3 .
- 371 Morton, H. and Bolton, H. C. "Preliminary Note of an Investigation of the Fluorescent and Absorption Spectra of Uranium Salts." Chem. News **28**, 244-6(1873).
- 372 Morton, H. and Bolton, H. C. "Preliminary Note of an Investigation of the Fluorescent and Absorption Spectra of Uranium Salts." Chem. News **28**, 257-9(1873).
- 373 Morton, H. and Bolton, H. C. "Preliminary Note of an Investigation of the Fluorescent and Absorption Spectra of Uranium Salts." Chem. News **28**, 268-70(1873).
- 374 Morton, H. and Bolton, H. C. "Preliminary Note of an Investigation of the Fluorescent and Absorption Spectra of Uranium Salts." Am. Chemist **3**, 401-05(1873).
This paper contains information similar to that reported in Chem. News (1873).
- 375 Morton, H. and Bolton, H. C. "Preliminary Note of an Investigation of the Fluorescent and Absorption Spectra of Uranium Salts." Am. Chemist **3**, 361-6(1873).
This paper contains information similar to that reported in Chem. News (1873).
- 376 Rammelsberg, C. F. "On Hypophosphites." J. Chem. Soc. **26**, 1-12(1873).
This paper is a condensation of that published in Monatsber. preuss. Akad. Wiss. 409-53(1872).
- 377 Reichardt, E. "Separation of Uranium Oxide from Phosphoric Acid." Arch. Pharm. **202**, 232-4(1873).
- 378 Schrauf, A. "Schrockingerite, a New Mineral from Joachimsthal; the Crystal Form of Pharmacoliths; Zeunerite with Uranotil from Joachimsthale; the Crystal Habit of Pseudo-malachits." Mineralog. Mitt. (1), **3**, 137-40(1873).
- 379 Schumann, C. "On the Determination of Phosphoric Acid." J. prakt. Chem. (1), **114**, 416-32 (1873).
The use of U in H_3PO_4 estn. is discussed.

- 380 Weisbach, A. "New Uranium Ore from Neustädtel near Schneeberg (Trögerite, Walpurgite, Zeunerite)." Neues Jahrb. Mineral. Geol. 314-17(1873).
- 381 Weisbach, A. "New Uranium Ore from Neustädtel near Schneeberg (Trögerite, Walpurgite, Zeunerite)." Berg-hüttenmänn. Jahrb. montan. Hochschule Leoben 119-21(1873).
- 382 Winkler, C. "On the Chemical Constitution of Some New Uranium Minerals." J. prakt. Chem. (2), 7, 1-14(1873).
- $\text{Ca}(\text{UO}_2)_2(\text{AsO}_4)_2 \cdot 8\text{H}_2\text{O}$ can be pptd. from a soln. of $\text{Ca}(\text{OH})_2$ in excess H_3AsO_4 by the addn. of $\text{UO}_2(\text{NO}_3)_2$.

PUBLICATIONS LOCATED IN 1874

- 383 Jean, F. "Note on a Procedure for Determining Phosphoric Acid." Compt. rend. 78, 1305-06(1874).
The use of U in H_3PO_4 estn. is discussed.
- 384 Lubarsch, O. "On Fluorescence." Ann. Physik Chem. (Wied.) 153, 420-40(1874).
Information is included on the absorption spectra of uranyl salt solutions.
- 385 Morton, H. "Fluorescent Relations of the Basic Salts of Uranic Oxide." Am. Chemist 4, 125-6(1874).
- 386 Morton, H. "Fluorescent Relations of the Basic Salts of Uranic Oxide." Chem. News 29, 17-18(1874).
- 387 Morton, H. "Fluorescent Relations of the Basic Salts of Uranic Oxide." Mon. sci. Docteur Quesneville 16, 318-20(1874).
- 388 Morton, H. and Bolton, H. C. "On the Fluorescence and Absorption Spectra of Salts of Uranium." Mon. sci. Docteur Quesneville 16, 24-34(1874).
- 389 Morton, H. and Bolton, H. C. "On the Fluorescence and Absorption Spectra of Salts of Uranium." Mon. sci. Docteur Quesneville 16, 305-18(1874).
- 390 Morton, H. and Bolton, H. C. "Preliminary Note of an Investigation of the Fluorescent and Absorption Spectra of Uranium Salts." Am. Chemist 4, 1-6(1874).
This paper contains information similar to that reported in Chem. News (1873).
- 391 Morton, H. and Bolton, H. C. "Preliminary Note of an Investigation of the Fluorescent and Absorption Spectra of Uranium Salts." Am. Chemist 4, 81-5(1874).
This paper contains information similar to that reported in Chem. News (1873).
- 392 Roscoe, H. E. "On a New Chloride of Uranium." J. Chem. Soc. 27, 933-5(1874).
This paper reports that UCl_5 is formed with UCl_4 when dry Cl_2 is led over a warmed mixt. of C and U oxide or U fluoride. UCl_5 may be formed in one of two modifications depending on the velocity of the Cl_2 stream. It is reported to be more volatile than UCl_4 and normally is deposited farther along the tube than the UCl_4 . UCl_5 appears in long needlelike dark crystals of a metallic green by reflected light and ruby-red by transmitted light when prepd. in a slow stream of Cl_2 . The product obtained in a rapid stream of Cl_2 is a brown mobile powder. UCl_5 is reported to decomp. to UCl_4 and Cl_2 when heated in an atm. of CO_2 . The disson. begins at 120° in CO_2 and is complete at 235° . UCl_4 also was found to dissolve in liq. Cl_2 yielding a dark-brown color. Heating of the material in NH_3 gave a black nitrogenous cpd. UCl_5 was found to be hydr., quickly liquefying in air. The yellowish-green liq. obtained sputters as it dissolves in H_2O and gives off HCl .

- 393 Roscoe, H. E. "On a New Chloride of Uranium." Ber. 7, 1131-3(1874).
This paper contains information similar to that reported in J. Chem. Soc. 27, 933-5(1874).

PUBLICATIONS LOCATED IN 1875

- 394 Atterberg, A. "On Some Ferrocyanides." Bull. soc. chim. France (2), 24, 355-8(1875).
U ferrocyanide is discussed and a probable formula is given.
- 395 Bolton, H. C. "Note on the Occurrence of Vanadium in Uranite." Am. Chemist 5, 363-4 (1875).
The sepn. of U from V is discussed.
- 396 Church, A. H. "On the Composition of Autunite." J. Chem. Soc. 13, 109-12(1875).
- 397 Isambert, F. "On the Precipitation of Silver by Uranium Protoxide." Compt. rend. 80, 1087-9(1875).
When UO_2 is added to a neutral AgNO_3 soln., a ppt. of Ag_2O is obtained. This ppt. is then transformed into metallic Ag, at the same time producing the uranyl ion. When an aq. soln. of UCl_4 is treated with AgNO_3 and the soln. filtered, it will turn yellow when evapd. forming uranyl nitrate. U_3O_8 was found to react very slowly with AgNO_3 soln.; metallic silver was deposited.
- 398 Lyte, F. M. "Volumetric Estimation of Zinc." Chem. News 31, 222(1875).
The use of U in the titration of Zn is reported.
- 399 Nilson, L. F. Researches on the Salts of Selenious Acid. Dissertation, Univ. of Uppsala, 1875.
It is reported that $\text{UO}_2\text{SeO}_3 \cdot 2\text{H}_2\text{O}$ is formed as a yellow ppt. when excess sodium selenite is added to a soln. of uranyl acetate or sulfate. The uranyl selenite resulting will lose its water of hydration at 100° yielding the anhyd. material. The dihydrate is insol. in water and easily sol. in HCl . A material reported as $3\text{UO}_2\text{SeO}_3 \cdot 2\text{H}_2\text{SeO}_3 \cdot 5(?)\text{H}_2\text{O}$ is formed from the dihydrate when it is treated with selenium oxide and H_2O at 60° . The use of a small amount of SeO_2 will produce the 9-hydrated material, the use of a greater excess of the 7-hydrate. The 7-hydrate appears in the form of a microcryst. powder which is insol. in water. All of the hydrates retain 1 mole of water when heated to 100° .
- 400 Nilson, L. F. "Researches on the Salts of Selenious Acid." Bull. soc. chim. France (2), 23, 494-500(1875).
This paper is a condensation of the dissertation written at the University of Uppsala (1875).
- 401 Nilson, L. F. "Researches on the Salts of Selenious Acid." Ber. 8, 655-60(1875).
This paper is a condensation of the dissertation written at the University of Uppsala (1875).

PUBLICATIONS LOCATED IN 1876

- 402 Gawalowski, A. "Working-up of Uranium Residues." Z. anal. Chem. 15, 292-4(1876).
- 403 Kern, S. "On Some Preliminary Researches on the Action of Metallic Magnesium on Certain Metallic Salts." Chem. News 33, 236-7(1876).
The action of Mg on U salt soln. is discussed.

404 Lupton, S. "Laboratory Notes. [1. Preparation of Nitrogen. 2. Solubility of Naphthalene in Water. 3. Tests for Aniline. 4. Tests for Succinic Acid.]" Chem. News 33, 90(1876).
The prepn. of U succinate is mentioned.

405 Vogel, H. W. "On the Absorption Spectra of Some Salts of Metals of the Iron Group and Their Application to Analysis." Ber. 8, 1533-40(1876).
Research on the absorption spectra of U^{+4} and $(UO_2)^{+2}$ salts is reported.

406 Wyroubov, G. N. "Research on the Ferrocyanides." Ann. chim. phys. (5), 8, 444-86(1876).
A formula for U ferrocyanide is given.

PUBLICATIONS LOCATED IN 1877

407 Becquerel, H. "Experimental Researches on Rotatory Magnetic Polarization. Third Part: Dispersion of the Plane of Polarization for Light Rays of Differing Wavelengths." Ann. chim. phys. (5), 12, 5-87(1877).

The magnetic plane of polarization for aq. $UO_2(NO_3)_2$ soln. was found to be neg. for sodium light at various d. The following table gives the relationship between the plane of polarization, (W), and the d. of soln., (D), when H_2O is unity:

D	2.0267	1.7640	1.3865	1.1963
W_{20°	+0.411	+0.598	+0.806	+0.906

408 Brügelmann, G. "On the Volumetric Determination of Arsenic Acid and Phosphoric Acid Using Uranium Solution." Z. anal. Chem. 16, 16-18(1877).

409 Chastaing, P. "Study on the Function of Light in Chemical Actions and Particularly in Oxidations." Ann. chim. phys. (5), 11, 145-223(1877).

This paper proposes that the reduction of $UO_2(NO_3)_2$ by photochem. methods in HNO_3 soln. can be attributed to the ultraviolet effect. It is reported that blue and violet light is effective in the oxidation of alc. to aldehydes in the presence of uranyl salt. Red and yellow light, however, is not effective.

410 Church, A. H. "Note on Uranocircite." Mineralog. Mag. 1, 234-6(1877).

411 Ditte, A. "On the Separation of Iron from Chromium and Uranium." Ann. chim. phys. (5), 12, 135-41(1877).

In the sepn. of U from Fe and Cr, the pptn. is carried out with NH_4OH and the ppt. is ignited in a current of H_2 . The Fe is then removed by HCl treatment and the UO_2 extd. with HNO_3 . Cr oxide remains and the U may be calcd. by using the wt. of the UO_2 and Cr_2O_3 found. The sepn. of U and F_2 using pptn. with NH_4OH and resolution with $(NH_4)_2CO_3$ and the HCl method using subln. by heating combined the ppt. in flowing HCl are also discussed.

412 Ditte, A. "On the Separation of Iron from Chromium and Uranium." Compt. rend. 85, 281-3 (1877).

This paper contains information similar to that reported in Ann. chim. phys. (5), 12, 135-41(1877).

413 Fairley, T. "Study of Hydrogen Dioxide and Certain Peroxides, Including Experiments to Determine the Heat of Formation of the Oxygen Molecule." J. Chem. Soc. 31, 125-42(1877).

This paper reports obtaining of anhyd. peroxide, UO_4 , (other investigators did not obtain this product) when a mixt. of H_2O_2 and uranyl nitrate was treated with great excesses of H_2SO_4 and allowed to stand for a long time. The unsuccessful attempts to prep. UO_4 by strong oxidation of an acidic, neutral, or

alk. soln. of uranic acid and uranates are reported. $\text{UO}_4 \cdot 2\text{H}_2\text{O}$, however, can be formed as a yellowish-white ppt. when pure dil. H_2O_2 is added to a soln. of uranyl nitrate or acetate. This material is stable in the presence of excess uranyl salts and can be dried at 100° without losing H_2O or O_2 . When H_2O_2 is used in excess, O_2 is lost during filtration, especially when the mother liquor is still warm. The formula for UO_4 , in view of the fact that it forms a wide variety of peruranates, is proposed to be $2\text{UO}_3 \cdot \text{UO}_6 \cdot 6\text{H}_2\text{O}$. These peruranates can be regarded as salts of $\text{UO}_4 \cdot 2\text{H}_2\text{O}$; however, in view of their behavior with alk., they are usually formulated as triple molecules as above, in which one or more of the UO_3 groups may be replaced by an alkali. The peroxide formula showing that type of linkage for peruranates is also proposed. It is reported that when $\text{Na}_2\text{U}_2\text{O}_{10} \cdot x\text{H}_2\text{O}$ is dried in air the product contains 6 moles of water. It was first observed as a by-product in the prepn. of $\text{Na}_4\text{UO}_8 \cdot x\text{H}_2\text{O}$ when an insufficient quantity of NaOH was used. $\text{Na}_4\text{UO}_8 \cdot 8\text{H}_2\text{O}$ is reported to exist as a yellow cryst. powder of golden needles and tablets. It is said to possess the capability of dissolving gold when in HCl soln. but to lose this property after ignition. Acidified soln. of permanganate, NaOCl and other unstable oxygenated cpds. split off three atoms of O when mixed with the material. Na_4UO_8 is not completely decompd. by boiling in aq. soln. but, when the material is boiled in excess NH_3 , the decompn. is also incomplete and cryst. flakes are deposited. A yellow or orange cryst. ppt. of $\text{K}_4\text{UO}_8 \cdot x\text{H}_2\text{O}$ can be obtained by treating a soln. of $\text{UO}_2(\text{NO}_3)_2$ with excess KOH and H_2O_2 (3 moles per atom of uranium) and then adding alc. The residue is said to contain 10 moles of water after drying between filter papers. This K salt is said to be much less stable than the corresponding Na and NH_4 salts and it will rapidly absorb CO_2 from the atmosphere and lose O_2 . It will decomp. upon heating losing both O_2 and H_2O . $(\text{NH}_4)_2\text{U}_2\text{O}_7 \cdot 8\text{H}_2\text{O}$ is also reported to have been obtained.

414 Fresenius, R. H. "A New Reaction of Uranium." *Z. anal. Chem.* 16, 238-9(1877).

A discussion is given on the solubility of U and Cu in ferricyanide soln. The work of Kern is discussed and considered to be valueless.

415 Sendtner, R. Ueber einige Verbindungen des Urans. Dissertation, Univ. of Erlangen, 1877.

The yellow ppt. produced in uranyl salt soln. by KCN is reported to contain no cyanide. When UCl_4 soln. was treated with KCN , the ppt. obtained contd. oxides and hydroxides but no U^{+4} cyanide. U^{+4} cyanide could not be obtained by fusing U_3O_8 and animal charcoal with either K_2CO_3 or Na_2CO_3 .

416 Weisbach, J. A. "Mineralogical Communication. (1. Walpurgite. 2. Zeunerite and Uranopirite. 3. Uranocirite. 4. Bismutosphaerite. 5. Roselithite. 6. Kobaltspat.)." Neues Jahrb. Mineral. Geol. 404-09(1877).

417 Weisbach, J. A. "Mineralogical Communication. (1. Walpurgite. 2. Zeunerite and Uranopirite. 3. Uranocirite. 4. Bismutosphaerite. 5. Roselithite. 6. Kobaltspat.)." Jahrb. Berg-Hüttenw. 42-53(1877).

418 Winkler, C. A. "Mineral Research. (1. Roselithite. 2. Kobaltspat. 3. Bismutosphaerite. 4. Uranocirite.)." J. prakt. Chem. (2), 16, 86-93(1877).

PUBLICATIONS LOCATED IN 1878

419 Berglund, E. "On Amidosulfonates." Bull. soc. chim. France (2), 29, 422-6(1878).

Uranyl amidosulfonate is reported in this paper. The material is said to be easily sol.

420 Burcker, E. "Note on the Preparation of Double Uranium-Ammonium Carbonate, and on the Separation of Iron and Uranium Oxides." J. pharm. chim. (4), 27, 347-9(1878).

It is reported that $(\text{NH}_4)_4\text{UO}_2(\text{CO}_3)_3$ can be prepd. by the combination of an NH_3 soln. of $\text{UO}_2(\text{NO}_3)_2$ and $(\text{NH}_4)_2\text{CO}_3$ in a M ratio of approx. 1:3. Ammonium uranyl carbonate is not easily sol. in water. The HCl method of U-Fe sepn. is discussed. The material in soln. is first pptd. with NH_4OH and then ignited in a current of H_2 and the metallic Fe dissolved out with HCl .

- 421 Konig, G. A. "Mineral from Bear Creek, Colorado. Randite." Proc. Acad. Nat. Sci. Phila. 408-09(1878).
- 422 Lefort, J. "Chemical Research on the Tungstates." Ann. chim. phys. (5), 15, 321-62(1878). $\text{UO}_3 \cdot 3\text{WO}_3 \cdot 5\text{H}_2\text{O}$ is obtained from sodium polytungstate with a slight excess of uranyl acetate. It is a pale-yellow amorph. ppt. which dehydrates to a brownish-yellow. $\text{UO}_3 \cdot \text{WO}_3 \cdot 2\text{H}_2\text{O}$ is obtained as a canary-yellow ppt. by mixing uranyl acetate soln. with sodium tungstate. At red heat the material becomes dark yellow. It is not easily sol. in H_2O .
- 423 Lefort, J. "Chemical Research on the Metallic and Sesquioxide Earth Tungstates." Compt. rend. 87, 748-51(1878).
This paper contains a condensation of the information presented in Ann. chim. phys. (5), 15, 321-62(1878).
- 424 Lockyer, J. N. "The Elements Shown in the Exterior of the Sun Which Produce Reversal of Spectral Radiation." Compt. rend. 86, 317-22(1878).
The effects on two U spectral lines, 3943.00 and 3965.8 μ , are discussed.
- 425 Patera, A. "On the Obtaining of Vanadium from Uranium Ores from Joachimstal." Oesterr. Z. Berg-Hüttenw. 26, 1-2(1878).
The sepn. of U and V is discussed.
- 426 Patera, A. "On the Obtaining of Vanadium from Uranium Ores from Joachimstal." Oesterr. Z. Berg-Hüttenw. 26, 13-14(1878).
The sepn. of U and V is discussed.
- 427 Patera, A. "Uranium. (Extract Taken from the Last Report by A. W. Hofmann.)" Mon. sci. Docteur Quesneville 20, 707-10(1878).
- 428 Thomas, J. W. "Action of Hydrochloric Acid upon Various Metallic Salts." J. Chem. Soc. 33, 367-75(1878).
It is reported that gaseous HCl acts on $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ when the latter has been more than half dehydrated. Heat is evolved and UO_2Cl_2 , H_2O , Cl_2 , and NO are produced.
- 429 Vogel, H. W. "On the Differences in the Absorption Spectra of One and the Same Material." Ber. 11, 1363-71(1878).
Information is given on the absorption spectra of uranyl salt soln. A discussion is also included on the difference in spectra observed from cryst. U^{+4} salts and the same salts in water soln.
- 430 Vogel, H. W. "Investigations on Absorption Spectra." Monatsber. preuss. Akad. Wiss. 409-31(1878).
Information is given on the absorption spectra of uranyl salt soln. The difference in spectra observed from cryst. U^{+4} salts and the same salts in water soln. is also discussed.
- 431 von Nordenskjöld, N. A. E. "Mineralogical Communication. 5. Cleveite, a New Yttrium-Uranium Mineral from the Feldspar Fracture at Garta near Arendal." Neues Jahrb. Mineral. Geol. 406-07(1878).

PUBLICATIONS LOCATED IN 1879

- 432 Baker, H. "A Study of Certain Cases of Isomorphism." J. Chem. Soc. 35, 760-9(1879).
 $\text{K}_3(\text{UO}_2)_2\text{F}_7 \cdot 2\text{H}_2\text{O}$ can be obtained by adding KF to a soln. of $\text{UO}_2(\text{NO}_3)_2$ until ppt. is formed, or by recrystg. $\text{K}_5(\text{UO}_2)_2\text{F}_9$ or $\text{K}_3\text{UO}_2\text{F}_5$ from water contg. some uranyl nitrate. A green fluorescence is

found and a d. at 20° of 4.108 is reported. It is reported to crystallize in small yellow crystals with smooth shiny surfaces, the shape of the crystals varying according to the prepn. method, being quadratic, triclinic, or monoclinic. Twins and triplets often occur. The axial ratio a:c was found to be 1:0.992. The crystals had a hardly perceptible fluorescence and would dissolve slowly in cold water. $K_5(UO_2)_2F_9$ can be prepd. by recrystn. of $K_3UO_2F_5$ from pure H_2O or from a soln. contg. not more than 13% KHF_2 . It can be recrystd. from H_2O or from dil. KHF_2 . Large hexagonal tablets showing a complicated twinning are obtained. Fluorescence is found and a d. at 20° of 4.379 is reported. $K_3UO_2F_5$ can be obtained as a lemon-yellow cryst. ppt. by treating a soln. of $UO_2(NO_3)_2$ with a slight excess of pure KF and recrystg. from an almost satd. soln. of KHF_2 . If recrystn. is done from pure H_2O or KHF_2 (dil.), the product obtained is $5KF \cdot 2UO_2F_2$. $(NH_4)_3UO_2F_5$ was obtained in the same manner as the K salt, that is, as a ppt. from an $UO_2(NO_3)_2$ soln. upon the addn. of a small amt. of NH_4HF_2 .

433 Brezina, A. "Concerning Autunite." Z. Krist. **3**, 273-9(1879).

434 Brezina, A. "On Autunite." Neues Jahrl. Mineral. Geol. 900-01(1879).

435 Ditte, A. "Action of Metallic Nitrates on Nitric Acid Monohydrate." Compt. rend. **89**, 641-3 (1879).

It is reported that yellow crystals of $UO_2(NO_3)_2 \cdot 3H_2O$ can be obtained from the soln. of the solidified melt of the hexahydrate in concd. HNO_3 .

436 Ditte, A. "Action of Metallic Nitrates on Nitric Acid Monohydrate." Ann. chim. phys. (5), **18**, 320-45(1879).

$UO_2(NO_3)_2 \cdot 6H_2O$ is reported to melt immediately on warming and to give off H_2O and HNO_3 on prolonged heating. $UO_2(NO_3)_2 \cdot 3H_2O$ or the basic nitrate can be isolated from the orange-yellow melt depending on the length of time the heat is applied. The melt of the hexahydrate when dissolved in HNO_3 first deposits the trihydrate which is yellow and sol. to about 39 parts $UO_2(NO_3)_2 \cdot 3H_2O$ /100 parts H_2O at 14°. Upon prolonged heating the trihydrate produces an iridescent yellow, cryst. powder which is reported to be the basic salt $3UO_3 \cdot N_2O_5$.

437 Donath, J. "The Specific Heat of Uranium Oxide and the Atomic Weight of Uranium." Ber. **12**, 742-5(1879).

Pure uranyl acetate may be reduced to UO_2 in a stream of H_2 and, when the product is treated with HNO_3 , it can be ignited to U_3O_8 . The mean sp. ht. of U_3O_8 between 0 and 100° is reported as 0.7979.

438 Donath, J. "The Specific Heat of Uranium Oxide and the Atomic Weight of Uranium." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse **79**, II, 699-704(1879).

This paper contains information similar to that reported in Ber. **12**, 742-5(1879).

439 Genth, F. A. "Examination of North Carolina Uranium Minerals." Chem. News **40**, 210-12 (1879).

440 Sendtner, R. "On Some New Uranyl Salts." Ann. **195**, 325-33(1879).

It is reported that $UO_2SeO_3 \cdot H_2SeO_3$ is ppt. in the form of yellow crystals when a concd. soln. of UO_2Cl_2 is boiled with concd. aq. SeO_3 . A lemon-yellow powder of this material can be obtained by introducing finely powd. $UO_2(OH)_2$ into the concd. SeO_2 soln. This material is insol. in water. An acid uranyl selenite, probably $H_6(UO_5)SeO_4$, can be obtained as a varnish-like mass by concg. a concd. soln. of uranyl hydroxide in selenic acid. The formula $UO_2SeO_4 \cdot xH_2O$ is suggested. If the same materials are allowed to stand for a long time near 0°, a cpd. of the approx. compn. $UO_2SeO_4 \cdot H_2SeO_4 \cdot 18H_2O$ is obtained. $K_2SeO_3 \cdot UO_2SeO_3$ or $K_2UO_2(SeO_3)_2$, is obtained from K_2UO_4 in warm selenic acid soln. The material forms as a yellow cryst. crust and is insol. in H_2O . $K_2H_4[UO_4(SeO_4)_2] \cdot H_2O$ is obtained from satd. K_2UO_4 in warm selenic acid or from concd. UO_3 soln. in selenic acid with the addn. of K_2SeO_4 . It forms as a powder which is sol. in hot water and stable in air. The corresponding ammonium salt, $(NH_4)_2UO_2(SeO_4)_2 \cdot 2H_2O$,

can be obtained in a similar manner. It is also sol. in H_2O . Unsuccessful attempts to isolate UO_2I_2 from aq. soln. are also reported. $2\text{KBr} \cdot \text{UO}_2\text{Br}_2 \cdot 2\text{H}_2\text{O}$ or $\text{K}_2\text{UO}_2\text{Br}_4 \cdot 2\text{H}_2\text{O}$ will cryst. from a soln. of K_2UO_4 in excess HBr as yellowish-brown, rhombic plates. The salt is reported to be sol. in water. When the material is brought to red heat, a bright shiny residue of UO_2 platelets results. A granular mass of $\text{UO}_2\text{Br}_2 \cdot 7\text{H}_2\text{O}$ can be obtained by evapg. a yellow-brown soln. of uranyl hydroxide in concd. HBr until syrupy and drying in a desiccator. $(\text{NH}_4)_2\text{UO}_2\text{Br}_4 \cdot 2\text{H}_2\text{O}$ is reported to cryst. from concd. $(\text{NH}_4)_2\text{UO}_4$ in aq. HBr over a water bath as yellowish-brown rhombic plates.

- 441 Vogel, H. W. "On the Differences in the Absorption Spectra of One and the Same Material." Ber. **11**, 913-20(1879).

Information is included on the absorption spectra of uranyl salt soln. including particularly $\text{UO}_2(\text{NO}_3)_2$. A discussion is also included on the difference in spectra observed from cryst. U^{+4} salts and the same salts in water soln.

- 442 von Nordenskjöld, N. A. E. "Cleveite, a New Yttrium-Uranium Mineral from the Garta Feldspar Cleavage near Arendal." Geol. Fören. i Stockholm Förh. **4**, 28-31(1879).

- 443 Zimmermann, J. L. C. "On Separation of the Heavy Metals of the Ammonium Sulfide Group." Ann. **199**, 1-16(1879).

In the sepn. of Fe and U by the NH_4CN method, the Fe is completely pptd. by NaHNO_3 and the U remains in soln. In order to obtain good results, dropwise pptn., washing with boiling water, and decompn. of the cyanides must be carried out before the U is pptd. The sepn. of U and Zn using a similar procedure is also mentioned.

- 444 Zimmermann, J. L. C. "On Separation of the Heavy Metals of the Ammonium Sulfide Group." Chem. News. **40**, 273(1879).

This paper is a condensation of the information presented in Ann. **199**, 1-16(1879).

PUBLICATIONS LOCATED IN 1880

- 445 Baker, H. "A Study of Certain Cases of Isomorphism." Ann. **202**, 229-42(1880).

The cryst. structure of uranyl salts, particularly the forms of potassium and ammonium uranyl fluorides, are discussed.

- 446 Chastaing, P. "On the Combinations of Uranium with Alkaline Pyrophosphates and Metaphosphates." Bull. soc. chim. France (2), **23**, 20-3(1880).

It is reported that, when a soln. of $\text{UO}_2(\text{OAc})_2$ is treated with metaphosphate, the ppt. obtained after standing with the mother liquor for a long period gradually turns to a pyrophosphate. $\text{U}_3\text{H}_4(\text{P}_2\text{O}_7)_4 \cdot 4\text{H}_2\text{O}$ is obtained when a soln. of sodium metaphosphate is warmed with an excess of UCl_4 . $\text{U}(\text{PO}_3)_4 \cdot 6\text{H}_2\text{O}$ can be obtained from a soln. of UCl_4 by adding excess sodium metaphosphate. A basic cpd. of the compn. $4\text{UO}_3 \cdot 3\text{P}_2\text{O}_5$ is obtained when uranyl acetate is treated with sodium metaphosphate or when UO_3 is treated with HPO_3 . At 25 to 30° the material contains 10 H_2O and at 100°, 9 to 10 H_2O ; at 110° the hydration drops to 7 moles. This paper contains reference to $\text{UH}_2(\text{PO}_4)_2 \cdot 2\text{H}_2\text{O}$; however, it is referred to as $\text{UP}_2\text{O}_7 \cdot 3\text{H}_2\text{O}$. This incorrect assumption has been accepted by other workers upon which they based incorrect calcns.

- 447 Comstock, W. J. "On the Chemical Composition of the Uraninite from Branchville, Conn." Am. J. Sci. (3), **19**, 220-2(1880).

- 448 Ditte, A. "On the Fluorine Compounds of Uranium." Compt. rend. **91**, 115-18(1880).

This paper describes the compound $\text{UF}_6 \cdot 2\text{HF}$. It is stated that the material will give UF_6 if heated in the presence of air. The method used to prepare the material, however, and the results obtained since the publication of this paper indicate that this material does not exist. Judging from the manner of prepn. and the initial material described by this author for his prepn. of UO_2F_2 , it is supposed that

the material which he actually prepd. was UF_4 . It is reported that UO_2 can be obtained by igniting U_3O_8 which has been moistened with a few drops of HF . This is said to be a particularly simple method of preparing black cryst. UO_2 .

- 449 Ditte, A. "On Several Fluorine Compounds of Uranium with Alkaline Metals." Compt. rend. 91, 166-8(1880).

Brilliant golden-yellow crystals of $4\text{NaF} \cdot \text{UO}_2\text{F}_2$ or $\text{Na}_4\text{UO}_2\text{F}_6$ are obtained when U_3O_8 and NaF with a small amt. of NaCO_3 are mixed and heated. However, later work by Smithells throws doubt on the compn. of the material and suggests that it is a uranate. Similar data on the Li cpd. are given. $\text{K}_3\text{UO}_2\text{F}_5$ obtained by fusing U_3O_8 with KHS_2 and treating the melt with water, filtering, and evapg. was erroneously identified as $4\text{KF} \cdot \text{UOF}_4 \cdot x\text{H}_2\text{O}$ by Smithells who prepd. it in the same manner. It is reported that $\text{Rb}_4\text{UO}_2\text{F}_6$ is obtained from U_3O_8 and RbF as an orange cryst. material which is insol. in water. Thallium uranyl fluoride can be prepd. in a similar manner. Its prepn. is difficult, however, because of the volatility of TlF . It is formed as small cryst. plates.

- 450 Genth, F. A. "Examination of North Carolina Uranium Minerals." Am. Chem. J. 1, 87-93 (1880).

- 451 Luckow, C. "On the Application of Electrical Current to Analytical Chemistry." Z. anal. Chem. 19, 1-19(1880).

This paper is one of the first concerning the electrolytic detn. of U. An oxyhydrated form of U_3O_8 is prepd. It is reported that thin, strongly adhering films of U_3O_8 can be electrolyzed from a soln. of $\text{UO}_2(\text{NO}_3)_2$ to which ammonium acetate and some acetic acid and alc. have been added.

- 452 Luckow, C. "On the Application of Electrical Current to Analytical Chemistry." Chem. News 41, 213-15(1880).

This paper is a condensation of that published in Z. anal. Chem. 19, 1-19(1880).

- 453 Mohr, C. "A Volumetric Determination Procedure for Phosphate Rocks and Superphosphates Containing Phosphoric Acid with Uranium in the Presence of Iron Oxide." Z. anal. Chem. 19, 150-3(1880).

- 454 Rand, T. D. "On Randite." Proc. Acad. Nat. Sci. Phila. 274-5(1880).

- 455 Schucht, L. "On Electrolysis." Chem. News 41, 280(1880).
The estn. of uranium by electrolysis is discussed.

- 456 Schucht, L. "On Electrolysis." Berg-hüttenmänn. Ztg. 39, 121-4(1880).

This paper is one of the first concerning the electrolytic detn. of U. An oxyhydrated form of U_3O_8 is prepd.

- 457 Smith, E. F. "New Results in Electrolysis." Am. Chem. J. 1, 329-40(1880).

It is reported that when an aq. soln. of uranyl salt is electrolyzed at low c.d., a yellow ppt. of $\text{UO}_3 \cdot x\text{H}_2\text{O}$ is obtained at the cathode. Further electrolysis of the soln. after the deposition will transform the deposit to black $\text{U}_3\text{O}_8 \cdot x\text{H}_2\text{O}$. For the electrochem. analysis of U, a soln. of 0.1 to 0.23 g U_3O_8 in the form of the acetate is combined with a few drops of HOAc and dild. to 125 cc. Deposition at a c.d. of 0.07 to 0.3 amp/100 cm^2 and a potential of 4 to 16 v at 70° is used; a time of 5 to 6 hrs is required. If the soln. contains the nitrate, all the U is removed in 5 to 7 hrs at 0.035 amp/ cm^2 and 2.25 to 4.5 v at 75° . For sulfate soln. the conditions should be 0.13 to 0.14 g U_3O_8 in 125 cc, c.d. 0.02 to 0.04 amp/ cm^2 , potential about 2 v at 75° , and time about 5 to 7 hrs. This method gives a sharp sepn. for U from alk. earths and alk. metals.

458 Smith, E. F. "New Results in Electrolysis." Ber. 13, 751-4(1880).

This paper contains information similar to that reported in Am. Chem. J. 1, 329-40(1880).

459 Vincent, C. "Note on the Reactions Produced by Aqueous Dimethylamine on Metallic Solutions." Bull. soc. chim. France (2), 33, 156-8(1880).

It is reported that the addn. of dimethylamine to a soln. of U salts will produce a yellow ppt. which may be used in the detn. of U.

460 Zimmermann, J. L. C. "On the Decomposition and Transformation Product of Uranyl Sulfide." Ann. 204, 204-24(1880).

This paper contains a discussion of the pptn. of U from soln. using carbonate-free $(\text{NH}_4)_2\text{S}$. The pptn. beaker must be kept at 100° until the soln. is clear. The same results are obtained using NH_4OH . It is reported that potassium uranium red can be prepd. quickly by treating the U salt soln. with freshly prepd. potassium hydrosulfide and boiling the ppt. in an excess of the reagent. This paper refutes the contention of Remelé that uranium red consists of a mixt. of uranyl hydroxide and uranyl sulfide. He suggests, instead, the formula $2\text{UO}_3 \cdot \text{UO}_2(\text{OK})\text{SK}$ for the K red. It is reported that ammonium uranium red can be obtained as a blood-red ppt. from uranyl salt soln. when treated with $(\text{NH}_4)_2\text{S}$ and the reaction mixt. allowed to stand in the presence of air for from one to two days. The compound U_7O_{20} was reported to have been prepd. by the conversion of uranyl sulfide to an oxyacid. The material was said to be black.

461 Zimmermann, J. L. C. "On the Decomposition and Transformation Product of Uranyl Sulfide." Ber. 13, 2078(1880).

This paper is a condensation of the information reported in Ann. 204, 204-24(1880).

462 Zimmermann, J. L. C. "On the Decomposition and Transformation Product of Uranyl Sulfide." Chem. Centr. 11, 756(1880).

This paper is a condensation of the information reported in Ann. 204, 204-24(1880).

463 Zimmermann, J. L. C. "On the Reaction of Uranyl Salts on Turmeric Paper." Ann. 204, 224-5(1880).

When U soln. is placed on turmeric paper, a brown color is obtained. This reaction differs from that of alk. in that the color also appears in slightly acid soln. The boric acid color which is similar, however, is not removed by mineral acid as is $(\text{UO}_2)^{+2}$ color. Na_2CO_3 will change the uranyl color from brown to dark violet. The sensitivity is given as ≈ 100 ppm.

464 Zimmermann, J. L. C. "On the Reaction of Uranyl Salts on Turmeric Paper." Chem. Centr. 11, 756(1880).

This paper is a condensation of the information reported in Ann. 204, 224-5(1880).

465 Zimmermann, J. L. C. "On Separation of the Heavy Metals of the Ammonium Sulfide Group." Ann. 204, 226-7(1880).

Mention is made of U^{+4} and $(\text{UO}_2)^{+2}$ sulfides.

466 Zimmermann, J. L. C. "On Separation of the Heavy Metals of the Ammonium Sulfide Group." J. Chem. Soc. 38, 188-9(1880).

This paper is a condensation of the information reported in Ann. 199, 1-16(1879) and Ann. 204, 226-7(1880).

467 Zimmermann, J. L. C. "On Separation of the Heavy Metals of the Ammonium Sulfide Group." Bull. soc. chim. France (2), 34, 713-14(1880).

This paper contains a condensation of the information presented in Ann. 199, 1-16(1879) and Ann. 204, 226-7(1880).

- 468 Zimmermann, J. L. C. "On Separation of the Heavy Metals of the Ammonium Sulfide Group." Chem. Centr. **11**, 40(1880).

This paper is a condensation of the information presented in Ann. **199**, 1-16(1879) and Ann. **204**, 226-8(1880).

PUBLICATIONS LOCATED IN 1881

- 469 Brauner, B. and Watts, J. I. "On the Specific Volumes of Oxides." Phil. Mag. (5), **11**, 60-4 (1881).

The specific gravity (5.14) and the specific volume (56.03) are reported for UO_3 .

- 470 Clarke, F. W. "An Abstract of the Results Obtained in a Recalculation of the Atomic Weights." Phil. Mag. (5), **12**, 101-12(1881).

Using a basis value for O of 15.9633 ± 0.0035 , a value of 238.481 ± 0.082 is calculated for U, using the results of Pélégot, Ebelmen, and Wertheim.

- 471 Clarke, F. W. and Owens, M. E. "Some New Salts of Uranium." Am. Chem. J. **2**, 331(1881). When sodium uranate is treated with appropriately substituted HOAc, $\text{NaUO}_2(\text{CHClCO}_2)_3 \cdot 2\text{H}_2\text{O}$ in the form of large sulfur-yellow crystals of a d. at 14° of 2.748 are formed, as well as $\text{NaUO}_2(\text{CHCl}_2\text{CO}_2)_3$ in the form of thin yellow crystals. Thin yellow bunched crystals of $\text{NaUO}_2(\text{CH}_2\text{BrCO}_2)_3$ were also prepd.

- 472 Clarke, F. W. and Owens, M. E. "Some New Salts of Uranium." Ber. **14**, 35-6(1881).

This paper contains information similar to that reported in Am. Chem. J. **2**, 331(1881).

- 473 Klein, D. "On Tungstoboric Acid and Its Salts. (Summary)." Compt. rend. **93**, 492-5(1881).

A brief discussion of uranyl tungsten acid borate is included.

- 474 Klein, D. "On the Tungstoborates." Bull. soc. chim. France (2), **36**, 205-09(1881).

A brief discussion of uranyl tungsten acid borate is included.

- 475 Leeds, A. R. "Upon the Compounds of the Aromatic Bases with Metallic Salts, with a Note upon Thiocarbanilide." J. Am. Chem. Soc. **3**, 134-51(1881).

This paper reports the prepn. of $\text{UO}_2\text{Cl}_2 \cdot 2\text{C}_6\text{H}_5\text{NH}_2$ from an alc. soln. of UO_2Cl_2 [or $\text{UO}_2(\text{NO}_3)_2$] and aniline. It is reported to form as small yellow needles which can be recrystd. from alc. When alc. soln. of UO_2Cl_2 and p-toluidine are combined, a greenish-yellow cryst. material, rhombic in form, is obtained which agrees with the formula $\text{UO}_2\text{Cl}_2 \cdot 2\text{C}_7\text{H}_7\text{NH}_2$. No cpd. was obtained with uranium (uranyl) acetate and aniline.

- 476 Reinsch, H. "On the Recognition and Distinction of Silica, Clay and Beryllia, Boric Acid, Alkaline and Other Metals, Using the Microscope." Ber. **14**, 2325-31(1881).

The detn. of U by chem. microscopy is discussed. When cryst. $\text{UO}_2\text{SO}_4 \cdot x\text{H}_2\text{O}$ is observed under the microscope, no change is seen upon the addn. of HNO_3 .

- 477 Riban, J. "On the Decomposition of Several Metallic Acetates in the Presence of Water. The Formation of Inorganic Crystal Species." Compt. rend. **93**, 1140-3(1881).

If an aq. soln. of $\text{UO}_2(\text{OAc})_2$ is heated for 100 hrs at 175° in a closed vessel in the absence of air, HOAc and cryst. uranic acid are obtained. The cryst. $\text{UO}_3 \cdot \text{H}_2\text{O}$ is reported in the form of hexagonal prisms.

478 Williams, C. G. "On β -Lutidine." Chem. News 44, 307-08(1881).

Dimethylpyridinium(β -lutidinium) uranyl chloride, $2C_7H_{10}NCl \cdot UO_2Cl_2$, can be obtained by mixing an aq. UO_2Cl_2 soln. with dimethylpyridinium chloride. It is a yellow salt. Dimethylpyridinium(β -lutidinium) uranyl sulfate, $C_7H_{10}N_2SO_4 \cdot UO_2SO_4$, is reported to be obtained from a mixt. of uranyl sulfate and dimethylpyridinium upon long standing. This product is also obtained as small yellow crystals.

479 Zimmermann, J. L. C. "On the Decomposition and Transformation Product of Uranyl Sulfide." Chem. News 43, 153(1881).

This paper contains a condensation of the information reported in Ann. 204, 204-24(1880).

480 Zimmermann, J. L. C. "On the Decomposition and Transformation Product of Uranyl Sulfide." J. Chem. Soc. 40, 79-80(1881).

This paper is a condensation of the information presented in Ann. 204, 204-24(1880).

481 Zimmermann, J. L. C. "On the Decomposition and Transformation Product of Uranyl Sulfide." Bull. soc. chim. France (2), 35, 176-8(1881).

This paper contains a condensation of the information reported in Ann. 204, 204-24(1880).

482 Zimmermann, J. L. C. "Investigations on Uranium. Preliminary Communications." Ber. 14, 440-2(1881).

It is reported that cryst. $Na_2O \cdot 2UO_3$ is prepd. by dissolving UO_2Cl_2 , NaCl, and NH_4Cl in water, evapd. the aq. soln. and igniting the residue. The material obtained is a micro. orange-yellow rhombic cryst. material, apparently isomorph. with the corresponding K cpd. and with Li_2UO_4 . It will decomp. when ignited at white heat and be completely reduced to UO_2 when heated in the presence of H_2 . The black residue from this reduction shows no change in crystal structure and the crystals are not attacked by either hot or cold water. It is easily sol. in acid, even in dil. HOAc. In the prepn. of $K_2U_2O_7$, freshly prepd. UO_2Cl_2 is mixed with KCl and NH_4Cl and the material dissolved in water, evapd. to dryness and the residue is then freed of NH_4Cl by gentle warming followed by ignition in a Pt crucible until the mass fuses giving off strong fumes of KCl. As fusion is cont., an orange-yellow color is obtained which does not change when the melt is cooled and then reheated. At this point the melt should be washed with H_2O and the orange-yellow cryst. residue dried at 100° and dehydrated by gentle heating. It will turn a dark blood-red upon high heating but return to its original color when cooled. It decomposes slightly at white heat and its reduction to UO_2 is incomplete. It is insol. in H_2O and easily sol. in acids. It is reported that Li_2UO_4 can be prepd. in the same manner. The properties of Li_2UO_4 are discussed, particularly as regards its stability in relationship to the K and Na uranates. It is reported that Li_2UO_4 turns brown when reduced by H_2 although the crystal structure is not changed, is attacked by water after slight heating, and upon boiling loses its orange color gradually changing to yellow, apparently splitting the cpds. into U and Li hydroxides.

483 Zimmermann, J. L. C. "Investigations on Uranium. Preliminary Communications." J. Chem. Soc. 40, 686(1881).

This paper is a condensation of the information presented in Ber. 14, 440-2(1881).

484 Zimmermann, J. L. C. "Investigations on Uranium. Preliminary Communications." Ber. 14, 779-82(1881).

The titration of U soln. with $KMnO_4$ is discussed.

485 Zimmermann, J. L. C. "Investigations on Uranium. Preliminary Communications." J. Chem. Soc. 40, 759(1881).

This paper is a condensation of the information reported in Ber. 14, 779-82(1881).

- 486 Zimmermann, J. L. C. "On the Reaction of Uranyl Salts on Turmeric Paper." Bull. soc. chim. France (2), 35, 178(1881).

This paper is a condensation of the information reported in Ann. 204, 224-5(1880).

- 487 Zimmermann, J. L. C. "Research on Uranium. The Vapor Pressure of Uranium Bromides and Chlorides." Ber. 14, 1934-9(1881).

The vapor d. of UCl_4 in nitrogen as referred to air is said to be 13.33 which corresponds to a single molecule vapor. The decompn. temp. for UCl_5 is recorded as 235° in an atm. of CO_2 . There is a discussion of the prepn. of UBr_4 using U_3O_8 and carbon in a hard-glass tube which is sealed because of the great hygroscopicity of the compound. UBr_4 is a cryst. material of brilliant brown-black flakes. The vapor d. with reference to air is said to be 19.46 (or calcd. 19.36). This paper reports lack of success in obtaining UBr_5 by heating UBr_4 with Br_2 in a sealed tube; a temp. as high as 230° was tried. The prepn. of UCl_4 is also discussed.

PUBLICATIONS LOCATED IN 1882

- 488 Clarke, F. W. "An Abstract of the Results Obtained in a Recalculation of the Atomic Weights." Am. Chem. J. 3, 263-75(1882).

This paper contains information similar to that reported in Phil. Mag. (5), 12, 101-12(1881).

- 489 Ditte, A. "Production by the Dry Way of Several Crystalline Uranates." Compt. rend. 95, 988-91(1882).

A crust of Na_2UO_4 is formed on the surface of a melt of U_3O_8 and NaCl upon fusion in a Pt crucible. Purification can be carried out by cooling and leaching with cold water. Further expts. indicated that Na_2CO_3 is also valuable in the prepn. Brilliant green to golden-yellow flakes are obtained. They are insol. in H_2O , slightly sol. in dil. acid, yield a yellow soln., and do not m. at bright-red heat. It is reported that K_2UO_4 can be prepd. in the same manner as greenish-yellow flakes, which fuse at bright-red heat. They are said to be optically neg. and insol. in water. It is reported that Li_2UO_4 has approximately the same properties as Na_2UO_4 and is prepd. in the same manner. CaUO_4 can be obtained very slowly by melting U_3O_8 with CaCl_2 . It forms as a small cryst. crust which can be sepd. from the CaCl_2 by extrn. with water. When pure, it is in the form of yellow flakes. $\text{Ca}_2\text{U}_2\text{O}_7$ can be prepd. by heating U_3O_8 with $\text{Ca}(\text{ClO}_3)_2$ and NaCl or CaCl_2 . The material is said to be formed as yellow-green flakes which are insol. in H_2O but sol. in dil. acids. $\text{BaO} \cdot 2\text{UO}_3$ can be obtained in cryst. form by heating U_3O_8 with $\text{Ba}(\text{ClO}_3)_2$ in a manner analogous to the prepn. of the Ca salt. The crystn. is, however, much faster. BaUO_4 is obtained in the same manner as the Ca salt. Crystn. is, as in the diuranate, faster. Brilliant yellow-green plates which are sol. in hot dil. HCl are obtained. A study of the cryst. form of SrUO_4 is reported. It is said to be similar to the Ca salt. The cryst. structure of $\text{SrO} \cdot 2\text{UO}_3$ is also said to be analogous to the corresponding Ca salt. RbUO_4 can be prepd. in the same manner as the sodium salt and has approx. the same property. MgUO_4 is reported to be obtained by melting U_3O_8 with MgCl_2 or by heating with the chlorate and adding MgCl_2 . Extrn. is accomplished with HCl and dark needles having a yellow tinge are obtained. These crystals are not affected by cold dil. HCl .

- 490 Grandeau, H. "On the Decomposition of Phosphates at High Temperatures by Potassium Sulfate." Compt. rend. 95, 921-2(1882).

KUO_2PO_4 can be obtained by heating uranyl phosphate with excess K_2SO_4 and K_2O . K_2UO_4 can be prepd. from uranyl phosphate by heating it for several hrs with KOH and excess K_2SO_4 between the temp. of formation of KUO_2PO_4 and UO_3 . The product usually can be isolated mechanically but is contaminated with other reaction products. It consists of fine orange-yellow flakes which appear hexagonal under the microscope and are mostly rhombic in shape.

- 491 Guerin, G. "Some Critical Observations on the Volumetric Determination of Phosphoric Acid by the Uranium Solution Method." J. pharm. chim. (5), 5, 143-4(1882).
- 492 Haswell, A. E. "On the Unsteady Titer Values of Uranium Solution." Repert. anal. Chem. 2, 251(1882).
- 493 Lecoq de Boisbaudran, P. E. "Separation of Gallium." Compt. rend. 95, 503-06(1882).
The sepn. of Ga from U salts using HCl soln. is discussed. The problems presented by large amounts of U and by interfering metals, such as Zn and Al, are treated.
- 494 Mohr, C. "Notice on Phosphoric Acid Determination." Z. anal. Chem. 21, 216-18(1882).
Comments on the volumetric method using U solutions are included.
- 495 Schrauf, A. "Uranothallite, False Liebigite from Joachimsthal." Z. Krist. 6, 410-13(1882).
- 496 Zimmermann, J. L. C. "Investigations on Uranium. Preliminary Communications." Ber. 15, 847-51(1882).
It is reported that U metal is softer than steel, rather easily polished, and somewhat malleable. Metal of various purities was investigated. The sp. ht. values were calcd. A pycnometric d. of 18.685 is also given. No rapid reaction of U with alk. of NH_3 was found. In attempts to dissolve U in HOAc, HCl, H_2SO_4 , and HNO_3 no reaction was found for the first, but soln. with gas evolution was noted for the last three. In expts. with halogen gases, Br_2 was found to attack U at about 240° without a flame forming UBr_4 . Powd. U in Cl_2 was found to ignite at 150° and to be partially converted into UCl_4 which formed a protective coating over the material. I_2 reacts very slowly, forming an iodide. It was found that U sulfide has the formula US_2 . The addn. of $\text{Hg}(\text{NO}_3)_2$, AgNO_3 , CuSO_4 , SnCl_2 , PtCl_4 , or AuCl_3 to U soln. will ppt. the non U metal even in cold soln. HgCl_2 , however, is not completely reduced and a mixt. of HgCl and Hg is obtained.
- 497 Zimmermann, J. L. C. "Investigations on Uranium. Preliminary Communications." J. Chem. Soc. 42, 1031(1882).
This paper is a condensation of the information reported in Ber. 15, 847-51(1882).
- 498 Zimmermann, J. L. C. "Investigations on Uranium. Preliminary Communications." Bull. soc. chim. France (2), 37, 350(1882).
This paper is a condensation of the information reported in Ber. 14, 440-2, 779-82(1881).
- 499 Zimmermann, J. L. C. "Investigations of Uranium." Ann. 213, 285-329(1882).
If Zn is used to reduce a soln. of $(\text{UO}_2)^{+2}$, the reduction is carried to the U^{+3} stage rather than stopping at U^{+4} . The red HCl soln. characteristic of the trivalent state can be prepd. by reducing UO_2Cl_2 with Zn and HCl. There is a discussion of the absorption spectra of U^{+3} , U^{+4} , and $(\text{UO}_2)^{+2}$ in aq. soln. The titration of U soln. after reduction to the U^{+3} state with Zn-amalgam using $\text{K}_2\text{Cr}_2\text{O}_7$ and diphenylamine as the indicator is discussed. A method for prepg. pure UO_3 from commercial uranyl hydroxide using warm HCl soln. satd. with H_2S to ppt. As_2S_3 and the small amts. of other sulfides present is given. The filtrate is treated with NH_3 and excess $(\text{NH}_4)_2\text{CO}_3$ after warming with $(\text{NH}_4)_2\text{S}$. The ppt. formed is filtered off and the soln. is acidified with HCl. The dissolved CO_2 is eliminated by boiling and the U pptd. as chocolate-brown UO_2S by adding NH_3 and $(\text{NH}_4)_2\text{S}$. This ppt. is converted to oxide and the raw U_3O_8 is dissolved in HNO_3 , filtered, evapd. and crystd., and the uranyl nitrate dissolved in Et_2O . The filtrate is then evapd. to dryness and the residue ignited strongly. It is reported that UO_3 will combine with bases forming uranates. This shows that UO_3 is a slightly acid material in contrast to UO_2 which is strongly basic. The prepn., properties, and crystal characteristics of Li, K, and Na uranates and diuranates are discussed.

- 500 Zimmermann, J. L. C. "Research on Uranium. The Vapor Pressure of Uranium Bromides and Chlorides." J. Chem. Soc. **42**, 143-4(1882).

This paper is a condensation of the information reported in Ber. **14**, 1934-9(1881).

PUBLICATIONS LOCATED IN 1883

- 501 Brezina, A. "On Uranothallite." Verhandl. geol. Reich. **269-70**(1883).
- 502 Buchner, G. "An Observation on the Behavior of Ammonium Sulfide on the Metals of the Ammonium Sulfide Group when These Are Found as Double Salts of Phosphoric Acid (Pyrophosphate Metalozide ~ Sodium Pyrophosphate) in Solution." Arch. Pharm. **221**, 118-20(1883).
(NH₄)₂S was found to produce a brown ppt. of UO₂S in U-contg. soln. (NH₄)₂CO₃ and alk. pyrophosphates prevent this pptn.
- 503 Donath, E. and Mayrhofer, J. "Remarks on Affinity and Its Relation to Atomic Volume, Atomic Weight and Specific Gravity." Ber. **16**, 1588-96(1883).
The d. of U is reported to be 18.33.
- 504 Gibbons, W. "Uranium Oleate." Pharm. J. (3), **13**, 737(1883).
The uranyl salt of oleic acid, UO₂(C₁₇H₃₃CO₂)₂·2H₂O, as reported by later observers, is reported in this paper to be anhyd.
- 505 Gibbons, W. "Uranium Oleate." Mon. sci. Docteur Quesneville **25**, 908-09(1883).
- 506 Hautefeuille, P. and Margottet, J. "Research on Crystalline Phosphates." Compt. rend. **96**, 849-52(1883).
Uranium metaphosphate, U(PO₃)₄, can be obtained by fusing UO₃ and uranium orthophosphate. This cpd. was first believed to be a uranyl salt and appeared in the form of green rectangular rhombic tablets which are stable to air and affect polarized light. The crystal structure is isomorphous with the Al, Cr, and Fe metaphosphates and all are insol. in H₂O, HCl, HNO₃, HNO₄, and boiling concd. acids.
- 507 Hautefeuille, P. and Margottet, J. "Research on the Phosphates." Compt. rend. **96**, 1142-4(1883).
Note on the phosphate derived from U sesquioxide, and its fine double crystals with Ag phosphate.
- 508 Klein, D. "On the Borotungstic Acids." Ann. chim. phys. (5), **28**, 350-432(1883).
A brief discussion of uranyl tungsten acid borate is included.
- 509 Regelsberger, F. F. Ueber einiger ammoniakalische Verbindungen des Uran. Dissertation, Univ. of Würzburg, 1883.
- 510 Smithells, A. "On Some Fluorine Compounds of Uranium." J. Chem. Soc. **43**, 125-35(1883).
This paper contains a discussion of the reaction between U₃O₈ and excess HF; U₃O₈ + 8HF → UF₄ + 2UO₂F₂ + 4H₂O. When UF₄ is prepd. by prolonged digestion of aq. HF and U₃O₈, the mixt. is very nearly unfilterable and difficult to purify. UF₄ is reported to be a green hydr. powder contg. no moisture at 100°, and being only slightly sol. in dil. acid. Boiling NaOH will cause decompn. into insol. U(OH)₄ and sol. NaF. When heated strongly in air, the material is said to go over to U₃O₈ without melting and, when heated in dry H₂, it will decomp. to a reddish-brown mass giving off HF. This residue is insol. in water and attacked very slightly by acids with the exception of concd. HNO₃. It is reported that in the prepn. of UF₄ by std. means, the heating step will give a subln. of white cryst. UO₂F₂. When a soln. contg. U₃O₈ and HF is evapd. under various conditions, the UO₂F₂ is often

obtained as a soapy mass. In addn. to the amorph. UO_2F_2 reported (β -modification) a cryst. material (α -modification) is also described. It is reported that α - and β - UO_2F_2 have the same chem. properties. A discussion is included on the soly. of UO_2F_2 in various liqs. A material identified as $4\text{KF} \cdot \text{UOF}_4 \cdot x\text{H}_2\text{O}$ was prepd. by fusing U_3O_8 with KHF_2 , leaching, filtering, and evapg. the filtrate. (This material actually was $\text{K}_3\text{UO}_3\text{F}_5$.) It appeared as small transparent tetragonal crystals. The author denies that $4\text{NaF} \cdot \text{UO}_2\text{F}_2$ is obtained by combining U_3O_8 , NaF , and a small amount of Na_2CO_3 as the material does not show any fluorine and, hence, is probably a uranate. (This is the method used by Ditte.) The inability of the author to confirm the existence of the Li and Rb uranyl fluorides which were obtained by Ditte, Zimmermann, and others is reported.

- 511 Streng, A. "On a New Microchemical Reaction of Sodium." Ber. oberhess. Ges. Natur-Heilk. Giessen **22**, 258-60(1883).

A method for the quant. analysis (micro) of Na is based on the prepn. of sodium uranyl acetate.

- 512 von Foullon, H. "On the Weathering Product of Uranium-Pitchblende and on the Separation of Uranium and Calcium." Jahrb. geol. Reich. **33**, 1-29(1883).

- 513 von Foullon, H. "On the Weathering Product of Uranium-Pitchblende and on the Separation of Uranium and Calcium." Verhandl. geol. Reich. **95**-6(1883).

514 Zimmermann, J. L. C. "Investigations on Uranium. Part II." Ann. **216**, 1-26(1883). Experimental verification of Mendelejeff's position for U in the periodic table is given using the vapor d. of UBr_4 . The prepn. of UBr_4 , using U_3O_8 and C, in a sealed hard-glass tube is discussed. UBr_4 is a cryst. material of brilliant brown-black flakes. The vapor d. with reference to air is 19.46 (or calcd. 19.36). UBr_5 was not obtained by heating UBr_4 with Br_2 in a sealed tube as high as 230° . UBr_3 dissolves easily in H_2O with sputtering and the evolution of a large amt. of heat. It yields a purplish-red soln. which, when shaken or allowed to stand in air, will turn to brown and then to green. The vapor d. of UCl_4 referred to air is 13.33. The decompn. temp. for UCl_5 is recorded as 235° in a CO_2 atm. A general treatment is given of the various reactions for U^{+4} salts. $\text{U}(\text{OH})_4$ is reported to be formed by the action of alkalis on U^{+4} . A voluminous light-green ppt. which is unstable in air is obtained. When U^{+3} soln. is treated with NH_3 a brown ppt. (probably a U^{+3} hydroxide) is obtained. This immediately turns to the $\text{U}(\text{OH})_4$. Information is given on the hardness of U. It is indicated that the material is softer than steel, rather easily polished, and somewhat malleable. Metal of various purities was investigated. The sp. ht. values are calcd. A pycnometric d. detn. (18.685) is reported. No rapid reaction of U with alkalis or NH_3 was found. In attempts to dissolve U in HOAc , HCl , H_2SO_4 , and HNO_3 , no reaction was found for the first, but soln. with gas evolution was noted for the latter three. Br_2 was found to attack U at about 240° without a flame and with the formation of UBr_4 . Powd. U in Cl_2 ignited at 150° and was partially converted into UCl_4 which formed a protective coating over the material. I_2 reacts very slowly with the formation of an iodide. The action of U on a soln. of noble metal salt is discussed.

PUBLICATIONS LOCATED IN 1884

- 515 Blomstrand, C. W. "On the Composition of Pitchblende." Compt. rend. **98**, 816-17(1884).

- 516 Blomstrand, C. W. "On a Uranium-Containing Mineral from the Moss Region and on Native Uranates in General." J. prakt. Chem. (2), **29**, 191-228(1884).

- 517 Blümcke, A. "On the Influence of Concentration Gradients on the Specific Heat of Aqueous and Alcoholic Solutions of Metal Chlorides." Ann. Physik Chem. (Wied.) (3), **23**, 161-73(1884). The sp. ht. of U is calcd. as 0.0280 in the range 0 to 98° .

518 Clarke, F. W. "Some Specific Gravity Determinations." Am. Chem. J. 5, 240-1(1884). Values of 3.280 at 16.5°, 3.0131 at 21.5°, and 3.363 at 19.1° are reported for $\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$, $\text{UO}_2(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$ and $\text{UO}_2\text{K}_2(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$. (The research reported was carried out by H. Schmidt under the supervision of F. W. Clarke.)

519 Classen, A. "Quantitative Analysis Using Electrolysis." Ber. 17, 2467-85(1884). This paper discusses the electrolytic sepn. of Fe and U in the presence of $(\text{NH}_4)_2\text{C}_2\text{O}_4$ which retains the U in soln. and allows the Fe to be electrolyzed out. The current must be adjusted so that the temp. of the bath does not go above 40°. The $(\text{NH}_4)_2\text{U}_2\text{O}_7$ ppt. does not filter easily and usually must be repptd. An electrolytic sepn. for U from Cr or Zn after pptn. of the oxyhydrate from the double oxalate soln. is also reported. In the sepn. of U from Ni the Ni is electrolyzed out and the U maintained in soln. by $(\text{HCO}_3)^-$. With heating, the U will ppt. as $(\text{NH}_4)_2\text{U}_2\text{O}_7$.

520 Ditte, A. "Research on Uranium." Ann. chim. phys. (6), 1, 338-58(1884). This paper is a continuation of earlier work by the author. It contains valuable early data on UO_2F_2 , UF_4 , UO_2 , U_3O_8 , and K, Na, Rb, and Tl double uranyl fluorides. Na, K, Li, Rb, Pb, Ca, Sr, Ba, and Mg uranates as well as Ba and Sr diuranates are also discussed. Information on methods of prepn., phys. properties, and appearance are included.

521 Fremy, E. Encyclopedia Chimique. Paris, 1844. Vol. 3, pt. II. The sepn. of U from Ca, Sr, and Ba by pptn. with H_2SO_4 in the presence of alc. is discussed on p. 85.

522 Fritz, H. "On the Common Relations of Physical Properties of the Elements." Ber. 17, 2160-5(1884). The m. p. of U is reported as 1850° and a calcd. value for the sp. ht. is included.

523 Lorenzen, J. "A Study on a Crystalline Uranium-Containing Ore from Moss." Nyt Mag. Naturvidenskab. 28, 249-52(1884).

524 Mills, E. J. "On the Numerics of the Elements." Phil. Mag. (5), 18, 393-9(1884). The place for U in the scheme is reported.

525 Rammelsberg, C. F. "On the Double Acetic Acid Salts of Uranium." Sitzber. preuss. Akad. Wiss. 857-87(1884).

The prepn., appearance, structure, and reactions to heat for a number of double uranyl acetates are given. $\text{KUO}_2(\text{CH}_3\text{CO}_2)_3 \cdot \text{H}_2\text{O}$, $\text{LiUO}_2(\text{CH}_3\text{CO}_2)_3$, $\text{NH}_4\text{UO}_2(\text{CH}_3\text{CO}_2)_3$, $\text{NaUO}_2(\text{CH}_3\text{CO}_2)_3$, $\text{Tl}(\text{UO}_2)_2 \cdot (\text{CH}_3\text{CO}_2)_5 \cdot 2\text{H}_2\text{O}$, $\text{Ba}(\text{UO}_2)_2(\text{CH}_3\text{CO}_2)_6 \cdot 6(3)\text{H}_2\text{O}$, $\text{Ca}(\text{UO}_2)_2(\text{CH}_3\text{CO}_2)_6$, $\text{BeUO}_2(\text{CH}_3\text{CO}_2)_4 \cdot 2\text{H}_2\text{O}$, $\text{Mg}(\text{UO}_2)_2(\text{CH}_3\text{CO}_2)_6 \cdot 12\text{H}_2\text{O}$, $\text{Mg}(\text{UO}_2)_2(\text{CH}_3\text{CO}_2)_6 \cdot 7\text{H}_2\text{O}$, $\text{ZnUO}_2(\text{CH}_3\text{CO}_2)_4$, $\text{CdUO}_2(\text{CH}_3\text{CO}_2)_4 \cdot 6\text{H}_2\text{O}$, and $\text{PbUO}_2(\text{CH}_3\text{CO}_2)_4 \cdot 4\text{H}_2\text{O}$ were obtained. An unsuccessful attempt to prep. Sr uranyl acetate is reported.

526 Reinsch, H. "On the Influence of Nitric Acid on Crystallization and Optical Properties of Sulfuric Acid Salts." Z. Krist. 9, 561-3(1884). When cryst. uranyl sulfate is observed under the microscope, no change is seen upon the addn. of HNO_3 .

527 von der Pfordten, O. F. "Contribution to the Knowledge of Molybdenum and Tungsten." Ann. 222, 137-65(1884). A discussion on uranyl molybdates and tungstates is included.

528 Zimmermann, J. L. C. "On the Paper by H. Fritz: 'On the Relationship of the Physical Properties of the Elements.'" Ber. 17, 2739-40(1884). A discussion is included with a note on at. wt., sp. gr., sp. ht., and m.p. of U metal. Other properties of the metal are also discussed.

PUBLICATIONS LOCATED IN 1885

- 529 Becquerel, E. "Spectral Study of Bodies Made Phosphorescent by the Action of Light or by Electrical Discharges." Compt. rend. 101, 205-10(1885).
Cpds. of U were examined in evacuated tubes.
- 530 Becquerel, H. "Relations between the Absorption of Light and the Emission of Phosphorescence in the Compounds of Uranium." Compt. rend. 101, 1252-6(1885).
This is one of the early discussions of the use of optical techniques in the detn. and detection of U. Studies of the absorption spectra of solid and aq. solns. of U^{+4} salts and solid uranyl salts between 3800 and 5100 Å are reported. It is reported that the phosphorescence spectrum of cryst. uranyl salts consists of 7- or 8-band groups with similar freq. differences and similar structures.
- 531 Blomstrand, C. W. "On the Native Uranates." Ann. chim. phys. (6), 4, 129-35(1885).
- 532 Blomstrand, C. W. "On a Uranium Containing Mineral from the Moss Region and on Native Uranates in General." Geol. Fören. i Stockholm Förh. 7, 59-101, 196(1885).
- 533 Blümcke, A. "On the Determination of the Specific Heat of Uranium." Ann. Physik Chem. (Weid.) 24, 263-5(1885).
The sp. ht. of U is calculated to be 0.0280 for the range 0 to 98°.
- 534 Casamajor, P. "Silver Iodide as a Blowpipe Reagent." J. Am. Chem. Soc. 7, 132-4(1885).
Noncharacteristic yellow (hot) and white (cold) reactions for Mn and U with AgI are reported.
- 535 Casamajor, P. "Silver Iodide as a Blowpipe Reagent." Chem. News 52, 1-2(1885).
The blowpipe reaction of U with AgI is discussed.
- 536 Gladstone, J. H. "On the Present State of Our Knowledge of Refraction Equivalents." Am. J. Sci. (3), 29, 55-7(1885).
The at. refraction for U by the Gladstone-Dale method was calcd. from the refraction of $UO_2(NO_3)_2$ in soln. to be 19.5.
- 537 Grandeau, H. "Research on the Phosphates." Compt. rend. 100, 1134-5(1885).
 KUO_2PO_4 can be prepd. by heating $(UO_2)_3(PO_4)_2$ with excess K_2SO_4 and K_2O . The double phosphate decompd. in presence of alk. forming K_2UO_4 . K_2UO_4 can also be prepd. from uranyl phosphate by heating for several hr with excess K_2SO_4 between the temp. of formation of potassium uranyl phosphate and UO_3 . It consists of fine orange-yellow flakes which appear hexagonal under the microscope.
- 538 Haushofer, —. Mikroskopische Reaktionen. Braunschweig. 1885.
A discussion is included on the microdetection methods used for U and its compounds.
- 539 Kowalewsky, N. "Uranyl Acetate, a Reagent for Albumin." Z. anal. Chem. 24, 551-6(1885).
- 540 Kritschewsky, L. Ueber die Anwendung des metallischen Wasserstoffs in der analytischen Chemie. Dissertation, Univ. of Bern. 1885.
It is stated that U salts cannot be reduced to metal in soln. This paper is comprehensive and presents a number of new facts concerning U and its compounds.
- 541 Lorenzen, J. "A Study on a Crystalline Uranium-Containing Ore from Moss." Z. Krist. 10, 496(1885).

- 542 Rammelsberg, C. F. "On the Double Acetic Acid Salts of Uranium." Ann. Physik Chem. (Wied.) **24**, 293-318(1885).

This paper contains information similar to that reported in Sitzber. preuss. Akad. Wiss. 857-87(1884).

- 543 Rammelsberg, C. F. "On the Oxides of Manganese and Uranium." Sitzber. preuss. Akad. Wiss. 97-103(1885).

- 544 Regelsberger, F. F. "On Some Ammoniacal Compounds of Uranyl Chloride." Ann. **227**, 119-32 (1885).

This paper recommends that in the prepn. of UO_2Cl_2 , the UO_2 be distributed between several boats in the hard-glass heating tube, reduced completely with H_2 , and the H_2 displaced with CO_2 , which is then displaced with Cl_2 in order to complete the reaction to UO_2Cl_2 . This method reduces the contaminating material which is found in most UO_2 . It is reported that, when dry NH_3 is led into an ether soln. of UO_2Cl_2 , an egg-colored ppt. of the compn. $\text{UO}_2\text{Cl}_2 \cdot 2\text{NH}_3 \cdot \text{C}_4\text{H}_{10}\text{O}$ is obtained. This material, when dried to const. wt. in vacuum, will yield almost pure $\text{UO}_2\text{Cl}_2 \cdot 2\text{NH}_3$. The triamine complex can be prepd. only as the etherate from the diamine etherate. In the prepn. the diamine etherate is allowed to stand in an atm. of NH_3 and then rapidly dried to const. wt. in H_2SO_4 desiccator. An orange-red amorph. cpd. which is stable in air is obtained. This material will turn lighter when warmed and lose 1 mole of NH_3 . Attempts to prep. the tetramine material were unsuccessful.

- 545 Streng, A. "On Some Microchemical Reactions." Neues Jahrb. Mineral. Geol. **I**, 21-42(1885). A method for the quant. microanalysis of Na based on the prepn. of sodium uranyl acetate is described.

- 546 Wyruboff, G. "On the Crystal Form of Double Acetates of Uranium and Lithium." Bull. soc. minéral. France **8**, 115-20(1885).

It is reported that yellow crystals of $\text{LiUO}_2(\text{OAC})_3 \cdot 5\text{H}_2\text{O}$, will form at 15° from a mixt. of solns. of the individual acetates or from the mother liquor of trihydrate. The resultant crystals are said to be effluorescent, becoming opaque. The water of hydration is lost at 120° . The trihydrated lithium uranyl acetate is reported to be less sol. than the pentahydrate. The trihydrate crystals, which are obtained by the same method at about 25° , are small and yellow. The d. of the trihydrate is reported to be 2.280 at 15° . Calcns. on the axial ratio of the crystals are included.

PUBLICATIONS LOCATED IN 1886

- 547 Alibegoff, G. "On Uranium Compounds." Ann. **233**, 117-43(1886).

It is reported that UBr_3 dissolves easily in H_2O with sputtering and the evolution of a large amt. of ht. It yields a purplish-red soln. which, when shaken or allowed to stand in air, will turn brown and then green. An attempt to duplicate the experiments of Fairley (J. Chem. Soc. **31**, 125-42(1877)) were unsuccessful and an anhyd. (UO_4) could not be obtained. $\text{UO}_4 \cdot 2\text{H}_2\text{O}$ is usually formed as a whitish-yellow amorph. powder. It can also be obtained in fine needles which are very stable and very hydr. When UO_4 is pptd. from a weakly acid soln. of $\text{UO}_2(\text{NO}_3)_2$, almost quant. reactions with H_2O_2 are observed. U_2S_3 was prepd. by heating UBr_3 in a stream of H_2S for 8 to 10 hr in the complete absence of O_2 . The material is formed in gray-black needle-shaped crystals. It will decomp. in air forming H_2S . Its soly. is also discussed. US was obtained by heating U_2S_3 slowly to a red heat over a period of 30 to 70 hr in dry H_2 . The material is a black amorph. powder which burns off when warmed on a Pt foil. It is very difficultly sol. in concd. HCl and dil. HNO_3 . It is slightly sol. in $\text{HCl}-\text{Br}_2$ soln. Fuming HNO_3 oxidizes it explosively while aqua regia reacts less violently.

- 548 Alibegoff, G. "Separation of Uranium from Alkaline Earths and Alkalis and the Determination of the Same." Ann. **233**, 143-53(1886).

U is said to be pptd. from a Cl^- soln. by a suspension of HgO . The pptn. is not complete in the presence of $(\text{NO}_3)^-$, but it may be made quant. by the addn. of NH_4Cl . If the ppt. is repeatedly heated with NH_4Cl

soln. and decanted, the alk. earths are eliminated and the process will yield a good sepn. When alk. earths are present in the ignition, they can be recognized in the olive-green mass as yellow- or orange-colored particles. The U should be weighed as U_3O_8 .

- 549 Athanasesco, N. "Research on Several Crystallized Basic Sulfates." Compt. rend. 103, 271-2 (1886).

It is reported that $3UO_3 \cdot SO_3 \cdot 2H_2O$, a lemon-yellow powder consisting of micro. crystals, and $4UO_3 \cdot SO_3 \cdot 7H_2O$, a dirty-yellow matted crust consisting of micro. needles, were obtained by heating a 3 to 15% soln. of UO_2SO_4 at about 250° . Both of the basic sulfates are reported to be insol. and not decompd. by H_2O . The water of hydration is given off at high temperatures.

- 550 Grandeau, H. "Of the Action of Potassium Sulfate at High Temperatures on Metallic Phosphates." Ann. chim. phys. (6), 8, 193-233(1886).

KUO_2PO_4 is reported to exist in the form of a yellow powder the color of subld. S, usually in the form of small yellow transparent crystals. It can be obtained by heating uranyl phosphate with excess K_2SO_4 and K_2O . The double phosphate, when combined with alk., forms the uranate, K_2UO_4 . The uranate is usually contaminated with other reaction products. It consists of fine orange-yellow flakes,

- 551 Mills, E. J. "On the Numerics of the Elements. Part II." Phil. Mag. (5), 21, 151-7(1886). This is a note on the numerics and the at. wt. of U.

- 552 Rammelsberg, C. F. "On a New Instance of Isomorphism between Uranium and Thorium." Sitzber. preuss. Akad. Wiss. 603-06(1886).

It is reported that a number of earlier preps. of $U(SO_4)_2 \cdot 8H_2O$ were in reality preps. of $U(SO_4)_2 \cdot 9H_2O$. $U(SO_4)_2 \cdot 9H_2O$ is reported to crystallize in the monoclinic system with an axial ratio a:b:c of 0.5970:1:0.6555; the β angle is $97^\circ 49'$. It is reported to be isomorphous with the corresponding Th salt. It is also reported that $U(SO_4)_2 \cdot 9H_2O$ slowly loses H_2O when heated but will not be completely dehydrated at 200° . Some SO_3 is lost at incipient red heat and almost all is driven out by prolonged ignition. H_2O decomp. the sulfate upon soln. at any temp.

- 553 Sandberger, K. L. F. "Uranium-Containing Calcium and Copper Mica from the Fichtel Mountains, Arsenosiderite as a Pseudomorph of Siderite from Neubulach near Calw in Württemberg, and Greenockite as a Disintegration Product from the Lettenkoble Region in Franconia." Neues Jahrb. Mineral. Geol. I, 250-2(1886).

- 554 Streng, A. "On a New Microchemical Reaction of Sodium." Ber. oberhess. Ges. Natur.-Heilk. Giessen 24, 56-8(1886).

Sodium magnesium uranyl acetate, $NaMg(UO_2)_3(OAc)_9 \cdot 9H_2O$, will crystallize from a weak HOAc soln. of Mg uranyl acetate when a little Na salt is present.

- 555 Verneuil, A. "On the Preparation of Calcium Sulfide Having Violet Phosphorescence." Bull. soc. chim. France (2), 46, 302-05(1886).

The effect of small amounts of U is said to be slight.

- 556 Verneuil, A. "On the Preparation of Calcium Sulfide Having Violet Phosphorescence." Compt. rend. 103, 600-03(1886).

The information in this paper is similar to that in Bull. soc. chim. France (2), 46, 302-05(1886).

- 557 Wyruboff, G. "Research on the Structure of Crystalline Materials Possessing Rotatory Power." Ann. chim. phys. (6), 8, 340-417(1886).

This paper contains a report of the observation of some optical anomalies in crystals of sodium uranyl acetate.

- 558 Zimmermann, J. L. C. "Research on Uranium. (Third Report from His Posthumous Work by George Alibegoff and Gerhard Krauss)." Ann. 232, 273-324(1886).

The at. wt. of U is detd. Sodium uranyl acetate is prepd. by treating pure uranyl nitrate with Na_2CO_3 and excess boiling HOAc. The microcryst. product should be dried at 120 to 150°. There is a discussion of the conversion to U_3O_8 of the ppt. obtained by treating U-contg. soln. with NH_3 . If this conversion is done in a current of O_2 , the oxide does not have a uniform compn.; therefore, it should first be reduced to UO_2 in a current of H_2 and the detn. made on the basis of that cpd. The U_2O_5 reported by some investigators is said to be mostly U_3O_8 with a certain amt. of UO_2 . Pure U_3O_8 is said to be obtained by igniting the purest possible uranyl salts to U_3O_8 , reducing the raw product with H_2 to UO_2 , and reoxidizing with pure O_2 to U_3O_8 . The product should be allowed to cool in a stream of O_2 . The color of the resulting material, which may be olive-green to black, is said to be influenced strongly by the method of prepn. and the heat of reduction. When U_3O_8 is ignited and cooled quickly in air, it will lose small quantities of O_2 . The losses are greatly increased if the cooling takes place in a gas such as N_2 or CO_2 which is inert. When the U_3O_8 is ignited in such atms. brown UO_2 is obtained. A green liq. is obtained with HCl when U_3O_8 is dissolved in a closed system (temp. approx. 200°). It is completely converted to uranyl and U^{+4} sulfate when heated with concd. H_2SO_4 for a long time.

PUBLICATIONS LOCATED IN 1887

- 559 Bolton, H. C. "Index to the Literature of Uranium, 1789-1885." Smithsonian Annual Report 915-45(1887).

There is a brief summary of the advantages and problems of indexing chem. literature. Extensive references covering the period indicated, including brief subject notes are given for U. A list of existing indexes to the chem. literature is included. Those mentioned concern Mn, U, Ti, V, O₃, H_2O_2 , electrolysis, chem. reaction speeds, starch, sugar, heat action on metal salts, and catalog of chem. periodicals.

- 560 Carnot, A. "On Various Reactions of Vanadates and Their Use in Analytical Chemistry." Compt. rend. 104, 1850-3(1887).

Ammonium uranyl vanadate, of the form $\text{NH}_4\text{UO}_2\text{VO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$, is prepd. from a V_2O_5 soln. neutralized with NH_3 and then heated with ammonium acetate and $\text{UO}_2(\text{NO}_3)_2$. The yellow ppt. is dried at 100° and decomposes upon heating to $2\text{UO}_3 \cdot \text{V}_2\text{O}_5$.

- 561 Carnot, A. "On Various Reactions of Vanadates and Their Use in Analytical Chemistry." Compt. rend. 105, 119-22(1887).

Brief reference is made to the use of vanadates in the sepn. of U.

- 562 Drechsel, E. "Simple Method for the Preparation of Some Complex Inorganic Acids." Ber. 20, 1452-5(1887).

It is reported that long, fine, yellow-green needles of $\text{H}_6(\text{UO}_2)(\text{UO}_4)(\text{SeO}_4)_3 \cdot 7\text{H}_2\text{O}$ can be obtained when 32 g of uranyl nitrate and 20 g of selenic acid are combined. This material is identical, except for water content, to that obtained by Sendtner (Ann. 195, 325-33(1879)).

- 563 Jannettaz, E. "Note on Uranite from Madagascar." Bull. soc. franç. mineral. 10, 47-50(1887).

- 564 Muthmann, W. "On the Low Oxide of Molybdenum." Ann. 238, 108-37(1887).

A comparison of Mo and U oxides is made.

- 565 Tammann, G. "This Vapor Pressure of Solutions." Mém. Acad. Imp. Sci. Petersbourg (7), 35, No. 9, 172(1887).

This paper contains a discussion of the calcn. of the concn. of $\text{UO}_2(\text{NO}_3)_2$ or UO_2SO_4 in water by means of measurements of the lowering of the vapor pressure of water. Tables of data are given. All values are reduced to 100° and 760 mm. Concns. from approx. 14 to 100 g/100 g H_2O are considered.

PUBLICATIONS LOCATED IN 1888

- 566 Becquerel, H. "Research on the Variations of Absorption Spectra in Crystals." Ann. chim. phys. (6), 14, 170-257(1888).

Information on the absorption spectrum of solid uranyl cpds. is given.

- 567 Carson, A. I. and Norton, T. H. "On the Uranates of Ammonium and of Certain Amines." Am. Chem. J. 10, 219-21(1888).

$(\text{NH}_4)_2\text{O} \cdot 2\text{UO}_3 \cdot x\text{H}_2\text{O}$ or $(\text{NH}_4)_2\text{U}_2\text{O}_7 \cdot x\text{H}_2\text{O}$, is obtained by pptn. of uranyl salts with excess NH_4 . It is a yellow ppt. Complexes of U with org. bases can be obtained by the pptn. from aq. soln. of $\text{UO}_2(\text{NO}_3)_2$ using such materials as di- or trimethylamine, mono-, di-, or triethylamine, isobutylamine, aniline, or toluidine. Each of these complexes is insol. in water, pale yellow to orange, and forms as an amorph. gelatin ppt. which can be purified by decantation, filtration, and drying at 100° . The single formula $\text{R}_2\text{O} \cdot 2\text{UO}_3$ is ascribed to this series.

- 568 Chittenden, R. H. and Hutchinson, M. T. "Influence of Uranium Salts on the Amyolytic Action of Saliva and the Proteolytic Action of Pepsin and Trypsin." Trans. Conn. Acad. Arts Sci. 7, 261-73(1888).

Information is given on the inhibitory effects of U salts on ferments and their action as kidney poisons. The amt. found in the urine is reported. The amount of urine is reported to increase and the animals become glycosuric. The late action was characterized by the development of a parenchymatous nephritis with a partial or complete arrest of urine formation. The renal injury found closely resembles that induced by P where both the epithelium and the vessels are involved in the injury.

- 569 Coloriano, A. "On Several Crystalline Metallic Molybdates." Bull. soc. chim. France (2), 50, 451-5(1888).

It is reported that ppts. of uranyl molybdate, UO_2MoO_4 , cannot be crystd.

- 570 Formánek, J. "On Uranyl-Potassium Chromate." Sitzber. Kgl. Böhm. Ges. Wiss. Math.-naturw. Klasse 12-19(1888).

- 571 Hampe, W. "On the Electrolytic Conductivity of Halogen Compounds." Chem. Ztg. 12, 106 (1888).

This paper reports that UCl_4 is a good electrical conductor. Specific resistivity values are given as follows:

t	570°	598°	620°
x	0.34	0.42	0.48

When fused UCl_4 is electrolyzed, Cl_2 is given off at the anode and small quantities of metallic U are deposited at the cathode. A lower chloride is apparently formed and the residue dissolves in water giving a dark-red color which soon changes to green. UCl_4 can be obtained completely free from UO_2Cl_2 by leading UCl_4 vapors through a long bed of glowing pieces of C. UO_2Cl_2 melts at dull-red heat and when electrolyzed will give off Cl_2 and deposit black, cryst. UO_2 .

- 572 Hillebrand, W. F. "Uraninite." Am. J. Sci. (3), 36, 295(1888).

- 573 Hodgkinson, W. R. E. and Lowndes, F. K. S. "Potassium Chlorate." Chem. News 58, 309 (1888).

It is reported that $\text{UO}_3 \cdot 2\text{H}_2\text{O}$ will react with KClO_3 to form $\text{K}_2\text{U}_2\text{O}_7$ and Cl_2 . When U_3O_8 is heated with KClO_3 the reaction involves the loss of O_2 with the evolution of a great deal of Cl_2 and the formation of K_2UO_4 . The reaction was found to begin at approx. 390° .

574 Kluss, K. "On the Knowledge of Hyposulfurous Acid Salts." Ann. 246, 179-220(1888).
The section of this paper on U salts (pp.191-3) contains a discussion of the characteristics of uranyl dithionate. This material was never obtained in a pure state. It is not stable. Various dithionates were obtained from solns. contg. U^{+4} and sodium thionate. The properties and compn. of these materials were, however, different depending on the concn. and temp. of the soln.; highly dil. solns. gave light-colored ppts. while concd. solns. gave dark ppts. U^{+4} dithionate was not prepd. in solid form. When a green soln. of freshly pptd. $\text{U}(\text{OH})_4$ in dithionic acid decompd. on long standing in vacuum over H_2SO_4 , SO_2 is evolved instead of pptg. the dithionate.

575 Lauth, C. and Dutailly, G. "Research on the Glazes of Porcelain." Bull. soc. chim. France (2), 50, 221-51(1888).

Coloring is one of the important items treated. U salts are among those materials discussed in this connection.

576 Michel-Lévy, A. and Lacroix, A. "Refringence and Birefringence of Several Compact Ores." Compt. rend. 106, 777-9(1888).

Autunite and klaprothite are among the minerals examined.

577 Quantin, H. "Action of Carbon Tetrachloride on Mineral Oxygen Compounds without Hydrogen." Compt. rend. 106, 1074-6(1888).

UO_3 can be converted to UCl_4 and UO_2Cl_2 by the action of Cl_4 or a mixt. of CO and Cl_2 at dull-red heat.

578 Rabuteau, A. Eléments de toxicologie et de médecine légale, appliquées à l'empoisonnement. Paris(?), 1888.

Information on the toxic properties of U and its cpds. is included.

579 Rohrig, A. "Revision of Some Age-Old Statements on Sulfurous Acid Salts." J. prakt. Chem. (2), 37, 217-53(1888).

It is reported that the basic $\text{UOSO}_3 \cdot 2\text{H}_2\text{O}$ or $\text{U}(\text{OH})_2\text{SO}_3 \cdot \text{H}_2\text{O}$, may be pptd. by treating an aq. soln. of UCl_4 with Na_2SO_3 . The gray-green ppt., which is filtered off, washed with alc., and dried over H_2SO_4 is the product. A certain amount of the salt can be recovered from the filtrate on long standing or by evapn. The basic sulfite will give off H_2O and SO_2 when heated and is so transformed to UO_2 in the absence of air or into U_3O_8 when air is present. It is insol. in water and easily sol. in acids. It is also reported that the basic U^{+4} sulfite is formed along with free S when a UCl_4 soln. is treated with sodium hyposulfite. $\text{UO}_2\text{SO}_3 \cdot 4\text{H}_2\text{O}$ can be prepd. by pouring SO_2 water over uranyl acetate and allowing the mixt. to stand. The yellow powder is then filtered off, washed with alc., and dried over H_2SO_4 . A pure product is said to result. $\text{UO}_2\text{SO}_3 \cdot 4\text{H}_2\text{O}$ will be converted to UO_3 upon mild heating in the absence of air. Strong ignition will convert it to U_3O_8 . When $\text{UO}_3\text{SO}_3 \cdot 4\text{H}_2\text{O}$ has been dissolved in aq. or alc. SO_2 , it may be removed from soln. by the addn. of alk. sulfite.

580 Wyrouboff, G. "Investigation on the Circular Polarization of Crystals." Z. Krist 14, 100-07 (1888).

This paper contains a report on the observation of some optical anomalies in crystals of sodium uranyl acetate.

PUBLICATIONS LOCATED IN 1889

- 581 Blomstrand, C. W. "On Monazites from the Urals." Lunds Univ. Årsskr. 25, No. 6 (Math.), 1-11(1889).
- 582 Blomstrand, C. W. "On Some Swedish Monazites." Geol. Fören. i Stockholm Förh. 11, 379-88 (1889).
- 583 Brand, A. "On the Application of Double Pyrophosphates to the Determination and Recovery of Metals during Electrolysis." Z. anal. Chem. 28, 581-605(1889).
This paper contains a discussion of the electrolytic sepn. of Ni and Zn from U in soln. A pyrophosphate soln. is used for the Zn sepn. and electrolysis carried out in this soln. When an electrolytic sepn. of Fe and U is carried out in $(\text{NH}_4)_2\text{CO}_3$ and $\text{Na}_4\text{P}_2\text{O}_7$ only, the Fe will ppt.
- 584 [Brief Note on Uranium.] Science 14, 217(1889)
This is a brief review of status of U prodn. on the 100th anniversary of its discovery. Notes are included on a new mine and possible new uses.
- 585 Butureanu, V. C. "Research on the Selenites." Ann. chim. phys. (6), 18, 289-351(1889).
 $\text{UO}_2\text{SeO}_3 \cdot 2\text{H}_2\text{O}$ is formed as a yellow ppt. when excess sodium selenite is added to a soln. of $\text{UO}_2(\text{OAc})_2$ or UO_2SO_4 . The uranyl selenite resulting will lose its water of hydration at 100° yielding the anhyd. material or when heated in a sealed tube at 200° with water and some selenious acid. The anhyd. material appears in the form of thick, prismatic, star-shaped clusters of crystals affecting polarized light. It is stable up to 100° , SeO_2 being given off upon ignition. It is insol. in water and sol. in acid. A voluminous ppt. of $\text{UO}_2\text{SeO}_3 \cdot \text{H}_2\text{SeO}_3 \cdot 6\text{H}_2\text{O}$ is obtained when a concd. SeO_2 soln. is added to UO_2SO_4 along with Na_2CO_3 . The ppt. is easily transformed to a light, dense-yellow microcryst. powder; apparently the crystals are monoclinic.
- 586 Chittenden, R. H. and Lambert, A. "Some Experiments on the Physiological Action of Uranium Salts." Z. Biol. 25, 513-32(1889).
This paper contains information similar to that reported in Trans. Conn. Acad. Arts Sci. 8, 1-18(1892). It is a continuation of the research reported in Trans. Conn. Acad. Arts Sci. 7, 261-73(1888).
- 587 Erb, R. "Crysto-Chemical and Physical Investigation of Some Double Uranyl Acetates." Neues Jahrb. Mineral. Geol. Beilage Bd. 6, 121-47(1889).
The existence and crystal form of a $\text{NaZn}(\text{UO}_2)_3(\text{OAc})_9 \cdot 9\text{H}_2\text{O}$ is reported. Later work indicates a different state of hydration. $\text{NaMg}(\text{UO}_2)_3(\text{OAc})_9 \cdot 9\text{H}_2\text{O}$ can be obtained from a mixed soln. of $\text{Mg}(\text{OAc})_2$ and $\text{UO}_2(\text{OAc})_2$ in the presence of a small amt. of Na^+ .
- 588 Fischel, V. Ueber Uransäure und deren Salze. Dissertation, Univ. of Bern, 1889.
Unsuccessful attempts to prep. the U^{+4} cyanide by fusing UO_3 and U^{+4} salts with KCN or by leading HCN or $(\text{CN})_2$ over a mixt. of U_3O_8 and C in a combustion tube are reported. $\text{UO}_3 \cdot 2\text{H}_2\text{O}$ was obtained as a yellow ppt. from uranyl soln. when treated with KCN. This reaction is accompanied by the evolution of HCN. It is indicated that $\text{K}_2\text{U}_2\text{O}_7$ can be obtained from uranic acid mixed with KCl and ignited strongly for two hrs. The melt which becomes a grayish-brown gradually changes to orange-yellow at which point it should be boiled with water and dried. It is reported that Li_2UO_4 can be prepd. in the same manner as K_2UO_4 . $\text{Na}_2\text{U}_2\text{O}_7$, like the K cpd., can be prepd. by igniting a mixt. of pptd. uranic acid and NaCl for two hrs in a blast lamp and boiling the residue with H_2O to leach out impurities prior to drying at 100° . BaU_2O_7 can be obtained by short intense heating of uranic acid with BaCl_2 . Purification is carried out in the same manner as in the prepn. of $\text{K}_2\text{U}_2\text{O}_7$. Expts. on the crystn. of MgUO_4 are reported with brown, irregular and amorph. materials being obtained. CaU_2O_7 can be obtained by heating uranic acid with CaCl_2 . The cryst. form of SrU_2O_7 is analogous to the corresponding Ca salt; however, it pro-

ceeds at a slower rate. When freshly pptd. uranic acid is heated to a dull-red heat with slight excess of BiCl_3 , silky brick-red crystals of the compn. $2\text{Bi}_2\text{O}_3 \cdot 3\text{UO}_3$ or $(\text{BiO})_4\text{U}_3\text{O}_{11}$ are formed. The excess BiCl_3 is volatilized by prolonged heating.

- 589 Hillebrand, W. F. "Mineralogical Notes." In Report of Work Done in the Division of Chemistry and Physics Mainly during the Fiscal Year 1886-'87. F. W. Clarke. Washington, U.S. Government Printing Office, 1889. (U. S. Geological Survey Bulletin No. 55.) p.48-51.

A discussion and the analysis of three samples of a mineral identified as samarskite which contains about 4% UO_2 is included.

- 590 Hillebrand, W. F. "Note on the Composition of Uraninite." Am. J. Sci. (3), 38, 329(1889).

- 591 Hodgkinson, W. R. E. and Lowndes, F. K. S. "The Decomposition of Potassium Chlorate in Contact with Metallic Oxides." Chem. News 59, 63-4(1889).

It is reported that $\text{UO}_3 \cdot 2\text{H}_2\text{O}$ will react with KClO_3 to form $\text{K}_2\text{U}_2\text{O}_7$ and free Cl_2 . When U_3O_8 is heated with KClO_3 , the reaction involves the loss of O_2 with the evolution of a great deal of Cl_2 and the formation of K_2UO_4 . The reaction was found to begin at approx. 390° .

- 592 Johnsson, K. R. "On Some Phosphates of Polyvalent Metals." Ber. 22, 976-80(1889).

Uranium metaphosphate, $\text{U}(\text{PO}_3)_4$, can be obtained from UO_2SO_4 and HPO_3 or by placing UO_2 and HPO_3 in a gold or porcelain combustion boat and heating at red heat in a stream of CO_2 . The resulting material was first believed to be a uranyl salt. Its crystals have a d. of 3.818 and it does not melt in the blowpipe flame. It is insol. in H_2O , HCl , HNO_3 , H_2SO_4 and in boiling concd. acids.

PUBLICATIONS LOCATED IN 1890

- 593 Blomstrand, C. W. "On Monazite from the Urals." J. prakt. Chem. (2), 41, 266-77(1890).

- 594 Böhlendorff, W. Studien zur Absorptions-Spectral-Analyse. Dissertation, Univ. of Erlangen, 1890.

Information is included on the absorption spectra of $(\text{UO}_2)^{+2}$ solns. Increasing diln. will cause spectra of the aq. soln. to become constant for all materials contg. $(\text{UO}_2)^{+2}$.

- 595 Borsbach, E. "On a Metal Quinoline and Double Quinoline Salt." Ber. 23, 431-40(1890).

According to this paper, uranyl acetate forms no cpds. with quinoline.

- 596 Bremer, H. Einfluss der Temperatur gefärbter Lösungen auf die Absorptionsspektren derselben. Dissertation, Univ. of Erlangen, 1890.

The influence of temp. on the absorption spectrum of uranyl solns. is investigated.

- 597 Brezina, A. "On the Crystal Form of Uranothallite." Ann. naturhistor. Hofmuseums 5, 495-502 (1890).

- 598 Ditte, A. "Research on Iodic Acid and Its Salts." Ann. chim. phys. (6), 21, 145-88(1890).

$\text{UO}_2(\text{IO}_3)_2 \cdot \text{H}_2\text{O}$ can be obtained as a yellow microcryst. salt when boiling solns. of $\text{UO}_2(\text{NO}_3)_2$ and HIO_3 are mixed in the presence of a large amt. of HNO_3 . There is a discussion of the polymorphism and crystal structure of $\text{UO}_2(\text{IO}_3)_2 \cdot \text{H}_2\text{O}$. A number of the phys. properties are mentioned. This paper also reports the prepn. of the anhyd. iodate, $\text{UO}_2(\text{IO}_3)_2$, in aq. soln. Later papers proposed that this anhyd. material is actually hydrated.

- 599 Fairley, T. "On the Detection and Separation of Minute Quantities of Hydrogen Dioxide and of Uranium." *Chem. News* 62, 227(1890).

A discussion of the pptn. of U using H_2O_2 is given. The presence of mineral acid, Na^+ , Bi^{+3} , and Ca^{+2} in excess were found to prevent pptn. In HOAc or dil. HNO_3 the pptn. will succeed. Analyses should be carried out on U_3O_8 prepd. by low temp. ignition of ppt.

- 600 Fairley, T. "Notes on the Limits of the Reactions for the Detection of Hydrogen Dioxide, and the Reactions for Uranium." *Rept. Brit. Assoc. Advanc. Sci.* 783(1890).

601 Formánek, J. "On Uranyl Chromate and Some of Its Double Salts." *Ann.* 257, 102-16(1890). Alk. chromate added to a soln. of uranyl salts will produce a yellow uranyl chromate. It is reported that $\text{K}_2\text{CrO}_4 \cdot 2\text{UO}_2\text{CrO}_4 \cdot 6\text{H}_2\text{O}$ or $\text{K}_2(\text{UO}_2)_2(\text{CrO}_4)_3 \cdot 6\text{H}_2\text{O}$ is obtained by heating a soln. of $\text{UO}_2(\text{NO}_3)_2$ and K_2CrO_4 in a 2:1 proportion. When a slightly warmed CrO_3 soln. is treated with excess Na_2UO_4 and filtered and evapd. over H_2SO_4 , crystals of $\text{Na}_2(\text{UO}_2)_2(\text{CrO}_4)_3 \cdot 10\text{H}_2\text{O}$ are obtained. Characteristics of these crystals are discussed. $(\text{NH}_4)_2\text{CrO}_4 \cdot 2\text{UO}_2\text{CrO}_4 \cdot 6\text{H}_2\text{O}$ is obtained with $(\text{NH}_4)_2\text{UO}_4$ from a warmed CrO_3 soln. upon filtering and drying over H_2SO_4 . A warmed CrO_3 soln. with excess $(\text{NH}_4)_2\text{UO}_4$ will form orange-red crystals of $(\text{NH}_4)_2\text{CrO}_4 \cdot 2\text{UO}_2\text{CrO}_4 \cdot 3\text{H}_2\text{O}$ which quickly decomp. in air to a yellow powder. [Compiler questions the prepn. of the hydrates as above.] It is reported that $\text{UO}_2\text{CrO}_4 \cdot 5\frac{1}{2}\text{H}_2\text{O}$ can be crystd. from boiling H_2O after formation from hot concd. CrO_3 soln. with excess uranyl hydroxide. When the HgNO_3 pptn. method is used to sep. Cr and U, the Hg soln. must be stored and heated in the dark since it is decompd. by light. The N oxide formed prevents the complete pptn. of the chromate. The results of the HNO_3 method of sepn. are said to be low since U sometimes remains in soln. and the UO_2 is not completely dissolved.

- 602 Fowler, G. J. and Grant, J. "The Influence of Different Oxides on the Decomposition of Potassium Chlorate." *J. Chem. Soc.* 57, 272-82(1890).

When U_3O_8 is heated with KClO_3 , the reaction involves the loss of O, the evolution of a great deal of Cl_2 , and formation of K_2UO_4 . The reaction was found to begin at approx. 390° .

- 603 Hillebrand, W. F. "Preliminary Remarks on North American Uraninites." In *Report of Work Done in the Division of Chemistry and Physics Mainly during the Fiscal Year 1887-'88*. F. W. Clarke. Washington, U. S. Government Printing Office, 1890. (U. S. Geological Survey Bulletin No. 60) p.131-3.

A brief description of these uraninites is included with a discussion of their compn.

- 604 Michel, L. "Crystallographic and Optical Study of Neutral Uranate and Anhydrous Soda." *Bull. soc. franç. minéral.* 13, 72(1890).

It is reported that Na_2UO_4 prepd. by the decompn. of uranium molybdate with NaCl is in the form of brilliant, reddish-yellow, transparent, rhombic prisms which are strongly birefringent.

- 605 Ouvrard, L. "On Some Phosphates of Lithium, Beryllium, Lead, and Uranium." *Compt. rend.* 110, 1333-6(1890).

$\text{K}_4\text{UO}_2(\text{PO}_4)_2$ can be obtained, in the form of thick yellow prisms, by melting K_3PO_4 with UO_3 . $\text{K}_2\text{UO}_2\text{-P}_2\text{O}_7$ can be obtained, in the form of small, transparent, yellow, double-refracting, rhombohedral prisms, by melting KPO_3 and UO_3 . The d. of these crystals is reported to be 4.2 at 20° . KUO_2PO_4 can be obtained by melting $\text{K}_4\text{P}_2\text{O}_7$ with UO_3 . These crystals are doubly refracting rhombohedrons. When a large amount of UO_3 is dissolved in molten $\text{Na}_4\text{P}_2\text{O}_7$ and the mixt. cooled and leached with water, crystals of $\text{Na}_4\text{UO}_2(\text{PO}_4)_2$ are obtained. If Na_3PO_4 or NaPO_3 is used in place of the sodium pyrophosphate, the same cpd. is obtained. Brilliant sulfur-yellow monoclinic prisms with an extinction angle of 30° of $\text{Na}_2\text{UO}_2\text{P}_2\text{-O}_7$ are reported. The crystals are larger if they are prepared in the presence of NaCl .

- 606 Vorosilsky, J. "On the Action of Uranium." *Arb. pharmakol. Inst. Dorpat* 5, 1-41(1890).

It is reported that the injection of uranyl nitrate or sodium uranium tartrate produces punctiform ecchymoses of the mucous membrane of the pylorus and intestines. Large doses of U cpds. cause marked

changes in blood pressure and death is said to be quite rapid, due usually to respiratory paralysis, apparently of a central origin.

PUBLICATIONS LOCATED IN 1891

- 607 Bremer, H. Über dem Einfluss der Temperatur gefärbter Lösungen auf die Absorptionsspektren derselben. Inaugural dissertation, Univ. of Erlangen, 1891.

The influence of temp. on the absorption spectrum of solns. of UO_2SO_4 , sodium uranyl sulfate, ammonium uranyl sulfate, $\text{UO}_2(\text{NO}_3)_2$ and $\text{UO}_2(\text{OAc})_2$ are investigated. (A summary of this paper appears in Z. anorg. Chem. 1, 112-22(1892).)

- 608 Cartier, F. Glycosuries toxiques et en particulier intoxication par le nitrate d'urane. Paris, G. Steinheil, 1891.

It is reported that glycosuria is important in U poisoning. (Reviewed in Therap. Gazz. 15, 776-7(1891).)

- 609 Hillebrand, W. F. "On the Occurrence of Nitrogen in Uraninite and on the Composition of Uraninite in General." U.S. Geol. Survey Bull. No. 78, 43-79(1891).

There is a discussion of the detn. of U in U_3O_8 . This is done after a weighed amt. is heated at 150° in a bomb tube with H_2SO_4 in a CO_2 atm. until the soln. is clear. Since U_3O_8 , according to its formula, dissolves to form UO_2SO_4 and $\text{U}(\text{SO}_4)_2$, the latter can be titrated directly. By calcn., or a new detn. after reduction to the U^{+4} form, it is possible to test the purity of U_3O_8 obtained by any other means. In sepg. V and U by the HCl method, if the soln. is evapd. to dryness with nitric acid heated in a current of HCl, the V will be removed by sublin. retaining the U in the ppt. If the $(\text{NH}_4)_2\text{CO}_3$ method of extrn. is used, cold water will dissolve any $\text{UO}_2(\text{NO}_3)_2$ present out of residue in a quant. manner. A number of analytical methods for the detn. of U in pitchblende are also discussed.

- 610 Hillebrand, W. F. "New Analyses of Uraninite." Am. J. Sci. (3), 42, 390-3(1891).

- 611 Knoblauch, O. "Absorption Spectral Analysis of Very Dilute Solutions." Ann. Physik Chem. (Wied.) 43, 738-83(1891).

Information is included on the absorption spectra of $(\text{UO}_2)^{+2}$ solns.

- 612 Wisbar, G. "Studies on Polybasic Acids. III. Decomposition of Tartaric Acid and of Butyric Acid by Sunlight in the Presence of Uranyl Salt." Ann. 262, 232-6(1891).

It is reported that, when $\text{UO}_2(\text{NO}_3)_2$ and butyric acid are exposed to light in an aq. soln., propane and CO_2 are formed and the uranyl salt is reduced to U^{+4} .

PUBLICATIONS LOCATED IN 1892

- 613 Blomstrand, C. W. "On Monazite from the Urals." Z. Krist. 20, 367-8(1892).

- 614 Blomstrand, C. W. "On Some Swedish Monazites." Neues Jahr. Mineral. Geol. (1, referet.) 45-7(1892).

- 615 Chittenden, R. H. and Lambert, A. "Some Experiments on the Physiological Action of Uranium Salts." Trans. Conn. Acad. Arts Sci. 8, 1-18(1892).

This paper continues the investigation reported in Trans. Conn. Acad. Arts Sci. 7, 261-73(1888) and also published in Z. Biol. 25, 513-32(1889).

- 616 Hillebrand, W. F. "New Analyses of Uraninite." U.S. Geol. Survey Bull. No. 90, 22-5(1892).

- 617 Hillebrand, W. F. and Melville, W. H. "On the Isomorphism and Composition of Thorium and Uranous Sulphates." Am. Chem. J. 14, 1-09(1892).
It is reported that $\text{U}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ forms tabular rhombic bipyramidal crystals which have an axial ratio a:b:c of 0.7563:1:0.3805. The material is said to be isomorphous with the corresponding Th cpd.
- 618 Hillebrand, W. F. and Melville, W. H. "On the Isomorphism and Composition of Thorium and Uranous Sulphates." U.S. Geol. Survey Bull. No. 90, 26-33(1892).
Two parts are included, one on chem. and the other crystallographic data. This paper is similar to that published in Am. Chem. J. 14, 1-9(1892).
- 619 Moissan, H. "Description of a New Electric Furnace." Compt. rend. 115, 1031-3(1892).
The preparation of U metal is discussed. It is reported that UO_3 may be reduced to metallic hue by treatment with C in an electric furnace at 3000° .
- 620 Rauter, G. "On Silicon Tetrachloride." Ann. 270, 235-66(1892).
It is reported that, when UO_3 is heated for about 8 hrs in a closed tube at 370 to 380° with SiCl_4 , Cl_2 and a residue containing unchanged UO_3 , UCl_4 , UO_2Cl_2 , and SiO_2 are obtained.
- 621 Rousseau, G. and Tite, G. "On the Decomposition of Basic Nitrates by Water." Compt. rend. 115, 174-5(1892).
When $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ is heated to 100 or 200° with CaCl_2 in a closed vessel, a product is obtained whose alc. soln. ppt. a basic nitrate. The compn. of this nitrate was not detd.
- 622 Sabatier, P. and Senderens, J. B. "Action of Nitric Oxide on Metals and on Metallic Oxides." Compt. rend. 114, 1429-32(1892).
 UO_2 was not found to be noticeably affected by light. It was found that NO will react with brown UO_2 below red heat with the evolution of light and the formation of black U_2O_5 .
- 623 Sabatier, P. and Senderens, J. B. "Action of Nitric Oxide on Metallic and on Metal Oxides." Compt. rend. 114, 1476-9(1892).
It is reported that NO will not reduce U oxide greatly.
- 624 Sabatier, P. and Senderens, J. B. "Action of Nitric Oxide on Metals and Metallic Oxides." Bull. soc. chim. France (3) 7, 502-07(1892).
Action of NO on UO_3 is compared with the action of air (heat to 500°). The first yields black U_2O_5 ; the second, yellow-brown U_3O_8 .
- 625 Schwartz, W. Beiträge zur Kenntniss der umkehrbaren Umwandlungen polymorpher Körper. Preisschrift, Univ. of Göttingen, 1892.
The transition temp. for $\text{NaCu}(\text{UO}_2)_3(\text{OAc})_9 \cdot 9\text{H}_2\text{O}$ is given as 93.8° . For the similar sodium cobalt uranyl cpd., 73.0 to 73.1° is given. The existence and crystal form of a $\text{NaZn}(\text{UO}_2)_3(\text{CH}_3\text{CO}_2)_9$ is reported. Nine moles of water of crystn. is said to accompany the crystal. However, later work disputes this opinion.
- 626 Seubert, K. and Schmidt, A. "On the Action of Magnesium upon Chloride." Ann. 267, 218-48 (1892).
It is stated that UO_2Cl_2 is partially reduced to metal using Mg.

PUBLICATIONS LOCATED IN 1893

- 627 Bach, A. "Contribution to the Study of the Chemical Phenomena of Assimilation of Carbonic Acid by Plants Having Chlorophyl." Compt. rend. 116, 1145-8(1893).

This paper contains a discussion of the formation of org. cpds. by the action of uranyl salts and CO_2 in light. It is reported that $\text{UO}_2(\text{OAc})_2$ soln. cannot be decompd. in light when CO_2 is being passed through the soln.

- 628 Bach, A. "Research on the Chemical Mechanism of the Assimilation of Carbonic Acid by Plants Having Chlorophyl." *Mon. sci. Docteur Quesneville* 41, 669-84(1893).

This paper contains further information similar to that reported in *Compt. rend.* 116, 1145-8(1893).

- 629 Bruttini, A. "Colorimetric Determination of Small Quantities of Uranium in Minerals." *Gazz. chim. ital.* 23, I, 251-7(1893).

This paper contains an analysis for U in various ores.

- 630 Dammer, —. *Handbuch der anorganischen Chemie*. Stuttgart, 1893.

Vol. 3, p. 686, contains a description of a spot test for U using $\text{K}_4[\text{Fe}(\text{CN})_6]$. After an acetate soln. of the salt is titrated with NaNH_4PO_4 , a distinct brown color is obtained in the spot test.

- 631 Hillebrand, W. F. "A Further Example of Isomorphism of Thoria and Uranium Dioxide." *U. S. Geol. Survey Bull.* No. 113, 41-3(1893).

A cryst. mixed Th-U oxide can be prepd. by mixing U_3O_8 and ThO_2 with borax glass in a Pt crucible and fusing. When only U_3O_8 is fused oxyhedral crystals consisting of UO_2 accompanied by some UO_3 are obtained. The UO_3 present will decrease as fusion continues. Crystals of UO_2 are found to be isomorphous with ThO_2 as detn. by prepn. of synthetic mixts.

- 632 Hillebrand, W. F. "A Further Example of Isomorphism of Thoria and Uranium Dioxide." *Z. anorg. Chem.* 3, 249-51(1893).

This paper is a translation of that published in *U. S. Geol. Survey Bull.* No. 113, 41-3(1893).

- 633 Hillebrand, W. F. "The Preparation and Specific Gravity of Crystallized Uranium Dioxide." *U. S. Geol. Survey Bull.* No. 113, 37-40(1893).

- 634 Hillebrand, W. F. "Preparation and Specific Gravity of Crystalline Uranium Dioxide." *Z. anorg. Chem.* 3, 243-8(1893).

This paper is a translation of that published in *U. S. Geol. Survey Bull.* No. 113, 37-40(1893).

- 635 Midden, W. E. and Hillebrand, W. F. "On Mackintoshite, a New Thorium and Uranium Mineral." *Am. J. Sci.* (3), 46, 98-103(1893).

- 636 Moissan, H. "On the Preparation of Uranium at High Temperatures." *Compt. rend.* 116, 347-9(1893).

Freshly melted U becomes coated with a corrosive film when in contact with water. At red heat it will react with HCl with a flash forming UCl_4 . A similar reaction with HI is reported. A discussion is also included on the reduction of U_3O_8 to U metal using sugar-derived C. The impurities found were C (13.5 to 2.06%) and N.

- 637 Odernheimer, E. "Production of Yellow and Brown Color in the Fiber Using Uranium Salts." *Z. angew. Chem.* 311(1893).

- 638 Seubert, K. and Elten, M. "On Knowledge of Basic Sulfites." *Z. anorg. Chem.* 4, 44-95(1893). It is reported that UO_2SO_3 can be obtained by mixing cold N solns. of $\text{UO}_2(\text{NO}_3)_2$ and Na_2SO_3 with the addn. of an equal vol. of alc. After prepn., the product should be washed with alc., as it is contaminated with hydroxide. The orange ppt. has an at. ratio $\text{U}:\text{SO}_3 = 1.605:1$ which corresponds to the formula $5\text{UO}_2\text{SO}_3 \cdot 3\text{UO}_2(\text{OH})_2 \cdot 10\text{H}_2\text{O}$, and, hence, is a basic uranyl sulfite. When a soln. of 10 g of cryst. $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ in 20 cc H_2O and 5.7 g cryst Na_2CO_3 in 20 cc H_2O are mixed in the cold, a vigorous evolu-

tion of CO_2 occurs and an orange-red ppt. is obtained. This consists of $3\text{UO}_2\text{CO}_3 \cdot 5\text{UO}_2(\text{OH})_2 \cdot 6\text{H}_2\text{O}$ which is, however, contaminated with Na.

PUBLICATIONS LOCATED IN 1894

- 639 Bach, A. "On the Origin of Hydrogen Peroxide in the Air and in Atmospheric Precipitation." Ber. 27, 340-4(1894).

It is reported that $\text{UO}_2(\text{OAc})_2$ soln. cannot be decompd. in light when CO_2 is being passed through the soln. A cpd. of uranyl acetate and diethylaniline is mentioned.

- 640 Crookes, W. Selected Methods in Chemical Analysis. (3rd ed.) London, 1894.
Page 131 contains a description of the sepn. of U^{+4} from the rare earths using the insoly. of the rare earth disulfates in concd. Na_2SO_4 . On p. 149 the pptn. of Zn from Zn-U solns., when the soln. is made acid with HOAc, is discussed.

- 641 Farley, T. "Sodium and Uranium Peroxides, etc." Nature 50, 103-04(1894).

- 642 Kahlenberg, L. and Hillyer, H. W. "Solubility of Metallic Oxides in Normal Potassium Salts of Tartaric and Other Organic Acids." J. Am. Chem. Soc. 16, 94-108(1894).

UO_3 is reported not to be attacked by a boiling soln. of potassium tartrate.

- 643 Kassner, O. "On Sodium Peroxide and Its Use in Analysis." Arch. Pharm. 232, 226-40(1894).
 $\text{Na}_4\text{UO}_8 \cdot x\text{H}_2\text{O}$ can be pptd. from $\text{UO}_2(\text{NO}_3)_2$ soln. with Na_2O_2 and the addn. of alc. The ppt. goes to cryst. form after short standing. $\text{Na}_4\text{UO}_8 \cdot x\text{H}_2\text{O}$ is reported to be sol. in water and to react with HCl with the evolution of Cl_2 . Addn. of alc. to the soln. used for the pptn. of Na_4UO_8 resulted in the sepn. of $\text{Na}_2\text{U}_2\text{O}_{10}$ as a red oil which gradually crystd. in the form of red needles which dissolved in water and evolved Cl_2 when treated with HCl. The crystals absorb CO_2 from the atm. and lose O_2 . It is reported that $\text{Na}_2\text{O} \cdot 2\text{UO}_3$ can be obtained by prolonged boiling of a yellow soln. of $\text{Na}_4\text{UO}_8 \cdot 8\text{H}_2\text{O}$.

- 644 Moissan, H. "On the Preparation of Uranium at High Temperatures." Bull. soc. chim. France (3), 11, 11-13(1894).

This paper contains information similar to that reported in Compt. rend. 116, 347-9(1893).

- 645 Poleck, T. "On Sodium Peroxide." Ber. 27, 1051-3(1894).

It is reported that $\text{Na}_2\text{O} \cdot 2\text{UO}_3$ can be obtained by prolonged boiling of a yellow soln. of $\text{Na}_4\text{UO}_8 \cdot 8\text{H}_2\text{O}$.

- 646 Reichard, C. "On the Action of Acid Potassium Arsenites on Metal Salts." Ber. 27, 1019-36 (1894).

It is reported that $\text{UO}_2 \cdot \text{As}_2\text{O}_3$ or $\text{UO}_2(\text{AsO}_2)_2$ is obtained as a light-yellow ppt. by treatment of a soln. of $\text{UO}_2(\text{NO}_3)_2$ with acid K arsenite.

- 647 Seekamp, W. "On the Decomposition of Tartaric and Citric Acid in Sunlight." Ann. 278, 373-4 (1894).

It is reported that, when tartaric acid and uranyl salts are exposed to light, a reduction occurs.

- 648 Smith, E. F. and Shinn, O. L. "Action of Molybdenum Dioxide upon Silver Salts." J. Am. Chem. Soc. 16, 569-71(1894).

UO_2 prepd. by the reduction of oxalate is reported to dissolve in an ammoniacal soln. of AgNO_3 , with the pptn. of metallic Ag.

- 649 Smith, E. F. and Shinn, O. L. "Action of Molybdenum Dioxide upon Silver Salts." Z. anorg. Chem. 7, 47-9(1894).

This paper contains information similar to that reported in J. Am. Chem. Soc. 16, 569-71(1894).

- 650 Wyruboff, G. "Research on the Triple Acetates of Uranyl, Sodium and a Magnesium Metal." Bull. soc. chim. France (3), 11, 531(1894).

PUBLICATIONS LOCATED IN 1895

- 651 Brunck, O. "On Ozone Formation." Z. anorg. Chem. 10, 222-47(1895).

It is reported that UO_3 prep'd. by the decompn. of the nitrate at 300° may be freed of N_2 by conversion to ammonium uranyl carbonate and then heating for approx. 24 hrs in a stream of air at 350° until litmus paper no longer shows any trace of base. The UO_3 still will contain small traces of NH_3 . Prolonged heating of UO_3 and CO_2 is reported to give a pure, mossy-green U_3O_8 . Prolonged heating of UO_3 in O_2 will produce detectable amts. of O_3 . When UO_3 is heated with KClO_3 , K_2UO_4 and free Cl_2 are formed. When $\text{UO}_4 \cdot 2\text{H}_2\text{O}$ is heated slowly in a stream of CO_2 as high as 150° , it will not lose H_2O and it undergoes no visible change. Above 150° , however, it will lose H_2O and O_2 and go to the orange-yellow UO_3 without forming any ozone.

- 652 Demarcay, E. Spectres Électriques. Paris, 1895.

Page 17 contains information on the observation of a number of characteristic, weak U lines in the continuous background of the spark spectrum found when a UCl_4 soln. is observed.

- 653 Fresenius, C. R. and Hintz, E. "Determination of Uranium in Phosphoric Acid- and Arsenic Acid-Containing Ores." Z. anal. Chem. 34, 437-9(1895).

When $\text{K}_3\text{Fe}(\text{CN})_6$ is added to a soln. contg. U and P, the U is quant. pptd. in the presence of NaCl . U should be repptd. by the addn. of KOH in order to obtain accurate results. This method is also applied to the analysis of U-bearing ores.

- 654 Fresenius, C. R. and Hintz, E. "Determination of Uranium in Phosphoric Acid and Arsenic Acid-Containing Earths." Z. angew. Chem. 502-03(1895).

- 655 Gibbs, W. "Researches on the Complex Inorganic Acids." Am. Chem. J. 17, 167-85(1895).

In the section on uranoso-tungstates it is reported that Na-U tungstate can be obtained from solns. of UO_3 in dil. H_2SO_4 in the presence of Zn metal upon the addn. of sodium paratungstate. The resultant double tungstate is an olive-green cryst. salt insol. in hot water and oxidized by heating with HNO_3 . Potassium uranium tungstate, $9\text{K}_2\text{O} \cdot 6\text{UO}_2 \cdot 8\text{WO}_3$, can be obtained in a similar manner. It also is green and possesses the same soly. characteristics. Similar information is given on the NH_4 -U tungstate.

- 656 Lescoeur, H. "Research on the Dissociation of Potash Hydrates and Similar Compounds." Ann. chim. phys. (7), 4, 213-34(1895).

The vapor pressure of a satd. soln. of UO_2SO_4 at 20° is reported to be approx. 10 mm Hg. The existence of $\text{UO}_2\text{SO}_4 \cdot \text{H}_2\text{O}$ is confirmed by vapor pressure measurements. The method of prepn. is the treatment of satd. UO_2SO_4 soln. with concd. H_2SO_4 . The material which is obtained remains stable when heated as high as 160° . This paper also reports vapor pressure measurements on $\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$. When it is dried for one day over H_2SO_4 or heated to 100° on a water bath, 1.5 moles of H_2O are removed. The monohydrate can be obtained at 110 to 115° ; the material is reported to go to the anhyd. salt above 175° .

- 657 Nichols, E. F. "A Method for the Study of Transmission Spectra in the Ultra-Violet." Phys. Rev. (1), 2, 302-05(1895).

Wavelength measurements in the absorption spectrum for uranyl salts between 0.4 and 0.3μ are reported.

658 Ramsay, W. "Discovery of Helium in Cleveite." J. Chem. Soc. 67, 1107-08(1895).

659 Sabatier, P. and Senderens, J. B. "Action of Nitric Oxide on Metals and Metallic Oxides." Bull. soc. chim. France (3), 13, 870-3(1895).

It is reported that brown UO_2 is obtained by reducing UO_3 with H_2 at red heat. It is not attacked by N_2O at 150° , whereas black UO_2 prep'd. at a lower reduction temp. is slowly oxidized by N_2O to U_2O_5 .

660 Sabatier, P. and Senderens, J. P. "Action of Nitric Oxide on Metals and Metallic Oxides." Compt. rend. 120, 618-20(1895).

This paper contains information similar to that reported in Bull. soc. chim. France (3), 13, 870-3(1895).

661 Smith, E. F. and Matthews, J. M. "Uranium Oxynitride and Uranium Dioxide." J. Am. Chem. Soc. 17, 686-8(1895).

When U_3O_8 is mixed with a large excess of NH_4Cl , placed in a porcelain crucible, and heated with charcoal for 6 hrs at white heat, a reddish-brown product is obtained which contains neither N nor Cl.

662 Wells, H. L. and Boltwood, B. B. "On the Double Salts of Caesium Chloride with Chromium Trichloride and with Uranyl Chloride." Am. J. Sci. (3), 50, 249-52(1895).

It is reported that $\text{Cs}_2\text{UO}_2\text{Cl}_4$ can be obtained by crystn. from solns. of the component chlorides. Evapn. or the addn. of HCl in the heated soln. will bring down the ppt.

663 Wells, H. L. and Boltwood, B. B. "On the Double Salts of Caesium Chloride with Chromium Trichloride and with Uranyl Chloride." Z. anorg. Chem. 10, 181-4(1895).

This paper contains information similar to that reported in Am. J. Sci. (3), 50, 249-52(1895).

664 Wiedemann, E. and Schmidt, G. C. "On Luminescence of Pure Inorganic Compounds and of Solid Solutions." Z. physik. Chem. 18, 529-52(1895).

The U cpds. investigated are uranium [uranyl] acetate, uranium [uranyl] nitrate, calcium uranium [uranyl] phosphate, uranium [uranyl] sulfate, uranium [uranyl] tartrate, uranium [uranyl] oxalate, uranium [uranyl] borate, uranium [uranyl] citrate, and hydrated uranium oxide. The first four of these showed a green cathode luminescence and photoluminescence, the others showed none.

665 Wiedemann, E. and Schmidt, G. C. "On Luminescence by Solid Compounds and Solid Solutions." Ann. Physik Chem. (Wied.) 56, 201-54(1895).

Uranyl and U cpds. are among those investigated. A green fluorescence is reported.

666 Wiedemann, E. and Schmidt, G. C. "On Luminescence." Ann. Physik Chem. (Wied.) 54, 604-25(1895).

Very brief notes on the luminous properties of U cpds. are included. Other materials are discussed in greater detail.

PUBLICATIONS LOCATED IN 1896

667 Aloy, F. J. "Thermal Studies on Uranium Compounds." Compt. rend. 122, 1541-3(1896).

This paper contains a discussion of the heat of soln. of $\text{UO}_2\text{CrO}_4 \cdot 5\frac{1}{2}\text{H}_2\text{O}$. NH_4 uranyl acetate hexahydrate was prep'd. by heating very dil. soln. of the individual acetates. This paper indicates a disagreement with the results of other authors on detg. the molar ht. of soln. for anhyd. $\text{UO}_2(\text{NO}_3)_2$ and its hydrates. The molar hts. of soln. for $\text{UO}_2\text{Cl}_2 \cdot \text{H}_2\text{O}$, $\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$, and $\text{UO}_2(\text{OAc})_2 \cdot 2\text{H}_2\text{O}$ in 1000 to 2500 moles of H_2O (18 to 20°) are reported to be 6.05, 5.1, and 4.5 kcal, resp. In the prepn. of $\text{UO}_2 \cdot \text{H}_2\text{O}$ from uranyl nitrate, it is recommended that the solid uranyl nitrate be heated on a sand bath until HNO_3 is no longer evolved. The hts. of neutralization of $\text{UO}_3 \cdot \text{H}_2\text{O}$ in various mineral acids, 0.5 N, are as follows: HCl, +8.4 kcal; HBr, +8.8 kcal; HNO_3 , +8.4 kcal; H_2SO_4 , +9.5 kcal; and HOAc, +7.5 kcal.

- 668 Becquerel, H. "On the Radiations Emitted in Phosphorescence." Compt. rend. 122, 420-1 (1896).

This paper reports the discovery of radioactivity in K-uranium [uranyl] sulfate which exposed a photographic plate covered with paper.

- 669 Becquerel, H. "On the Invisible Radiations Emitted by Phosphorescent Bodies." Compt. rend. 122, 501-03(1896).

Information is given on the phosphorescence and radioactivity of K uranyl sulfate.

- 670 Becquerel, H. "On the Invisible Radiations Emitted by the Salts of Uranium." Compt. rend. 122, 689-94(1896).

- 671 Becquerel, H. "On the Different Properties of the Invisible Radiations Emitted by the Salts of Uranium, and of the Radiation of the Anode-Wall of a Crookes Tube." Compt. rend. 122, 762-7 (1896).

- 672 Becquerel, H. "Emission of New Radiations by Metallic Uranium." Compt. rend. 122, 1086-8 (1896).

- 673 Becquerel, H. "On Different Properties of Uranium Rays." Compt. rend. 123, 855-8(1896).

- 674 Bourgeois, L. "On a Crystalline Phosphate of Uranium." Bull. soc. philomath. Paris, 9, 125-30 (1896).

It is reported that $\text{UO}_2\text{HPO}_4 \cdot 4\text{H}_2\text{O}$ exists in the form of yellow, optically neg. tetragonal crystals having a d. 3.03, and an axial ratio a:c = 1:1.7284. The presence of Ca salts will accelerate the formation of these crystals. It is also reported that square poorly formed crystals of $\text{UO}_2\text{HAsO}_4 \cdot 4\text{H}_2\text{O}$, uranyl hydrogen orthoarsenate, show greater optical activity than the corresponding orthophosphate.

- 675 Braun, J. Beiträge zur Kenntnis der Uranverbindungen. Dissertation, Univ. of Berlin, 1896. A dark-yellow flocculent ppt. is obtained in the prepn. of $\text{K}_4\text{UO}_2(\text{CO}_3)_3$ from cold satd. $\text{UO}_2(\text{NO}_3)_2$ soln. with K_2CO_3 . Further treatment with K_2CO_3 will yield the cryst. material. There is indication that $\text{K}_4\text{UO}_2(\text{CO}_3)_3 \cdot 2\text{H}_2\text{O}$ is obtained when very dil. $\text{UO}_2(\text{NO}_3)_2$ soln. (4 g UO_2) is combined with very dil. K_2CO_3 soln., the mixt. being concd. on a water bath until yellow cryst. powder results. $(\text{NH}_4)_4\text{UO}_2(\text{CO}_3)_3$ can be obtained in cryst. form from $\text{UO}_2(\text{NO}_3)_2$ soln. and excess concd. $(\text{NH}_4)_2\text{CO}_3$ soln. The Na salt can be obtained as a coherent crust in a similar fashion. When a soln. of NH_4 uranyl carbonate is heated, a yellow flocculent ppt. is obtained which is probably a mixt. of uranyl carbonate, UO_3 , and the uranate. If an excess of a satd. soln. of KHCO_3 or NH_4HCO_3 is added dropwise to a soln. of $\text{UO}_2(\text{NO}_3)_2$, the yellow ppt. obtained contains K_2UO_4 or $(\text{NH}_4)_2\text{UO}_4$, as well as uranyl carbonate and the double carbonate.

- 676 Chesneau, G. "On the Temperature of the Spark Produced by Uranium." Compt. rend. 122, 471-3(1896).

- 677 Fay, H. "The Action of Light on Some Organic Acids in the Presence of Uranium Salts." Am. Chem. J. 18, 269-89(1896).

This paper contains a discussion of the photolytic action of uranyl cpds. with various org. acids. There are discussions of the catalytic character of the photolysis, especially of oxalic acid, in the presence of uranyl salts. It is reported that the uranyl salt of malonic acid, $\text{UO}_2\text{CH}_2(\text{CO}_2)_2 \cdot 3\text{H}_2\text{O}$, is an almost insol. yellow powder. The velocity of decompn. of malonic acid in the presence of uranyl salts and light is substantially less than that of oxalic acid. Uranyl salts and propionic acid in the presence of light will form ethane and CO_2 and U^{+4} salts.

- 678 Hauke, A. "On the Equivalent Refraction of the Elements." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse. Abt. IIa 105, 749-77(1896).

The at. refraction for U calcd. by the Gladstone-Dale method is reported to be 16.57 and by the Lorentz-Lorenz method to be 8.16.

679 Heidenreich, M. "Quantitative Analysis by Electrolysis." Ber. 29, 1585-90(1896).
This paper contends that U cannot be detd. electrolytically in any way.

680 Larsson, A. "Investigations on Niobium." Z. anorg. Chem. 12, 188-207(1896).
It is reported that a melt of U niobate in boric acid yields a number of different cpds., among them a yellow tabular crystal which could not be satisfactorily analyzed but which was supposed to have had the compn. $3\text{UO}_3 \cdot \text{B}_2\text{O}_3$.

681 Lescoeur, H. "Research on the Dissociation of Potash Hydrates and Similar Compounds." Ann. chim. phys. (7), 7, 416-32(1896).
 $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ is deliq. in air even at ordinary temp. It is found to liquefy in moist air and is reported to be decompd. at 80° , giving off HNO_3 and leaving behind a mixture of UO_3 and the trihydrate. The vapor pressure over $\text{UO}_2(\text{NO}_3)_2$ at 60° is 11.7 mm Hg; the vapor pressure of a satd. soln. aq. of $\text{UO}_2(\text{NO}_3)_2$ at 60° is about 12.2 mm Hg.

682 Moissan, H. "Action of Fluorine on Argon." Ann. chim. phys. (7), 8, 141-4(1896).
The trials reported indicate no reaction between U and A.

683 Moissan, H. "On a New Method of Preparing Alloys." Bull. soc. chim. France (3), 15, 1282-4 (1896).
The prepn. of an Al-U alloy using liq. Al and U oxide is reported.

684 Moissan, H. "On a New Method of Preparing Alloys." Compt. rend. 122, 1302-03(1896).
A note on obtaining an alloy of Al and U is included.

685 Moissan, H. "Preparation and Properties of Uranium." Ann. chim. phys. (7), 9, 264-72(1896).
 $2\text{NaCl} \cdot \text{UCl}_4$ or Na_2UCl_6 , can be obtained by treating NaCl with UCl_4 vapor at dull-red heat. The resulting material is an apple-green cryst. mass, less hygr. and more stable than UCl_4 , melting at about 300° , and sol. in water and alc. with decompn. U metal is obtained when the double chloride is heated with metallic Na in an Fe cylinder. The heat of reaction is great enough to bring the material to red heat. The metal, in powder form, is then washed with alc. and cold water. U contents of 99.28 to 99.40% are obtained. Information is also included on the paramagnetic properties of this metal. The metal will melt in an electric furnace and at higher temp. will volatilize. It is more volatile than Fe. The prepn. of U_3O_8 by the ignition of uranyl nitrate, which is easy to obtain pure, is discussed. Ignition is carried out in a porcelain crucible.

686 Moissan, H. "Preparation and Properties of Uranium." Compt. rend. 122, 1088-93(1896).
This paper contains information similar to that reported in Ann. chim. phys. (7), 9, 264-72(1896).

687 Moissan, H. "Study of Several Metallic Carbides Decomposed by Cold Water." Ann. chim. phys. (7), 9, 302-37(1896).
U carbide is one of those studied. The analysis of the material for total C and for U is reported.

688 Moissan, H. "Study of Uranium Carbide." Compt. rend. 122, 274-80(1896).
 UC_2 is obtained when a finely powd. mixt. of U_3O_8 and sugar charcoal (1:1) is placed in a C crucible and heated for 8 to 10 min in an electric oven. A brief and vigorous reaction is noted. This carbide has a metallic appearance similar to that of Bi, possesses a dense finely cryst. structure, and is harder than rock crystal but softer than corundum. Its d. at 18° is 11.28 as measured in benzene. U_3N_4 can be prepd. by heating UC_2 in a stream of N_2 at 1100° . It is reported that UC_2 , like U, will give bright sparks when hammered and, if powd. in an agate mortar without proper precautions, will take fire and burn. It will detonate in O_2 at 370° with the evolution of CO_2 . The residue, which is a bluish-black oxide, gives a

green streak on porcelain. UC_2 will decomp. H_2O at room temp. with the evolution of gas, the reaction becoming violent upon heating. In the absence of air this reaction produces a green, hydrated oxide which turns grayish-black when exposed to air. The gas evolved is a mixt. of hydrocarbons which accounts for a third of the C present in the carbide, the H coming from the water, and the remainder of the C in the form of liq. and solid hydrocarbons can be extrd. from the soln. with Et_2O . UC_2 will burn in S vapor at moderately high temp. forming sulfide and CS_2 . Se has an analogous effect in that the selenide is formed. Dil. HCl , HNO_3 , and H_2SO_4 react with UC_2 like pure H_2O and the solns. obtained are yellow. Concd. acids, except HNO_3 , react slowly with UC_2 in the cold but give violent reactions when heated. UC_2 will burst into flame at 600° in HCl , forming a chloride which is unstable in H_2O . At red heat UC_2 is partially decompd. in an atm. of NH_3 giving a nitride and deflagrating violently when fused with KNO_3 or KClO_3 forming a uranate. Later work has shown that the material reported as U_2C_3 is actually UC_2 (see P. Lebeau, Compt. rend. 155, 955(1911)).

- 689 Moissan, H. "On the Volatilization of Several Refractory Compounds." Ann. chim. phys. (7), 9, 133-44(1896).

The distillation of U metal is reported to remove C impurities.

- 690 Sabatier, P. and Senderens, J. B. "Research on the Oxides of Nitrogen, Nitric Oxide, Nitrous Oxide, Nitrogen Peroxide." Ann. chim. phys. (7), 7, 348-415(1896).

It was found that NO will react with brown UO_2 below red heat, with the evolution of light and the formation of black U_2O_5 . Brown UO_2 is obtained by reducing UO_3 with H_2 at red heat. It is not attacked by N_2O at 150° , whereas black UO_2 prepared at a lower reduction temp. is slowly oxidized by N_2O to U_2O_5 .

- 691 Troost, L. "Observation on the Occasion of a Communication from Mr. H. Becquerel: 'On the Invisible Radiations Emitted by the Salts of Uranium.'" Compt. rend. 122, 694(1896).

- 692 Wyruboff, G. "Research on the Silicotungstates." Bull. soc. franç. minéral. 19, 219-354(1896). Various tungsten uranyl acid silicates are obtained by mixing solns. of $\text{UO}_2(\text{NO}_3)_2$ with wolfric and silicic acid solns. Isomorphic, isotropic crystals are obtained, containing from 91 to 267 moles of water and having the general "mineral" structures.

PUBLICATIONS LOCATED IN 1897

- 693 Becquerel, H. "Research on Uranium Rays." Compt. rend. 124, 438-44(1897).

- 694 Becquerel, H. "On the Law of Discharge in Air of Uranium Electricity." Compt. rend. 124, 800-03(1897).

- 695 Hofmann, K. A. "On the Hydroxylamine-Ammonia Compounds of Uronic Acid." Z. anorg. Chem. 15, 75-80(1897).

A complex between hydroxylamine and U of the form $(\text{NH}_3\text{OH})_2\text{UO}_4 \cdot \text{H}_2\text{O}$ can be obtained by the digestion of uranic acid or $\text{UO}_2(\text{NO}_3)_2$ with an aq. soln. of hydroxylamine in great excess. It is reported to occur as yellow, elongated, doubly refracting crystals which are cut at each end at 126° . The diamine addn. cpd. is also reported. When the monohydrate is treated with HOAc in excess, an ammonium hydroxylamine uranyl acetate complex is obtained as yellow prisms with a vitreous luster.

- 696 Humphreys, W. J. "Changes in the Wave-Frequencies of the Lines of Emission Spectra of Elements, Their Dependence upon the Elements Themselves and upon the Physical Conditions under Which They Are Produced." Astrophys. J. 6, 169-232(1897).

A discussion is included on the pressure shift of some of the arc lines in the U spectrum.

- 697 Lespleau, R. "Ebullioscopy of Several Salts in Ether Solution." Compt. rend. 125, 1094-6 (1897).

Changes in b. p. for Et₂O solns. of UO₂(NO₃)₂·6H₂O are given for several concns.

- 698 Lohse, O. "Investigation of the Violet Part of Some Many-Lined Metal Spectra." Sitzber. preuss. Akad. Wiss. 179-97(1897).

About 1400 lines in the U-arc spectrum are identified between 4646 and 3381 Å.

- 699 Melikoff, P. G. and Pissarjewsky, L. "On Uranic Acid and Its Salts." Ber. 30, 2902-07(1897). The structure of the peruranates is discussed and it is proposed that the peroxide formula R₂U₂O₁₀ = R₂O₂·2UO₄ and R₄UO₈ = 2R₂O₂·UO₄ is to be preferred since these substances can be characterized as cpds. of metallic peroxides with UO₄. It is stated that dil. H₂SO₄, HCl, HOAc, and succinic acid will split off H₂O₂ from Na₄UO₂·xH₂O; when shaken in an aq. soln. of Al(OH)₃, it will split into 2Na₂O₂ and UO₄. Na₄UO₈ can be obtained by dissolving hydrated UO₃ or UO₄ in excess NaOH and adding H₂O₂. The cpd. crystallizes in a hydrated form from concd. soln. after a few hrs, or from dil. soln. upon the addn. of alc. The cryst. cubes are isotropic under the polarizing microscope. Li₂U₂O₁₀·8H₂O can be produced by treating UO₂(NO₃)₂ with LiOH and H₂O₂, and adding alc. to the orange-yellow soln. which results. The peruranate is pptd. and should be dried over H₂SO₄ and soda lime. It is obtained in the form of small light-yellow isotropic prisms. These crystals are decompd. by H₂SO₄ with the loss of H₂O. The cpd. is split into Li₂O₂ and 2UO₄ when the soln. is shaken with Al(OH)₃. It is also claimed that a red cryst. cpd. of the formula Li₄UO₈ was obtained in the same manner, but this material is said to be very unstable, losing O₂ when allowed to stand over H₂SO₄. It is reported that (NH₄)₂U₂O₁₀·xH₂O is obtained when UO₂(NO₃)₂ soln. is treated with H₂O₂ and NH₃ in excess. A yellow-orange ppt. is obtained with alc. When excess H₂O₂ is present, the material appears to decomp. BaU₂O₁₀·9H₂O is obtained as a flocculent ppt. in the same manner as the corresponding NH₄ salt. When it is dried over H₂SO₄ and soda lime, a yellow cryst. powder results. It can be decompd. in the presence of CO₂. BaUO₈·8H₂O is obtained in the same manner as the corresponding Na salt, using BaCl₂. Orange, powderlike crystals result after drying of the ppt. over H₂SO₄ and soda lime. Studies of these crystals are also included. Dark-orange lead peruranate, Pb₃U₂O₁₀, can be obtained by mixing solns. of Na₂U₂O₇ and Pb(OAc)₂ and drying the resultant ppt. over H₂SO₄ and soda lime. The product occurs in the form of small isotropic prisms which are decompd. by H₂SO₄ with the sepn. of H₂O₂. Calcium peruranate, Ca₂UO₈·10H₂O, is reported to be formed as a ppt. of pale-yellow crystals by decompn. of the corresponding Na salt with CaCl₂. These crystals decomp. with H₂SO₄ by sepg. H₂O₂.

- 700 Miolati, A. and Alvisi, U. "On the Electrolytic Behavior of Certain Fluoro- and Fluorooxy-Complexes." Atti reale accad. Lincei (5), 6, II, 376-81(1897).

K₃UO₂F₅ is reported to behave like the salt of a tribasic uranyl hydrofluoric acid when its molar cond. in aq. soln. is detd. The difference in molar cond. for the dilutions 1024 and 32 M⁻¹ is 29.1. Information on the molar cond. of ammonium uranyl fluoride is also given.

- 701 Moissan, H. Le Four Électrique. Paris, Steinheil, 1897.

A general treatment of U chemistry is included. (A German translation dated 1897 is available.)

- 702 Moissan, H. Der Elektrische Ofen. Berlin, M. Krayn, 1897. (Tr. by T. Zettel.) Translation of Le Four Électrique. (1897).

- 703 Moissan, H. "Preparation and Properties of Uranium." Bull. soc. chim. France (3), 17, 266-71 (1897).

This paper contains information similar to that reported in Ann. chim. phys. (7), 9, 264-72(1896) and Compt. rend. 122, 1088-93(1896).

- 704 Moissan, H. "Study of Uranium Carbide." Bull. soc. chim. France (3), 17, 12-18(1897).

This paper contains information similar to that reported in Compt. rend. 122, 274-80(1896).

- 705 Pincussohn, L. Beiträge zur Kenntnis der Pyridinverbindungen. Dissertation, Univ. of Berlin, 1897.

Pyridinium uranyl nitrate can be prepd. by the evapn. of its components on a water bath. The product is amorph., yellow, and stable in air; it is sol. in water and alc. but insol. in ether.

- 706 Pincussohn, L. "On the Metal Compounds of Pyridine and the Electrolysis of Pyridine." Z. anorg. Chem. 14, 379-403(1897).

Pyridinium uranyl nitrate can be prepd. by the evapn. of its components on a water bath. The product is amorph., yellow, and stable in air. It is sol. in water and alc., but insol. in ether.

- 707 Walden, P. "A New Procedure for Increasing the Optical Rotatory Power." Ber. 30, 2889-95 (1897).

When an aq. or alc. soln. of malic acid and $\text{UO}_2(\text{NO}_3)_2$ is neutralized with KOH, a max. in the optical rotatory power is reached at the ratio of 4-KOH:1- $\text{C}_4\text{H}_6\text{O}_5$:1- $\text{UO}_2(\text{NO}_3)_2$. In both the Na and K uranyl tartrates the specific optical rotatory power of tartaric acid is lost by the addn. of KOH. There is a discussion of the optical rotatory power for solns. of uranyl salt quinic acid of the formula $\text{UO}_2[\text{C}_6\text{H}_7(\text{OH})_4\text{CO}_2]_2 \cdot x\text{H}_2\text{O}$. The change in this rotatory power upon the addition of NH_3 is discussed.

- 708 Waterman, F. A. "The Specific Heats of the Metals." Phys. Rev. (1), 4, 161-90(1897). The sp. ht. of U in the range 0 to 98° is calcd. to be 0.02765.

PUBLICATIONS LOCATED IN 1898

- 709 Bach, A. "On the Biochemical Evolution of Carbon." Arch. sci. phys. nat. (4), 5, 401-15(1898). It is reported that $\text{UO}_2(\text{OAc})_2$ solns. cannot be decompd. in light when CO_2 is being passed through the soln. There is a discussion of the formation of org. cpds. by the action of uranyl salts and CO_2 in light.

- 710 Bornträger, H. "On the Uranium Determination by A. Patera." Z. anal. Chem. 37, 436-7(1898). A discussion is included on the analysis of U in pitchblende ores. NaOH and KOH in U salt soln. was found to ppt. a yellow amorph. oxyhydrate of the type $\text{UO}_2(\text{OH})_2$ which, in the presence of excess alk., is immediately converted into the uranate. The ppt. was found to be difficult to filter.

- 711 Bourgeois, L. "On a Crystalline Phosphate of Uranium." Bull. muséum natl. hist. nat. (Paris) 4, 118-23(1898).

This paper contains information similar to that reported in Bull. soc. philomath. Paris 9, 125-30(1896).

- 712 Bourgeois, L. "On a Crystalline Phosphate of Uranium." Bull. soc. franc. minéral. 21, 32-9 (1898).

This paper contains information similar to that reported in Bull. soc. philomath. Paris 9, 125-30(1896).

- 713 Chretien, P. "Study of the Action Exercised by Several Acids on Iodic Acid and the Iodates." Ann. chim. phys. (7), 15, 358-432(1898).

Uranyl molybdenum acid iodate, $2\text{UO}_3 \cdot 4\text{I}_2\text{O}_5 \cdot 3\text{MoO}_3 \cdot 3\text{H}_2\text{O}$, can be prepd. as small yellow crystals from dil. solns. of free molybdic acid upon the addn. of $\text{UO}_2(\text{NO}_3)_2$.

- 714 Curie, M. S. "Rays Emitted by the Compounds of Uranium and of Thorium." Compt. rend. 126, 1101-3(1898).

All the cpds. of U behave like U, and the more so the more U they contain. Th oxide is more powerful than U itself. U and Th have the two highest at. wts. Ce, Nb, and Ta cpds. are slightly active. Yellow P is very active, perhaps for some other cause; red P and phosphates are not. Pitchblende (U oxide) is more powerful than the metal itself; so is natural chalcocite (Cu and U phosphate), while artificial chal-

colite is not: it seems these minerals contain some element more powerful than U. The effects produced increase with the thickness of the material: more so with Th than with U. The radiations from Th cpds. are more powerfully absorbed by Al than those from U cpds. Th radiations have less photographic effect than U radiations. All these radiations are very much like Sagnac's secondary radiations.

- 715 Curie, P. and Curie, M. S. "On a New Radioactive Substance Contained in Pitchblende." Compt. rend. 127, 175-8(1898).

The discovery of Po is reported. Information is given on the comparative radioactivity of U, Th, and the ores from which they come.

- 716 Deussen, F. J. P. E. Ueber die Absorption der Uranylsalze. Dissertation, Univ. of Erlangen, 1898.

This dissertation is concerned with absorption spectra measurements on $(\text{UO}_2)^{+2}$ solns.

- 717 Deussen, [F. J. P.] E. "On the Absorption of Uranyl Salts." Ann. Physik Chem. Wied. 66, 1128-48(1898).

Information is included on the absorption spectra of salt solns.

- 718 Exner, F. and Haschek, E. "On the Ultraviolet Spark Spectrum of Elements." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse. Abt. IIa 107, 1335-80(1898).

Several thousand lines are identified in the spark spectrum of U between the wavelengths of 6449 and 2195 Å.

- 719 Franklin, E. C. and Kraus, C. A. "Liquid Ammonia as a Solvent." Am. Chem. J. 20, 820-36(1898).

It is reported that $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ is slightly affected by liq. NH_3 . UF_4 is reported to be somewhat sol. in NH_3 yielding a yellow color in the soln. UO_3 is attacked only slightly by liq. NH_3 .

- 720 Goldschmidt, H. "On a New Method of Preparing Metals and Alloys Using Aluminum." Ann. 301, 19-28(1898).

The prepn. of U is discussed.

- 721 Hofmann, K. A. and Kohlschütter, V. "Inorganic Hydroxylamine Compounds." Z. anorg. Chem. 16, 463-74(1898).

It is reported that the hydroxylamine uranium complex can exist in the diamine form, $(\text{NH}_3\text{OH})_2\text{UO}_4 \cdot 2\text{NH}_3$.

- 722 Holmquist, P. J. "Synthesis Studies on Perovskite and Pyrochlorominerals." Bull. Geol. Inst. Univ. Upsala 3, 181-268(1898).

Na-U niobate in the form of orange tablets of $7(\text{Na}_2\text{O} \cdot \text{Nb}_2\text{O}_5) \cdot 2(2\text{UO}_2 \cdot \text{Nb}_2\text{O}_5)$ is obtained by heating U_3O_8 , Nb_2O_5 , and NaF in a porcelain crucible.

- 723 Koenigsberger, J. "Magnetic Susceptibility of Liquid and Solid Compounds." Ann. Physik Chem. (Wied.) 66, 732(1898).

This paper contains reports on some investigations of the magnetic properties of U. The material is said to be slightly paramagnetic.

- 724 Lienau, H. Beiträge zur Kenntnis der Uranylsalze. Dissertation, Univ. of Berlin, 1898.

$\text{KUO}_2\text{PO}_4 \cdot 3\text{H}_2\text{O}$ can be obtained by mixing a soln. of 6.8 g of KH_2PO_4 in 7 cc dil. HNO_3 (d. = 1.2) and H_2O with 4.1 cc of a soln. of $\text{UO}_2(\text{NO}_3)_2$ contg. 0.351 g/cc. When a NaH_2PO_4 soln. contg. HNO_3 is treated with $\text{UO}_2(\text{NO}_3)_2$, it will become cloudy and deposit a sulfur-yellow cryst. cpd. which, after drying over H_2SO_4 , has the compn. $\text{UO}_2\text{HPO}_4 \cdot 2\frac{1}{2}\text{H}_2\text{O}$. Uranyl hydrogen orthophosphates are reported to have the characteristic dull-yellow color which serves to differentiate them from the alk.-contg. uranyl phosphates, which are a brilliant greenish-yellow. If $\text{UO}_2(\text{NO}_3)_2$ is added to a soln. of LiH_2PO_4 contg. HNO_3 , a fluorescent, yellowish-green liq. is obtained. In a short time the liq. will become turbid, lose its fluores-

cence, and deposit $\text{UO}_2\text{HPO}_4 \cdot 6\frac{1}{2}\text{H}_2\text{O}$. $\text{NH}_4\text{UO}_2\text{AsO}_4 \cdot 3\text{H}_2\text{O}$ and $\cdot 5\text{H}_2\text{O}$ will ppt. from a HNO_3 -ammonium arsenate soln. in the presence of $\text{UO}_2(\text{NO}_3)_2$. $\text{KUO}_2\text{AsO}_4 \cdot 2\frac{1}{2}\text{H}_2\text{O}$ can be pptd. in a similar manner when solns. are not too dil. In dil. soln. $2\text{K}_2\text{O} \cdot 6\text{UO}_3 \cdot 3\text{As}_2\text{O}_5 \cdot 37\text{H}_2\text{O}$ is formed. When an attempt was made to corroborate earlier work on the prepn. of Na uranyl arsenate by the mixing of $\text{UO}_2(\text{NO}_3)_2$ and Na_3AsO_4 solns., the only material pptd. was $\text{UO}_2\text{HAsO}_4 \cdot 7\text{H}_2\text{O}$. It can be obtained by the addn. of $\text{UO}_2(\text{NO}_3)_2$ soln. to Na_3AsO_4 . The pentahydrate can be obtained in the same manner except that Li_3AsO_4 , rather than Na_3AsO_4 , is used in the pptn. There is a discussion of the prepn. of K uranyl sulfite using uranic acid and potassium hydrosulfite in the presence of SO_2 . Information is given which leads to questioning the existence of Na uranyl sulfite which was reported by Kohlschütter and by Scheller. The prepn. of NH_4 uranyl sulfite as reported by Scheller in 1867 could not be duplicated. When SO_2 is introduced into an aq. suspension of alk. uranate, a ppt. of pure $\text{UO}_2\text{SO}_3 \cdot 4\text{H}_2\text{O}$ is produced. This ppt. is said to be amorph. at high concn. and cryst. only when obtained from dil. soln. When finely powd. $(\text{NH}_4)_2\text{UO}_4$ is heated in an oil bath at 250° for about 30 hrs, it will decomp. to UO_3 . However, the temp. of a sand bath is not uniform enough and the cpd. on the floor of the vessel is probably more highly oxidized than the material higher in the container.

725 Melikoff, P. and Pissarjewsky, L. "Peroxide." Z. anorg. Chem. **18**, 59-65(1898).

A large number of peroxides, including UO_4 and the double peroxides of U with Ba, Na, and Li are mentioned. The peroxides of U and Mo are compared and structures for UO_3 and UO_4 are proposed.

726 Melikoff, P. G. and Pissarjewsky, L. "Peruranic Acid and Its Salts." Zhur. Russ. Fiz. Khim. Obshchestva **30**, 103-10(1898).

The structure of the peruranates is discussed and it is proposed that the peroxide formula $\text{R}_2\text{U}_2\text{O}_{10} = \text{R}_2\text{O}_2 \cdot 2\text{UO}_4$ and $\text{R}_4\text{UO}_8 = 2\text{R}_2\text{O}_2 \cdot \text{UO}_4$ is to be preferred since these substances can be characterized as cpds. of metallic peroxides with UO_4 . (This paper is summarized in Bull. soc. chim. France (3), **22**, 8-9 (1899).)

727 Moissan, H. "Study of Some New Phenomena of Fusion and Volatilization of Materials Using the Electric Arc." Compt. rend. **116**, 1429-34(1898).

A discussion on the melting and volatilization of U is included.

728 Smith, E. F. and Wallace, D. L. "Electrolytic Determinations." J. Am. Chem. Soc. **20**, 279-81 (1898).

A discussion is included on the electroanalysis of U, the nitrate soln. being investigated. It is reported that, when electrolysis is carried out on $(\text{UO}_2)^{+2}$ solns., a black $\text{U}_3\text{O}_8 \cdot \text{H}_2\text{O}$ is obtained after the yellow ppt. of $\text{UO}_3 \cdot \text{H}_2\text{O}$.

729 Villari, E. "Uranite Rays." Elettricista (Rome) **7**, No. 5, 101-03(1898).

The paper describes expts. with uranite on the discharging of a gold-leaf electroscope. Trials under various conditions of distance, etc., were made. The author found phenomena the same as in the case of Roentgen rays. When the uranite was closed in a paper envelope no action was observable, though an image was obtained on a sensitive plate through black paper after an exposure of 24 hrs.

730 Walker, P. H. "Some Further Applications of Hydrogen Peroxide to Quantitative Analysis." J. Am. Chem. Soc. **20**, 513-15(1898).

In the sepn. of U and Fe by the H_2O_2 method, a large excess of H_2O_2 is added and the U is retained in soln. when Fe is pptd. with NaOH. The U- and Fe-salt soln. must be poured into the reaction mixt. and not in the reverse direction.

731 Walker, T. L. "The Crystalline Symmetry of Torbernite." Am. J. Sci. (4), **6**, 41-4(1898).

732 Wilson, C. T. R. "On the Action of Uranium Rays on the Condensation of Water Vapour." Proc. Cambridge Phil. Soc. **9**, 333-8(1898).

U rays produce, in moist air, nuclei on which condensation takes place if a certain degree of supersatn. is exceeded. To produce this supersatn., sudden expansion is necessary so that the ratio of the final to the initial volume of the air is equal to 1.25, the same limit as was found in similar experiments with Roentgen rays described in a former paper (Trans. Roy. Soc. (London) A. 189, 265-307(1897)). Thus, nuclei of the same kind are introduced by Roentgen rays and U rays; the view is taken that they are identical with the ions to which the conducting power of the gas under the same conditions is due.

PUBLICATIONS LOCATED IN 1899

- 733 Aloy, F. J. "On the Double Chlorides and Bromides of Uranium." Bull. soc. chim. France (3), 21, 264-6(1899).

K_2UCl_6 is obtained by treating KCl with UCl_4 vapor at red heat. Best results are obtained when the reaction is carried out in the same tube used to prep. UCl_4 . When K_2UCl_6 has been prepd., it appears as a green mass which is easily sol. in HOAc, almost insol. in ether, m. at 350° , dissolves in warm water with decompn., and slowly oxidizes in air in aq. soln. The prepn. and properties of $CoUCl_6$, $RbUCl_6$, and Li_2UCl_6 are reported to be similar to those of the corresponding K salt. The Ca, Ba, and Sr salts, $XUCl_6$, are also prepd. in the same manner. It is reported that UBr_4 vapor reacts with alk. or alk. earth chlorides at red heat to form complex bromides. The prepn. and properties of the Na and K double bromides are reported. They are, in general, fusible, and slightly sol.

- 734 Aloy, F. J. "On the Double Cyanides of Uranium and Potassium." Compt. rend. assoc. franç. avance. sci. II, 329-30(1899).

735 Aloy, F. J. "On Several Uranium Compounds." Bull. soc. chim. France (3), 21, 613-16(1899). The cryst. $U(OH)_4$ remains stable in air for several days without visible change. Upon heating, green U_3O_8 is obtained which is sol. in dil. acids. A cryst. cpd. of the compn. $UO_2 \cdot 2H_2O$ has been prepd. by treating cryst. $U(SO_4)_2$ with a soln. of KOH or NaOH. The reaction is said to be slow when cold but rapid when hot, and the material obtained is black and cryst., contg. no $(SO_4)^{-2}$ or alk. after repeated washing with boiling water. UCl_4 can be pptd. as a light-green material by the addn. of ether to an alc. HCl soln. of the ions. It is difficult to remove all the ether from the ppt. when it is obtained in this manner. A soln. of UCl_4 is easily prepd. by the reducing effects of sunlight by starting with a uranyl salt in HCl in the presence of small amts. of oxidizable substances such as alc. The crystals of uranium oxalate, $U(C_2O_4)_2 \cdot 6H_2O$, are large rectangular elongated prisms when obtained from H_2SO_4 . These crystals can be reduced by a stream of H_2 . The material is insol. in water and dil. acids and is decompd. by alk. Bundles of pale-green needles of $UH_2(AsO_4)_2 \cdot 2H_2O$ are obtained from a soln. of $U(OH)_4$ in moderately dil. H_2SO_4 after treatment with arsenic acid, or when the acid is allowed to react on freshly pptd. $U(OH)_4$. It is stable in air at ordinary temp., insol. in water, fairly sol. in dil. acid, especially arsenic acid, and is decompd. by alk. to give $U(OH)_4$ and alk. arsenate.

- 736 Becquerel, H. "Note on Several Properties of the Radiation of Uranium and Radioactive Bodies." Compt. rend. 128, 771-7(1899).

- 737 Crookes, W. "On the Source of Energy in Radioactive Materials." Compt. rend. 128, 176-8 (1899).

The anomaly in the radiation from U, Th, Po, and Ra, the source of which has not yet been discovered, may be elucidated by assuming that these metals have the power of Maxwell's "demon" in being able to sep. the rapidly moving from the slow-moving mols. of air and appropriating some of the energy of the former. The energy thus gained seems to be employed partly in dissocg. some of the gaseous mols., and partly in maintaining a radiation across the ether.

- 738 Dittrich, C. *Die Uranylsalze vom physikalisch-chemischen Standpunkt aus betrachtet*. Dissertation, Univ. of Leipzig, 1899.

- 739 Dittrich, C. "Uranyl Salts Examined from a Physical Chemical Standpoint." *Z. physik. Chem.* 29, 449-90(1899).

This is a very important paper in which many U cpds. are investigated. A large amt. of specific data is given for which the article should be consulted directly. The electrical cond. and f.p. of solns. of a number of uranyl salts and of mixt. of uranyl and Na salts are measured, also the soly. of uranyl oxalate in $\text{Na}_2\text{C}_2\text{O}_4$ soln. and some thermochem. data. Qual. expts. show that the U migrates to the anode when solns. of Na uranyl acetate (concd.), propionate, oxalate, tartrate, and citrate are electrolyzed. It is shown that in these cases complex anions contg. the $(\text{UO}_2)^{+2}$ radicle are formed. The dissertation published at the University of Leipzig in 1899 contains a more complete report of this research.

- 740 Friedel, C. and Cumenge, F. "On a New Mineral of Uranium, Carnotite." *Compt. rend.* 128, 532-4(1899).

This paper reports an extrn. method for U in the presence of V. The soln. is evapd. to dryness with nitric acid and the $\text{UO}_2(\text{NO}_3)_2$ extrd. with warm $(\text{NH}_4)_2\text{CO}_3$ soln. A discussion is also included on the sepn. of U from P using ammonium molybdate. The Mo remaining is removed by satg. the soln. with H_2S and warming in a pressure flask. The U is then pptd. from the filtrate using NH_3 and oxidized with HNO_3 for gravimetric detn. in the usual way.

- 741 Friedel, C. and Cumenge, E. "On a New Mineral of Uranium, Carnotite." *Bull. soc. chim. France* (3), 21, 328-31(1899).

- 742 Friedel, C. and Cumenge, E. "On a New Mineral of Uranium, Carnotite." *Bull. soc. franc. minéral.* 26-9(1899).

- 743 Hébert, A. and Reynaud, G. "Study of the Specific Absorption of X-rays by Metal Salts." *Bull. soc. chim. France* (3), 21, 394-402(1899).

A discussion of the absorption of x rays by $\text{UO}_2(\text{NO}_3)_2$ solns. is included.

- 744 Herschel, A. S. "Triboluminescence." *Nature* 60, 29(1899).

It is indicated that crystals of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ show a light-greenish-yellow triboluminescence.

- 745 Jorissen, W. P. and Reicher, L. T. "On the Influence of Catalysts toward the Oxidation of Oxalic Acid Solutions." *Z. physik. Chem.* 31, 142-63(1899).

The influence of uranyl salts is mentioned, but not examined in detail, as is the influence of a number of other salts.

- 746 Kohlschütter, V. and Hofmann, K. A. "Inorganic Hydroxylamine Compounds." *Ann.* 307, 314-37(1899).

This paper contains a discussion of alk. complexes of the hydroxylamine U complex. There is also a discussion of the hydroxylamine U complex, $(\text{NH}_3\text{OH})_2\text{UO}_4 \cdot \text{H}_2\text{O}$.

- 747 Ley, H. "Studies on the Hydrolytic Dissociation of Salt Solutions." *Z. physik. Chem.* 30, 193-257(1899).

Cond. measurements on aq. $\text{UO}_2(\text{NO}_3)_2$ soln. at 25° and 1024 M^{-1} gave approx. $\alpha = 5.9\%$ where α is the degree of hydrolysis.

- 748 Melikoff, P. G. and Pissarjewsky, L. V. "Peruranic Acid and Its Salts." *Bull. soc. chim. France* (3), 22, 8-9(1899).

This is a condensation of the article published in *J. Russ. Phys.-Chem. Soc.* 30, 103-10(1898).

- 749 Melikoff, P. and Pissarjewsky, L. "The Salt of Pyropervanadic Acid and the Constitution of Its Acid Salt." Z. anorg. Chem. **19**, 405-16(1899).

Comparisons are made with the similar salts of Mo, U, and W. Structures for pyrouvanic acid salts are given. The structural formula below is assigned to Na_4UO_8 .

- 750 Meyer, S. "On the Magnetic Properties of Elements." Monatsh. **20**, 369-82(1899).
The detn. of magnetic susceptibility of U from a U-Fe prepn. is reported.

- 751 Meyer, S. "Magnetization of Inorganic Compounds." Ann. Physik Chem. (Wied.) **69**, 236-63 (1899).

$\text{UO}_2(\text{NO}_3)_2$ is reported to be diamagnetic. The magnetic vol. susceptibility for loose material having a d. = 1.649 g/cc at 15° is reported as 0.053×10^{-6} . The susceptibility at 16° for UO_3 is said to be 0.146×10^{-6} , 0.351×10^{-6} for U_3O_8 , and 2.46×10^{-6} for UO_2 . There is a discussion of the magnetic susceptibility and the vol. susceptibility for UCl_4 .

- 752 Rosenheim, A. (experimental work by Lineau, H., Bierbrauer, K., and Platsch, M.) "On the Action of Inorganic Metal Salts on Organic Acids. III. Communication." Z. anorg. Chem. **20**, 281-322(1899).

Section I, on alk. uranyl oxalates, is by H. Lineau (p. 284-90). The prepn. and compn. of $\text{UO}_2\text{C}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$, as reported in the earlier literature by Peligot and Ebelmen are confirmed. Large monoclinic crystals of $\text{Li}_2\text{C}_2\text{O}_4 \cdot \text{UO}_2\text{C}_2\text{O}_4 \cdot 4\frac{1}{2}\text{H}_2\text{O}$ are obtained by satg. a soln. of LiHC_2O_4 with UO_3 or $\text{UO}_2\text{C}_2\text{O}_4$. Lithium uranyl arsenate prepn. attempts yield $\text{UO}_2\text{HASO}_4 \cdot 5\text{H}_2\text{O}$ rather than as a true double arsenate when Li_3AsO_4 is treated with $\text{UO}_2(\text{NO}_3)_2$. The prepn. of a basic uranyl oxalate, $\text{UO}_2\text{C}_2\text{O}_4 \cdot \text{UO}_3 \cdot 7\text{H}_2\text{O}$, is reported upon the recrystn. of $\text{Li}_2\text{UO}_2(\text{C}_2\text{O}_4)_2 \cdot 4\frac{1}{2}\text{H}_2\text{O}$. The basic oxalate is reported to be a microcryst., yellow, almost insol. powder. $\text{K}_2(\text{UO}_2)_2(\text{C}_2\text{O}_4)_3 \cdot 4\text{H}_2\text{O}$ obtained by the satn. of boiling aq. KHC_2O_4 with UO_3 or $\text{UO}_2\text{C}_2\text{O}_4$. The material appears in the form of a brilliant yellow cryst. ppt. $\text{K}_2\text{UO}_2(\text{C}_2\text{O}_4)_2 \cdot 3\frac{1}{2}\text{H}_2\text{O}$ is reported to crystallize from the mother liquor of $\text{K}_2(\text{UO}_2)_2(\text{C}_2\text{O}_4)_3 \cdot 4\text{H}_2\text{O}$ as dull light-yellow crusts. The double oxalates of $(\text{UO}_2)^{+2}$ with Na, Cs, and NH_4 were prepd. in a similar manner. The existence of the complex ion $[\text{UO}_2(\text{C}_2\text{O}_4)_2]^{-2}$ is proved by the transformation of the alk. salts of the type $\text{R}_2[\text{UO}_2(\text{C}_2\text{O}_4)_2]$ with BaCl_2 to the corresponding Ba salt. No salts with Ca or Sr were obtained, however.

- 753 Rutherford, E. "Uranium Radiation and the Electrical Conduction Produced by It." Phil. Mag. (5), **47**, 109-63(1899).

The author finds no evidence to show that polarization or refraction takes place; in this respect he differs from Becquerel. Expts. are described which show that U radiation is complex: in it there are present at least two distinct types—one that is readily absorbed, called α radiation, and the other of a penetrating character, termed the β radiation. There are indications that the β radiation is approx. homogenous. In expts. with different U cpds. it was found that the amt. of α radiation depended chiefly on the surface of the U cpd., while the β radiation depended also on the thickness of the layer. There is a great difference in the power of penetration of the two types of radiation. The transparency of Al for the β radiation is over 100 times as great as for the α radiation. The opacity of the metals Al, Cu, Ag, and Pt for the β radiation follows the same order as their at. wts.

- 754 Stavenhagen, A. "Production of Molybdenum and Uranium Using Liquid Air." Ber. **32**, 3065 (1899).

The reduction of U oxides using Al and liq. air is violent and gives a good yield.

PUBLICATIONS LOCATED IN 1900

- 755 Aloy, F. J. "New Methods of Preparing Several Oxides of Uranium." Bull. soc. chim. France (3), 23, 368-70(1900).

When UO_2 is exposed to air, a slow oxidation will take place in which U_3O_8 is formed. The reduction, at 900 to 1200°, of damp or dry UO_3 or U_3O_8 in a stream of H_2 will yield a very pure UO_2 product. It is reported that UO_2 can also be obtained by heating U_3O_8 in vacuum at 2000°. It is said to form as rhombic platelets with flattened corners. Cryst. $\text{UO}_3 \cdot \text{H}_2\text{O}$ does not give up any water in vacuum or in dry air at 100° and can be conveniently prepd. by the air oxidation of moist $\text{U}_3\text{O}_8 \cdot x\text{H}_2\text{O}$. Although the bright-yellow amorph. $\text{UO}_3 \cdot \text{H}_2\text{O}$ is obtained at room temp., the cryst. modification can be obtained at 100°. The velocity of decompn. of $\text{UO}_2(\text{OAc})_2$ soln. in light is discussed. The mixed U^{+4} - U^{+6} hydroxide is reported to be a flocculent violet ppt. which cannot be crystd. by freezing or heating in a closed tube. In the prepn. of the mixed hydroxide, the starting material is the acetate, rather than the oxalate, because of very slight soly. of the acetate. In the presence of alc. an aq. soln. the acetate decomps. very quickly in light. The ppt. is less easily oxidized than the prepn. previously reported.

- 756 Aloy, F. J. "Preparation of Uranium Iodide." Compt. rend. assoc. franç. avance. sci. I, 147 (1900).

- 757 Aloy, F. J. "Research on the Determination of the Atomic Weight of Uranium." Compt. rend. assoc. franç. avance. sci. I, 145(1900).

- 758 Becquerel, H. "Note on the Radiation of Uranium." Compt. rend. 130, 1583-5(1900).

Two different kinds of Becquerel rays have, so far, been discovered. One kind had practically all the characteristics of cathode rays, and is deflected by both magnetic and electric forces. The other is not deflected by either, and shows various degrees of absorption by metals and other opaque substances. The author endeavors to det. the exact nature of the rays emitted by U, the first substance which was found to emit the rays named after him. The difficulty of operating with U lies in the feebleness of its radiation. The rays emitted were deflected to about the same extent as the most penetrating Ra rays. That might be explained by the supposition that U contains a small amt. of Ra, and that the true U rays are feeble. The author believes that these deflected rays are due to Ac. They can be removed by treating the UCl_4 with BaCl_2 . Radioactive BaSO_4 and a purified U salt remains. Further purification makes no difference, and, hence, it is probable that U has a definite, though feeble, radiation of its own.

- 759 Becquerel, H. "Note on the Radiation of Uranium." Compt. rend. 131, 137-8(1900).

When UCl_4 is mixed with BaCl_2 , and the Ba is pptd. as BaSO_4 , the greater part of the radioactivity is pptd. The question remains as to whether further application of the process would eventually result in the U being made entirely inactive. The author has, therefore, applied the same process eighteen times to the same specimen. He found that the BaSO_4 pptd. was less and less active, and that correspondingly the loss of activity of the U became less and less in proportion to its initial activity. Between the eighth and twelfth operations the variations in activity were sometimes pos. and sometimes neg., and possibly could be due to the presence of more or less water, as the salt is hydr. In the case of the unpurified product, Al is more transparent for the rays than glass, but the case is reversed in the purified U, whose rays obey the rules of light rather than those of Roentgen rays. After the fifteenth operation another decided diminution of activity sets in, bringing it down to one-sixth of the original activity. What happens after the eighteenth operation is not yet known.

- 760 Becquerel, H. "Uranium Radiation." In Report of the International Physics Congress at Paris 3, 47-78(1900).

The photographic and electric methods of observation are discussed and the use of a U sphere is mentioned as a new method of obtaining the potential of a point in space, the rate of fall of potential of the sphere when connected to a capacitor of known capacitance being expressed by

$$\frac{\delta V}{\delta t} \left(a + \frac{b}{V} \right) = -1,$$

where a and b are consts. depending on the capacitance of the system. Other effects, such as phosphorescence and magnetic and electrostatic deviation, are described. The report does not confine itself to the radiation from U.

761 Bruner, L. "On the Hydrolysis of Salt Solutions." Z. physik. Chem. **32**, 133-6(1900).
Solns. of UO_2Cl_2 , $\text{UO}_2(\text{NO}_3)_2$, and UO_2SO_4 were among those investigated and for which values of α , the degree of hydrolysis, are reported at various dilns.

762 Curie, P. and Curie, M. "New Radioactive Substances." Intern. Phys. Congress at Paris, Report 3, 79-114(1900).
A method of measuring radioactivity by means of an electrometer is described, and a list of U cpds. and their activities is added. The report deals also with Th, Po, and Ra.

763 Curtius, T. and Darapsky, A. "New Investigations on the Nitrogen Hydride, N_3H ." J. prakt. Chem. (2), **61**, 408-22(1900).
A U azide may be obtained by treating a soln. of $\text{UO}_2(\text{NO}_3)_2$ with NaNH_2 . The soln. turns a yellowish-red color which is not destroyed by heat. The prolonged boiling of this soln. will ppt. $\text{UO}_3 \cdot \text{H}_2\text{O}$. It is not possible to ppt. the U azide which is formed. Basic azides were obtained by dissolving uranyl hydroxide or K_2UO_4 in HN_3 and evapg. the soln. No exhaustive investigation was carried on these materials.

764 Formánek, J. "Detection of Metal Salts Using Absorption-Spectrum Analysis under the Use of Alkanna." Z. anal. Chem. **39**, 409-34(1900).
It is reported that the addn. of alc. alk. to aq. $\text{UO}_2(\text{NO}_3)_2$ or UO_2Cl_2 will yield a color lake with characteristic absorption bands in the red. A green-colored neutral soln. of U having a characteristic absorption spectrum whose principal line is 687μ and whose weaker subsidiary line is 631.5μ is obtained using alkanna tincture.

765 Formánek, J. "Detection of Metal Salts Using Absorption Spectrum Analysis under the Use of Alkanna. II." Z. anal. Chem. **39**, 673-93(1900).
A very brief note on U is included in the table.

766 Goldstein, E. "On the Phosphorescence of Inorganic Chemical Preparations." Sitzber. preuss. Akad. Wiss. 818(1900).

767 Hillebrand, W. F. and Ransome, F. L. "On Carnotite and Associated Vanadiferous Minerals in Western Colorado." Am. J. Sci. (4), **10**, 120-44(1900).
This paper contains a discussion of the $(\text{NH}_4)\text{CO}_3$ extrn. method for U in the presence of V where the U is removed as $\text{UO}_2(\text{NO}_3)_2$. Doubtful results are reported.

768 Kohlschütter, V. "On the Compounds of Uranic Acid with Sulfurous Acid." Ann. **311**, 1-25 (1900).
This paper contains a discussion of the prepn. and formula for cpds. of UO_3 and SO_2 , the uranyl sulfites which are considered to be uranyl sulfurous acids and their salts. UO_2SO_3 can be prepd. by passing SO_2 through a soln. of $\text{UO}_2(\text{OAc})_2$ or $\text{UO}_2(\text{NO}_3)_2$. $\text{UO}_2\text{SO}_3 \cdot 4\text{H}_2\text{O}$ is a pale-green cryst. substance. It is said to give off only 3.5 moles of H_2O /mole when heated in a toluene bath at 105° . Consequently, the formula $\text{UO}_2(\text{OH})\text{HSO}_3$ is proposed. The material is reported to be insol. in H_2O and sol. in aq. or alc. SO_2 in which it yields a green color. It may be sepd. from soln. by spontaneous evapn. When dry $\text{UO}_2\text{SO}_3 \cdot 4\text{H}_2\text{O}$ is heated on a water bath in a covered beaker with an amt. of aq. SO_2 not sufficient to dissolve it. The liq. first turns green, then dark-yellow, and finally a light-green microscryst. deposit will be seen which is then replaced by larger yellow crystals. This ppt. can be transferred to a porcelain plate where it will

form a brilliant gold mass of crystals. These are reported to be $\text{UO}_2\text{SO}_3 \cdot 2.75\text{H}_2\text{O}$. Under the microscope these crystals appear to be elongated prisms, grouped radially, showing beautiful polarization colors with parallel extinction. These crystals will go to the anhyd. salt (UO_2SO_3) when heated to 105° . $\text{K}_2\text{O} \cdot 2\text{UO}_3 \cdot 3\text{SO}_2$ can be prepd. from potassium hydrosulfite and uranic acid in the presence of excess SO_2 . If a soln. of $\text{UO}_2\text{SO}_3 \cdot 4\text{H}_2\text{O}$ with SO_2 is mixed with a soln. of KHSO_3 in the warm, the liq. immediately clouds and a more or less cryst. ppt. is obtained by stirring. The ppt. when quickly dried in vacuum over H_2SO_4 , will show yellow-green crystals. It is stable to 105° . $\text{K}_2\text{O} \cdot 4\text{UO}_3 \cdot 5\text{SO}_2 \cdot x\text{H}_2\text{O}$ can be obtained by pptg. a $\text{UO}_2(\text{NO}_3)_2$ soln. with KHSO_3 . Under repeated heating with SO_2 and stirring, small rhombic crystals result. A green soln. is obtained with H_2O , and upon evapg., a yellow powder-like residue of $\text{K}_2\text{O} \cdot 3\text{UO}_3 \cdot 2\text{SO}_2$ is obtained in the form of very fine needles radially arranged, showing optical activity when placed between crossed Nicol prisms. It is reported that $(\text{NH}_4)_2\text{UO}_2(\text{SO}_3)_2$ can be obtained by pptn. from a soln. of $\text{UO}_2(\text{NO}_3)_2$ with excess NH_3 and SO_2 . The ppt. is obtained after about one day's standing in the form of large strongly adhering cryst. masses. It can also be obtained by the addn. of excess hydrosulfite and uranyl nitrate. By this procedure a voluminous yellow crystal-like residue is obtained. Under the microscope, crystals of this material appear to be irregular and composed of superimposed laminated plaes with an oblique effacement at about 30° . Na salts are obtained in approx. the same manner.

769 Langmuir, A. C. "The Determination of Nickel in Nickel Ores." J. Am. Chem. Soc. **22**, 102-06 (1900).

This paper contains a brief discussion of the removal of Fe from U soln. using the $(\text{NH}_4)_2\text{CO}_3 - (\text{NH}_4)_2\text{S}$ and Et_2O method. The method is said to be unsatisfactory when the amt. of U is small.

770 Ley, H. "On the Constitution of Uranyl Salt." Ber. **33**, 2658-61(1900).

771 Lordkipanidze, S. "Fluoro-Hyperuranium Compounds." Zhur. Russ. Fiz. Khim. Obshchestva **32**, 283-7(1900).

A potassium fluoride uranium peroxide of the formula $\text{K}_4\text{F}_6\text{U}_4\text{O}_{15} \cdot 4\text{H}_2\text{O}$ is obtained by treating an aq. soln. of $3\text{KF} \cdot \text{UO}_2\text{F}_2$ with excess H_2O_2 . The compn. of the ppt. is not influenced by excess of KF or H_2O_2 and appears as a yellow powder which decomp. when heated above 100° .

772 Lordkipanidze, S. "Fluoro-Hyperuranium Compounds." J. Chem. Soc. **78**, II, 658-9(1900). This is a short version of the paper published in Zhur. Russ. Fiz. Khim. Obshchestva **32**, 283-7(1900).

773 Oechsner de Coninck, F. W. "Study of Uranium Nitrate." Compt. rend. **131**, 1219-20(1900). This paper contains a discussion of the d. of solns. of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ in commercial EtOH (85%) between 11.5 and 16.5° . Data on the soly. in H_2O is reported. There is an indication of a disagreement with the results of other authors on detg. the molar ht. of soln. for anhyd. $\text{UO}_2(\text{NO}_3)_2$ and its hydrates. It is reported that the nitrate is insol. in CS_2 , benzene, toluene, xylene, ligroin, and CHCl_3 at room temp. It is almost completely insol. in turpentine. It is sol. in dil. HCl and less easily in concd. HCl. It is very sol. in dil. HBr and H_2SO_4 and fairly sol. in concd. H_2SO_4 . It is sol. in any concn. of HNO_3 . It is easily sol. in dil. and concd. formic acid and dil. HOAc, but is less sol. in glacial. It is reported that it is insol. in aq. KOH, NaOH, and NH_3 . It is sol. in lime water, the soln. eventually yielding a flocculent, yellow ppt. It is also found to be sol. in MeOH, PrOH, and iso-BuOH. It is less sol. in commercial AmOH and insol. in glycerine.

774 Oechsner de Coninck, F. W. "Study of Uranium Nitrate." Compt. rend. **131**, 1303-05(1900). This paper contains a discussion of the reaction between alcs. and uranyl salts in the presence of light. Sunlight will reduce uranyl salts to the U^{+4} state and the sensitivity of the salts to photochem. reduction varies. The salts of org. acids are much more easily reduced. The soly. of uranyl nitrate in various common alcs. is discussed. It is reported that one part of uranyl nitrate dried at 90° will dissolve in 5.6 parts of pure HOAc ($B = 1.035$) at 14° . The d. of $\text{UO}_2(\text{NO}_3)_2$ solns. in HOAc is studied and reported between 10.4 and 16.9° . One part of uranyl nitrate dried at 90° will dissolve in 65 parts of pure acetone at 12° . There is a discussion of the solns. of $\text{UO}_2(\text{NO}_3)_2$ in commercial MeOH and dil. EtOH. It is indicated

that they are very unstable and decomp. in diffuse sunlight depositing a black oxide. The d. of $\text{UO}_2(\text{NO}_3)_2$ solns. in commercial MeOH between 10.7 and 12.9° is also discussed.

775 Pissarjewsky, L. V. "On Uranic, on Molybdic, and on Wolframic Acids and Corresponding Acids. Thermochemical Investigation." *Z. anorg. Chem.* **24**, 108-22(1900).

The heat of reaction for $\text{UO}_3 \cdot \text{H}_2\text{O} + \text{H}_2\text{O} \rightarrow \text{UO}_4 \cdot 2\text{H}_2\text{O}$ has been calcd. as -6151 cal. Na_4UO_8 is reported to crystallize with $9\text{H}_2\text{O}$. $\text{UO}_3 \cdot \frac{1}{2}\text{H}_2\text{O}$, or $\text{H}_2\text{U}_2\text{O}_7$, is said to be formed somewhat above 160° at a water-vapor pressure of 15 mm Hg. At 300° it goes to anhyd. UO_3 . The heat of neutralization for 1 mole of this material by 2 moles of NaOH is +17,859 kcal. It is reported that the heat of reaction liberated in the decompn. of Na_2UO_8 with H_2SO_4 is 36,497 cal.

776 Zehenter, J. "On the Behavior of Uranyl Acetate and Some of Its Double Salts in Water." *Monatsh.* **21**, 235-55(1900).

$\text{KUO}_2(\text{OAc})_3 \cdot \text{H}_2\text{O}$ can be crystd. from mixed solns. and by a method given, the $\frac{1}{2}$ hydrate may be obtained. It is reported that dehydration of $\text{UO}_2(\text{OAc})_2 \cdot 2\text{H}_2\text{O}$ takes place at 110° and the cpd. decomp. when the temp. rises to 275° forming pure UO_3 . It is sol. in H_2O at 15° to the extent of 7.694 g/100 g H_2O . The d. of $\text{UO}(\text{OAc})_2 \cdot 2\text{H}_2\text{O}$ is 2.893 at 15°. It is indicated that a cold satd. aq. soln. of Na uranyl acetate is stable for a month but, when it is boiled, it will deposit a sulfur-yellow powder which is probably $\text{UO}_3 \cdot 2\text{H}_2\text{O}$. Prepn. of NH_4 uranyl acetate by the method of Wertheim is reported. There is also information on the decompn. of $\text{UO}_2(\text{OAc})_2$ soln. in light. There is a discussion of the prepn. of the mixed U^{+4} - U^{+6} hydroxide from uranyl acetate and oxalate. (See also the work of Aloy and Ebelman.) U^{+4} - U^{+6} hydroxide is a vaguely cryst. material when examined under the microscope. Aq. solns. of $\text{UO}_2(\text{OAc})_2$ are reported to be stable in the dark over long periods, but in the sunlight they first form a basic salt and finally decomp. The basic uranyl acetate $(\text{UO}_2)(\text{OAc})_2 \cdot \text{UO}_2(\text{OH})_2 \cdot 3(+)\text{H}_2\text{O}$ is formed when a satd. aq. soln. of uranyl acetate is allowed to stand for a long time in daylight. This material is said to be unaffected by cold water, easily sol. in HCl, in dil. H_2SO_4 and HOAc when warmed. It is insol. in alc. The salt $\text{UO}_2(\text{OAc})_2 \cdot 2\text{UO}_2(\text{OH})_2$ is said to be formed when an aq. soln. of the neutral salt is refluxed in a sealed tube at about 140° or when the soln. is evapd. on a water bath. It is a cryst., yellow powder consisting of uniform micro. prisms, is almost insol. in H_2O , alc., and Et_2O . It is easily sol. in most dil. acids, decompd. by strong alk. and very dil. solns. When heated it will yield $\text{UO}_2(\text{OH})_2$. Hydrolysis is said to begin at 25°. $\text{UO}_2 \cdot 2\text{H}_2\text{O}$ can be used as a starting material for the prepn. of $\text{UO}_3 \cdot \text{H}_2\text{O}$ but the oxidation of $\text{UO}_2 \cdot 2\text{H}_2\text{O}$ is considerably slower than the oxidation of $\text{UO}_2(\text{NO}_3)_2$. In the prepn. of $\text{UO}_3 \cdot \text{H}_2\text{O}$ from uranyl acetate, it is said that heating for 8 hrs at 140 to 150° is sufficient. If heating is carried out as high as 170 to 180°, the tube in which the material is heated almost always explodes. The d. of $\text{KUO}_2(\text{OAc})_3 \cdot \frac{1}{2}\text{H}_2\text{O}$ is reported to be 2.396 at 15°. $\text{K}_2\text{O} \cdot 4\text{UO}_3 \cdot 5\text{H}_2\text{O}$, can be obtained by evapg. an aq. soln. of K uranyl acetate with repeated addns. of H_2O until the liq. is no longer acid, the residue is washed with hot water and a yellow powder similar in appearance and properties to $\text{K}_2\text{O} \cdot 6\text{UO}_3 \cdot 10\text{H}_2\text{O}$ is obtained. The tetrauranate will lose $2\text{H}_2\text{O}$ at 110° and the remainder is given off at higher temp. Apparently it is more stable than the hexauranate when ignited and shows a partial greenish color after long ignition, whereas most of the sample appears red when hot and yellow when cold. The hexauranate is obtained by refluxing a 1% soln. of K uranyl acetate for several hrs and washing the ppt. with hot water. Uniform micro. yellow, 6-sided crystals with figured surfaces are obtained. The hexauranate which is obtained as a decahydrate loses $5\text{H}_2\text{O}$ at 110° and the rest between 300° and dull red heat. It turns a dark olive-green when heated, apparently with the formation of U_3O_8 and potassium tetrauranate. It is almost insol. in H_2O and easily sol. in hot HOAc and dil. mineral acid. It is insol. in alk., alc., and Et_2O . Na or NH_4 multiuranates can be prepd. in the same manner as the K salts. $\text{NH}_4\text{UO}_2(\text{OAc})_3 \cdot 3\text{H}_2\text{O}$ can be obtained from heated solns. of $\text{UO}_2(\text{OAc})_2$ with $(\text{NH}_4)_2\text{CO}_3$ and dissolving the ppt. in HOAc.

777 Zehenter, J. "On the Behavior of Uranyl Acetate and Some of Its Double Salts in Water." *Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse Abt. IIa* **109**, 110-30(1900).

This paper contains information similar to that reported in *Monatsh.* **21**, 235-55(1900).

PUBLICATIONS LOCATED IN 1901

- 778 Aloy, J. "On the Double Uranyl and Alkaline Metal Chlorides and the Hydrate of Uranyl Chloride." Bull. soc. chim. France (3), 25, 153-5(1901).

- 779 Aloy, J. "On a New Method for the Determination of the Atomic Weight of Uranium." Compt. rend. 132, 551-3(1901).

This paper contains a discussion of the prepn. of pure $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ in which the commercial product, containing NH_4 salts as impurities, is ignited to the oxide and repeatedly extrd. with dil. HCl and then converted to the nitrate.

- 780 Aloy, J. "On the Preparation of Uranium." Bull. soc. chim. France (3), 25, 344-6(1901). Attempts to reduce U_3O_8 with C at a c. d. of 25 amps did not give complete reduction; 100 amps at 50 to 60 v were required.

- 781 Aloy, J. Recherches sur l'uranium et ses composés. Dissertation, Univ. of Toulouse, 1901. (In Toulouse, Faculté des Sciences de l'Université (2), 3, 23-67(1901).)

This is one of the outstanding dissertations on U prior to the recent interest in at. energy. A literature review (brief bibliography) and original research on the prepn. of U, uranous salts, uranic cpds., and calcns. on the at. wt. of U are included. The cpds. discussed include oxides, chlorides, bromides, arsenates, oxalates, phosphates, iodides, cyanides, hydroxides, carbonates, etc. The information included is also published by the author in short form in various technical journals.

- 782 Aloy, J. "Uranium and Its Compounds." Ann. chim. phys. (7), 24, 412-32(1901).

The author gives an account of his researches on (1) the prepn. of U, (2) uranous and uranic salts, and (3) the detn. of the at. wt. of U, the method employed being the measurement of the vol. of N_2 and of the wt. of oxide obtained from a given wt. of U nitrate. The mean value found for the at. wt., taking O as 16, is 239.40. The numbers obtained by previous observers are given. $\text{UO}_3 \cdot \text{H}_2\text{O}$ can conveniently be prepd. by the air oxidation of moist $\text{U}_3\text{O}_8 \cdot x\text{H}_2\text{O}$. (This paper contains a comprehensive summary of the data presented in the dissertation published at the University of Toulouse in 1901.)

- 783 Brode, J. "Catalysis of the Reaction between Hydrogen Peroxide and Hydrogen Iodide." Z. physik. Chem. 37, 257-307(1901).

It is reported that UO_2SO_4 accelerates the oxidization of HI with H_2O_2 in aq. soln.

- 784 Férée, J. "On Uranium Amalgam and Pyrophoric Uranium." Bull. soc. chim. France (3), 25, 622-3(1901).

This paper contains an indication that a new Hg alloy of U can be prepd. This amalgam is found to be very unstable in moist air but can be obtained in the Hg cathode upon electrolysis of a soln. of UCl_4 in HCl . When this amalgam is heated in vacuum at 241° , a pyrophoric U powder is obtained.

- 785 Hofmann, K. A. and Heidepriem, W. "On Brögerite Analysis." Ber. 34, 914-15(1901). UO_2 and UO_3 were among those oxides investigated in the analysis of the mineral.

- 786 Itzig, H. "On Some Complex Compounds of Uronic Acid." Ber. 34, 3822-7(1901).

It is reported that uranic acid forms complex cpds. with tartaric acids or tartrates. These cpds. are said to be derived from urano-tartaric acid of the compn. $\text{H}_2[\text{UO}_3(\text{C}_4\text{H}_4\text{O}_6)]$. Changes in the rotatory power of tartaric acid caused by the addn. of uranyl salts lend wt. to the suggestion that complex ions are formed. Yellow crystals of uranyl tartrate tetrahydrate, $\text{UO}_2(\text{C}_4\text{H}_4\text{O}_6) \cdot 4\text{H}_2\text{O}$, are deposited from aq. solns. of uranic and tartaric acids. The material is said to be slightly sol. in H_2O . An optical rotatory power for NaD light at 14° is given as 269.3 and 272.8 for concns. of 0.597 and 0.2985 g of uranyl tartrate/100 g of H_2O . In K uranyl tartrate the acid salts with 1 atom of K/mol. and the neutral salts with

2 atoms of K/mol. will lose 1 mole of tartaric acid in the formation of the other acid salts. K acid uranyl tartrate, $\text{KH}[\text{UO}_3(\text{C}_4\text{H}_4\text{O}_6)]$, has not been isolated but it is claimed that it might be obtained from potassium hydrotartrate and uranic acid. This paper contains information on the specific optical rotation of aq. solns. of $\text{UO}_2(\text{C}_4\text{H}_4\text{O}_5) \cdot \text{H}_2\text{O}$ at 15° with NaD light. Prepn. methods for the material are also discussed. Similar data are given for $\text{NaH}[\text{UO}_3(\text{C}_4\text{H}_4\text{O}_5)] \cdot 2\text{H}_2\text{O}$. The concns. investigated in both instances range from approx. 0.85 to 0.21 in g malic acid/100 cc soln.

- 787 Kern, E. F. "The Quantitative Separation and Determination of Uranium." J. Am. Chem. Soc. **23**, 685-726(1901).

This is a comprehensive paper which reviews old methods and presents new modifications. The sepn. from many materials is discussed, as are a number of methods of detn. This was an excellent review article to the time of its writing.

- 788 Kohlschütter, V. "On the Occurrence of Nitrogen and Helium in Uranium Minerals." Ann. **317**, 158-89(1901).

This paper contains a discussion of the prepn. of U_3N_4 by grinding 848 parts of U_3O_8 with 192 parts of Mg and heating the mixt. slowly to redness in an atm. of N_2 . Mg salts are eliminated from the sintered product by the use of H_2O and HCl . The remaining UO_2 contg. H_2O is washed with HCl , alc., but not with H_2O . After converting this material to the chloride, usually as a mixt. with NaCl , the nitride may be obtained by treatment with NH_3 . There is also a discussion of the reactions of U_3N_4 with various materials. In particular, it was found to react with O_2 , to be insol. in HCl and H_2SO_4 , sol. in HNO_3 , insol. in KOH , but decompd. by alk. fusion. High temp. treatment with H_2 will decomp. the material. Some metal oxides will decomp. the nitride, forming uranates. Heating U_3N_4 with KClO_3 and KNO_3 produces a very violent reaction, and Cl_2 treatment will ignite it.

- 789 Kohlschütter, V. "On Uranium-Oxalate Compounds." Ber. **34**, 3619-35(1901).

U oxalate was formed by the pptn. from UCl_4 solns. using $\text{H}_2\text{C}_2\text{O}_4$. When $\text{U}(\text{C}_2\text{O}_4)_2 \cdot 6\text{H}_2\text{O}$ is boiled with alk. sulfate, a green ppt. contg. alk. is produced. When Na_2SO_3 is used, a flocculent ppt. contg. sulfite is obtained. With sodium arsenite, a brown weakly fluorescent soln. results. Hydrolysis of weakly acid U oxalate solns. split off alk. oxalates giving products poor in $\text{H}_2\text{C}_2\text{O}_4$. Many complex oxalates were obtained. Details on these reactions are also found in papers by Rossi.

- 790 Kohlschütter, V. "On Uranium Red." Ann. **314**, 311-38(1901).

This paper reports the at. ratio of U:S:R (where R = alk. metal) of 5:2:5 for U red. It is also claimed that all of the U is present as UO_3 . The K-U red is proposed to have the formula, $5\text{UO}_3 \cdot 2\text{K}_2\text{O} \cdot \text{KHS}_2$. A method for the prepn. consists in treating 100 cc of soln. contg. 5 g $\text{UO}_2(\text{NO}_3)_2$ with 140 cc KOH soln. (11 g/l). A rapid stream of H_2S is led through a suspension of the yellowish-green ppt. and an orange-red ppt. of the compn. $2\text{K}_2\text{O} \cdot \text{H}_2\text{S}_2 \cdot 5\text{UO}_3$ is formed. This is sepd. from the soln., dispersed in water, and warmed for a half hr with stirring in K_2CO_3 soln. A transformation is obtained to the blood-red K-U red. This same transformation can be effected with KOH soln., but the U red will not be so pure. It should be dried on porcelain to glassy, brittle, red-black pieces, which will be rather hard, and which will powder to a bright carmine. Ba-U red can be obtained in a method similar to that for the K material. A brilliant carmine powder is obtained.

- 791 Kohlschütter, V. and Rossi, H. "On Uranium Oxalate." Ber. **34**, 1472-9(1901).

This paper contains a report of the prepn. of U oxalate by the reduction of uranyl salts with Cu, Zn, or $\text{Na}_2\text{S}_2\text{O}_4$. $\text{U}(\text{C}_2\text{O}_4)_2 \cdot 6\text{H}_2\text{O}$ can be prepd. by pptn. with oxalic acid from HCl solns. of the U^{+4} salts. The product is reported to be a gray to greenish white, changing to green crystals when allowed to remain in contact with the mother liquor. There is confirmation of the results of Rosenheim and Kelmy in which it is indicated that 5 moles of H_2O will be removed from $\text{U}(\text{C}_2\text{O}_4)_2 \cdot 6\text{H}_2\text{O}$ at from 100 to 110° and that the last mole of water is not removed until 200° has been reached. The prepn. of basic U^{+4} sulfite by pptn. of $(\text{UO}_2)^{+2}$ solns. with $\text{Na}_2\text{S}_2\text{O}_4$. UCl_4 solns. can be obtained by boiling the HCl soln. of $(\text{NH}_4)_2\text{UO}_2(\text{CO}_3)_2$

with an excess of Cu turnings and Pt chloride. When the soln. is dild. and cooled, the Cu is pptd. as chloride. The rest is removed with H_2S and the latter driven off by vigorous boiling. In order to eliminate NH_4Cl , the U is pptd. as $U(OH)_4$, and this is then dissolved in HCl to form the UCl_4 soln. It is reported that $K_4[U(C_2O_4)_4] \cdot 5H_2O$ can be obtained by dissolving excess $U(C_2O_4)_2$ in $K_2C_2O_4$ soln. A moss-green, platelike cryst. material is obtained. $Ba_2[U(C_2O_4)_4] \cdot 9H_2O$ is obtained as a white ppt. in the same manner as the K salt. Upon heating this ppt., violet-red crystals are obtained. $NH_4HU_2(C_2O_4)_5 \cdot 8H_2O$ is obtained from dil. solns. of $(NH_4)_2UO_2(CO_3)_2$, upon the addn. of HCl in excess in cool $H_2C_2O_4$. Long fine needles are reported. Attempts to prep. an ortho uranium oxalic acid corresponding to the formula $R_4[U(C_2O_4)_4]$ were unsuccessful.

- 792 Kollock, L. G. and Smith, E. F. "The Electrolytic Method Applied to Uranium." J. Am. Chem. Soc. **23**, 607-09(1901).

The authors have ascertained the conditions under which U can be quantitatively detd. by the electrolysis in solns. of the acetate, sulfate, and nitrate. Details of the expts. with the acetate, nitrate, and sulfate are reported as are particulars of the sepn. of U from Ba, Ca, Mg, and Zn.

- 793 Mylius, F. and Dietz, R. "Uranyl Chloride and Water." Ber. **34**, 2774-8(1901).

The aq. soln. of UO_2Cl_2 is reported to be acid to litmus and Congo Red. The d. of a satd. soln. of UO_2Cl_2 at 18° is said to be 2.740. The evapn. of the soln. gives small, very dilq., needlelike crystals which are yellowish-green, fluorescent, birefringent, oblique prisms. This material cannot be dehydrated without decompn. $UO_2Cl_2 \cdot xH_2O$ is very sol. in H_2O , one part dissolving in 0.134 part at 18° . It is also reported that $UO_2Cl_2 \cdot 3H_2O$ is easily sol. in alc. and Et_2O . This paper contains a discussion of the hydrolysis of $UO_2Cl_2 \cdot 2H_2O$. It is said that one of the products is $UO_3 \cdot HCl \cdot 2H_2O$, or $HUO_3Cl \cdot 2H_2O$. This material, whatever the structural formula, undergoes a small amt. of hydrolysis in H_2O , and is parted from its Cl by $AgNO_3$. The soln. is weakly acid and can take up approx. the amt. of alk. characteristic of a mono-basic acid. The addn. of more alk. will produce a yellow ppt. which contains no Cl. With $NaOH$, a soln. of UO_2Cl_2 will give a ppt. which dissolves slowly forming an intensely yellow soln., which finally takes on a permanent turbidity when the ppt. of Na_2UO_4 is formed. Upon cooling and evapg. the supernatant liq. one will obtain crystals of NaF and a yellow noncryst. syrup. It is reported that free HCl can be eliminated from uranic acid solns. or sols. by dialysis.

- 794 Oechsner de Coninck, F. W. Recherches sur le nitrate d'uranium. Dissertation, Univ. of Montpellier, 1901.

- 795 Oechsner de Coninck, F. W. "Study of Uranium Nitrate." Compt. rend. **132**, 48(1901).

796 Oechsner de Coninck, F. W. "Study of Uranium Nitrate." Compt. rend. **132**, 90-1(1901). This paper contains a description of the detn. of the d. of $UO_2(NO_3)_2$ solns. in KNO_3 (d. = 1.153) and H_2SO_4 (d. = 1.138) at 11 and 12° . The soly. of uranyl nitrate in various common alcs. is discussed. It is reported that $UO_2(NO_3)_2$ dissolves in $EtOAc$ to the extent of one part in 18.4 at 10.4° , one part in 5.3 parts of concd. formic acid at 15° , and one part in 16 in Et_2O at about 12° .

- 797 Oechsner de Coninck, F. W. "Study of Uranium Nitrate." Compt. rend. **132**, 204(1901). Igniting $UO_2(NO_3)_2 \cdot 6H_2O$ beyond the trihydrate and dihydrate forms will give a modification of UO_3 .

- 798 Renz, C. "On Indium." Ber. **34**, 2763-5(1901).

It is reported that In uranate can be prepd. by pptn., using solns. of In chloride with Na_2UO_4 . Precise studies are not reported.

- 799 Ruff, O. "Catalytic Reactions. II. Dissociation of Chlorosulfonic Acid into Sulfuryl Chloride and Sulfuric Acid." Ber. **34**, 3509-15(1901).

UO_2Cl_2 , one of many catalysts tried, is not so effective as the Hg, Sn, Sb, Bi, and Pt salts tried.

800 Tschugaeff, L. "On Triboluminescence." Ber. 34, 1820-5(1901). Crystals of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ show a light-greenish-yellow triboluminescence. Crystals of uranyl acetate (formula not given) are also reported to show triboluminescence.

PUBLICATIONS LOCATED IN 1902

801 Aloy, J. "On the Atomic Weight of Uranium. Answer to G. Hinrichs." Bull. soc. chim. France (3), 27, 260-1(1902).

802 Aloy, J. "On a Colored Reaction of Uranium Salts and of Oxygenated Water." Bull. soc. chim. France (3), 27, 734-5(1902).

When H_2O_2 is used to ppt. U from soln. in the presence of moderate quantities of K_2CO_3 , a red color is found. Upon addn. of large amts. of alc., a ppt. is formed. The same reaction also takes place in concd. K_2CO_3 soln. without the presence of H_2O_2 . KHCO_3 produces, however, a yellow color which will change to red upon heating.

803 Drossbach, G. P. "On Ultraviolet Absorption Spectra." Ber. 35, 91-3(1902).

This paper contains the statement that a 10% soln. of U chloride (UCl_4 ?) is transparent to all ultraviolet radiation up to 400 $\text{m}\mu$.

804 Exner, F. and Haschek, E. Wellenlängentabellen für spektralanalytische Untersuchungen auf Grund der ultravioletten Fünkenspektren der Elements. Leipzig - Vienna, 1902.

Several thousand U lines are identified in the range 6449 and 2195 Å. Similar information is included for many other elements.

805 Gutbier, A. "On Some Salts of Telluric Acid." Z. anorg. chem. 31, 340-51(1902).

It is reported that a yellow flocculent ppt. of U tellurate, which is sol. in cold HCl, is obtained from solns. of K tellurate and $\text{UO}_2(\text{OAc})_2$.

806 Kalischer, B. Zur Kenntnis der Halogenide des Höherwertigen Wolframs und Molybdäns. Dissertation, Univ. of Berlin, 1902.

Pyridinium uranyl chloride, $2\text{C}_5\text{H}_5\text{NCl} \cdot \text{UO}_2\text{Cl}_2$, can be obtained from an alc. HCl soln. of UO_3 with pyridinium chloride. The product is obtained as a yellowish cryst. powder which is readily sol. in H_2O and sol. in alc. only upon heating.

807 Kollock, L. G. and Smith, E. F. "The Electrolytic Method Applied to Uranium." Chem. News 86, 65-6(1902).

This paper contains information similar to that reported in J. Am. Chem. Soc. 23, 607-09(1901).

808 Oechsner de Coninck, F. W. La chimie de l'uranium, historique comprenant les recherches principales effectuées sur l'uranium et ses composés des 1872 à 1901. (2nd ed.) Paris(?), 1902.

809 Oechsner de Coninck, F. W. "Some Observations on Uranium Oxide." Compt. rend. 135, 900-01(1902).

When UO_2Br_2 is calcined in air, Br is split off and a brick-red UO_2 remains. In contrast to the product obtained from UO_2Cl_2 , the UO_2 obtained is oxidized to green U_3O_8 . When the material is heated in a stream of hydrogen, brick-red UO_2 goes over into the black modification. The use of this calcining method for U detn. is described.

- 810 Richards, T. W. and Merigold, B. S. "New Investigation on the Atomic Weight of Uranium." *Z. anorg. Chem.* 31, 235-70(1902).

When U_3O_8 is heated in Br_2 vapor or in dry HBr a partial reduction to black UO_2 takes place. Information on the prepn. of pure UBr_4 by the U_3O_8 -carbon method is given. The material obtained was used to det. the at. wt. of U. The UBr_4 obtained had a $d_4^{21} = 4.838$. It fumes in air and is deliq. forming a dark-green liq. The surface of the salt is reported to be oxidized immediately in moist air to UO_2Br_2 in which reaction HBr is evolved. (This reaction cannot be reversed by treatment with gaseous HBr). A black-brown ppt. of $\text{U}(\text{OH})_4$ is obtained from aq. UBr_4 soln. upon the addn. of NH_3 . The yield of $\text{UO}_2\text{Br}_2 \cdot 7\text{H}_2\text{O}$ was poor and the crystals were difficult to sep. from the mother liquor when it was prepd. from boiling UO_2 with Br_2 and H_2O or when UO_3 was dissolved in HBr . It is reported that UO_2Br_2 is easily sol. in alc. The paper includes a method of purifying $\text{UO}_2(\text{IO}_3)_2 \cdot \text{H}_2\text{O}$ by repeated recrystn. from boiling H_2O . $\text{UO}_2(\text{IO}_3)_2 \cdot \text{H}_2\text{O}$ is said to be converted completely to the iodide by treatment with sulfurous acid. It is reported to be only slightly sol. in H_2O at ordinary temp., its soly. being approx. 10 g/l in the presence of a small amt. of HNO_3 . This paper mentions the existence of $\text{UO}_2(\text{IO}_3)_2 \cdot 2\text{H}_2\text{O}$ which is said to be a pale yellow and more sol. than the monohydrate. It will yield the monohydrate rapidly at high temp. but only slowly at room temp. or lower. It can be obtained as a ppt. by treating dil. or concd. solns. of $\text{UO}_2(\text{NO}_3)_2$ with NaIO_3 at room temp.

- 811 Rossi, H. *Beiträge zur Kenntnis des vierwertigen Urans*. Dissertation, Univ. of Munich, 1902. It is indicated that $\text{U}(\text{C}_2\text{O}_4)_2 \cdot 6\text{H}_2\text{O}$ can be prepd. by pptn. of U with oxalic acid from HCl soln. of the U^{+4} salts. The product is said to be gray to greenish-white, changing to green crystals when allowed to remain in contact with the mother liquor. The crystals are probably rhombic. The loss of 5 moles of water at 100 to 110° and the loss of the last mole at 200° is confirmed. The residue is a pale-violet substance. Large dark-green crystals of $(\text{NH}_4)_4\text{U}(\text{C}_2\text{O}_4)_4 \cdot 7\text{H}_2\text{O}$ can be obtained from excess $\text{U}(\text{C}_2\text{O}_4)_2$ in concd. $(\text{NH}_4)_2\text{C}_2\text{O}_4$ soln. In the presence of CaCl_2 a gray-green powder results. It is said that $(\text{NH}_4)_4\text{U}(\text{C}_2\text{O}_4)_4 \cdot 6\text{H}_2\text{O}$ can be obtained from the heptahydrate by quick evapn. of the soln. in vacuum over H_2SO_4 or P_2O_5 . This hexahydrate forms reddish-brown elongated prisms. $\text{K}_4\text{U}(\text{C}_2\text{O}_4)_4 \cdot 5\text{H}_2\text{O}$ can be obtained by dissolving excess $\text{U}(\text{C}_2\text{O}_4)_2$ in $\text{K}_2\text{C}_2\text{O}_4$ soln. A moss-green, platelike cryst. material is obtained. Na uranium oxalate, like the corresponding K and (NH_4) salts, can be formed in the family $\text{R}_4[\text{U}(\text{C}_2\text{O}_4)_4] \cdot x\text{H}_2\text{O}$. It, however, crystd. poorly and was not analyzed for that reason. The double oxalate of the form $\text{Na}_2\text{U}_2(\text{C}_2\text{O}_4)_5 \cdot 8\text{H}_2\text{O}$ has been prepd. as small gray prisms in the same manner as the K salt. $\text{Ba}_2\text{U}(\text{C}_2\text{O}_4)_4 \cdot 9\text{H}_2\text{O}$ is obtained as a white ppt. in the same manner. Upon heating the white ppt., violet-red crystals are obtained. $\text{K}_2\text{SrU}(\text{C}_2\text{O}_4)_4 \cdot 8\text{H}_2\text{O}$ can be obtained by mixing excess K uranium oxalate with dil. SrCl_2 soln. The crystals are pale-lilac and ppt. as aggregated platelike pieces. A complex of the form $[\text{U}(\text{C}_2\text{O}_4)_4]^{-4}$ is said to exist because the transformation of K salts with BaCl_2 to Ba salts and vice versa proceeds without difficulty. $\text{CaH}_2\text{U}_2(\text{C}_2\text{O}_4)_6 \cdot 24\text{H}_2\text{O}$ can be obtained from an acid soln. of UCl_4 with CaCl_2 and $\text{H}_2\text{C}_2\text{O}_4$ as fine white needles. $\text{Na}_2\text{CaU}(\text{C}_2\text{O}_4)_4 \cdot 8\text{H}_2\text{O}$ is reported to be prepd. from $\text{K}_4\text{U}(\text{C}_2\text{O}_4)_4$ with CaCl_2 solns. The crystals are violet-red and slightly sol. in water from which they can be recrystd. The prepn. of $\text{K}_2\text{U}_2(\text{C}_2\text{O}_4)_5 \cdot 8\text{H}_2\text{O}$ is reported. $\text{K}_2\text{U}_2(\text{C}_2\text{O}_4)_4 \cdot 7\text{H}_2\text{O}$ can be obtained by digestion of $\text{U}(\text{C}_2\text{O}_4)_2$ with concd. K_2SO_4 or KCl soln. The material is a light yellowish-green, microcryst. ppt. It is also reported that a light powder of $2\text{U}(\text{C}_2\text{O}_4)_2 \cdot \text{H}_2\text{C}_2\text{O}_4 \cdot 8\text{H}_2\text{O}$ is obtained when an acid soln. of UCl_4 is treated with excess $\text{H}_2\text{C}_2\text{O}_4$, then washed with alc. and Et_2O . When this material is treated with H_2O or dil. acids, oxalic acid is split off, yielding the green oxalate, $\text{U}(\text{C}_2\text{O}_4)_2 \cdot 6\text{H}_2\text{O}$. It is indicated that $(\text{NH}_4)_2\text{U}_2(\text{C}_2\text{O}_4)_5 \cdot 8\text{H}_2\text{O}$ and $(\text{NH}_4)_2\text{U}_2(\text{C}_2\text{O}_4)_4 \cdot 7\text{H}_2\text{O}$ can be obtained in the same manner as the K salts and that $\text{NH}_4\text{HU}_2(\text{C}_2\text{O}_4)_5 \cdot 8\text{H}_2\text{O}$ can also be obtained by treating an aq. soln. of U oxalate with $(\text{NH}_4)_2\text{C}_2\text{O}_4$. The prepn. of the substituted U oxalate, $\text{U}_2(\text{SO}_4)_2(\text{C}_2\text{O}_4)_2 \cdot 6\text{H}_2\text{O}$, from U oxalate soln. and H_2SO_4 is described. The crystals obtained are dark-green tabular prisms, insol. in H_2O and dil. acids. $\text{NH}_4\text{H}_3\text{U}(\text{C}_2\text{O}_4)(\text{PO}_4)_2$ can be obtained by pptn. of U oxalate or one of the complex oxalates with H_3PO_4 , the cpd. ppt. being a blue-green microcryst. material which is stable in H_2O .

- 812 Russ, F. "On Niobium Oxalate." *Z. anorg. Chem.* 31, 42-91(1902).

Niobium uranyl oxalate ppts. as a yellow cryst. residue from solns. of K niobium oxalate and $\text{UO}_2(\text{NO}_3)_2$ in a small amt. of water.

- 813 Stavenhagen, A. and Schuchard, E. "On the Knowledge of Tungsten, Molybdenum, Uranium and Titanium." Ber. 35, 909(1902).

According to this paper, it is possible to obtain alloys of U with Mn and Co. The alloy with Mn is obtained by the aluminothermic method. Results of this were not duplicated in later attempts. The U-Co alloys are obtained in the same manner. The same procedure is discussed for the preparation of U-Mo alloys and U-Mo-Cu-Ti alloys. A modified procedure is used in order to obtain the multiple component system.

- 814 Streintz, F. "On the Electrical Conductivity of Pressed Powders." Ann. Physik (4), 9, 854-85 (1902).

It is reported that U_3O_8 is a nonconductor at ordinary temp. when tested in the form of a compressed powder.

PUBLICATIONS LOCATED IN 1903

- 815 Aloy, J. "On a New Class of Peruranates." Bull. soc. chim. France (3), 29, 292-4(1903).

A cpd. reported to be $Na_2UO_5 \cdot 5H_2O$, now thought to be $Na_2UO_6 \cdot 4H_2O$, has been prepd. by treating a suspension of UO_4 in H_2O_2 with alc. and carbonate-free NaOH. Upon stirring, a voluminous ppt. is obtained which gradually redissolves except for a red mass clinging to the walls of the vessel. Repeated washing with MeOH causes the red mass to become cryst. It is fairly stable, loses O_2 slowly at ordinary temp., decomp. rapidly and completely at 100° . The material is decompd. by water with the pptn. of the uranate, by HCl with the evoln. of Cl_2 , and by HNO_3 with the formation of peroxide and no gas. This paper makes reference to $K_2UO_5 \cdot 3H_2O$ which is actually $K_2UO_6 \cdot 2H_2O$. The prepn. and properties are similar to the corresponding Na cpd.

- 816 Aloy, J. "Precipitation of Several Alkaloids by Uranium Nitrate. Reaction of Morphine." Bull. soc. chim. France (3), 29, 610-11(1903).

A discussion is included on the reaction of U^{+4} salts, which form colored cpds. with alkaloids and plant pigments. It is said that the reactions are not totally characteristic.

- 817 Brearley, H. The Analytical Chemistry of Uranium. New York, 1903.

- 818 Clarke, F. W., (tabulator) Mineral Analyses from the Laboratories of the United States Geological Survey 1880 to 1903. Washington, U. S. Government Printing Office, 1903. 119p. (U. S. Geological Survey Bulletin No. 220; H. R. Document No. 65, 58th Congress, 2nd Session)

A very large no. of minerals and their analyses are listed. The U-bearing minerals include yttrialite, mackintoshite, samarskite, xenotime, carnotite, and many different uraninites. References are given, in most instances, to the original place of publication of the data.

- 819 Colani, A. "Some Binary Compounds of Uranium." Compt. rend. 137, 382-4(1903).

The sulfide, US ; the selenides, USe and U_4Se_3 ; the telluride, U_4Te_3 ; the nitride, U_3N_4 ; the phosphide, U_3P_2 ; the arsenide, U_3As_2 ; and the antimonide, U_3Sb_2 were prepd. The general method was to heat the double Na-U chloride in a current of the appropriate H cpd. of the nonmetal at about 500 to 1000° . The cpds. do not burn easily in air, but when in the Bunsen flame yield bright sparks. They are all violently attacked by concd. HNO_3 . In the prepn. of US_2 , the double Na-U chloride is preferred to UCl_4 . Instead of heating this material in a stream of H_2S , since H_2S is difficult to dry, it can be heated in a stream of H_2 contg. S vapor, if the air is excluded. The reaction is said to begin at 500° and the product forms in better crystals as the reaction temp. rises. After cooling, the residue should be washed with deaerated H_2O and US_2 will remain behind. Subsequent treatment is performed with alc. and Et_2O and the product is dried in vacuum in order to obtain a particularly pure product. The crystals of the material are said to be very small and black or iron-gray with a metallic luster and tetragonal in form. These will not

melt or decomp. when heated to 1000 or 1100° in the absence of air. They are attacked only slightly by HCl when dil. but moderately rapidly when concd. When the double chloride is treated with Na_2Te and a large excess of Te, black four-cornered lamellae of U_2Te_3 with a metallic luster are obtained. A material of the compn. UTe_2 could not be obtained. USe_2 can also be formed by the action of SnSe on the double U chloride in dry H_2 . The resulting selenide is composed of small, black, brittle crystals. It is often pyrophoric and should be kept in sealed tubes. The chem. behavior is similar to that of the sulfide but the selenide is more rapidly affected by oxidizing agents, and it will take fire when oxidization is carried out with HNO_3 . The U^{+3} selenide, U_2Se_3 , is formed during the prepn. of USe_2 if the Se concn. is too low or the mixt. is heated above 1000°.

820 Harden, J. "Light and Uranium Nitrate." *Physik. Z.* **4**, 306-07(1903).

Crystals of U nitrate shaken in a glass tube give off a yellowish-green shimmering light. In a tube containing air at ordinary pressures they enable the air to act like the rarefied gas in a Geissler tube; but the light produced has no photographic and no fluorescence-exciting power when a dark card intervenes. An ordinary induction coil brings out this effect much better than a Tesla coil. A magnetic field does not induce luminescence.

821 Hartley, W. N. "The Absorption Spectra of Metallic Nitrates. Part II." *J. Chem. Soc.* **83**, 221-46(1903).

Information is included on the absorption spectra of $(\text{UO}_2)^{+2}$ solns.

822 Meyer, R. J. and Wendel, F. "Uranyl Double Nitrates." *Ber.* **36**, 4055-8(1903).

The double nitrates of $(\text{UO}_2)^{+2}$ with K, (NH_4) , Rb, Cs, and Tl crystallized well from HNO_3 and, with the exception of the Tl salt, exhibit strong fluorescence. They are decompd. into their components by H_2O , the Tl salt even by moist air. The compn. is in all cases represented by the formula $\text{R}'\text{UO}_2(\text{NO}_3)_3$. Attempts to prep. similar salts of Na and Li, or of bivalent metals, failed. $\text{KUO}_2(\text{NO}_3)_3$ is obtained by dissolving the individual nitrates in concd. HNO_3 and allowing the soln. to evap. over H_2SO_4 or KOH. Drying of the crystals can be done on porcelain or between filter papers. The crystals are a vivid yellow with a bluish-green fluorescence. $\text{RbUO}_2(\text{NO}_3)_3$, $\text{NH}_4\text{UO}_2(\text{NO}_3)_3$, $\text{TlUO}_2(\text{NO}_3)_3$, and $\text{CsUO}_2(\text{NO}_3)_3$ can be obtained in the same manner as the K cpd. The soly. of the alk. double nitrates in concd. HNO_3 decreases rapidly in the order K, NH_4 , Rb, Cs. Unsuccessful attempts to obtain lithium uranyl nitrate from acid soln. of the components are reported in this paper.

823 Oechsner de Coninck, F. W. "Study of Some Salts of Uranium." *Ann. chim. phys.* (7), **28**, 5-15 (1903).

$\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$ may be prepd. as a light-yellow cryst. cpd. by treating hydrated UO_3 with pure concd. H_2SO_4 . When $\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$ is dried for one day over H_2SO_4 or heated to 100° on a water bath, 1.5 moles of H_2O are removed. The monohydrate can be obtained at 110 to 115°. This reaction is said to be reversible in moist air. The material is reported to go to the anhyd. salt above 175°. The heat of soln. (molar) for $\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$ in excess H_2O at 17.3° is reported to be 5.5 kcal. Detns. of the d. of H_2SO_4 soln. of UO_2SO_4 between 20 and 23° are also reported. The refractive index for an 8% UO_2SO_4 soln. is reported to be 1.365 and that of a 10% soln., 1.371. The report of soly. for $\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$ in water, as being 1 to 5 rather than 1 to 0.5, as given by earlier experimenters, is probably due to a typographical error. $\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$ is reported to be difficultly sol. in concd. formic and glacial acetic acids. Its soly. is 1:37.9 in 85% alc. at 16.7° and at 15.8°, 1:38.6. It is reported that at high c.d. UO_2SO_4 soln. is reduced to the U^{+4} state. In the presence of free H_2SO_4 , a small deposit of metal is reported. In neutral or alk. solns., black and yellow oxides were obtained. During the electrolysis of an aq. UO_2SO_4 soln. $\text{UO}_3 \cdot 2\text{H}_2\text{O}$ is formed at the cathode. After some time an olive-green ppt. of oxide and basic sulfate will be observed. At high temp. a black nonpyrophoric oxide is pptd. The reaction between alc. and uranyl salts in the presence of light is discussed. It is reported that $\text{U}(\text{SO}_4)_2 \cdot 8\text{H}_2\text{O}$ is dilq. and that it may be hydrolyzed by H_2O pptg. a basic sulfate. This hydrolytic tendency is lessened below room temp. Soly. detns. at 13, 11.3, and 9.1° show that one part of salt dissolves in 4.23 to 4.4 parts of water. There is a discussion of the reactions of dil. aq. solns. of $\text{U}(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$ with Au and Pt. When uranyl salts are ignited with volatile acids, it was found that the U_3O_8 formed is accompanied by black U_2O_5 .

- 824 Pissarjewsky, L. "The State of Some Peracids and Their Salts in Solution." Z. physik. Chem. 43, 160-72(1903).

Na_4UO_8 is not regarded as a salt of uranic acid but as a salt of the hypothetical weak acid, $\text{UO}(\text{OH})(\text{O}_2\text{H})_3$ or $\text{H}_4(\text{O}_2)_3\text{UO}_2$, which hydrolizes strongly in aq. soln., splitting off NaOH and H_2O_2 . A 1/20 M soln. of Na_4UO_8 will gradually decomp. upon standing, leaving UO_4 . This pptn. is delayed when excess H_2O_2 or NaOH is present but, on the other hand, if the excess of H_2O_2 is very large the O_2 evolved accelerates the pptn. The author disagrees with Fairley (J. Chem. Soc. 31, 125-42(1877)) on the structure of UO_4 . He regards the material as a free peruranic acid when hydrated with 2 mols. of water.

- 825 Pulman, O. S. "The Determination of Uranium and Uranyl Phosphate with the Help of Zinc Reductors." Z. anorg. Chem. 37, 113-24(1903).

- 826 Renz, C. "On Combinations of Metal Halides with Organic Bases." Z. anorg. Chem. 36, 100-18 (1903).

It is reported that UCl_4 will dissolve in acetone yielding a light-green to yellow soln. Cpds. of UCl_4 with quinoline and pyridine are reported. They are obtained as voluminous ppts. when the org. material is added to an acetone soln. of UCl_4 and may be crystd. from boiling abs. alc. in which they are very slightly sol.

- 827 Rutherford, E. and Soddy, F. "Radioactivity of Uranium." Phil. Mag. (6), 5, 441-5(1903). A discussion of the different types of radiation given out by U, the α and β rays, is included.

PUBLICATIONS LOCATED IN 1904

- 828 Bach, A. "On the Knowledge of Decomposition of Carbonic Acid under the Influence of Light." Ber. 37, 3985-6(1904).

It is reported that $\text{UO}_2(\text{OAc})_2$ soln. cannot be decompd. by light when CO_2 is passing through the soln.

- 829 Bechhold, J. H. "Flocculation by Suspensions or Colloids and Bacterial Agglutination." Z. physik. Chem. 48, 385-423(1904).

Page 417 contains the report of trials, at various gelatin levels, with uranyl bacteria.

- 830 Becquerel, H. "Spontaneous Emission of Light by Uranium Salts." Compt. rend. 138, 184-7 (1904).

The author calls attention to certain salts of U that emit light continuously and with an intensity not expected from their feeble radioactivity. The salt in which this emission of light is most intense is the double K uranyl sulfate but other salts of U also exhibit the property. To observe the slight glimmer, which is all that can be seen in most cases, the observer's eye should be rested for a long time in the dark. The emission of light is spontaneous and continuous, exhibiting all the characteristics of an effect produced by the radioactivity of U. A specimen of the double salt referred to, which had been kept shut up for eight years and screened from all luminous excitation, exhibited the property as distinctly as specimens recently exposed to light. The spontaneous luminosity is permanent and seems due to the phosphorescence excited in the salt itself by the radiation which U sends out. An approx. photometric estn. showed that the glimmer emitted by the double salt was about twenty thousand times more feeble than that of the light emitted from a prepn. of U chloride whose activity was a million times greater. The order of magnitude of the luminous effects is thus not the same as that of the effect on the ionization of air.

- 831 Biltz, W. and Clinch, J. A. "Note on Acetyl Acetonate." Z. anorg. Chem. 40, 218-24(1904). This paper contains information on the prepn. of a U^{+4} cpd. and a uranyl cpd. of acetyl acetone. The former is said to form as brownish to olive-green flakes, and the latter as an orange-yellow cryst. ppt.

- 832 Brunck, O. "On the Action of Sodium Hyposulfite on Metal Salts. (Second Communication)." Ann. 336, 281-98(1904).

It is reported that, when a soln. of $\text{UO}_2(\text{NO}_3)_2$ or $\text{UO}_2(\text{OAc})_2$ is treated with $\text{Na}_2\text{S}_2\text{O}_4$, a reddish-brown ppt. is first formed which quickly becomes grayish-green and dissolves in excess reagent, yielding a green color. Upon boiling, this green-colored soln. will again produce the grayish-green ppt. of basic U sulfite.

- 833 Burger, H. Beiträge zur kenntnis der Uranyldoppelsalze. Dissertation, Univ. of Bonn, 1904. There is a discussion of the results of heating $\text{K}_2\text{UO}_2\text{Cl}_4 \cdot 2\text{H}_2\text{O}$ to decompn. $\text{Rb}_2\text{UO}_2\text{Cl}_4 \cdot 2\text{H}_2\text{O}$ is reported to be obtained from a 2:1 soln. of RbCl_2 and UO_2Cl_2 . It forms as large yellow-green crystals. $\text{Cs}_2\text{UO}_2\text{Cl}_4$ can be obtained in a similar manner and recrystd. from H_2O . Methyl ammonium uranyl chloride can be obtained as a yellow-green dilq. analog of the alk. salts. Soly. measurements at several temps. are given. $\text{NH}_4\text{UO}_2(\text{NO}_3)_3$ can be obtained by the evapn. of aq. soln. of the components in molar proportions above 60° . $\text{K} \cdot \text{UO}_2(\text{NO}_3)_3$ cryst. when an aq. soln. of the components in correct molar ratio is evapd. at approx. 80° . It is specified, however, that the solns. have a min. concn. of 26% KNO_3 . It can also be obtained by evapg. a soln. of $\text{K}_2\text{O} \cdot 2\text{UO}_3$ in excess HNO_3 . The crystals obtained are said to be very hydr., gaining wt. in air and soon becoming clouded. Evidence is shown for the decompn. of the material by water at low temp. but, from around 60° the cpd. will dissolve without decompn. and can be recovered by evapn. $\text{RbUO}_2(\text{NO}_3)_3$ and $\text{CsUO}_2(\text{NO}_3)_3$ can be crystd. from solns. of the component nitrates in strong HNO_3 . $\text{K}_2\text{UO}_2(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$ can be obtained from the solns. of its components in molar proportions or by dissolving $\text{K}_2\text{O} \cdot 2\text{UO}_3$ in excess H_2SO_4 and evapn. of the soln. in vacuum. Because of the extreme soly. of hydroxyl ammonium uranyl sulfate, $(\text{NH}_3\text{OH})_2\text{SO}_4 \cdot 2\text{UO}_2\text{SO}_4$, in H_2O , evapn. of the soln. to a ppt. is very difficult. The yellow-green crystals which are obtained always contain impurities which are not removed by recrystn. A fairly pure cryst. powder can be obtained by pptn. with alc. It is stable at room temp. $(\text{NH}_4)_3\text{UO}_2\text{F}_5$ was reported as obtained in the same manner from $(\text{NH}_4)_2\text{U}_2\text{O}_7$ and recrystd. from water. A discussion of double K uranyl and NH_4 uranyl propionic acid salts is given. Regular yellow tetrahedral crystals are reported. The K uranyl complex salts of butyric acid are also discussed, as well as the K uranyl complex salts of valeric and isovaleric acid. This material is reported to be yellow and difficulty sol.

- 834 Euler, H. "On Knowledge of the Assimilation Process." Ber. 37, 3411-18(1904). A footnote on p. 3415 contains information on the photochemical reduction of U salts. Information on the reaction between uranyl salts and HOAc in the presence of CO_2 is also given.

- 835 Glasmann, B. "On an Iodometric Method for the Determination of Uranium in Uranyl Compounds." Ber. 37, 189-91(1904).

When KI and KIO_3 are added to the uranyl soln., the reduction produces $\text{U}(\text{OH})_4$. The I is distd. with steam into a flask of KI soln. and this soln. titrated with $\text{Na}_2\text{S}_2\text{O}_3$. The results are claimed to be very accurate.

- 836 Meyer, S. and Schweidler, E. V. "Uranium Radiation." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse. Abt. IIa 113, 1057-79(1904).

It is pointed out that the choice of a solid U cpd. as a standard with which to compare other radioactive substances introduces indefiniteness on account of the different phys. condition in which the std. substance may be taken. The authors, therefore, recommend that a soln. be taken of definite concn. and thickness. It is proved that the activity is proportional to the surface area and rapidly increases with the thickness of the soln. layer. For a layer thicker than 1 cm, the radiation is constant. It increases faster than the d. of the soln. They then separate the UX from the nitrate and obtain the same result as Rutherford and Grier for the rise of activity of the latter, viz., it is found to reach half its max. in 22 days.

- 837 Milbauer, J. "On the Effect of Potassium Thiocyanide on Metal Oxides at High Temperatures." Z. anorg. Chem. 42, 433-49(1904).

It is reported that pure cryst. UO_2S may be obtained by strong ignition of KCNS, U_3O_8 , and S in 12:3:5 ratio. Before being used the KCNS should be recrystd. twice from alc., dried in vacuum, and fused several times. The U_3O_8 should be prepd. by the ignition of uranyl acetate. The product, UO_2S , will consist of black iridescent tetragonal crystals. Ignition in air causes the evolution of SO_2 and U_3O_8 . The material will oxidize quickly in the presence of aqua regia or concd. HNO_3 . It is stable toward HCl at ordinary temp. but will dissolve when heated.

- 838 Milbauer, J. "Two New Selenium Compounds: Uranyl Selenide and Potassium Chromium Selenide." *Z. anorg. Chem.* **42**, 450-2(1904).

UO_2Se can be prepd. by igniting a 7:5:1 mixt. of Se, KCN, and U_3O_8 in a closed crucible. The ignition product is leached with water and then washed with water and alc. and dried at 98° . The resulting selenide is composed of short, 6-sided prisms, having a black to red cast and a metallic luster. It will decomp. slowly in water turning the soln. red. Dil. alk. solns. have no effect on the crystals. They are highly sol. in cold KCl with the formation of H_2Se and UO_2Cl_2 and react violently with HNO_3 in the cold, Se being thrown down first but later oxidized by the excess acid.

- 839 Naumann, A. "Reactions of Salts in Nonaqueous Solutions. I. Ethyl Acetate." *Ber.* **37**, 3600-05 (1904).

It is reported that $\text{UO}_2(\text{NO}_3)_2$, UBr_4 , UO_2I_2 , UO_2Cl_2 , and uranium acetate [$\text{UO}_2(\text{OAc})_2 \cdot 2\text{H}_2\text{O}$] are insol. in EtOAc. Much of this information is contained in a dissertation by Alexander published in 1899.

- 840 Naumann, A., Eidmann, W., Schulz, P., Vogt, E., and Müller, M. "Reactions of Salts in Nonaqueous Solutions. II. In Acetone." *Ber.* **37**, 4328-31(1904).

It is reported that UO_2Cl_2 , UO_2I_2 , UBr_4 , and $\text{UO}_2(\text{NO}_3)_2$ are sol. in acetone.

- 841 Naumann, A. "Reactions of Salts in Nonaqueous Solutions. III. In Pyridine." *Ber.* **37**, 4609-14 (1904).

It is reported that UO_2Cl_2 , UO_2I_2 , UBr_4 , and $\text{UO}_2(\text{NO}_3)_2$ are sol. in pyridine. Much of this information is included in a dissertation by Schroeder published in 1901.

- 842 Oechsner de Coninck, F. W. "Contribution to the Study of Uranyl Chloride." *Ann. chim. phys.* (8), **3**, 500-06(1904).

This paper reports that the d. of 1 to 10% solns. of UO_2Cl_2 at 13 to 16° lie between the values 1.0056 and 1.0517. There is a discussion of the prepn. of uranate, particularly from UO_2Cl_2 , the reactions of this oxychloride with various materials, its soly. in acids and other solvents. UO_2Cl_2 is reported to give off yellowish vapors when heated in air and to be gradually calcined to U_3O_8 . In a diffused light a soln. of UO_2Cl_2 will slowly ppt. $\text{UO}_3 \cdot 2\text{H}_2\text{O}$ and, when boiled, this soln. remains clear at first but will ppt. the same material when cooled. A number of reactions of UO_2Cl_2 with common inorg. reagents is discussed.

- 843 Pimmer, V. *Zur Charakterisierung des Uranpentachlorids*. Dissertation, Univ. of Zürich, 1904.

It is reported that the mol. wt. of UCl_5 cannot be satisfactorily obtained from vapor d. or ebullioscopic detns. UCl_5 is said to volatilize at 70° and 7 mm Hg. The behavior of UCl_5 with a number of org. solvents is investigated. UCl_5 is formed at 500 to 600° and, in order to effect complete sepn. of UCl_5 and UCl_4 , the pentachloride is best sucked dry or subld. from the mixt. of chlorides.

- 844 Rimbach, E. "On the Solubility of Instability of Double Salts in Water. Double Uranyl Salts." *Ber.* **37**, 461-87(1904).

This is a comprehensive paper which contains a large amt. of valuable data. The prepn. and appearance of the following cpds. is treated: $\text{K}_2\text{UO}_2\text{Cl}_4 \cdot 2\text{H}_2\text{O}$, $(\text{NH}_4)_2\text{UO}_2\text{Cl}_4 \cdot 2\text{H}_2\text{O}$, $\text{Rb}_2\text{UO}_2\text{Cl}_4 \cdot 2\text{H}_2\text{O}$, $\text{Cs}_2\text{UO}_2\text{Cl}_4 \cdot 2\text{H}_2\text{O}$, methyl ammonium uranyl chloride, $\text{KUO}_2(\text{NO}_3)_3$, $\text{NH}_4\text{UO}_2(\text{NO}_3)_3$, $\text{RbUO}_2(\text{NO}_3)_3$, $\text{CsUO}_2(\text{NO}_3)_3$, $\text{K}_2\text{UO}_2(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$, $\text{Rb}_2\text{UO}_2(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$, $(\text{NH}_4)_2\text{UO}_2(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$, $(\text{NH}_3\text{OH})_2\text{UO}_2(\text{SO}_4)_2$, $\text{Na}_2(\text{UO}_2)_2(\text{CrO}_4)_3 \cdot 10\text{H}_2\text{O}$, $\text{KUO}_2\text{AsO}_4 \cdot 3\text{H}_2\text{O}$, the ammonium uranyl salt of propionic acid, and the K uranyl salts of propionic,

butyric, valeric, and isovaleric acids. An unsuccessful attempt to prep. Li uranyl nitrate is also reported. Results of heating UO_2Cl_2 and the soln. properties of many of the salts mentioned above are also discussed.

- 845 Sachs, A. "On the Relations of Rubidium to Potassium on the One Hand and to Cesium on the Other Hand to Crystallographic Observations on New Double Uranyl Salts of These Metals." Z. Krist. 38, 496-8(1904).

$\text{RbUO}_2(\text{NO}_3)_3$ is reported to exist as greenish-yellow crystals which are nearly always trigonal prisms. $\text{CsUO}_2(\text{NO}_3)_3$ is said to be isomorphous with it. Crystal measurements on $\text{KUO}_2(\text{NO}_3)_3$, α -modification, disagree with those obtained later by Nichols and Howes.

- 846 Strutt, R. J. "Occurrence of Radium with Uranium." Nature 70, 222(1904).

The mineral torbernite or copper uranite forms uniform, transparent, green, tetragonal crystals of the compn. $\text{CuO} \cdot 2\text{UO}_3 \cdot \text{P}_2\text{O}_5 \cdot 8\text{H}_2\text{O}$. It dissolves to a clear, green soln. in H_2SO_4 . This soln. when boiled liberates the Rn at about the same rate as an equal wt. of Joachimsthal pitchblende. The proportion of U is also about the same. Most radioactive minerals are complex in character, but in this case it is clear that, if the Ra has been produced from the other constituents of the mineral, it must have come from the U.

- 847 Wehnelt, A. "On the Escape of Negative Ions from Incandescent Metal Compounds and Phenomena Dependent thereon." Ann. Physik (4), 14, 425-68(1904).

U oxide was investigated as was the fluorescence of U glass at 670 v.

PUBLICATIONS LOCATED IN 1905

- 848 Boltwood, B. B. "Production of Radium from Uranium." Am. J. Sci. 20, 239-44(1905).

The author's expts., extending over 13 mos., have shown no trace of the formation of Ra from U, although the electroscope was capable of detecting 5×10^{-7} of the equil. quantity.

- 849 Bruhat, J. and Dubois, H. "On the Perborates." Compt. rend. 140, 506-09(1905).

U perborate is reported to have been obtained from UO_2 and Na perborate as a yellow, anhyd., very stable salt of the compn. UBO_4 .

- 850 Burke, J. B. "Note on Fluorescence and Absorption." Proc. Roy. Soc. (London), A. 76, 165-7(1905).

Information is included on the characteristics of U glass.

- 851 Carmichel, C. "On Fluorescence." Compt. rend. 140, 139-41(1905).

Notes on the characteristics of U glass are included.

- 852 Friedheim, C. "On So-Called Stable Solutions of Nonreactive Gas in Uranium Oxides." Ber. 38, 2352-9(1905).

This paper contains an explanation of $(\text{NH}_3\text{OH})_2\text{UO}_4 \cdot \text{H}_2\text{O}$ as the transition product of the uranate to the anhydride which is not stable and which is decompd. by the sepn. of either H_2O or an acid radical.

- 853 Gernez, D. "Triboluminescence of Metallic Compounds." Compt. rend. 140, 1337-9(1905).

It is reported that uranyl acetate and the double acetates with Na or K are triboluminescent, as are uranyl phosphate and sulfate. No formulas are given for the crystals examined.

- 854 Godlewski, T. "Uranium Radioactivity." *Phil. Mag.* (6), 10, 45-60(1905).
Meyer and von Schweidler have found if UX is sepd. from $\text{UO}_2(\text{NO}_3)_2$ by shaking the aq. soln. with Et_2O , its rate of decay is abnormal. This paper is an investigation as to the cause of this. The rate of decay is quite normal if the evapn. of the aq. portion is carried far enough to drive off the water of crystn. Proceeding exactly according to the method of Meyer and von Schweidler the decay curve is different according to which crop of crystals is taken. A discussion of the results shows that the first crystals produced from the aq. soln. contain even less than the equil. amt. of UX. All the observations are explained by the fact that the crystn. starts at the bottom of the vessel and the upper portions become relatively richer in UX. The top and bottom of the plate of crystals formed give a different initial activity and a different rate of decay. Conclusive expts. are performed in support of this view, and it is shown that UX can diffuse through a crystal plate even in the absence of H_2O . The author looks on the UX, and in fact the other active products, such as ThX and ThEm, as existing in a state of solid soln., and he supposes that the diffusion takes place as the result of a species of osmotic pressure. The abnormal rate of decay is merely a result of the crystn. causing a mixt. of UX and the original U salt in different proportions.
- 855 Hagenbach, A. and Konen, H. Atlas der Emissionspektren. Jena, 1905.
Page 35 identified approx. 5000 lines in the U spark spectrum between 4700 and 2195 Å.
- 856 Kohlschütter, V. and Vogdt, K. "On Stable Solutions of Nonreactive Gas in Uranium Oxide." *Ber.* 38, 1419-30(1905).
When alk. is added to $(\text{UO}_2)^{+2}$ soln. and the yellow ppt. mixed without filtering with hydroxylamine chloride until a slight acid reaction is obtained, a complex of the form $(\text{NH}_3\text{OH})_2\text{UO}_4 \cdot \text{H}_2\text{O}$ is obtained and, at the color change, a yellow-green cryst. powder will ppt. When $(\text{NH}_3\text{OH})_2\text{UO}_4 \cdot \text{H}_2\text{O}$ is heated in a test tube, a fine spray of UO_2 will be given off in a stream of NH_3 and water vapor. When heated in vacuum, the material suddenly explodes at 200° giving off much heat, NH_3 , and NO_2 . Other methods of decompn. are discussed.
- 857 Kohlschütter, V. and Vogdt, K. "On Stable Solutions of Nonreactive Gas in Uranium Oxides. II." *Ber.* 38, 2992-3002(1905).
- 858 Kollock, L. G. and Smith, E. F. "The Use of the Rotating Anode and Mercury Cathode in Electro-Analysis." *J. Am. Chem. Soc.* 27, 1527-49(1905).
The sepn. of Fe and U by the Hg cathode method is mentioned. Considerable detail is given to sepn. for ions other than U.
- 859 Rimbach, E. "On the Solubility and Decomposition of Double Salts in Water." *Ber.* 38, 1564-72 (1905).
It is reported on the final page that $\text{K}_2\text{SO}_4 \cdot \text{UO}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$ is obtained from a strong H_2SO_4 soln. of the component sulfates. Decompn. of $2\text{K}_2\text{SO}_4 \cdot \text{UO}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$ is obtained by crystn. from very strong H_2SO_4 as $\text{K}_2\text{SO}_4 \cdot \text{UO}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$.
- 860 Rutherford, E. and Boltwood, B. B. "Proportion of Radium and Uranium in Minerals." *Am. J. Sci.* 20, 55-6(1905).
It has been shown by both Boltwood and Strutt that the proportion of Ra to U in radioactive minerals is const. The authors seek to det. the wt. of Ra in equilibrium with 1 g of U, and find it equal to 7.4×10^{-7} g. This value is obtained by comparing the quantity of emanation obtainable from a mineral of known U content with that from a soln. of the purest RaBr_2 obtainable. This amt. is about that to be expected if U is the parent of Ra.
- 861 Rutherford, E. and Boltwood, B. B. "Proportion of Radium and Uranium in Minerals." *Chem. News* 92, 38-9(1905).
This paper contains information similar to that reported in *Am. J. Sci.* 20, 55-6(1905).

862 Soddy, F. "Production of Radium from Uranium." *Phil. Mag.* (6), 9, 768-79(1905).
1 kg of $\text{UO}_2(\text{NO}_3)_2$ is dissolved in water, H_2SO_4 is added, and then successive quantities of $\text{Ba}(\text{NO}_3)_2$ soln., filtering following each addn. The soln. is enclosed in a bottle and air drawn through; testing with an electroscope shows that the soln. is practically free from Ra. This test has been repeated over a period of eighteen months, showing a gradual growth of Ra in the soln. The amount of Ra produced is only 0.1% of the amt. that should be produced on the assumption of a direct change from UX into Ra. An intermediate product whose life is long compared with the time of the expts. would account for this. Reasons are given for supposing that either Bi or Pb are the final products of the radioactive changes.

863 Steinmetz, H. "On the Transformation Process in Polymorphous Substances." *Z. physik. Chem.* 52, 449-66(1905).

$\text{NaMg}(\text{UO}_2)_3(\text{OAc})_9 \cdot 9\text{H}_2\text{O}$ is reported to exist as monoclinic prisms. The crystallography of the material is discussed.

864 Trautz, M. "Studies in Chemiluminescence." *Z. physik. Chem.* 53, 1-111(1905).
It is reported uranyl acetate (no formula) exhibits triboluminescence, but that UO_2SO_4 , UO_2Cl_2 , pulverized UO_3 , and $\text{UO}_2(\text{NO}_3)_2$, when crystd. from Et_2O over P_2O_5 , do not.

865 Zenghelis, C. "On the Evaporation of Solid Compounds at Ordinary Temperature." *Z. physik. Chem.* 50, 219-24(1905).

U_3O_8 was one of the cpds. investigated.

PUBLICATIONS LOCATED IN 1906

866 Bach, A. "Action of Light on Uranyl Acetate." *Ber.* 39, 1672-3(1906).
It is reported that slow reduction of $(\text{UO}_2)^{+2}$ occurs when no CO_2 is passed through a soln. of HOAc and uranyl salts.

867 Blinkoff, C. *Beiträge zur Kenntnis kondensierter Uranylverbindungen*. Dissertation, Univ. of Bern, 1906.

Basic Ca uranyl phosphate, approx. $3\text{CaO} \cdot 5\text{UO}_3 \cdot 2\text{P}_2\text{O}_5 \cdot 16\text{H}_2\text{O}$, is obtained as 4-sided yellow plates by heating a soln. of Ca phosphate in HNO_3 with aq. $\text{UO}_2(\text{NO}_3)_2$ at 200° . Information is given on the prepn. of $\text{Ba}(\text{UO}_2)_2(\text{PO}_4)_2 \cdot 10(8)\text{H}_2\text{O}$ by treating $\text{BaO} \cdot \text{UO}_3$ in HOAc and HNO_3 with H_3PO_4 . The prepn. of Sr uranyl orthophosphates is also reported, with brief information on their cryst. form. It is indicated that, when a soln. of $\text{Cd}_3(\text{PO}_4)_2$, acidified with HNO_3 , is treated with $\text{UO}_2(\text{NO}_3)_2$, the ppt. obtained is $\text{UO}_2\text{HPO}_4 \cdot 4\frac{1}{2}\text{H}_2\text{O}$ and not a Cd cpd. Uranyl nitrate arsenate, $2\text{UO}_3 \cdot \text{N}_2\text{O}_5 \cdot \text{As}_2\text{O}_5 \cdot 20\text{H}_2\text{O}$, can be obtained when a soln. of BaUO_4 in HOAc is treated with the calcd. quantity of arsenic acid. The ppt. obtained is redissolved in HNO_3 and the soln. is concd. to ppt. the small light-green crystals which begin to appear from the syrupy mother liquor. These crystals of nitrate arsenate decomp. in H_2O under 10 atm. CO_2 . $\text{Ca}_2\text{UO}_2(\text{CO}_3)_3 \cdot 3\text{UO}_3 \cdot 22\text{H}_2\text{O}$ was prepd. This material crystd. in the form of pale-yellow quadrangular plates. The prepn. of basic $\text{BaCO}_3 \cdot \text{UO}_2\text{CO}_3 \cdot \text{UO}_3 \cdot 5(8)\text{H}_2\text{O}$ is reported upon the mixt. of solns. of $\text{UO}_2(\text{NO}_3)_2$ with the addn. of streaming CO_2 . Basic $\text{SrCO}_3 \cdot \text{UO}_2\text{CO}_3 \cdot \text{UO}_3 \cdot 10\text{H}_2\text{O}$ can be obtained as an amorph. yellow ppt. from a suspension of SrUO_4 in H_2O by treatment with CO_2 at 10 atms.

868 Boltwood, B. B. "On Some Radioactive Properties of Uranium." *Radium, Le* 3, 334-6(1906).
Since the at. wt. of U is 238 and that of Ra is 225, then if the α particles are atoms of He of at. wt. 4, it should be expected that there exists between U and Ra two products giving off α rays. A no. of expts. were undertaken to sep. another radioactive constituent from U, but with neg. results. Although subjected to a number of chem. reactions, no constituent other than UX could be sepd. The U_3O_8 deposited on the electrodes when a U soln. was subjected to electrolysis, as well as the oxide which had been heated in the electric arc, showed normal activity. When U nitrate was subjected to fractional crystn., some of the

crystals obtained seemed to show abnormal rates of increase but no definite conclusion could be drawn that the irregularities were due to a new radioactive constituent.

869 Bragg, W. H. " α -Particles of Uranium and Thorium." *Phil. Mag.* (6), 11, 754-68(1906). The range of the α particles is investigated from the ionization due to a radioactive layer, the substance being covered by a screen. This is found to be a function of the stopping power of the screen and the range of the particle. The ionization and stopping power can be determined experimentally, and the range deduced. In practice the results for U and Th are compared with those for Ra; the general conclusions are that U, Th, Ra, emit α particles of nearly, if not exactly, the same speed. It is also found that U atoms break down very nearly five times as fast as Th.

870 Crowther, J. A. "On the Coefficient of Absorption of the β -Rays from Uranium." *Phil. Mag.* (6), 12, 379-92(1906).

The absorption of the β rays of U was detd. by measuring the ionization current when a film of U_3O_8 was covered by one or more thin layers of various substances. If I_0 and I are the intensities of the β rays before and after passing through a screen of thickness, d , then $I = I_0 e^{-\lambda d}$; λ is the absorption coeff. If p is the density, λ/p is a periodic function of the at. wt. of the absorbing element. The value of λ/p increases on the whole in each succeeding period. Allotropic forms of an element show identical absorption. Very little secondary radiation is produced by the β rays from U.

871 Finn, A. N. "Determination of Uranium and Vanadium." *J. Am. Chem. Soc.* 28, 1443-6(1906). The soly. of the carbonates of U and V in excess of Na_2CO_3 is used to sep. these metals from any others which may be present. From this $(CO_3)^{-2}$ soln. the U is ppt. by $(NH_4)_2HPO_4$ and filtered from the soln. contg. the V. The ppt. is dissolved in H_2SO_4 , reduced by Zn, and titrated with $KMnO_4$. The filtrate is acidified with H_2SO_4 , reduced with SO_2 , and titrated with $KMnO_4$. No results are given of detns. on mixts. with known U and V content, but in four runs on different amts. of an unknown mixt., results varied from 1.063 to 1.085% U_3O_8 and from 1.407 to 1.429% U_2O_3 .

872 Fleckseder, R. "Hydrops and Glycosuria in Uranium Poisoning." *Arch. exptl. Path. Pharmacol.* 56, 54-68(1906).

Animals poisoned by U salts often suffer from exudations into the serous cavities and into the tissues. The type of diet is of importance in detg. the presence of the exudate. With diets containing little H_2O , no hydrops is obtained. The method of administration is important. Those animals which received U subcutaneously died with effusion. Anuria and plethora are not the all-determining factors, for nephrectomized animals poisoned with U salts die with effusion, while nephrectomized animals, which receive no poison, do not. Estn. of the amt. of sugar in the blood showed that the increase after the administration of U salts was independent of the kidney.

873 Fosse, R. and Lesage, L. "Basicity of Xanthyl Oxide. Xanthyl-Metallic Double Halogens." *Compt. rend.* 142, 1543-5(1906).

This paper contains a report of the prepn. of a xanthylum bromide of U of the form $UO_2Br_2 \cdot 2C_{13}H_9OBr$ which is said to form in yellow crystals. Golden-yellow prismatic crystals of $UO_2Cl_2 \cdot 2C_{13}H_9OCl$ are obtained by treating UO_2Cl_2 solutions with xanthylum chloride.

874 Giolitti, F. and Liberi, G. "Upon the Phenomena of Equilibrium Between the Hydrates of Uranium Sulfates. III. Hexahydrates, Pentahydrates and Sulfates." *Gazz. chim. ital.* 36, II, 443-50 (1906).

When the system $UO_2SO_4 \cdot H_2O - H_2SO_4 - EtOH$ is exposed to sunlight for several hrs, hydrated and basic U sulfates are pptd. by varying the temp. and concn., the authors obtained octahydrates, hexahydrates, and pentahydrates and complex mixts. of these with basic hydrated salts. Analysis of these ppts. indicated formulas such as: $U(SO_4)_2 \cdot 5H_2O$; $3UOSO_4 \cdot U(SO_4)_2 \cdot 10H_2O$; $3UOSO_4 \cdot U(SO_4)_2 \cdot 15H_2O$; $3UOSO_4 \cdot U(SO_4)_2 \cdot 20H_2O$; $3UOSO_4 \cdot U(SO_4)_2 \cdot 32H_2O$. As a rule these salts display a definite cryst. structure though in some cases salts with widely differing phys. properties were nearly identical in chem. compn. It was

noticed that BaCl_2 gave no ppt. from solns. of these salts except on long standing. The authors explain this phenomenon by the supposition that the ions are complex. (This is a continuation of a previous research and is preliminary to a further physicochemical study.)

- 875 Goettsch, H. M. "The Absorption Coefficients of Uranium Compounds." J. Am. Chem. Soc. **28**, 1541-55(1906).

The absorption coeffs. of the α rays of U were detd. by the method of McCoy (J. Am. Chem. Soc. **27**, 391 1905)). A characteristic const. was found for each of the six cpds. examined. The radioactivity, as calcd. from the absorption coeff. and the observed activity of a thick film of a cpd., was, in each case, proportional to the U content of the substance. The total activity of 1 g of U is independent of its chem. combination and equal to 790 times the activity of 1 cm^2 of a thick film of U_3O_8 . The activity of six cpds. was also detd., by extrapolation, from the values observed for very thin films. The results of the two methods agree well. The activities of thick films were detd. for 22 other U cpds. From the values so obtained the absorption coeffs. were calcd.

- 876 Grossmann, H. and Schuck, B. "On Some Ethylene Diammonium Double Salts." Z. anorg. Chem. **50**, 21-32(1906).

Ethylene diammonium uranyl chloride, $\text{C}_2\text{H}_4(\text{NH}_3)_2\text{Cl}_2 \cdot \text{UO}_2\text{Cl}_2$, can be obtained by neutralization of 1 mole of ethylene diamine with HCl and the addn. of 1 mole of dissolved UO_2Cl_2 . The product is obtained as yellow, prismatic, very hygr. crystals with m.p. about 219° . Ethylene diammonium uranyl sulfate, $\text{C}_2\text{H}_4(\text{NH}_3)_2\text{SO}_4 \cdot \text{UO}_2\text{SO}_4$, is obtained in a similar manner with UO_2SO_4 . It is a powder decomp. at 285° without melting, occurring as small 6-sided crystals which are not easily sol. in cold water and almost insol. in alc. Ethylene diammonium uranyl nitrate, $\text{C}_2\text{H}_4(\text{NH}_3)_2 \cdot \text{UO}_2(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}$, prep. in the same way is formed as greenish-yellow tetragonal prisms with m.p. of 215° .

- 877 Hidden, W. E. and Warren, C. H. "Yttrocrasite, a New Yttrium-Thorium-Uranium Titanate." Am. J. Sci. **22**, 515-19(1906).

A radioactive mineral contg. 49.72% TiO_2 , 25.67% Y_2O_3 , 8.75% ThO_2 , 1.98% UO_2 , and C is described.

- 878 Houstoun, R. A. "Investigation on the Influence of Temperature on the Absorption of Light in Isotropic Substances." Ann. Physik (4), **21**, 535-73(1906).

U glass was investigated in the red, green, and blue regions at temps. up to 360° .

- 879 Kohn, M. "On Knowledge of Precipitated Basic Zinc Carbonate and Precipitated Cadmium Carbonate." Z. anorg. Chem. **50**, 315-17(1906).

When basic zinc carbonate is mixed into a paste with H_2O and dissolved in a soln. of U salt, the U is completely pptd. The ppt. apparently is a yellow zinc uranate.

- 880 Kuzel, H. Converting into the Colloidal State Cr, Mn, Mo, U, Ta, Nb, Ti, B, Sn, Th, Zr, Pt, Os, and Ir. Nov. 15, 1906. (British Patent 25,864).

This process involves previous subdivision as finely as possible by mechanical means or cathodic atomizing, then the metals are alternately treated, under moderate heating and good agitation, for a prolonged period, first with dil. acid solns., and then again with dil. basic or neutral solns., and washing with distd. H_2O or other imbibition liq. taking place each time between such treatments, this alternate treatment being so often repeated until the elements used have completely gone into soln. with distd. H_2O or other imbibition liq.

- 881 Levin, M. "On Some Radioactive Properties of Uranium." Physik. Z. **7**, 692-6(1906).

Attempts were made, by various phys. and chem. processes, to sep. from U some radioactive substance other than UX. Neg. results were obtained in all cases.

- 882 McCoy, H. N. "Relation between Radio-Activity and Composition of Uranium Compounds." Phil. Mag. (6), **11**, 176-86(1906).

The fact that only a roughly approx. proportionality was found to exist between the radioactivity of pure U cpds. and their content of U has been shown to be due to neglect of the absorption of the α rays by the cpds. themselves. The following method is given for prepg. an empirical std. of radioactivity, which can be reproduced with an accuracy of less than 1%. Ordinary U salts are purified by successive treatments with $(\text{NH}_4)_2\text{CO}_3$, $(\text{NH}_4)_2\text{SO}_4$, and Ba salts. The pptd. $(\text{NH}_4)_2\text{UO}_4$ is converted into U_3O_8 by ignition in a stream of O_2 . 0.8 to 1.0 g U_3O_8 is ground to an impalpable powder in an agate mortar with a little freshly distilled CHCl_3 . The powder is then stirred up with about 15 cc more CHCl_3 and poured into a shallow metal dish, which is kept covered until the solid has settled, the CHCl_3 afterwards being allowed to evap. spontaneously. The oxide is left as a uniform black film adhering to the dish and may be used daily for months without deterioration. The total activity of 1 g of U is 791 times the observed or surface activity of each cm^2 of such a film. For five different minerals contg. varying proportions of U, the ratio of activity to U content is found to have a very nearly const. value, viz., 3280, which is 4.15 times the corresponding value for pure U cpds. These results tend to confirm the conclusion that U is the parent, not only of Ra, but also of all the other active substances accompanying it. Ra is about 4.25×10^6 times more active than U. (A summary of this paper is contained in Phys. Rev. 20, 381(1905).)

- 883 McCoy, H. N. and Goettsch, H. M. "The Absorption of the α -Rays of Uranium." J. Am. Chem. Soc. 28, 1555-60(1906).

The absorption of the α rays of U is an at. property. Each element present in a U cpd. has a characteristic power of absorption, which is independent of its form of combination. The absorption by unit wt./unit area is, for any element, inversely proportional to the (at. wt.)⁻². The absorption coeffs. of 26 cpds., calcd. on this basis, agree well with the observed values. The radioactivity of a thick film of any pure U cpd. may be calcd. from a knowledge of its chem. compn. and a single known const.

- 884 Marckwald, W. "Radioactivity of the Uranyl Double Salts." Ber. 39, 200-03(1906).

It has been stated that certain uranyl double salts have an abnormally powerful radioactive effect upon the photographic plate. Expts. showed a normal effect on the electroscope and also on the photographic plate when the latter was shielded with opaque paper; the α and β radiations are therefore normal and the added effect, which is noticed on an unprotected photographic plate, is probably due to the fact that in the double salts, which are characterized by a strikingly beautiful fluorescence, an exceptionally large part of the Becquerel radiation is converted into light energy.

- 885 Marckwald, W. "Radioactivity of the Uranyl Double Salts." Chem. News 93, 98(1906). This paper contains a summary of the information reported in Ber. 39, 200-03(1906).

- 886 Moissan, H. "Distillation of Nickel, Iron, Manganese, Chromium, Molybdenum, Tungsten and Uranium." Compt. rend. 142, 425-30(1906).

By means of the electric furnace and condensing arrangement used for the distn. of Cu, Au, and the elements of the Pt group the author has distd. Ni, Fe, Mn, Cr, Mo, W, and U using a c.d. of from 500 to 1000 amps at 110 v. U has a higher b.p. than Fe, and requires a d.c. of 700 amps, while Mo and W only distil with difficulty with c.ds. of 700 and 800 amps, resp. In each case the cryst. powder obtained by condensation of the vapor possesses the same chem. properties as the finely powd. metal.

- 887 Moissan, H. "The Ebullition and Distillation of Nickel, Iron, Manganese, Chromium, Molybdenum Tungsten and Uranium." Bull. soc. chim. France (3), 35, 944(1906).

The metals were heated in an electric furnace, their vapors being condensed upon a Cu tube through which passed a rapid stream of water. Ests. of the differences in the b.-ps. can be made from the c.d. and the proportions of the metals distd. in a given time. The results of the principal experiments are summarized in the following table:

Metal	Wt. taken (g)	Time (min)	Amps	Volts	Wt. distd. (g)
Nickel	150	5	500	110	56
Nickel	200	9	500	110	200
Iron	150	5	500	110	14
Iron	825	10	1000	55	150
Iron	800	20	1000	110	400
Manganese	150	3	500	110	38
Manganese	150	5	500	110	80
Chromium	150	5	500	110	38
Molybdenum	150	10	700	110	0
Molybdenum	150	20	700	110	56
Tungsten	150	20	800	110	25
Tungsten	150	5	500	110	0
Uranium	150	5	700	110	15
Uranium	200	9	900	110	200

- 888 Moore, R. and Schlundt, H. "Some New Methods for Separating Uranium X from Uranium." Phil. Mag. (6), 12, 393-6(1906).

When U nitrate is dissolved in acetone, MeOAc, EtOAc, We, Et, or Am alc. or acetoacetic ester a small residue is left which contains a large part of the UX. The balance of the latter may be removed from the clear filtrate by moist $\text{Fe}(\text{OH})_3$. The UX so obtained gave α as well as β rays; the activity of each decayed to half-value in 22 days.

- 889 Nutting, P. G. "Line Structure. I." Astrophys. J. 23, 64-78(1906).

It was reported that the lines in the U spectrum have no internal structure.

- 890 Riddle, F. H. "The Coloring Power of Uranium Oxide in Glazes of Various Composition." Trans. Am. Ceram. Soc. 8, 210-21(1906).

The coloring power of U oxide in six typical glaze compns. is investigated. The content of this coloring oxide was varied from 0.003 to 0.005 equivs., added to the formula weight of the glaze, corresponding to an average range of from 0.78 to 12.9% of U_3O_8 , in terms of the dry glaze. The facts brought out in the expts. are that U oxide produces rich orange shades in all glazes high in PbO while in such glazes low in or free from Pb, characteristic lemon-yellow tints are obtained. The presence of H_3BO_4 intensifies this lemon color. Fritted glazes take up more U oxide in soln. than raw glazes. A content of 0.05 equivalent of U oxide is entirely too great and 0.02 equivalent seems to be the limit corresponding to an av. content of 5.17% of U_3O_8 .

- 891 Rosenheim, A. and Jacobsohn, F. "On the Effect of Liquid Ammonia on Some Metallic Acid Anhydrides." Z. anorg. Chem. 50, 297-308(1906).

UO_2Cl_2 will react with liq. NH_3 depositing a gray-green ppt. whose compn. was not detd.

- 892 Svedberg, T. "On the Electrical Production of Colloidal Solutions." Ber. 39, 1705-14(1906). A table shows brief data on colloidal U.

- 893 Szilard, B. "On a Colloidal Compound of Thorium with Uranium." Compt. rend. 143, 1145 (1906).

Several methods were used for the prepn. of this colloidal cpd., the most satisfactory one consisting of the addn. to a hot soln. of $\text{UO}_2(\text{NO}_3)_2$, small lots of well-washed, pptd. Th hydroxide. The latter dissolves and forms, after filtering, a brilliant red soln. That the substance is a cpd. is indicated by the fact that an increase in the amt. of U does not alter the color. Other U salts will behave like the nitrate. KMnO_4 does not affect the aq. soln. of the substance.

- 894 Usher, F. L. and Priestly, J. H. "A Study of the Mechanism of Carbon Assimilation in Green Plants." Proc. Roy. Soc. (London), B. 77, 369-76(1906).

It is reported that when UO_2SO_4 or $\text{UO}_2(\text{OAc})_2$ soln. and CO_2 are mixed in the presence of light, formaldehyde or formic acid is formed in the reduction.

- 895 Usher, F. L. and Priestly, J. H. "The Mechanism of Carbon Assimilation in Green Plants. The Photolytic Decomposition of Carbon Dioxide in vitro." Proc. Roy. Soc. (London), B. 78, 318-27(1906).

It is reported that when UO_2SO_4 or $\text{UO}_2(\text{OAc})_2$ soln. and CO_2 are mixed in the presence of light, formaldehyde or formic acid is formed in the reduction. The decompn. of uranyl formate in light is discussed.

- 896 Wachter, F. "Behavior of Uranium and Thorium Compounds in the Electric Arc." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse. Abt. IIa 115, 1247-60(1906).

Plates of the oxides are placed in the arc and their photographic activity afterwards compared with portions of the unheated cpds. A decrease in activity is found, whereas, if the high temp. caused the formation of UX or ThX, an increase might be expected. This may be due to U and Th both being inactive, the active component being distd. by the arc. Further expts. do not support this view and the cause of this behavior is left open.

PUBLICATIONS LOCATED IN 1907

- 897 Aloy, J. and Auber, —. "Preparation of Uranous Salts." Bull. soc. chim. France (4), 1, 569-71 (1907).

A 5 to 10% soln. of uranic sulfate is treated with small portions of powd. sodium hydrosulfite until a slight permanent ppt. results which is then redissolved by the addn. of a few drops of H_2SO_4 . The addn. of an equal vol. of 90% alc. produces an abundant light-green ppt. This ppt., after having been washed with dil. alc., is dissolved in dil. H_2SO_4 . On evapn., a cryst. cpd. $\text{U}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ is obtained in 60% yield. Uranous oxalate can be prepd. by pptg. with $\text{H}_2\text{C}_2\text{O}_4$, the H_2SO_4 soln. of $\text{U}(\text{SO}_4)_2$. In like manner the corresponding arsenate and phosphate may be obtained. The presence of uranic salts in soln. may be readily detected by subjecting the soln. to the action of violet light (the rays of an arc lamp passed through violet glass). Uranic salts give a beautiful fluorescence, uranous salts do not.

- 898 Bacon, R. F. "Catalysis by Means of Uranium Salts in the Sunlight." Philippine J. Sci. A. 2, 1293-7(1907).

Aq. solns. of $\text{H}_2\text{C}_2\text{O}_4$ in the presence of sol. U salts decomp. fairly rapidly in sunlight with the formation of CO , CO_2 , H_2O , and HCOOH , but in the absence of U salts, the decompn. is negligible both in the dark and in the sunlight. The soln. was placed in a flask and the gas that came off was collected. The rate of decompn. increases only slightly when the concn. of either the $\text{H}_2\text{C}_2\text{O}_4$ or the U salt is doubled. The presence of HCOOH does not prove that it is an intermediate step, for it is not decompd. into CO and

H₂O by the action of U salts. A soln. of pitchblende which was much more radioactive than the U salt did not catalyze the decompn. more strongly than the latter, thus showing that radioactivity has no connection with the catalysis. Th salts catalyze the reaction slightly, Fe⁺³ salts, to a marked degree, but in the latter case ferrous oxalate ppts. and the rate falls off. Some preliminary expts. were also made with propionic, tartaric, mandelic, and citric acids.

- 899 Becquerel, H. "Phosphorescence of Uranium Salts in Liquid Air." Compt. rend. 144, 459 (1907).

The recent observation that the lines of the absorption spectra of some crystals are split up into sets of finer lines when the temp. is reduced greatly below ordinary temp. has led to expts. upon the effect of low temp. upon the emission spectra, with the results that these have been found to vary in the same manner as the absorption spectra. In some cases the finer lines are of greater intensity and of a different color. The author has studied this phenomenon in U nitrate, and the double K-U sulfate and chloride, and also with U glass and gives the results in tabular form.

- 900 Becquerel, H. "A Contribution to the Study of Phosphorescence." Compt. rend. 144, 671-8 (1907).

The emission spectra of some phosphorescent salts of U, previously studied, show striking modifications at the temp. of liq. air. At low temp. the max. of intensity has a tendency to shift toward the shorter wavelengths, while the less refrangible bands of each group become dim, and almost disappear; e.g., the double U-K sulfate exhibits, at ordinary temp., groups of bands that fade away toward the less refrangible side but at the temp. of liq. air these bands are far less intense, and are accompanied by two other narrow bright bands toward the side of decreasing wavelength. The different bands of the spectra emitted by the phosphorescent salts of U at low temp. are polarized in different directions. Other phosphorescent substances, in most cases, show a diminution of intensity in portions of the spectrum at low temp., and some emit light of a different color. Various double cyanides of Pt and other metals were examined, also rubies and crystals of fluorspar. In the case of U salts, the author believes that the phenomena of phosphorescence are intimately associated with the at. itself.

- 901 Becquerel, H. "On the Influence of Temperature Changes on the Absorption in Solid Compounds." Physik. Z. 8, 929-42(1907).

Changes in the absorption spectra of U glass, uranyl salts, and a number of minerals are discussed at temps. as low as that of liq. air.

- 902 Boltwood, B. B. "Ultimate Disintegration Products of Uranium." Am. J. Sci. (4), 23, 77-88 (1907).

As Ac is probably an intermediate product between U and Ra, the field of search for final products is narrowed. The examn. of various minerals places Ba and Bi out of the main line of descent of U and Th. Pb, however, appears to fulfill the conditions defined within the limits of exptl. error, and may be regarded as a final disintegration product of U. If formed, He is likely to escape; the best test that can be applied is to see whether the He ever exceeds that calcd. from the equation $U(238.5) = Pb(206.9) + He(31.6)$. This is found never to be the case, and therefore He may be looked on as a final product, since it is always present with U. Neither of these is a final product of Th.

- 903 Boltwood, B. B. "Ultimate Disintegration Products of Uranium." Physik. Z. 8, 97-103(1907). This paper contains information similar to that reported in Am. J. Sci. (4), 23, 77-88(1907).

- 904 Burger, A. Reduktion durch Calcium. Dissertation, Univ. of Basel, 1907.
It was found that UO_3 can be reduced smoothly in vacuum with Ca to a product (powder) 98.7 to 99.4% U.
- 905 Cantone, M. "Emission Spectra of Uranium Salts at Low Temperatures." Rend. accad. sci. fis. mat. Soc. reale Napoli (3), 13, 149-56(1907).
The author has investigated the groups of narrow bands exhibited by the spectra of U sulfate, NH_4 -U sulfate, $(\text{NH}_4)_2\text{UO}_4$, NH_4 -U fluoride, K-U acetate, uranyl nitrate, and U acetate at the temp. of liq. air. It is found that the lines for each of these cpds. obey the law $1/\lambda = A + mB$, where λ is the wavelength of a line occupying the position m in the series; the constant B has the same value, namely, about 84, for all the above compounds but the characteristic coeff. is, in general, different for the different cpds.
- 906 Cantone, M. "New Researches on the Emission Spectra of Uranium Salts at Low Temperatures." Rend. accad. sci. fis. mat. Soc. reale Napoli (3), 13, 275-88(1907).
The author has investigated a number of U salts and finds results similar to those obtained by H. Becquerel with three U salts.
- 907 Colani, A. Recherches sur les composés uraneux. Dissertation, Univ. of Paris, 1907.
- 908 Colani, A. "Pyrophoric Properties of Some Uranium Compounds." Ann. chim. phys. (8), 12, 59-144(1907).
This lengthy paper is chiefly of chem. interest. Uranous arsenide, U_3As_4 (or U_3As_2), when in the fused form, emits voluminous sparks at the least shock. The sparks will ignite the mixed gases of a Bunsen burner, the behavior thus being similar to that of U carbide as studied by Chesneau, Compt. rend. 122, 471-3(1896). U antimonide shows similar properties. Two pieces of this alloy when knocked together will light a Bunsen burner and even a spirit lamp. It also gives off sparks under the file but is too friable to be useful. A large amt. of information is included on the prepn. and reactions of various U chlorides, UI_4 , double chlorides with alkali metals, US_2 , USe_2 , UTe_3 , U_3N_4 , U phosphites and phosphates and the uranyl phosphates.
- 909 Greinacher, H. "On the Thermal Determination of Radioactivity of Common Substances." Ann. Physik (4), 24, 79-104(1907).
Uranyl nitrate was one of the cpds. investigated.
- 910 Guichard, M. "On Iodation in the Observation of Several Elements." Compt. rend. 145, 807-08(1907).
A report of the prepn. of U iodide is included.
- 911 Guichard, M. "A New Uranium Compound, the Tetraiodide." Compt. rend. 145, 921(1907).
 UI_4 is prepd. by the method described by the author in Compt. rend. 145, 807-08(1907) as predicted by Moissan. This cpd. when heated in H_2 , gives up its I in the form of HI. Cl_2 causes decompn. of UI_4 and the formation of UCl_4 , the reaction being accompanied by the evolution of light. It is also decompd. by moist or dry air.

- 912 Hess, V. F. "Uranium X." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse. Abt. IIa 116, 109-28(1907).

Moore and Schlundt have stated that UX is insol. in various org. liqs. and that these give a means of sepg. it from U. They also find that UX gives α rays as well as β rays. To separate UX from U the author finds that, of the liqs. mentioned, acetone and MeOAc are most efficient, but that the sepn. is by no means perfect, at least when pure substances are used. On the other hand, the addn. of a small amt. of impurity, especially $\text{Fe}(\text{OH})_3$, as recommended by Schlundt and Moore, makes the sepn. practically perfect. Levin's method of boiling with soot or animal charcoal, published in Physik. Z. 8, 129-33(1907), does not produce complete sepn.

- 913 Jorissen, W. P. and Ringer, W. E. "Action of Cathode Rays on Uranium Salts." Chem. Weekblad 4, 242-6(1907).

Exposure of 0.1 g of U_3O_8 to cathode rays for an hr reduced the wt., on cooling, to 71 mg. It was found that the activity of the resulting substance in discharging an electroscope is 30% greater than that of a similar prepn. not exposed in this way.

- 914 Jorissen, W. P. and Ringer, W. E. "Action of Cathode Rays on Uranium." Chem. Weekblad 4, 476-9(1907).

When metallic U is exposed to cathode rays the activity is more than doubled. With metallic Th, Pb, and Bi there is little change in activity. U_3O_8 has its activity increased about 45% by this treatment, and Th oxide 25%. In the former case the change is not due to reduction to U.

- 915 Kuzel, H. Process of Peptizing (Rendering Soluble) Coagulated Solutions of the Elements. March 13, 1907. (British Patent 6,109)

This is a process of peptizing the coagulated colloids of the elements, Cr, Mo, U, Zr, V, Ta, Nb, Ti, Th, W, B, and Si, using dil. solns. of electrolytes, especially alk., as NH_3 or NH_4 bases, and more especially org. or inorg. bases or their carbonates. NH_3 or an NH_4 base, as methylamine, is added to a colloidal metal such as W, in a coagulated, pastelike form, until after frequent shaking it just begins to blue litmus paper, whereupon, by the addn. of a large quantity of pure distd. water, the whole mass of jelly goes over into a pseudo soln. which appears opaque in reflected light but transparent in thin layers. The product has in concd. form a great binding power for dry powder, as of metal, and holds the latter in gelatin form, so that it is applied in the manufacture of incandescent filaments. (A similar process was patented in 1907 by Kuzel in German Patent 186,980.)

- 916 Lancien, A. "Uranyl Molybdate." Compt. rend. 144, 1434-5(1907).

A green to green-black cpd. of uranium molybdate, $\text{U}(\text{MoO}_4)_2$, is formed by the reduction of $3\text{UO}_3 \cdot 7\text{MoO}_3$ and UO_2MoO_4 with ethyl or methyl alc. in the presence of HOAc. Uranyl molybdate, UO_2MoO_4 , can be obtained in theoretical yields from solns. of $(\text{NH}_4)_2\text{MoO}_4$ and $\text{UO}_2(\text{NO}_3)_2$. In the dark the ppt. is an amorph. white powder. After isolation, the phys. properties undergo a change, and after 30 hrs the color has become golden-yellow. The molybdate is a radioactive body of activity about equal to that of Ra Ba bromide (activity 40) and of much greater activity than U nitrate. The comparison was made by sealing up the substances in similar tubes and exposing Lumière " Σ " plates to the radiations for 5 days. (See Szilard, Compt. rend. 145, 480-1(1907) for better data on the activity of this cpd.)

- 917 Levin, M. "On Some Properties of Uranium and Actinium." Physik. Z., 8, 129-33(1907).

When a desiccated sample of $\text{UO}_2(\text{NO}_3)_2$ was brought into moist air, the β -ray activity decreases for a

period of two days. By this time a soln. of the nitrate had formed, owing to deliq., and the β activity now increased until, in the course of several days more, nearly its initial value is reached. The decrease in activity is thought to be due to the increased absorption of the β rays in the hydrated salt; the subsequent increase in activity is ascribed to the accumulation of an excess of UX in the upper aq. layer, owing to the greater soly. of UX in water than in crystals of the nitrate, as the author had shown previously. UX, sepd. from a U soln. by means of soot, appears to give some α rays. The apparent α -ray activity decayed with a period of 22 days. By deviation of the β rays of UX by a magnetic field it was found that the α -ray radiation was much smaller in amount than Moore and Schlundt found. The author is inclined to think that the easily absorbed rays are not α rays, but secondary β rays produced by the β and α rays of UX. Metallic Zn, Pb, and Cu, ppt. AcX from acid soln. Animal charcoal carries down radioactinium from Ac solns. and ThB from Th solns.

918 Lobel, H. Ueber Halogenverbindungen des Urans. Dissertation, Univ. of Berlin, 1907. The formation of UCl_5 is dependent upon the temp. at which Cl_2 and the C-U oxide mixt. is reacted. The reaction is best regulated in such a way that UO_3 serving as starting product is first converted to UCl_4 and then transformed to UCl_5 . Results obtained from testing the behavior of UCl_5 with a no. of org. solvents are shown. There is an indication that UCl_6 is not known. Unsuccessful attempts to prep. the material by treating UCl_5 with liq. Cl_2 under pressure with catalyzers is reported. An app. is described which is said to be extremely successful for the prepn. of UCl_4 from UO_3 and excess animal charcoal (found to be better than wood charcoal) and the products which are obtained using this app. are said to contain neither C nor UO_3 . UCl_4 crystallizes in dark regular octahedra with a metallic luster. These subl. as a red vapor at red heat. UCl_4 is very hydr., fumes in air, and liquefies readily to an emerald-green color. It is more stable in air than is UCl_5 . UO_3 can also be chlorinated to UCl_4 by Cl_2 satd. with S_2Cl_2 . After chlorination is complete, the by-products, UCl_5 , UO_2Cl_2 , and S, are removed by heating and the remaining mixt. of UCl_4 and sulfide is sepd. by subln. UCl_4 dissolves in acetone, yielding a light-green to yellow soln., is apparently hydrolyzed by H_2O since the green soln. is acid, and gives no double cpds. with alk. chlorides. It is sol. in HOAc and benzoic ester and these solns. are light-green in color. It was found to be insol. in Et_2O , CHCl_3 , although it gave a light-green color. In the prepn. of UCl_3 from chlorinated U oxide (UCl_4) by reduction by the material with H_2 at low temp., it is absolutely necessary that pure H_2 be used. UCl_3 is more stable in air than UCl_5 and it is found to be just as hydr. as UCl_4 . The soln. of UCl_3 in fuming HCl is red; in alc. and fuming HCl, it will decomp. immediately causing a vigorous evolution of H_2 and the appearance of a green color. Glacial HOAc will dissolve it, yielding a red soln. A soln. prepd. by dissolving UCl_3 in fuming HCl is stable in air for some time but, when it is heated, will turn green and be oxidized to U^{+4} . A soln. of UBr_3 can be obtained by electrolytic reduction of a soln. of UO_3 in dil. HBr. This soln. is similar to the corresponding chloride but less stable and more easily oxidized. The existence of a trivalent U sulfate is indicated (p. 34), however, no proof of the formula suggested is given. There is also a report that pyridinium uranyl bromide, $2\text{C}_5\text{H}_5\text{NBr}\cdot\text{UO}_2\text{Br}_2$, can be obtained by mixing a boiling UO_3 soln. in alc. HBr with a few drops of pyridine and heating until a strong acid reaction is obtained, at which point the product ppts. as a yellow cryst. powder. It is said that pyridinium uranyl thiocyanide, $2\text{C}_5\text{H}_5\text{NCNS}\cdot\text{UO}_2(\text{CNS})_2$, can be obtained from a soln. of uranic acid in aq. HCNS and a small amt. of pyridine. It is pptd. with EtOAc as yellow crystals.

919 McCoy, H. N. and Ross, W. H. "The Relation between Uranium and Radium." Phys. Rev. (1), 24, 124-5(1907).

New detns. of the compn. and radioactivity of U mineral were made using flat films and an electroscope with an ionization chamber sufficiently large to allow the max. range of all α rays. The observed activities

were corr. for deficiencies due to spontaneous loss of emanation by the films made from the powd. minerals. The earlier observation, that the activity of a mineral free from Th is directly proportional to its U content, was confirmed. The ratio of the activity of a U mineral to that of a pure U cpd. of equal U content was found to be 4.58, instead of 4.15 as first announced. The activity of a minute quantity of Ra, free from all its products, was compared with a std. film of U_3O_8 ; and the activity of the emanation from this quantity of Ra was compared with that of the emanation associated with known amt. of U in a mineral. It was found that the activity of a quantity of U is 1.87 times that of the equil. amt. of Ra. From this ratio and the ratio of the activity of Ra to the activity of its products, it was calcd. that the activity of U plus the equil. amts. of Ra and its known products should be 4.60 times that of the U alone. The value found, by expt. for minerals, was 4.58. Since the ranges of the α particles of U and Ra are each about 3.5 cm and U is nearly twice as active as the equil. amt. of Ra, it is thought each atom of U produces 2 particles directly upon disintegration or that there is an α -ray product, not yet isolated, between U and UX.

- 920 McCoy, H. N. and Ross, W. H. "The Specific Radioactivity of Uranium." J. Am. Chem. Soc. **29**, 1698-1708(1907).

New detns. of the compn. and radioactivity of U minerals were made with flat films and an electroscope with an ionization chamber sufficiently large to allow the max. range of all α rays. The observed activities were corr. for deficiencies due to spontaneous loss of emanation by the films made from the powd. minerals. The results gave for the specific activity of U in minerals the value 3616, while the corresponding const. for pure U cpds. was found to be 796, (the unit of activity being the activity of one cm^2 of a thick film of U_3O_8). For equal U and Ra content, minerals free from Th are therefore 3616/796 or 4.54 times as active as pure cpds. It was found by expt. that Ra is 0.53 times as active as the equil. amt. of U in a mineral, while the activity of U, together with Ra and subsequent products, was calcd. to be 4.60 times as great. Since direct expt. gave the value 4.54 for this ratio, it follows that the activity of a U mineral, free from Th, is fully accounted for by the activity of U and Ra and their recognized products. Only a very small fraction of the activity of U mineral can, therefore, be due to Ac. To account for its presence in U minerals, it is suggested that the atoms of UX may decomp. in two ways, each with its own rate of change, the more rapid disintegration giving rise to the Ra series, while the slower gives the Ac series. Since Ra is 0.53 times as active as the equil. amt. of U, while the α rays for both have approx. the same range, it is suggested that the excess α -ray activity in U may be due to a new U product which gives α rays with a range of about 3.25 cm.

- 921 McCutcheon, T. P., Jr. "New Results in Electro-Analysis." J. Am. Chem. Soc. **29**, 1445-55 (1907).

This paper contains a discussion of the sepn. of U from particular alk. earths and alks., rather than from these elements as a group. Sepns. for U from Na, K, Li, Ba, and Sr are described, as are sepns. of Ba from Th, Ce, La, and Nd.

- 922 Orlow, N. A. "Uranyl Chromate." Chem. Ztg. **31**, 375(1907).

The author describes the prepn. and properties of uranyl chromate, $UO_2CrO_4 \cdot 3H_2O$. The hexahydrate was also prepd. Uranyl chromate behaves in soln. like a mixt. of uranic acid and chromic acid; that is, like a double compound.

- 923 Plotnikow, J. "The Photochemical Oxidation of Hydrogen Iodide in the Presence of Oxygen." Z. physik. Chem. **58**, 214-44(1907).

Brief notes are included on effect of uranium (uranyl) nitrate as a catalyst.

- 924 Schaaf-Regelman, E. "Rare Metals and Minerals and Their Uses," Eng. Mag. **33**, 91-8(April 1907).

This is a semipopular paper dealing with the properties and uses of W, Mo, V, U, Ti, Ta, the rare earths, and Li. The minerals containing them are briefly described and their localities are given. There is nothing of scientific interest in the paper.

- 925 Soddy, F. and T. D. Mackenzie. "Relation between Uranium and Radium." Phil. Mag. (6), 14, 272-95(1907).

The first part of the paper summarizes what has been done to show the production of Ra from U. In the old expts. of Soddy the U was freed from Ra by repeated pptn. of Ba as sulfate. After 550 days the Ra content had increased a hundredfold, but was still much less than was expected, this being probably due to the formation of intermediate products. According to the process of purification initially adopted these intermediate products may or may not be removed; a new method of purification has now been used, viz., the soln. of $\text{UO}_2(\text{NO}_3)_2$ in Et_2O . The first expts. started in Oct. 1905; the results on this sample of U to date show that the amount of Ra produced in 600 days by 250 g of U is too small to be conclusive. In another expt. the gases from the solns. are being stored and tested in case a rayless change intervenes. A third expt. leaves it doubtful whether Ra has been produced in a quantity of UX; further time is required. Other expts. show that the residual activity of Ac is not due to Ra. The paper is a description of expts. that are in progress rather than of results attained.

- 926 Szilard, B. "Action of Thorium and Uranyl Nitrates on Albumens." J. chim. phys. 5, 495-6 (1907).

A 2% soln. of $\text{Th}(\text{NO}_3)_4$ or $\text{UO}_2(\text{NO}_3)_2$ peptizes albumens such as the white of an egg which has been coagulated by boiling. In this way very concd. solns. of albumens may be obtained. These salt solns., when satd. with one colloid, are unable to peptize another colloid.

- 927 Szilard, B. "On the Colloidal Hydroxides of Thorium, Zirconium, and Uranyl." J. chim. phys. 5, 488-94(1907).

When uranyl acetate is mixed with Et_2O and subjected to the light, a violet ppt. is obtained which gradually turns yellowish. A stable colloidal soln. is formed by agitating this ppt., washing with distd. water, and adding the suspension to a soln. of $\text{UO}_2(\text{NO}_3)_2$ as long as it dissolves.

- 928 Szilard, B. "Heterogeneous Colloidal Hydroxides of Uranyl, Thorium, Zirconium, Lead, Yttrium, Iron and Copper." J. chim. phys. 5, 636-46(1907).

By a heterogeneous colloidal hydroxide the author means one which is formed by dissolving the hydroxide of one metal in the salt of another. For example, $\text{UO}_2(\text{NO}_3)_2$ readily dissolves Zr hydroxide. To prep. these solns., the hydroxide is pptd. by the double decompn. of the salt and NH_3 , washed completely by decantation, and then dissolved in the soln. of the nitrate or other suitable salt of some other metal in exactly the same manner as that described in an earlier paper in the prepn. of the stable colloidal solns. containing electrolytes. Certain so-called "isomeric" colloids can thus be formed; e.g., $\text{UO}_2(\text{NO}_3)_2$ and Th hydroxide, and from Th nitrate and uranyl hydroxide. These "isomers," however, possess in most cases very different properties, both chem. and phys. The solns. are for the most part highly colored and do not give the chem. reactions of the metals they contain.

- 929 Szilard, B. "The Probable Formation of Thorianite and Uraninite." Compt. rend. 145, 463-4 (1907).

The two minerals contain U and Th in inverse proportions, but not such as to permit supposing that they form a definite cpd. with each other. The author earlier described substances contg. the two elements in the same proportions as in the natural minerals named, made by dissolving Th hydrate in uranyl nitrate and the uranyl hydrate in Th nitrate. He has since found that the salts of Th and U can dissolve the hydroxides of all the metals that enter into the compn. of thorianite and uraninite. Hence, he concludes that the mode of formation of those minerals was analogous to the process just mentioned.

- 930 Szilard, B. "On the Radioactivity of Uranyl Molybdate." Compt. rend. 145, 480-1(1907).

It had been stated by Lancien in Compt. rend. 144, 1434-5(1907), that a sample of $\text{UO}_2(\text{MOO}_4)$ which he had prepd. had an activity 40 times as great as that of U. The author prepd. 2 samples of the salt according to Lancien's method, using in one case an excess of uranyl salt, in the other an excess of ammonium molybdate. The activity of each sample as measured electrically, was only 0.3 of that of metallic U. The photographic activity also was perfectly normal. Lancien's statements are said to be in error.

- 931 Wedekind, E. "Luminosity of Radium Emanation and Radioactivity of Uranyl Molybdate." Chem. Ztg. **31**, 1108-09(1907).

The gas evolved on treating 1 g of Ba-Ra(CO₃) with HCl is passed into a glass tube and then acted on by KOH. The upper part of the tube is found to glow when examined in the dark, although only a very small quantity of gas remains. The neg. results obtained by Szilard in Compt. rend. **145**, 480-1(1907) with uranyl molybdate are borne out by the author's expts. with this substance.

- 932 Wherry, E. T. and Smith, E. F. "Use of Rotating Anode in Electrolytic Precipitation of Uranium and Molybdenum." J. Am. Chem. Soc. **29**, 806-08(1907).

Conditions are given for the quant. pptn. of U and Mo by electrolysis. Mo can be readily sepd. from the alk. metals in this way. When the electrolysis of U-contg. soln. is accomplished with rotating anodes, a detn. can be made in about 30 min. Weak HOAc containing approximately 2 to 5 g of NaOAc or (NH₄)₂CO₃ should be used. The c.d. should be 4 amp and the p.d. 12 v. A bath temp. of 50° is satisfactory.

PUBLICATIONS LOCATED IN 1908

- 933 Acqua, C. "The Action of Radioactive Salts of Uranium and Thorium on Vegetation." Ann. botanica **6**, 387-401(1908).

934 Baur, E. "On a Model of Carbon Dioxide Assimilation." Z. physik. Chem. **63**, 683-710(1908). This paper records the observation of the so-called Becquerel effect, the name given to the phenomenon whereby the equil. potential of U⁺⁶/U⁺⁴, at the Pt electrode, is shifted under the influence of light. In the dark, M UO₂(NO₃)₂ soln. has a p.d. of E_h = 0.900 v with the Pt electrode. By exposure to light the p.d. becomes greater. This paper discusses the photochem. reaction between HOAc and NaOAc and the (UO₂)⁺² salts.

- 935 Briggs, S. H. C. "On Chromate." Z. anorg. Chem. **56**, 246-60(1908).

A pyridine cpd. of the Cr U salts can be obtained in the form 2UO₃·3CrO₃·2C₅H₅N from warm pyridine solns. in the same type of reaction as the formation of ammonium salts or from a HNO₃ soln. of 10 g of UO₂(NO₃)₂ with 4 g of CrO₃ by the addn. of a small amt. of pyridine. The material forms as small shiny orange crystals.

936 Defacqz, E. "The Compounds of Silicon and Uranium, Si₂U." Compt. rend. **147**, 1050-2(1908). By the ignition of a mixt. of finely powd. Al, flowers of sulfur, silica, and uranium oxide, and then treating the mass with HCl and HNO₃, a small quantity of the glittering crystals of Si₂U, d. = 8.0, was obtained. This reacts with Cl₂ at 500°, forming the corresponding chlorides; dissolves easily in H₂F₂ with the formation of UF₄; is insol. in HCl, HNO₃, H₂SO₄, and aqua regia. It burns slowly in O₂ at 800°; at a red heat, alk. carbonates convert Si₂U into alk. silicates and uranates. The analyses show that this substance has the same formula as the corresponding Mo and U compounds.

- 937 du Bois, H. and Elias, G. J. "The Influence of Temperature and Magnetism on Selected Absorption and Fluorescence Spectra." Ann. Physik (4), **27**, 233-300(1908).

Information is included on the investigation of the fluorescent spectra of uranyl salts in the presence of a magnetic field. K₂UO₂(SO₄)₂·2H₂O and UO₂(NO₃)₂·6H₂O were investigated as well as many other non-U salts.

- 938 Ebler, E. "On the Separation of Metals of the Ammonium Sulfide Group." Z. anal. Chem. **47**, 665-77(1908).

This paper contains a discussion of the hydroxylammonium salt sepn. of U and Th. The treatment of the filtrates is also discussed.

- 939 Evans, C. deB. "Traces of a New Tin-Group Element in Thorianite." J. Chem. Soc. 93, 666-8(1908).

By mixing solns. of Th-U oxalate with $(\text{NH}_4)_2\text{C}_2\text{O}_4$, large green crystals of the triple salt $(\text{NH}_4)_{10}\text{ThU}_2(\text{C}_2\text{O}_4)_{10} \cdot 14\text{H}_2\text{O}$ are obtained. (The values were obtained with the cooperation of Miss K. A. Burke.)

- 940 Faehr, E. Ueber die Reduktion der Metalloxyde der Chromgruppe mittelst Wasserstoffs in der Hochspannungsflamme. Dissertation, Univ. of Munich, 1908.

It is indicated that UO_2 may be obtained as the end-product when U_3O_8 is reduced with H_2 in the high-voltage flame. It is claimed that U oxides with a ratio of more than 2.61 atoms of O per U cannot be volatilized because of the high-vapor pressure of the O in the cpd.

- 941 Fenton, H. J. H. "Titani-Dihydroxymaleic Acid and the Detection of Titanium." J. Chem. Soc. 93, 1064-9(1908).

Uranyl salts yield a red color with this reagent.

- 942 Fleck, H., Haldane, W. G., and White, E. D. Extracting Uranium and Vanadium. March 3, 1908. (U. S. Patent 880,645)

To a given quantity of ore, H_2SO_4 is added and then more ore to neutralize the acid. Sulfurous acid is forced in to reduce the metals and recover the H_2SO_4 .

- 943 Gernez, D. "Research on Triboluminescence." Ann. chim. phys. (8), 15, 516-56(1908).

This paper contains information on the triboluminescence of uranyl acetate, sodium uranyl acetate, uranyl phosphate, uranyl sulfate, potassium uranyl sulfate, and $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$.

- 944 Giolitti, F. and Tavanti, G. "The Preparation of Uranium." Gazz. chim. ital. 38, II, 239-51 (1908).

For the prepn. of U the reduction of its oxide with Al is considered. The "pure" uranyl salts available in commerce for the prepn. of U_3O_8 always contain alk. in the form of double salts. Thus, the pure uranyl acetate of Merck and Kahlbaum corresponds to $\text{UO}_2(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot \text{Na}(\text{C}_2\text{H}_3\text{O}_2) \cdot 2\text{H}_2\text{O}$ and give Na pyrouranate, $\text{Na}_2\text{U}_2\text{O}_7$ on ignition. To remove the alk. the authors proceed thus: (1) ignite the mass contg. the alk. pyrouranate in a stream of H_2 , extract the reduction product with H_2O ; or (2) dissolve the ignition product contg. the pyrouranate in acid (HNO_3) and transform into pure NH_4 -uranate by repeated pptns. with NH_3 . The latter, on ignition, gives pure U_3O_8 which cannot be obtained by method (1). The importance of these observations in analytical detns. is pointed out. The method of Moissan (Compt. rend. 122, 1302-3(1896)) in which Al is used is not suitable for the prepn. of metallurgical U nor its alloys. The Goldschmidt method, as modified by Stavenhagen (Ber. 32, 3065(1899), and Ber. 35, 909(1902)) was fairly successful.

- 945 Goldschmidt, V. M. "Radioactivity as an Aid in Mineralogical Research." Z. Krist. 44, 545-60(1908).

The method was applied particularly to U-bearing minerals.

- 946 Greenwood, H. C. "The Reduction of Refractory Oxides by Carbon." J. Chem. Soc. 93, 1483-96(1908).

It is reported that the thermal decompn. of UO_2 begins in vacuum at about 1600° . When a mixt. of UO_2 and C is heated electrically in vacuum, the reduction begins at about 1490° (detd. by optical measurements of the temp.) at which an increase in pressure due to the evolution of CO occurs.

- 947 Groth, P. Chemische Krystallographie. Leipzig, Engelmann, 1908.

$\text{RbUO}_2(\text{NO}_3)_3$ crystallizes in the rhombohedral division of the hexagonal system. (Vol. II, p.151)

948 Gubler, H. Beiträge zur Kenntniss des Hydroxylamins. Dissertation, Univ. of Bern, 1908. The method of Kohlschütter and Vogdt for the prepn. of the hydroxylamine uranium complex has a disadvantage in that decompn. occurs. It is recommended that an aq. soln. of excess hydroxylammonium chloride be mixed with dil. HCl and then with $\text{UO}_2(\text{NO}_3)_2$ and neutralized with NaOH with stirring. Then HCl should be added, dropwise, until the soln. is weakly acid. A flocculent ppt. changing suddenly to small, pale-yellow crystals will be obtained. Purification can be obtained by washing with alc. and Et_2O on a filter paper. Ammonium tetrauranate, $(\text{NH}_4)_2\text{O} \cdot 4\text{UO}_3 \cdot 7\text{H}_2\text{O}$, can be obtained by dissolving uranyl acetate in dil. HCl and H_2O and mixing with excess NH_3 . The tetrauranate forms as a gelatinous ppt. which should be filtered dry and pulverized. It is a light orange-yellow. Systematic research on the behavior of hydroxylammonium uranate, the hydroxylamine uranium complex $(\text{NH}_3\text{OH})_2\text{UO}_4 \cdot \text{H}_2\text{O}$, when heated in air or O_2 is reported.

949 Guichard, M. "On Iodation in the Observation of Several Elements." Bull. soc. chim. France (4), 3, 10-12(1908).

The prepn. of U iodide is reported.

950 Guichard, M. "Uranium Tetraiodide." Bull. soc. chim. France (4), 3, 13(1908).

951 Hartinger, L. and Ulrich, K. "Report on the Working-up of Uraninite Residues." Monatsh. 29, 485-96(1908).

This is a detailed description of the procedure adopted by the authors in working up for the Austrian Radium Commission 10,000 kg of U residues.

952 Hauser, O. "Notice Concerning the Solubility of the Rare-Earth Oxalates in Uranyl Salts." Z. anal. Chem. 47, 677-80(1908).

The pptn. of the rare earths with $\text{H}_2\text{C}_2\text{O}_4$ is not quant. in the presence of uranyl salts. A few cc of a strong soln. of $\text{Ce}(\text{NO}_3)_3$ or $\text{La}(\text{NO}_3)_3$ are pptd. completely with $\text{H}_2\text{C}_2\text{O}_4$ and then a concd. soln. of $\text{UO}_2(\text{NO}_3)_2$, UO_2SO_4 , or even UO_2Cl_2 is added until finally the ppt. dissolves almost entirely. Soln. of the oxalate takes place just as readily if $(\text{NH}_4)_2\text{C}_2\text{O}_4$ is used as pptg. agent instead of free $\text{H}_2\text{C}_2\text{O}_4$. On standing for 12 hrs the pptn. was completed (from a Ce soln. prepd. as above and filtered immediately) of a microcryst. blue-yellow salt, $3[\text{UO}_2(\text{C}_2\text{O}_4)_3]\text{Ce}_2 \cdot 5\text{H}_2\text{O}$, a derivative of uranyl tetroxalic acid. In a dil. soln. of La_2O_3 in HCl treated with 2 moles of UO_2SO_4 , and $\text{H}_2\text{C}_2\text{O}_4$ with shaking until a permanent cloud remained and filtered, there appeared on standing for ten days in the light, large crusts of leaflike crystals of $3(?)[\text{U}(\text{C}_2\text{O}_4)_3]\text{La}_4 \cdot 3\text{H}_2\text{O}$, a deriv. of urano-oxalic acid. The soly. of the cerium uranyl tetroxalate is notably greater than that of $\text{Ce}_2(\text{C}_2\text{O}_4)_3$. In general, then, this class of cpds. will not be found as impurities in oxalate ppts. of the rare earths but will cause considerable loss through their formation. It is necessary in analyzing or working up rare-earth mixtures contg. uranyl salts to add $\text{H}_2\text{C}_2\text{O}_4$ in amts. sufficient not only for the rare earth present but also for the U and then to test the latter after soln. of the ppt. and decompn. with K_2SO_4 for Ce and La. The less basic earths show the reaction to a less degree. The La and Ce salts of urano-oxalic acid are much less sol. than the corresponding oxalates. Here U goes into the ppt., but this can easily be avoided for the reaction takes place only on standing for a considerable time in full daylight.

953 Karl, A. "On the Triboluminescence of Mineral Substances." Compt. rend. 146, 1104-06(1908). Uranyl acetate, $(\text{U-Zn})\text{S}$ (1/200 U), U oxides and many other compounds were studied. It is stated that triboluminescence seems to be a property of solid solns.

954 Kohn, M. "A New Double Salt of Thallium." Z. anorg. Chem. 59, 111-13(1908).

The double salts of uranyl sulfate with the alk. sulfates have long been known. The chemical analogy of Tl to the alk. is shown by the fact that the author has been able to prep. a double salt of Tl and uranyl sulfates, which from his analysis, appears to have the formula $\text{Tl}_2\text{SO}_4 \cdot \text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$.

955 Lancien, A. "Uranomolybdate Compounds." *Bull. sci. pharmacol.* **15**, 132-40(1908).
A soln. of $(\text{NH}_4)_2\text{MoO}_4$, in excess, with U nitrate yielded a heavy curdy ppt. of U heptamolybdate, $(\text{MoO}_3)_7(\text{UO}_3)_3$, which is amorph. yellow powder and dissocs. in excess of H_2O into $2(\text{MoO}_3)$, UO_3 + UO_3 + 5MoO_3 . Heated strongly it gives the green and black oxides of U. It is sol., giving a fluorescent soln. in all of the mineral acids. It is insol. in H_2O , CHCl_3 , Et_2O , EtOAc , and alk. On prolonged heating with alk., alk. uranates are formed. Characteristic yellow solns. are given with H_2O_2 and with H_2O_2 and $(\text{NH}_4)_2\text{CO}_3$. Uranyl octomolybdate, $\text{UO}_2\text{O}(\text{MoO}_3)_8 \cdot 13\text{H}_2\text{O}$, was formed by dissolving the ppt. obtained by adding U nitrate to NH_4 molybdate in HNO_3 and crystg. by evapn. Freshly pptd. U heptamolybdate treated with a large excess of AcOH gives a cpd. which rapidly turns blue in sunlight, owing to the formation of Mo_2O_5 . Both the hepta- and octomolybdates, but especially the former, are radioactive.

956 Lemaire, P. "New Differential Reaction for the Salts of Uranium and Cadmium." *Répert. pharm.* (3), **20**, 433-4(1908).

The author finds that a persistent yellow ppt. is produced by boiling an alk. soln. of thiosinamine to which a salt of U or Cd has been added; no other heavy metals or alk. or alk. earth metals yield a ppt. with this reagent.

957 Luther, R. and Michie, A. C. "Electromotive Behavior of Uranyl-Uranous Mixtures." *Z. Elektrochem.* **14**, 826-9(1908).

In acid solns. U^{+4} salts are strong reducing agents. The rate of oxidation of solns. of uranous salts by O_2 in the air is greatly accelerated by Pt^- black, Fe salts, and especially by Cu salts. In the presence of acid, solns. contg. a mixt. of U^{+4} and $(\text{UO}_2)^{+2}$ show a potential which is in agreement with the formula

$$e = e_0 + RT/2F \ln((\text{UO}_2)^{+2})(\text{H}^+)^4/\text{U}^{+4}.$$

The value of e_0 is 0.419 v more pos. than Nernst's zero potential and 0.696 v more pos. than that of Ostwald. The measurements were made at room temp., but the e.m.f. did not change rapidly with the temp. Solns. were used in which H_2SO_4 concn. varied from 0.1 to 1.0 N, the UO_2SO_4 varied from 0.01 to 0.09 M, and the $\text{U}(\text{SO}_4)_2$ from 0.007 to 0.09 M. In connection with these expts. it was observed that the e.m.f. of Hg-Hg $_2\text{SO}_4$ electrodes in not too dil. H_2SO_4 varies but slightly with the concn. of the H_2SO_4 , which is in agreement with the theory that H_2SO_4 dissociates in steps and that HSO_4 is a fairly weak acid.

958 Lutz, O. "On the Analytical Application of Colored Glass." *Z. anal. Chem.* **47**, 1-36(1908).

The bead test for U is discussed. A grass-green to blue-green bead was found in the reducing flame for both borax and microcosmic salt. In the oxidizing portion of the flame the borax bead is yellow to yellow-green and the microcosmic bead is orange-yellow to yellow-green. A green fluorescence is typical of U in both beads in the oxidizing flame.

959 McCoy, H. N. and Ashman, G. C. "The Preparation of Urano-Uranic Oxide, U_3O_8 , and a Standard of Radioactivity." *Am. J. Sci.* (4), **26**, 521-30(1908).

Radioactive substances accompanying U in minerals are almost completely removed by the ordinary process of prepn. of so-called chemically pure $\text{UO}_2(\text{NO}_3)_2$. Minute traces of Ra may be removed by means of BaSO_4 . Pure U_3O_8 , of perfectly definite compn., is readily obtained by heating the nitrate or any lower or higher oxide of U in air at 700° . Uniform circular films of U_3O_8 , 7 cm in diameter, weighing 0.6 to 0.8 g, have definite and const. α -ray activity and are, therefore, recommended as stds. of activity. The α -ray satn. current for such a std. film was measured in abs. units by means of a gold-leaf electroscope, combined with a std. amp/cm 2 of the standard film. The total α current of 1 g of U, in an infinitely thin film, was calcd. to be 4.61×10^{-10} amp.

960 Mitscherling, H. *Ueber die Darstellung flüssiger und fester Chloride*. Dissertation, Univ. of Munich, 1908.

A mixture of various oxychlorides is probably formed when a mixture of U_3O_8 and C is chlorinated in a high-voltage a.c. arc in a Cl_2 atm.

- 961 Monasch, B. "The Use of Metallic Oxides as Arc Light Electrodes." Trans. Illum. Eng. Soc. (N.Y.) 3, 253-394(1908).

An attempt was made to discover some oxide or mixture of oxides for electrodes in an arc lamp of greater eff. than is now obtainable. The oxides of Ti, V, Y, Ce, U, and W are best suited for the purpose, TiO_2 being the most efficient light producer.

- 962 Müller, A. "On the Preparation of Metal Oxide Hydrosols Using Cauterization (Peptization) of Gels." Z. anorg. Chem. 57, 311-22(1908).

Brief information is included on the prepn. of hydrosols of hydrated U oxide.

- 963 Noyes, A. A., Bray, W. C., and Spear, E. B. "A System of Qualitative Analysis for Common Elements. Part III. Analysis of the Aluminum and Iron Groups, Including Beryllium, Uranium, Vanadium, Titanium, Zirconium, and Thallium." J. Am. Chem. Soc. 29, 137-205(1908).

In continuing their task of producing an improved system of qual. analysis, the authors present a large amt. of information. Methods for the sepn. of the various elements above have been worked out and a careful study as to their applicability to mixts. presenting extreme variations in compn. has been made. The metals of the group are pptd. by NH_4OH and $(\text{NH}_4)_2\text{S}$. The authors have introduced into their system well-known quant. methods of sepn. in place of the more or less approx. processes which are customary in qual. analyses. The theoretical aspects of the subject are discussed. Copious references are appended.

- 964 Oechsner de Coninck, F. W. "Molecular Weight of Uranium Oxide." Bull. classe sci. Acad. roy. Belg. 163(1908).

A new series of detns. by the decomp. of UO_2Cl_2 by H_2 is reported. A novelty over the old method is the introduction of a little free Cl_2 to prevent the action of atmospheric water vapor. Of the ten detns. made, reliance is put upon three, whose av. mol. wt. is 270.3.

- 965 Oechsner de Coninck, F. W. "Uranium Compounds." Bull. classe sci. Acad. roy. Belg. 992-5(1908).

UO_2 was obtained by reduction with H_2 at low red heat of the orange-red $\text{UO}_3 \cdot \text{H}_2\text{O}$. The dark-brown UO_2 obtained in this way was converted slowly by H_2O_2 into the hydrate $\text{UO}_2 \cdot \text{H}_2\text{O}$, which oxidized to $\text{UO}_3 \cdot \text{H}_2\text{O}$, while at the same time a small amt. of the green dihydrate was formed. If UO_2 was heated with H_2O_2 almost to the b.p. the oxidation was completed more rapidly. With very dil. HNO_3 , UO_2 was hydrolyzed; if heated gently it dissolved without oxidizing. By heating to 105 to 110°, $\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$ lost $2\text{H}_2\text{O}$; heated higher, some H_2SO_4 . If the dry salt is heated to low redness it decomp. into UO_3 and SO_3 ; at red heat it becomes UO_2 , SO_3 , and O_2 ; the UO_2 oxidized to the green U_3O_8 . Strongly heated with H_2 , the black UO_2 was set free from UO_2SO_4 . If heated, the uranous was converted at low redness to the uranic salt; further UO_2 was formed, which was converted to U_3O_8 , then U_4O_{10} . U acetate, by dry distn., gave CO_2 acetone, H_2O , and HOAc besides the black (including brown) UO_2 , which, heated in air, oxidized. If the acetate is heated in air, the true black UO_2 was formed. At red heat with $\text{Ca}_3(\text{PO}_4)_2$, UO_2SO_4 gave CaSO_4 and a black intermediate oxide but no phosphate or U. CaCO_3 with UO_2SO_4 gave also CaSO_4 and an intermediate oxide. If the heating is much prolonged, CaUO_4 results in small amt.

- 966 Pascal, P. "On the Magnetic Properties of Metal-Oxygen Radicals." Compt. rend. 147, 742-4(1908).

This paper contains a discussion of the calcn. of the molar magnetic susceptibility of UO_2SO_4 , based on detns. made in H_2SO_4 solns. The $\underline{M}$ magnetic susceptibility for $\text{U}(\text{SO}_4)_2$, based on detns. in H_2SO_4 solns., are also reported.

- 967 Pozzi-Escot, E. "New Method of Qualitative and Quantitative Analytical Separation of Metallic Bases." Bull. soc. chim. Belg. 22, 327-38(1908).

This paper gives a review of the quant. sepn. of U from the other elements.

- 968 Roger, H. "The Action of Uranium Acetate upon Some Amylolytic Ferments." Compt. rend. soc. biol. 65, 388-9(1908).

U acetate in small amts. inhibits not merely ptyalin but also maltase. The addn. of enough Na_2HPO_4 to neutralize the U removes the inhibition. Blood serum and egg yolk are not inhibited in this way. The author is inclined to believe that the action is due not to the absence of phosphates but to the action of the U upon the enzyme.

- 969 Rosenheim, A. and Loebel, H. "A Sulfate of Trivalent Uranium." Z. anorg. Chem. 57, 234-9(1908).

The authors confirm Pélégot's method of prepg. UCl_3 by reducing heated UCl_4 with H_2 . The solid UCl_3 crystals are very hygr. Their red aq. soln. is very quickly oxidized to green UCl_4 by air, H_2O , alc., Et_2O , etc. The stability of the soln. can be increased greatly by the addn. of concd. HCl . The red soln. was also prepd. by reducing UCl_4 electrolytically in an inert gas with Hg cathode. They were unable to form other salts of U^{+3} by transposition, except that concd. H_2SO_4 caused pptn. from ice-cold solns. of crystals which appeared to be a U^{+3} sulfate. They assign the formula $\text{U}(\text{SO}_4)_2\text{H}$.

- 970 Schlundt, H. and Moore, R. B. "An Anomalous Behavior in the Radioactivity of Some Uranium Compounds." Physik. Z. 9, 81-4(1908).

The sepn. of UX from solns. of $\text{UO}_2(\text{NO}_3)_2$ by the method of Crookes, (addn. of $(\text{NH}_4)_2\text{CO}_3$ in excess), does not take place when strong solns. of the carbonate are used. The uranyl ammonium carbonate that sepd. out from concd. solns. of uranyl salts by the addn. of 4 N $(\text{NH}_4)_2\text{CO}_3$ in excess, gradually increases in activity. This behavior is not due to the production of a new radioactive product in the cpd., but is caused by a loss in wt. The cpd. undergoes spontaneous decompn. in air at room temp. and thus decreases the absorption of the rays by the layer of radioactive material. The change in activity with loss in wt. was further studied in $\text{UO}_2(\text{NO}_3)_2$ and $\text{UO}_2(\text{OAc})_2$. The results obtained are presented in tables and curves.

- 971 Trivelli, A. P. H. Radioactive Bodies from Uranium. January 30, 1908. (British Patent 2,153) The process of producing radioactive bodies from U or its cpds., consists in exposing U, or its cpds., in vacuum, to the action of cathode rays or Roentgen rays, or to the action of the rays of radioactive substances.

PUBLICATIONS LOCATED IN 1909

- 972 Baskerville, C. "The Rare Minerals: Uranium." Eng. Mining J. 87, 257-8(1909). The author gives a list of minerals containing U and describes the most prominent.

- 973 Campbell, E. D. and Griffin, C. E. "On the Volumetric Estimation of Uranium and Vanadium." J. Ind. Eng. Chem. 1, 661-5(1909).

This method, based on differential reduction, is a means of detg. V and U in the presence of each other, not involving a gravimetric sepn. of the two elements. After the removal of any element which would interfere with the est., the soln. contg. V and U is reduced by SO_2 , and titrated with 0.05 N KMnO_4 . As U is not reduced by SO_2 this titration will give V only. The soln. is again treated by an Al spiral, which reduces both V and U, and titrated with KMnO_4 . The difference gives KMnO_4 used to reoxidize UO_2 to UO_3 .

- 974 Danne, J. "A New Radioactive Product of the Uranium Series." Compt. rend. 148, 337-9(1909). In the process of sepg. and concg. the UX in 24 kg of U nitrate the author was able to identify a new radioactive product belonging to the U series. The UX was sepd. from the U soln. by repeated pptn. with BaSO_4 . The sulfates obtained were converted into carbonates and the carbonates decompd. by HCl . The hydroxides pptd. from this soln., and which contd. the greater part of the UX, were converted into

nitrate and any U present sepd. from the UX by treatment with acetone. To remove any UX absorbed by the acetone the latter was shaken up with a little freshly pptd. $\text{Fe}(\text{OH})_3$. The nitrate insol. in acetone and the $\text{Fe}(\text{OH})_3$ were combined, washed with acetone, and then treated with water. The water soln. was then evapd. to dryness, ignited, and treated with dil. HCl. The portion remaining insol. in HCl contd. the UX. The residue obtained on evapg. the soln. was but slightly active at first, but the activity increased until it became 10 times the initial value. This increase in activity was shown to be due to UX which had formed in a prepn. entirely free from U. It is therefore concluded that a new product giving rise to UX had been sepd. from the U by the treatment described. The author proposes the name radio-uranium for the new substance and points out that its presence in the U series as the immediate parent of UX explains many peculiarities observed in the study of U salts.

- 975 Dickson, E. C. "The Experimental Production of Chronic Nephritis in Animals by the Use of Uranium Nitrate." Arch. Internal Med. **3**, 375-410(1909).

By the use of $\text{UO}_2(\text{NO}_3)_2$, it is possible to produce in animals lesions which closely resemble those found in subacute and chronic diffuse nephritis in man. A long-continued mild intoxication with this drug will lead to the "subchronic" (Weigert) interstitial nephritis appearing progressive.

- 976 Gibbs, R. C. "The Effect of Temperature on Fluorescence and Absorption." Phys. Rev. (1), **28**, 361-76(1909).

Investigations are reported on "canary" glass of the composition SiO_2 , 70%; K_2O , 24%; CaO , 6%; and Na_2UO_2 , 2.5 to 3.0%.

- 977 Gleditsch, E. "The Radium and Uranium Contained in Radioactive Minerals." Compt. rend. **148**, 1451-3(1909).

The relation between U and Ra was detd. in three radioactive minerals by a method which differed from any previously employed by other investigators in that the Ra was detd. after it had been completely sepd. from the mineral. This permitted a comparatively large amt. of the mineral, from 40 to 100 g, to be treated for analysis. After it had been brought into complete soln. the Ra was sepd. by pptg. BaSO_4 in the soln. The sulfates were then converted into carbonates and the latter decompd. by HCl. The Ra in the soln. thus obtained was detd. by the amt. of emanation involved. When the U had also been detd., it was found that the amt. of Ra associated with 1 g of U was not const. The value found for a pitchblende from Joachimsthal agreed with that found by McCoy, Boltwood and others, but in an autunite from France and thorianite from Ceylon, smaller and larger ratios, resp., were found. The values found are not given. It is pointed out that although the low value obtained for the amount of Ra in autunite may be due to a chemical sepn. caused by water, this could not explain the high value found for thorianite.

- 978 Gleditsch, E. "The Relation between Uranium and Radium in Radioactive Minerals." Compt. rend. **149**, 267-8(1909).

To verify the accuracy of the method as described in a previous paper for detg. the ratio between U and Ra in radioactive minerals the products formed in the sepn. of Ra from its minerals were tested for Ra but the amt. retained was found to be so small as to have no appreciable effect on the results first found. It is therefore concluded that the Ra-U ratio in radioactive minerals is not const. The values found for autunite from France, pitchblende from Joachimsthal, and thorianite from Ceylon are 2.85×10^{-7} , 3.58×10^{-7} , and 4.19×10^{-7} , resp. Although the author considers that there really exists a generic relationship between U and Ra yet it is held that the manner of transformation is not so simple as it generally admitted. It is pointed out that the rate of transformation may not be entirely independent of ext. circumstances but that it may depend on the age of the mineral or the presence of certain other elements as Th and Ac.

- 979 Gray, J. H. "The End Product of the Decomposition Series of Uranium." Phil. Mag. (6), **18**, 816-18(1909).

- 980 Jones, H. C. and Strong, W. W. "The Absorption Spectra of Various Potassium, Uranyl, Uranous, and Neodymium Salts in Solution and the Effect of Temperature on the Absorption Spectra of Certain Colored Salts in Solution." Proc. Am. Phil. Soc. 48, 194-234(1909).
The main results of an extended investigation are given. The exptl. method, which is the same as that employed in previous investigations in the same lab. is briefly described. The absorption spectra of solns. of several uranyl salts, of Nd chloride, and of some other salts in various solvents were examined; in addn., aq. solns. of a large no. of salts—including several salts of rare-earth metals—were studied through a range of temps. It was found that Beer's law held in all cases, as long as the solns. were dil., and that the deviations at greater concs. were usually not great. The position of the uranyl bands was different for the different uranyl salts, and for any one salt was changed by changes in the solvent; it was however unaltered by simple dil. of the solvent (1 N to 0.008 N). The bands of $\text{UO}_2(\text{NO}_3)_2$ in MeOH soln. are all displaced about 50 Å toward the red as compared with the bands in aq. soln. In mixts. of MeOH and H_2O , both sets of bands appear, the " H_2O bands" increasing in intensity with the amount of H_2O . For any one band, however, for constant salt conc. the absorption decreases steadily until about 20% H_2O has been added; further addition of H_2O produces little effect. Similar effects were noticed with other salts and solvents. It was found that, in general, increase in temp. causes an increased amount of absorption and a broadening of the bands, which may, or may not, be symmetrical. These effects demonstrate the necessity of employing only pure substances in investigations of absorption spectra.
- 981 Jones, H. C. and Strong, W. W. "The Absorption Spectra of Various Potassium, Uranyl, Uranous, and Neodymium Salts in Solution and the Effect of Temperature on the Absorption Spectra of Certain Colored Salts in Solution." Physik. Z. 10, 499-503(1909).
This article is a condensation of that published in Proc. Am. Phil. Soc. 48, 194-234(1909).
- 982 Kuzel, H. et al. Pure Zirconium, Titanium, Thorium, Cerium, Vanadium, Uranium, Chromium, Tungsten, and Molybdenum. October 11, 1909. (British Patent 23,215)
This process involves the production of pure metals by reducing the cpds. of the metals, preferably the oxides, by means of metallic Ca.
- 983 Lowenstein, E. "A Study of Hydrates, the Vapor Pressures of Which Vary Continuously with the Composition." Z. anorg. Chem. 63, 69-139(1909).
The vapor pressures were detd. at temps. varying from 24.5 to 26° by exposing weighed samples of the substance to the desiccating action of solns. of H_2SO_4 of various strengths, and reweighing at intervals until the wt. was const. The material investigated was brought into initial equil. over 5% H_2SO_4 . The vapor pressure changed discontinuously during the dehydration of the nitrates of Ce, La, Y, Zr, and UO_2 , and of the sulfates of Ce, La, Y, Di, Zr, and Th; and in these cases the crystals lost their clearness, owing to the formation of a lower hydrate. By this means, the existence of a number of new hydrates was demonstrated, while in certain cases no evidence was obtained for the existence of hydrates which, according to other authors, crystd. as such out of solns. The vapor pressure curves of the oxalates of the above metals were, however, continuous, and the continuity of the curve is not affected by the presence of impurities, although the abs. value of the vapor pressure is lowered thereby.
- 984 McCoy, H. N. and Bunzel, H. H. "The Speed of Oxidation, by Air, of Uranous Solutions, with a Note on the Volumetric Determination of Uranium." J. Am. Chem. Soc. 31, 367-73(1909).
The rate of oxidation of uranous solns. by air is found to vary inversely with the square of conc. of H^+ , hence, the rate can be reduced to any desired amount by increasing the amt. of free H_2SO_4 present. When UO_2SO_4 is reduced to $\text{U}(\text{SO}_4)_2$ by Zn and H_2SO_4 about 1% is as U^{+3} , so that titration in an atm. of CO_2 gives results that are too high. The following procedure gives satisfactory results: 50 cc UO_2SO_4 soln. (about 0.3 g U), 55 cc H_2O and 20 cc H_2SO_4 (d. = 1.84) are poured upon 100 g pure Zn, in sticks about 2 cm long, made active by previous treatment with acid contg. a little CuSO_4 . The soln. is heated almost to boiling. After 15 min the soln. is filtered into a large porcelain dish, the Zn, about 95 g of which remains, is washed with cold dil. H_2SO_4 (1:10 = about 3 N) and the final vol. is

made about 300 cc. The soln., which changes during filtration and washing from light brown to sea-green, is titrated with 0.1 N KMnO_4 . The results by this method correspond, within a few tenths of a mg, to those obtained by evapg. the soln. and igniting the residue. The sepn. of U from the elements usually accompanying it in minerals is best effected by pptn. as phosphate, which can then be dissolved in H_2SO_4 and U determined volumetrically as above.

- 985 Metzger, F. J. and Heidelberger, M. "On the Nature of Certain Sodium Uranium Compounds." J. Am. Chem. Soc. 31, 1040-5(1909).

An investigation to det. whether the final product obtained in the analysis of U by Patera's method was correctly represented by the formula $\text{NaO}(\text{U}_2\text{O}_3)_2$. Through oversight the old-time formula $\text{NaO}(\text{U}_2\text{O}_3)_2$ still used instead of $\text{Na}_2\text{U}_2\text{O}_7$. Samples of Na uranate were prepd. and the Na-U ratio detd. The same ratio was also detd. for Patera's ppt. The exptl. results show that the ratio of Na to U in the Na uranate was 4:5.17 instead of 1:1, thus making the analytical formula $\text{Na}_4\text{U}_5\text{O}_{17}$. For the Patera's ppt. the formula was $\text{Na}_9\text{U}_{10}\text{O}_{35}$. It was found that, while Na uranate may actually be pptd. as $\text{Na}_2\text{U}_2\text{O}_7$, on completely removing the excess of alk. by washing with water, the ppt. undergoes a partial hydrolysis or reversal of the reaction by which it was formed, the extent of this reversal depending upon the amt. of washing and upon certain phys. const. not yet detd.

- 986 Meyer, S. "Uranium and Its Immediate Decomposition Products. (A Review.)" Jahrb. Radioakt. Elektronik 6, 361-408(1909).

This paper deals especially with the relation between U and UX. A complete bibliography (139 references) is given.

- 987 Naumann, A. "Reactions in Nonaqueous Solutions. IV. In Methyl Acetate." Ber. 42, 3789-96(1909).

It is reported that $\text{UO}_2(\text{NO}_3)_2$, UO_2I_2 , UBr_4 , and UO_2Cl_2 are sol. in MeOAc. Much of this information is included in dissertations by Rill (1907) and Bezold (1906).

- 988 Oechsner de Coninck, F. W. "The Action of Uranic Sulfate on Calcium Carbonate." Bull. classe sci. Acad. roy. Belg. 838-43(1909).

UO_2SO_4 treated under varying conditions with CaCO_3 was found to give from 20 to 30% CaSO_4 .

- 989 Oechsner de Coninck, F. W. "The Analogy between Uranium and the Other Elements." Bull. classe sci. Acad. roy. Belg. 175-6(1909).

Uranates of the type R_2UO_4 , diuranates of the type $\text{R}_2\text{U}_2\text{O}_7$, and peruranates of the type R_2UO_5 were found to form many combinations with oxides and especially with alk. and oxides of alk. earths. These are analogous to the cpds., as well as somewhat similar to the pyroacids, of P, Sb, and Bi in the higher condition of oxidation.

- 990 Oechsner de Coninck, F. W. "Contributions to the Study of Uranyl Chloride." Compt. rend. 148, 1769-70(1909).

The author treated a freshly prepd. soln. of UO_2SO_4 with BaCl_2 , drop by drop, until the BaSO_4 had come down. The filtrate evapg. to dryness on a water bath, left a yellow deliq. substance, $\text{UO}_2\text{Cl}_2 \cdot n\text{H}_2\text{O}$. A soln. of this allowed to evap. in a dry atm. deposited crystals of $\text{UO}_2\text{Cl}_2 \cdot \text{H}_2\text{O}$. UO_2Cl_2 is reduced by H_2 with heat to UO_2 and HCl . The crystals heated in an open tube with an excess of KOH form the red peruranate, K_2UO_5 , which slowly loses O_2 , giving K_2UO_4 . The yellow BaUO_4 is pptd. from UO_2Cl_2 by BaCl_2 .

- 991 Oechsner de Coninck, F. W. "A Method of Formation of Uranyl Nitrate." Bull. classe sci. Acad. roy. Belg. 743-4(1909).

$\text{UO}_2(\text{NO}_3)_2$ was produced by the interaction of UO_2Cl_2 and AgNO_3 .

- 992 Oechsner de Coninck, F. W. "Peruranic Acid." Bull. classe sci. Acad. roy. Belg. 692(1909). $\text{UO}_4 \cdot 2\text{H}_2\text{O}$ was produced by adding H_2O_2 , slightly acid with HCl , to uranous and uranic sulfates. This confirmed the results of Fairley who obtained the same substance in the same lab. in May, 1909.
- 993 Oechsner de Coninck, F. W. "The Preparation of Uranates in the Wet Way." Bull. classe sci. Acad. roy. Belg. 835-6(1909). UO_2Cl_2 in dil. soln. was treated with BaCl_2 , SrCl_2 , CaCl_2 , or MgCl_2 in soln. before adding $\text{N H}_4\text{OH}$ free from carbonate. The uranate was pptd. as the hydrate.
- 994 Oechsner de Coninck, F. W. "The Reduction of Uranyl Chloride." Compt. rend. 147, 1477 (1909).
As UO_2Cl_2 is readily reduced at a red heat by H_2 to UO_3 , the author carried out ten such reductions with a view to testing a method of detg. the at. wt. of Cl_2 . While the average of his results gives the value 35.36, the individual detns. differ so much that the method is considered to be unreliable.
- 995 Oechsner de Coninck, F. W. "The Stability of the Reactions of Uranyl Chloride." Bull. classe sci. Acad. roy. Belg. 836-7(1909).
Dry UO_2Cl_2 , out of contact with the air, does not decomp.; in H_2O soln., $\text{UO}_2 \cdot \text{H}_2\text{O}$ is formed. Exposed to the air, the H_2O soln. forms first UO_2 then UO_3 , which probably finally forms $\text{UO}_3 \cdot \text{HCl}$.
- 996 Oechsner de Coninck, F. W. "A Study of the Uranates." Bull. classe sci. Acad. roy. Belg. 173-5(1909).
Uranates, in general, correspond to the formula R_2UO_4 . When UO_2Cl_2 was fused with KOH in the presence of O_2 , K_2UO_5 was obtained. Heated for some time to the point of fusion with KOH , O_2 was evolved and K_2UO_4 left. Pure K_2UO_5 , Na_2UO_5 , and BaUO_5 were prepd. and analyzed. CaUO_5 was obtained, impure, with CaUO_4 . The salts vary in color from red to orange and yellow.
- 997 Oechsner de Coninck, F. W. "Observations on the Oxides of Uranium." Compt. rend. 148, 1462-5(1909).
This paper is a brief account of expts. showing that a modification of $\text{UO}_2 \cdot \text{H}_2\text{O}$ is spontaneously oxidizable in air according to the equation, $\text{UO}_2 \cdot \text{H}_2\text{O} + \frac{1}{2} \text{O}_2 \rightarrow \text{UO}_3 \cdot \text{H}_2\text{O}$.
- 998 Oechsner de Coninck, F. W. "Uranous Oxide." Bull. classe sci. Acad. roy. Belg. 744-6(1909).
 K and Na react with UO_2Cl_2 to give UO_2 contaminated with alk. uranate; Mg and Al react to give UO_2 . CaO and Ba(OH)_2 react with UO_2Cl_2 to give UO_2 ; CuO reacts to give UO_2 with a small amt. of Cu uranate.
- 999 Pascal, P. "Contribution to the Study of Complex Compounds (Chemical and Magnetic Study)." Ann. chim. phys. (8), 16, 520-74(1909).
The molar magnetic susceptibility for $\text{U(SO}_4)_2$, based on detns. in H_2SO_4 soln., are reported, as are data on UO_2SO_4 in the same medium.
- 1000 Peters, W. "Residual Affinity and Addition Ability." Ber. 42, 4826-36(1909).
This paper reports that when vacuum-dried UCl_4 is treated with NH_3 (gas) at 165° a black addn. product is obtained which contains 2.958 moles of NH_3 , and retains 2.797 moles upon standing in vacuum. The reaction produces a large amt. of heat. Similarly, at ordinary temp., light-yellow UO_2Cl_2 dried in vacuum will take up approx. 2 moles of NH_3 and turn orange. The cpd. will retain 1 mole of NH_3 in vacuum forming relatively stable $\text{UO}_2\text{Cl}_2 \cdot \text{NH}_3$.
- 1001 Ray, J. and Pradier, G. "Uranium Nitrate and Manganese Nitrate, Their Advantageous Employment in Culture of Fruit Trees." Engrais 24, 1029(1909).
Fertilizing with MnSO_4 increased the vegetation of the apricot tree and produced larger fruit. U nitrate favored the development of young cherry and pear trees when spread about the trees in soln. contg. 0.2 ppm. With trees five or six years old, the treatment had no appreciable effect.

- 1002 Ray, J. and Pradier, G. "The Use of Manganese and Uranium as Fertilizer." J. agr. prat. (2), No. 35, 311-12(1909).

The information included in this article is similar to that reported in Engrais 24, 1029(1909).

- 1003 Ritzel, A. "Absorption of Uranium X by Charcoal." Z. physik. Chem. 67, 724-61(1909). Charcoal takes up UX from $\text{UO}_2(\text{NO}_3)_2$ soln. at first very rapidly and subsequently more and more slowly until after about ten days, equil. is reached represented by the equation $C_X = kC_C$ where C_X and C_C are the concns. of the UX in the soln. and charcoal, resp. The results obtained are explainable on the assumption that the UX is first adsorbed by the charcoal and later is absorbed. The value of the ratio $C_X:C_C \rightarrow 0$ as the concn. of the $\text{UO}_2(\text{NO}_3)_2$ falls. Further, the value of $C_X:C_C$ varies with different specimens of $\text{UO}_2(\text{NO}_3)_2$ if these have not been previously shaken once with charcoal, owing to the fact that fresh $\text{UO}_2(\text{NO}_3)_2$ contains other radioelements besides UX. When the $\text{UO}_2(\text{NO}_3)_2$ soln. contains a small quantity of Th, the UX is, for the most part not adsorbed. The distribution of the UX between charcoal and a soln. contg. no U also has been studied. In the case of HCl, HNO_3 , or H_2SO_4 , equil. is attained after a few hrs and is represented by the equation $C_X = k(C_C - K)$. UX is also absorbed by NaOH soln., but not by H_2O , salt solns., or Et_2O .

- 1004 Ruff, O. and Heinzelmann, A. "Uranium Hexafluoride." Z. anorg. Chem. 72, 63-84(1909). When UCl_5 is treated with F_2 , UF_4 , UF_6 , and Cl_2 result. The UF_6 was sepd. from UF_4 by subln. From the fact that both UF_4 and UF_6 are formed, the authors suggest that UCl_5 has the constitution $\text{UCl}_4 \cdot \text{UCl}_6$. When UCl_5 is boiled with anhyd. HF until HCl is no longer given off, and the HF removed by distn., the residue obtained is probably $\text{UF}_5 \cdot \text{HF}$. When this is heated HF is first evolved, then UF_6 , leaving a residue of UF_4 . UF_6 is also obtained by treating U or UCl_2 with F_2 , in the presence of Cl_2 , which acts as catalyzer. The yield with U is 85 to 94%. UF_6 forms pale-yellow, glittering, monoclinic crystals which are strongly hygr. The best solvent for it is C_2Cl_6 ; others are CCl_4 , CHCl_3 , and $\text{C}_6\text{H}_5\text{NO}_2$, but it reacts with other org. solvents. It reacts energetically with H_2O , H_2 , and other reducing agents of all kinds, generally giving UF_4 . With S a new cpd. is formed, a colorless gas of unknown compn., m.p. 135° , b.p. 40° . The b.p. of UF_6 is 56° at 760 mm Hg the m.p. 69.5° , the sp. gr. 4.68 at 20.7° , the mean ht. of vaporization between 37 and 57.2° (calcd. from b.p. detns.) is 29.4 cal/g.

- 1005 Ruff, O., Zedner, J., Schiller, E., and Heinzelmann, A. "New Fluorides." Ber. 42, 492-7(1909). As the reaction of F_2 with metallic U is too violent, freshly prepd. UCl_5 is used to prepare UF_6 . The temp. is kept low with CO_2 snow. Crysts. of UF_6 are formed, which show double refraction in polarized light, subl. without melting, are sol. in H_2O with a greenish-yellow color. When a trace of H_2O is present, UF_6 reacts with the glass forming UO_2F_2 and SiF_4 . KMnO_4 is not decolorized by the soln. of UF_6 . The soln. is decomp. by NH_3 , forming $(\text{NH}_4)_2\text{U}_2\text{O}_7$ and NH_4F .

- 1006 Rugheimer, L. and Gonder, L. "The Molecular Weight of Uranium Tetrachloride in Boiling Bismuth Chloride Solution." Ann. 364, 45-50(1909).

Good results are obtained in detg. the mol. wt. of an electrolyte by the osmotic method if the solvent used is an electrolyte contg. one of the ions of the solute. A boiling soln. of BiCl_3 is a good solvent for metallic chlorides, results obtained being better than those obtained by the vapor density method at high temp. The mol. wt. of UCl_4 is found to be 373; theoretical 380.3 ($\text{U} = 238.5$). Corrections are made for the introduction of glass. The method of prepn. of UCl_4 is fully described. (See also Ann. 339, 311(1898) and Ber. 36, 3030(1903).)

- 1007 Schoorl, N. "Contribution on Microchemical Analysis. VII. The 'Residual Group' (Magnesium, Lithium, Potassium, and Sodium)." Z. anal. Chem. 48, 593-611(1909).

This paper contains a discussion of the characteristic crystals of double and triple acetates which are formed by uranyl acetate with other metallic ions. A method for the quant. analysis (micro) of Na is based on the prepn. of Na uranyl acetate.

- 1008 Schröter, F. Ueber die elektrische Verstaubung der Metalle in flüssigen Argon und flüssigem Stockstoff. Dissertation, Univ. of Berlin, 1909.

The electric dispersion of U using an electric arc discharge in liq. A is described. The temporary appearance of U vapor is noted.

- 1009 Senderens, J. B. "Catalysis of Formic Acid." *Compt. rend.* 149, 213-15(1909).
Symmetrical ketones can be prepd. using U_3O_8 obtained by calcining UO_3 as catalyst.

1010 Soddy, F. "Production of Helium from Uranium." *Nature* 79, 129(1909).
The rate of production of He was detd. in a soln. contg. 4 kg of $\text{UO}_2(\text{NO}_3)_2$. The dissolved gases were first completely removed by a method previously described. After 61 days, the accumulated gases were removed and freed from H_2O and all but the inert gases by cooling. These were then subjected to the action of Ca vapor in a special vacuum furnace. After cooling, the vapor space was filled with Hg and any residual gas compressed into the smallest possible spectrum tube. Several times the min. quantity of He capable of being detected was found. A second test was made after 27 days. He was now found in but little more than the min. detectable amount. No He was found when a third test was made 12 days later. Corresponding results were obtained with a smaller amt. of $\text{UO}_2(\text{NO}_3)_2$. From these expts. on the assumption that 1 atom of U produced but 1 atom of He, it was calcd. that the rate of production of He must not be far from about 2 mg He/ 10^6 kg U. These exptl. measurements lend no support to the view previously held that U on disintegrating expels 2 He ions.

1011 Soddy, F. and Russell, A. S. " γ -Rays of Uranium." *Nature* 80, 7-8(1909).
The present expts. are carried out by means of UX obtained in the form of films weighing only a few mg. UX contributes all the β and γ rays of U. The γ rays are found to decay at the same rate as the β rays, namely, to half in 22 days. From data given, allowing for the decay during the process of sepn., it is provisionally estd. that the ratio of radiation of U to that of Ra is about 1 to 500 million, when absorption is eliminated and only γ rays are dealt with.

- 1012 von Unruh, A. Einwirkung von trockenem Ammoniak auf wasserfreie Uranylsalze. Dissertation, Univ. of Rostock, 1909.

A discussion is included of the cpd. (or complex) formation exhibited in Et_2O solns. of $\text{UO}_2(\text{NO}_3)_2$. A cpd. of the formula $\text{UO}_2(\text{NO}_3)_2 \cdot \text{C}_4\text{H}_{10}\text{O}$ is said to be obtained when $\text{UO}_2(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$ is dried thoroughly over H_2SO_4 , dissolved in Et_2O , the Et_2O freed of H_2O with metallic Na, filtered, and evapd. to crystn. It is yellowish-green, in the form of bundles of crystals, which cannot be completely freed of Et_2O without decompn. The formation of a complex with NH_3 of the form $\text{UO}_2(\text{NO}_3)_2 \cdot 2\text{NH}_3$, as a voluminous egg-colored ppt. when NH_3 is introduced into an anhyd. Et_2O soln. of $\text{UO}_2(\text{NO}_3)_2$, is discussed. Upon drying in a desiccator over H_2SO_4 , it was found that the material still contains Et_2O but it was eliminated, almost completely, when the material was allowed to stand for a long time in vacuum. A similar material obtained, using AmOH , was found to be badly contaminated with the solvent. This contamination was eliminated by washing with Et_2O . The triamine can be obtained from the diamine material by treating it with NH_3 . The reaction product may be purified in a desiccator over H_2SO_4 by allowing it to stand until the wt. is const. or until the odor of NH_3 disappears. A tetramine cpd. can be obtained by treating with liq. NH_3 in a Weinhold flask at 5° . This material is a deep orange-red amorph. powder contg. Et_2O which will decomp. at ordinary temp. giving off NH_3 . If the temp. is raised above 20° , the decompn. is extremely violent. $\text{UO}_2(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$ can be obtained by heating the hexahydrate at 200° for several hrs. If $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ is dissolved in Et_2O , the lower (aq.) layer can be removed and the Et_2O soln. evapd. under vacuum or a stream of dry air. When this is done, a yellowish-green, fluorescent, cryst. mass of $\text{UO}_2(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O} \cdot \text{C}_4\text{H}_{10}\text{O}$ is obtained. After the Et_2O is entirely removed, this cpd. goes to amorph. trihydrate. $\text{Na}_2\text{O} \cdot 2\text{UO}_3$ can be obtained when an Et_2O soln. of $\text{UO}_2(\text{NO}_3)_2$ is treated with metallic Na. The decompn. of $\text{UO}_2(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$ yields orange-red UO_3 , which is said to be formed at 250 to 300° . $\text{CaO} \cdot 2\text{UO}_3$ can be formed by the action of CaO . It is impossible to ppt. the anhyd. $\text{UO}_2(\text{NO}_3)_2$ from solns. of AmOH . A soln. of UO_2Cl_2 in AmOH can be prepd. by placing uranyl acetate in a porcelain dish, freeing it from HOAc by repeated evapn. of HCl and then evapn. to a small

vol. 4 to 6 times with H_2O to remove the HCl . The product is then crystd. in vacuum in the form of yellowish-green, fluorescent, tubular crystals. These can be dissolved in AmOH and the soln. completely freed of water by heating to the b.p. $\text{UO}_2\text{Cl}_2 \cdot 2\text{NH}_3 \cdot \text{C}_4\text{H}_{10}\text{O}$ can be prepd. by pptn. upon the addn. of NH_3 to an AmOH soln. of UO_2Cl_2 , washing the ppt. free of AmOH and Et_2O and drying it in vacuum or in a stream of dry air. It is also claimed that the tetramine cpd., $\text{UO}_2\text{Cl}_2 \cdot 4\text{NH}_3$, can be obtained, also contaminated with some Et_2O , by treating UO_2Cl_2 which is as free as possible of ether, with liq. NH_3 in a Weinhold glass at 5° . A deep orange-red amorph. powder which begins to lose NH_3 at 10° is obtained. It is indicated that a pure uranyl acetate can be obtained by dehydrating commercial uranyl acetate with AmOH . Uranyl amine acetates are discussed. The diamine, triamine, and tetramine were prepd. and briefly characterized. $\text{UO}_2(\text{OAc})_2 \cdot 4\text{NH}_3$ was obtained by treating the diamine with liq. NH_3 below 5° ; a deep-orange powder results. The triamine material was an orange powder obtained by allowing the diamine to stand for a long time in an atm. of NH_3 . The diamine is an amorph. yellow powder which is obtained by introducing dry NH_3 into an anhyd. AmOH soln. of $\text{UO}_2(\text{OAc})_2$. Repeated evapn. of uranyl acetate with HBr and H_2O on a water bath and then in vacuum over H_2SO_4 will yield large, tubular, yellowish-green crystals of $\text{UO}_2\text{Br}_2 \cdot 7\text{H}_2\text{O}$ after several days. When $\text{UO}_2\text{Br}_2 \cdot 7\text{H}_2\text{O}$ stands in air at ordinary temp., a small amt. of Br_2 is split off and the crystals which are originally yellowish-green soon turn red. UO_2Br_2 is sol. in Et_2O and an anhyd. soln. of UO_2Br_2 may be prepd. by dissolving $\text{UO}_2\text{Br}_2 \cdot 7\text{H}_2\text{O}$ in Et_2O or AmOH and decanting the water of hydration, drying the soln. with CaCl_2 or Na and then heating the AmOH soln. to boiling. The prepn. of ammoniated UO_2Br_2 is discussed. The diammonia material combined with Et_2O is obtained as a yellow ppt. when dry NH_3 is led into Et_2O soln. of UO_2Br_2 . This material will lose Et_2O when placed in a stream of dry air and form the mono-ammoniated material. The triammoniated material can be obtained by reacting the diammoniated oxybromide with gaseous NH_3 and allowing the product to stand in vacuum until const. wt. is achieved and the odor of NH_3 has disappeared. It is also reported that a deep orange-red amorph. powder of $\text{UO}_2\text{Br}_2 \cdot 4\text{NH}_3$ can be obtained by treating UO_2Br_2 , or the diamine material, with liq. NH_3 in a Weinhold flask. The paper also contains a discussion of the formation of uranyl bromide etherate, $\text{UO}_2\text{Br}_2 \cdot 2\text{C}_4\text{H}_{10}\text{O}$. UO_2Br_2 is obtained in the prepn. of UBr_4 from U_3O_8 and C and can be removed by treatment of the product with Et_2O . UBr_4 is said to be insol. in Et_2O . Solid UO_2I_2 cannot be obtained in the dry way in the same manner as the corresponding chloride and bromide since UO_2 or an incandescent mixture of UO_2 and C are not attacked either by I vapor or by gaseous HI . When dry NH_3 is introduced to freshly prepd. UO_2I_2 Et_2O solns., a golden-yellow amorph. ppt. of the compn., $\text{UO}_2\text{I}_2 \cdot 2\text{NH}_3 \cdot \text{C}_4\text{H}_{10}\text{O}$, is obtained which will lose Et_2O in vacuum or in a stream of dry air going over to almost pure $\text{UO}_2\text{I}_2 \cdot 2\text{NH}_3$. This same cpd. can be obtained from AmOH soln. using the same procedure; however, the yellow ppt. should be washed in Et_2O and the Et_2O removed as shown above. The triamine can be obtained as an orange-red product by allowing the diamine to stand in an atm. of NH_3 and then drying over H_2SO_4 until the odor of NH_3 disappears. $\text{UO}_2\text{I}_2 \cdot 4\text{NH}_3$ can be obtained by treating the diamine with liq. NH_3 at 0° . It is reported to be very unstable and to decomp. a little above 5° . Anhyd. UO_2F_2 is reported to be best prepd. as follows: place 20 g of commercial uranyl acetate in a platinum dish, evap. repeatedly over a water bath with HF present, in order to drive off all HOAc . Remove the HF which is present by evapn. with H_2O , finally evapg. to dryness. The salt will lose its H_2O completely after prolonged standing in vacuum and at that time will be a yellow powder. It is indicated that, in contrast to the other halides, UO_2F_2 is insol. in Et_2O and AmOH . There is a discussion of the NH_3 complexes with uranyl fluoride, $\text{UO}_2\text{F}_2 \cdot 4\text{NH}_3$, being particularly discussed. It is reported to be obtained by the action of liq. NH_3 at 0 to 5° upon UO_2F_2 or upon one of the lower amines. It is said to be a deep orange-red amorph. powder and more stable than the corresponding cpds. of Cl or Br . $\text{UO}_2\text{F}_2 \cdot 3\text{NH}_3$ is prepd. by treating UO_2F_2 for several hrs with a stream of dry NH_3 and storing the orange-red product in a desiccator over H_2SO_4 until const. wt. is achieved and the odor of NH_3 disappears. Moderate warming of this triamine will cause the loss of 1 mol. of NH_3 and the formation of yellow $\text{UO}_2\text{F}_2 \cdot 2\text{NH}_3$. There is a discussion of the prepn. and properties of amine uranyl sulfates. $\text{UO}_2\text{SO}_4 \cdot 4\text{NH}_3$ is obtained as a deep-orange amorph. powder by treating UO_2SO_4 or one of the less ammoniated cpds. with liq. NH_3 at about 5° . $\text{UO}_2\text{SO}_4 \cdot 3\text{NH}_3$ can be prepd. by exposing anhyd. yellow-green UO_2SO_4 to an atm. of NH_3 and storing the orange product over H_2SO_4 in a desiccator until the odor of NH_3 has disappeared and const. wt. is achieved. Very mild heating accelerates the absorption of NH_3 in the first step of the process. Gentle heating will cause the product to lose NH_3 and go to $\text{UO}_2\text{SO}_4 \cdot 2\text{NH}_3$. The UO_2SO_4 , which was prepd., was found to be insol. in Et_2O , benzene, and AmOH .

1013 Wyruboff, G. "Some Compounds of Uranium." *Bull. soc. franç. minéral.* 32, 340-65(1909). The following salts are briefly described crystallographically, and in some instances analyses are given: $\text{UO}_2(\text{SO}_3)_2$; $\text{ThO}_2 \cdot 2\text{SeO}_3 \cdot 9\text{H}_2\text{O}$; $\text{UO}_2(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$; $\text{UO}_2\text{SO}_4 \cdot 2\text{H}_2\text{SO}_4 \cdot 5\text{H}_2\text{O}$; $\text{K}_2\text{UO}_4 \cdot 2\text{C}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$; $(\text{NH}_4)_2\text{UO}_4 \cdot 2\text{C}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$; $\text{Rb}_2\text{UO}_4 \cdot 2\text{C}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$; $\text{Cs}_2\text{UO}_4 \cdot 2\text{C}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$; $\text{Tl}_2\text{UO}_4 \cdot 2\text{C}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$; $\text{Na}_2\text{UO}_4 \cdot 2\text{C}_2\text{O}_3 \cdot 6\text{H}_2\text{O}$; $\text{Li}_2\text{UO}_4 \cdot 2\text{C}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$; $(\text{NH}_4)_2\text{UO}_4 \cdot (\text{NH}_4)_2\text{O} \cdot 3\text{C}_2\text{O}_3$; $\text{Tl}_2\text{UO}_4 \cdot \text{Tl}_2\text{O} \cdot \text{C}_2\text{O}_3$; $2\text{K}_2\text{UO}_4 \cdot \text{K}_2\text{O} \cdot 5\text{C}_2\text{O}_3 \cdot 10\text{H}_2\text{O}$; $2\text{Na}_2\text{UO}_4 \cdot \text{Na}_2\text{O} \cdot 5\text{C}_2\text{O}_3 \cdot 13\text{H}_2\text{O}$; $\text{UO}_3 \cdot \text{K}_2\text{UO}_4 \cdot 3\text{C}_2\text{O}_3 \cdot 4\text{H}_2\text{O}$; $\text{UO}_3 \cdot \text{Tl}_2\text{UO}_4 \cdot 3\text{C}_2\text{O}_3$.

PUBLICATIONS LOCATED IN 1910

1014 Bacon, R. F. "A Solution of Oxalic Acid and Uranium Salts as a Chemical Photometer." *Philippine J. Sci.* 5, 281-303(1910).

Since reactions measured by gas evolution are subject to several errors, the author now detcs. the undecompd. $\text{H}_2\text{C}_2\text{O}_4$ by direct titration with KMnO_4 in the presence of H_2SO_4 , after the removal of the U salts with a slight excess of NH_4OH . It is considered that the active waves measured by this soln. are in the ultraviolet. $\text{UO}_2(\text{OAc})_2$ is as efficient as the nitrate, though the latter is preferable, since it is itself more stable in sunlight, and has the power of catalyzing a larger quantity of $\text{H}_2\text{C}_2\text{O}_4$. The concn. of the U salt is, within wide limits, the sole factor in detg. the speed of the reaction. The reaction is not influenced by acids (provided they do not reduce the content of the U in soln.); 80 and 20°K (liq. H_2) to 0.13 to alkaloids and is markedly influenced by the presence of dyes (fluorescein, malachite green, etc.) and by the size and shape of the contg. vessel. Some expts. indicated that the reaction over a wide range has no temp. coeff. The author discusses the expts. of Duclaux, who exposed to the sun 0.05 N solns. of $\text{H}_2\text{C}_2\text{O}_4$ in shallow vessels; this reaction is autocatalytic. A few comparative expts. made with $\text{H}_2\text{C}_2\text{O}_4$ -uranyl acetate mixt. in Manila and in Chicago show that the sunlight is much more active, so far as this one reaction is concerned, in Manila.

1015 Baur, E. "Remarks on the Papers by N. Titleslad and C. Schaper." *Z. physik. Chem.* 72, 323-37(1910).

With pure uranyl salts a pos. effect of light on the p.d. is reported. Other information on the $\text{U}^{+4}/\text{U}^{+6}$ p.d. is also given.

1016 Becquerel, H., Becquerel, J., and Onnes, H. K. "Phosphorescence of Uranyl Salts at Very Low Temperatures." *Ann. chim. phys.* (8), 20, 145-65(1910).

When the temp. is lowered to the m.p. of H_2 the phosphorescence bands of uranyl salts become increasingly narrow, the max. of emission being displaced toward the small wavelengths. Between ordinary temp. and 80°K the displacements amount to 2 to 3 $\mu\mu$, and between 80 and 20°K (liq. H_2) to 0.13 to 0.26 $\mu\mu$; between 20 and 14°K the displacements are scarcely perceptible, and as the temp. is lowered the position of the bands seems to approach a limiting position. This change is of the same nature as the change of vol. and, probably, the change of the dielectric const. The phosphorescence spectrum of a uranyl salt is composed of seven or eight groups occurring at intervals, their aspects being, if not identical, only slightly different; the more refrangible groups often differ in appearance from the others. The name "homologous band" is given to those occupying the same relative positions in the different groups. The different aspects of the different groups are found to depend only on progressive changes in the relative intensities of the bands. All uranyl salts contg. one acid and different bases united with the uranyl group give spectra having the same general aspect, so that the constitution of the spectrum depends principally on the nature of the acid of the salt, and is only slightly influenced by the bases. Between two consecutive homologous bands the difference of the freqs. is sensibly const., not only for any one series, but for all the series of homologous bands of the same salt; further, the constant expressing the difference of freq. between two consecutive homologous bands varies only slightly from one salt to another. In a magnetic field exceeding 20,000 gauss no appreciable action is exerted on the bands at 14°K. Certain of the bands in the two most refrangible groups of the emission spectrum are reversible, being transformable into emission bands; it is to these reversible bands that the marked differences between the more and less refrangible groups are mainly due. Uranyl salts form a separate class among phosphorescent substances, since their phosphorescence spectra are due to the U itself and not to the presence of

a phosphorogen. It seems probable that, with uranyl salts, the luminous centers producing phosphorescence bands are very few in comparison with the total number of the molecules.

- 1017 Becquerel, H., Becquerel, J., and Onnes, H. K. "Phosphorescence of Uranyl Salts at Very Low Temperatures." *Compt. rend.* 150, 647-52(1910).

This paper contains information similar to that reported in *Ann. chim. phys.* (8), 20, 145-65(1910).

- 1018 Berry, A. J. "Adsorption of Uranium X by Barium Sulphate." *J. Chem. Soc.* 97, 196-200(1910). Becquerel has shown that when Ba is pptd. as sulfate in a U soln., the photographic activity of the latter is removed by the BaSO_4 ; this activity is due to UX. The adsorption of UX has been investigated quantitatively, and evidence obtained of a definite partition coeff. between the UX in the BaSO_4 and in the soln.

- 1019 Bourion, F. "On a General Method of Preparing Anhydrous Chlorides and Its Application to Chemical Analysis. Second Part. Use of Sulfuryl Chloride, S_2Cl_2 , for Transformation of Oxides or Oxygenated Salts into Anhydrous Chlorides." *Ann. chim. phys.* (8), 21, 49-86(1910).

It is reported in Section IV of Chapter 3 that UO_2 can be converted to UCl_4 by sulfur monochloride at temps. ranging from 230 to 250°. U_3O_8 will be converted to UCl_4 by S_2Cl_2 . In the conversion of UO_2 or U_3O_8 to UCl_4 using Cl-free S_2Cl_2 , the reaction was found to go quantitatively below the subln. temp. Almost all of the UCl_4 remains behind in an oxide-free condition and the other products are removed. The drying and cooling of the UCl_4 which is prepd. is carried out in a Cl_2 atm.

- 1020 Brown, J. N. "Rate of Emission of Alpha-Particles from Uranium and Its Products." *Proc. Roy. Soc. (London), A*, 84, 151-4(1910).

The object of the expts. was to est. the no. of α particles/sec/g U in equil. with all its products (i.e., as it occurs in pitchblende). The pitchblende was used in films so thin that there was no appreciable absorption of the α particles by the films themselves, and the α particles emitted were detd. by the scintillations they produced on a zinc sulfide screen. The pitchblende used was analyzed to det. its % U, the latter being pptd. as phosphate; this percentage was 41.80. The final result obtained was 7.36×10^{-4} α /sec/g U, the value obtained by a series of calcns. from Rutherford's value for RaC and assuming two α -ray changes in U and one each in ionium, Ra, RaEm, RaA, RaC, and Po, is 9.25×10^4 .

- 1021 Buckminster, I. H. and Smith, E. F. "Electrolytic Separations." *J. Am. Chem. Soc.* 32, 1471-7(1910).

Electrolytic sepn. of certain metals have been worked out successfully, and the investigators now present an account of several important observations, including details sufficient for the guidance of an analyst in effecting the sepn. of Hg, Co, or Ni from U.

- 1022 Camboulives, P. "Action of Carbon Tetrachloride Vapor on Anhydrides and Oxides." *Compt. rend.* 150, 175-7(1910).

This paper contains a report showing that UO_3 is attacked by CCl_4 vapor at 360° forming UCl_4 and UCl_5 .

- 1023 Fischer, F. and Schröter, F. "New Investigations of the Combining Ability of Argon." *Ber.* 43, 1442-54(1910).

No reaction was found when finely divided U was treated with A in an electric arc.

- 1024 Freer, P. C. "Tropical Sunlight." *Philippine J. Sci.* 5, 1-18(1910).

The author summarizes the work which has been done in Manila on the quality of tropical sunlight and its influence on microorganisms and on certain chem. reactions, such as the decompn. of oxalic acid in the presence of U acetate by sunlight. (This is the address of the President at a Meeting of the Far Eastern Association of Tropical Medicine held in Manila, March 5, 1910.)

- 1025 Geiger, H. and Rutherford, E. "Number of α -Particles Emitted by Uranium and Thorium and by Uranium Minerals." *Phil. Mag.* (6), 20, 691-8(1910).

The material under investigation was deposited as a thin uniform film, and the α particles emitted by this film were determined by the scintillations produced on a zinc sulfide screen which had previously been standardized by reference to the α particles emitted by a known amt. of RaC. The results obtained were as follows:

	α particles/g U/sec		Volume He/g U/yr
	Calculated	Observed	
Uranium	2.32×10^4	2.37×10^4	$2.75 \times 10^{-5} \text{ mm}^3$
Uranium mineral	9.67×10^4	9.6×10^4	$11.0 \times 10^{-5} \text{ mm}^3$
Thorium, no. of α particles/g	-	2.7×10^4	$3.1 \times 10^{-5} \text{ mm}^3$

In the case of U, the theoretical result was obtained by assuming that 1 g Ra emits 3.4×10^{10} α particles per sec, and that the amount of Ra in equil. with 1 g U is 3.4×10^{-7} , and also that U in its transformation emits two α particles. In the case of the U mineral (uranite) a correction was necessary for the small quantity of Ac which Boltwood has shown to be genetically connected with Ra. In the course of the expts. a detn. of the range of the α particle from U was made; it was found to be about 2.7 cm, which is less than the range found by Bragg.

- 1026 Gissing, C. E. *Spark Spectra of the Metals*. London, 1910.
Photographs of the spark spectrum of U are included.

- 1027 Grossmann, H. and Loeb, A. "On the Knowledge of Rotation Dispersion of Some Colored, Complex Tartrates. Third Communication: On the Rotatory Powers of Colored Solutions." *Z. physik. Chem.* 72, 93-112(1910).

This paper reports that the specific rotatory power of the soln. of tartaric acid and alk. uranyl nitrate reaches a max. at a mole ratio for NaOH : C₄H₆O₆ : UO₂(NO₃)₂ of 3 : 1 : 1.

- 1028 Grossmann, H. and Rothgiesser, F. "Multirotation of Cane Sugar in the Presence of Alkaline Solutions of Uranyl Salts." *Ber.* 43, 675-82(1910).

The authors have detd. the rotatory powers, at 20°, in yellow light, of aq. solns. contg. varying quantities of cane sugar, NaOH, and UO₂(NO₃)₂, the results being given in tables and also in the form of a curve. In general, the solns. have a higher *d*-rotation than that of the sugars alone, but the rotatory power falls gradually and may, finally, change its sign; e.g., a 1/40 N sugar soln. contg. sugar, nitrate, and NaOH in the ratio 1 : 1.2 : 13.5 moles, after 5 min had [α_D] = 110°, after 60 min [α_D] = 0°, after 24 hrs [α_D] = -17.8°. For the pure sugar [α_D] = 64°. This behavior is ascribed to the formation of complex salts, such as C₁₂H₂₀O₉(OUO₂ONa)₂ or C₁₂H₂₁O₁₀OUO₂ONa, which are supposed to be *d*-rotatory; they are assumed to hydrolyze slowly to NaOH and C₁₂H₂₀O₉(OUO₂OH)₂ or C₁₂H₂₁O₁₀OUO₂OH, resp., and these are assumed to be *l*-rotatory.

- 1029 Haber, F. "On the Production of Ammonia from Nitrogen and Hydrogen." *Z. Elektrochem.* 16, 244-6(1910).

U contg. a small amt. of C or the carbide was found to be an excellent catalyst in the synthesis of NH₃ from N₂ and H₂ when the temp. is maintained below 500°. The eff. is especially good because the pressure of the mixt. freezes the total pressure to 200 kg/cm² at which pressure the U will break down to an extremely fine powder.

- 1030 Hahn, O. and Meitner, L. "A New Beta Radiation with Thorium X. Analogies in the Uranium and Thorium Series." *Physik. Z.* 11, 493-7(1910).

Reasoning that simple substances give only one kind of radiation, the authors conclude that Ra is complex. One attempt to sep. Ra into its constituents seems to have been successful, but it was found impossible to repeat the expt. Proof is given of the existence of a very slightly penetrating β radiation from ThX by a detn. of the activity and penetrating power of β radiation from ThX (+ ThB) and ThX carefully freed from ThB by pptn. of the latter with animal charcoal and by heating. The existence of this radiation was also confirmed photographically. This radiation is analogous to the soft β radiation of Ra and the analogy between the decompn. series of U and Th is shown by the following series of successive disintegration products:

U α rays	α rays	Th
RaU?	?	MsTh ₁
UX complex β rays	complex β rays	MsTh ₂
?		?
Ionium slow α rays	slow α rays	RaTh
Ra $\left\{ \begin{array}{l} \text{Ra slow } \beta \text{ rays} \\ \text{RaX } \alpha \text{ rays} \end{array} \right.$	$\left\{ \begin{array}{l} \text{slow } \beta \text{ rays} \\ \alpha \text{ rays} \end{array} \right.$	$\left\{ \begin{array}{l} \text{ThX}_1 \\ \text{ThX}_2 \end{array} \right. \text{ThX}$
RaEm α rays	α rays	ThEm

1031 Honda, K. "The Thermomagnetic Properties of Elements." *Ann. Physik* (4), 32, 1027-63(1910). Work on the detn. of the magnetic susceptibility of U is reported. The temp. dependence of the magnetic susceptibility value is discussed. More accurate values are given by Owen.

1032 Jones, H. C. and Strong, W. W. A Study of the Absorption Spectra. Washington, Carnegie Institute, 1910. (Publication No. 130)

This publication contains a large amt. of information on the absorption spectra of $(\text{UO}_2)^{+2}$ solns.

1033 Jones, H. C. and Strong, W. W. "The Absorption Spectra of Various Salts in Solution, and the Effect of Temperature on Such Spectra. Part I. The Absorption Spectra of Various Potassium, Uranium and Neodymium Compounds." *Am. Chem. J.* 43, 37-90(1910).

This article is a summary of a portion of the work carried out with grants from the Carnegie Institution of Washington. The exptl. methods and prepn. of solns. is described. The studies on U cpds. included investigations of UO_2Cl_2 in H_2O with and without the presence of CaCl_2 and AlCl_3 , in MeOH , EtOH and in $\text{MeOH} + \text{H}_2\text{O}$. In $\text{MeOH} + \text{H}_2\text{O}$ the addn. of CaCl_2 to the U soln. was also investigated. The absorption spectra of solid UO_2Cl_2 , $\text{UO}_2(\text{OAc})_2$, $\text{UO}_2(\text{NO}_3)_2$, and $\text{UO}_2(\text{NO}_3)_2 \cdot x\text{H}_2\text{O}$ were also studied. Investigations are also reported on solns. of $\text{UO}_2(\text{NO}_3)_2$ in H_2O (including diln. effect), in MeOH , in EtOH , and in $\text{MeOH} + \text{H}_2\text{O}$; UO_2Br_2 in H_2O , UO_2SO_4 in H_2O , $\text{UO}_2(\text{OAc})_2$ in H_2O and in MeOH . The seven bands found by Becquerel in the fluorescence spectrum of uranyl nitrate, acetate, chloride, and sulfate as well as measurements made at room temp. and at the temp. of liq. air for the nitrate are tabulated. Fluorescence data for other cpds. as obtained by other authors are also tabulated, particularly the double sulfates of UO_2 and Na, and UO_2 and NH_4 and the double UO_2 -Na acetate. The absorption spectra of $\text{U}(\text{SO}_4)_2$ and UCl_4 solns. are also reported. The paper contains a number of spectrograms showing the results of the research. The summary of the paper, with minor modifications, follows:

The absorption spectra of the uranyl salts contains a series of bands in the blue and violet. Twelve of these bands can usually be detected for each salt. Starting from the blue end of the series, the bands are designated by the letters a, b, c, etc. These bands are usually diffused and from 30 to 50 Å wide. The uranyl bands of $\text{UO}_2(\text{NO}_3)_2$ in H_2O are all farther to the violet than the uranyl bands of any other salt investigated, or of $\text{UO}_2(\text{NO}_3)_2$ in other solvents. The uranyl absorption bands of crystals of $\text{UO}_2(\text{NO}_3)_2$ agree with the absorption bands of an aq. soln., with the exception of the f, g, h, and i bands, these latter being shifted to the red in the crystal. Diln. within the ranges studied does not affect the position of the

uranyl bands. Theoretically, all the uranyl salts in H_2O should give the bands of the same wavelength for very dil. solns. The uranyl bands of the nitrate in MeOH are all shifted to the red about 50 Å with reference to the bands in H_2O . Mixts. of H_2O and MeOH show that we have both sets of bands existing for the same soln., the "water" bands increasing in intensity as the amt. of H_2O increases. The water bands are the more persistent. This indicates the existence of a hydrate and an alcoholate of the $(\text{UO}_2)^{+2}$ group. In EtOH the a, b, c, and d bands are shifted to the red with reference to the MeOH bands. The other bands appear to have the same positions as the MeOH bands. The bands of UO_2Br_2 in H_2O , of $\text{UO}_2(\text{OAc})_2$ in H_2O and MeOH, and also of the anhyd. salt, are approx. of the same wavelengths, differing but slightly from the wavelengths of the $\text{UO}_2(\text{NO}_3)_2$ bands of aq. soln. The bands of uranyl sulfate in H_2O are all shifted toward the red about 50 Å with reference to the $\text{UO}_2(\text{NO}_3)_2$ bands in H_2O . For both the sulfate and nitrate in H_2O the bands are very much alike. The i band is very weak in both cases. UO_2Cl_2 bands of an aq. soln. are shifted to the red with reference to the $\text{UO}_2(\text{NO}_3)_2$ bands of an alc. soln. The addn. of CaCl_2 or AlCl_3 is found to produce very marked effects upon the UO_2Cl_2 bands. The addn. of sufficient AlCl_3 to an aq. soln. of UO_2Cl_2 , or of CaCl_2 to a MeOH soln. of UO_2Cl_2 , is found to cause the d and e bands to come together, so as to form a single wide band, and to cause the other uranyl bands to shift so that the whole resulting series of bands is almost identical with the series of bands of an EtOH soln. of UO_2Cl_2 . The effect of adding foreign substances also greatly modifies the intensity of the bands. An example of this difference of action is the effect of adding AlCl_3 to an aq. soln. of UO_2Cl_2 . The a and b bands are affected entirely differently, the a band being very much reduced in intensity and made narrower, whereas the b band becomes very much stronger and wider. A new set of fine bands in the green has been discovered in the absorption spectrum of an aq. soln. of UO_2Cl_2 . These appear only for pure H_2O solns., a small amt. of AlCl_3 or CaCl_2 causing them to vanish. They do not appear for MeOH or EtOH solns., nor for any other uranyl salt except very faintly for the sulfate. The absorption spectrum of several uranous salts has been photographed. The spectrum is entirely different from that of the uranyl cpds. The absorption spectra of UCl_4 in MeOH and in H_2O were found to be very different. The intensity of the phosphorescence of the same uranyl salts, obtained from different solvents by evapn., is found to be very different. Monochromatic stimulation fails to excite phosphorescent bands until the wavelengths reach the region of the uranyl bands. It is found that the NO_3 group has a very great influence on the freq. of the uranyl bands of absorption, of the uranous absorption bands and of the uranyl phosphorescent bands.

- 1034 Jones, H. C. and Strong, W. W. "The Absorption Spectra of Various Salts in Solution and the Effect of Temperature on Such Spectra. Part II. The Effect of Rise in Temperature on the Absorption Spectra of Various Salts in Aqueous Solution." *Am. Chem. J.* **43**, 97-135(1910).

The paper reports investigation in the ultraviolet at approx. 10 and 80° on UO_2Cl_2 , $\text{UO}_2(\text{NO}_3)_2$, $\text{UO}_2(\text{OAc})_2$, UCl_4 and UO_2SO_4 . General conclusions are given on these and many other non-U salts showing changes with rise in temp.

- 1035 Jones, H. C. and Strong, W. W. "The Absorption Spectra of Solutions. A Possible Method for Detecting the Presence of Intermediate Compounds in Chemical Reactions." *Am. Chem. J.* **43**, 224-7(1910).

It is found that, when H_2SO_4 is added to a soln. of $\text{UO}_2(\text{NO}_3)_2$ contg. free HNO_3 , the absorption spectrum is not characteristic of either the nitrate or the sulfate, but is intermediate between the two, until, after the addn. of much H_2SO_4 , the bands finally coincide with those exhibited by solns. of $\text{UO}_2\text{SO}_4 + \text{H}_2\text{SO}_4$. This gradual shift of bands "would indicate the possibility of the formation of a series of more or less unstable systems or compounds, intermediate in compn. between the nitrate and sulfate." It seems to show that "the final product is not formed at once from the initial substances, as our chemical equations would indicate."

- 1036 Jones, H. C. and Strong, W. W. "The Absorption Spectra of Certain Uranous and Uranyl Compounds." *Phil. Mag.* (6), **19**, 566-72(1910).

This paper contains data already published in *Am. Chem. J.* **43**, 37-90, 97-135, 224-7(1910).

- 1037 Jones, H. C. and Strong, W. W. "The Absorption Spectra of Certain Uranous and Uranyl Compounds." J. chim. phys. **8**, 131-4(1910).

This paper contains information already published in Am. Chem. J. **43**, 37-90, 97-135, 224-7(1910).

- 1038 Michael, A. and Murphy, A., Jr. "Action of Chlorine in a Solution of Carbon Tetrachloride and of Carbon Tetrachloride on Metallic Oxides." Am. Chem. J. **44**, 365-84(1910).

CCl_4 absorbs at 0° 25%, at room temp. 10%, of its wt. of Cl_2 . The soln. keeps indefinitely in closed vessels if the materials are pure and dry. UO_2 with CCl_4 alone forms UCl_4 at 250° ; UO_3 or U_3O_8 with CCl_4 or with soln. at 250° forms UCl_5 .

- 1039 Monasch, B. "The Use of Metallic Oxides as Arc Light Electrodes." J. Gasbeleucht. **53**, 1122-3(1910).

This paper is a summary of that published in Trans. Illum. Eng. Soc. (N.Y.) **3**, 253-394(1908).

- 1040 Pearce, R. M. "The Problems of Experimental Nephritis." Arch. Internal Med. **5**, 133-67 (1910).

This paper classes U with the chromates as a kidney poison and considers the early damage to be largely tubular and confined to the convoluted tubules. A brief bibliography is included.

- 1041 Praetorius, P. and Korn, F. "Effect of Light on Unsaturated Ketones in Presence of Uranyl Salts." Ber. **43**, 2744-6(1910).

When dissolved or suspended in glacial HOAc, dibenzalacetone and a uranyl salt, on exposure to sunlight during 1 to 2 days, gives 2 cpds.; the more readily sol. crystallizes from alc., m. about 174° . The same cpd. appears to be produced also by exposure to light of the solid, cryst. material dibenzalacetone- $\text{UO}_2\text{Cl}_2 \cdot \text{AcOH}$; white needles from CCl_4 , m. 183° . The second of the 2 cpds. mentioned above is produced in much the larger quantity; white needles from AcOH m. about 245° ; mol. wt., in naphthalene, 419-429. It is oxidized by CrO_3 to CO_2 , BzOH and α -truxillic acid. Dibenzalacetone uranyl chloride decomps. in a similar manner giving a cpd.; colorless, pointed prisms from CHCl_3 , m. 248° . It gives an orange-yellow color with concd. H_2SO_4 . Benzalacetophenone uranyl chloride and anisalacetophenone- $\text{UO}_2\text{Cl}_2 \cdot \text{AcOH}$ are but little changed by light and dianisalacetone- UO_2Cl_2 is stable toward light and air.

- 1042 Ruff, O. and Heinzelmann, A. "On Uranium Hexafluoride." Z. anorg. Chem. **72**, 63-84(1910).

This is a lengthy article on the prepn. of UF_6 starting with UCl_5 . The results (UO_2F_2) are unsatisfactory starting with U_3O_8 , especially with HF, rather than F_2 . The properties of UF_6 (and some of UF_4) are given.

- 1043 Sabatier, P. and Mailhe, A. "Action of Metallic Oxides on Primary Alcohols." Ann. chim. phys. (8), **20**, 289-352(1910).

The actions of UO_2 and UO_3 are discussed along with other metal oxides. Trials of UO_3 on ethyl, methyl, and benzyl alcohol are described. UO_2 is reported to act as a catalyst in the formation of primary alcohols.

- 1044 Stein, A. "On Molecular Vibration of Solid Compounds." Physik. Z. **11**, 1209-12(1910).

A discussion is included on the relationship between characteristic freq., at. wt., and at. vol. One of the elements considered is U.

- 1045 Strong, W. W. "Uranium and Neodymium Aggregates." Physik. Z. **11**, 668-71(1910).

This is a continuation of work previously reported. Expts. on the absorption bands of salts of U and Nd in different solvents are interpreted. The solvate bands are characteristic and independent of bands pertaining to other solvates; when one salt is changed over into another (e.g., by addn. to the soln. of the corresponding acid), intermediate cpds. are often formed. The absorption spectra of uranium cpds. are composed of bands differing entirely from those exhibited by uranyl cpds. The displacement of uranyl bands with the temp. is different from what one would expect, in the case that complex aggregates were being destroyed. The " H_2O -bands" and "alc.-bands" of Nd do not follow Beer's law, and are influenced differently by change of temp.

- 1046 Titlestad, N. "Photo-Volt Chain with Uranium and Uranyl Sulfate." *Z. physik. Chem.* **72**, 257-307(1910).

This paper discusses the oxidation-reduction potential of $(\text{UO}_2)^{+2}$ and U^{+4} and certain of their oxidation-reduction reactions. It is reported that the p.d. of uranyl-uranium sulfate soln., 0.5 M UO_2SO_4 , 0.25 M $\text{U}(\text{SO}_4)_2$ and about 30 g of free H_2SO_4 in the dark against Pt, is 0.403 v. A temp. coeff. of 0.0002 v/° is reported. With pure uranyl salts a pos. effect of light on the p.d. is reported. Information is included on the absorption spectra of U^{+4} and $(\text{UO}_2)^{+2}$ solns.

- 1047 Vasil'ev, A. M. "Uranyl Salts. I and II. Hydrates of Uranyl Nitrate." *Zhur. Russ. Fiz.-Khim. Obshchestva* **42**, 570-81(1910).

$\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ loses H_2O in the desiccator changing to $\text{UO}_2(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}$. Contrary to Zimmermann's statement U_3O_8 produced by calcining the hydrates of $\text{UO}_2(\text{NO}_3)_2$ hardly loses any O_2 even upon prolonged calcination. At 100° $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ loses H_2O very slowly, the loss after 2 weeks amounting to 4 to 4.5 mols. H_2O ; at the same time there is a loss of HNO_3 at this temp. $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ m. 60.2° changing to $\text{UO}_2(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$ which seps. out, but redissolves at 75°. On further heating the molten salt loses HNO_3 leaving a basic salt completely sol. in H_2O with a yellow color, but without fluorescence. If $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ be kept for some time at a little above its m.p., it changes to $\text{UO}_2(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}$. $\text{UO}_2(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$ can be obtained in monoclinic crystals by recrystn. of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ from HNO_3 (1.4) in a desiccator; some of the crystals resemble gypsum; it m. 121.5° changing to $\text{UO}_2(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$. The latter can be obtained in thick fluorescent green rhombs by recrystn. of $\text{UO}_2(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$ from HNO_3 (1.502); it m. 179.3° without decompn. $\text{UO}_2(\text{NO}_3)_2 \cdot 1.5\text{H}_2\text{O}$ does not exist. The cryohydrate of $\text{UO}_2(\text{NO}_3)_2$ is formed at -18.1° and contains 54.9% $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ corresponding to $\text{UO}_2(\text{NO}_3)_2 \cdot 28.93\text{H}_2\text{O}$. The % soly. of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ at various temps., calcd. for the anhyd. salt is as follows, these values being followed by the number of moles H_2O for 1 mole $\text{UO}_2(\text{NO}_3)_2$: -18.1°, 43.12, 28.93; -12.1°, 45.33, 26.20; -2.2°, 48.77, 23.01; 0°, 49.46, 22.38; 5.5°, 50.55, 21.42; 12.3°, 52.88, 19.52; 21.1°, 55.98, 17.23; 25.6°, 57.17, 16.41; 36.7°, 61.27, 13.85; 45.2°, 65.12, 11.73; 51.8°, 67.76, 10.67. By extrapolation of this table we find in accord with the above statement that the cpd. of the satd. soln. at 75° would correspond to $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$. The following table gives the concns., calcd. for $\text{UO}_2(\text{NO}_3)_2$, of dil. solns. of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, the temps. at which ice seps. and the number of moles of H_2O in the soln. for 1 mole $\text{UO}_2(\text{NO}_3)_2$:

Temp.	-1.6°	-2.1	-2.9°	-4.4°	-6°	-7.9°	-11.2°	-18.1°
% $\text{UO}_2(\text{NO}_3)_2$	10.83	12.24	17.19	23.52	26.20	32.53	37.09	43.12
H_2O	180.34	157.05	105.52	71.22	61.70	45.43	37.15	28.93

This table can be used as material for detg. the variations in the degree of dissocn. of electrolytes. For detg. the mol. wt. of an electrolyte by the method of the lowering of the f.p. we have the well-known formula $M_1 = KGi/LT$, in which M_1 is the mol. wt. and G the wt. taken of the solute, K a const. depending on the nature of the solvent, L the wt. of the solvent, T the number of degrees by which the f.p. is lowered, and i the number of ions produced by the dissocn. of 1 mole of the solute. This formula is also applied to the data given.

- 1048 von Sensel, G. "Attempts to Separate Uranium and Uranium X by Electrolytic Methods and by Cathodic Disintegration." *Z. physik. Chem.* **71**, 563-70(1910).

The electrolytes from which the author attempted to sep. UX were uranyl oxalate, acetate, and nitrate are described. The voltages used varied from 0.05 to 1.5 v, and the time of electrolysis from 1 to 170 hrs. Cu-foil electrodes were used, one side being coated with paraffin wax. The activity of the deposit, which was slowly dried, was measured by means of a Schmidt-Kurz electrometer. In no case was pure UX obtained, although the amt. present in the deposit was generally in excess of the equil. quantity. With the oxalate electrolyte the excess was 7.1 to 14.1% with the acetate electrolyte, 4.3 to 4.5%. In the case of the nitrate electrolyte no excess of UX over the equil. quantity could be detected. In the expts. on cathode disintegration the discharge tube contd. a beaker-shaped hollow cathode, in which the material to be investigated was placed. Opposite the cathode was a Cu disk, the distance of which from the cathode could be varied. The material used was black U oxide, which had been well heated and compressed. It was found that the Cu disk became active when a discharge was passed through the tube, so that disintegration

of the U oxide undoubtedly took place. Continuous observation over a period of 43 days showed that the activity remained const., the U and UX being present in the equil. quantity. UX cannot, therefore, be obtained pure, either by electrolysis or by cathodic disintegration.

- 1049 West, A. P. and Jones, H. C. "The Conductivity, Dissociation and Temperature Coefficients of Conductivity at 35°, 50°, and 65° of Aqueous Solutions of a Number of Salts." Am. Chem. J. **44**, 508-44(1910).

Measurements are recorded of the cond. of solns. of $\text{UO}_2(\text{OAc})_2$ at 35°, 50°, and 65°.

PUBLICATIONS LOCATED IN 1911

- 1050 Antonov, G. N. "The Disintegration Products of Uranium." Phil. Mag. (6), **22**, 419-33(1911). When UX is sepd. by a Ba method and by a ferric method, the rate of decay of the unscreened product is not the same. The decay curve of the product sepd. by the ferric method shows a greater initial drop which is probably due to a product which he calls U_γ having a half-period of 1.5 days. It could not be completely sepd. from UX. It emits β rays and α rays, the presence of latter being detd. by measuring the scintillations over a 3-day period; the half life was 1.5 days. U_γ is not an intermediate product between U and UX but a lateral disintegration product. The quantity is small compared with UX.

- 1051 Barthe, L. "Uranyl and Amine Phosphates." Compt. rend. **152**, 1396-7(1911). Phosphates of UO_2 and Me, Et, and trimethylamine were obtained by satg. a soln. of H_3PO_4 with the amine and adding, drop by drop and with constant stirring, a soln. of $\text{UO}_2(\text{OAc})_2$. In each case a homogeneous, pale-yellow, colloidal ppt. is obtained, which settles very slowly. This is washed repeatedly, by decantation, first with H_2O satd. with the amine, and then with alc. The ppt. is colloidal even when formed in boiling soln. The following formulas are assigned: $\text{CH}_3\text{NH}_3\text{UO}_2\text{PO}_4$; $\text{C}_2\text{H}_5\text{NH}_3\text{UO}_2\text{PO}_4$; and $(\text{CH}_3)_3\text{NHUO}_2\text{PO}_4$. These are very stable cpds., do not dissoc. at 100°, and the compn. is independent of the concn. of the original substances from which they are formed.

- 1052 Becquerel, J. "The Duration of Phosphorescence of Uranyl Salts." Compt. rend. **152**, 511-13 (1911). Certain $(\text{UO}_2)^{+2}$ salts are examined to ascertain whether the duration of their phosphorescence is independent of temp. The simple or double acetates, tartrates, oxalates, follow the usual rule, having much longer phosphorescence at low than at ordinary temps. Other salts such as chloride and autunite, are a little more persistent at the temp. of liq. N_2 than at ordinary temps. On the other hand, the sulfates (simple and double) and the nitrate do not show any change in the duration of the emission with change of temp. The sulfates are perhaps a little more luminous at low temps., but the nitrate behaves in a similar manner under all temp. conditions, the light emitted undergoing change neither in intensity nor duration.

- 1053 Berthelot, D. and H. Gaudechon. "Photolysis of Complex Acids by Ultraviolet Rays. Action of Uranium Salts as Luminous Catalyzers." Compt. rend. **152**, 262-5(1911). Under the influence of ultraviolet rays, dibasic acids of a normal series split up into a monobasic acid and CO_2 . Oxalic acid gives HCOOH and CO_2 ; malonic acid AcOH and CO_2 ; similar results are found with succinic and adipic acids. When the action is prolonged the decompn. products may also undergo a partial photolysis. In aq. soln. the dibasic acids give the same products and the authors conclude that whatever may be the physical state of a substance (solid, liq., gas, or dissolved) its mode of decompn. by ultraviolet rays is the same. With maleic and fumaric acids the gas obtained is made up to 90% CO_2 and 10% CO , indicating a decompn. of the acrylic acid formed. Maleic acid (with the COOH groups in the cis position) gives five times as much gas as fumaric acid. (COOH groups in the trans position), α - and β -ketonic acids show the same behavior as when heated, breaking up into an aldehyde or ketone with loss of CO_2 . Levulinic acid gives a mixture of CO_2 , CH_4 , and CO ; lactic acid CO_2 , CO , H_2 , and CH_4 . Finally the effect of a number of radioactive and fluorescent substances on the photolysis has been investigated. Fluorescent substances appear to inhibit the photolysis while U salts exert a catalytic action.

- 1054 Brown, J. N. "Rate of Emission of Alpha Particles from Uranium and Its Products." Proc. Roy. Soc. (London), A. 84, 151-4(1911).

The total number of α particles emitted by a known wt. of pitchblende in the form of thin films was detd. by the scintillation method. The U content of the pitchblende was also detd., and from these data it was calcd. that 7.36×10^4 α particles are emitted/sec/g of U in equil. with its products. Rutherford has shown that 1 g Ra in equil. with RaA, B, and C, emits 13.6×10^{10} α particles/sec. This includes 4 α -ray changes. There are in addn. 2 changes in U, 1 in Ionium, and 1 in Po, making four more, and bringing the total to 27.2×10^{10} /sec/g of Ra, or $27.2 \times 10^{10} \times 3.4 \times 10^{-7}$ /g of U, or 9.25×10^4 which is in fair agreement with the above result.

- 1055 Bruner, L. and Kozak, J. "On the Knowledge of Photocatalysis. I. The Light Reaction in Mixtures: Uranium Salts + Oxalic Acid." Z. Elektrochem. 17, 354-60(1911).

In the photolytic reaction between uranyl salts and $\text{H}_2\text{C}_2\text{O}_4$, the presence of a small amt. of HNO_3 or HCl produces no change in the reaction nor its velocity. The effect of the concn. of the uranyl salt and $\text{H}_2\text{C}_2\text{O}_4$ and that of introducing absorbers between the light source and the reaction vessel are investigated. It is stated that the temp. has almost no effect on the velocity. Studies are reported between 4° and 80°.

- 1056 Brüninghaus, L. "On Stokes Law and a General Relation between Absorption and Phosphorescence." Compt. rend. 152, 1578-80(1911).

It is reported that Stokes law is valid for uranyl salt in its most general form. The fluorescence spectrum in contrast to the absorption spectrum is displaced to the long wavelength. Brief information on the characteristics of the fluorescence and absorption spectra for $\text{UO}_2(\text{NO}_3)_2$ is given.

- 1057 Butavand, F. "Note on the Subject of Absorption of Secondary Rays from Cathode Rays." Ann. chim. phys. (8), 24, 421-32(1911).

The mass absorption coeff. of U for β rays was found to be 10.1.

- 1058 Chauvenet, E. "A General Method of Preparing Anhydrous Chlorides." Compt. rend. 152, 87-9 (1911).

The author extends his method of preparing anhyd. ThCl_4 to the prepn. of chlorides of V, W, Ta, Ti, Zr, Th, Zn, Ba, Mg, Zn, Be, Al, Fe, Cr, Mn, Ni, U, Ce, Y, and La. The temps. used ranged between 450 and 650°. Usually the highest chloride was formed, oxychlorides being exceptional. The chlorinating power of COCl_2 (as in all the modifications of Oerstedt's method) is inferior to that of the mixture of C and Cl_2 , evidently because the decompn. of COCl_2 is endothermic. The advantages of this method are the satisfactory yield of chloride as well as the ease of manipulation.

- 1059 Christian, H. A., Smith, R. M., and Walker, I. C. "Experimental Cardiorenal Disease." Arch. Internal Med. 8, 468-551(1911).

The paper reports studies of acute nephritis induced by U poisoning in rabbits. The kidney injuries induced by the poison are discussed in both the early and late stages. This is an extensive study with U poisoning examined in detail.

- 1060 Crymble, C. R. "The Relation between the Absorption Spectra of Metallic Ions and Their Valency." Proc. Chem. Soc. (London) 27, 68(1911).

This is an abstract of paper presented and later published in J. Chem. Soc. 101, 266-73(1912).

- 1061 Ebler, E. "On General Separation Method without the Use of Hydrogen Sulfide." Z. anal. Chem. 50, 603-09(1911).

The pptn. of the sulfide group elements, when U is present, can be done with hydroxylamine or hydrazine. U is the only metal remaining in soln. and is detd. in the usual manner after the complex is decompd. with Br_2 or fuming HNO_3 .

- 1062 Egerton, A. C. G. "Tribo Luminescence of Uranium." Nature **85**, 308(1911). Crystals of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ show a light-greenish-yellow triboluminescence. The author disagrees with earlier writers which report no triboluminescence for crystals of uranyl acetate. The triboluminescence reported for UO_3 by Rudge is said to be characterized as an oxidation phenomenon. A discussion is included on the oxidation of U powder and upon the burning of U powder in flames.
- 1063 Eisenbrey, A. B. "A Study of the Elimination of Phenolsulphonephthalein in Various Experimental Lesions of the Kidney." J. Exptl. Med. **14**, 462-75(1911). It is reported that the removal of injected phenol red from the blood varies in the same direction as the urine flow when the subject has been poisoned with U. A transitory increase in the elimination of the dye was found in the U-poisoned animals followed by a progressive decrease.
- 1064 Exner, F. and Haschek, E. Die Spektren Der Elemente bei normalen Druck. Leipzig-Vienna, 1911. Vol. II, p. 282 contains information on the identification of several hundred lines in the U arc spectrum between 6827 and 2264 Å. Page 256, identifies 93 lines in the arc spectrum of U between the wavelengths of 2209 and 374 Å.
- 1065 Foch, A. "Measurement of the Range of the Alpha Particles of Uranium by the Method of Scintillations." Radium **8**, 101-04(1911). A spherical glass balloon of 48 mm radius is coated on the inside with a thin film of the U acetate. Exactly in the center of the flask was placed a button of ZnS and outside the flask a telescope through which the no. of scintillations could be observed. The no. of scintillations was zero at 42 cm Hg. The range of the α particle of U in air at atmospheric pressure is then 2.68 cm.
- 1066 Friedmann, F. "Ranges of α Particles from Uranium." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse. Abt. IIa **120**, 1361-71(1911). From the shape of the absorption curve (A1) for the α particles from a thin film of U_3O_8 under various exptl. conditions, it is deduced that U emits two sets of α particles whose ranges are calcd. to be 1.6 cm and 2.7 cm resp. [in air?].
- 1067 Grunbaum, —. "The Work of the Physikalisch-Technischen Reichsanstalt in 1910." Elektrotech. Z. **32**, 829(1911). An investigation of the narrowest bands of the spectrum of Fe, Ni, Mo, Pd, Si, Fe, U, and W was made using the Wehnelt cathode.
- 1068 Grunbaum, —. "The Work of the Physikalisch-Technischen Reichsanstalt in 1910." Electrician **67**, 818(1911). This paper contains information similar to that reported in Elektrotech. Z. **32**, 829(1911).
- 1069 Ibbotson, F. and Clark, S. G. "The Volumetric Determination of Uranium." Chem. News **103**, 146-7(1911). Pour the soln. of uranyl sulfate contg. 2 to 5% by vol. of free H_2SO_4 into a flask contg. about 50 g of pure, finely divided and amalgamated Zn (20 to 30 mesh) and heat until a dark-brown color is developed. Cool the flask rapidly under a stream of H_2O , and then pour the cold soln. through a small pulp filter, wash with cold water, aspirate air through the filtrate for a min, and titrate with KMnO_4 . A detn. can be made in 15 min. Since uranyl solns. are not reduced by SO_2 , Fe^{+3} may be reduced and titrated when present.
- 1070 Jackson, D. E. and Mann, F. C. "Pharmacological Action of Uranium." Indiana Univ. Studies **8**, 2-15(1911).

Intravenous injection of a soln. of Na uranyl tartrate into dogs did not produce any marked increase in the rate of lymph flow from the thoracic duct. The action of this salt differs from that of cyanides in that it produces a more pronounced and prolonged rise in blood pressure, and a much smaller action on the respiration. The method by which U prevents coagulation of the blood appears to be different from that exercised by most other substances, and probably consists in the formation of a combination between the metal and those proteins of the blood which are essential for the process of coagulation. The addition of thrombokinase, fibrin ferment, or CaCl_2 to blood previously treated with Na uranyl tartrate does not cause clotting to occur, nor is it possible to bring about coagulation in such blood by pptg. the U with Na_2HPO_4 . The U cpd. differs further in its action from the cyanides, in that it does not form chem. combinations with hemoglobin and methemoglobin, and does not produce a similar inhibition of the decomp. of H_2O_2 by blood, or of the oxidation of guaiacum tincture by potato extr.

- 1071 Jones, H. C. and Strong, W. W. The Absorption Spectra of Solutions. Washington, Carnegie Institution, 1911. (Publication No. 160)

This is a comprehensive paper on the subject containing a large amt. of data on U salts in soln.

- 1072 Jones, H. C. and Strong, W. W. "Absorption Spectra of Certain Salts of Cobalt, Erbium, Neodymium, and Uranium, as Affected by Temperature and by Chemical Reagents." Am. Chem. J. 45, 1-36, 113-59(1911).

This is a very lengthy, two-part paper of considerable value. With the exception of $\text{UO}_2(\text{NO}_3)_2$ in water, which gives a spectrum differing widely from that of other uranyl salts, it is found that the spectra are dependent to a far smaller extent on the nature of the acid radical than on the nature of the solvent. This is attributed to the association of the colored cation with mols. of the solvent in accordance with the theory put forward by Kohlrausch for aq. solns. Sometimes the bands can be subdivided by change of solvent or addn. of various agents, e.g., changes are produced in the case of 6 bands near 5000 A produced by uranyl salts in acetone, several of which become doublets or triplets when HCl is added.

- 1073 Jones, H. C. and Strong, W. W. "Selective Oxidation." Am. Chem. J. 45, 36-8(1911).

If UBr_4 is dissolved in a mixt. of H_2O and MeOH, 2 sets of absorption bands are obtained, the "water bands" and the "methyl alc. bands." If NaClO_4 or $\text{Ca}(\text{NO}_3)_2$ is added to this soln., the "water bands" disappear, while the "methyl alc. bands" are not affected. H_2O_2 , however, causes the disappearance of both sets of bands. Similar phenomena were observed with UCl_4 . The authors conclude that NaClO_4 and $\text{Ca}(\text{NO}_3)_2$ oxidize the "hydrated" but not the "alcoholated" salt.

- 1074 Jorissen, W. P. and Trivelli, A. P. H. "The Metallic Uranium of Commerce." Chem. Weekblad 8, 59-62(1911).

U quickly powd. and brought to red heat to expel absorbed gases and then heated in vacuum is shown to give off CO_2 (0.40 and 1.25% in two cases cited) and N_2 (0.94 and 0.92% in same cases). The former amt. of N_2 contained as U_3N_4 would be equal to 12.9%. The powdering in a porcelain mortar especially if many sparks are formed, increases the C content and Moissan found that the carbide reacted with H_2O , if present, giving CH_4 , C_2H_4 , and C_2H_2 and, hence, the odor noticed.

- 1075 Lancien, A. "New Double Uranium Nitrates." Bull. sci. pharmacol. 18, 213-16(1911).

$\text{UO}_2(\text{NO}_3)_2 \cdot \text{Cd}(\text{NO}_3)_2 \cdot 30\text{H}_2\text{O}$ as yellow, long, flat crystals, loses $10\text{H}_2\text{O}$ over H_2SO_4 , loses $22\text{H}_2\text{O}$ at 100° , and become anhyd. at 125° . $10\text{Ni}(\text{NO}_3)_2 \cdot 3\text{UO}_2(\text{NO}_3)_2$ forms as yellowish-green needles. $\text{Rh}_2(\text{NO}_3)_6 \cdot 2\text{UO}_2(\text{NO}_3)_2 \cdot 10\text{H}_2\text{O}$ forms as orange, mica-like plates, loses $5\text{H}_2\text{O}$ in a vacuum and becomes anhyd. at 125° .

- 1076 Lebeau, P. "The Formula of Uranium Carbide." Compt. rend. 152, 955-8(1911).

Moissan assigned the formula U_2C_3 . The author finds the cpd. more nearly to agree with the formula UC_2 , and ascribes Moissan's error to the lack of uniformity of product and the fact that the C content of the carbide was evaluated from the total C and the graphite, while the U content was detd. by difference. In this work the carbide was treated with HNO_3 , the residual graphite heated to 400° and weighed, while the U was pptd. from the soln. by NH_4OH and weighed as U_3O_8 . UC_2 in its formula and in its decompn. products with H_2O resembles the rare-earth carbides, especially that of Th.

- 1077 Lebeau, P. "Uranyl Nitrate and the Nature of Its Ethereal Solution." Compt. rend. 152, 439-41(1911).

In spite of the great soly. of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ in Et_2O there is not only no lowering of temp. but actually a rise, which would indicate that actual combination with Et_2O takes place. When this salt is dissolved in ether, H_2O seps. out, contg., at 7° , 62.5% of the salt, while the Et_2O soln. contains 59%. The Et_2O soln., when dried over $\text{Ca}(\text{NO}_3)_2$ and then cooled to -70° , yields a well crystd. cpd. containing ether. The latter, when melted and kept at -10° , gives another cpd. Both of these give up all of their Et_2O at ordinary temp. in a stream of dry air, and leave a residue of $\text{UO}_2(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}$. We have here a hydrated salt which, in a nonaq. soln., retains its H_2O in the presence of a dehydrating agent.

- 1078 Lebeau, P. "Uranyl Nitrate and the Nature of Its Ethereal Solution." Bull. soc. chim. France, (4), 9, 295-7(1911).

This paper contains information similar to that reported in Compt. rend. 152, 439-41(1911).

- 1079 Lebeau, P. "The Hydrates of Uranyl Nitrate." Bull. soc. chim. France, (4), 9, 298-300(1911).

This is a brief review of the work on the dehydration of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, and a confirmation of the results obtained by Loewenstein and Vasilev. The trihydrate may also be obtained by dehydrating $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ over H_2SO_4 at ordinary temp. and pressure, or in a vacuum in the presence of CaO , while $\text{UO}_2(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}$ may be obtained by dehydrating the hexahydrate in a vacuum over conc. H_2SO_4 .

- 1080 Lenz, W. and Schoorl, N. "Microchemical Reaction of Sodium." Z. anal. Chem. 50, 263-5(1911). A method for the quant. micro analysis of Na is based on the prepn. of Na uranyl acetate. The detection of about 0.8 γ of Na is reported.

- 1081 Marckwald, W. and Russell, A. S. "On the Radium Content of Some Uranium Ores." Ber. 44, 771-5(1911).

A number of U ores of the autunite, carnotite, and pitchblende types were investigated. It is also reported that UO_2CO_3 cannot be prepd. synthetically by the heating of the double ammonium salt.

- 1082 Marckwald, W. and Russell, A. S. "On the Radium Content of Uranium Ores." Jahrb. Radioakt. Elektronik 8, 457-70(1911).

Pitchblendes, thorianite, plumboniobite, autunite, carnotite, and rutherfordine were investigated.

- 1083 Nichols, E. L. and Merritt, E. "Studies in Luminescence. XVI. Fluorescence and Absorption of Certain Uranyl Salts." Phys. Rev. (1), 33, 354-78(1911).

The chief purpose of the investigation was to det. whether the different bands of the luminescence spectrum are to be regarded as independent bands, each with its own region of excitation, or form a connected series, such that the excitation of one band necessarily involves the excitation of all. In all the salts studied the general appearance of the luminescence spectrum was much the same, although the bands differed somewhat in width in different salts. The luminescence spectra of different salts appeared to differ from one another chiefly as the result of a shift of the spectrum as a whole. In all cases the bands in the intermediate region of the spectrum were stronger than those toward the extremities. The distribution of energy among the different bands of the series in the uranyl salts seems to be very similar to the distribution of energy in a single band of a luminescent substance like fluorescein or Sidot blende. The distribution of energy in a single band is very similar to the distribution among the several bands. It is known that the width of each of the uranyl bands depends upon the temp., the bands being almost as narrow as lines at the temp. of liq. air, and about 100 Å in width at room temp. It seems probable that at still higher temps. this broadening would continue, and that finally the series of bands would overlap to such an extent as to appear as a single band. The relative intensities of the different bands were detd. for several salts by the authors, and the results are given. It seems clear that the law of distribution of energy among the bands is much the same for all of the salts studied. The shift in wavelength of the bands in passing from one salt to another does not appear to bear any simple relation to the mol. wt. of the salt or of its acid component. In comparing, however, the anhyd. and the cryst. nitrate, a slight shift

toward the longer waves is found in the latter. This seems reasonable on account of the added wt. of the water of crystn. Measures were made of the intensities of the three brightest bands for excitation by different ultraviolet lines of the quartz mercury lamp, in order to test whether wavelengths might be found which would excite one band and not the rest. The results indicate that the first effect of excitation, whatever the wavelength of the exciting light, is to produce all the bands with a definite and const. intensity distribution, such variations as were found being attributable to selective absorption by the salt. Expts. were made on uranyl potassium sulfate to det. the relative effectiveness of different wavelengths in producing fluorescence, and particularly whether rays falling within the sharp absorption bands at 4918, 4760, and c., were specially effective. It is clear that the ability to excite luminescence is not confined to rays falling within the narrow absorption bands, but extends to the region of general absorption lying between. Both the fluorescence and absorption bands of uranyl salts show a slight shift in wavelength with temperature. New bands, not seen at ordinary temp., become easily observable at the temp. of liq. air. At low temp. the fluorescence and absorption bands appear much sharper than at ordinary temp., but in the case of the absorption bands there is some doubt as to whether the narrowing is as great as appears to the eye. In 1885 H. Becquerel published wavelengths for U nitrate indicating that the freq.-difference is const. throughout the series of luminescence bands, and remains const. in passing from the luminescence to the absorption spectrum; thus, bearing out E. Becquerel's suggestion that the absorption and emission bands belong to the same series. H. Becquerel also showed that two of the bands were reversible. The authors' work with the K uranium sulfate confirms H. Becquerel's conclusions so far as the existence of reversible bands is concerned, and they find a third such band. They also find the freq. increment for the luminescence bands to be very nearly const. But this increment does not appear to have the same value for the absorption bands as for the luminescence bands, and there is thus a distinct break in the series in passing from luminescence to absorption. Uranyl sulfate has the peculiarity of possessing two series of fluorescence bands lying close together, one set much more intense than the other. The absorption bands are also double, but it is curious to note the stronger components lie to the left (shorter wavelength) in the absorption series, whereas they lie to the right in the luminescence series.

1084 Oechsner de Coninck, F. W. "A Determination of the Molecular Weight of Uranium Oxide." Compt. rend. 152, 711-12(1911).

The author has made a few detns. of the mol. wt. of UO_2 by reducing UO_2Cl_2 with H_2 according to the equation $\text{UO}_2\text{Cl}_2 + \text{H}_2 \rightarrow 2\text{HCl} + \text{UO}_2$. Five detns. gave a mean value of 270.07.

1085 Oechsner de Coninck, F. W. "Determination of the Molecular Weight of Uranous Oxide." Compt. rend. 152, 1179(1911).

Pure $\text{UO}_3 \cdot \text{H}_2\text{O}$ was reduced with H_2 at a bright-red heat. Using 238.5 as the at. wt. of U and 304.5 as the mol. wt. of $\text{UO}_3 \cdot \text{H}_2\text{O}$, the means of 5 detns. gave 270.66 as the mol. wt. of UO_2 , the theoretical value being 270.5.

1086 Oechsner de Coninck, F. W, and Raynaud, A. "Uranic Hydroxide." Compt. rend. 153, 63-4(1911). $\text{UO}_3 \cdot 2\text{H}_2\text{O}$ on being slowly heated, gradually loses 1 mole H_2O , the color passing from pale-yellow to orange-yellow. The second mole H_2O is not lost except at a much higher temp., when the cpd. also begins to lose O_2 . The mol. wt. of UO_2 was detd. from the ratio $\text{UO}_3 \cdot 2\text{H}_2\text{O} : \text{UO}_2$, the reduction being accomplished by heating the dihydrate to redness in a stream of H_2 . The mean of 5 detns. gave 270.46 as compared with the calcd. value of 270.5 ($\text{U} = 238.5$).

1087 Oechsner de Coninck, F. W. and Raynaud, A. "On Several Reactions of Calcium Oxalate." Bull. soc. chim. France (4), 9, 301-06(1911).

$\text{UO}_3 \cdot \text{H}_2\text{O}$ is reported to react at dull-red heat according to the equation $\text{CaC}_2\text{O}_4 + \text{UO}_3 \cdot \text{H}_2\text{O} \rightarrow \text{CaCO}_3 + \text{CO}_2 + \text{UO}_2 + \text{H}_2\text{O}$. When U_3O_8 is heated to redness with excess CaC_2O_4 , UO_2 will be obtained. The formation of UO_3 could not be detected.

1088 Raynaud, A. "Solubility of Uranous Oxide in Several Acids." Compt. rend. 153, 1480-2(1911). Soly. by wt. in HCl, HBr, H₂SO₄, HNO₃, HOAc, and aqua regia are reported to be UO₂ : acid, 1 : 3100, 1 : 4650, 1 : 2200 (66° Bé.), 1 : 8 (36° Bé.), 1 : 12000, and 1 : 29.6. All values are at temps. near 18°C. The UO₂ was obtained by calcining UO₂C₂O₄, which had been purified by several crystns., in a closed crucible.

1089 Rudge, W. A. D. "Triboluminescence of Uranium." Nature 85, 207(1911). When a bottle of metallic U is shaken, a considerable luminescence is produced; the same was observed, but to a much smaller degree, with the nitrate and yellow oxide, while the black oxide and sodium uranate do not give it. A. C. G. Egerton (Nature 85, 308(1911)) points out that Moissan first directed attention to the pyrophoric properties of metallic U, the luminosity being due to oxidation, and not being exhibited in an atm. of H₂. The luminescence of U nitrate when shaken is, however, unabated in H₂ and is true triboluminescence.

1090 Ruff, O. and Goecke, O. "On the Smelting and Evaporation of Our So-Called Highly Refractory Material." Z. angew. Chem. 24, 1459-65(1911).

The m.p. of U is reported to be 2176° in N₂ atm. and of UC₂ 2200° as measured optically in a vacuum oven, or 2260° as measured in a cathode-ray oven.

1091 Sabatier, P. and Mailhe, A. "On the Catalytic Decomposition of Formic Acid." Compt. rend. 152, 1212-15(1911).

When UO₂ is heated to 230° with formic acid, the acid is catalytically decompd. A number of other catalysts were tested.

1092 Samsonow, A. "A New Uranium Colloid." Z. Chem. Ind. Kolloide 8, 96(1911).

By electrolysis of a soln. of UO₂Cl₂ a black ppt. forms, sol. in H₂O and shows the Brownian motion when freshly dissolved. The colloid is attracted to the neg. pole of a battery and is pptd. by neutral electrolytes though not by acids. Analysis shows it to consist entirely of UO₂. Reduction of UO₂Cl₂ by Zn or Cu in dil. HCl soln. gives the same colloidal soln.; reduction of the sulfate fails, probably because of the soly. of the colloid in H₂SO₄.

1093 Siemssen, J. A. "A Reaction for Uranium Salts." Chem. Ztg. 35, 139(1911).

A soln. of commercial ethylenediamine added to U soln. produces at once a bright-yellow cryst. ppt., sol. in an excess of the reagent. The reaction is at least as delicate as the ferrocyanide or the H₂O₂ tests.

1094 Siemssen, J. A. "A Reaction for Uranium Salts." Chem. Ztg. 35, 752(1911).

The ppt. obtained when 10% ethylenediamine soln. is added to a soln. of a U salt settles rapidly, is easily filtered, is insol. in Me₂CO, PhH, Et₂O, EtOH, C₅H₁₁OH, CHCl₃, CS₂, MeOH, PhMe, PhEt, and petroleum ether. The ppt. can be washed with cold H₂O, ignited moist in Pt, weighed as U₃O₈. The soln. should be fairly concd., otherwise the ppt. is gelatinous. Other metals give ppts. with the same reagents. No results are given.

1095 Southern, L. "A Determination of the Ratio of Mass to Weight for the Radioactive Substance." Proc. Roy. Soc. (London), A 84, 325-44(1911).

A new form of rigid pendulum with two fixed knife-edges was constructed in such a way that the change from one knife-edge to the other could be made without in any way handling the pendulum or opening the case in which it was enclosed. The bob of this pendulum was filled with red lead or with 1015 g U₃O₈, to which was added a little MgO, to render it similar to red lead in packing properties. Its time of swing was compared with that of a standard pendulum by a flashing method susceptible of great accuracy. The results indicate that the ratio of mass to wt. for U₃O₈ does not differ from that of Pb oxide by more than 1 part in 200,000.

1096 Strecker, W. and Schiffer, P. "On the Titration of Phosphate." *Z. anal. Chem.* 50, 495-9(1911). The detn. of $(\text{PO}_4)^{-3}$, using U soln., is discussed. The results of a number of trials are given and they are compared with other analytical methods.

1097 Trautmann, W. "The Analysis of Ferrouanium." *Z. angew. Chem.* 24, 61-2(1911). 0.4-0.6 g of the alloy is dissolved in aqua regia, which may require 3 hrs. The soln. is dild. without regard to any SiO_2 which may sep. and is neutralized with a large lump of $(\text{NH}_4)_2\text{CO}_3$. After standing for 24 hrs with frequent stirring, the Al, Fe, and SiO_2 are filtered off and the filtrate is boiled for some time, which ppts. most of the U. By adding a few drops of NH_4OH to the slightly acid filtrate, the remaining U is pptd. and after washing with weakly ammoniacal NH_4NO_3 soln., both ppts. are ignited in porcelain to U_3O_8 . C is detd. by combustion in O_2 as usual. To det. Si the alloy is dissolved in aqua regia, and several evaporations with HCl are carried out as usual. A common impurity is Al, which is detd. by fusion of the powd. alloy with Na_2O_2 , pptn. by NH_4OH of SiO_2 and Al from the ext., and sepn. of these by HF or H_2SO_4 . No control analyses are given.

1098 Vanino, L. "Action of Acetic Anhydride on Uranium Nitrate." *Chem. Ztg.* 35, 1005-06(1911). $\text{UO}_2(\text{NO}_3)_2$ reacts with Ac_2O with evolution of NO_2 . The course of the reaction varies with the amt. of Ac_2O used. A yellow liq. is formed when a small amt. is used, while anhyd. $\text{UO}_2(\text{AcO})_2$ seps. as a yellow cryst. powder, when 20 cc of Ac_2O is added to 25 g of $\text{UO}_2(\text{NO}_3)_2$. The reaction depends on the presence of AcOH as an impurity in the Ac_2O which liberates HNO_3 . Small amts. of other acids, as HCl, produce the same results. Other nitrates as $\text{Pb}(\text{NO}_3)_2$, $\text{Th}(\text{NO}_3)_4$, and $\text{Tl}(\text{NO}_3)_3$ react slowly.

1099 Vasil'ev, A. M. "Investigation of Uranyl Salts. III. Index of Refraction and Specific Gravity of Solutions of Uranyl Nitrate." *Zhur. Russ. Fiz.-Khim. Obshchestva* 43, 1183-4(1911). The % of solns. of $\text{UO}_2(\text{NO}_3)_2$, n_D and d_{17}^{17} are, resp., 54.77, 1.41155, 1.7536; 53.91, 1.40843, 1.7480; 52.04, 1.40511, 1.7118; 49.92, 1.39889, 1.6506; 47.94, 1.39714, 1.6155; 44.02, 1.38974, 1.5275; 43.11, 1.38804, 1.5204; 39.73, 1.38272, 1.4669; 37.85, 1.37901, 1.4295; 34.88, 1.37489, 1.3939; 29.77, 1.36758, 1.3247; 25.58, 1.36158, 1.2599; 20.05, 1.354.2, 1.1983; 16.96, 1.25041, 1.1625; 14.26, 1.34675, 1.1299; 10.92, 1.34417, 1.1035; 5.73, 1.33869, 1.0510; 2.80, 1.33597, 1.0257. By interpolation of values formerly obtained for the soly. of this salt the compn. of its satd. soln. was found to be $\text{UO}_2(\text{NO}_3)_2 \cdot 18.08\text{H}_2\text{O}$.

1100 Winston, L. G. and Jones, H. C. "The Conductivity, Temperature Coefficients of Conductivity and Dissociation of Certain Electrolytes in Aqueous Solution from 0 to 35°. Probable Inductive Action in Solution, and Evidence for the Complexity of the Ion." *Am. Chem. J.* 46, 368-413(1911).

Molar conductivity in Hg units at 0, 12.5, 25, and 35° as well as temp. coeffs. for dilns. from 8:1 to 4096:1 are reported for uranyl acetate, chloride, nitrate, and sulfate.

PUBLICATIONS LOCATED IN 1912

1101 Acqua, C. "The Action of Uranium on the Vegetable Cell." *Arch. farmacol. sper.* 14, 81-4(1912). The author reports that U can be absorbed by certain cells of higher plants, in which it hinders karyokinesis, checking cell division. This influence is said to be considerable in the tissues of the root system, but much less so in the stem tissues on account of less ready absorption there. Th and Mn are said to show somewhat analogous properties, but the latter in much less degree and in a way more compatible with the development of the plant.

1102 Agulhon, H. and Sazerac, R. "Activation of the Bacterial Oxidation Processes by Uranium Salts." *Compt. rend.* 115, 1186-8(1912).

U salts in the proportion of 1/1000 stimulate vinegar fermentation. The organism studied was *Mycoderma aceti*. U acetate was used because it is very much less antiseptic than the nitrate. Similar results were obtained with the sorbose bacterium in its action on glycerol.

- 1103 Agulhon, H. and Sazerac, R. "Action of Uranium Salts on Certain Microorganisms." Bull. soc. chim. France (4), 11, 868-72(1912).

A. niger did not thrive well in media containing U nitrate and acetate. Yeast and acetic acid ferment were somewhat stimulated.

- 1104 Anderson, A. "A Copper-Zinc Uranium Oxide Cell Contact E.M.F." Proc. Phys. Soc. (London) 24, 102-06(1912).

The cell was designed for observing variations in atmospheric temp., humidity, and pressure. It is a Cu vessel containing a Cu plate on a Cu tripod; the plate is covered with U oxide to ionize the air, and a zinc plate rests above on a zinc fork. A pile of this type is also mentioned. The emf gradually falls from 0.73 to 0.625 v in 4 days and in 3 mos. to 0.34 v. The voltage increases with rising temp., the formula being $E = 0.27 + 0.002t$. E should vanish at -135°C , while the neutral point of Cu-Zn is -67°C . An explanation of the peculiarity on the electron theory is suggested.

- 1105 Andrews, L. W. "Asserted Explosivity of Uranyl Nitrate." J. Am. Chem. Soc. 34, 1686-7(1912). Apropos of a statement by Ivanov, the author describes, explosions he has experienced or produced with uranyl nitrate but attributes the phenomena to a substance produced from Et_2O and HNO_3 , since the explosive substance was formed when an aq. soln. of HNO_3 and $\text{UO}_2(\text{NO}_3)_2$ was shaken with Et_2O .

- 1106 Artmann, P. "Uranyl Iodate." Z. anorg. Chem. 79, 327-42(1912). $\text{UO}_2(\text{IO}_3) \cdot 2\text{H}_2\text{O}$ was obtained by adding KIO_3 to a hot or an acid soln. of UO_2NO_3 . It occurs in 2 polymorphous forms, one is obtained from acid soln. as rhombic prisms, stable form at ordinary temp., $d_{18} = 5.220$, 100 cc H_2O dissolve 0.1049 g at 18° ; the other obtained at the b.p. without addn. of acid, $d_{18} = 5.052$, soly. 0.1214 g in 100 cc H_2O at 18° , is transformed into the former in the presence of acid at ordinary temp. Sol. iodates, except $\text{KIO}_3(?)$, ppt. $\text{UO}_2(\text{IO}_3)_2 \cdot 2\text{H}_2\text{O}$, (soly. 0.2044 g in 100 cc H_2O at 18° , $d_{18} = 3.911$) from both dil. and concd. solns. in the cold. KIO_3 in large excess, or NaIO_3 in the presence of much KNO_3 , ppts. $\text{KUO}_2(\text{IO}_3)_3 \cdot 3\text{H}_2\text{O}$ as a clear yellow cryst. powder, $d = 3.706$.

- 1107 Auger, V. "A New Volumetric Determination of Uranium." Compt. rend. 155, 647-9(1912). U is usually detd. volumetrically by titration with KMnO_4 , but this method is not applicable in the presence of Fe or Ti. When Fe alone is present, U can be detd. by titration with a Fe^{+3} salt in acid soln., after reduction with amalgamated Zn, using KCNS as indicator. When both Fe and Ti are present a large excess of Na tartrate is added, the mixt. reduced with a Ti^{+3} salt, using nitroinduline as indicator. If the end-point is passed, Fe^{+3} can be added, but this part of the detn. must be carried on in an atm. of CO_2 . After exact reduction of the U, the Ti complex is broken up with a strong mineral acid, and the U titrated as before, using KCNS as indicator. Analytical results are given.

- 1108 Chapman, J. C. "Fluorescent Röntgen Radiation from Elements of High Atomic Weight." Proc. Roy. Soc. (London), A 86, 439-51(1912).

Early measurement on the L-level lines in the U and other x-ray spectra are reported. Absorption coeffs. in Al were measured. In the study of the U spectrum, powd. U oxide was used as the radiator.

- 1109 Colani, A. "Action of Acids on Uranous Oxide." Compt. rend. 155, 1249-51(1912). UO_2 was obtained by heating the pure green oxide in a current of H_2 , also by heating $\text{UO}_2\text{C}_2\text{O}_4$ in a current of H_2 at a lower temp. Obtained by the latter method, it was found to be more sol. in HCl than by the former. Both forms are slightly sol. in HCl if allowed to react a long time (2 to 28 weeks). The results obtained by Raymond are reported to be low because time of soln. was too short.

- 1110 Crymble, C. R. "The Relation between the Absorption Spectra of Metallic Ions and Their Valency." J. Chem. Soc. 101, 266-73(1912).

The term "nonabsorptive" is applied to all solns. when a N soln. transmits all rays of a wavelength greater than 2350 Å through a layer 10 mm thick. The metals which yield nonabsorptive salts are Li, Na, K, Rb, Cs, Mg, Ca, Be, Ba, Sr, Zn, Cd, Th, Al, and Zr. Those that are absorptive are Cu, Au, Ti, Ce,

V, Cr, U, Mn, Fe, Co, Ni, Pd, and Pt, which give visibly colored solns.; and Ag, Hg, Tl, Sn, Pb, Sb, and Bi, which give solns. that absorb the ultraviolet rays. The metals of the nonabsorptive group have a constant valency, while those of the absorptive group are of varying valency. The more electropositive metals are found to have a const. valency, and to form salts whose solns. are nonabsorptive.

- 1111 du Bois, H. "The Generalized Zeeman Effect in Selective Absorbents." Physik. Z. **13**, 128-36(1912).

This paper includes an investigation of the fluorescent spectrum of uranyl salts in the presence of a magnetic field.

- 1112 Fischer, A. "Electrochemistry of the Chromium Group. I. Tungsten and Uranium." Z. anorg. Chem. **81**, 170-208(1912).

A full description of app. and methods is given. A modification of the Wehnelt method of fusing pure metals in vacuo was used and purity-tested by analysis and microphotographs, of which a number are shown. Cond. measurements of the system U/UCl_4 in EtOH and LiCl were made at 18° with concns. ranging from 0.054 to 0.00042 M and the degree of dissocn. varying from 0.152 to 0.700. For U, $EP_{alc.} = 0.301$ v, hence $EP_{water} = 0.301 - 0.071$ or 0.230 v and U is placed between Cu and H. This figure (0.230) is tentative, although very nearly correct. The literature on electroanalysis of U salts is reviewed in detail. pH and decompn. voltages of $UO_2(NO_3)_2$ and $UO_2(OAc)_2$ in CH_3COOH and $(NH_4)_2CO_3$ solns. are calcd.

- 1113 Folin, O., Karsner, H. T., and Denis, W. "Nitrogen Retention in the Blood in Experimental Acute Nephritis of the Cat." J. Exptl. Med. **16**, 789-96(1912).

By using U, acute nephritis was produced in the cat. Marked blood nitrogen retention was noted.

- 1114 Freer, P. C. and Gibbs, H. D. "Sunlight." J. Phys. Chem. **16**, 709-38(1912).

Part II of this paper (p. 717-30) contains a discussion of the use of the photolytic reaction between $UO_2C_2O_4$ and $H_2C_2O_4$ as an actinometer.

- 1115 Geiger, H. and Nuttall, J. M. "Ranges of α -Particles from Uranium." Phil. Mag. (6), **23**, 439-45(1912).

Expts. are described which show that α particles of two different ranges are given off from pure U, the values found being 2.5 and 2.9 cm in air at atmospheric pressure and $15^\circ C$. The method used is to compare the Bragg ionization curves of U, Po and Ionium in H_2 , using a specially designed app. The curves of the two latter are exactly similar; the curve for U, however, has a less conspicuous "knee" indicative of two ranges. No evidence was obtained of α particles of range 1.6 cm as suggested by Friedmann. The above figure for the range of U, viz., 2.5 cm, is in much better agreement with the straight-line relation between the logs of the ranges and transformation consts. of the α -ray products of the U-Ra family. Hence, it is deduced that U_I , which has a period of 5×10^9 yrs and emits α particles of range 2.5 cm, is followed by another α -ray product U_{II} , which has a period of about 2×10^6 yrs and emits α particles of range 2.9 cm. These two substances must have chem. properties very closely allied.

- 1116 Glaser, F. "The Valuation and Technical Working-up of Uranium Mica." Chem. Ztg. **36**, 1166-7(1912).

The granites and micas of Portugal are considered. The valuation of autunite is based on its radioactivity and content of U, of micas contg. Cu, also on Cu content. The autunite studied varied in U_3O_8 content from 0.1 to 4.5%. The various acid and alk. methods of extrn. are discussed. Since in the presence of $(SO_4)^{-2}$ the soly. of Ra salts is notably increased by other substances, e.g., Fe_2O_3 salts, technical HCl can be used without loss of Ra for extg. the raw material. The concn. of autunite by mech. means (washing) is not practicable as its sp. gr. is too near that of the parent rock; the low content of U makes it unprofitable to ship crude ore and local conditions will det. feasibility of working up at quarry. (cf. Marckwald)

- 1117 Griffin, C. E. "Chemical Estimation of Uranium and Vanadium." Mining Eng. World **37**, 247-8(1912).

After the usual reduction of V by SO_2 and titration with KMnO_4 , both the V and U are reduced by an Al spiral, which is then removed, washed with Fe^{+3} alum soln., then with H_2O , and titrated with KMnO_4 , heating the soln. to 80° at the end and the U is calcd. from the difference between the two KMnO_4 values.

- 1118 Guggiari, P. B. "On Metal-Salt Precipitation by Hydroxyl-Containing Dyestuffs." Ber. **45** 2442-7(1912).

This paper reports the existence of the uranyl salt of 1, 4-dihydroxyanthraquinone otherwise known as quinizarine. The formula $\text{UO}_2\text{C}_{14}\text{H}_6\text{O}_2(\text{O})_2$ is suggested.

- 1119 Hardtung, H. Beiträge zur Kenntnis der Metallnitride. Dissertation, Univ. of Hannover, 1912. It is reported that U_3N_4 may be obtained by treating U metal powder with liq. NH_3 at 1000° .

- 1120 Harris-James, F. H. "Uranium: Its Discovery, Chemical Composition and Uses." J. Roy. Soc. Arts **60**, 1112-14(1912).

- 1121 Hartley, W. N. and Moss, H. W. "On the Ultimate Lines, and the Quantities of the Elements Producing These Lines, in Spectra of the Oxyhydrogen Flame and Spark." Proc. Roy. Soc. (London), **A 87**, 38-48(1912).

The lines 3102, 3090, and 3019 A were distinguished in the U spectrum by a special sensitivity, since they appeared after only one discharge when 0.000275 mg of metallic U was decompd. at the cathode. After five discharges, during which 0.001375 mg of U were decompd., the complete line spectrum (4300 lines) was observed.

- 1122 Howard, S. H. and Jones, H. C. "The Conductivity, Temperature Coefficients of Conductivity and Dissociation of Certain Electrolytes in Aqueous Solution at 35, 50, and 65° ." Am. Chem. J. **48**, 500-36(1912).

Molar conductivity in Hg units at 35, 50, and 65° , as well as the temp. coeff. for dilns. from 8:1 to 4096:1 are reported for uranyl acetate, sulfate, nitrate, and chloride.

- 1123 Ivanov, V. N. "Explosibility of Uranyl Nitrate." Chem. Ztg. **36**, 499(1912).

The phenomena of explosibility of uranyl nitrate was previously ascribed to radioactivity. The Ra content of the salt was negligible.

- 1124 Ivanov, V. N. "Explosiveness of Uranyl Nitrate." Zhur. Russ. Fiz.-Khim. Obshchestva **44**, 678-9(1912).

An old sample of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ exploded when dropped into a flask, or on the floor, or even into H_2O . Each explosion in the H_2O was accompanied by a flash of light. Freshly prepd. crystals of the salt also emit light when strongly shaken in a bottle or dropped on the floor, but do not explode. Radioactive substances could not be found in the explosive salt.

- 1125 Jones, H. C. and Strong, W. W. "The Absorption Spectra of Comparatively Rare Salts. The Spectrophotography of Certain Chemical Reactions, and the Effect of High Temperature on the Absorption Spectra of Nonaqueous Solutions." Am. Chem. J. **47**, 27-85, 126-79(1912).

This is a lengthy, two-part paper of considerable value. It is a record and discussion of the absorption spectra of solns. of salts of Nd, U, Dy, Sa, and Gd in H_2O , various alcs., and certain other org. solvents, at temps. extending up to 195° in some cases. The absorption bands widen with rise in temp. up to the highest temp. employed; colored solns., therefore, become more and more nearly opaque. On the other hand, a pressure of 200 atm. is altogether without effect on the absorption spectra of the solns. employed. A study was made of the effect of various oxidizing agents on solns. of uranous salts in various solvents (both single and mixed). When UCl_4 is dissolved in aq. alc., both the "alc." and the "water" bands come out simultaneously on the plate. A mild oxidizing agent oxidizes the "hydrated" portion, but

leaves the "alcoholated" salt unaffected; a strong oxidizing agent oxidized both portions to the uranyl condition. These observations indicate that each characteristic spectrum is evidence of the existence of an aggregate, which "may be assumed to consist of one or more mols. or ions of the dissolved salt and one or more mols. of the solvent." Finally the authors discuss the properties of these aggregates, and the bearing of the results in general on the theory of solvents.

- 1126 Jones, H. C. "Absorption Spectra and the Solvate Theory of Solution." Phil. Mag. (6), 23, 730-42(1912).

Pages 733-6 contain information on U cpds. The data are similar to those presented in Am. Chem. J. 47, 27-85, 126-79(1912) and elsewhere.

- 1127 Jones, H. C. "The Absorption Spectra of Solutions." Z. physik. Chem. 80, 362-77(1912). This paper contains information similar to that published in Am. Chem. J. 47, 27-85, 126-79(1912) and elsewhere.

- 1128 Kayser, E. "Influence of the Salts of Uranium on Alcoholic Ferments." Compt. rend. 155, 246-8(1912).

The salts of U behave toward sugar as toward yeast, and their toxicity is lessened by the presence of large masses of yeast. Small doses of the salts stimulate alc. fermentation.

- 1129 Kayser, H. Handbuch der Spektroskopie. Leipzig, Hirbel, 1912. A number of references on the emission spectra of U appear on p. 722 of vol. 6.

- 1130 Kratky, — and Bruckner, —. "Process for the Preparation of Cerium and Similar Metals and Their Alloys." Rev. électrochim. électromét. 6, 273-6(1912).

Such metals as Ce, La, Ti, W, Mo, U, V, etc., cannot be obtained as solids by the electrolysis of their salts because they are deposited in a finely divided state. They may be obtained, however, by electrolyzing a fused mixt. of salts of more electropositive metals and the metal chlorides. The liberated more electropositive metals then ppt. the Ce, etc. Fusion is not accomplished by direct heating because of the formation of oxides and carbides but by placing the contg. crucible inside a larger one filled with the same mixt. of salts as the smaller. The free metal being heavier than the salts sinks and may be drawn off by a pipe leading from the bottom of the interior crucible through the heating bath and the exterior crucible; the lower electrode is introduced through this pipe also. In addition to obtaining the solid metals, their alloys may also be obtained by adding a salt of the metal whose alloy is desired. Some of these have remarkable properties.

- 1131 Lebeau, P. "Decomposition of Uranyl Nitrate by Heat." Compt. rend. 154, 1612-14(1912). If $\text{UO}_2(\text{NO}_3)_2 \cdot \text{H}_2\text{O}$ is heated for some time at a temp. between 100 and 150°, decompn. into HNO_3 and $\text{UO}_3 \cdot \text{H}_2\text{O}$ occurs. If the temp. is rapidly raised the salt alters little until it m. ~180° to a golden yellow liq., from which, when slowly cooled to 160°, orange-red tinted crystals sep. At 170° these crystals became yellow like those formed by rapid cooling of the fusion. Above the m.p. the salt loses HNO_3 , but remains liq. up to 245°, where the decompn. becomes rapid with evolution of nitrous vapors and the formation of a yellow ppt., a mixt. of UO_3 and $\text{UO}_3 \cdot \text{H}_2\text{O}$. The author thinks that above the m.p., the salt is partly changed to anhyd. nitrate whose decompn. is superimposed on that of the hydrate.

- 1132 Lebeau, P. "Decomposition of Uranyl Nitrate by Heat." Bull. soc. chim. France (4), 11, 737-40(1912).

This paper contains information similar to that reported in Compt. rend. 154, 1612-14(1912).

- 1133 Lebeau, P. "New Determination of the Atomic Weight of Uranium." Compt. rend. 155, 163-6(1912).

$\text{UO}_2(\text{NO}_3)_2$, prepd. from 2 different sources, was purified by repeated fractional crystn., the $\text{UO}_2(\text{NO}_3) \cdot 6\text{H}_2\text{O}$ obtained changed to the dihydrate by drying in vacuum over H_2SO_4 or P_2O_5 , and a weighed amt.

of the latter changed to UO_2 by reduction with H_2 . Six detns. ranged from 238.48 to 238.64, the mean confirming the value 238.5.

- 1134 Lebeau, P. "New Determination of the Atomic Weight of Uranium." Bull. soc. chim. France (4), 11, 847-50(1912).

This paper contains information similar to that reported in Compt. rend. 155, 163-6(1912).

- 1135 Lebeau, P. "Uranic Anhydride and Its Hydrates." Compt. rend. 154, 1808-11(1912). UO_3 , prepd. in the usual way, contains H_2O and N_2 ; to obtain the pure cpd. it is necessary to heat for some time at 500° in a current of O_2 . In contact with the H_2O vapor, UO_3 is rapidly transformed into $\text{UO}_2(\text{OH})_2$, and the latter is sol. in a concd. soln. of $\text{UO}_2(\text{NO}_3)_2$. When this soln. is evapd. at 100° , $\text{UO}_2(\text{OH})_2$ is obtained; when allowed to evap. at ordinary temp. over H_2SO_4 , $\text{UO}_2(\text{OH})_2 \cdot \text{H}_2\text{O}$ is obtained; and when the latter is heated to 100° , it is changed to $\text{UO}_2(\text{OH})_2$.

- 1136 Lebeau, P. "Uranic Anhydride and Its Hydrates." Bull. soc. chim. France (4), 11, 799-802 (1912).

This paper contains information similar to that reported in Compt. rend. 154, 1808-11(1912).

- 1137 Marketos, M. "The Anhydrous Nitrates of Uranium and Zinc." Compt. rend. 155, 210-13 (1912). Anhyd. $\text{UO}_2(\text{NO}_3)_2$ was obtained by heating the trihydrate in a current of dry HNO_3 to 170 to 180° . It is decompd. by heating to above 200° , reacts violently with dry Et_2O and absorbs H_2O rapidly from the air. Its ht. of soln. is +16 cal/mole; that of the dihydrate, +5.42 cal; the trihydrate, +2 cal, and the hexahydrate, -4 cal.

- 1138 Mazzucchelli, A. and d'Alceo, O. G. "Absorption Spectra of Some Uranyl Salts." Atti reale accad. Lincei (5), 21, II, 850-4(1912).

Reproductions are given of the absorption spectra of Na uranyl oxalate with and without the addn. of pyridine or hexamethylenetetramine, and of Na uranyl tartrate alone and in presence of pyridine, showing that the addn. of the amine alters the spectra of the uranyl salts slightly, indicating a chem. reaction between them.

- 1139 Mazzucchelli, A. and d'Alceo, O. G. "Uranium Salts." Atti reale accad. Lincei (5), 21, II, 620-6(1912).

Additive compds. were practically not found in the following: $\text{Hg}(\text{CN})_2$, carbamide or thiocarbamide with uranyl nitrate and carbamide hexamethylenetetramine with uranyl oxalate; hexamethylenediamine, PhNH_2 , or pyridine with complex Na uranyl pyrophosphate, malonate, or succinate. The aspartate, $\text{UO}_2(\text{C}_4\text{H}_5\text{O}_4\text{N})_2 \cdot 3\text{H}_2\text{O}$, the aminobenzoate, $\text{UO}_2(\text{C}_7\text{H}_6\text{O}_2\text{N})_2 \cdot 4\text{H}_2\text{O}$, and the sulfoanilate, $\text{UO}_2\text{C}_6\text{H}_7\text{O}_3\text{NS} \cdot \text{H}_2\text{O}$, were obtained, but no complex salts were found. Diurano oxalic acid gives ordinary salts with both pyridine, $[2\text{U}(\text{C}_2\text{O}_4)_2 \cdot \text{C}_2\text{O}_4(\text{C}_5\text{H}_5\text{N})_2]$, and aniline, $[2\text{U}(\text{C}_2\text{O}_4)_2 \cdot \text{C}_2\text{O}_4(\text{C}_6\text{H}_7\text{N})_2]$. Basic salts: succinate, $\text{UOC}_4\text{H}_4\text{O}_4 \cdot 2\text{H}_2\text{O}$; malonate, $\text{UOC}_3\text{H}_2\text{O}_4 \cdot 6\text{H}_2\text{O}$; phthalate, $\text{UO}:\text{C}_8\text{H}_4\text{O}_4 \cdot 3\text{H}_2\text{O}$; and trichloroacetate, $\text{UO}(\text{C}_2\text{O}_2\text{Cl}_3)_2 \cdot 3\text{H}_2\text{O}$, were prepd. Uranous salts show little tendency to form complexes with amino acids.

- 1140 Merton, T. R. "The Changes in Certain Absorption Spectra in Different Solvents." Proc. Roy Soc. (London), A, 87, 138-47(1912).

This is a study with tabulated data, diagrams and one photograph of the absorption spectra (6800 to 4800 Å) of UCl_4 in H_2O , MeOAc , MeOH , Et_2OH , and formamide.

- 1141 Meyer, S. and Paneth, F. "The Intensity of the Alpha Radiation of Uranium." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse. Abt. IIa 121, 1403-12(1912).

A pure sample of U_3O_8 was prepd. and the satn. current of 1 cm^2 detd. to be 1.73×10^{-3} e.s.u., in good agreement with the value, 1.74×10^{-3} , found by McCoy. From the new "McCoy number" 796, the ratio $\text{U}_\alpha/\text{Ra}_\alpha = 100/57.3$ is calcd., which also agrees with the ratio 100/58, detd. theoretically from the value, 3.2×10^{-7} , of the ratio of Ra to U in an ore, the total satn. current, 2.42×10^6 e.s.u., for the α

radiation of 1 g of Ra, and from Bragg's ionization curve which gives the ionization from the ranges of the respective α particles. From all of which it appears that the McCoy number 796 is correct to within at least 1%, and that the old Boltwood ratio 100/45 should be replaced by 100/57.3, also correct to 1%. There remains then no reason from these results to suppose the existence of a third α -radiating U product besides U_I and U_{II} , and support is also lent to the view that UY is a side chain product emitting few α particles.

1142 Michiels, L. "The Radioactivity of Solutions of Uranium Salts." Radium, Le 9, 432-4(1912). Exact measurements of the activity of solns. of U salts allow the easy prepn. of feeble stds. relatively comparable, and a radioactive method of estg. U in the absence of other active substances, but in the presence of other nonactive metals.

1143 Michiels, L. "The Radiation from Uranium Solutions and a Radioactive Method for Determining Uranium." Z. anorg. Chem. 81, 49-60(1912).

This paper contains information similar to that reported in Radium, Le 9, 432-4(1912).

1144 Mixer, W. G. "Heat of Formation of the Oxides of Vanadium and Uranium, and Eighth Paper on Heat of Combination of Acidic Oxides with Sodium Oxide." Am. J. Sci. 34, 141-57(1912).

This is a continuation of work already reported, making use mainly of Na_2O_2 to carry out the reactions. Inability to prepare pure V left the results with it subject to some uncertainty. Among the results are $3U + 4O_2 \rightarrow U_3O_8 + 845,200$ cal; $U + 3O \rightarrow UO_3 + 303,900$ cal; $UO_3 + Na_2O \rightarrow Na_2UO_4 + 96,100$ cal; $U_3O_8 + \frac{1}{2}O_2 \rightarrow 3UO_3 + 16,200$ cal.

1145 Mixer, W. G. "Heat of Formation of Oxide of Vanadium and Uranium." Z. anorg. Chem. 78, 221-38(1912).

This paper presents data similar to those published in Am. J. Sci. 34, 141-57(1912).

1146 Nenadkevich, K. A. "Tyuyamunite, a New Species of Mineral." Bull. acad. imp. sci. (Petrograd) (6), -, 945-6(1912).

1147 Oechsner de Coninck, F. W. "Determination of the Atomic Weight of Uranium." Compt. rend. 155, 1511(1912).

$UO_2C_2O_4 \cdot 3H_2O$ was pptd. from a dil. soln. of $UO_2(NO_3)_2$ by a satd. soln. of $H_2C_2O_4$ and was then dehydrated by heating at 100° for 3 hrs. From the wt. of UO_2 produced by the ignition of the dehydrated oxalate, the mol. wt. of UO_2 was calcd. The mean of 7 detns. was 270.40 which gives, as the at. wt. of U, 238.4.

1148 Oechsner de Coninck, F. W. and Raynaud, A. "Action of Pure Methyl Alcohol on Uranium Formate." Bull. soc. chim. Belg. 26, 430(1912).

A mixt. of a few dg of pure U formate and an excess of MeOH was heated for 1 hr to keep the latter quietly boiling; a small amt. of green U oxide was produced which gradually changed to brownish black when the flask contg. it was stoppered and kept in diffused light for a few days. U formate was not affected when heated with 94% EtOH under the same conditions.

1149 Oechsner de Coninck, F. W and Raynaud, A. "Uranyl Oxalate." Bull. soc. chim. France (4), 11, 531-3(1912).

$UO_2C_2O_4$, recrystd. several times, contains 3 moles H_2O . It is sol. in H_2O and but slightly sol. in EtOH or MeOH. The H_2O escapes when the salt is heated to 100° for 4 hrs. Upon calcination pure UO_2 is left in the form of black powder, not readily sol. in hydroacids or in H_2SO_4 , but readily sol. in HNO_3 or aqua regia. The dry oxalate absorbs H_2O from air incompletely unless the air is moist. The calcination of the salt must be done carefully, with exclusion of air; otherwise the pyrophoric UO_2 is formed and, consequently, UO_3 .

- 1150 Oechsner de Coninck, F. W. and Raynaud, A. "Uranium Oxides." Bull. soc. chim. France (4), 11, 1037-8(1912).

Uranyl formate, left exposed to diffused light for 3 mos. in the presence of MeOH, deposited a brown UO_2 , while HCOOH was also formed. On ignition in the air this brown UO_2 formed an oxide which, on analyzing by reduction to UO_2 with H_2 , corresponded to the formula U_4O_{10} .

- 1151 Owen, M. "Magneto-Chemical Investigation. The Thermomagnetic Properties of the Elements. II." Ann. Physik (4), 37, 657-99(1912).

Information is given on measurements of the sp. magnetic susceptibility, X , of U. The value of X reported is 2.6×10^{-6} at 18°C . This is the lowest value obtained from the measurement of three Fe-U alloys considering the dependence of the susceptibility upon the magnetic field which is present. X appears to decrease somewhat, with increasing temps., and this is explained as a possible result of the presence of Fe.

- 1152 Pauli, W. and Flecker, L. "Alterations in the Physical Condition of Colloids. XIII. Relations of Protein to the Inorganic Colloids and the Salts of the Heavy Metals." Biochem. Z. 41, 461-512(1912).

The inorganic colloids are divided into 2 classes: the suspensoids, including As_2S_3 , CuS , CdS , and Au , which are very sensitive toward electrolytes, show a minimum viscosity, and have a strong tendency to lose their stability with age; and the lyocolloids, which show greater viscosity and stability. To this latter class belong the basic oxides $\text{Fe}(\text{OH})_3$, $\text{Cr}(\text{OH})_3$, and the acid oxides such as those of Si, Mo, and W. Under proper conditions proteins can be completely pptd. by the lyocolloids. Salts of the heavy metals behave peculiarly with the electrolyte-free proteins. Slight amts. of the salts added to the protein solns. produce ppts.; larger amts. redissolve them until the salt concn. has ascended over a certain zone, beyond which pptn. of the protein-salt complex begins again. This behavior was noted with FeCl_3 , UO_2Cl_2 , CuSO_4 , CuCl_2 , HgCl_2 , ZnSO_4 , and $\text{Pb}(\text{NO}_3)_2$. The behavior of these salts is explained.

- 1153 Peters, W. "The Binding Force of Werner's Theory of Secondary Valence for the Region of Ammoniates." Z. anorg. Chem. 77, 137-90(1912).

In this lengthy article on ammoniates, it is reported that at ordinary temp. light-yellow UO_2Cl_2 , dried in vacuum, will take up approx. 2 moles of NH_3 and turn orange. The cpd. will retain 1 mole of NH_3 in vacuum, forming the relatively stable $\text{UO}_2\text{Cl}_2 \cdot \text{NH}_3$.

- 1154 Raynaud, A. "On the Density of Uranous Oxide and Its Solubility in Nitric Acid and in Aqua Regia." Bull. soc. chim. France (4), 11, 802-04(1912).

The paper contains a graph showing the soly. of UO_2 . The d. of UO_2 is reported to be 8.2.

- 1155 Roderburg, A. "The Preparation of Pure Uranium." Z. anorg. Chem. 81, 122-9(1912).

This is an account of several unsuccessful attempts to prep. pure U. The reduction of UCl_4 by Na in a closed iron bomb heated to redness gave a product containing 95 to 96% U, the chief impurity being Fe from the bomb. Trials were made of various special steels, and a Ni steel was found to be the least attacked, but pure U could not be obtained with it. Expts. using UF_4 and K did not give the desired result.

- 1156 Russell, A. S. "Measurements of Specific Heat at Low Temperatures." Physik. Z. 13, 59-65(1912).

By means of the Nernst-Koref-Lindemann Cu calorimeter the mean sp. hts. were detd. over the approx. ranges 45 to 0° , 0 to -78° and -78 to -190° for U_3O_8 and other salts. From these data the conclusion is drawn that Kopp's law does not hold at low temp., where the Dulong and Petite rule is invalid. Or expressed in terms of the new theories of sp. ht., the freq. of vibration of an at. in a cpd. is not the same as in the free state. The most striking illustration of this failure of Kopp's law is the fact that the mol. ht. capacity of SiC at 138° abs. is less than the at. ht. of Si.

- 1157 Russell, A. S. and Rossi, R. "An Investigation of the Spectrum of Ionium." Proc. Roy. Soc. (London), A. 87, 478-84(1912).

The use of a U impurity in the study indicates at least one intermediate disintegration product between U and Io.

- 1158 Salvadori, R. "Compounds of Uranium with Hydrazine." Atti reale accad. Lincei (5), 21, II, 455-60(1912).

When hydrazine hydrate (50% soln.) is treated with aq. $\text{UO}_2(\text{NO}_3)_2$ soln., a yellow ppt., $(\text{N}_2\text{H}_5)_2\text{O} \cdot 5\text{UO}_3 \cdot 8\text{H}_2\text{O}$, is produced, stable up to 100° , at which temp. it loses nearly all N. On boiling it becomes yellow-green and after 20 mins olive-green, the compn. of the ppt. having become $(\text{N}_2\text{H}_5)_2\text{O} \cdot 5\text{UO}_2 \cdot 6\text{H}_2\text{O} \cdot 2\text{UO}_2$. When hydrazine uranate is treated with H_2O in the presence of an excess of U nitrate or sulfate an orange-yellow ppt. of $5\text{UO}_3 \cdot 2(\text{N}_2\text{H}_5)_2\text{O} \cdot \text{H}_2\text{S} \cdot 6\text{H}_2\text{O}$ is formed which, after removing the excess of H_2S with a current of O_2 and adding an excess of hydrazine hydrate, gives a vermillion-red cpd., "hydrazine uranium red", $5\text{UO}_3 \cdot 2(\text{N}_2\text{H}_5)_2\text{O} \cdot \text{H}_2\text{S} \cdot \text{N}_2\text{H}_5 \cdot 4\text{H}_2\text{O}$, which is analogous to Kohlschutter's uranium red. At 100° it decomps. somewhat giving H_2S , N_2 , and UO_2 . Exposed to the air it loses 1 mole of N_2H_4 slowly, but with greater facility than the NH_4 salt. Hydrazine U red is easily prepd.

- 1159 Salvadori, R. "Compounds of Uranium with Hydrazine." Gazz. chim. ital. 42, II, 432-44(1912). This paper contains information similar to that reported in Atti reale accad. Lincei (5), 21, II, 455-60 (1912).

- 1160 Salvadori, R. "Uranyl Perchlorate." Chem. Ztg. 36, 513(1912).

When $\text{K}_2\text{O} \cdot \text{UO}_2$ is treated with the calcd. amt. of dil. HClO_4 , the ppt. of KClO_4 filtered off, the yellow filtrate strongly concd., again filtered, and kept over P_2O_5 , uranyl perchlorate, $\text{UO}_2(\text{ClO}_4)_2 \cdot 6\text{H}_2\text{O}$, seps. in beautiful yellow prismatic crystals. The salt is deliq. and liquefies at 90° in its water of crystn. which is held at 100° ; it loses, over P_2O_5 at 100° , 2 moles of H_2O , yielding a yellow salt, $\text{UO}_2(\text{ClO}_4)_2 \cdot 4\text{H}_2\text{O}$, that melts at 110° with decompn., leaving a red residue of $\text{UO}(\text{?})$ and UCl_6 . For the quant. detn. of U the sepn. with hydrazine hydrate gives good results.

- 1161 Samsonow, A. "Becquerel Effect in Uranyl and Quinine Sulfates and Chlorophyll." Z. wiss. Phot. 11, 33-59(1912).

With the sulfates used the potential falls, with chlorophyll it rises; the result is best explained on the hypothesis of a discharge process associated with diffusion. There is also a fatigue effect caused by prolonged illumination, and there is an aftereffect in subsequent darkness. Traces of urano-salts are necessary to produce the effect in uranyl salts.

- 1162 Sborgi, U. "Anodic Behavior of Uranium." Atti reale accad. Lincei (5), 21, I, 135-40(1912). The U used still contd. some C and N, and gas was always evolved in the anode chamber; in the case of a very impure sample (7 to 8% C), enough of this gas was evolved to be measured and identified as CO_2 . In all the expts. the amt. of U dissolved corresponded to that calcd. for a valence of 4 (where considerable gas was evolved, due correction was made for it). In H_2SO_4 and sulfates, HNO_3 and nitrates, HCl and chlorides, in bromides, acetates, and chlorates, the U dissolved; in iodides there was partial sepn. of halogen and partial soln. of U. In phosphates and alk., the U anode became covered with a yellow layer and the current fell to a minimum value, but when this layer was mechanically scraped off, the current rose to the initial value, and if this was done continuously, the amt. of U dissolved again corresponded to a valence of 4. Anode polarization expts. confirm Muthmann and Fraunberger's potential measurements and indicate that U cannot be passivized.

- 1163 Sborgi, U. "Anodic Behavior of Uranium." Gazz. chim. ital. 42, II, 144-73(1912).

This paper contains information similar to that reported in Atti reale accad. Lincei (5), 21, I, 135-40 (1912).

- 1164 Schiller, H. "On the Becquerel Effect in Complex Iron and Uranium Salts." (with some remarks by E. Baur) Z. physik. Chem. 80, 641-69(1912).

The Becquerel effect of molar solns. of K oxalate contg. varying amts. of ferrous and ferric salt was measured with the aid of the calomel electrode; artificial light was used, as daylight was too strong. The total light effect was measured at intervals for 24 hrs, and the difference between the values thus obtained and the potential measured in the dark (which is a measure of the reduction that has taken place under the influence of light) gives the Becquerel effect alone, since the change of potential with time is to be considered as the superposition of a Becquerel and a reduction effect. In the case of uranyl formate the reduction is represented by the equation: $\text{UO}_2^{++} + 3\text{H}^+ + \text{COOH}^- \rightarrow \text{U}^{++++} + \text{CO}_2 + 2\text{H}_2\text{O}$, which is contrary to the results of Fay (Am. Chem. J. 18, 269(1896)). The author discusses the theory of the Becquerel effect and decides that Baur's energy explanation fits all the facts better than the electron idea. Numerous curves illustrate the article.

- 1165 Siemssen, J. A. "The Action of Higher Phenols on Uranium Salts." Chem. Ztg. 36, 353-4 (1912).

The originally yellow soln. of U salts with resorcinol and other higher phenols gives a shade varying from bright to purple red according to the concn. Attempts to use this material as a dye are reported. Linen is not dyed even with 10% KHSO_4 soln. as mordant, but wool, after being boiled and washed with H_2O , acquires an intense yellow shade which increases with NH_3 and is stable to soda and soap solns. and heat and light. The cpd. was not isolated.

- 1166 Siemssen, J. A. "Explosibility of Uranyl Nitrate." Chem. Ztg. 36, 423-4(1912).

Siemssen found, contrary to Ivanov, that uranyl nitrate is not explosive. The preps. used were Merck's.

- 1167 Sieverts, A. and Bergner, E. "Research on the Solubility of Argon and Helium in Solid and Liquid Metals." Ber. 45, 2576-83(1912).

At 1100° and atmospheric pressure, 100 g of very pure U was found to absorb 1.6 mg of H_2 . It will not take up He or A. The ability of U to take up H_2 is said to be responsible for its catalytic effect.

- 1168 Spath, E. "Compound of Uranyl Nitrate with Nitrogen Peroxide." Monatsh. 33, 853-7(1912). $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ is partially dehydrated by heating at 100° for 2 hrs. This is then dissolved in red fuming HNO_3 (d. = 1.52) with gentle warming, cooled quickly and treated with a mixt. of 20 g N_2O_5 and 12 cc liq. NO_2 , the mixt. being well stirred. A heavy yellow cryst. powder was pptd. This was sepd. and dried on porous plates in a desiccator. The analysis indicates $\text{UO}_2(\text{NO}_3)_2 \cdot 2\text{NO}_2$. It decomps. with effervescence when treated with H_2O . Moist air decomps. it, but it is rather stable in dry air and remains unaltered when heated in vacuum to 100° , but at 160° loses NO_2 , and the anhyd. uranyl nitrate is formed.

- 1169 Suzuki, T. Zur Morphologie der Nierensekretion unter physiologischen und pathologischen Bedingungen. Jena, Carl Fischer, 1912.

Investigation of guinea pigs poisoned with U are included. It is here first pointed out that regenerated tubular epithelium, resulting from repeated U poisoning, is less sensitive than normal tissue.

- 1170 Trautmann, W. "Analysis of Ferrouanium. II." Z. angew. Chem. 25, 19(1912).

A typographical error in a previous paper is corr. The sepn. of Fe and Al from U by $(\text{NH}_4)_2\text{CO}_3$ is incomplete. Good results are obtained by using $(\text{NH}_4)_2\text{S}$ in conjunction with $(\text{NH}_4)_2\text{CO}_3$. Details of procedure are given.

- 1171 Zahn, J. G. Ueber Peroxyuranate. Dissertation, Univ. of Friburg, 1912.

This dissertation includes considerable information on the properties of the peruranates. The individual series show the following colors. $\text{R}_2\text{U}_2\text{O}_{10}$, light-green to light-yellow; R_2UO_6 , reddish-yellow to brownish-red; R_3UO_7 or $\text{R}_6\text{U}_2\text{O}_{13}$, yellow to brown; R_4UO_8 , yellow to dark-red; and the cpds. of R_4UO_8 with H_2O_2 , light-green and extremely explosive. It is stated that most peruranates turn red in air and

take up H_2O , all of them turning red upon ignition. Each is sol. in water and the least sol. cpds. are in the family $\text{R}_2\text{U}_2\text{O}_{10}$. All are sol. in dil. acids except HOAc which quantitatively ppts. white U peroxide. The 3-, 5-, 6-, and 8-hydrates of $\text{Na}_2\text{U}_2\text{O}_{10}$, $\text{Na}_4\text{UO}_8 \cdot 8\text{H}_2\text{O}$, $\text{Na}_4\text{UO}_8 \cdot x\text{H}_2\text{O}$, and $\text{Na}_2\text{UO}_6 \cdot \text{H}_2\text{O}$ were obtained as were $(\text{NH}_4)_6\text{UO}_{13}$, $(\text{NH}_4)_2\text{U}_2\text{O}_{10} \cdot 6\text{H}_2\text{O}$, $\text{K}_4\text{UO}_8 \cdot 4\text{H}_2\text{O}_2 \cdot x\text{H}_2\text{O}$, $\text{K}_6\text{U}_2\text{O}_{13} \cdot 10\text{H}_2\text{O}$ (given as $\text{K}_3\text{UO}_7 \cdot 5\text{H}_2\text{O}$), $\text{K}_2\text{U}_2\text{O}_{10} \cdot x\text{H}_2\text{O}$, $\text{K}_2\text{UO}_6 \cdot x\text{H}_2\text{O}$, $\text{K}_2\text{UO}_8 \cdot x\text{H}_2\text{O}$, $\text{Li}_2\text{U}_2\text{O}_{10} \cdot 8\text{H}_2\text{O}$, $\text{Rb}_2\text{UO}_6 \cdot 3\text{H}_2\text{O}$, $\text{Rb}_4\text{UO}_8 \cdot 8\text{H}_2\text{O}$, and $\text{Rb}_4\text{UO}_8 \cdot 4\text{H}_2\text{O}_2 \cdot 3\text{H}_2\text{O}$. The crystals of each are described.

PUBLICATIONS LOCATED IN 1913

- 1172 Acqua, C. "The Degeneration of Cell Nuclei Produced in Plant Cells by Uranium." Atti reale accad. Lincei (5), 22, II, 390-2(1913).

In order to det. the exact nature of the effect of U, its effect on root tips of Triticum sativum was studied. When plants were placed in an H_2O soln. of uranyl nitrate 1:10,000, growth ceased and the young roots became yellow. Microscopic examn. of the meristem gives various results depending on the duration of the exposure to the soln. In the earlier stages the nuclei are unchanged but the tissues show yellow granules (probably U oxide); when placed in HCl or HNO_3 the granules are removed and the root is again capable of growth. After prolonged action the nuclei are smooth, less spherical, and look hollow. When stained with hematoxylin or borax-carmin only unchanged nuclei stain normally; the others are weakly stained or colorless depending on the amt. of changes that has taken place. The chromatin of the nucleus is apparently destroyed and growth prevented.

- 1173 Agulhon, H. and Sazerac, R. "Action of Uranium Salts and Metallic Uranium on Bacillus pyocyaneus." Compt. rend. 156, 162-4(1913).

The toxic dose of U salts in glycerol bouillon cultures is 1/500 with U acetate and 1/200 with U nitrate. Doses of salts from 1/50,000 to 1/1000 slightly favor development, causing an increase in thickness of surface growth and in amt. of coloring matter. Below 1/50,000, the U salts are again unfavorable to growth thus exhibiting a fluctuating curve similar to that for Ra influence. Metallic, insol. U possesses a similar influence on the B. pyocyaneus, showing by the mechanical exclusion of chem. action that the effect is due to radiation.

- 1174 Antonov, G. N. "The Separation of Uranium Y from Uranium." Radium, Le 10, 406-08(1913). Full details are given of method of sepg. UY.

- 1175 Artmann, P. "On Uranyl Iodate." Z. anorg. Chem. 79, 327-42(1913).

It is reported that $\text{KIO}_3 \cdot \text{UO}_2(\text{IO}_3)_2 \cdot 3\text{H}_2\text{O}$ or $\text{KUO}_2(\text{IO}_3)_3 \cdot 3\text{H}_2\text{O}$ is obtained by adding a concd. soln. of KIO_3 to concd. $\text{UO}_2(\text{NO}_3)_2$ at room temp. The cpd. is reported to be a light-yellow fine cryst. powder which darkens with loss of H_2O . When melted the material liberated O_2 and I_2 leaving an orange vitreous mass. Upon boiling a soln. of the material, KIO_3 , is liberated. $\text{UO}_2(\text{IO}_3)_2$ and $\text{UO}_2(\text{IO}_3)_2 \cdot \text{H}_2\text{O}$ are also discussed, especially their polymeric forms. (See Z. anorg. Chem. 80, 280(1913) for addn. to this paper.)

- 1176 Artmann, P. "Addition to 'On Uranyl Iodate.'" Z. anorg. Chem. 80, 280(1913).

Additional structural formulas are given for polymeric uranyl iodate. (See Z. anorg. Chem. 79, 327-42(1913) for original paper.)

- 1177 Aschoff, L. "The Pathogenesis of the Contracted Kidney." Arch. Internal Med. 12, 723-38(1913). A discussion of the biol. effects of U poisoning is included.

- 1178 Barlot, J. and Chauvenet, E. "Action of Carbonyl Chloride on the Natural Phosphates and Silicates." Compt. rend. 157, 1153-5(1913).

This paper contains the report that UCl_4 , which is volatile, can easily be sepd. from CaCl_2 . This is done by using COCl_2 ; the process is particularly applicable to the extrn. of U from phosphatic minerals, such as uraninite.

- 1179 Bauer, O. and Deiss, E. "Determination of Cobalt and Uranium in Steel." Chem. Ztg. 37, 1374(1913).

- 1180 Baur, E. "On Preparation, Decomposition, and Conversion of Glycolic Acid." Ber. 46, 852-63(1913).

It is reported that when a mixt. of glycolic acid and uranyl salts is exposed to light, a reduction occurs.

- 1181 Becquerel, P. "Influence of the Salts of Uranium and Thorium on the Development of B. tuberculosis." Compt. rend. 156, 164-6(1913).

The nitrates of U and Th were used in small portions in veal bouillon cultures of B. tuberculosis (1/10 to 1/10,000), and cultures were compared at the end of 3 wks on the basis of relative amts. of surface growth. These salts behave from a physiologic point of view like many radioactive salts. There is an optimal dose above which the growth of bacteria is retarded or prevented. Below this optimal dose no effect is noticeable.

- 1182 Berthelot, D. and Gaudechon, H. "Uranium Salts as Photochemical Catalyzers." Compt. rend. 157, 333-5(1913).

The authors differ from the statement of Mathews and Dewey that the catalysis of the decompn. of oxalic acid in light by U salts is due to their radioactive properties. Addn. of U salts to acetone and EtOH retards or stops the photolysis by ultraviolet light; Th salts have no effect on the decompn. The homologs of oxalic acid give the same decompn. products in the presence or absence of U salts; the decompn. products of oxalic acid are different from different conditions of decompn. Addn. of quinine sulfate, ThO_2 , $\text{Th(SO}_4)_2$, radioactive BaCl_2 , AgNO_2 , or NaOAc causes the same amt. of gas to be formed from pyrotartaric acid in a given time, but if U nitrate was added, the amt. of gas was 9 times as great. All of the reactions studied were produced spontaneously in ultraviolet light. The addn. of a catalyzer allows the reaction to proceed in visible light; it decreases the vibratory freq. of the photochem. reaction just as an ordinary catalyzer lowers the temp. at which a chem. reaction can proceed with measurable velocity.

- 1183 Blair, A. A. "The Determination of Uranium and Vanadium in Carnotite Ores of Colorado and Utah." Proc. Am. Phil. Soc. 52, 201-05(1913).

The following methods are applicable to the carnotite ores of Utah and Colo. To det. U, boil 2 g finely ground ore with 25 cc strong HNO_3 and 25 cc H_2O for 30 min, dil., filter, add NH_4OH until ppt. forms, then add moderate excess strong $(\text{NH}_4)_2\text{CO}_3$ soln. (vol. should be 250 cc, temp. 40 to 50°), stir 20 min, let settle, decant., wash with 2% $(\text{NH}_4)_2\text{CO}_3$ soln., evap. filtrate, dissolve ppt. in hot dil. HNO_3 and repeat pptn., adding filtrate to original filtrate; evap. filtrates until $(\text{NH}_4)_2\text{CO}_3$ is expelled, acidify with few drops HNO_3 , evap. to 200 cc, add NH_4OH until ppt. appears, add HNO_3 drop by drop until soln. clears, then 10 to 15 cc NH_4OAc soln. (made by adding 30% AcOH to strong NH_4OH until acid to litmus); ppt. is ammonium uranyl vanadate, $\text{V}_2\text{O}_5 \cdot 2\text{UO}_3 \cdot (\text{NH}_4)_2\text{O} \cdot \text{H}_2\text{O}$, which settles rapidly after boiling a few mins. Decant, wash twice with 5 cc above NH_4OAc soln. in 100 cc H_2O , dissolve ppt. in HNO_3 , evap. to dryness on the H_2O bath, dissolve in little dil. HNO_3 , add NH_4OH until ppt. forms, then $(\text{NH}_4)_2\text{CO}_3$ to dissolve U and V and ppt. any SiO_2 and Al_2O_3 , filter, reppt. $\text{V}_2\text{O}_5 \cdot 2\text{UO}_3 \cdot (\text{NH}_4)_2\text{O} \cdot \text{H}_2\text{O}$ as above, ignite at low red heat, weigh as $\text{V}_2\text{O}_5 \cdot 2\text{UO}_3$. In case there is not an excess V in the ore, some must be added to insure complete pptn. of U. An alternative method for U, based on the sepn. of AlCl_3 in Et_2O and strong HCl soln. by HCl , as described by Gooch, is given.

- 1184 Bleecker, W. E. — assigned to Standard Chemical Co. Process for Separating Vanadium from Uranium. January 21, 1913. (U. S. Patent 1,050,796)

This patent describes the sepn. of U from V in soln. as alk. vanadate by first pptg. alk. uranate and uranyl hydrate by addn. of NaOH to the hot soln., dissolving the ppt. with acid, then rendering it slightly alk. and sepg. the V by electrolysis, and finally recovering the V-free U salts in the soln.

- 1185 Bleecker, W. E. — assigned to Standard Chemical Co. Extracting the Valuable Constituents of Carnotite Ores. July 29, 1913. (U. S. Patent 1,068,730)

The finely ground ore is treated with a soln. of NaOH and Na_2CO_3 , and the alk. vanadate soln. is removed. The residue is then heated with Na_2CO_3 soln. to obtain sol. U cpds., and the Ra is extd. from the residue with a 10% soln. of H_2SO_4 .

- 1186 Bodenstein, M. "A Theory of Photochemical Reaction Velocity." Z. physik. Chem. **85**, 329-97(1913).

The presence of O_2 in the soln. in which a photolytic reaction between uranyl salt and $\text{H}_2\text{C}_2\text{O}_4$ is taking place has no effect upon the velocity of the reaction.

- 1187 Boll, M. "Photochemical Decomposition of Oxalic Acid Solutions in the Presence of Uranyl Nitrate." Compt. rend. **156**, 1891-5(1913).

Using 0.001N solns. of oxalic acid and uranyl nitrate the reaction is unimolecular. The mass formed per sec is proportional to the power of the absorbed rays and is not a function of the concn. The absorption is the same whether there is a chem. reaction or not. The absorption is augmented by the int. energy of the moles.

- 1188 Boycott, A. E. and Ryffel, J. H. "The Action of Diuretics in Experimental Nephritis." J. Path. Bact. **17**, 458-501(1913).

This paper attempts to classify the various nephrotoxic agents. U salts are reported to fall in the class which are primarily epithelial poisons. For the rabbit, 2 mg/kg is considered as the min. fatal dose, with the injury being essentially limited to the convoluted tubules and to a lesser extent to the cells of the loop of Henle; with larger doses, 20 mg/kg, injuries were more diffuse, but still tubular in character.

- 1189 Brunck, O. "Determination of Cobalt and Uranium in Steel." Chem. Ztg. **37**, 1374(1913).

- 1190 Chapman, J. C. "A Comparison of the Spectra of Fluorescent Röntgen Radiations." Proc. Roy. Soc. (London), **A. 88**, 24-37(1913).

Certain elements emit a secondary fluorescent x-ray radiation when excited by a primary beam of roentgen rays. The radiations emitted by any particular element when excited consist of 2 diff. types: (a) the scattered radiation, having the same penetrating power as the primary beam and indistinguishable from it; (b) the homogeneous x-radiation characteristic of the particular element in question. Each element exerts a selective absorption for radiations which are of such a degree of hardness that they lie in the neighborhood of an absorption band. The coeffs. of absorption of the radiation in Al for the rays given off by diff. elements are given. For U 7.5 is given. The following empirical equation connects the at. wts. of two elements which, though in diff. groups, emit characteristic radiations which appear the same when measured by their coeffs. in Al: $W_K = \frac{1}{2}(W_L - 48)$.

- 1191 Courtois, G. "Uranyl Formate." Bull. soc. chim. France (4), **13**, 449-54(1913).

An anhyd. uranyl formate cannot be obtained at ordinary temps. from an aq. soln. of the salt. The salt so obtained has the formula $\text{UO}_2(\text{HCO}_2)_2 \cdot \text{H}_2\text{O}$, crystg. into yellow octahedrons. This salt previously dried over H_2SO_4 is very stable at 100° and at 150° becomes anhyd. with only a slight decompn. The anhyd. salt in aq. soln., either hot or cold, dissocs. with formation of basic crystals having the formula $\text{UO}_2(\text{HCO}_2)_2 \cdot \text{UO}_3 \cdot 2\text{H}_2\text{O}$. This basic formate on prolonged boiling, decomp., forming $\text{UO}_3 \cdot \text{H}_2\text{O}$. These properties of the salt obtained are different from those described by Oechsner-de Coninck and Raynaud.

- 1192 de Forcrand, M. "The Dehydration and Decomposition of the Hydrates of Uranyl Nitrate. Formation of the Monohydrate." Compt. rend. 156, 1044-8(1913).

By dehydrating the hexahydrate in a desiccator at ordinary temp. and pressure the trihydrate is obtained in 4 to 5 days, but the dihydrate only after 1 mo. In a vacuum the dehydration is faster, the dihydrate being obtained in 5 to 6 days. By heating the dihydrate in a current of CO_2 at 160° all the H_2O is driven off, but a considerable amt. of HNO_3 is lost, the compn. of final product being $\text{UO}_2(\text{NO}_3)_2 \cdot 2\text{UO}_3$. Upon heating the dihydrate in CO_2 at 120 to 125° , a loss in wt. corresponding to 1 mole of H_2O is obtained in 4 to 5 hrs, while const. wt. is obtained only after 65 to 60 hrs, thus indicating the existence of a monohydrate. The final product has a compn. $\text{UO}_2(\text{NO}_3)_2 + \frac{1}{4}(\text{UO}_3 \cdot \text{H}_2\text{O})$ and is yellow. Dehydrating at 98° in CO_2 for 150 hrs the loss of H_2O and HNO_3 indicates that the residue has the compn. $\text{UO}_2(\text{NO}_3)_2 \cdot \text{H}_2\text{O} \cdot \frac{1}{8}(\text{UO}_3 \cdot \text{H}_2\text{O})$. Heating in a current of CO_2 and vapors of HNO_3 at 165° the loss in wt. at the end of 3 hrs indicated the existence of a monohydrate. After 3 hrs the loss was very slow, taking 12 hrs before the anhyd. salt is obtained; even the presence of HNO_3 gas in the CO_2 did not prevent the loss of the former from the salt, the final product being $\text{UO}_2(\text{NO}_3)_2 \cdot \frac{1}{31}(\text{UO}_3 \cdot \text{H}_2\text{O})$. To obtain an anhyd. product not contg. any UO_2 it was necessary to work at temps. not above 130° in a current of gas contg. HNO_3 vapors, the time necessary for dehydrating being more than 60 hrs.

- 1193 de Forcrand, M. "Thermochemical Study of Uranyl Nitrate and of Its Hydrates." Compt. rend. 156, 1207-10(1913).

As stated in a previous note, there are 1-, 2-, 3-, and 6-hydrated $\text{UO}_2(\text{NO}_3)_2$. The thermochem. data concerning these cpds. have appeared a little uncertain to the author, and the present note gives the results of a further study. The dihydrate is obtained in a state of abs. purity. It is neither deliq. nor efflorescent in the cold. The hexahydrate of commerce, purified, never contains exactly 6 moles of H_2O . The specimen used always lost exactly 3.975 moles H_2O in passing to the dihydrate and therefore had 5.975 moles H_2O . Consequently, it was slightly efflorescent. As for the trihydrate, if its existence is certain, its prepn. is much less sure and the monohydrate is still less easy to obtain. For the trihydrate a product was used which contd. 2.95 or 2.90 moles H_2O . For the monohydrate a product was used which contained in reality $\frac{1}{6}$ of $\text{UO}_3 \cdot \text{H}_2\text{O}$ (should be less than 1%). The anhyd. salt contd. $\frac{1}{28}$ of uranic acid. Dissolution was effected in the usual manner between 11 and 13° . Tables are given of the results. It is possible to calc. from these data the b.p. of the hydrates.

- 1194 de Forcrand, M. "The Hydrates of Uranic Anhydride and the Heat of Formation of Uranyl Nitrate." Compt. rend. 156, 1954-8(1913).

The monohydrate is quite stable and may be formed by allowing the anhydride to remain in a moist atm. for a short time. The dihydrate is formed by allowing UO_3 to remain in moist atm. for several days; it loses 1 mole of water in a H_2SO_4 desiccator. The hts. of simple dehydration and of dehydration accompanied by decompn. are almost the same, so that dehydration cannot be accomplished without decompn. The hts. of combustion of U and UO_2 are also discussed.

- 1195 de Forcrand, M. "Cupric Hydrates, and the Heat of Formation of Copper Nitrate. Comparison with Uranyl Nitrate." Compt. rend. 157, 441-4(1913).

The ht. of soln. of blue $\text{CuO} \cdot \text{H}_2\text{O}$ in dil. HNO_3 is 14.72 kcal, the green hydrate, 14.46 kcal; that of $\text{UO}_3 \cdot \text{H}_2\text{O}$ is 14.84 kcal.

- 1196 Fajan, K. and Beer, P. "The Behavior of the Radioelements in Precipitation Reactions." Ber. 46, 3486-97(1913).

Seqn. processes for the radioactive elements are discussed.

- 1197 Fischer, A. "Electrochemistry of the Chromium Group. I. Tungsten and Uranium." Z. anorg. Chem. 81, 170-208(1913).

The Wartenberg method does not, according to the author and E. K. Rideal, yield a U metal of sufficient cond. for producing fused rods. The U was not free from C, and its potential in alc. soln. of UCl_6 could not definitely be detd. either; it lies between Cu and H_2 . The same investigators also tried to prepare

the two metals by electrolysis of solns. in abs. alc. WCl_6 gave green crystals of a cpd. $\text{C}_6\text{H}_{16}\text{O}_3\text{Cl}_2\text{W}$, possibly $\text{WOC}_3(\text{OEt})_3$. U did not yield a similar cpd.; but from U acetate a hydrate was obtained, and various acid and alk. solns. gave on electrolysis the same U oxide, not metal.

- 1198 Frouin, A. "Influence of Uranium and Thorium Salts on the Development of the Tubercle Bacillus." *Compt. rend. soc. biol.* 74, 282-4(1913).

Contrary to results obtained by Becquerel, it was observed that the development of *B. tuberculosis* was slightly favored by Th salts, and not at all by U salts (sulfate and nitrate). Becquerel measured the surface of the colonies, while Frouin weighed the dry cultures; this and the diff. culture media employed may partially explain the contradiction. The protoplasmic condensations observed by Becquerel with U salts are doubtless due to pptn. of the albuminous substances of the bouillon. Salts of Th, and of rare earths in general, cause pptn. of albuminous substances in neutral or alk. solns.; no pptn. occurs in acid soln., even when the latter is boiled. The culture medium to which the salts of the rare earths were added consisted of 1 kg distd. H_2O , 5 g glycerol, 1.5 g Na citrate, 1.5 g K_2HPO_4 , and 1.5 g MgSO_4 . This medium alone is very favorable to the development of *B. tuberculosis* and the production of tuberculin.

- 1199 Ghoreyeb, A. A. "A Study of the Mechanical Obstruction to the Circulation of the Kidney Produced by Experimental Acute Toxic Nephropathy." *J. Exptl. Med.* 18, 29-49(1913).

Perfusion expts. are reported using double strength Adler's soln. in kidneys which had been rendered nephritic with U and other materials.

- 1200 Jones, H. C. "Evidence Bearing on the Solvate Theory of Solution." *J. Franklin Inst.* 176, 479-564(1913).

A section on U is included. When the absorption spectra of UCl_4 and UBr_4 are observed in H_2O , MeOH, EtOH, PrOH, and iso-BuOH or methyl ester, acetone, or glycerine the typical solute bands are observed. The position and intensity of the bands appear to depend more on the solvent than on the anion so that the formation of the complex between $(\text{UO}_2)^{+2}$ and the solvent is assumed.

- 1201 Jones, H. C. and Guy, J. S. "The Absorption Spectra of Solutions as Affected by Temperature and by Dilution." *Am. Chem. J.* 49, 1-46(1913).

Previous results obtained by Jones and Strong using Anderson's app. (see Carnegie Institution, Publication 130, 1910), showed that up to the b.p. of soln. the general absorption of any salt in H_2O increases with temp. rise and also showed a broadening and intensification of the absorption bands. For nonaq. soln. a closed cell made of Au-plated steel tubing with glass window was used, thus permitting nonaq. solns. to be studied up to about 200° . Usually before this temp. was reached a ppt. formed in the tube and prevented observations at higher temps. Owing to corrosive effects, aq. solns. could not be used in the steel tube, but using a brass tube with Au-plate lining these disturbing effects were eliminated, and a number of aq. solns. were studied up to 200° including UO_2SO_4 . For uranyl salts nearly every band widened with temp. rise, this effect being in 2 instances rapid toward the red end of the spectrum. Several of the bands seem to have their centers shifted as much as 15 Å toward the red. The uranyl bands almost all occur in the ultraviolet end of the spectrum, and in this region the general absorption increases rapidly as temp. rises. This, with the general haziness of uranyl bands, renders exact measurement difficult. In some cases it seems that both the width and position of bands are changed as temp. rises. Using a radiomicrometer energy absorption graphs were made for Nd chloride to illustrate method. These graphs the authors name transmission curves, since the abscissas are percentages of transparency, and the ordinates are wavelengths, and they thus represent the transparencies of the solns. in question.

- 1202 Just, A. *Filaments*. April 16, 1913. (British Patent 8,956)

Filaments of microcryst. solid solns. of W with V, Cr, Mo, Th, Ti, Mn, Bi, Ta, U, or Zr singly or mixed are obtained by heating and chilling W with between 0.1 and 3% of the added metal. Heating is done by passing electric current through a pressed rod in a furnace with a protective atm. Temps. to 3000° are used. Tempering is done in pure H_2 or N_2 at 1200° .

1203 König, H. "Determination of Cobalt and Uranium in Steel." Chem. Ztg. **37**, 1106-07(1913).
To det. U a 2-g sample is dissolved in aqua regia, the WO_3 is filtered off, the HCl fumed off with H_2SO_4 , and the Fe, Ni, and Co are removed by electrolysis in $(\text{NH}_4)_2\text{C}_2\text{O}_4$ soln. Electrolysis is continued until the oxalate is completely converted into carbonate, the soln. is then boiled down from 300 to 100 cc to destroy the $(\text{NH}_4)_2\text{CO}_3$ and insure complete pptn. of the U. The ppt., which contains traces of Co, V, Mn, Fe, and Al in addn. to all the U, is dissolved in dil. HCl , the small amt. of CrO_4 is reduced by a few drops of alc., and the soln. oxidized with HNO_3 and transferred to a small Erlenmeyer flask. To the cold weakly acid soln., $(\text{NH}_4)_2\text{CO}_3$ is added in excess, then $(\text{NH}_4)_2\text{S}$, the flask is stoppered and allowed to stand about 12 hrs. U and V remain in soln. The filtrate is acidified with AcOH , boiled, the V removed by filtration, the filtrate oxidized with HNO_3 , and the U pptd. by boiling with NH_4OH . The green-yellow ppt. of U hydroxide is filtered off, washed with NH_4Cl , ignited to U_3O_8 in a Pt crucible or to UO_2 in a Rose crucible in a stream of H_2 , and weighed.

1204 König, H. "Determination of Cobalt and Uranium in Steel." Chem. Ztg. **37**, 1225(1913).
This is a reply to Welwart.

1205 Kraus, W. M. "The Effect of Uranium Nephritis on the Excretion of Creatinin, Uric Acid, and Chlorides, and the Effect of Creatinin Injections during Uranium Nephritis." Arch. Internal Med. **11**, 613-29(1913).

This paper describes studies on the elimination of creatinin, uric acid, and chlorides in dogs which had been made experimentally nephritic with U. The creatinin excretion was found to be decreased and the uric acid and chlorides increased. In subacute U injuries, all of the substances decreased. In acute stages of nephritis all the substances diminished and finally led to the death of the animals.

1206 Lacombe, C. "Analysis of Minerals in Portugal." Rev. chim. pura e applicada **9**, 43-5(1913).
The methods employed in detg. U in minerals contg. only 0.10 to 0.50% U_3O_8 are discussed.

1207 Landau, M. "On the Phenomenon of Photocatalysis." Compt. rend. **156**, 1894-6(1913).
It is reported that, in the photolytic reaction between uranyl salts and oxalic acid, the anion of the uranyl salt plays no part. The U cpds. used as catalyzers were U metal, black oxide, green oxide, potassium uranate, uranyl nitrate, uranyl sulfate, double uranyl-potassium uranate, uranyl chloride, and uranyl acetate. A comparison of the oxalic acid decompn. with uranyl nitrate and nitrates of other metals is included. The uranyl nitrate was, by far, the most effective.

1208 La Rosa, M. "Change in Activity of a Sample of Uranium Nitrate." Nuovo cimento (6), **5**, 73-82(1913).

Sensitive app. showed the activity of $\text{UO}_2(\text{NO}_3)_2$ to be diminished temporarily by the radiations from an electric arc, by warming to 100° , and by placing in a dry atm. These changes are attributed to the hyd. nature of the salt and to the presence of a substance of very short period, as ThEm or AcEm . Thus, when the salt is placed in a dry atm., any Em produced would pass freely into the air, and the activity of the salt when placed in the app. would show at first a less value than before; but when it is allowed to remain in a moist atm. sufficiently long, the absorbed moisture of the salt would become satd. with the Em, and the sample would then show as great an activity as when the dry salt is allowed to remain in the ionization chamber for some time. The anomalies in the radioactive behavior of U salts observed by Meyer and Schweidler, Godlewski and Leivin, and the explanations they advanced, are discussed.

1209 Lebeau, P. and Damiens, A. "Composition of Gaseous Mixtures Resulting from the Action of Water on the Carbides of Uranium and Thorium." Compt. rend. **156**, 1987-9(1913).

The amt. and nature of the gas obtained from the same samples are very similar. When graphite is present in UC_2 the reaction proceeds very slowly and hydrogenation occurs, the gas containing less H_2 and more hydrocarbons (CH_4 , C_3H_8 , C_4H_{10} , C_3H_6) than gas obtained from the carbide containing no graphite. The gas from UC_2 consisted principally of H_2 , CH_4 , C_2H_6 , C_3H_8 , with small amts. of C_5H_{10} , C_6H_{12} , C_2H_4 , and acetylene homologs. The gas from ThC_2 is very similar except that it contains a large amt. of acetylene homologs and a comparatively small amt. of CH_4 .

1210 Lenz, W. "Microchemical Reactions." *Z. anal. Chem.* **52**, 90-9(1913).
The prepn. of NH_4 uranyl acetate as an analytical tool is reported.

1211 Lepierre, C. "Replacement of Zinc by Uranium in Cultures of *Aspergillus niger*." *Compt. rend.* **156**, 1179-81(1913).

U replaces Zn perfectly in Raulin medium and, like it, plays a remarkable role (but less favorable) in the rapid growth of *A. niger*.

1212 Lepierre, C. and de Carvalho, A. "Analysis of Minerals Containing Phosphates and Small Amounts of Uranium." *Rev. chim. pura e applicada* **9**, 45-8(1913).

The authors have tested all the methods available for the sepn. of U and P_2O_5 . The only satisfactory method was by dissolving the mineral in HNO_3 , freeing from SiO_2 , adding alk. until only slightly acid, and boiling after addn. of AcONa ; all P_2O_5 was pptd. as Fe^{+3} phosphate and the remaining Fe in the mineral was pptd. as the basic acetate.

1213 McCoy, H. N. "Transformation Periods of Uranium and Thorium." *Phys. Rev.* (2), **1**, 401-04(1913).

It now appears to be well established that the number of ions, N, produced by any α particle of range R is closely proportional to $R^{3/2}$ or $N = KR^{3/2}$. The const. may be calcd. from the number of ions known to be produced by an α particle of Po, i.e. 163,000. This gives $N = 6.97 \times 10^4 R^{3/2}$. If I is the total ionization current in amps of 1 g of a radioactive element of at. wt., M, and decay constant, λ , it follows that

$$\lambda(\text{sec.}) = \text{IM}/\text{NF} = \text{IM}/(6.97 \times 10^4 R^{3/2} F)$$

where F = 96,600 coulombs. This gives a method of detg. λ , and, thus, the half-life. Putting in the value of I for U, viz., 4.61×10^{-10} amp, the author calcs. the half-life of U_1 to be 5.04×10^9 yrs. Rutherford and Geiger's value calcd. from the number of α particles emitted is 4.8×10^9 yrs. For Th the author deduced a value of 1.8×10^{10} yrs, Rutherford and Geiger's value being 1.31×10^{10} yrs.

1214 Mathews, J. H. and Dewey, L. H. "A Quantitative Study of Some Photochemical Effects Produced by Ultra-Violet Light." *J. Phys. Chem.* **17**, 211-18(1913).

Studies are included on the photolytic reaction velocity of uranyl salts, particularly $\text{UO}_2(\text{NO}_3)_2 \cdot \text{UO}_2\text{SO}_4$ and $\text{UO}_2(\text{CH}_3\text{CO}_2)_2$ with $\text{H}_2\text{C}_2\text{O}_4$. The effect of concn. of $\text{H}_2\text{C}_2\text{O}_4$ and $(\text{UO}_2)^{+2}$ is discussed.

1215 Mazzucchelli, A. and d'Alceo, O. G. "Absorption Spectra of Some Uranyl Salts." *Atti reale accad. Lincei* (5), **22**, I, 41-3(1913).

Continuing their work, the authors have compared the absorption spectra of UCl_4 with and without the addn. of an excess of urea, and of UCl_4 and $\text{U}(\text{SO}_4)_2$ with and without addn. of glycocoll. The presence of urea has no effect, but reproductions of the spectra with and without glycocoll show that the latter has a marked influence, the absorption being greater, especially at the ends of the spectrum.

1216 Mazzucchelli, A. and Perret, U. "Absorption Spectra of Some Uranium Salts." *Atti reale accad. Lincei* (5), **22**, II, 445-51(1913).

Only the visible part of the spectrum was studied. In dil. solns. (0.05N) urea does not form addn. cpds. with $\text{UO}_2(\text{NO}_3)_2$, but a 30% urea soln. reacting with a 40% $\text{UO}_2(\text{NO}_3)_2$ soln. gives a golden-yellow soln. instead of green-yellow as above. A 1% soln. added to a 40% $\text{UO}_2(\text{NO}_3)_2$ soln. gives a similar result. Stronger NH_3 gives ppts. The spectra shows 2 bands, 487 and 468.4, in the blue for pure $\text{UO}_2(\text{NO}_3)_2$; with urea they are 497 and 475; with NH_3 , 492 and 471. This shifting cannot be due to the basicity because urea is more effective than NH_3 but must be due to addn. cpds. as was shown by partition expts. with AmOH and H_2O . Uranyl malate soln. was used to det. whether complexes are formed with other N_2 derivs. To a 0.1M UO_2 malate soln. KOH (till pptn. begins), NH_3 , $\text{C}_5\text{H}_5\text{N}$, or PhNH_2 (in excess) were added and the spectra studied at once since the mixts. ppt. in a few hrs. The position of the bands is almost identical in all; however, where uranyl malate shows 3 bands the mixts. show but one. This is attributed to the complex uranyl malate ion studied by Itzig in alk. soln. and which is here formed by

the action of other bases also. Solns. contg. UO_2 as cation show more absorption bands, but when it is present as a complex ion there are very few. Bolton-Marton's rule that the addn. of the free acid to the salt makes the bands sharper was not verified; the reverse was observed. The effect of the presence of alk. on the spectrum was studied further by adding alk. to the UO_2 salt (obtained by double decompn. with UO_2Cl_2) until turbidity appeared; nearly 1 equiv. was required for 1 at. wt. U. UO_2 tartrate gives a spectrum almost identical with that of the malate, addn. of alk. gradually weakened the 2 outer bands until the max. effect corresponded to the 1 band observed with the malate-KOH soln. UO_2 citrate shows 2 bands; alk. causes them almost to disappear, but a new band appears (492), UO_2 lactate, 2 bands; with KOH the 2 bands disappear but absorption at the ends of the spectrum increases. UO_2 quinate shows 1 band; with PhNH_2 this band disappears giving a continuous spectrum. The UO_2 salts of the 3-hydroxybenzoic acids were found to be inner complex salts. UO_2 salicylate gives a bright red soln., the *p*- $\text{HOC}_6\text{H}_4\text{CO}_2\text{H}$ salt is also red, but the *m*- $\text{HOC}_6\text{H}_4\text{CO}_2\text{H}$ salt has the usual color of UO_2 salts. The characteristic bands are very weak. Attempts to follow the double decompn. of UO_2 salts with alk. salts gave poor results. The absorption spectra of uranous malate, uranous malate-malic acid, uranous tartrate, uranous quinate, uranous quinate-K quinate, uranous citrate, uranous lactate (addn. of lactic acid makes no marked change), uranous glycollate, uranous oxalate, K uranous tetroxalate, and K uranous malate are described.

- 1217 Merton, T. R. "Changes in Certain Absorption Spectra in Different Solvents." Proc. Roy. Soc. (London), A, 87, 138-47(1913).

The absorption spectra of UCl_4 in a no. of org. solvents were measured, the results indicating that the differences cannot be considered as a shift of the bands, since the entire character and intensity of the absorption varies in different solvents. Expts. with aq. solns. of UCl_4 and $\text{U}(\text{SO}_4)_2$ and of $\text{UO}_2(\text{NO}_3)_2$ and UO_2Cl_2 showed that the apparent gradual shifts observed when 1 acid radical is replaced by another can be explained simply by the superposition of absorption curves. A marked change in the character of the absorption was found in the presence of free acid, especially in solvents containing a ketone group (acetone, propione, Et acetoacetate, acetophenone). The addn. of another solvent to these solns. causes a slow disappearance of the lines without shift, in accordance with the results of Jones and Strong. The completely different spectra which were found in different solvents indicate that an explanation of the phenomena must be found on the basis of chem. cpds. rather than on a change in the optical properties of the solvent. The influence of pressure up to 750 atms. on the absorption spectra of solns. was investigated with neg. results.

- 1218 Merton, T. R. "Absorption of Light by Uranous Chloride in Different Solvents." Proc. Chem. Soc. (London) 29, 284(1913).

This is a summary of a paper presented and later published in J. Chem. Soc. (London) 105, 23-7(1914).

- 1219 Meyer, S. "Life of Uranium and Radium." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse. Abt. IIa 122, 1085-94(1913).

The fundamental data for the calcn. of the av. life of U are discussed. The ionization current, produced by the α particles from 1 g $\text{U}_I + \text{U}_{II}$, is found to be 1.37 e.s.u., which is in agreement with McCoy and Ashman's value. Assuming ranges of 2.5 cm and 2.9 cm for α rays from U_I and U_{II} and the number of ions produced to be 1.26×10^5 and 1.37×10^5 , resp., then the following relation holds: $i = 1.37 = n(1.26 + 1.37)10^5 \times e$, where n is the number of α particles/sec by each U product. If $e = 4.65 \times 10^{-10}$ e.s.u. (Rutherford's value) then $n = 1.12 \times 10^4$. If $e = 4.78 \times 10^{-10}$ e.s.u. (Millikan's value) then $n = 1.09 \times 10^4$. Hence, taking Rutherford's value for e , the number of α particles/sec from $\text{U}_I + \text{U}_{II}$ is 2.24×10^4 , while Rutherford and Geiger found it to be 2.37×10^4 . This slightly higher value found by Rutherford and Geiger is explained by the fact that there may be a small quantity of ionium present in the prepn. of U used—the presence of 10^{-5} g of Io-Th would account for the difference between the two values. The author, by using U salt freed from ionium found that $\lambda_{\text{U}_I} = 4.4 \times 10^{-18} \text{ sec}^{-1}$, $t = 7.2 \times 10^{10} \text{ yrs}$, $T = 5.0 \times 10^9 \text{ yrs}$. By a second method based on the relation $\lambda_{\text{U}_I} = 238/226 \times \text{Ra}/\text{U}$ another value of λ_{U_I} is calcd. Substituting values of λ_{Ra} and Ra/U in the above equation we obtain the following mean values: $\lambda_{\text{U}_I} = 4.3 \times 10^{-18} \text{ sec}^{-1}$, $t_{\text{U}_I} = 7.37 \times 10^9 \text{ yrs}$, $T_{\text{U}_I} = 5.1 \times 10^9 \text{ yrs}$, which agree very closely with those

obtained by the first method. It is found that the most consistent results are obtained if the following values be taken for the quantities concerned: $\lambda_{UI} = 4.3 \times 10^{-18} \text{ sec}^{-1}$, $n_{UI} = 1.1 \times 10^4$, $T_{UI} = 5.0 \times 10^9$ yrs, $e = 4.78 \times 10^{-10} \text{ e.s.u.}$

- 1220 Moore, B. and Webster, T. A. "Synthesis by Sunlight in Relationship to the Origin of Life. Synthesis of Formaldehyde from Carbon Dioxide and Water by Inorganic Colloids Acting as Transformers of Light Energy." Proc. Roy. Soc. (London), B. 87, 163-76(1913).

Brief information on the photolytic effect of colloidal U oxide is included.

- 1221 Moore, R. B. and Kithil, K. L. A Preliminary Report on Uranium, Radium and Vanadium. Washington, 1913. (101p.) (U. S. Bureau of Mines, Bulletin 70).

A description is given of the carnotite fields in Utah and Colo. All districts are included where ore has been found in commercial quantities. A salable U ore has been regarded as one contg. not less than 2% U_3O_8 . The origin of the ores is undoubtedly secondary, probably due to the infusion of U in soln. from above or below into sandstones already containing V. In support of this view, it has been detd. that the overlying strata contain in some cases many times the normal radioactivity, although pitchblende does not occur even in small quantities, so far as is known, in the carnotite districts. Mining costs and methods, as well as methods of concn. for low-grade ores are discussed. The electroscopic method of roughly estg. the U content of ores by an α -ray method is presented and also a detailed description of app. for the accurate detn. of Ra by the Em method. Existing commercial methods for the extrn. of U, V, and Ra from both carnotite and pitchblende are quoted at length. The method found most useful in the Bureau of Mines for U and V is the combined gravimetric method. A table is appended giving the constitution of all the known minerals contg. U and V.

- 1222 Oechsner de Coninck, F. W. and Raynaud, A. "Uranium Formate." Bull. soc. chim. France (4), 13, 221-3(1913).

U formate is a deliq. yellow salt. When heated in a closed vessel it leaves a residue of uranous oxide. When heated in air, traces of a higher oxide are also formed. The salt is hydrolyzed on boiling with large amts. of H_2O , forming $UO_3 \cdot 2H_2O$. When exposed to diffused daylight during 3 mos., in the presence of MeOH, the U formate forms a brown deposit of the oxide, and the strongly acid MeOH soln. contd. HCO_2Me . A similar expt. in the presence of EtOH caused very slight decompn., little HCO_2H being formed.

- 1223 Oechsner de Coninck, F. W. and Raynaud, A. "Uranyl Formate: Reply to Courtios." Bull. soc. chim. France (4), 13, 665-6 (1913).

The U oxides obtained were evidently made from a different salt and under different conditions than those used by Courtios.

- 1224 O'Hare, J. P. "Acute Renal Lesions Produced by Uranium Nitrate in the Dog in Comparison with the Rabbit." Arch. Internal Med. 12, 61-3(1913).

This paper contains the results of studies of U poisoning. The difficulty of inducing glomerular changes is discussed.

- 1225 O'Hare, J. P. "Experimental Chronic Nephritis Produced by the Combination of Chemical (Uranium Nitrate) and Bacterial (*B. coli communis*)." Arch. Internal Med. 12, 49-60(1913).

- 1226 Pascal, P. "Complex Derivatives of Uranyl Pyrophosphate." Bull. soc. chim. France (4), 13, 1089-1103(1913).

It is made evident that 2 types of complex salts exist derived from $P_2O_7(UO_2)_2$: the normal uranyl pyrophosphates of the type $[(UO_2)_2(P_2O_7)_3]M_8$, which are relatively stable in their alk. salts but whose double uranyl-Na salt, $[(UO_2)_2(P_2O_7)_3]UO_2Na_6$, is easily transformed into the double pyrophosphate, $P_2O_7UO_2Na_2 \cdot H_2O$, and the uranyl pyrophosphates of the second type, $[(UO_2)_2(P_2O_7Na)_4]M_8$, which are always partially decompd. in soln. according to the equation: $[(UO_2)_2(P_2O_7Na)_4]Na_8 = [(UO_2)_2(P_2O_7)_3]Na_8 + P_2O_7Na_4$. This work is intended as an introduction to a series of researches having the object of showing that $(UO_2)^{+2}$ is capable of furnishing a series very rich in complex salts which possesses an index of coordination generally equal to 6 but sometimes equal to 4 and in which the stability decreases when one substitutes for $H_4P_2O_7$ successively H_2CO_3 , H_2SO_3 , H_2SO_2 , $HCNO$, $HCNS$, and H_2SO_4 .

- 1227 Pascal, P. "The Complex Salts of Uranium." Compt. rend. 157, 932-5(1913).

Uranyl pyrophosphates when dissolved in a soln. of a Na salt have the initial f.p. raised, being at a max. when the two salts are in proportion $3P_2O_7Na_4 : P_2O_7(UO_2)_2$ and then at a min. for $2P_2O_7Na_4 : P_2O_7(UO_2)_2$. When the soln. is satd. the ratio is $P_2O_3Na_4 : P_2O_7(UO_2)_2$. The complex intermediary cpd. is a normal uranyl pyrophosphate having the formula $[(UO_2)_2(P_2O_7)_4]Na_3$. The mixt. of 2 alc. solns. of KCNO and $UO_2(CNO)_2$ produced a yellow microcryst. ppt. of $[UO_2(CNO)_4]K_2$. This is analogous to the anhyd. cobaltocyanate, $Co(CNO)_4K_2$.

- 1228 Rideal, E. K. Das elektrochemische Verhalten des Urans und einiger Uranverbindungen. Dissertation, Univ. of Bonn, 1913.

A description of the reduction of U_3O_8 by Na and Mg in the presence of $CaCl_2$ is given. Metal of 99.4 to 99.6% U was obtained. The material discussed by Moissan and Lebeau (UC_2) was supposed by this writer to have the compn. U_2C_3 . UC_2 is reported to burn in air at 400° . Information is also given on the combustion of UC_2 in HCl and other acids.

1229 Roderburg, A. "Preparation of Pure Uranium." Z. anorg. Chem. **81**, 122-9(1913).

The author started from UCl_4 and UF_4 . The UCl_4 is prepd. by heating ground U_3O_8 with sugar to redness and then passing Cl_2 over the produce in a porcelain boat, from which the chloride always takes up Si and Al. The brown metal obtained by using Na as a reducing agent in an iron vessel contains Fe; vessels of Ni, Ag, magnesia, and graphite are also attacked, nickel steel less so. The reduction of UF_4 , which is more easily purified, has to be effected by means of K because the NaF cannot be washed out subsequently; but a suitable vessel which will prevent the escape of K vapors has not been found.

1230 Rossi, P. "Electrochemical Properties of Uranium X." Nuovo cimento, (6), **5**, 5-14(1913).

Expts. on the electrochem. properties of U, both by electrolysis of solns. of its salts, and by immersing rods of various metals in them, show that the sepn. of U and UX is more difficult than for the elements of the Ra family, which is in accord with the theory of Lucas. Contrary to this, however, UX is not more readily sepd. than U. Adding small quantities of other salts to the U solns. before electrolysis, e.g., CuSO_4 , NiSO_4 , or FeSO_4 , to a soln. of U sulfate, AgNO_3 to a soln. of U nitrate, or $\text{Pb}(\text{OAc})_2$ to one of U acetate, a deposit is obtained on the anode having an activity due entirely to UX, which the author attributes to absorption, and on the cathode a deposit which is either almost inactive or has an activity due as much to U as to UX.

1231 Rudge, W. A. D. "On the Electrification Associated with Dust-Clouds." Phil Mag. (6), **25**, 475-94(1913).

It is reported that finely divided UO_2 or UO_3 when dispersed in a strong blast of air will acquire a pos. charge of static electricity. Many other materials are also investigated.

1232 Sabatier, P. and Gaudion, G. "On the Decomposition of Glycerine in the Presence of Various Catalysts: Formation of Ethyl and Allyl Alcohols." Compt. rend. **166**, 1033-9(1913).

UO_2 is reported to have a catalytic effect on the decompn. of glycerine vapors. The effect in UO_2 is not so marked as that of other materials, such as copper.

1233 Sborgi, U. "Anodic Behavior of Uranium." Z. Elektrochem. **19**, 115-17(1913).

1234 Senderens, J. B. "Catalytic Preparation of Ketones." Ann. chim. phys. (8), **28**, 243-344 (1913).

Pages 293-4 contain information on the use of U_3O_8 as a catalytic agent in the prepn. of ketones from org. acids. UO_3 may also be used as a catalyst in such reactions.

1235 Shaeffer, E. J. and Jones, H. C. "A Study of the Conductivity, Dissociation, and Temperature Coefficients of Conductivity of Certain Inorganic Salts in Aqueous Solution, as Conditioned by Temperature, Dilution, Hydration and Hydrolysis." Am. Chem. J. **49**, 207-53(1913).

This paper reports values of the molar cond. of Hg units for solns. of UO_2SO_4 from 8 to 4096 M^{-1} and of the temp. coeff. of cond. at 0, 12.5, and 35° . These values do not agree with earlier detns. or with later results by the same authors.

1236 Soddy, F. "The Radio-Elements and the Periodic Law." Chem. News **107**, 97-9(1913).

A chart is given showing graphically the evolution of the elements through the periodic table from U to Pb.

1237 Stoklasa, J. "The Influence of Uranium and Lead on Plants." Compt. rend. **156**, 153-55(1913).

The author investigated the effect of U and Pb salts. The expts. were made in large pots, the salts being added in increasing quantity in the different series. Oats and buckwheat were grown. U nitrate in small quantity seemed to stimulate plant growth, but when used in large amts. it was detrimental. Pb was much more actively toxic than U. The results indicated that both U and Pb in the form of nitrates and in very dil. soln. increased the growth of plants, and these results were confirmed by field tests.

- 1238 von Hevesy, G. and von Putnoky, L. "Diffusion of Uranium." Phil. Mag. (6), 25, 415-18(1913).

The authors can find no chem. proof of the existence of U_{II} . Diffusion expts. failed to show a sepn. of U_I and U_{II} . If U_I and U_{II} are different elements, as seems quite likely from the observation of Marsden and Barratt, that the 2 α particles of U were not given off simultaneously, and of Geiger and Nuttall, that the α rays of U fall into 2 groups which differ by 4 mm in their range, then U_{II} must have the same valence as U_I and be most closely related to it in chem. properties. The authors suggested the following arrangement for these elements in the series:

- 1239 von Hevesy, G. and von Putnoky, L. "Diffusion of Uranium." Physik. Z. 14, 64-5(1913). This paper contains information similar to that reported in Phil. Mag. (6), 25, 415-18(1913).

- 1240 von Traubenberg, H. R. "Contribution on Radiation and Energy Distribution in the Electrical Spark Discharge at High Frequency." Ann. Physik (4), 40, 249-80(1913). A discussion is included on the dependency of the radiation in the high-freq. spark upon the discharge conditions as applied to the U spectrum. Information on expts. on the U spark spectrum using U electrodes is included.

- 1241 Walker, C. and Dawson, R. P. "The Effect of Diuretic Drugs on the Life of Animals with Severe Acute Nephritis." Arch. Internal Med. 12, 171-7(1913). Rabbits, which had been intoxicated with U, were given daily doses of theocin, caffeine, potassium acetate, and spartein sulfate. In severe nephritis they found the use of these drugs actually shortened the lives of the animals. In less severe injuries theobromine sodium salicylate appeared to have a beneficial effect by increasing the output of urine unless it was repeated often enough to cause renal fatigue.

- 1242 Wedekind, E. "Synthesis of the Borides in the Electric Vacuum Furnace." Ber. 46, 1198-1207(1913).

The electric arc vacuum furnace can be used for the prepn. of the metallic borides. Its use eliminates two great difficulties attendant in the prepn. of the borides, namely, the effect of the components of the air and the contamination of the product with C. The material used must be compressed into rods or cylinders that are fair conductors of electricity. These rods are used as the electrodes. For the compression, pressures sometimes exceeding several hundred atms. are used. The calcd. amts. of amorph. B and the powd. metal to be used are compressed into rods, and current is then passed through them. The borides of Zr, V, Mo, U, Ti, and W were formed. Difficulties were met with only in the prepn. of the borides of Ti and Mo. UB_2 is a silvery gray cpd. with a metallic appearance. It is stable to acid and alk.; HF and HNO_3 , however, react with it.

- 1243 Welwart, N. "Determination of Cobalt and Uranium in Steel." Chem. Ztg. 37, 1224-5(1913).

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- 1244 Agulhon, H. and Robert, T. "Action of Colloidal Uranium on Pyocyanic Bacilli." Compt. rend. 158, 349-52(1914).

Colloidal U, in cultures of pyocyanic bacilli, caused marked increase of blue pigment in excess over control cultures without U or contg. the powd. metal.

- 1245 Aloy, J. and Rabaut, C. "Detection of Morphine and the Phenols Using the Salts of Uranium." Bull. soc. chim. France (4), 15, 680-2(1914).

It is reported that a satd. uranyl acetate soln. will yield a red soln. with morphine chloride. This reaction is also said to be obtained with pure morphine.

- 1246 Bidwell, C. C. "Thermal Electromotive Forces in Oxides." Phys. Rev. (2), 3, 204-16(1914). This paper gives calcns. of thermoelectric power for U_3O_8 from 250 to 1200°. A graph of these data as a function of temp. is included.

- 1247 Bolin, I. "The Photochemical Decomposition of Lactic Acid in Presence of Uranyl Sulfate." Z. physik. Chem. 87, 490-506(1914).

The photochem. decompn. of lactic acid in the presence of uranyl sulfate proceeds in accordance with $CH_3CHOHCO_2 + UO_2^{++} + 3H^+ \rightarrow CH_3CHO + CO_2 + 2H_2O + U^{++++}$. The uranyl sulfate exerts a catalytic action only when O_2 is passed through the reaction mixt. in sufficient quantities to oxidize the reduced uranyl sulfate.

- 1248 Boll, M. and Henri, V. "Lack of Influence of Oxygen on Certain Photochemical Reactions." Compt. rend. 158, 32-4(1914).

The presence of O_2 in the soln. in which a photolytic reaction between uranyl salt and oxalic acid is taking place has no effect upon the velocity of the reaction.

- 1249 Boycott, A. E. "On the Regulation of the Blood Volume in Normal and Nephritic Animals. Part I. Experiments with Salt Solutions." J. Path. Bact. 18, 11-31(1914).

This describes expts. on blood concn. and vol. in animals made experimentally nephritic with U.

- 1250 Boycott, A. E. "On the Regulation of the Blood Volume in Normal and Nephritic Animals. Part II. Experiments with Protein Solutions." J. Path. Bact. 18, 498-512(1914).

This describes expts. on blood concn. and vol. in animals made experimentally nephritic with U.

- 1251 Burfeind, J. H. Extracting Uranium, Vanadium and Radium from Ores. May 5, 1914. (U. S. Patent 1,095,377)

The ore is treated with an aq. soln. of SO_2 to dissolve the U and V and convert the Ra-bearing constituents of the ore into an amorph. mud and then effect sepn. of the different values from the mud and soln.

- 1252 Chisolm, R. A. "The Water Content of the Tissues in Experimental Nephritis." J. Path. Bact. 18, 404-13(1914).

This describes expts. on blood concn. and vol. in animals made experimentally nephritic with U. Extensive tubular necrosis was noted.

- 1253 Chisolm, R. A. "The Regulation of Blood Volume in Experimental Nephritis." J. Path. Bact. 18, 552-65(1914).

This describes expts. on blood concn. and vol. in animals made experimentally nephritic with U. Extensive tubular necrosis was noted.

- 1254 Christian, H. A. "The Effect of Theobromin Sodium Salicylate in Acute Experimental Nephritis, as Measured by the Excretion of Phenolsulphonephthalein." Arch. Internal Med. 14, 827-43(1914).

This article is a study of the elimination of dye from U-intoxicated animals using diuretics.

1255 Classen, A. Nitrogen Pentoxide. March 28, 1914. (British Patent 7,866)

The prepn. of colloidal Au, Ag, W, Mo, U, Ti, and Nb by boiling saltlike cpds. of the metals with gelatin, fish glue, etc., is reported. These materials on contact carriers such as oxides of U, Ni, or W are used to catalyze the direct synthesis of N_2O_5 .

1256 Courtois, G. "Organic Uranium Salts of Monobasic, Aliphatic Acids." Compt. rend. 158, 1511-14(1914).

The following uranyl salts were prepd. by treating an aq. soln. of $UO_3 \cdot H_2O$ with an excess of acid: uranyl formate, $(HCO_2)_2UO_2 \cdot H_2O$, as yellow octahedrons; acetate (2 moles H_2O); propionate, $(EtCO_2)_2UO_2 \cdot 2H_2O$, as yellow crystals; butyrate (2 moles H_2O), giving rise to an acid salt, $(PrCO_2)_2UO_2 \cdot PrCO_2H$, when dissolved in $PrCO_2H$; isobutyrate (2 moles H_2O) as yellow microcrystals forming an acid salt, $(iso-PrCO_2)_2UO_2 \cdot iso-PrCO_2H$; valerate (2 moles H_2O) as yellow scales; isovalerate (2 moles H_2O) as cream-colored leaflets, similarly forming an acid salt. A satd. soln. of uranyl formate, when kept in the dark, gradually deposits a basic salt, $(HCO_2)_2UO_2 \cdot UO_3 \cdot 3H_2O$. The satd. aq. solns. of all of the neutral uranyl salts are slowly decompd. by sunlight, with the liberation of CO_2 and CO by uranyl formate, and of CO_2 and satd. hydrocarbons, in other cases.

1257 Courtois, G. "On Uranyl Glycolate, Lactate, and Several Uranyl Salts of the Polyacids of the Fatty Series." Compt. rend. 158, 1688-91 (1914).

The following uranyl salts were prepd.: glycolate, $[CH_2(OH)CO_2]_2UO_2$; basic glycolate, $[CH_2(OH)CO_2]_2UO_2 \cdot H_2O$; lactate, $[MeCH(OH)CO_2]UO_2$; oxalate (contg. 3, 1, or 0 moles H_2O , depending on the temp. of drying; cf. Péligré, Ann. chim. phys. (3), 5, 39 and Oechsner de Coninck, et al.); malonate (cf. Rammelsberg, Jahresb. Chem. 467, 1855; tartrate (contg. 1 or 5 moles H_2O); cf. Péligré, Ann. chim. phys. (3), 12, 463; citrate (contg. 1, 2, or 6 moles of H_2O , depending on the temp. of drying); and basic citrate, $(C_6H_5O_7)_2(UO_2)_3 \cdot 2H_2O \cdot 2(H_2UO_4) \cdot 20H_2O$.

1258 de Broglie, M. "On Direct Spectral Analysis by Secondary Rays from Roentgen Rays." Compt. rend. 158, 1785-8(1914).

Early measurement on the L-level lines in the x-ray spectrum of U are given. Measurements were made on UO_2 .

1259 Dewar, J. "Atomic Specific Heats between the Boiling Points of Liquid Nitrogen and Hydrogen. I. The Mean Atomic Specific Heats at 50° Absolute of the Elements, a Periodic Function of the Atomic Weights." Proc. Roy. Soc. (London), A. 89, 158-69(1914).

The sp. ht. and at. ht. for U are reported to be 0.0138 and 3.30, resp.

1260 Eggert, J. "Velocity of Absorption of Hydrogen and Oxygen by Metal-Salt Solutions." Z. Elektrochem. 20, 370-81(1914).

Velocity of oxidation and reduction of Fe salts by O_2 and H_2 has been followed by measuring the vol. of gas absorbed at 17°. Several forms of Pt stirrers, coated with Pt black, were used. The max. absorption effect was obtained when the Pt, by drawing the stirrer out of the soln., was in contact with the oxidizing or reducing atm. This max. effect was proportional to the Pt surface and the length of time it remained in the gas, but independent of its period. The gas absorption was const. and independent of the metal of the dissolved salt. A temp. coeff. of occlusion velocity of 1.8 to 2.3% was found, independent of the pH, with the anion exerting an influence. Expts. were performed with U salts, and they were found to be completely reversible, i.e., reduced by H_2 and oxidized to the original state by O_2 .

1261 Eichorn, W. "Apparent Explosibility of Uranyl Nitrate." Chem. Ztg. 38, 139(1914).

A sample of $UO_2(NO_3)_2 \cdot 6H_2O$ obtained by pptn. with Et_2O showed a slight deficiency in H_2O , and on standing in a moist atm. it at first took up considerable H_2O , then remained at practically const. wt. The prepn. obtained with Et_2O did not show triboluminescence.

- 1262 Fitz, R. "The Immediate Effect of Repeated Doses of Theobromine Sodium Salicylate and Theocin on Renal Function in Acute Experimental Nephritis." Arch. Internal Med. **13**, 945-56(1914).

The use of theobromine sodium salicylate and theocin in anesthetized rabbits which had been made nephritic with U is said to increase the flow of urine and the elimination of NaCl and N.

- 1263 Fleck, A. "The Relation of Uranous Salts to Thorium." J. Chem. Soc. **105**, 247-51(1914). This paper reports that UF_4 and ThF_4 can be sepd. by fractional pptn. because of their differing soly.

- 1264 Henri, V. and Landau, M. "Application of Spectroscopy to the Study of Chemical Equilibrium. Systems Formed by Oxalic Acid and Uranyl Salts." Compt. rend. **158**, 181-3(1914).

The quant. measurement of absorption spectra in the ultraviolet may be used to follow the progress of a reaction in case the products have absorption spectra different from the components entering the reaction. The expts. cover mixts. of $\text{UO}_2(\text{NO}_3)_2$, UO_2SO_4 , UO_2Cl_2 , and $\text{UO}_2(\text{AcO})_2$ with $(\text{COOH})_2$ over the light range $\lambda = 2195$ to $3306 \text{ \AA}$. Considering the extreme photochem. instability of the systems, the observed absorption constitutes a new proof of the general law that chem. lability causes an exaltation of the absorptive power in the ultraviolet. The exaltation was strong with sulfates and nitrates, feeble from chloride, and still more feeble for acetates. A direct relation exists between the photocatalytic power and exaltation of absorption for uranyl salts on $(\text{COOH})_2$.

- 1265 Hess, F. L. and Schaller, W. T. "Pintadoite and Uvanite, Two New Vanadium Minerals from Utah." J. Wash. Acad. Sci. **4**, 576-9(1914).

- 1266 Hofmann, K. A. and Hörschele, K. "Magnesium Chloride as a Mineralizer, with Some Remarks on the Spectro Chemistry of the Rare Earths." Ber. **47**, 238-47(1914).

It is reported $3\text{MgO} \cdot 2\text{UO}_3$ can be obtained by melting UO_3 in MgCl_2 and washing. Double refractive prisms are obtained which are sol. in dil. HOAc.

- 1267 Hönigschmid, O. "Revision of the Atomic Weight of Uranium." Compt. rend. **158**, 2004-05(1914).

UO_2 was obtained from 2 sources and very carefully purified. A mixt. of UO_2 and sugar charcoal was heated in Br_2 vapor in a quartz app., and the UBr_4 formed was sublimed, first in Br_2 vapor, then in N_2 . The UBr_4 was finally condensed in a tiny quartz tube, without coming in contact with air in any of the process. Two detns. of the ratio $\text{UBr}_4 : 4\text{AgBr}$ gave 238.06 and 238.10 for the at. wt. of U; of the ratio $\text{UBr}_4 : 4\text{Ag}$ gave 238.17 and 238.12. Another series gave 238.18 and 238.17 for these ratios. The UBr_4 of Richards and Merigold is reported to have contd. alk. bromides derived from the glass app. used. The difference between the at. wts. of Ra as detd. by the author and U as detd. here is $238.17 - 225.97 = 12.2$, the theoretical difference being $3 \times \text{at. wt. of He}$, or 12.006.

- 1268 Hönigschmid, O. "Revision of the Atomic Weight of Uranium." Z. Elektrochem. **20**, 452-60(1914).

This paper contains information similar to that reported in Compt. rend. **158**, 2004-05(1914).

- 1269 Jorissen, W. P. and Vollgraff, J. A. "Immutability of Uranium Radiation." Chem. Weekblad **11**, 832-7(1914).

No difference could be detected in the activity of untreated U_3O_8 and of U_3O_8 which had been subjected to the action of cathode rays in vacuum; the latter sample was of a black color and was partially reduced to UO_2 .

- 1270 Lebeau, P. and Damiens, A. "On the Composition of Gas Mixtures Resulting from the Action of Water on Carbides of Uranium and Thorium." Bull. soc. chim. France (4), 15, 367-70(1914).

The decompn. products for UC_2 igniting in H_2O are reported to be hydrocarbons.

- 1271 Lely, D., Jr. and Hamburger, L. "Preparation of the Elements Thorium, Uranium, Zirconium, Titanium." Z. anorg. Chem. 87, 209-29(1914).

The reduction of the metals from the chlorides is effected by means of metallic Na in vacuum (steel) vessel; the reduced metals in small globules or scales are compressed into rods which are heated as resistance by a.c. in a vacuum furnace. The difficulties are that the raw materials (oxides) are not pure, that the chlorides, purified by subln., are hydr. and that the prepn. of rods of sufficient stability is often very troublesome; moreover, air and other metals have to be excluded. The resulting compact metals generally are more stable than might be expected, and their m.ps. are much below that of W. The finely divided U was too brittle to allow compression, and was therefore heated in an alundum tube wound with Mo wire; it became harder and conducting at 1400° ; the color was darker than that of Th, the U turning brown in air. It is fairly stable in H_2O , HOAc, and alk. It dissolved in HCl and HNO_3 . The material prepd. contd. about 0.5% O_2 .

- 1272 Low, A. H. Technical Methods of Ore Analysis. New York, 1914.

Page 273 of this book discusses the alk. phosphate method of sepg. U and V. In hot strong acetic soln. V can be pptd. by alk. phosphates. U does not entirely remain in soln. so a recrystn. is necessary.

- 1273 McDermott, F. A. "Some Chemical Activities of Citromyces: Utilization of Nitrogenous Substances, and Effects of Heavy Metals in the Medium." Mycolog. Centr. 3, 159-60 (1914).

C. glaber and *C. pfefferianus* utilize uric acid, hippuric acid, and urea as sources of N, but not hexamethylenetetramine. Small amts. of $Mn(OAc)_2$ and uranyl acetate accelerated the growth somewhat; $FeCl_3$ and $ZnCl_2$ produced a distant retardation.

- 1274 MacNider, W. deB. "The Difference in the Response of Animals of Different Ages to a Constant Quantity of Uranium Nitrate." Proc. Soc. Exptl. Biol. Med. 11, 159-62(1914).

Forty-eight dogs varying in age from a few mos. to old age were given $UO_2(NO_3)_2 \cdot 6H_2O$ subcutaneously in the dose of 6.7 mg/kg on 2 successive days. In over 90% of the older animals glycosuria appeared within 24 hrs following the first injection, while in 90% of the puppies it was absent until the second injection. The puppies and young animals which show low glucose in the urine show a small amt. of fat in the liver and kidney.

- 1275 Massol, G. and Faucon, A. "The Absorption of Ultraviolet Rays by Certain Colored Organic and Inorganic Solutions." Bull. soc. chim. France (4), 15, 147-8(1914).

The absorption by dil. aq. solns. of the 21 authorized dyes and of ammoniacal $CuSO_4$, K_2CrO_4 , $K_4Fe(CN)_6$, $UO_2(NO_3)_2$, $AuCl_3$, green $Cr_2(SO_4)_3$, and $NiSO_4$, of ultraviolet rays ($\lambda = 2200$ to $4045 \text{ \AA}$) was investigated. The solns. fall into 2 classes; those which absorb only the rays of shorter wavelength, and those which absorb rays at both ends of the ultraviolet spectrum. The rays of medium wavelength ($\lambda \sim 3500 \text{ \AA}$) are least absorbed. Yellow and red substances give the most complete absorption. Solns. of the inorg. substances must be from 10 to 1000 fold more concd. than those of the org. dyes to give equiv. absorption. The absorption does not vary uniformly with the thickness of the layer traversed.

- 1276 Mazzucchelli, A. "Absorption Spectra at Very Low Temperatures." Atti reale accad. Lincei (5), 23, I, 953-9(1914).

Certain uranyl salts and organic dyes were examined. The liq. to be studied was placed in a tube and this set in a Dewar flask containing liq. air; a black cardboard cover contg. 2 opposite holes was placed over the latter. The light passed through the holes, through the liq., and into the slit of the spectrograph.

The solns. were considered ready for examn. when the EtOH had passed the viscous stage and had solidified into a fragile glass of which the temp. was -180° or a little higher. In all cases this glass was obtained without having any crystn. of the solns. which did not exceed 1%. The position of the bands was detd. by comparison with the He spectrum. A 1% soln. of UO_2SO_4 was obtained in the cold by the action of SO_2 on U peroxide suspended in 100 parts H_2O to which was added 1% H_2SO_4 . The soln. evapd. gives a salt, $\text{UO}_2\text{SO}_4 \cdot \text{H}_2\text{O}$, which is very slowly but completely sol. in EtOH; if evapd. to a sirupy consistency it is instantly sol. The spectrum at ordinary temp. shows the typical uranyl salt spectrum but the bands 509-491, 478-473, 458-454, and from 445 on are very weak and indistinct. At low temps. it shows 2 sharp bands at 645-626 and 582-576 which are not characteristic of uranyl salts and probably arise from small amts. of urano salts since they do not disappear again at room temp. In the highly refractive part of the spectrum complete absorption takes place. Uranyl chloride gives similar absorption spectra as well as the extra bands. The strong general absorption may be due to the extra bands or to an inadequate exposition. Uranyl bromide gives an almost continuous spectrum at ordinary temp. and at low temps. 2 bands appear (481-475, 465-455). The expts. with uranyl iodide were unsatisfactory because free I_2 was present. Solns. of uranyl salicylate are red at ordinary temp. and show weak signs of absorption bands; but at low temps. the yellow color of uranyl salts is seen and 3 sharp bands 480-477, 463-462, and 447-443 appear. The yellow soln. of uranyl p-hydroxybenzoate shows 2 bands at ordinary temp. (466-461 and 451-444). The spectrum is sharply terminated at 433, perhaps owing to the presence of another band, which was not identified. At low temp. 2 bands at 478-477 and 465-458 are present and an indistinct one at 488-441; the spectrum ends at 431. The influence of temp. seems limited mainly to those cpds. in which (like the U salts) the selective absorption is limited by the properties of one element.

- 1277 Merton, T. R. "Absorption of Light by Uranous Chloride in Different Solvents." J. Chem. Soc. 105, 23-7(1914).

In solns. in pure solvents the absorption spectra were not very sharply defined, but when the solns. were satd. with HCl gas or when a few drops of aq. HCl were added, the broad masking bands disappeared and were replaced by a sharply defined spectrum. The solvents used were acetone, Et acetoacetate, acetonitrile, and EtOH. There was a general absorption which disappeared on adding HCl and a group of bands between 5900 and 6050 A, which appeared after HCl was added. The spectrum of solns. in acetophenone appears peculiar to that substance. It does not appear possible to explain the phenomena without assuming that different kinds of aggregates coexist in the soln., and that the vibrators responsible for the less refrangible bands are situated in different aggregates from those of the more refrangible bands.

- 1278 Moore, R. B. and Kithil, K. L. Preliminary Report on Uranium, Radium, and Vanadium. Washington, U. S. Government Printing Office, 1914. 101p. (U. S. Bureau of Mines Bulletin No. 70, rev.)

- 1279 Mosenthal, H. O. "Nitrogen Metabolism and the Significance of the Non-Protein Nitrogen of the Blood in Experimental Uranium Nephritis." Arch. Internal Med. 14, 844-68(1914). Dogs which had been poisoned with U were investigated, and it was found that the elimination of N was variable.

- 1280 Nichols, E. L. and Merritt, E. "Fluorescence of Frozen Solutions of Uranyl Salts." Phys. Rev. (2), 3, 457-63(1914).

The solns. were placed in a test tube within a cylindrical Dewar flask with unsilvered walls. Fluorescence was excited by a conical beam from a right-angled C arc and the spectrum was observed with a Hilger spectrocope. A ray filter absorbed all the light from 0.47μ to the extreme red, so that the fluorescence bands appeared on a dark background. In no case, with the exception of uranyl acetate in alc., was a resolution of the fluorescence of aq. solns. into narrow linelike bands observable. Within the errors of observation, there was no shift in the bands of UO_2SO_4 with change of concn. until a diln. of 0.001 was passed. In 0.0001N soln. there was a shift toward the red. Tables for

$\text{UO}_2(\text{OAc})_2$, UO_2SO_4 , and $\text{UO}_2(\text{NO}_3)_2$ in H_2O and $\text{UO}_2(\text{NO}_3)_2$ in EtOH at liq. air temp. are given.

- 1281 Opie, E. L. and Alford, L. B. "Influence of Diet on the Toxicity of Substances Which Produce Lesions of the Liver or Kidneys." *J. Am. Med. Assoc.* 63, 136-7(1914).

Animals on a diet rich in carbohydrates are much less susceptible to nephritis produced by K_2CrO_4 and $\text{UO}_2(\text{NO}_3)_2$ than animals on a meat or fat diet. A diet of fat increases the toxicity of $\text{UO}_2(\text{NO}_3)_2$, which alters the loops of Henle and produces nephritis.

- 1282 Pascal, P. "Some Double and Complex Cyanates." *Bull. soc. chim. France* (4), 15, 11-19(1914).

By adding a soln. of KCNO in 70% EtOH to a neutral soln. of $\text{UO}_2(\text{NO}_3)_2$ a yellow ppt. is obtained. It is purified by washing with 70 and 95% EtOH and with Et_2O . The dry powder has a green fluorescence. Its formula is $\text{K}_2\text{UO}_2(\text{CNO})_4$. Treated with acid it gives off CO_2 . It is very sol. in H_2O , but in aq. soln. the salt undergoes decompn. and a new orange-colored cyanate is pptd., of which the formula is $\text{K}(\text{UO}_2)_2(\text{CNO})_5$. One can modify the evolution of the uranyl cyanate by adding to its soln. an excess of a uranyl salt or a soln. of an alk. cyanate. The existence of 4 cyanates that are uranyl derivs. is proved, e.g., $\text{K}_2\text{UO}_2(\text{CNO})_4$, $\text{K}(\text{UO}_2)_2(\text{CNO})_5$, $\text{UO}_2(\text{CNO})_2$, and $\text{KUO}_2(\text{CNO})_3$. From cryoscopic examn. of the uranyl cyanates it seems probable that solns. which contain much alk. cyanate contain the K salt of a bivalent acid, $\text{K}_2\text{UO}_2(\text{CNO})_4$ easily dissociated by H_2O . Further work showed it is probable that the disappearance of the uranyl reactions in solns. that are rich in alk. cyanate is due solely to the diminution of the dissocn. of the tetracyanate, which is stabilized by the excess of the alk. salt. Cryoscopic examns. of solns. of cobaltocyanates gave results quite comparable to those which had been obtained with the uranyl cyanates. Disso. is greater than is the case with the uranyl cyanates, but the similar effect obtained upon the addn. of an excess of alk. cyanate shows the identity of constitution of the two sorts of complex cpds.

- 1283 Pascal, P. "Uranyl Thiocyanate." *Compt. rend.* 158, 1672-4(1914).

By treating $\text{UO}_2(\text{SO}_4)_2$ with $\text{Ba}(\text{CNS})_2$, filtering and evapg. the filtrate in vacuum an orange-yellow cryst. salt was obtained, the formula of which was $\text{UO}_2(\text{CNS})_2 \cdot 8\text{H}_2\text{O}$. It is very deliq. and is strongly ionized in H_2O soln. By the addn. of a soln. of pyridine (just the amt. necessary to form a ppt.), an insol. cryst. basic salt, $5\text{UO}_2(\text{CNS})_2 \cdot \text{UO}_3 \cdot n\text{H}_2\text{O}$, is formed. With some metallic thiocyanates uranyl thiocyanate forms more than one series of double salts as $\text{UO}_2(\text{CNS})_2 \cdot 3\text{NH}_4\text{CNS} \cdot 6\text{H}_2\text{O}$, $\text{UO}_2(\text{CNS})_2 \cdot 5\text{NH}_4\text{CNS} \cdot 2\text{H}_2\text{O}$. With the alk. earth metals only one series of double salts is formed, $\text{UO}_2(\text{CNS})_2 \cdot \text{Ba}(\text{CNS})_2 \cdot 6\text{H}_2\text{O}$. All of the cpds. are very sol. in acetone, AmOH and Et_2O , but the solns. in org. solvents are unstable. The thiocyanate together with the sulfate occupies the last place on the list when UO_2 salts that are capable of giving complex cpds. are arranged in the order of their stability.

- 1284 Rideal, E. K. "The Reduction of Uranium Oxide. *J. Soc. Chem. Ind.* 33, 673-6(1914). The utilization of U salts is important due to the accumulation as a by-product of the Ra industry. Several methods for the reduction of U_3O_8 were tried. The best results were obtained by an electrothermal-thermite process. A granular resistor was used to heat a tube of pure MgO which contd. a mixt. of 80% U_3O_8 and 20% Mg powder pressed into the form of rods. The ends of the rods were placed in contact with C electrodes and a current of H_2 passed through the app. When the rods were hot enough to become conducting, the main electrodes were connected to the 110-volt circuit, causing an arc of Mg vapor which reduced the oxide to metal. The H_2 was displaced by CO_2 and the MgO removed from the product by washing with dil. acetic acid. A yield of 98-99% metal was obtained. A good reduction was also obtained by heating a mixt. of 50% U_3O_8 , 15% CaCl_2 , 15% Mg , and 20% Na in a steel cylinder to a bright-red heat.

- 1285 Soddy, F. *Chemistry or Radio-Elements. The Radio-Elements and the Periodic Law.* London, Longmans, Green, & Co., 1914.

- 1286 Tiede, E. and Birnbrauer, E. "Special Methods for Producing Higher Temperatures in Vacuo, and the Behavior of Some Metals, Oxides and Carbides." Z. anorg. Chem. **87**, 129-68(1914).

UO₂ and C began to react at about 1600°; the m.p. of UC₂ was found to be 2260°.

- 1287 Truffaut, G. "Radioactivity and Vegetation." Gardeners' Chronicle **55**, 378-9(1914). While the expts. were not conclusive, it appears that black U oxide gives a considerable increase in yield at low cost and that commercially made radioactive substances contain injurious Ba salts or H₂SO₄.

- 1288 Truffaut, G. "Radioactivity and Vegetation." Agr. News (Barbados) **13**, 215(1914). This paper contains information similar to that reported in Gardeners' Chronicle **55**, 378-9(1914).

- 1289 U. S. Geological Survey. "Survey Publications on Antimony, Chromium, Monazite, Nickel, Platinum, Quicksilver, Tin, Tungsten, Uranium, Vanadium, etc." U. S. Geol. Survey Bull. No. 540, 547-9(1914).

- 1290 Wunder, M. and Wenger, P. "Separation of Beryllium and Uranium." Z. anal. Chem. **53**, 371-4(1914).

Expts. using pure BeCl₂, UCl₄, UO₂(NO₃)₂ are reported. The soln. of the chlorides is treated in a Pt dish on a water bath with 3% H₂O₂ soln., the U₃O₈ filtered rapidly on a fine double filter and washed with dil. H₂O₂ or NH₄NO₃ and ignited to Pt to const. wt. The filtrate is boiled to expel O₂ and ppt. Be(OH)₂ with NH₄OH, filtered, washed, ignited and weighed as BeO. If Be is present in large amt. a double pptn. of the U with H₂O₂ is advisable. With nitrate solns. The same procedure is followed. Results obtained on known mixts. were excellent.

PUBLICATIONS LOCATED IN 1915

- 1291 Baragiola, W. I. "Preparation of Pure Uranium and Other Metals." Schweiz. Apoth. Ztg. **53**, 477-8(1915).

This is a claim of priority. The author describes his prepn., in 1903-4, of U by chlorinating U₃O₆(?) with CO₂ and CCl₄ and reducing UCl₄ with Na.

- 1292 Becker, A. and Jannasch, P. "Radioactivity and Chemical Analysis of Uranium Pitchblende from Joachimsthal." Jahrb. Radioakt. u. Elektronik **12**, 1-34(1915).

Method and results of analyses are reported for a mineral of about 98.5% U₃O₈.

- 1293 Behrens, H. and Kley, P. D. C. Mikrochemische Analyse. Leipzig - Hamburg, 1915. Vol. 1 contains a discussion of the crystal structure and microdetection methods used for U and its cpds.

- 1294 Benedicks, C. "Electric Properties of Rare Metals." Intern. Z. Metallog. **7**, 225-38(1915). Most of the metals examined were specimens of about 10 g presented to Uppsala University. A value of 62 for the sp. resistance of U is reported which is too high owing to the presence of carbide; however, U almost surely conducts better than Bi.

- 1295 Boycott, A. E. and Douglas, J. S. C. "On the Regulation of the Blood Volume in Normal and Nephritic Animals. Part III. Experiments with Tissue Fluid." J. Path. Bact. **19**, 221-5(1915).

This describes expts. on blood concn. and vol. in animals made experimentally nephritic with U.

- 1296 Boycott, A. E. and Douglas, J. S. C. "On an Attempt to Discover the Composition of Tissue Fluid in Normal and Nephritic Animals." *J. Path. Bact.* 19, 528-48(1915).

This describes expts. on blood concn. and vol. in animals made experimentally nephritic with U.

- 1297 Chisolm, R. A. "The Regulation of the Blood Volume in Experimental Nephritis." *J. Path. Bact.* 19, 265-75(1915).

This describes expts. on blood concn. and vol. in animals made experimentally nephritic with U. Extensive tubular necrosis was noted.

- 1298 Danforth, C. W., Samuels, W. P., and Martersteck, W. T. Recovering Values from Complex Refractory Carnotite Ores. January 26, 1915. (U. S. Patent 1,126,182)

Recovery may be effected by subjecting the ore to an oxidizing roast, treating with H_2SO_4 while still hot to fix the Ra and Ba as insol. sulfates and dissolve nearly all the V and U, filtering, and then recovering the Ra from the residue and the U and V from the soln.

- 1299 de Forcrand, M. "Hydrates of Uranyl Nitrate." *Ann. chim.* (9), 3, 5-48(1915).

A marked similarity exists between the nitrates of UO_2 and Cu. The formation of H_2UO_4 and loss of HNO_3 upon heating the 3- or 2-hydrate is analogous to the formation of basic Cu nitrate, $(NO_3)_2UO_2 \cdot nUO_2(OH)_2$ and $(NO_3)_2Cu \cdot 3Cu(OH)_2$. The reactions during dehydration might be considered as the simple dehydration which, according to the data of Marketos, absorbs 29.9 cal, or more complicated, which might be formulated: $N_2O_6UO_2 \cdot 2H_2O (s) \rightarrow N_2O_6UO_2 (s) + 2H_2O (g) - 29.9 \text{ cal}$; $N_2O_6UO_2 (s) \rightarrow N_2O_5 (g) + UO_3 (s) \pm x$; $N_2O_5 (g) + H_2O (g) \rightarrow 2HNO_3 + 10.8 \text{ cal}$; $UO_3 (s) + H_2O (g) \rightarrow UO_4H_2 (s) \pm y$; $H_2UO_4 (s) + N_2O_6UO_2 (s) \rightarrow \text{basic nitrate} \pm q$. The thermochem. data are lacking but by analogy with Cu should approximate $x = -32.6$; $y = +17$; $q = +4.03$. The following exptl. results and data are presented: (1) dehydration of 6-hydrate at room temp. and atmospheric pressure over H_2SO_4 gives 2-hydrate only after 30 days; the 3-hydrate (approx.) after 3 days but no abs. sepn. of the 2 phases; and marked retardation of rate of dehydration near the 3-hydrate. (2) Same in vacuum (4 to 5 mm), 3.454 moles H_2O removed in 1 day; 4 moles after 9 days. (3) Dehydration of 2-hydrate in current of CO_2 , (a) at 160° , dehydration complete after 3 to 4 hrs with much loss of HNO_3 ; (b) at 125 to 130° , approx. 1 mole H_2O lost after 4 to 5 hrs if HNO_3 loss detd. and corr. for; const. wt. after 55 to 60 hrs; product = $N_2O_6UO_2 + \frac{1}{2}H_2UO_4$; (c) at 98 to 99° , 1 mole H_2O removed after 150 hrs; residue is then $N_2O_6UO_2 \cdot H_2O + \frac{1}{2}H_2UO_4$. This expt. fixed the location of t_a and t_b and served to isolate the previously unknown monohydrate. (4) Dehydration of the 2-hydrate in a current of CO_2 charged with HNO_3 vapor (a) at 165° , after 15 hrs, $N_2O_6UO_2 + \frac{1}{2}H_2UO_4$; (b) at 155° , after 30 hrs, $N_2O_6UO_2 + \frac{1}{2}H_2UO_4$. By this method a practically pure anhyd. salt should be obtained at 125° . The thermochem. data were obtained by dissolving the various hydrates thus prepd., of which the actual compn. was 5.975 H_2O , 2.85 to 2.90 H_2O , 2-hydrate pure, 1-hydrate with $\frac{1}{16}H_2UO_4$ and anhyd. salt with $\frac{1}{28}H_2UO_4$, the necessary corrections for compn. being made. Heats of soln.: 6-hydrate, -5.45 cal ; 3-hydrate, -1.35 ; 2-hydrate, -5.05 ; 1-hydrate, -11.87 ; anhyd., -19.00 . Efflorescence pressure = 1 atm. at: 1-hydrate, 292° ; 2-hydrate, 281° ; 3-hydrate, 176° ; 6-hydrate, 128° . Heat of soln., of UO_3 (prepd. at 290 to 300°) = 19.803 cal ; of $UO_3 \cdot H_2O$, 14.846 ; of $UO_3 \cdot 2H_2O$, 12.375 ; for hts. of hydration, 1st mole H_2O , 4.975 cal ; for 2nd mole, 2.471 cal . Ht. of formation of $UO_2(NO_3)_2 (s) = 67.25$; dissolved = 86.25 . An explanation is appended of the fact noted by Mailhe that addn. of the blue hydrate of Pélégot, $CuO \cdot H_2O$, to a not too concd. soln. of $UO_2(NO_3)_2$ causes CuO to displace UO_3 , the latter pptg. out. $UO_3 \cdot H_2O$ and $CuO \cdot H_2O$ dissolved in HNO_3 liberated nearly the same hts., 14.84 and 14.72 . Both dissolve in solns. of their nitrates to form basic salts. When $CuO \cdot H_2O$ is added to a soln. of $UO_2(NO_3)_2$, HNO_3 is partitioned between the 2 bases; then $UO_3 \cdot H_2O (s) + H_2O (l) \rightarrow UO_3 \cdot 2H_2O (s) + 2.471 \text{ cal}$.

- 1300 Ebler, E. and Bender, W. "New Methods for the Extraction of Radium from Uranium Minerals." *Z. angew. Chem.* 28, 25-40(1915).

This is a complete discussion of the occurrence and minerology of U ores and of numerous methods for the extn. of Ra. Reduction of the crude sulfates by CaC_2 or CaH_2 and sepn. of the Ra from Ba by fractional adsorption and disadsorption with colloidal Mn perhydroxide are recommended.

- 1301 Freundlich, H. and Kaempfer, H. "Influence of Foreign Substances on the Sorption of Uranium X_1 by Charcoal." *Z. physik. Chem.* 90, 681-716(1915).

Expts. were made with $\text{UO}_2(\text{NO}_3)_2$, $\text{Th}(\text{NO}_3)_4$, $\text{Th}(\text{SO}_4)_2$, ZrOCl_2 , strychnine nitrate, benzoic acid, basic dyes, and $\text{Al}_2(\text{SO}_4)_3$. All these, except the Al salt, inhibited or diminished the sorption of the UX_1 by charcoal or reversed it when subsequently added to the soln. which was shaken for periods up to 216 hrs. Freshly prepd. UX was more strongly taken up than solns. of long standing, probably because $\text{UO}_2(\text{NO}_3)_2$ and also Th salts contain small quantities of some still undiscovered radio-elements, which are, however, completely adsorbed when shaken with charcoal.

- 1302 Haber, F. and Greenwood, F. C. "Researches on Ammonia. VII. The Action of Uranium as Catalyzer in the Synthesis of Ammonia from Its Elements." *Z. Elektrochem.* 21, 241-5 (1915).

U carbide was made in an arc furnace from the oxide and an excess of resin lampblack. This cpd. caused the formation of NH_3 under pressure at about 500° . The active agent was found to be a cpd. of the probable compn. U_3N_4 , which forms gradually from the carbide as the gas flows. In presence of O_2 or H_2O the mass becomes compacted and less effective, owing probably to the cementing action of the oxide. Admixture of graphite diminishes this action but also diminishes the catalytic action. Metallic U made in several different ways (in all cases contg. some oxide) also gave catalytic action, but less effectively than the carbide.

- 1303 Hedvall, J. A. "Remainder on Reactions between CoO and Various Metal Oxides at High Temperatures." *Z. anorg. allgem. Chem.* 93, 313-19(1915).

When a mixt. of CoO and UO_3 was heated at 1100 to 1300° , the only definite information obtained was the proof of the existence of a beautiful cryst. yellow cobalt uranate.

- 1304 Hofmann, K. A. and Hörschele, K. "Magnesium Chloride as a Mineralizer. II. Uranium-Cerium-Blue and the Nature of Constitutive Coloring. Magnesium-red and Magnesium-green." *Ber.* 48, 20-8(1915).

The authors show that anhyd. molten MgCl_2 is an excellent crystg. medium for many inorg. oxides. Heating 5 parts of $\text{Ce}_2(\text{SO}_4)_3$ and 2 parts of $\text{UO}_2\text{SO}_4 \cdot 31/2\text{H}_2\text{O}$ with an excess of MgCl_2 for 15 hrs over a Teclu burner caused the formation of a dark-blue double oxide of CeO_2 and UO_2 in the ratio of 2:1. Expts. show that from solns. of Ce salts NH_4OH ppts. only colorless $\text{Ce}(\text{OH})_3$ and from solns. of U salts reddish-brown flakes of $\text{U}(\text{OH})_4$. If an excess of NH_4OH is added to a soln. containing both salts, a yellowish ppt. is formed which in 10 to 20 min. forms a more compact, deep-blue ppt. The deep-blue oxide is therefore a cpd. and not a mixt. This cpd. has the same compn., aside from its H_2O content, as the blue oxide obtained from the MgCl_2 melt. The authors assume that the change in color is due to a change in the state of oxidation of the atoms within the mol. under the influence of light and that in U-Ce blue there is an oscillating change in the state of oxidation in the sense, $\text{Ce}^{+4} - \text{Ce}^{+4} \text{O}_6\text{U}^{+4} \rightleftharpoons \text{Ce}^{+3} - \text{Ce}^{+3} \text{O}_6\text{U}^{+6}$.

- 1305 Hönigschmid, O. "A Revision of the Atomic Weight of Uranium." *Monatsh.* 36, 51-73(1915). When UBr_4 is subld. in a stream of Br_2 vapor, some Br is taken up, and on analysis with Ag the resulting at. wt. for U, 238.085 ± 0.016 , is too low. If subld. in a stream of N_2 there is dissocn. into UBr_3 and Br_2 , giving a high value, viz., 238.175 ± 0.0125 . The true value is considered to be very near the latter and certainly between the two.

- 1306 Howes, H. L. "Fluorescence of Frozen Solutions of Uranyl Salts." *Phys. Rev.* (2), **6**, 192-206(1915).

The changes produced in the spectra of aq. soln. (acid, alk., and alc.) of uranyl sulfate, chloride, nitrate, and a few double salts by slowly lowering the temp. from that of the room to liq. air are: (1) proportionate increase in the intensity of all the bands; (2) a shift either toward the red or the violet; (3) a narrowing of the bands, and in some solns. a tendency toward resolution; and (4) a slight change in the freq. interval between bands, although this appears to be const. at any given temp. The only exception to (4) is the fact that occasionally an extreme red or blue band does not join the const. interval series. A suddenly cooled soln. of $\text{UO}_2(\text{NO}_3)_2$ has a spectrum different from that of the same soln. slowly cooled. This is also true of the double nitrates. Diln. with acid produces larger shifts than diln. with H_2O and often radically changes the appearance of the bands. Alc. solns. invariably give dim, broad-banded spectra. On the basis of the (assumed) formation of different hydrates, the formation of different spectra by the same soln. could be explained. The extraordinary shifts and other changes in the spectra are most readily explained by assuming that the bands in such spectra are complex and consist of overlapping components which vary in intensity with changes in temp. A Hilger const. deviation spectroscope was used with a special Cu app. which enabled the temp. of the specimen to be kept at any desired (const.) temp. between 0 and -180° . Fluorescence was excited by rays from a C arc which had passed through a water cell, a focusing condenser, and a soln. of ammonia- CuSO_4 which absorbed all of the exciting light of wavelength greater than 0.478μ , so that the fluorescent light from the collimator of the spectrometer could be viewed on a black background.

- 1307 Lenz, W. "Fluorescence in Microchemical Analysis." *Z. anal. Chem.* **54**, 27-42(1915). $\text{NaUO}_2(\text{OAc})_3$ fluoresces under ultraviolet light in a greenish-yellow color; other points about the fluorescence of U salts are also discussed.

- 1308 Mazzucchelli, A. and Sabatini, G. "Polarimetric Measurements of Some Complex Uranyl Salts." *Gazz. chim. ital.* **45**, II, 225-50 (1915).

It is known that the uranyl salts (UO_2X_2) given by UO_3 with acids in aq. soln. do not give the addn. cpds. with NH_3 and org. amines that are so easily obtained with Mg, Zn, Fe, Co, Ni, etc. This is not due to an incapacity of these cpds. to exist for such addn. cpds., although quite unstable, having the formula $\text{UO}_2\text{X}_2 \cdot n\text{NH}_3$ ($n = 2, 3, 4$) are obtained from gaseous NH_3 acting on the uranyl salts in Et_2O or AmOH soln. Their nonformation is no doubt due to the fact that in the presence of H_2O they are immediately decompd. with the pptn. of NH_4 pyrouranate, because the acid function of UO_3 is too weak and because of the basic properties that NH_3 possesses in H_2O . Such addn. cpds. could perhaps also be maintained in aq. soln. if the X group were composed of hydroxy org. acids since their salts are decompd. by bases with difficulty. Their complexity is also shown by the extraordinarily high values for the optical rotation in those cases in which the org. acid is optically active. The optical rotation is increased by the addn. of soda or potash which probably gives origin to the formation of complex salts. If the bases act on the salts by virgure of their common chem. function, i.e., through the OH^- they form, their addn. will cause variations equal to or little less than those caused by strong alks. If, however, they are also able to form definite addn. cpds. the rotation will vary individually with the base used. The rotatory powers of uranyl tartaric acid and uranyl quinic acid were detd. alone and in the presence of NH_3 or $\text{C}_5\text{H}_5\text{N}$ for temps. from 15 to 30° and for light of varying wavelength. Likewise the rotatory power of uranyl malic acid was detd. in the presence of NH_3 . The results show that the formation of complex addn. products is excluded. The same salts are formed as when fixed alk. is used. The changes in rotatory power of the uranyl cpds. on the addn. of variable amts. of KOH was also detd. The detns. showed the formation of a monobasic salt and a dibasic salt. From the preceding detns. and from the variations in the rotatory power of the uranyl tartrate in the presence of H_2SO_4 , it is clear that the complex anion of uranyl tartrate is only slightly stable. For the numerous detailed discussions and tabulated measurements, see the original paper.

1309 Melting Points of Chemical Elements, and Other Standard Temperatures. Washington, Bureau of Standards, rev. Jan. 1, 1915. (Circular of the Bureau of Standards No. 35, 2d ed.)

The m.p. for U metal is given as less than 1950°C.

1310 Mendenhall, C. E. and Wood, R. W. "The Effect of Electric and Magnetic Fields on the Emission Lines of Solids." Phil. Mag. (6), **30**, 316-20(1915).

No Stark effect was found with 50,000 v/cm for crystals of fluorite, ruby, monazite, $\text{Pr}_2(\text{SO}_4)_3$, $\text{Nd}_2(\text{SO}_4)_3$, $\text{Nd}(\text{NO}_3)_3$, and $\text{UO}_2(\text{NO}_3)_2$.

1311 Moore, R. B. —dedicated for free use by the public. Extracting Vanadium, Uranium, and Radium from Ores. December 28, 1915. (U. S. Patent 1,165,692)

Ores contg. V, U, and Ra are leached with a soln. of Na_2CO_3 and NaOH. V is recovered from the soln. and the residue is leached with HCl or HNO_3 , and U and Ra are recovered from the soln. thus formed. Stronger acid may be applied to the residue for ext. any V still remaining in it.

1312 Moore, R. B. Extracting Vanadium, Uranium and Radium from Ores. December 28, 1915. (U. S. Patent 1,165,693)

Ra ores which may also contain V, U, and Fe are leached with hot HCl or HNO_3 , and BaCl_2 and H_2SO_4 are added to the soln. obtained to ppt. BaSO_4 together with RaSO_4 . NaOH or KOH is added to the remaining soln. to ppt. U and Fe together with any Ra still remaining in soln. Then the V is pptd. from the soln. as Fe, Cu, Pb, or Ba vanadate. The ppt. containing U, Fe, and Ra is treated with dil. H_2SO_4 or HCl and BaCl_2 to dissolve U and Fe, and the soln. of U and Fe is boiled with an excess of Na_2CO_3 , the Fe is pptd. and the U subsequently pptd. with NaOH. Na_2CO_3 may, if desired, be used instead of NaOH or KOH for the first alk. pptn., in which case Fe, Al, and Ra with some of the U and V will be pptd. This ppt. is treated in the same manner as that obtained with NaOH, and the U and V are successively pptd. from the remaining soln.

1313 Müller, A. "Uranyl Formate." Z. anorg. allgem. Chem. **93**, 267-70(1915).

$\text{UO}_2(\text{HCO}_2)_2 \cdot \text{H}_2\text{O}$ was prepared by pptg. a warm acid soln. of $\text{UO}_2(\text{NO}_3)_2$ with H_2O_2 , dissolving the pptd. peruranic acid in HCO_2H with the aid of a catalyzer (platinized asbestos), and evapg. the soln. so obtained in a vacuum desiccator. The crystals were freed from excess acid and H_2O with KOH and H_2SO_4 , resp., in a vacuum desiccator kept in the dark. $\text{UO}_2(\text{HCO}_2)_2 \cdot \text{H}_2\text{O}$ was obtained in hard octahedral, greenish-yellow crystals; $d_{19} = 3.695$; insol. in EtOH, Et_2O , CHCl_3 and Me_2CO ; sol. in concd. HCOOH , MeOH, H_2O . The aq. soln. hydrolyzes with sepn. of a light-yellow basic salt. Heated in a test tube, decrepitates and leaves a residue of U_3O_8 . It is sensitive to light. Its H_2O is lost completely at 110°, leaving a grayish-green residue which is decompd. by H_2O and MeOH.

1314 Newton, H. D. and Hughes, J. L. "Estimation of Uranium and Phosphorus." J. Am. Chem. Soc. **37**, 1711-15(1915).

U was estd. (in the absence of Fe) by reducing with $\text{Ti}_2(\text{SO}_4)_3$, oxidizing the excess Ti salt with Bi trioxide and reduced Bi, filtering off the remaining Bi salt, and titrating the U with KMnO_4 . The method was adapted to the detn. of P, if phosphate soln. was treated with $\text{NH}_4\text{C}_2\text{H}_3\text{O}_2$ and HOAc, then with an excess of $\text{UO}_2(\text{NO}_3)_2$, and the ppt. filtered off on a Pt Gooch funnel. After the ppt. was dissolved in 16% H_2SO_4 it was reduced with $\text{Ti}_2(\text{SO}_4)_3$ and titrated with KMnO_4 as above. An agreement between the amt. of P taken and that obtained was found, the errors being about 0.1 mg.

1315 Nichols, E. L. and Howes, H. L. "Polarized Fluorescence of Ammonium Uranyl Chloride." Proc. Natl. Acad. Sci. U. S. **1**, 444-50(1915).

The spectrum of $\text{UO}_2\text{Cl}_2 \cdot 2\text{NH}_4\text{Cl} \cdot 2\text{H}_2\text{O}$ consists of several equidistant groups, each contg. 5 nearly equidistant bands, with the spacing repeating itself with such precision in successive groups that the homologous bands form a series having a common and const. freq. interval. Observations at the temp. of liq. air show that these bands are really doublets, unresolved at 20° but sepd. at lower temps.; a dim companion of the band is observed at 20° increasing greatly in brightness as the temp. falls, while the dominant member becomes relatively feeble or disappears entirely. At low temps. all the bands

are very narrow, so that overlapping components which are entirely indistinguishable at the temp. of the room appear as separate bands at -180° . The relative brightness and the temp. effect vary greatly with different bands. $\text{UO}_2\text{Cl}_2 \cdot 2\text{NH}_4\text{Cl} \cdot 2\text{H}_2\text{O}$ crystallizes in triclinic plates which show a marked pleochroism. When the fluorescence and absorption bands are observed through a Nicol prism, marked changes are observed as the prism is turned with its plane of polarization parallel successively to the green and white planes of the crystal. Complete sepn. of the 2 polarized components occurs only when the crystal is perfect. Comparison of the fluorescence bands shows that in the various groups each band consists of 2 components polarized at right angles to each other. The stronger fluorescence is polarized in the green direction, corresponding with the greater absorption. The location and roughly approx. relative intensity of the fluorescence of each group is shown in a diagram.

- 1316 Nichols, E. L. and Merritt, E. "New Fluorescence Spectrum of Ammonium Uranyl Chloride." *Phys. Rev.* (2), 6, 358-76(1915).

Triclinic plates of $\text{UO}_2\text{Cl}_2 \cdot 2\text{NH}_4\text{Cl} \cdot 2\text{H}_2\text{O}$ were strongly fluorescent, and the fluorescence spectrum, unlike that of other uranyl salts, is resolved at room temp. into at least 8 groups of narrow bands. Each group, which corresponds to a single band of the usual uranyl fluorescence spectrum, consists of 5 nearly equidistant bands. The bands, while not so narrow as some of the linelike bands of the uranyl spectra at the temp. of liq. air, are well sepd. from their neighbors and about 18A in width. A detn. of the distribution of intensities within the visually brightest group was made with the spectrophotometer as follows: 5302 = 18, 5253 = 33, 5203 = 24, 5157 = 11, 5114 visible but too faint for measurement. Tables are given of the positions of bands at 20° , of shifts between this temp. and -185° , av. intervals between homologous bands, calcd. and observed freqs. of the various series of bands, and of the absorption spectrum at 20° ; also tables showing the fluorescence and absorption bands arranged in series at -185° . The absorption bands reported are approx. coincident with those reported by Jones and Strong for solns. of the simple chloride.

- 1317 Oechsner de Coninck, F. W. "The Densities of Solutions of Uranyl Nitrate in Water, Alcohol and Certain Acids." *Bull. soc. chim. France* (4), 17, 422-4(1915).

Tables are given showing the d. of $\text{UO}_2(\text{NO}_3)_2$ at various concns. in water, 85% alc., CH_3OH (commercial), AcOH , HNO_3 , H_2SO_4 , and HBr .

- 1318 Oliver, J. "The Histogenesis of Chronic Uranium Nephritis with Especial Reference to Epithelial Regeneration." *J. Exptl. Med.* 21, 425-51(1915).

This paper confirms the earlier observations of Aschoff and Suzuki on chronic U poisoning studies.

- 1319 Opie, E. L. and Alford, L. B. "Influence of Diet upon Necrosis Caused by Hepatic and Renal Poisons. II. Diet and the Nephritis Caused by Potassium Chromate, Uranium Nitrate or Chloroform." *J. Exptl. Med.* 21, 21-37(1915).

Diet exerts a profound influence upon the toxicity of CHCl_3 , P, K_2CrO_4 , and $\text{UO}_2(\text{NO}_3)_2$, which cause necrosis of the parenchymatous cells of the liver or of the kidney. Susceptibility to intoxication with all of these substances is less after a diet rich in carbohydrate than after a diet consisting of meat. Carbohydrate protects from necrosis caused by these substances.

- 1320 Parson, C. L., Moore, R. B., Lind, S. C., and Schaefer, O. C. Extraction and Recovery of Radium, Uranium and Vanadium from Carnotite. Washington, U. S. Government Printing Office, 1915. 124p. (U. S. Bureau of Mines Bulletin 104)

A method of treatment of carnotite for the recovery of Ra, U, and V has been devised, and a plant has been constructed in Denver with a daily capacity of 3.5 tons of ore. Using this method, over 700 tons of ore had been treated up to Sept. 15, 1915, the results of which are reported. The ore was mined in Long Park in the Paradox Valley Region, Colo., and has av. 2.66% U_3O_8 and 4.28% V_2O_5 . The Ra content has been shown to be in the theoretical equil. ratio with U and therefore av. 7.5 parts/billion by wt. The ore is ground to 20-mesh and then extd. in earthenware pots with hot 35% HNO_3 . 500 lbs of ore are introduced into the hot (85°) acid in each pot. The heat of reaction on adding the ore raises

the temp. to about 92°. The heating is cont. for about 15 min after all the ore is added, and the acid soln. of Ra, V, U, and other sol. bases is then dropped onto an earthenware suction filter and is filtered through asbestos cloth or filtrose. The ore residue is washed once with hot HNO_3 dild. 3 fold from the original, and once with hot distd. water and is then discarded. The residue is mainly silica, should be quite light in color and does not retain more than 2 to 5% of the Ra and about the same proportion of U. The total sol. portion of the ore is about 15%. The V extrn. with HNO_3 is not very satisfactory owing to the tendency of V_2O_5 to be pptd. out by the oxidizing action. The filtrate from the extrn. and the 2 washes are brought together from a number of pots into a wooden tank and are first dild. 2 to 3 fold with cold water. Since about 1/2 of the original acid is still present, it is necessary to neutralize this as far as possible with NaOH until pptn. of Fe or V is just on the point of taking place. This partial neutralization still leaves about 1/4 of the original acid unneutralized, but this point must not be exceeded or the Fe and V will contaminate the Ra-BaSO₄ ppt. Fifty lbs of concd. H_2SO_4 and 5 lbs of BaCl_2 are now added; these are sufficient, together with the Ba in the ore, to produce 15 to 20 lbs of BaSO₄. The whole is pumped up, during continued agitation, through a "duriron" pump into a large wooden settling tank provided with a conical bottom into which the Ra-BaSO₄ ppt. is allowed to settle for 2 to 4 days. On the 2nd day 1 lb of BaCl_2 is added in the settling tank to furnish new pptn. nuclei for the RaSO₄. After settling the supernatant liq. is siphoned off through a floating siphon which automatically interrupts the flow so as to leave enough liq. above the ppt. in the conical bottom to avoid disturbing the ppt. which is then brought down together with the rest of the liq. onto a large suction filter. The Ra is recovered from the solid. The filtrate contains the V and U and is run into a wooden tank contg. a hot soln. of excess of Na_2CO_3 to ppt. the Fe and other bases; these are filtered off in presses and discarded. In the filtrate the U is pptd. as $\text{Na}_2\text{U}_2\text{O}_7$ by NaOH in boiling soln. The recovery of U in this form has been from 75 to 94%, av. 84.4%. Several preliminary methods of freeing the uranate from V and of converting it into the oxide UO_2 are described. The alk. filtrate from the U is rendered neutral or very slightly acid and V is pptd. as ferrous vanadate of variable compn. contg. 35 to 40% of V_2O_5 . The av. cost of producing 1 lb of $\text{Na}_2\text{U}_2\text{O}_7$ has been \$0.3149. Detailed costs of construction and equipment operation, including cooperation of the Bureau of Mines are presented and have been included in estg. final costs. A more detailed abstract of this bulletin is to be found in J. Ind. Eng. Chem. 8, 48-53(1916).

1321 Plum, H. M. "The Extraction and Separation of the Radioactive Constituents of Carnotite." J. Am. Chem. Soc. 37, 1797-1816(1915).

The prepn. of $\text{Na}_4\text{UO}_2(\text{CO}_3)_3$ by the reaction between hot Na_2CO_3 soln. and U in carnotite is used as a method of sepn. for U from Ca and Fe.

1322 "Rubber Latex Prepared with Uranium Borate." India Rubber World 52, 569(1915).

It is stated that 8 oz of U borate to every 100 lbs of latex, when thoroughly mixed with the latex before coagulating, influences considerably the appearance of the rubber, prevents oxidation, and increases tensile strength.

1323 Simonis, H. and Elias, A. "On the Residual Affinity in Benzopyrones." Ber. 48, 1499-516 (1915).

It is reported that 2,3-dimethylchromone and thiochromone will ppt. complex cryst. materials when added to solns. of UO_2Cl_2 .

1324 Smillie, W. G. "Potassium Poisoning in Nephritis." Arch. Internal Med. 16, 330-9(1915).

Expts. with U-nephritic rabbits showed that a stage of intoxication was reached, as measured by 100 mg of nonprotein N/100 cc blood, in which the kidneys were difficultly permeable to K salts. These salts were toxic and caused the death of the nephritic animals while normal animals found no difficulty in tolerating similar amts. of sol. K.

- 1325 Smith, E. F. "The Development of Electroanalysis in America." Trans. Am. Electrochem. Soc. 27, 23-30(1915).

This is an historical review of the author's early work in the electrolytic detn. and sepn. of Cu, Cd, U, etc. Tribute is paid to Robert Hare, Gibbs, Genth, and others.

- 1326 Soddy, F. and Hitchins, A. F. R. "The Relation between Uranium and Radium. VI. The Life-Period of Ionium." Phil. Mag. (6), 30, 209-19(1915).

A continuation of the Em measurements of the amt. of Ra produced in a purified U soln. shows no notable increase in the rate of growth of Ra in the case of 2 early solns. from which the UX and ionium had been removed by extrn. with ether. A third such sample shows an increase, while a fourth sample of 3 kg of U, prepd. by recrystn. in 1909, shows a threefold increase in the rate during 1912-15 as over that in the first 3 yrs. The rate of production of Ra is thus proportional to the square of the time, as is required by theory if ionium is the only long-lived member of the series between U and Ra. The 3 early solns. are considered less reliable because they contain less U, and the ionium was not completely removed.

- 1327 Trumpler, G. "The Theory of the Urano-Uranyl Sulfate Photochains." Z. physik. Chem. 90, 385-457(1915).

When current is withdrawn, urano-uranyl sulfate photochains behave like ordinary elements. It has been found that the cause of the Becquerel effect lies in the uranyl salt. This effect is the manifestation of an aftervolume effect of light in the soln. of the uranyl salt. The potential displacement in light depends upon the chem. condition of the electrode. Although the displacement of the equil., $U^{+6} + 2A^n = U^{+4} + 2A^{n+1}$, is not reversible in light, certain substances exert a strong influence on the potential displacement in light, so much so, that these displacements are pushed back to a marked extent by small quantities and under certain conditions can change their signs. Therefore, according to the compn. of the system, a pos. or neg. effect may result. The neg. effect is diminished by I_2 , HI, $V_2(SO_4)_3$, $VOSO_4$, HCl, $Fe_2(SO_4)_3$, and $FeSO_4$. Change of sign if brought about by I_2 , HI, $VOSO_4$, and $FeSO_4$; that is, the neg. effect appears to be pos. The pos. effect is diminished by SO_2 , $U(SO_4)_2$, and oxalic acid. The foregoing substances, which exert either a pos. or neg. influence on the Becquerel effect, also decrease the fluorescence of uranyl sulfate solns. The fluorescence of these solns. is also decreased by rise in temp. In conclusion a theory is put forward to explain the Becquerel effect of U salts.

- 1328 Wedekind, E. and Horst, C. "Magnetizability of Oxides of Manganese, Chromium, Uranium, Molybdenum and Tungsten." Ber. 48, 105-12(1915).

The hexavalent metals U, Mo, and W show scarcely any latent magnetism and only the horizontal rows of the periodic table can be used in detg. the latent magnetization of Cr. The measured values for U cpds. $\times 10^6$ are: UO_2 , 7.51; UO_3 , 1.08; U_3O_8 , 0.95.

- 1329 Wick, F. G. "Fluorescence of the Uranyl Salts Caused by X-Rays." Phys. Rev. (2), 5, 418-25(1915).

The fluorescence excited in uranyl salts by x rays differs from that excited by light in intensity only. The greater absorption for light than for x rays accounts for the difference in intensity of the fluorescence under the two sources. The phosphorescence following excitation by light is less intense and of shorter duration than that excited by x rays. The difference in penetration of the two kinds of radiation seems to explain this, the more penetrating x rays producing a phosphorescence which is more intense and of longer duration than that following the less penetrating light rays.

PUBLICATIONS LOCATED IN 1916

- 1330 Baudisch, O., Gurewitsch, H., and Rothschild, S. "On the Inner Metal Complex Salts of p-Toluenesulfonic Acid (o-Nitroso-Hydroxylamino-Phenyl) Esters. II. Communication on Nitroso-Arylhydroxylamine." Ber. 49, 180-90(1916).

The existence of an intense yellow uranyl o-nitroso-hydroxylaminophenyl ester of p-toluene sulfonic acid is reported. This salt is assigned the formula $\text{UO}_2(\text{C}_{13}\text{H}_{12}\text{N}_2\text{OSO}_3)_2$.

- 1331 Baxter, G. P. "Twenty-Third Annual Report of Committee on Atomic Weights. Determination Published during 1915." J. Am. Chem. Soc. 38, 489-96(1916).

This paper contains a bibliography and discussion of new detns. The new values for those elements whose at. wts. have been changed 0.1 unit or more are Sn 118.7, Pb 207.20, Ra 226.0, U 238.2, Yb 173.5 (old value 172.0), Pr 140.9, Y 88.7, Lu 175.0 (old value 174.0).

- 1332 Colani, A. "Potassium Uranyl Oxalates." Compt. rend. 163, 123-5(1916).

A study of the system $\text{H}_2\text{O}-\text{K}_2\text{C}_2\text{O}_4-\text{UO}_2\text{C}_2\text{O}_4$ was made at 15° and at 50°. At the lower temp. hydrates with 3.5, 4, and 10 moles H_2O were found; at the higher temp. anhyd. 4- and 10-hydrates were indicated. The 3-hydrate does not form at ordinary temp. but may exist below 50°. The soly. of $\text{UO}_2\text{C}_2\text{O}_4$ increased very rapidly with increasing $\text{K}_2\text{C}_2\text{O}_4$, which indicates formation of complexes, but the analytical character of UO_2 salts is retained even in solns. satd. with $\text{K}_2\text{C}_2\text{O}_4$, from which the presence of double salts only is concluded.

- 1333 de Broglie, M. "On the Extremely Penetrating Radiations Originating in the K-Series of Tungsten and on the X-Ray Spectra of the Heavy Metals." Compt. rend. 162, 596-7(1916).

The L-absorption edges for the x-ray spectrum of U is given for L_{II} and L_{III} .

- 1334 de Gramont, A. "Of the Control by Spectral Analysis in Material for Determination of Atomic Weight." J. chim. phys. 14, 336-9(1916).

This paper describes the spectral analysis of a very pure sample of U which shows that very small amts. of Ca, V, Fe, Mg, and Cu can be detected.

- 1335 Elsholz, W. Ueber die Uranoxyde in den Pechblenden. Dissertation, Univ. of Berlin, 1916.

This paper contains a discussion of the detn. of U in various U-bearing ores.

- 1336 Gans, R. "On Paramagnetism." Ann. Physik (4), 50, 163-98(1916).

A theoretical discussion of the temp. dependence of the magnetic susceptibility value of U is given.

- 1337 Hallimond, A. F. "The Crystallography and Dehydration of Torbernite." Mineralog. Mag. 17, 326-39(1916).

- 1338 Hofmann, K. A. and Schumpelt, K. "Formation of Formaldehyde and Other Organic Materials from Formic Acid. I. Communication, Self-Reduction of Formate." Ber. 49, 303-17(1916).

This paper discusses the catalysis, using UO_2 , of reactions of the formate ion. Uranyl formate is also discussed.

- 1339 Hönigschmid, O. and Horovitz, S. "The Atomic Weight of Uranium." Monatsh. 37, 185-90 (1916).

U from pure cryst. uraninite from Morogoro in German East Africa, whose age, calcd. from the Pb-U ratio, is 8×10^8 yrs, was used to det. the at. wt. of U by the method previously described. The value obtained, 238.159 (Ag being 107.88), agrees within exptl. error with the value, 238.175, obtained with U from Joachimsthal pitchblende whose age is no greater than 2.5×10^8 yrs. There is no reason to suppose a complexity of U beyond the 0.04% content of U_{II} demanded by radioactive evidence.

- 1340 Howes, H. L. and Wilber, D. T. "Fluorescing Sodium Uranyl Phosphate." Phys. Rev. (2), 7, 394-6(1916).

Mixts. of $\text{HUO}_2\text{PO}_4 \cdot 3.5\text{H}_2\text{O}$ and Na_2HPO_4 in the mol. ratio 1:1, 2:1, and 4:1 at -180° gave exactly similar spectra when excited by the C arc. Other specimens were prepd. contg. more H_3PO_4 , and in these the strongest line series were suppressed and the dimmer lines were merged into broad bands. The spectra of the mixts. containing no H_3PO_4 consisted of recurring groups of bands. The interval on any one of these line series has a value lying between 80 and 81 Å, which is the shortest interval yet observed in the study of the fluorescence spectra of uranyl salts. With either H_3PO_4 or HNO_3 as a solvent, the solid at low temps. has a vitreous appearance, perhaps because the acid is still dissolving the phosphate even at the temp. of -180° . If the acid were cryst. presumably the broad bands which appear would not be present. From the expts. with glassy and cryst. solids it appeared that the cryst. form was necessary if a resolved spectrum were to be obtained.

- 1341 MacNider, W. deB. "Inhibition of the Toxicity of Uranium Nitrate by Sodium Carbonate, and the Protection of the Kidney Acutely Nephropathic from Uranium from the Toxic Action of an Anesthetic by Sodium Carbonate." J. Exptl. Med. 23, 171-87(1916).

The toxicity of U in animals of different ages is associated with the power of the metal to lead to the formation of org. acids, such as acetoacetic acid, and acetone. The power of Na_2CO_3 to lessen the toxicity of U depends upon its power to delay the formation of such bodies and to cause their appearance in the urine in lessened amt. and is not due to any detoxicating action of the carbonate on the metal. The protection of the kidney by Na_2CO_3 is probably dependent upon 2 factors: the neutralization of org. acids formed prior to and during the anesthesia and the neutralization of HCl which Graham has shown to be liberated by CHCl_3 during an anesthesia induced by this substance.

- 1342 Meissner, K. W. "Experiments and Wave Length Determinations in the Red and Infrared Spectrum Regions." Ann. Physik 50, 713-28(1916).

Plates sensitized by dicyanin or dicyanin-A can be used for measurements up to wavelengths of 9300 Å. The iron spectrum is very weak in this region and cannot be used as a std. No wholly satisfactory std. was found, but infrared wavelengths are recorded for U and other elements.

- 1343 Moore, R. B. and Kithil, K. L. A Preliminary Report on Uranium, Radium, and Vanadium. (2nd rev. ed.) Washington, 1916. 114p. (U. S. Bureau of Mines Bulletin 70)

The bulletin contains an extensive survey of the U, Ra, and V ore resources of the United States, especially carnotite and pitchblende, together with a description of the various processes of extrg. these metals as practiced by American and Austrian producers. Accurate methods of detg. U and V in carnotite ores, both gravimetrically and volumetrically, are described. The use of the electro-scope in detg. the Ra content of ores and the various products obtained in working them into RaCl_2 or RaBr_2 is explained.

- 1344 Müller, A. "The Explosibility of Uranium Nitrate." Chem. Ztg. 40, 38-9(1916).

The nitrate was prepd. by extg. 2 aq. solns. with Et_2O , 1 soln. contg. little HNO_3 , the other much; the amt. influenced the compn. of the nitrate, but not the phenomena. The Et_2O soln. was evapd. under vacuum, the residue cooled and poured on ice and the crystals dried by pressing. Analyses are given. Occasional triboluminescence was observed when the crystals were moistened with H_2O , but in only 3 cases out of 20 were there signs of decrepitation. Small amts. of gas were evolved, probably consisting of Et_2O and oxides of N. These phenomena appeared only with crystals from Et_2O soln. extrd. from aq. soln. containing free HNO_3 , disappearing on recrystg. from H_2O . The author considers the phenomena to be due to the formation of an unstable cpd. of a lower oxide of N with a U- Et_2O addn. cpd. which is decompd. under certain chem. and phys. conditions, among which is int. friction, but in which radioactivity has no part.

- 1345 Newbery, E. and Prign, J. N. "The Reduction of Metallic Oxides with Hydrogen at High Pressures." *Proc. Roy. Soc. (London), A* 92, 276-85(1916).

U_3O_8 will not be reduced by H_2 any further than UO_2 when heated as high as 2500° at pressures up to 150 atms.

- 1346 Nichols, E. L. "Note on the Phosphorescence of Uranyl Salts." *Proc. Natl. Acad. Sci. U. S.* 2, 328-33(1916).

It is reported that the fluorescence of uranyl cpds., either solid or in soln., fades quickly. The duration at room temp. is reported for ammonium uranyl phosphate. The momentary and long-lasting phosphorescence shown to accompany uranyl cpds. are reported to be spectrally identical.

- 1347 Nichols, E. L. and Howes, H. L. "The Fluorescence and Absorption of Certain Pleochroic Crystals of the Uranyl Salts." *Phys. Rev.* (2), 8, 364-85(1916).

Well-formed crystals of certain uranyl salts show a marked pleochroism. When viewed through a Nicol prism their color changes from a yellowish-green to a pale yellowish-white when the plane of the prism is turned through 90° . The previous study of the polarized spectrum of $UO_2Cl_2 \cdot 2NH_4Cl \cdot 2H_2O$, in which it was shown that these changes are connected with striking and significant variations in the fluorescence and absorption spectra, has been extended to include $UO_2Cl_2 \cdot 2KCl \cdot 2H_2O$, $UO_2Cl_2 \cdot 2RbCl \cdot 2H_2O$, and $UO_2Cl_2 \cdot 2CsCl \cdot 2H_2O$. The crystals of these salts, which crystallize in the triclinic system, are pleochroic and their fluorescence and absorption spectra are polarized. Their spectra differ from those of the other uranyl salts thus far studied in the greater degree of resolution exhibited at 20° , each band in both the fluorescence and absorption regions being resolved into a group of 5 bands forming homogeneous series of const. freq. interval. Each series terminates toward the violet in the so-called reversing region where its last member is identical in position with the first member of a series of absorption bands extending into the ultraviolet and having likewise a const. but shorter freq. interval. Each of the 5 bands is a doublet, the components of which show indications of further complexity. These components are polarized at right angles to one another. The freq. is the same or nearly the same for each series in a given salt. Indications have been obtained that the variations in the av. freq. interval for the different salts decrease with increase of mol. wt. This applies to both the fluorescence and absorption series. The position of a given band in a typical region of the spectrum varies regularly with the mol. wt. of the salt. The drift toward violet occurs in the order K, NH_4 , Rb, Cs. The same drift occurs throughout the entire fluorescence and absorption spectrum. At the temp. of liq. air, the bands become narrow, and apparent shifts of position and changes of interval occur.

- 1348 Siegbahn, M. "Information on the Röntgen Spectra of the Chemical Elements. (Experimental Methods and Results)." *Jahrb. Radioakt. Elektronik.* 13, 296-341(1916).

The tables given show information on U along with that for other elements.

- 1349 Siegbahn, M. "A Further Series (M-Series) in the High Frequency Spectra of the Elements." *Verhandl. deut. physik. Ges.* (2), 18, 278-82(1916).

As a result of the examn. of the spectra of a number of elements of high at. wt. in the region $\lambda = 2$ to 10×10^8 cm, a new group of lines which has been distinguished as the M series was found. The wavelengths of 4 to 6 lines belonging to this series have been measured in the spectra emitted by Au, Tl, Pb, Bi, Th and U. The freqs. of the strongest (α and β) lines are connected with the at. nos. by Moseley's formula, but this does not seem to hold in the case of the weaker lines. The uranium l line, referred to in the previous paper, belongs in all probability to the L series, forming a doublet with the n line of the L-group spectrum

- 1350 Siegbahn, M. "On the Existence of a New Group of Lines (M-Series) in High-Frequency Spectra." *Compt. rend.* 162, 787-8(1916).

This paper includes values for the α , β , γ_2 , δ_1 , and δ_2 lines in the M level of the x-ray spectrum of U.

- 1351 Siegbahn, M. and Friman, E. "High-Frequency Spectra (L-Series of the Elements Tantalum-Uranium)." *Phil. Mag.* (6), 32, 39-49(1916).

Eleven different line groups were found in the L-series spectra of most of these elements.

- 1352 Siegbahn, M. and Friman, E. "High-Frequency Spectra (L-Series) of the Elements Polonium, Radium, Thorium, and Uranium." *Physik. Z.* 17, 61-2(1916).

In an earlier paper the results were given of an investigation of the L series of the elements from Ta to Bi. At least 11 groups of lines were detd. The measurements are now extended to the elements Po, Ra, Th, and U. Both Th and U gave multiple-line spectra. The values of the wavelengths, relative intensities, etc., of the various lines are tabulated. Plotting the values of $1/\lambda$ against at. nos. it is found that the new α_2 , α_1 , and β_2 values fall exactly on the same straight line as the old values, while the remainder (β_1 , β_3 , γ_1 , γ_2 , γ_3) are too high.

- 1353 Siegbahn, M. and Friman, E. "The High-Frequency Spectra of the Elements Gold to Uranium." *Phil. Mag.* (6), 31, 403-06(1916).

A continuation of Moseley's series, using only the stronger α line of the L series in every case. These spectra fall in exactly with Moseley's linear relation, $\nu_v = a(N - b)$ and b is calcd. as 7.12 and a as 122.8. The atomic numbers are: Au, 79; Hg, 80; Tl, 81; Pb, 82; Bi, 83; Th, 90; and U, 92.

- 1354 Siegbahn, M. and Friman, E. "High-Frequency Spectra of the Elements Gold-Uranium." *Physik. Z.* 17, 17-18(1916).

Moseley has shown, by the x-ray method of detn. of the at. nos. of the elements, that between Al and Au there are only 3 elements as yet unknown. In the present investigation the range of elements from Au to U has been examined. Between Bi and Th there exist 6 unknown elements, and 1 between Th and U. High-freq. wavelength of U is reported to be 0.919×10^{-8} cm.

- 1355 Simonis, H. and Elias, A. "On a New Synthesis of 1-Thiochromonen and the Preparation of 1, 4-Dithiochromonen." *Ber.* 49, 768-80(1916).

The uranyl chloride complex of the dimethylthio material is reported to have the formula $\text{UO}_2\text{Cl}_2(\text{C}_{11}\text{H}_{10}\text{OS})_2$. (See the authors' second paper in *Ber.* 49, 1116-25(1916) for further data.)

- 1356 Simonis, H. and Elias, A. "On the Residual Affinity of Benzopyronen. II. Double Compounds of 2, 3-Dimethyl-4-Thiochromons." *Ber.* 49, 1116-25(1916).

The information on uranyl derivatives in this paper continues the information found in *Ber.* 49, 768-80(1916).

- 1357 Thomlinson, J. C. "The Use of Uranium in Analysis." *Chem. News* 114, 239(1916).

In the detn. of H_3PO_4 by titration with U acetate soln. $\text{K}_4\text{Fe}(\text{CN})_6$ is untrustworthy as an indicator.

- 1358 Tribe, E. M., Hopkins, F. G., and Barcroft, J. "Vascular and Metabolic Conditions in Kidneys of Rabbits Injected with Uranium Acetate." *J. Physiol. (London)* 50, xi-xii(1916).

Direct measurements of blood flow through the mammalian kidney indicate that the circulation of the kidney is not decreased after injection of uranyl salts. This is a summary of a paper delivered before the meeting of the Physiological Society, Jan. 22, 1916.

1359 Turner, W. A. "Separation of Vanadium from Phosphoric and Arsenic Acids and from Uranium." Am. J. Sci. (—), **42**, 109-10(1916).
 V_2O_5 can be sepd. from As_2O_5 as well as from P_2O_5 by pptn. of the V with cupferron; the exptl. procedure is the same as that previously described, except that the ppts. require a more thorough washing. Results given are excellent. The method did not give such good results in the sepn. of V_2O_5 from U_3O_8 , due to the great acidity required to prevent the pptn. of uranyl vanadate.

1360 Voelcker, J. A. "Woburn Pot-Culture Experiments. 1916." J. Roy. Agr. Soc. Engl. **77**, 251-64(1916).

A finely ground material said to be radioactive natural ore contg. 0.15% U oxide was applied to wheat in quantities equiv. to 5 cwt, 10 cwt, and 1 ton per acre, resp. It is concluded from the results obtained that no advantage whatever accrued from the application of the ore.

PUBLICATIONS LOCATED IN 1917

1361 Aurén, T. E. "Notes on the Absorption of X-Rays." Phil. Mag. (6), **33**, 471-87(1917). This paper discusses the relative absorption of roentgen rays by aq. solns. of UO_2SO_4 . The at. absorption coeff. in the x-ray region is compared for U and H_2O .

1362 Benrath, A. "Photochemical Reactions of Compounds of Less Common Elements. II." Z. wiss. Phot. **16**, 253-61(1917).

The greenish-yellow powder deposited when UO_2Cl_2 in Et_2O is exposed to sunlight has been examined and found to have the formula $UOCl_2$, and the similar ppt. obtained by exposing an aq. soln. of $UO_2(NO_3)_2$ contg. a little alc. to sunlight is $UO(NO_3)_2$.

1363 Case, T. W. "Notes on the Change of Resistance of Certain Substances in Light." Phys. Rev. (2), **9**, 305-10(1917).

A large number of cpds. and minerals, including torbernite, were examined. Torbernite is reported to be practically nonconducting in the dark and to exhibit no change in the light.

1364 Colani, A. "Study of the System Water, Uranyl Oxalate, Sodium Oxalate." Compt. rend. **165**, 111-13(1917).

The soly. of uranyl oxalate at 15 and 50° in wt. % anhyd. salt is given. The transition points found are tabulated below:

15°			50°		
$Na_2C_2O_4$, %	$UO_2C_2O_4$, %	Solid Phase	$Na_2C_2O_4$, %	$UO_2C_2O_4$, %	Solid Phase
0	0.47	$UO_2C_2O_4 \cdot 3H_2O$	0	1.00	$UO_2C_2O_4 \cdot 3H_2O$
0.80	2.65		1.01	3.58	$Na_2(UO_2)_4(C_2O_4)_5 \cdot 11H_2O$
1.80	5.01	$Na_2(UO_2)_4(C_2O_4)_5 \cdot 11H_2O$	3.60	9.84	$Na_2UO_2(C_2O_4)_2 \cdot 5H_2O$
4.93	3.14	$Na_2UO_2(C_2O_4)_2 \cdot 5H_2O$	4.62	12.33	$Na_2UO_2(C_2O_4)_2 \cdot 5H_2O$
3.09	0	$Na_2C_2O_4$	9.03	13.69	$Na_2C_2O_4$
			4.28	0	

It is also reported that $Na_2UO_2(C_2O_4)_2 \cdot 5H_2O$ is identical to the tetrahydrate reported earlier

by Rosenheim and Lienau. The cpd., $\text{Na}_6(\text{UO}_2)_2(\text{C}_2\text{O}_4)_5 \cdot 13\text{H}_2\text{O}$, which was reported by Wyruboff, could not be reproduced. A compn. diagram is given.

- 1365 Colani, A. "Study of the System Water, Uranyl Oxalate, Neutral Ammonium Oxalate." Compt. rend. 165, 234-6(1917).

An attempt was made to prepare $(\text{NH}_4)_2\text{UO}_2(\text{C}_2\text{O}_4)_2 \cdot 3\text{H}_2\text{O}$; however, it was not successful. The information presented is analogous to the study of the $\text{H}_2\text{O}-\text{UO}_2\text{C}_2\text{O}_4-\text{Na}_2(\text{C}_2\text{O}_4)$ system reported in Compt. rend. 165, 111-13(1917).

- 1366 Gillett, H. W. and Mack, E. L. Preparation of Ferro-Uranium. Washington, U. S. Government Printing Office, May 1917. 46p. (U. S. Bureau of Mines Technical Paper 177)

- 1367 Gillett, H. W. and Mack, E. L. "Ferro-Uranium." J. Ind. Eng. Chem. 9, 342-7(1917). The history, prepn., properties, etc., of ferro-uranium are discussed. Sources (in 1917) are also treated. Lay and technical data are given.

- 1368 Goto, K. "A Study of Acidosis, Blood Urea, and Plasma Chlorides in Uranium Nephritis in the Dog, and of the Protective Action of Sodium Bicarbonate." J. Exptl. Med. 25, 693-719 (1917).

Severe acid intoxication was demonstrated which could be markedly decreased by the feeding of NaHCO_3 . Graphs, plates, and a list of 29 references are included.

- 1369 Howes, H. L. and Wilber, D. T. "Fluorescence of Four Double Nitrates." Phys. Rev. (2), 10, 348-57(1917).

The nitrates studied were $\text{NH}_4\text{UO}_2(\text{NO}_3)_3$, $(\text{NH}_4)_2\text{UO}_2(\text{NO}_3)_4 \cdot 2\text{H}_2\text{O}$, $\text{KUO}_2(\text{NO}_3)_3$, and $\text{K}_2\text{UO}_2(\text{NO}_3)_4$. The spectra of the double uranyl nitrates resemble those of the previously studied uranyl salts in that the bands can be arranged in series having const. freq. intervals. These intervals, while const. for any one series, are different for different series. In $\text{NH}_4\text{UO}_2(\text{NO}_3)_3$ and $\text{KUO}_2(\text{NO}_3)_3$ the ratio of the interval of a fluorescence series to the interval of the absorption series which joins that fluorescence series is approx. const. Although the grouping of the bands shows a strong family resemblance in the 4 spectra, yet the abs. position of a group is largely detd. by the crystal system.

- 1370 Imhof, A. "Contribution to the Knowledge of Triboluminescence." Physik. Z. 18, 78-91 (1917).

It is reported that at low temp. (-80°), $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ will show a triboluminescence which is displaced toward green although its intensity remains the same as at room temp. K uranyl sulfate is also investigated.

- 1371 Kithil, K. L. and Davis, J. A. Mining and Concentration of Carnotite Ores. Washington, U. S. Government Printing Office, 1917. (U. S. Bureau of Mines Bulletin 103)

- 1372 Lewis, G. N. and Gibson, G. E. "The Entropy of the Elements and the Third Law of Thermodynamics." J. Am. Chem. Soc. 39, 2554-81(1917).

Calcns. were made for the entropy of solid U at 25° and 1 atm. pressure assuming the validity of the Nernst heat theorem. The value obtained was 11.07 entropy u/g atom.

- 1373 Luckiesh, M. "The Physical Basis of Color-Technology. [Part II.]" J. Franklin Inst. 184, 227-50(1917).

Information on the light transmission of yellow U glass is included.

- 1374 MacNider, W. deB. "A Consideration of the Relative Toxicity of Uranium Nitrate for Animals of Different Ages. I." J. Exptl. Med. 26, 1-18(1917).

This continuation of the studies by the same author in 1914 indicates that the toxic effect of U in the kidney depended upon the ability of the substance to induce tissue acidosis. This metabolic disturbance was more severe in older animals than in young ones. Dogs were used in this expt.

- 1375 MacNider, W. deB. "The Efficiency of Various Diuretics in the Acutely Nephropathic Kidney, Protected and Unprotected by Sodium Carbonate. II." J. Exptl. Med. 26, 19-35 (1917).

Results of detn. of changes in acid-base equil. and the effect of diuretics on dogs poisoned with a const. wt./kg of U are reported.

- 1376 Nichols, E. L. and Howes, H. L. "Phosphorescence of Uranyl Salts." Phys. Rev. (2), 9, 292-304(1917).

It has been found that the salts examined exhibit phosphorescence with increasing rates of decay. This is true, not only of the cryst. forms, but also of uranyl cpds. in solid soln. or in the plastic state characteristic of the double phosphates. The rate of decay is not influenced by exposure to red and infrared radiations. The phosphorescence appears to be independent of the mode of excitation, and the structure of the intricate spectrum is the same during excitation and through the observable phosphorescent interval. Changes in the rate of decay are not continuous, but occur in definite steps which follow a law such that $I^{-1/2}$ is in linear relation to the time. The rate of decay varies greatly with the number of moles of H_2O in the salt, but this variation is due more to the changes in cryst. form than to the amt. of H_2O .

- 1377 Nichols, E. L. and Merritt, E. "The Influence of Water of Crystallization upon the Fluorescence and Absorption Spectra of Uranyl Nitrate." Phys. Rev. (2), 9, 113-26(1917).

The spectra observed with different uranyl salts are so similar in their general characteristics that it can scarcely be doubted that the nature of these spectra is chiefly detd. by the $(UO_2)^{+2}$, and the effect of the acid radical is merely to modify the consts. of the vibrating system without changing the type of vibration. It is natural to expect that water of hydration would produce a similar effect. In the expts. the wavelengths were detd. in some cases photographically and in others visually. For observations of the fluorescence spectrum the C arc with suitable absorbing screens was used as the exciting source, while for the absorption the gas-filled tungsten lamp was used. All observations were made at the temp. of liq. air. In the case of each of the nitrates the fluorescence spectrum is made up of series in which the intervals between bands are const. and the same for all the series. The interval increases slightly as the amt. of water of hydration decreases. For $UO_2(NO_3)_2 \cdot 6H_2O$ the interval is 86.0; for $UO_2(NO_3)_2 \cdot 3H_2O$, 86.8; for $UO_2(NO_3)_2 \cdot 2H_2O$, 88.1; and for the anhyd. salt, $UO_2(NO_3)_2$, 88.5. Numerous const.-interval series occur in the absorption spectra, in which the interval is approx. 71 Å. This interval does not appear to be the same for different series even when these occur in the spectrum of the same salt. No systematic variation with the amt. of water of hydration could be detected. Nearly all of the series in the absorption spectrum have their origin in the "reversing region"; the first member of the absorption series is in coincidence with the last member of a fluorescence series and constitutes a reversible band. On the whole, the spectra of the different hydrates differ from one another fully as much as do the spectra of two different uranyl salts. This is surprising, since it is customary to think of water of hydration as loosely attached and, therefore, incapable of exerting a great influence upon the properties which depend upon the int. structure of the mol. In the uranyl salts the connection is apparently more intimate than is generally supposed.

- 1378 Parsons, C. L. "Preparation of Black Oxide of Uranium (UO_2).'' J. Ind. Eng. Chem. 9, 466-7(1917).

UO_2 may be prepd. by fusing $\text{Na}_2\text{U}_2\text{O}_7$ with NaCl and charcoal. This also permits recovery of the vanadic acid which may be contd. in the Na_2UO_4 as an impurity.

- 1379 Pereira-Forjaz, A. "Spectrographic Studies of Portuguese Uranium and Zirconium Minerals." Compt. rend. 164, 102-03(1917).

The components of Portuguese chalcocites (torbernites) and autunite are reported. Other minerals associated with these were walpurgite, trögerite, and zeunerite.

- 1380 Piccard, A. "Existence of a Third Fundamental Radioactive Substance in the Uranium Series." Arch. sci. phys. nat. (4), 44, 161-4(1917).

It has been supposed that two simple substances, U_I and U_{II} , occupy in the periodic system the place designated "uranium". The author now introduces a third element into the series, this substance being called "Actinuranium" (AcU). This substance has the following characteristics: (1) AcU does not belong to the U-Ra family, but it is at the head of the Ac series. (2) It is not produced by any simple substance at present in existence on the earth; its length of life is consequently very long, which places this substance in a category similar to U_I and Th. (3) Its at. wt. is greater than that of U_I , hence greater than all other known at. wts. (4) The atom AcU, on emitting an α particle, is transformed into a substance generally referred to as UY, which by successive transformations originates the Ac family. The author produces evidence in favor of his hypothesis.

- 1381 Watanabe, C. K., Oliver, J., and Addis, T. "Function of Kidneys under Strain in Uranium Nephritis and the Relation between Anatomy and Function under These Conditions." Proc. Soc. Exp. Biol. Med. 14, 147(1917).

Rabbits were injected subcutaneously with $\text{UO}_2(\text{NO}_3)_2$ in doses which varied from those which produced marked anatomical and functional changes to those which led to no certain effect. A strain was placed on the urea-excreting function of the kidneys by the administration of urea by stomach tube. While the kidneys were under the influence of this strain the vol. of urine, the rate of urea excretion, and the const. of urea in the blood and urine were detd. before and after the injection of U. The most marked and const. functional change produced by the U was found to be a depression of the ratio between the rate of urea excretion and the const. of urea in the blood. The degree of depression in this ratio was fairly closely parallel to the degree of anatomical damage, as judged from extent of intensity of the necrosis and the degenerative changes.

- 1382 Wilcox, R. W. "The Therapeutics of Uranium Nitrate." Med. Record 92, 361-4(1917). This paper contains a description of $\text{UO}_2(\text{NO}_3)_2$ nephritis and general poisoning with information on the therapy which may be applied. Results of treating a number of patients are given.

PUBLICATIONS LOCATED IN 1918

- 1383 Baur, E. "Photolysis and Electrolysis." Helv. Chim. Acta 1, 186-201(1918).

Uranyl salt solns. act as if they contd. both a higher and a lower state of oxidation, i.e., in reacting with $\text{H}_2\text{C}_2\text{O}_4$ they are able both to oxidize to CO_2 and to reduce to CO; $5\text{U}^{+6} + \text{light} = 3\text{U}^{+8} + 2\text{U}^{+3}$, which reacts as follows: $\text{U}^{+8} + \text{C}_2\text{O}_4^{-2} = \text{CO}_2 + \text{U}^{+6}$; and $\text{U}^{+3} + \text{C}_2\text{O}_4^{-2} = \text{CO} + \text{U}^{+6}$. Uranyl salts, however, are also fluorescent, indicating a dislocation or loosening of electrons. This leads to the assumption that the action of light is not a complementary oxidation and reduction of different U ats., but is a rearrangement of the electrons within single mols. in such a manner that the mols. become electrically polarized, one terminal of the mol. being pos. and the other neg. Both anodic oxidation and cathodic reduction can thus be produced by the same mol. due to the p.d. within itself. The e.m.f. so generated is calcd. on the basis of the quantum theory and is of the order of 2.4 v for

yellow light, 3.2 v for blue, 5.5 v for ultraviolet, and about 100,000 v for the shortest γ rays. The interpretation is given to a no. of newly demonstrated photochem. oxidations and reductions, including HgCl_2 + cane sugar by uranyl salts in light and photochem. oxidation of uranyl formate.

1384 Baur, E. "The Photolysis of Uranium Salts," *Schweiz. Chem. Ztg.* 2, 40-1(1918). When light is absorbed by a soln. of a U salt, $(\text{UO}_2)^{+2}$ undergoes a reversible change from the "dark" condition into the "light" condition; when the reverse action takes place, the light energy absorbed is given off in the form of fluorescence. The addn. of certain substances, such as Cl^- or I^- , ferric and vanadyl salts, vanadic acid, and U^{+4} salts, extinguishes the fluorescence. The same substances also destroy the Becquerel effect. In the "light" condition, the U is resolved into U^{+8} and U^{+3} and the 2 reunite to U^{+6} in reverting to the "dark" condition. When an inhibiting substance is added, the formation of the intermediate products is prevented, because they are immediately taken up by the substance, for example I^- , to form U^{+6} . Under the influence of light, uranyl formate is decompd. with liberation of CO_2 and H_2 , a reaction in which the octavalent uranyl ion plays a part. The reaction dies down again through the accumulation of U^{+6} , which acts as an extinguisher. Another instance of photolysis is the decompn. of $\text{H}_2\text{C}_2\text{O}_4$ by UO_2SO_4 under the action of light.

1385 Fleck, H., Haldane, W. G., and White, E. D. Extracting Uranium and Vanadium from Ores. June 9, 1918. (U. S. Patent 1,890,584)

U and V may be removed by subjecting the finely divided ore to sulfurous acid soln., heating the soln. to expel SO_2 , and pptg. the basic U sulfite and V from soln. by caustic lime.

1386 Germann, F. E. E. "A New Hydrate of Uranium Nitrate: Uranium Nitrate Icositetrahydrate." *Phys. Rev.* (2), 11, 245-6(1918).

On cooling an aq. soln. of $\text{UO}_2(\text{NO}_3)_2$, a hitherto undescribed hydrate of this salt, stable below about -19° , forming spontaneously at about -35° (at which point heat is liberated) was discovered. The compn. of the hydrate, which was detd. by thermal analysis, measuring the heats of formation from equal vols. of solns. of varying concn. corresponds to $\text{UO}_2(\text{NO}_3)_2 \cdot 24\text{H}_2\text{O}$. The transformation from the hexahydrate which is stable at room temp. to the new icositetrahydrate, is accompanied by a large vol. increase and may be suppressed by rapid cooling. Due to supercooling phenomena, the temp. of formation and max. temp. of stability are not fixed.

1387 Hatt, E. C. "The Photolysis of Uranyl Formate." *Z. physik. Chem.* 92, 513-62(1918). The decompn. of solns. of uranyl formate under the influence of light has been further examined with a view to the detn. of the influence of the concn. of the uranyl salt, the intensity of the light, and the presence of foreign substances. The expts. with varying concn. indicate that the photolysis is retarded by the uranous salt, which is one of the products of the light reaction. For widely varying light intensities, the initial velocity of the reaction is proportional to the intensity of the light, but at later stages the velocity increases less rapidly than the intensity of the acting light. KCl , KI , FeCl_3 , vanadyl sulfate, and vanadic acid retard the reaction, but K_2SO_3 appears to produce no change in the velocity of the reaction. The view that U cpds. of higher and lower valency are formed is rendered probable by the fact that the solns. have an oxidizing action on KI and a reducing action on KMnO_4 . In terms of the oxidation and reduction products, it is possible to explain a number of facts which have been established in this and previous investigations of the photochem. decompn. of uranyl formate. A method for the estn. of uranous salts in presence of formic acid is described. The U soln. acidified with H_2SO_4 is added to a soln. contg. NH_4 acetate and Na phosphate placed in a cylindrical sepg. funnel connected with a suction pump through a filter bottle. The funnel is provided with a Gooch filter and with an attachment by which the air in the funnel can be replaced by H_2 . The mixt. of uranyl NH_4 phosphate and uranous phosphate, which is pptd., is filtered by suction in the H_2 atm., the ppt. washed with NH_4 acetate soln., and then dissolved in H_2SO_4 (1:4), the soln. thus obtained being titrated with std. permanganate. This method of estg. uranous salts has been found to give quite satisfactory results in the investigation of the uranyl formate solns.

- 1388 Hoskins, E. R. and Hoskins, M. M. "The Reaction of Selachii to Injections of Various Non-Toxic Solutions and Suspensions (Including Vital Dyes), and to Excretory Toxins." J. Exptl. Zoöl. 27, 101-55(1918).

Expts. were performed on the dogfish (Mustelus canis). The toxins used were K_2CrO_4 , tartaric acid, and $UO_2(NO_3)_2$. Results of examining the organs of the exptl. animals are given including many plates showing histological specimens.

- 1389 Howes, H. L. "Certain Absorption Bands in the Spectra of the Uranyl Salts." Phys. Rev. (2), 11, 66-9(1918).

Previous observers have noticed that the fluorescence and absorption spectra of the uranyl salts overlap. It has been found possible to reverse a complete group of fluorescence bands lying between 5080 and 4880 Å. In the present paper this "reversing region" has been extended toward the red to about 5600 Å. at 20°, where two additional groups of reversals are found. The bands cannot be traced as far into the red when the crystal is cooled to -185°. It is evident that Stokes' law does not hold and it may be that every fluorescence band has an absorption band of the same wavelength.

- 1390 Howes, H. L. "Absorption Bands in the Spectra of the Uranyl Salts." Phys. Rev. (2), 11, 143-4(1918).

This is an abstract of a paper read before the American Physical Society. In their study of the uranyl double chlorides Nichols and the author found it possible to reverse a complete group of fluorescence bands lying between 5080 and 4880 Å. The present work was undertaken to extend this reversing region toward the red. A theory of luminescent radiation recently proposed by Kennard lent interest to the investigation. Difficulties were encountered owing to the fact that the crystals are of a greenish-yellow color, necessitating the use of crystals of increasingly thicker layers to bring out the dimmer absorption bands as the light admitted is changed from blue to yellow. Orange or yellow screens had to be used. The role of the new bands discovered in producing fluorescence is a minor one because they are excessively dim. No doubt if special crystals of great size and exceptional clearness were formed the bands would appear stronger, and more bands could be discovered. The present work had added the reversals of two complete groups to the original group mentioned. For some reason the bands cannot be traced as far into the red when the crystal is cooled to -185°C. It is evident that Stokes' law does not hold, and it may be that every fluorescence band has an absorption band of the same wavelength.

- 1391 Karsner, H. T., Reimann, S. P., and Brooks, S. C. "Studies in Uranium Poisoning. II. The Solubility of Uranium Oxide in Artificial and Human Gastric Juice." J. Med. Research 39, 163-8(1918).

U oxide, although insol. in H_2O , is sol. in gastric juice. Sugar, fat, and peptone (albumose) do not materially alter the soly., while milk and casein reduce it.

- 1392 Mott, W. R. "Relative Volatilities of Refractory Materials." Trans. Am. Electrochem. Soc. 34, 255-95(1918).

The boiling point for UC_2 is reported to be 4100°. Data on the volatility of U added to Fe is also given.

- 1393 Müller, A. "Studies on the Complex Formation of Uranyl Compounds." Z. anorg. allgem. Chem. 103, 55-68(1918).

Uranyl cacodylate, $UO_2(AsO_2Me_2)_2$, is a light-yellow, odorless, tasteless powder, insol. in H_2O and org. solvents, and was obtained by double decompn. of $UO_2(OAc)_2NaHCO_3$ and cacodylic acid in H_2O soln. Uranyl dithiocacodylate, $UO_2(AsOSMe_2)_2$ is a red-brown cryst. mass, melting sharply at 60 to 65°, has a mercaptan-like odor, is easily sol. in Me_2CO , $MeOH$, $EtOH$, insol. in Et_2O , C_6H_6 , slightly sol. in H_2O , and was obtained from the above by treatment with H_2S in $MeOH$ suspension, and evapn. of the filtered soln. in vacuum. Uranyl o-sulfonamidobenzoate, $UO_2(C_6H_4 \cdot COO \cdot SO_2NH_2) \cdot 3H_2O$, occurs as greenish-yellow crystals with a metallic sweet taste, sol. in H_2O , $EtOH$, insol. in $CHCl_3$,

C_6H_6 , Et_2O , Me_2CO , which decompd. on heating, was obtained from the Ba salt and UO_2SO_4 in H_2O soln. by evapn. to dryness and crystn. from MeOH. Uranyl m- and p-sulfonamidobenzoate, with compn. and properties similar to above, were obtained from $UO_2(OAc)_2$ and the Na or K salt. Uranyl o-toluenesulfonate, $UO_2(C_6H_4 \cdot Me \cdot SO_3)_2 \cdot 2H_2O$, appears as large, light-yellow flakes, with properties similar to the above from UO_2SO_4 and Ba salt, upon evapn. of the filtrate and crystn. from EtOH. Uranyl α -phenylcinchonate, $UO_2[C_9H_5N \cdot C_6H_5 \cdot CO_2]_2$, is a dark-yellow, tasteless, odorless, amorph. powder, insol. in all ordinary solvents, was pptd. on adding UO_2OAc to a H_2O soln. of the Na salt.

- 1394 Nichols, E. L. and Howes, H. L. "Types of Phosphorescence." Proc. Natl. Acad. Sci. U. S. 4, 305-12(1918).

It was formerly assumed that curves of decay of phosphorescent bodies were all of the same type. Two different types have been shown by the authors to exist: (1) persistent phosphorescence which is made up of a succession of linear processes of diminishing slope proceeding with the origin of time, (2) vanishing type in which the linear processes are of decreasing slope. The location of the breaks is dependent on the intensity of excitation in the case of uranyl salts. In uranyl cpds. and in Franklin Furnace calcite both types may be obtained, the vanishing under photoexcitation and the persistent under cathode discharge. The two types are entirely independent of each other, and calcite crystals after cathode bombardment do not show persistent curves when photoexcited.

- 1395 Nichols, E. L. and Howes, H. L. "The Unpolarized Fluorescence and Absorption of Four Double Chlorides of Uranyl." Phys. Rev. (2), 11, 285-310(1918).

In a recent paper an account was given of the fluorescence spectrum of NH_4 uranyl chloride and more recently the polarized fluorescence and absorption of the four double chlorides $UO_2Cl_2 \cdot 2NH_4Cl \cdot 2H_2O$, $UO_2Cl_2 \cdot 2KCl \cdot 2H_2O$, $UO_2Cl_2 \cdot 2RbCl \cdot 2H_2O$, and $UO_2Cl_2 \cdot 2CsCl$ have been described and discussed. Complete measurements of the fluorescence spectra and absorption spectra of this group of fluorescent cpds. have been completed and the data are recorded together with a discussion of the bearing of these data on the structure of fluorescent spectra and the relations between fluorescence and absorption.

- 1396 Smith, E. F. Quantitative Electroanalysis. 6th ed. Philadelphia, Blakiston, 1918.
A discussion of the detn. of U by electrochem. methods and of the most favorable concns. of U in soln. for the detn. are included. The accuracy is said to be restricted by the relative amts. of cations present.

- 1397 Stenstrom, W. "Experimental Investigation of Roentgen Spectra. M Series." Ann. Physik (4), 57, 347-75(1918).

Data are given on the lines M_{III} , M_{IV} , M'_V , and M_V for the x-ray spectrum of U.

- 1398 Watanabe, C. K., Oliver, J., and Addis, T. "Determination of the Quantity of Secreting Tissue in the Living Kidney." J. Exptl. Med. 28, 359-76(1918).

It was found that when urea was injected it could be used as a functional test for U poisoning based on the fact that in U nephritis an N retention occurs. The effects of various doses of uranyl acetate upon the secretion of urine, 72 hrs after poisoning, are discussed.

- 1399 Wick, F. G. "A Study of the Fluorescence of Certain Uranyl Salts at Room Temperature." Phys. Rev. (2), 11, 121-9(1918).

This paper includes a spectrophotometric study of the relative intensities of the fluorescence bands, with detns. of the shape of a few bands which show partial resolution at room temp. Comparison of the intensities was made with an C_2H_2 flame, the results being reduced to relative energy curves by using Coblenz' values for C_2H_2 . Fluorescence was excited by a quartz mercury lamp with a deep-blue glass filter. Measurements were made for double salts of uranyl and the alk. metals as well as for simple uranyl salts. The $(NH_4)^+$ radical seemed to have a superproportional effect in shifting the energy curve similar to that noticed by Tutton on the optical properties of alk. metal salts. It is considered that the results are in agreement with those of Nichols and Merritt.

The fluorescence bands form a series with a freq. interval nearly uniform for a given salt. Absorption bands appear to be a continuation of fluorescence bands, but with a shorter interval. The two series overlap and certain bands in the violet reversing region appeared as absorption or fluorescence bands according to the illumination conditions.

- 1400 Wick, F. G. and McDowell, L. S. "A Preliminary Study of the Luminescence of the Uranyl Salts Under Cathode Ray Excitation." Phys. Rev. (2), 11, 421-9(1918).

Three conclusions are drawn: (1) The irregularities in the fluorescence spectrum of the uranyl salts under light excitation are due to absorption. (2) The spectrum of the long-time phosphorescence produced by cathode-ray excitation at liq. air temp. is identical with the fluorescence spectrum. (3) The decay curve is the type usual to phosphorescence of long duration in which the second process is less rapid than the first. No satisfactory conclusion as to the effect of variations in time of exposure and strength of cathode-ray bombardment or the influence of previous excitation were drawn.

PUBLICATIONS LOCATED IN 1919

- 1401 Baur, E. "On the Relationship between Electrolysis and Photolysis and on the Irreversible Electrolysis." Z. Elektrochem. 25, 102-09(1919).

It is reported that when a mixt. of glycolic acid and uranyl salts is exposed to light, a reduction occurs. The reaction mechanism of the photolysis of aq. $\text{UO}_2(\text{OAc})_2$ soln. is discussed. The use of $(\text{UO}_2)^{+2}$ as a catalyzer in photochem. processes is also discussed.

- 1402 Biltz, W. "Systematic Affinity Rule. X. Dependence of Valence on Temperature. III." Z. anorg. allgem. Chem. 109, 132-44(1919).

A discussion is included on the dissociation of AuCl_3 , VCl_3 , VCl_2 , Fe_2O_3 , Fe_3O_4 , UO_3 , PbO_2 , hydrates of $\text{UO}_2(\text{NO}_3)_2$, FeS_2 , FeS , CuS , CuO , and a number of NH_3 cpds., from the point of view of valence isobars.

- 1403 de Broglie, M. "Spectroscopy by X-Rays: On the L-Absorption Spectrum of Radium." Compt. rend. 168, 854-5(1919).

A brief comparison with the spectrum of U is included.

- 1404 de Broglie, M. "On the Spectrum of X-Rays from Tungsten." Compt. rend. 169, 962-5 (1919).

Values for L_1 , L_2 , $\Delta\nu$ observed, and $\Delta\nu$ calcd. for U are included with similar data for other elements.

- 1405 Dessauer, F. and Back, E. "Production of X-Rays Using Very High Voltages." Ber. deut. physik. Ges. (2), 21, 168-200(1919).

Values for $K\alpha$, $K\alpha_2$, and $K\beta$ in the spectrum of U were measured and compared with extrapolated values from Pt and with those calcd. from Sommerfeld's formula.

- 1406 Gin, G. "Uranium and Its Extraction from Pitchblende." Trans. Am. Electrochem. Soc. 35, 191-8(1919).

The author discusses the occurrence and compn. of pitchblende (uraninite), the methods of treatment by which U oxide is sepd. from it when it contains V, and the simplified method for use when V is absent. A method is proposed for purification, involving fusion and electric furnace treatment, to convert most of its constituents into carbides, followed by sepn. based on the differing properties of the carbides. S. C. Lind referred to later developments since Gin's paper was written, emphasizing the importance of carnotite as the chief source of U and V.

- 1407 Gomez, L. "Principal Methods for the Determination of the Ionic Constitution of Solutions of Electrolytes and the Application of These to the Solution of Uranyl Nitrate." Anales soc. españ. fís. quím. 17, 24-49(1919).

With reference to the soln. of $\text{UO}_2(\text{NO}_3)_2$, the results of the cryoscopic measurements of Dittrich are examined. It is shown by extrapolation that the apparent mol. wt. at infinite diln. is almost exactly one-third of the real mol. wt., so that an ionization according to the scheme $\text{UO}_2(\text{NO}_3)_2 \rightleftharpoons [\text{UO}_2]^{+2} + 2[\text{NO}_3]^-$ may be assumed. With the increasing concn., the ratio of the apparent to the real mol. wt. approaches the value 2.5, so that even in concd. soln. the salt is ionized to a considerable extent, possibly in accordance with the equation $2\text{UO}_2(\text{NO}_3)_2 \rightleftharpoons [\text{U}_2\text{O}_4]^{+4} + 4[\text{NO}_3]^-$. The values of the degree of dissocn., calcd. on the assumption that the salt is a simple ternary electrolyte, are uncertain. Dittrich's measurements of the equiv. cond. show that up to an equiv. diln. of 4096 l^{-1} the values of λ do not converge to a limit. By forming the difference between each value of λ and the next succeeding at double the diln., it is shown that the difference decreases until the dil. $v = 64 \text{ l}^{-1}$ is reached. From this point, the difference increases progressively throughout the range of diln. considered. This behavior is attributed to the progressive ionization of the salt, according to the equations $\text{UO}_2(\text{NO}_3)_2 \rightleftharpoons [\text{UO}_2(\text{NO}_3)]^{\frac{3}{2}} + [\text{NO}_3]^-$ and $[\text{UO}_2(\text{NO}_3)]^{\frac{3}{2}} \rightleftharpoons [\text{UO}_2]^{+2} + [\text{NO}_3]^-$, with subsequent hydrolysis at dilns. beyond $v = 64 \text{ l}^{-1}$. The transport numbers for the anion were detd. at concns. between 0.0024 and 0.074M, the fall in concn. of UO_2 at the anode being measured. The curve obtained resembles that for a typical ternary electrolyte, and shows a min. at 0.015M, indicating a max. concn. of $[\text{UO}_2(\text{NO}_3)]^{\frac{3}{2}}$. At concns. beyond 0.07M, the transport number approaches unity, the "metallic" radical now forming part of the anion. At concns. lower than 0.01M, the presence of $[\text{UO}_2]^{+2}$ is indicated. The addn. of NH_3 to a uranyl soln. pptd. the cpd. $(\text{NH}_4)_2\text{U}_2\text{O}_7$. This indicates the probable presence of $[\text{U}_2\text{O}_7]^{+2}$.

- 1408 Grau, C. A. "Contribution to the Study of Thiocol. III." Bull. sci. pharmacol. 26, 457-62 (1919).

There is a violet color produced with a 1% soln. of titanium sulfate and thiocol. If a few crystals of the substance are placed on a porcelain plate, and a crystal of U nitrate is added, a reddish color develops, which changes to yellow on the addn. of a few drops of HNO_3 , the red reappearing with an excess of acid. The colors obtained with other reagents are described, together with the methods of testing.

- 1409 Hedvall, J. A. and von Zweigbergk, N. "Study of Some Rapid Low-Temperature Oxide Reactions by Means of Heating Curves." Z. anorg. allgem. Chem. 108, 119-36(1919). Formation of a cpd. of BaO with the added oxide was indicated in the following cases: ZnO , TiO_2 , Al_2O_3 , PbO , V_2O_5 , As_2O_3 , Sb_2O_3 , Ta_2O_5 , Cr_2O_3 , MoO_3 , WO_3 , UO_3 , MnO_2 , Fe_2O_3 , NiO , and CuO .

- 1410 Johnson, C. M. "Determination of Uranium, Zirconium, Chromium, Vanadium, and Aluminum in Steel. I. U in Chrome Tungsten Steel." Chem. Met. Eng. 20, 523-4(1919). To the filtered H_2SO_4 soln. add NH_4OH (1:1) until the ppt. takes a reddish tint, changing to a blackish and finally a bluish-white tint. Add 2 cc more NH_4OH to complete the pptn. of U with only a trace of Fe. Immediately filter the soln. and finish as in plain steel. Wash the insol. portion into the original beaker with dil. H_2SO_4 and heat, and then oxidize with 30 cc HNO_3 (dil.). Heat until the residue assumes a bright-yellow color. Filter off the U and wash 25 times with dil. H_2SO_4 . Then oxidize and finish as in plain steel.

- 1411 Kelley, G. L., Myers, F. B., and Illingworth, C. B. "The Determination of Uranium in Alloy Steels and Ferro-Uranium." J. Ind. Eng. Chem. 11, 316-17(1919). The method is described in detail. It provides for the presence of Cr, Mo, V, W, Co, Ni, C, Mn, Si, P, and S.

- 1412 Lind, S. C. and Davis, C. W. "A New Deposit of Uranium Ore." Science (2), 49, 441-3 (1919).

This paper reports the discovery of commercial quantities of uranophane mineral contg. about 20% U near Lusk, Wyo.

- 1413 MacNider, W. deB. "A Functional and Pathological Study of the Chronic Nephropathy Induced in the Dog by Uranium Nitrate." J. Exptl. Med. 29, 513-29(1919).

- 1414 Moir, J. "Color and Chemical Constitution. VII. Spectra of Solid Compounds of Cobalt, Nickel, Manganese, and Uranium." Trans. Roy. Soc. S. Africa 7, 45-9(1919).

Evidence is given to show that the effect on the absorption spectrum of loading the mol. either internally by substitution or by combination with a nonionizing solvent, noted in the case of certain org. cpds., may also be observed among Co, Ni, and UO_2 salts and among permanganates. It is noted that the wavelengths of homologous lines of UO_2 cpds. are proportional to the 6th root of the mol. wts. of the cpds. compared.

- 1415 Moir, J. "Color and Chemical Constitution. VIII. Fluorescence and Its Laws." Trans. Roy. Soc. S. Africa 7, 51-3(1919).

The emission spectra of the green fluorescences exhibited by UO_2 cpds. in the solid condition or in nonaq. soln. have been examined. The bands are equally spaced and probably are always five in number, but usually some are too faint to be observed. It is found that for all of them $A_n/A_1 = F_n/F_1$, in which A_n and F_n are corresponding wavelengths in the absorption and fluorescent spectra, and A_1 and F_1 are the resp. wavelengths of the lowest bands in each.

- 1416 Müller, A. "A New Colorimetric Method for Small Amounts of Uranium." Chem. Ztg. 43, 739-40(1919).

Aliphatic α -hydroxy and keto acids as well as aromatic hydroxycarboxylic acids, and especially higher phenols, give characteristic colors with uranyl salts. In a test on a known uranyl soln. (0.2%) 5 cc were treated with 5 cc 2% $\text{HOC}_6\text{H}_4\text{CO}_2\text{Na}$, and the red color was compared in a colorimeter. The value detd. analytically was 0.0038%, while this method gave 0.0034%. The formula used is given.

- 1417 Nichols, E. L. and Howes, H. L. Fluorescence of the Uranyl Salts. Washington, 1919. 241p. (Carnegie Institution Publication 298)

The historical introduction is followed by chapters devoted to structure of fluorescence spectra; preliminary observations on certain uranyl salts; phosphorescence of the uranyl salts; intimate structure on cooling to -185° ; polarized spectra of double chlorides; the nitrates and phosphates; water of crystn., crystal form; the acetates; the sulfates; frozen solns. Since the fluorescence of certain uranyl cpds. is resolved into groups of narrow linelike bands when these cpds. are excited to luminescence at very low temps., a study of the fluorescence has been undertaken. "The spectra of numerous uranyl salts, many of which were especially prepd. for this purpose, have now been mapped. Owing to the extraordinarily complex character of the phenomena, no satisfactory theory has as yet been evolved, but the mass of facts here recorded and the general principles established will, it is hoped, afford a basis for the successful theoretical development of this important and little understood branch of the science of radiation." Appendixes are devoted to the chemistry and crystallography of the uranyl salts and to the subject of phosphoroscopes.

- 1418 Nichols, E. L. and Howes, H. L. "Fluorescence and Absorption of the Uranyl Sulfates." Phys. Rev. (2), 14, 293-305(1919).

The fluorescence spectrum of the uranyl sulfates consists of 8 equidistant bands, the 1st and 8th of which disappear at the temp. of liq. air. The remaining bands are resolved into groups of narrow, linelike bands, the homologous members of which form series having const. freq. intervals, ranging from 85.7 in $\text{UO}_2\text{SO}_4 \cdot \text{Cs}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$ to 83.0 in $\text{UO}_2\text{SO}_4 \cdot \text{K}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$. The fluorescence groups are

distinguished by a strong pair of bands about 8 freq. units apart and several weak bands, some of which are doublets. There is a shift of all bands toward the violet, with increasing mol. wts. of about 15 freq. units in passing from the spectrum of uranyl sulfate to the Cs double salt. The absorption spectrum of the sulfates is made up of a series of bands having a freq. interval of about 70.3. These absorption series extend into group 7 without a break of interval. There are many reversals where fluorescence and absorption overlap. The reversing region is, therefore, one group further toward the red than in most spectra of the uranyl cpds.

- 1419 Nichols, E. L., Howes, H. L., and Wick, F. G. "Fluorescence and Absorption of the Uranyl Acetates." *Phys. Rev.* (2), 14, 201-21(1919).

The paper deals with the fluorescence and absorption spectra of the 2 known forms of uranyl acetate and of 13 double uranyl acetates as they appear when excited at the temp. of liq. air. The essential identity of the spectra of the double acetates of Li, K, Ca, Mn, Sr, both as regards the location of the principal bands and the structure of the fluorescence groups, is established and the deviations from this type occurring in the spectra of the uranyl acetates contg. Ba, NH_4 , Rb, Na, Mg, Zn, Ag, and Pb are considered. The approx. identity of freq. intervals for all series and for all salts is likewise established; this interval is 84.76.

- 1420 Pierle, C. A. "The Electrochemistry of Uranium and the Single Potential of Some Oxides of Uranium." *J. Phys. Chem.* 23, 517-53(1919).

The previous work on the electrochemistry of U is reviewed. Attempts to prep. pure U electrolytically were unsuccessful, but several U salts were thus obtained. In aq. solns. with low c.d. uranyl salts deposit first $\text{UO}_3 \cdot \text{H}_2\text{O}$, which is later changed by the action of current to a black oxide of a varying compn. With higher c.d. UO_2SO_4 is reduced to $\text{U}(\text{SO}_4)_2$, but in the presence of free acid the deposit obtained is small in amt. and poorly adherent, though metallic in appearance. In neutral or alk. soln. the deposit formed is a mixt. of the black and yellow oxides. Diaphragms do not influence the deposit. Alk. uranyl tartrate and citrate solns. give deposits richer in U than acidified solns. The cond. of nonaq. solns. of uranyl salts is a function of the H_2O present and the deposits formed are oxides contaminated with org. matter. Anhyd. pyridine treated with anhyd. UCl_4 forms conducting solns. From these solns. deposits may be obtained at the cathode contg. U and pyridine. UCl_4 in anhyd. acetone gives a soln. which conducts well but deposits no metallic U. The deposit replaced Hg from Hg_2SO_4 . Solns. of KUO_2F_3 (neutral, acid, or alk.) form a deposit contg. F. In acid soln. the deposit is $\text{UF}_4 \cdot 6\text{H}_2\text{O}$. Neutral and alk. solns. give a mixt. of UF_4 and U oxide. Deposits from double K uranyl cyanide solns., when neutral, consist of K_2UO_4 . When acid with HCN the deposit is the yellow hydrated oxide contaminated with some of the black oxide. The single potential of metals and oxides in powder form can be measured accurately by pasting the finely powd. material on a Pt electrode with gelatin. The single potentials of the more stable oxides of U have been measured. The black deposit formed when U salts are electrolyzed is not $\text{U}_3\text{O}_8 \cdot 2\text{H}_2\text{O}$, as claimed by Smith, but is $\text{U}_3\text{O}_{10} \cdot 2\text{H}_2\text{O}$. It does not give the same potential as U_3O_8 . The position of U in the electrochem. series has not been definitely fixed because of inability to make pure U; the potential of a sample of U contg. 91.4% U and 8.34% Fe_2O_3 is -0.093 v.

- 1421 Scholl, C. E. "A Rapid Method for Determining Uranium in Carnotite." *J. Ind. Eng. Chem.* 11, 843(1919).

Elements such as Fe, Al, and V which produce difficulties in the analysis of U are removed by adding Fe^{+3} , followed by pptns. with Na_2CO_3 without boiling, and NaOH with boiling. H_2O_2 is not used, as it prevents U from pptg. The method is rapid and accurate and can be recommended to technical labs.

- 1422 Siegbahn, M. and Jönsson, E. "On the Absorption Frequency Limit for Roentgen Rays in the Heavy Elements, as Well as in the Rare Earths." Physik. Z. 20, 251-6(1919).

Early data are given on the K-absorption edge in measurements of the x-ray spectrum of U.

- 1423 Siemssen, J. A. "The Triboluminescence of Uranium Compounds." Chem. Ztg. 43, 267 (1919).

Various U salts were sprinkled with different org. solvents and sealed up in glass bulbs for 4 yrs. There was no evidence of any explosion nor did the walls of the glass become colored as radioactivity would tend to color them. Triboluminescence was produced in all freshly crystd. U cpds. worked with and was unaffected by x rays, sparking, ozone, or vacuum. The explosibility of $\text{UO}_2(\text{NO}_3)_2$ noted by others is explained as the probable presence of some labile oxide of N. Triboluminescence is due to p.d. in the crystals and is probably a property of the U atom itself.

- 1424 Smith, P. T. "The Occlusion of Hydrogen by the Metallic Elements and Its Relation to Magnetic Properties." J. Phys. Chem. 23, 186-202(1919).

This paper discusses the relationship of the magnetic susceptibility of U and other elements to the occlusion of H_2 .

- 1425 Soddy, F. "The Relation between Uranium and Radium. Part VII." Phil. Mag. (6), 38, 483-8(1919).

The growth of Ra in U prepns. over a long period is discussed.

- 1426 Staehling, C. "Radioactivity of Uranium." Compt. rend. 169, 1036-9(1919).

The author describes some interesting expts. relating to the radioactivity of the "black" and "green" oxides of U. These oxides, in addn. to a penetrating radiation, emit a very soft radiation which forms the basis of the present investigation. It has been demonstrated consistently, that even when the black oxide U_2O_5 and the green oxide U_3O_8 are prepd. from the same sample of uranyl nitrate by the direct method of calcination, the soft radiation is always greater from the black oxide than from the green; the penetrating radiation being the same in the two cases. If the less active green oxide is reconverted into nitrate and subsequently converted into black oxide, it is always found to have increased in activity (as measured by the soft (or total) radiation). Other expts. of this nature are described, with substantially the same result.

- 1427 Swensson, T. "Photoelectric Investigations of Salt Solutions." Arkiv Kemi, Mineral. Geol. 7, No. 19, 143p. (1919).

Contributions are made to the data on the mechanism of the $\text{U}^{+6}/\text{U}^{+4}$ potential at the Pt electrode.

PUBLICATIONS LOCATED IN 1920

- 1428 Aloy, J. and Rodier, E. "Violet Compounds of Uranium." Bull. soc. chim. France, (4), 27, 101-05(1920).

The violet cpd., first obtained by Ebelmen (Ann. chim. phys. (3), 5, 198 (1842)), by the action of solar light on a soln. of uranic oxalate, which he considered a hydrate of U_3O_8 , can be obtained from uranic salts of either mineral or org. acids in the presence of an O acceptor, alc., aldehyde, or ether. Salts of mineral acids must be neutralized to the start of pptn. The same action is caused by slight warming, in total absence of light, of a neutral uranate to which a crystal of uranous salt has been added. FeSO_4 has not the same effect. It is concluded that the uranous salt not only acts as O acceptor but takes part in the formation of the violet cpd. and that the reaction is $2\text{UO}_2(\text{OH})_2 + \text{U}(\text{OH})_4 \rightarrow 2\text{H}_2\text{O} + \text{UO}_2(\text{OH})\text{OU}(\text{OH})_2\text{OUO}_2(\text{OH})$, equiv. to $\text{U}_3\text{O}_8 \cdot 2\text{H}_2\text{O}$. Solar heat and x rays had no effect, but ultraviolet light formed the violet cpd. rapidly.

- 1429 Auger, V. "Salts of Nitrosophenylhydroxylamine (Cupferron); Uranous Salt." Compt. rend. 170, 995-6(1920).

Cupferron in neutral soln. ppts. all metal ions except the alks.; the products can be divided into simple salts, decompd. by dil. acids and insol. in CHCl_3 and complex salts, sol. in CHCl_3 , and more or less resistant to strong acids. Only the latter class appears of interest for analytical sepns. $(\text{UO}_2)^{+2}$ is not pptd. by cupferron, but if reduced by Zn in HCl or H_2SO_4 , the resulting uranous salt is quant. pptd. in acid soln. in brown flocs sol. in CHCl_3 , forming brown prisms on evapn. of the solvent. Air-dried, the cpd. corresponded closely with $\text{U}(\text{C}_6\text{H}_5\text{N}_2\text{O}_2)_4$. One can thus sep. and ppt. V and U successively.

- 1430 Bruhart, G. "Researches on Abnormal Rotatory Dispersion." Ann. phys. (9), 13, 25-48(1920). The results of measurements, using spectropolarimeters, on uranyl tartrate, ammoniacal didymium tartrate, and several Co tartrates are presented. The results obtained with the uranyl and didymium tartrates in the case of narrow absorption bands confirm the quant. rule previously given by the author, as well as Natanson's rule.

- 1431 de Broglie, L. "The Calculation of the Limiting Frequencies of K and L Absorptions for Heavy Metals." Compt. rend. 170, 585-7(1920).

The K frequency is calcd. for the following metals: Cd, Te, Pt, Pb, Th, and U; and the L for W, Pt, Au, Pb, Bi, Th, and U. For the former, the relativity correction has to be applied; for the latter, it can be neglected.

- 1432 de Gramont, A. "Table of Very Sensitive Rays for Elements Destined for Analytical Research." Compt. rend. 171, 1106-09(1920).

It is reported that U does not yield any rays of great sensitivity.

- 1433 Dhar, N. R. "Catalysis. IX. Thermal and Photochemical Reactions." Proc. Roy. Acad. Sci. Amsterdam 23, 44-9(1920).

Evidence is presented that reactions which have a large temp. coeff. are sensitive to light. Hence, sensitiveness to temp. and to light radiations accompany each other. Salts of U function as general pos. catalysts in photochem. reactions, while salts of Mn act as general neg. catalysts in both the presence and absence of light.

- 1434 Duane, W., Fricke, H., and Stenstrom, W. "Absorption of X-Rays by Chemical Elements of High Atomic Numbers; Critical Absorption Wave Lengths in K-Series." Proc. Natl. Acad. Sci. U. S. 6, 607-12(1920).

In the research described, the authors have measured the crit. absorption wavelengths in the K series of most of the available elements from W to U inclusive.

- 1435 Duane, W. and Patterson, R. A. "Characteristic Absorption of X-Rays: L-Series." Proc. Natl. Acad. Sci. U. S. 6, 509-18(1920).

The L-absorption edges for the x-ray spectrum of U is recorded as for $L_I = 568.5$, $L_{II} = 591.8$, and $L_{III} = 721.4$.

- 1436 Elsey, H. McK. "The Alkyl Amines as Solvents." J. Am. Chem. Soc. 42, 2080-5(1920). Uranyl nitrate is reported to be insol. in trimethylamine and ethylamine. Uranyl acetate is slightly sol. in methylamine and somewhat more sol. in ethylamine.

- 1437 Gunzburg, I. "The Influence of Uranium and Potassium on the Viscosity of Liquid Colloids." Arch. néerland. physiol. 4, 233-42(1920).

This work is a continuation of a previous investigation which showed that U could replace K in the circulation but that larger amts. of U salts stimulated muscular contractions and finally caused paralysis. The effects of increasing the concn. of $\text{UO}_2(\text{NO}_3)_2$ and KCl, resp., were noted and the results compared with a similar detn. of ox serum. The viscosity curves for the two salts were diametrically

opposed. The viscosity was greater than that of normal juice when the liq. contd. less than 25 mg or more than 75 to 100 mg $\text{UO}_2(\text{NO}_3)_2/1$. Between these levels there was a point at which the viscosity was below normal.

1438 Hallimond, A. F. "Meta-Torbernite I and Torbernite." Mineralog. Mag. **19**, 13-50(1920).

1439 Harkins, W. D. "The Stability of Atoms as Related to the Positive and Negative Electrons in Their Nuclei, and the Hydrogen, Helium, H_3 , H_2 Theory of Atomic Structure." J. Am. Chem. Soc. **42**, 1956-97(1920).

The ratio of neg. to pos. units, which is a measure of the nuclear stability, is 0.614 in the U nucleus. Similar calcns. are presented for all the members of the radioactive series known at the time of writing.

1440 Kiess, C. C. and Meggers, W. F. "Wave Lengths Longer than $5500 \text{ \AA}$ in the Arc Spectra of Seven Elements." Sci. Papers Bur. Standards **16**, 51-73(1920). (Scientific Paper No. 372)

The concave-grating spectrograph of the Bureau of Standards was used in photographing the yellow, red, and infrared arc spectra of Ti, V, Cr, Mn, Mo, W, and U. The photographs were made on plates sensitized to the red and infrared rays with pinacyanol and dicyanin. American-made dyes were used for many of the plates and were as effective in their sensitizing action as those formerly imported from Germany. Impurity lines were eliminated from the tables so far as known, those not identified being brought together in a sep. table. Lines whose wavelengths agreed with those in the series spectrum of O_2 were repeatedly observed in the spectra of arcs in air. Freq. differences which were suspected of being const. were found in each of the spectra.

1441 MacNider, W. deB. "A Study of Renal Function and the Associated Disturbance in the Acid-Base Equilibrium of the Blood in Certain Experimental and Naturally Acquired Nephropathies." Arch. Internal Med. **26**, 1-37(1920).

Exptl. acute nephritis was induced by U and HgCl_2 and was superimposed upon chronic kidney injury acquired by U intake. Rapid reduction of blood alk. was found along with an acute degeneration of the convoluted-tubule epithelium. Changes in the output of urea were also noted.

1442 Mott, W. R. "Arc Images in Chemical Analysis." Trans. Am. Electrochem. Soc. **37**, 665-706(1920).

The arc between electrodes of metallic U, or of graphite which contains U cpds. in the craters, is of an intense blue, green, and red color. The core is blue, the red on the outside, and the green on the inside.

1443 Muguet, A. and Seroin, J. "On the Age of Autunites from Portugal." Compt. rend. **171**, 1005-06(1920).

Ages are calcd. from data on the Ra/U ratio of the minerals.

1444 Müller, A. "Uranyl Radical as a Chromophore." Z. anorg. allgem. Chem. **109**, 235-74(1920).

The formulas, crystal forms, m.p., solys., and colors of a large number of org. uranyl derivs. are tabulated, and the methods of prepn. of a number of them are given. The effect of the various groupings on the color is discussed; general conclusions are that hydroxyl or keto groups, particularly in the α - or o-positions, displace the color from yellow to red, as does also the benzene nucleus, particularly when the UO_2 group is directly connected to phenolic O.

1445 Pierle, C. A. "The Analytical Chemistry of Uranium and Its Separation from Other Rare Elements." J. Ind. Eng. Chem. **12**, 60-3(1920).

A crit. review of the more common methods of detg. U is followed by a quant. study of the sepn. of U from V, W, and Mo. Tables of analytical results deal with the following features: pptn. of U by means of NH_4OH ; detn. of U as $(\text{UO}_2)_2\text{P}_2\text{O}_7$; pptn. of U by means of $(\text{NH}_4)_2\text{S}_x$; volumetric detn. of U by KMnO_4 ; action of Jones reductor; sepn. of U from V, Mo, and W by extn. of $\text{UO}_2(\text{NO}_3)_2$ with Et_2O ; and extn. of $\text{UO}_2(\text{NO}_3)_2$ with glacial AcOH .

- 1446 Polushkin, E. P. "Alloys of Iron and Uranium." Carnegie Scholarship Mem. Iron Steel Inst. (London) 10, 129-50(1920).

Ferro-uranium was produced in an arc-type furnace from charges consisting of U oxide, petroleum, coke, and steel turnings, fluorspar being added. The pyrophoric properties of ferro-uranium were found to increase with the U content, but alloys reduced by Si, contg. 16 to 18% Si and of low C content, did not exhibit such properties even with as much as 40% U. Investigation of the decompn. of ferro-uranium by H_2O showed the C content to be an important factor, but no explanation was advanced. Analysis of the various U-steel ingots produced verified the observation that the U was uniformly distributed and not subject to segregation. The microstructure of the alloys is very fully described, special methods having been devised for the identification of the various constituents present. The author concludes that U occurs in the free state, combined with Fe, as a carbide or double carbide with Fe, or as oxide.

- 1447 Schilow, N. and Lepin, L. "Adsorption as a Molecular Phenomenon. Communication I." Z. physik. Chem. 94, 25-71(1920).

This paper discusses the adsorption of UO_2Cl_2 by C from aq. and nonaq. solns.

- 1448 Schwarz, R. "Determination of Uranium." Helv. Chim. Acta 3, 330-46(1920).

Of the various reagents proposed for the quant. pptn. of U, HgO is untrustworthy, H_2O_2 is unsatisfactory, ethylene-diamine has no advantages over NH_4OH and is more expensive; HF and $(CO_2H)_2$ are inconvenient owing to the oxidation of uranous salts by atmospheric O_2 . The simplest and most trustworthy ppts. are $(NH_4)_2S$ and NH_4OH . Pptn. with $(NH_4)_2S$ is best made at 80° in the presence of NH_4Cl (about 3 g in 150 cc of soln. contg. 0.3 g U_3O_8); the ppt. always contains some NH_4 uranate, and complete sepn. from the alk. metals requires a repptn. with NH_4OH (cf. Zimmermann, Ann. 199, 15(1879) and Kern, J. Am. Chem. Soc. 23, 685(1901)). Dil. the soln., contg. 0.3 to 0.4 g U to 100 to 150 cc, heat to boiling and add 0.5 cc concd. HNO_3 to oxidize uranous salts; add 5 g NH_4Cl and then 2.5% NH_3 soln. dropwise until the soln. assumes a darker color. Continue the addn. of NH_4OH , stirring after each drop, until the soln. has a faint NH_3 odor, add a few cc of NH_4OH , let settle, filter, and wash with NH_4Cl soln. contg. a little NH_4OH . Owing to the tendency of NH_4 uranate to carry SiO_2 with it, the pptn. should not be made in glass vessels. Ignition of the ppt. from the $(NH_4)_2S$ or NH_4OH procedure to U_3O_8 (cf. Zimmermann, Ann. 232, 287(1886)) should be carried out in porcelain crucibles with access to air, since Pt permits diffusion of gases from the flame, causing a partial reduction to UO_2 . Reduction of U_3O_8 to UO_2 by means of H_2 is not quant. (cf. Kern, loc. cit.), owing to the formation of nitride. The pptn. of U as uranyl phosphate in $AcOH$ soln. as a means of sepn. from the alk. metals was found to be practically impossible owing to the fineness of the ppt. The volumetric process, based on the soln. of U_3O_8 in H_2SO_4 (cf. Boller, Dissertation, Univ. of Zürich, 1915) and titration of the $U(SO_4)_2$ with $KMnO_4$, was simplified and gave exact results. This was not true if complete reduction to uranous salts were first attempted (cf. Pulmann, Z. anorg. Chem. 37, 113(1903)). The detn. of U in the presence of Al is most conveniently made volumetrically with $KMnO_4$. The pptn. of Al by $(NH_4)_2CO_3$ in the presence of $(NH_4)^+$ is not only incomplete but some U is also pptd. An involved procedure is outlined which gives good results for the sepn. and detn. of Al and U. Contrary to Kern's conclusion, Pisani's method (Compt. rend. 52, 106(1861)) for the sepn. of Fe from U by $(NH_4)_2CO_3$ and $(NH_4)_2S$ is very satisfactory. Ditte's method (Ann. chim. phys. (5), 12, 139(1879)) for the sepn. of U from Cr salts is inaccurate (cf. Formanek, Ann. 257, 111(1890)), as they must first be oxidized to CrO_3 (best by Br_2 in alk. soln., although Jannasch's $(NH_4)_2S_2O_8$ method gives exact results). The ppt. of Na_2UO_4 obtained in presence of chromate (cf. Gibbs, Z. anal. Chem. 12, 310(1873)) always contains uranyl-alkali chromate, and repptn. with NH_4OH is necessary to effect a sepn.; the SiO_2 in the weighed U_3O_8 should be detd. by dissolving the latter in HNO_3 . A redetn. of the disson. pressure of U_3O_8 showed that the results reported by Colani (Ann. chim. (8), 12, 76(1907)) are erroneous, and, considered in conjunction with the heat of formation of U_3O_8 from UO_2 , indicates the existence of an intermediate oxide. On igniting U_3O_8 in a current of CO_2 in an elec. furnace at 1122° , a black residue was obtained corresponding approx. with the formula U_2O_5 ; on heating U_3O_8

in N_2 , traces of nitride were formed. The results of Zimmermann (loc. cit.) were vitiated by the use of a Pt crucible over a gas flame, which permitted reduction. Expts. showed that the ignition of Cr_2O_3 is best carried out in a Pt crucible, as this avoids any oxidation to chromate.

- 1449 Sommerfeld, A. "Remarks on the Fine Structure of Roentgen Spectra." Z. Physik **1**, 135-46(1920).

Information is given on the hyperfine structure and splitting order of the M series in the x-ray spectrum of U.

- 1450 Viale, G. "Researches on Photodynamic Phenomena. II. Photocatalytic and Photobiological Reactions." Arch. soc. biol. Montevideo **1**, 259-65(1920).

A study was made of the action of certain salts of U, Fe, and Mn on erythrocytes and on a mixt. of 4 vols. 1% starch soln. and 1 vol. 1% KI soln. The salts of the 3 metals were found not suitable for the production of photodynamic phenomena in cells. Salts of U and UO_2 , but not those of Mn and Fe, caused oxidation of KI in the sunlight in a few minutes; only the fluorescent salts were photodynamically active. While U salts were photodynamically active, they did not act on cells, probably because they were not absorbed.

- 1451 Wilke-Dörfurt, E. "Purification of Uranium Compounds." Wiss. Veröffentl. Siemens-Konzern **1**, 143-6(1920).

This paper discusses the prepn. of U_3O_8 and mentions that the classical method which uses a uranyl nitrate extrn. with Et_2O contains the disadvantage of the danger of explosion during the purification process. It proposes that alk.-free U_3O_8 cannot be obtained by this method. Alk.-free products can be obtained by recrystg. the nitrate several times in H_2O as follows: A slight excess of carbonate-free NH_3 is added and the soln. is satd. with H_2S . It is then heated to boiling without interruption of the H_2S and the ppt. is washed well with water contg. $(NH_4)_2S$, sucked dry in a filter and dissolved in a small quantity of concd. HCl . The dark-green UCl_4 is formed. The H_2S is driven off by boiling the soln., and a further treatment with NH_3 and H_2S is made. The UCl_4 soln. is again pptd. with NH_3 and the ppt. again dissolved in strong HNO_3 . The uranyl nitrate formed is recrystd. from pure H_2O until no free acid remains, and then it is ignited in the normal manner to U_3O_8 .

PUBLICATIONS LOCATED IN 1921

- 1452 Angeletti, A. "The Use of Cupferron in the Separation of Zirconium from Uranium." Gazz. chim. ital. **51**, I, 285-8(1921).

Zr occurs in several minerals associated with U, and these 2 metals are sepd. only with difficulty by Rose's method. This method is based on the pptn. of Zr by means of K_2SO_4 , and according to Rose himself does not always give good results. The author has found that cupferron gives an easy, rapid, and exact sepn. of Zr from U. The detn. of Zr with cupferron was pointed out by Schroeder and studied by Ferrare and by Thornton and Hayden, who sepd. Zr from Al in this way. An aq. 6% soln. of cupferron added at ordinary temp. to a soln. of a Zr salt acid with H_2SO_4 gives a white flocky ppt. of $Zr[C_6H_5(NO)_4NO]_4$. When all the Zr is pptd., the nitrosophenylhydroxylamine begins to sep.; this is easily distinguished from the Zr ppt. The ppt. is filtered, washed with cold water and dil. NH_4OH , and dried in the Pt crucible at 100° . It is then slowly heated finally to redness with the Teclu burner until completely converted into ZrO_2 . The detn. of Zr and U may be carried out in 2 ways. First, the Zr may be pptd. in acid medium as described above and the U pptd. in the filtrate with NH_4OH . Second, the soln. may be divided into 2 parts and the Zr pptd. as above in one and the Zr and U together with NH_4OH in the other and ignited and weighed as a mixt. of ZrO_2 and U_3O_8 . When the Zr is present in great excess better results are obtained on reducing the mixt. to $ZrO_2 \cdot UO_2$ in a current of H_2 . Quant. tests on the 1st method are described here. The presence of excess cupferron in the soln. does not interfere with the detn. of U. The results on the detn. of Zr and U in known solns. gave good and concordant results. The same method may be used for the sepn. of Ti and U.

- 1453 Browning, P. E. "The Qualitative Separation and Detection of Uranium, Vanadium, and Chromium When Present Together." *J. Am. Chem. Soc.* **43**, 114-5(1921).

The soln. of the alk. salts is made barely alk. with NH_4OH , and the U is pptd. as phosphate and identified by the ferrocyanide reaction. The chromate and vanadate are reduced by SO_2 and the V oxidized back by Br_2 . The Cr is pptd. by NH_4OH and the V detected by the formation of pink or violet oxysulfide with H_2S in the filtrate.

- 1454 Bryan, A. P. "Conductivity of Flames Containing Salt Vapors." *Phys. Rev.* (2), **18**, 275-91 (1921).

$\text{UO}_2(\text{NO}_3)_2$ solns. contribute little when atomized in the flame of a bunsen burner.

- 1455 Chaudron, G. "Study of the Reversible Reactions of Hydrogen and of Carbon Oxide on the Metallic Oxides." *Ann. chim.* (9), **16**, 221-81(1921).

Pages 251-2 contain information on attempts made to confirm the early work of Regnault (1836) on the oxidation of UO_2 by H_2O vapor. The expts. reported by the early experimenter showing U_3O_8 could not be duplicated.

- 1456 Coster, D. "On the Emission and Absorption Wave-Lengths of the Characteristic Radiation in the L-Series." *Phys. Rev.* (2), **18**, 218-20(1921).

A table gives the following values for the L-series lines of uranium:

$$\alpha_1 = 721.4 \pm 0.3$$

$$\beta_5 = 724.1 \pm 0.4$$

$$\alpha_2 = 591.8 \pm 0.3$$

$$\gamma_2 = 592.6 \pm 0.4$$

$$\alpha_3 = 568.5 \pm 0.7$$

- 1457 Coster, D. "The Fine Structure of X-Ray Series." *Compt. rend.* **173**, 77-9(1921).

Results are given of precise measurements of L-series lines of the elements from Ta to U. A new line γ_6 of L_2 , is found in some of these elements, and a discussion of Moseley diagrams show that it probably exists in all. The principle of combinations is discussed, and a system of 19 energy levels (crit. absorption freqs.) is proposed.

- 1458 Coster, D. "Precision Measurements in the L-Series of the Heavy Metals." *Z. Physik* **4**, 178-88(1921).

The measurements of Hjalmar are cont. from W to U, although the accuracy is slightly less.

- 1459 Coster, D. "On the Combination Principle in Roentgen Series." *Z. Physik* **5**, 139-47(1921).

Data are given on the M_I , M_{II} , M_{III} , M_{IV} and M_V lines of the x-ray spectrum for U. Information is also included on its L-level lines.

- 1460 Coster, D. "Systematics of Roentgen Spectra." *Z. Physik* **6**, 185-203(1921).

The x-ray spectra of Pt, Os, Ir, W, U, Bi, Ta, Pb, Th, Ti, and Au have been measured, and certain relations between the wavelengths detd.

- 1461 Dauvillier, A. "On the Structure of the L Series." *Compt. rend.* **172**, 915-17(1921).

Using a quartz x-ray tube of the Coolidge type with a mica window and a spectrometer of great dispersion, the L series of U was studied. Only 8 lines were previously known. Nine new ones were found, of which 7 are known in lighter elements. Nomenclature of lines is discussed. Six Sommerfeld doublets were identified. Moseley curves, now extended to U, show necessary changes in classification of L lines of tungsten. Emission and absorption spectra of U were photographed on the same plate.

L_1 , between β_1 and β_5 , and L_2 and L_3 , resp., are slightly shorter than the series heads γ_2 and γ_4 . The L_1 series, isolated by proper const. voltage, contains $\beta_5, \beta_7, \beta_2, \beta_6, \alpha_1, \alpha_2$, and λ . L_1 lines are strong and fall on straight Moseley plots; L_2 lines are weak and fall on curved plots; L_3 lines are strong and fall on curved plots.

1462 Dauvillier, A. "On the L Series of Uranium and the Principle of Combinations in X-Ray Spectra." Compt. rend. 172, 1350-3(1921).

The line β_2 of the L_1 series of U is found to have 2 satellites, β'_2 and β''_2 . This makes a total of 9 lines at present known to belong to L_1 . Working at const. voltage the L_2 and L_3 series were sepd. Six lines were found in L_2 and 9 in L_3 . Nomenclature of the L-series lines is rediscussed. To account for the known lines of W and U on the principle of combinations it is necessary to assume the existence of no less than 16 crit. freqs. as follows: K, $L_3, L_2, L_1, M_5, M_4, M_3, M_2, M_1, N_7, N_6, N_5, N_4, N_3, N_2$, and N_1 . A careful detn. of the L_1 -absorption freq. and the freq. of the line β_5 gives the value of N_1 corresponding to 200 A. A photograph of the absorption spectrum of U in the neighborhood of L_1 made with great dispersion shows a sharp, distinct, white absorption line just at the edge of the L_1 discontinuity. The width of this line is the same as that of the emission lines obtained with the same apparatus.

1463 Dauvillier, A. "On the Principle of Combination and the Absorption Lines in X-Ray Spectra." Compt. rend. 173, 35-8(1921).

Observations are contd. concerning a bright absorption line in the L_{III} edge for U x-ray spectrum. The position of the Br edge is given as between α and α_2 for U.

1464 Dauvillier, A. "Contribution to the Study of the Electronic Structure of the Heavy Atoms and of Their Spectral Lines." Compt. rend. 173, 647-9(1921).

In the L level, the β lines for U are given as $\beta_4 = 734.0$ X-E, $\beta'_2 = 747$ X-E (spark lines), $\gamma_7 = 708$ X-E, $\gamma'_7 = 624$ X-E, $\gamma = 568.9$ X-E. Further discussion is included on the positions of electron shells in U, especially the P-level shell which actually does not appear in the spectrum.

1465 Dauvillier, A. and de Broglie, L. "The Distribution of Electrons in Heavy Atoms." Compt. rend. 173, 137-9(1921).

A study is made of the Moseley curves of absorption freq. of elements W to U, extended by the results of Duane and Patterson and by calcn. on combination theory from the emission-line values of Coster and the authors. Details of the points of intersection with each other and with the axis are given, these having an important bearing on the numbers of electrons in the various orbits; and schemes of the authors and of Bohr are compared as follows:

K	L	M	N'	N''	O	P	Q
2 ₁	8 ₂	18 ₃	18 ₄	14 ₄	18 ₃	8 ₂	6 ₁

Large figures represent the numbers of electrons in each orbit and subscripts show the number of energy quanta associated with each. Bohr's N series combines N' and N'' of this scheme, and the authors' O series combines N'' and O. The authors believe that x-ray evidence and many phys. and chem. properties are in accord with their scheme.

1466 Dayser, E. "Influence of Uranium Salts on Nitrogen Fixation." Compt. rend. 172, 1133-4 (1921).

Studies of the influence of U phosphate and acetate on the growth and activity of *Azotobacter agile* in mannite and glucose cultures showed that both U cpds. increased the fixation of N by these organisms. The greater fixation took place where the acetate was used. It is considered probable that the radioactive power of U is a dominant factor in contributing to the stimulation of N fixation by soil organisms.

- 1467 de Broglie, M. "On Corpuscular Spectra and Their Use in the Study of X-Ray Spectra." Compt. rend. 173, 1157-60(1921).

Information is included on the corpuscular spectra in the L and M levels of U by excitation with x rays.

- 1468 de Broglie, M. and de Broglie, L. "The Corpuscular Spectra of the Elements." Compt. rend. 173, 527-9(1921).

Following the work of Ellis (Proc. Roy. Soc. Arts 99, 261), expts. were made in connection with the corpuscular excitation of heavy metals by x rays, showing the levels L, M, and N. U, Th, and Pb give, under the rays of a tube with W anticathode, similar spectra, where intense bands seem to correspond to levels L_2 and L_3 and to certain levels M. With a Ba radiator and a tube with Rh anticathode two levels L and at least two levels M were exhibited. The expts. were made with a view to find the connection between the sudden variations in the coeff. of absorption in the absorption spectra of x rays and the intensity of flow of electrons.

- 1469 de Broglie, L. and Dauvillier, A. "On the Electronic Structure of the Heavy Atoms." Compt. rend. 172, 1650-3(1921).

There is the conclusion that the electron shells in the U atom were K_2 , L_8 , M_{18} , N_{18} , O_{32} , P_8 , and Q_6 . These values were obtained by x-ray spectrum measurement.

- 1470 Duane, W. "On the Calculation of the X-Ray Absorption Frequencies of the Chemical Elements." Proc. Natl. Acad. Sci. U. S. 7, 260-7(1921).

The author has calcd. the K crit. absorption freqs. of Mg, S, Ca, Fe, Se, Mo, Sn, Ce, Dy, W, Pb, and U, on the basis of the Rutherford-Bohr theory of the structure of atoms and the mechanism of radiation. The assumption is made that the electrons are distributed in circular orbits, which do not lie in planes passing through the nucleus of the atom. In order to estimate the forces exerted on an electron in one orbit, X, due to the electrons in the parallel orbit, B, it is assumed that they are the same as if the charges are concd., half at the nearest point to the orbit A and half at the point furthest from X. A series of values is obtained which are in fair agreement with those observed.

- 1471 Duane, W. "On the Calculation of the X-Ray Absorption Frequencies of the Chemical Elements (Second Note)." Proc. Natl. Acad. Sci. U. S. 7, 267-73(1921).

Information is included on the K-absorption edge of the x-ray spectrum for U. A compilation of many measurements of L- and M-series lines in the U x-ray spectrum is also included and discussed.

- 1472 Ellis, C. D. "Magnetic Spectrum of the β -Rays Excited by γ -Rays." Proc. Roy. Soc. (London), A. 99, 261-7(1921).

The magnetic spectrum of the β rays is excited by the γ rays of RaB in U, Pb, Pt, W, and Ba.

- 1473 Feigl, F. and Stern, R. "The Application of Spot Reactions in Qualitative Analysis." Z. anal. Chem. 60, 1-43(1921).

U can be detected with $K_4Fe(CN)_6$ paper (brown spot), with alizarin paper (blue spot), or by means of α -nitroso- β -naphthol (yellow spot). In the presence of Fe, the spot produced with $K_4Fe(CN)_6$ should be moistened with water; the U ppt. is then to be detected at the outer border. If considerable Fe is present, it is best to place a drop of strong NH_3 soln. upon a filter paper and, before the first drop is entirely absorbed, add a drop of the soln. to be tested and stir with a glass rod, dry, moisten with a drop of $(NH_4)_2CO_3$ soln. and, with the aid of a stirring rod, make certain that every bit of the spot is wetted by the carbonate soln. Then dry and carefully add a drop of dil. HCl and one of $K_4Fe(CN)_6$ soln. just outside the border of the spot.

1474 Foote, H. S. "Uranium Steels." Chem. Met. Eng. 25, 789-92(1921).

The results of an examn. of a series of steels of similar C content and with increasing amts. of U present, made in charges of two tons or more in an electric furnace are given. Hypo-eutectoid steels containing not more than 0.6% U are normally pearlitic, but any increase in U over this figure produces a characteristic carbide component which heat-tints in a manner similar to U carbide. The residue obtained by treatment of pearlitic steels containing not more than 0.6% U indicates that the U is combined with C, but there is not sufficient evidence as to whether the U forms a true double carbide or a mixture of carbides of Fe and U. U exerts little influence on the transformation points up to 2.0%; over this percentage the A_r transformations are lowered and markedly suppressed even at normal rates of cooling. Steels having the lowered transformations are characterised by a martensitic structure, while those having the points suppressed or nearly so, exhibit the polyhedral structure of γ iron and austenite. U steels, when quenched, sometimes contain micro. white crystals which do not heat-tint like U carbide, and which are only etched by aqua regia. These appear to be double or complex carbides of Fe and U. U, as an alloying element does not need to be augmented or intensified by the addn. of other elements and U steels lend themselves to water-quenching. U increases the hardness and hardening power of steels by means of its ability to emphasise the characteristics of the cementite; the harshness imparted thereby is not accompanied by so great a degree of brittleness as that induced by other carbide-forming alloys. Carbon-U steels are particularly suitable for uses which necessitate a low drawing temp., in that they possess under these conditions, a remarkable combination of hardness, strength, and ductility. Results are given of mech. tests on a number of U steels and U-Ni steels. The latter, as compared with pearlitic Ni steels, show higher elastic limits for the same ductility, are harder when heat-treated, are more susceptible to heat treatment, and possess superior dynamic toughness and resistance to fatigue when properly heat-treated. A metallographic study of U high-speed steels indicates that U tends to promote the formation of complex carbides on which the cutting eff. and property of "red hardness" depend. A comparison between the microstructures of U and U-free high-speed steels annealed at the same temp. shows that the former contains, in general, a larger number of carbide globules than the latter.

1475 Hahn, O. "A New Radioactive Substance in Uranium." Ber. 54, 1131-42(1921).

The isolation of UZ contg. only 0.5% UX impurity is described.

1476 Hess, F. L. "Cobalt, Molybdenum, Nickel, Titanium, Tungsten, Radium, Uranium, and Vanadium in 1917." In Mineral Resources of the United States, 1917. Washington, U. S. Geological Survey, 1921. (Part I, p.899-959)

A list of references and patents issued is included.

1477 Korczyński, A. "Remarks on the Catalytic Action of Salts of Several Metals in the Reactions of Organic Compounds." Bull. soc. chim. France (4), 29, 283-90(1921).

U was found to be a good catalyst for the hydrogenation of org. cpds.

1478 Larsen, E. S. The Microscopic Determination of the Nonopaque Minerals. Washington, U. S. Government Printing Office, 1921. 294p. (U. S. Geological Survey Bulletin 679.)

Methods and results are discussed and tables of optical data are included. The minerals probably contg. U or Th which were examined include allanite, auelite, betafite, brannerite, carnotite, caryocerate, cenosite, cerite, chalcoprite, churchite, dietrichite, dysanallyte, eschynite, euxenite, fergusonite, florencite, fluocerite, gadolinite, gilpinite, hatchettolite, hielmite, johannite, johnstrupite, koppite, lanthanite, liebigite, mackintoshite, milanocerite, microlite, naégite, neotantalite, phosphuranylite, pilbarite, polycrase, polymignite, pyrochlore, pyrrnite, retzian, rhabdophanite, risorite, rowlandite, rutherfordine, samarskite, samirésite, schroeckingerite, sipylite, tenerite, thorianite, thorite, tritomite, trögerite, tscheffkinite, tysonite, tyuyamunite, uraconite, uranocalcite, uranocircite, uranophane, uranopilite, uransphaerite, uranospinite, uranothallite, voglite, volborthite, walpurgite, yttrialite, yttracrasite, yttrotalite, zeunerite, zipperite, and zirkelite.

- 1479 Lohmann-Metall Ges. Decarburizing Tungsten and Like Metals. January 10, 1921. (British Patent 157,780)

C is removed from W, U, and similar metals by heating to a temp. near the m.p. in vacuum or a gas such as H_2 .

- 1480 Lyden, R. "The Decomposition of Oxalic Acid by Sunlight in the Presence of Uranium Salts." Finska Kemistsamfundets Medd. 30, 90-6(1921).

The author has followed the decompn. closely and finds the products to be only H_2O , CO, and CO_2 . No formic acid was found. Light rays with short wavelength are the most active.

- 1481 Meyer, G. "The Spectroscopy of Uranium and Other Rare Earths According to Experiments of Dr. Greulich." Physik. Z. 22, 583-5(1921).

This investigation concerns itself with the spectra of Ce, La, Di, Th, U, and detts. (1) the metal content of solns. which still permit detection by spectroscopic methods, and (2) the influences of the presence of other metals upon the appearance of the spectral lines of the metal under test. The min. concn. showing U was 5 mg/cm^3 . The presence of rare earths affects the visibility of U lines very little, 1% being readily detected, but mixts. with other metals such as Fe, Ti, Ni, Cr, Mn, or Li, Na, Mg, Al, Ca require larger U content, e.g., 7% in Fe. An attempt is made to apply these results to solar phenomena, the absence of U lines in the sun's spectrum being explained as due to the presence of relatively large quantities of Fe.

- 1482 Moir, J. "Permanganate Absorption Spectrum: Claim for Priority. Formula for Calculating the Uranium Spectrum." Trans. Roy. Soc. S. Africa 10, 33-4(1921).

Moir claims priority over Adinolfi for a formula giving the wavelengths of the bands of permanganates. The formulas put forward by the two authors differ in form, but reduce to the same expression. From the formula for the absorption spectrum of uranyl salts, $n = 1/\lambda = 2113 + 66N$, where $N = 0, 1, 2, 3$, or 4, it is now shown that the bands of nonionized solid salts may be calcd. Thus, the bands of autunite are given by dividing the figures calcd. by the formula above by the sixth root of the ratio or the mol. wt. of the salt to that of $(UO_2)^{++}$. In this case the observed bands are 1945, 2000, 2062, 2138, and 2190 Å while the bands calcd. by the formula $n = 1/\lambda = (2113 + 66N)/\sqrt[6]{914/2 \times 270} = 1937 + 60.5N$ are 1937, 1997, 2058, 2118, and 2179 Å.

- 1483 Nakazono, T. "The Use of Amalgams in Volumetric Analysis II. Determination of Vanadium and Uranium." J. Chem. Soc. Japan 42, 761-8(1921).

U, when reduced in air, is obtained as U^{+4} and may be titrated back to U^{+6} with permanganate.

- 1484 Nichols, E. L. and Wilber, D. T. "The Luminescence of Certain Oxides Sublimed in the Electric Arc." Phys. Rev. (2), 17, 707-17(1921).

Thin layers of U oxide when subld. in an electric arc show no luminescence of high temp. either when excited with a flame or when bombarded with cathode rays.

- 1485 Oliver, J. "Mechanism of Urea Excretion." J. Exptl. Med. 33, 177-86(1921).

This study concerns the ability of U-poisoned rats to secrete urea. The animals were fed a urea-contg. diet and sacrificed after pptg. the urea in the body.

- 1486 Sabatier, P. and Kubota, B. "Catalytic Splitting of Allyl Alcohol; Action of Various Oxides." Compt. rend. 173, 212-16(1921).

Blue oxide of W, prepd. by reducing WO_3 (obtained by pptg. $(NH_4)_2WO_4$ with HNO_3 , washing and dehydrating below 400°) with H_2 at 350° , was the most active catalyst of the oxides investigated. At 350° there was a regular evolution of gas of d. 1.34 consisting of $C_3H_6 = 73.5\%$, $C_2H_4 = 10\%$, $CO_2 = 3\%$, and $CO = 13\%$ by vol. 2 vols. H_2O are formed to 1 of supernatant liq. consisting of C_3H_5OH , H_2O , $CH_3:CHCHO$, $MeCH_2CHO$, and a small vol. of higher unsatd. aldehydes. A considerable amt. of voluminous C is deposited on the catalyst, corresponding to the prodn. of the H_2 which

reduces to C_3H_6 the allene formed by dehydration and resulting in a progressive diminution of catalytic activity. UO_2 , by reduction with alc. of U_3O_8 obtained by heating the nitrate on a sand bath, greatly resembled the W oxide in the products of its action, which, however, was much less intense.

1487 Schoep, A. "Curite, New Radioactive Mineral." *Compt. rend.* 173, 1186-7(1921). Information is given on a new orange mineral of the approx. compn. $2PbO \cdot 5UO_3 \cdot 4H_2O$.

1488 Staehling, C. "Radioactivity of Oxides of Uranium." *Compt. rend.* 173, 1468-71(1921). The paper is a continuation of the author's earlier expts. Certain peculiarities in the behavior of the red and black oxides of U have been explained. It is shown that the red U oxide, even in a state of great purity, "hydrates" slowly in air, without change in external appearance. This hydration only becomes appreciable after several mos. and may go on for several yrs. This phenomenon explains the remarkable radioactive behavior previously observed, for by decreasing the superficial d. of the U layer, it affects the absorption of the α rays. The black oxide is, however, not hydr.; this behavior explains why its apparent radioactivity does not diminish. The results thus obtained afford a complete explanation of the apparently anomalous behavior of the red oxide.

1489 Tomaschek, R. "Phosphorescent Zinc Sulfide." *Ann. Physik* (4), 65, 189-215(1921). The phosphorescence bands for ZnS-Cu and ZnS-Mn are described and discussed. Measurements have also been made for the phosphorescence bands of a series of heavy metals in ZnS including Bi, Pb, Ag, and U, as well as for Ni and Co, and the results are presented graphically.

1490 Treadwell, W. D., Luthy, M., and Rheiner, A. R. "Reduction with Zinc and Cadmium in Volumetric Analysis." *Helv. Chim. Acta* 4, 551-65(1921). The reduction of Fe^{+3} in a Jones reductor was studied although the Zn was not amalgamated as is customary in American practice. The reduction was found to take place best with solns. of low acidity and with Zn of fine grains. The results obtained were slightly above the theoretical value but no blank was run or correction applied to the titration. Expts. were tried with metallic Cd which is not capable of reducing an appreciable quantity of Fe^{+3} to the metallic condition even in solns. of low acidity. A suitable Cd powder was prepd. by the electrolysis of $CdSO_4$ solns. acid with H_2SO_4 and using a current of 0.3 amp./cm². As soon as H_2 began to be evolved it was necessary to add more $CdSO_4$ to the bath. With a layer of Cd of only 5 to 7 cm in the reductor tube, it was possible to secure complete reduction of Fe^{+3} in slightly acid solns. and there was much less evolution of H_2 than when unamalgamated Zn was used. With UO_2SO_4 the results indicated a reduction to U^{+4} .

PUBLICATIONS LOCATED IN 1922

1491 Aloy, J. and Rodier, E. "Action of Light upon Uranic Salts." *Bull. soc. chim. France* (4), 31, 246-9(1922).

Designating by UO_2R_2 a uranyl salt in which R is a monovalent acid radical the transformation of this salt into a normal U^{+4} salt under the influence of sunlight in the presence of an O acceptor, A_O , may be expressed thus: $UO_2R_2 + 2RH + A_O \sim UR_4 + H_2O + (A_OO)$. The dark-brown colors, with or without formation of black ppts., result from a progressive decompn. of the U^{+4} salt under the combined influence of solar light and heat. All of the normal salts produce this effect provided their solns. are acid and that the light action is prolonged. When the quantity of free acid is insufficient, the U^{+4} salt formed under the influence of light is decompd. with the production of an insol. basic salt.

- 1492 Balarev, D. "Method for the Removal of Phosphoric Acid in Qualitative Analysis." Z. anorg. allgem. Chem. **121**, 254-6(1922).

The method depends upon the pptn. of $\text{Pb}_3(\text{PO}_4)_2$ in the presence of very dil. acid. Although FePO_4 , AlPO_4 , and CrPO_4 are insol. in dil. AcOH enough of these elements remains in soln. to give good tests although sometimes most of the Cr is pptd. Ti, U, and Zr, however, are carried down with the $\text{Pb}_3(\text{PO}_4)_2$ ppt. This method of removing $(\text{PO}_4)^{-3}$ is claimed to be more satisfactory than the Sn or basic acetate procedures.

- 1493 Barlot, J. and Brenet, M. T. "The Determination of Fatty Acids by the Formation of Their Basic Complexes with Uranyl and Sodium." Compt. rend. **174**, 114-16(1922).

A method for the quant. analysis (micro) of Na based on the prepn. of sodium uranyl acetate is mentioned. Large crystals of the complex sodium uranyl butyric salts are reported, as is the complex sodium uranyl valeric and isovaleric salts which are said to exist as yellowish-green crystals. Similar data are given for the salt of caproic acid. The sodium uranyl complex salt of phenyl-acetic acid is reported to exist in the shape of fine yellow needles.

- 1494 Baur, E. "Photolysis of Uranyl Oxalate." Z. physik. Chem. **100**, 34-41(1922).

The photolysis of $\text{UO}_2\text{C}_2\text{O}_4$ was studied at 12° by subjecting a mixt. of UO_2SO_4 , $\text{H}_2\text{C}_2\text{O}_4$, and aq. H_2SO_4 to the action of sunlight and detg. the quantities of CO_2 , O_2 , and CO evolved. It was found that HCO_2H was present in only a very small quantity during photolysis. In the evolved gas the oxides of C were present in the ratio $\text{CO}_2 : \text{CO}$. The uranyl salt was gradually reduced to the uranous salt.

- 1495 Baur, E. and Rebmann, A. "The Photolysis of Uranyl Oxalate and of Uranyl Acetate." Helv. Chim. Acta **5**, 221-39(1922).

The Seekamp photolysis of uranyl acetate is represented by the equation

The symbol $\text{U}^{+6} \begin{cases} \oplus\oplus \\ \ominus\ominus \end{cases}$ indicates that the light receptor, U^{+6} , has been activated to a state of "photo-chem. polarization" by its having received a quantum of light energy. In this state it acts electrolytically upon its surroundings, functioning simultaneously as an anode and a cathode. Attempts to demonstrate the presence of $\text{CH}\cdot\text{COOH}$ and its decompn. products in the above reaction were neg. The effect on this reaction of HgCl_2 , KI, $(\text{FeSO}_4 + \text{Fe}^{+3})$, Na_2SO_3 , $\text{H}\cdot\text{COOH}$, pyrogallol, hydroquinone, and UO_2Cl_2 was tried. These reactions were complex, but in many cases a cathodic polarization could be demonstrated, e.g.,

A corresponding anodic polarization was not observed, e.g.,

The photolysis of uranyl acetate may follow two courses, namely, the photocatalytic decompn. into CH_4 and CO_2 and the noncatalytic oxidation of $(\text{C}_2\text{H}_3\text{O}_2)^-$ to C_2H_6 and CO_2 , accompanied by the reduction of U^{+6} to U^{+4} . The latter reaction occurs only in the presence of free AcOH plus an excess of $(\text{C}_2\text{H}_3\text{O}_2)^-$. HgCl_2 , Cl^- , Fe salts, and HCOOH decrease the sensitiveness of uranyl acetate to light, the latter two almost completely. In general, the results show the oxidation, reduction nature of photolysis, and the close analogy between it and electrolysis.

- 1496 Boardman, L. J. "A Study of the Exciting Power for Fluorescence of the Different Parts of the Ultraviolet Spectrum." Phys. Rev. (2), 20, 552-72(1922).

About 70 substances were exposed to different regions of the spectrum extending from 0.55 to 0.20 μ . A preliminary visual study revealed no excitation for 20 oxides and 8 chlorides; a few silicates, phosphates, and sulfates fluoresced faintly; some like anthracene, eosin, etc., fluoresced well, while 20 uranyl cpds. fluoresced strongly. The exciting wavelengths for the uranyl compds. extend from 0.55 to 0.35 μ . The fluorescence spectra of 12 uranyl cpds. were then photographed and measured on a spectrophotometer and the data derived show that every excitation band observed corresponds to an absorption band of the cpd. This fact permits the extension of the absorption spectrum into both the red and violet regions.

- 1497 Bridgman, P. W. "The Compressibility of Metals at High Pressures." Proc. Natl. Acad. Sci. U. S. 8, 361-5(1922).

The compressibility coeff. for U metal is reported to be $9.66 \times 10^7/\text{kg}/\text{cm}^2$ as measured at 12,000 kg/cm^2 .

- 1498 Brown, A. C. "The Adsorption of Uranium-X and Its Isotype Thorium by Basic Ferric Acetate." J. Chem. Soc. 121, 1736-43(1922).

The adsorption of UX from a soln. of $\text{UO}_2(\text{OAc})_2$, contg. no Th, by basic ferric acetate was measured by means of its β activity. The measurements were repeated with solns. of the same concn., to which small amts. of Th had been added. A graph was prepd., with $\log x/m$ as ordinate and $\log c$ as abscissa, where c is the concn. of element "at. No. 90". This shows that in the absence of Th, and with small quantities of the same, $1/n = 1$; but with increasing concn. $1/n$ diminishes. Thus, Freundlich's law is strictly true over the region where $1/n = 1$. The fall in the value of the exponent with increasing concn. is in general agreement with Langmuir's theoretical deductions on the adsorption of gases at solid surfaces.

- 1499 Buell, H. D. "New Qualitative Test for Uranium." J. Ind. Eng. Chem. 14, 593(1922).

A method of testing slags and ores for U is described. A HNO_3 soln. of the material is treated with excess granulated Zn. When all the free acid has disappeared a yellow color develops on the remaining Zn. The color corresponds to that of $\text{UO}_2 \cdot 2\text{H}_2\text{O}$. Less than 1 mg of U in 1 cc of the soln. will show. The depth of color increases with the U content. The reaction evidently is due to the oxidizing power of the HNO_3 . Fe and V only, among the metals usually encountered, interfere with the reaction. In this case the deposit on the Zn is black, but if the spent liq. is poured off and more HNO_3 added the black deposit disappears and the yellow color appears when the free acid is used up.

- 1500 Coster, D. "On the Principle of Combination and Stokes' Law in the X-Ray Series." Phys. Rev. (2), 19, 20-23(1922).

The M series of lines in the x-ray spectrum of U is discussed. Wavelength measurements $M_I = 2228$ and $M_{II} = 2385$, $M_{III} = 2873$, $M_{IV} = 3326$, and $M_V = 3491$ are reported.

- 1501 Dauvillier, A. "Analysis of the Electronic Structure of the Elements." J. phys. radium 3, 221-51(1922).

This is a complete study of the metals by a method previously described in which the number of electrons in each ring is allocated experimentally. Divisions of the work refer to the line γ_8 , the validity of Stokes' law and the structure of the γ group, linear phenomena of absorption, detailed study of the spectra of Au, Pt, Ir, Os, W, Ce, Sb, the K series of Cu, the principle of combination in the M series, Rubinowicz' principle of selection, a quant. graph of the complete absorption spectrum of U, a graph representing the spectra of the elements following Moseley but for all the series from K to P. From these spectral graphs the no. of electrons for each complete shell is given.

1502 de Broglie, M. "Corpuscular Spectra of the Elements." Compt. rend. 174, 939-41(1922). A schematic representation of the corpuscular spectra of Ag, Sn, Au, and U as excited by 4 lines of the K series of W from a Coolidge tube is given. The details are promised in a future publication. A continuous spectrum due to β rays is detected and evidence is obtained that the absorption of corpuscles by matter must be selective to a certain degree.

1503 Dolejsek, V. "The N Series in X-Ray Spectra." Z. Physik 10, 129-36(1922). By the powerful x-ray spectroscopic outfit constructed by Siegbahn it was possible to detect lines which probably must be referred to as the N series of the elements U and Th. Calcns. for these elements show that some of the lines must have wavelengths of about the measured values, which for U are between 8.6 and 12.0 A., and for Th between 9.4 and 13.5 A. For B and all the elements in its neighborhood, all the N lines must have a wavelength of more than 13 A.

1504 Dolejsek, V. "The N Series in X-Ray Spectra." Nature 109, 582(1922). This is a brief version of the paper published in Z. Physik 10, 129-36(1922).

1505 Duane, W. and Patterson, R. A. "Note on X-Ray Spectra." Proc. Natl. Acad. Sci. U. S. 8, 85-90(1922).

A compilation of the measurements of the L series of x-ray spectrum lines for U is given.

1506 Duval D'Adrian, A. L. —assigned to B. F. Drakenfield and Co., Inc. Process of Recovering Metals. November 7, 1922. (U. S. Patent 1,434,485)

A method for obtaining oxides or chlorides of Cr, Zr, V, U, Co, Ag, or Ni from ores or residues is given. Powd. ore is mixed with sawdust and molasses; then bricks are prepd. and carbonized in a furnace. Direct chlorination is then used and the chlorides are sepd. by volatilization and selective condensation.

1507 Ellsworth, H. V. "Radium-Bearing Pegmatites of Ontario." In Geological Survey Summary Report, 1921, Part D. Ottawa, Canada Dept. of Mines, 1922. (p.51-70).

The compn. of a number of radioactive ores high in U, with their location, notes on the extent of deposits, and information on ownership, etc., is given.

1508 Ewing, D. T. and Eldridge, E. F. "The Electrometric Titration of Uranium with Potassium Permanganate and Potassium Dichromate." J. Am. Chem. Soc. 44, 1484-9(1922).

If a soln. of UO_2SO_4 is passed through a Jones reductor, a part of the U is reduced to U^{+3} and the remainder to U^{+4} . If the reduced soln. is titrated electrometrically with KMnO_4 , 2 end points are obtained; the first corresponds to the oxidation of U^{+3} to U^{+4} and varies with the rate at which the U soln. was passed through the reductor; the second corresponds exactly to the oxidation of U^{+4} to U^{+6} . Std. $\text{K}_2\text{Cr}_2\text{O}_7$ may be used instead of KMnO_4 but the U soln. should not contain more than 2 cc concd. $\text{H}_2\text{SO}_4/100$. The titration cell used in these expts. was fitted with a tight cover through which passed the bottom of the reductor tube, the bottom of the buret, a shaft for a stirrer, and tubes for the introduction and escape of CO_2 gas, which was used to prevent atmospheric oxidation. The stirrer was fitted with a Hg seal. If Fe is present in the soln., there are 3 end-points; the first corresponds to the oxidation of U from 3 to 4, the second to the oxidation of U^{+4} to U^{+6} , and the third to the oxidation of Fe^{+2} to Fe^{+3} .

1509 Germann, F. E. E. "New Hydrate of Uranyl Nitrate." J. Am. Chem. Soc. 44, 1466-9(1922).

By methods of thermal analysis $\text{UO}_2(\text{NO}_3)_2 \cdot 24\text{H}_2\text{O}$ was found to exist below -20° , forming spontaneously at -35° . The cpd. was detd. from both cooling and heating curves in close agreement. An explanation of the anomalous group of spectra observed by Howes is given as due to too rapid cooling. The numerous spectra observed can be explained by assuming the pure spectrum of the hexahydrate, of the icositetrahydrate and of various mixtures of the two depending on concn., rate of cooling, etc.

- 1510 Germann, F. E. E. "Thermal Analysis at Low Temperatures." Phys. Rev. (2), 19, 623-8 (1922).

Thermal analysis with a simple app. shows that $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ may change to a 24-hydrate between -20 and -35° . The existence of this hydrate and the possibility of imperfect transformation explain the apparent discovery of several fluorescence spectra at low temps.

- 1511 Gustavson, R. G. and Knudson, C. M. "The Successive Electrometric Titration of Iron, Vanadium, and Uranium." J. Am. Chem. Soc. 44, 2756-61(1922).

Analyses were made of solns. contg. Fe, V, and U alone and in combination. These elements can be titrated electrometrically after reduction with Zn and H_2SO_4 , but with V the titration must be carried out in an indifferent atm. A mixt. of Fe and U salts may be titrated with KMnO_4 after reduction with Zn, provided the acidity is kept low (about 5 cc concd. $\text{H}_2\text{SO}_4/250$ cc soln.), Fe and V can be titrated similarly in an atm. of CO_2 and with about twice as much acid present. If U is present, the V is obtained from the final step in the titration curve and the U by deducting this value from the first step of the same curve. The detn. of U and V in mixts. is accomplished similarly. When all three elements are present, it is best to proceed in the same way but with less acid at the start (4 cc). After the second inflection, the acid concn. is increased twofold. The V and Fe are represented by the last and next to the last steps and the U is found by deducting the V value as found in the last step from that indicated on the curve between the first and second inflections.

- 1512 Heller, P. A. "On Uranium Alloys." Metall Erz 19, 397-9(1922).

U-Ni alloys may be prepd. by fusing NiO with U_2C_3 in a C crucible by means of the arc or by heating a mixt. of the two oxides with the requisite amt. of C. In this way an alloy contg. 65 to 70% U and 4.5% C is readily obtained, but the C content could not be reduced by fusion with NiO in magnesia without serious loss of U. An Fe-U alloy contg. 45% of the latter and 6.5% C has been made in large quantities by heating a mixt. of Fe_2O_3 and U oxide with C in an arc. Alumino-thermic reduction of U oxide in the presence of excess Al does not yield a satisfactory alloy. By digesting the oxide with HF a mixt. of UF_4 and UO_2F_2 is obtained, which may be reduced with metallic Ca and Al in an iron bomb to give an alloy contg. 63% U and 35% Al.

- 1513 Henrich, F. "Contribution to the Knowledge of Calcium-Uranium-Mica (Autunite)." Ber. 55, 1212-15(1922).

- 1514 Hess, F. L. "Uranium-Bearing Asphaltite Sediments of Utah." Eng. Mining J.-Press 144, 272-6(1922).

- 1515 Hjalmar, E. "Experiments on X-Ray Series." Compt. rend. 175, 878-80(1922).

The M-series wavelengths for elements W(74) to U(92) are detd. and tabulated. While previous work has indicated only 3 principal members of the series, there are in reality 24 for U including satellites ranging from M_5P_1 (indicating energy level origin) = 2.248 to M_1N_5 = 4.929.

- 1516 Hüttig, G. F. "On the Acids of Uranium, Tungsten, and Molybdenum." Z. angew. Chem. 35, 391-2(1922).

This paper discusses the compn. curve of the hydrated U oxides, particularly UO_3 and U_3O_8 . The ht. of formation for $\text{UO}_3 \cdot \text{H}_2\text{O}$ was obtained from calorimetric measurements of the ht. of neutralization. It is $\text{UO}_3 + \text{H}_2\text{O}(l) \rightarrow \text{UO}_3 \cdot \text{H}_2\text{O}(s) + 4.957 \text{ kcal}$. The ht. of formation for $\text{UO}_3 \cdot 2\text{H}_2\text{O}$ is similarly calcd. to be +7.428 kcal.

- 1517 Hüttig, G. H. and Schroeder, E. V. "Hydrates of Uranium Tetroxide and Trioxide." Z. anorg. allgem. Chem. 121, 243-53(1922).

Carefully purified $\text{UO}_2(\text{NO}_3)_2$ was pptd. by H_2O_2 and the washed product, dried 10 hrs at room temp. and 10 hrs at 35° , was heated in the tensi-eudiometer. Analysis of the dried product showed $\text{UO}_{2.9}\text{O}_{1.03}(\text{H}_2\text{O})_{4.56} = \text{UO}_3 \cdot \text{H}_2\text{O}_2 \cdot 3.5\text{H}_2\text{O}$ or $2\text{H}_2\text{UO}_5 \cdot 7\text{H}_2\text{O}$. At 54° the compn. became $\text{UO}_{3.0} \cdot 5\text{H}_2\text{O}_2 \cdot 2.5\text{H}_2\text{O} = \text{H}_2\text{U}_2\text{O}_8 \cdot 5\text{H}_2\text{O}$; at $54\text{--}163^\circ$ 1 mole H_2O was gradually given off; and at 163° the compn. was $\text{UO}_{3.0} \cdot 5\text{H}_2\text{O}_2 \cdot 1.5\text{H}_2\text{O} = \text{H}_2\text{U}_2\text{O}_8 \cdot 3\text{H}_2\text{O}$. Although the form of the decompn. curve suggests solid soln. rather than a definite cpd., at 163° 1.5 mole H_2O and 0.5 mole of O_2 was given off and the compn. became $\text{UO}_{3.0} \cdot 5\text{H}_2\text{O} = \text{H}_2\text{U}_2\text{O}_7$. No information as to the conditions of loss of the last 0.5 mole H_2O was obtained; at 450° in vacuum the product is certainly anhyd. It is concluded that no grounds exist for assuming UO_4 , and the so-called hydrates of UO_4 are addn. products of UO_3 and H_2O_2 . On similarly heating $\text{UO}_3 \cdot 2\text{H}_2\text{O}$ in the tensi-eudiometer at 15 mm, the first 0.5 mole H_2O was given off gradually below 100° , the second 0.5 mole sharply at 100° , the third gradually above 100° , and the fourth sharply at 300° . The pentahydrate of peruranic acid and pyrouranic acid was first described here. This systematic investigation makes improbable the existence of any other free stable acids of UO_3 .

- 1518 Jolibois, P. and Bossuet, R. "Relations between the Different Uranium Oxides." Compt. rend. 174, 386-8(1922).

It is reported that when UO_2 is heated in O_2 , it will oxidize to U_3O_8 within a very narrow temp. beginning at 185° without the appearance of any intermediate oxide phase. The reduction of damp or dry UO_3 or U_3O_8 in a stream of H_2 will yield a very pure UO_2 product. The reduction is carried out at 900 to 1200° . UO_2 heated in vacuum at 500° begins to go over to U_3O_8 [?]. This decompn. is not reversible. Cold dil. HNO_3 was found to have a hydrolytic effect upon UO_2 . Gentle warming will dissolve some of the UO_2 without oxidizing it even when the soln. is allowed to stand for 24 hrs or more. The reduction of U_3O_8 in a H_2 atm. even at 625 to 650° is found to be successful. It is quant. if the H_2O produced is continually removed by P_2O_5 . No other reaction takes place as high as 1000° . If U_3O_8 is heated in vacuum for about 3 hrs at 1000° , it will lose 0 to the compn. of about $\text{UO}_{2.62}$. It is said that in order to prep. nitrate-free UO_3 , decompn. must be carried out at about 500° .

- 1519 Jolibois, P. and Bossuet, R. "The Precipitation of Uranyl Nitrate by Sodium Hydroxide. Radioactivity of the Precipitate." Compt. rend. 174, 1625-8(1922).

A $1/40$ M soln. of $\text{UO}_2(\text{NO}_3)_2$ is mixed as rapidly as possible with a soln. of NaOH . The pptn. does not commence until the introduction of an equimolar quantity of NaOH . The ppt. is partly colloidal. An examn. of the radioactivity of the ppt. shows that the colloidal ppt. and the salt remaining in soln. are richer in UX than the ppt. which comes down first. The oxide of UX is more basic than the oxide of U.

- 1520 Kano, N. "Use of Amalgams in Volumetric Analysis. IV. Uses of Cadmium Amalgam." *J. Chem. Soc. Japan* **43**, 333-40(1922).

Instead of Zn-Hg, Cd-Hg is used. The method of prepn. of the amalgam and analysis are exactly the same as that of Zn-Hg, except that the tube is filled with dil. H_2SO_4 instead of boiled water. The results are fully as satisfactory in the detn. of Mo and Fe, less satisfactory in the detn. of V and Ti, and the presence of CO_2 is desirable in the detn. of U, although undesirable when Zn-Hg is used.

- 1521 Kano, N. "Uses of Amalgams in Volumetric Analyses. VI. Electrometric Titration of Iron, Molybdenum, Uranium, Vanadium, and Titanium." *J. Chem. Soc. Japan* **43**, 550-6(1922).

With a view of detg. more accurately the end point of titration of colored solns., electrometric titration is applied. The metallic salts were first reduced with the amalgam (Zn-Hg), and after each addn. of the oxidizing agent (KMnO_4), the e.m.f. was detd., Pt and calomel electrodes being used. The results with Fe, Mo, and V show very close agreement with the theoretical values. In the case of U, it was previously shown that presence of air was necessary to convert the salts to U^{+4} by Zn-Hg. The results of electro-metric titration of U show that in spite of a sharper end point, the error was fairly large (theoretical 0.2028 g; that found 0.2020 g). In cases where the air interferes with titration, the electrometric method might produce more error than ordinary indicator titration, the former requiring more time than the latter. In all cases, a great increase of the soln. during the titration should be avoided.

- 1522 Kikuchi, S. "Uses of Amalgams in Volumetric Analyses. V. Estimation of Iron, Titanium, Uranium and Methylene Blue." *J. Chem. Soc. Japan* **43**, 544-50(1922).

Zn-Hg is applied to a mixt. of 2 metallic cpds. each metal to be estd. by differential titration with 2 different oxidizing agents. Fe and U. According to Kano, a reduction of U salt by Cd-Hg in CO_2 gives U^{+4} . Thus by reducing the mixt. of Fe and U by Cd-Hg, and by titrating with KMnO_4 and iron-alum, Fe and U can be estd. Ti and U. It is found that U^{+4} is not oxidized by an excess of I_2 in presence of Na tartrate. Thus if the mixt. is reduced by Cd-Hg in CO_2 and titrated with KMnO_4 and I_2 , Ti and U can be estd.

- 1523 Kopatschek, F. "Action of Uranyl Acetate on Organic Compounds. I. The Action of Uranyl Acetate on Tartaric Acid and Its Salts." *Anales assoc. quím. argentina* **10**, 133-51(1922).

Uranyl acetate has no effect upon the optical rotation of carbohydrates in soln. With other cpds. contg. one or more central OH groups, optically active cpds. are formed, which are called aceturanilic cpds. These are unstable and sensitive to light. The reaction with tartaric acid was studied in detail. It is influenced by concn. The optical rotation is greatly increased, but the amt. of increase is affected more or less by the addn. of almost any common inorg. salt; Na_2CO_3 nullifies it almost completely.

- 1524 Kopatschek, F. "The Action of Uranyl Acetate on Organic Substances. II. Action on Malic Acid." *Anales asoc. quím. argentina* **10**, 318-24(1922).

$\text{UO}_2(\text{OAc})_2$ has no effect on the optical properties of inactive lactic acid. Added to a weak soln. of malic acid, it causes an enormous increase (sometimes more than 80-fold) in the optical rotation due to the formation of an aceturanilic cpd. similar to that produced with tartaric acid. This effect is diminished or nullified by the presence of almost any of the common inorg. salts.

- 1525 Kunz-Krause, H. and Manicke, P. "Action of the Arc Light on Aqueous Oxalic Acid Solutions in the Presence of Ferric, Chromic, and Mercuric Chloride, and of Uranyl Acetate and of Iodic Acid." *Ber. deut. pharm. Ges.* **32**, 209-16(1922).

Uranyl acetate and HIO_3 effect decompn. of cryst. $\text{C}_2\text{H}_2\text{O}_4$ to the extent of 5.49 and 4.55%, resp., after a 4- and a 3-hr exposure, resp. Qual. action equivalence obtains between natural and arc light in the case of $\text{C}_2\text{H}_2\text{O}_4$ and HgCl_2 , uranyl acetate, and HIO_3 .

- 1526 Lebeau, P. "On the Oxides of Uranium." *Compt. rend.* **174**, 388-91(1922).

Cold dil. HNO_3 was found to have a hydrolytic effect on UO_2 . Gentle warming will dissolve some of the UO_2 without oxidizing it even when the soln. is allowed to stand for 24 hrs or more. A powd. gray product is obtained, which will not lose wt. at 1000° , when U_3O_8 is heated to 800° . This paper contains a

discussion of the reduction of damp or dry UO_3 or U_3O_8 in a steam of H_2 which yields a very pure UO_2 product. The reduction is carried out at 900 to 1200°C. The UO_2 produced is a chestnut-brown and the reduction was found to begin at about 500°. There is an examn. of the method of heating U_3O_8 with a few drops of HF in order to prep. UO_2 ; however, this method does not prevent the reoxidation to U_3O_8 in O_2 . Regardless of the prepn. method, true UO_2 is said to be brown. UO_3 is reported to show no noticeable change when heated in air to 600°. Decompn. is evident at 700° and is rapid and complete at 800°. U_3O_8 prepd. below the red heat will never be completely pure, always contg. some UO_3 . This UO_3 in moist air, at ordinary temp., was found to go $\text{UO}_3 \cdot 2\text{H}_2\text{O}$. U_3O_8 , prepd. by the heating of uranyl oxalate in a covered crucible at 350°, is found to be grayish-black. If this product is heated for 12 hrs in air at 350°, it turns orange-brown and shows almost exactly the increase in wt. which would be required to convert it to UO_3 .

1527 Lewis, G. N., Gibson, G. E., and Latimer, W. M. "A Revision of the Entropies of the Elements." J. Am. Chem. Soc. 44, 1008-17(1922).

The information on U in this paper is similar to that published in J. Am. Chem. Soc. 39, 2554-81(1917). Revised and additional data on other elements are provided.

1528 Lifschitz, J. "Several Optically Active Heavy Metal Complexes." Rec. trav. chim. 41, 627-36 (1922).

The neutral Cu salt is obtained as a black-green mass from hydroxymethylenecamphor, $\text{C}_8\text{H}_{14} \cdot \text{CO} \cdot \text{C} : \text{CHOH}$, in MeOH and $\text{CuSO}_4 + \text{NaOAc}$ in H_2O . The Ni salt was obtained similarly as light-green crystals. The UO_2 salt was obtained similarly as an orange powder, the specific rotation was 122° for $\lambda = 5940 \text{ \AA}$ in CHCl_3 .

1529 Little, S. "Method for the Determination of Uranium in Steels." Chemist-Analyst No. 38, 22 (1922).

Five grams of steel is dissolved in 100 cc HCl, the soln. oxidized with 15 cc of HNO_3 and evapd. to dryness. The residue is then dissolved in 30 cc of HCl and 60 cc of hot water. After filtration the liq. is again evapd. to dryness, the residue dissolved in 60 cc of 1 : 1 HCl and the soln. treated with 85 cc of Et_2O to remove the Fe. The aq. layer is sepd., boiled to expel ether, oxidized with KClO_3 , and evapd. just to dryness. The residue is then dissolved in H_2O , 0.5 g of ammonium phosphate is added, and the whole is poured into 200 cc H_2O contg. 10 g Na_2CO_3 . The liq. is boiled, treated with 10 g of $(\text{NH}_4)_2\text{CO}_3$, and filtered after half an hr. The filtrate is boiled to decomp. $(\text{NH}_4)_2\text{CO}_3$, acidified with H_2SO_4 , treated with an excess of ammonium phosphate, 10 g of NH_4OAc , and 15 cc of HOAc, heated 30 min on the water bath and filtered. The ppt. is washed with dil. NH_4OAc , ignited, and weighed as uranyl pyrophosphate (factor to U = 0.6855).

1530 Nichols, E. L. "A Convenient Method of Determining the Brightness of Luminescence." Science (2), 55, 157-9(1922).

Brightness values (mL) are given as follows for solid fluorescent uranyl salts:

potassium uranyl sulfate	35.2	cesium uranyl nitrate	5.71
ammonium uranyl sulfate	23.0	uranyl acetate	5.39
rubidium uranyl chloride	8.11	potassium uranyl fluoride	4.69
potassium uranyl nitrate	7.53	cesium uranyl acetate	4.56
uranyl nitrate	6.61	lead uranyl acetate	3.75

1531 Nodon, A. "On the Photographic Action of Ultraradiations." Compt. rend. 174, 1061-2(1922). This is a comparison of the photographic action of U and of "high altitude rays." (Comparison of shadow photography with U radiation and cosmic rays.)

1532 Pearson, R. E. and Craig, E. N. Electrolytic Reduction of Oxides of Metals of the Chromium Group. July 18, 1922. (Canadian Patent 221,941)

A pasty mixt. of an oxide of Cr, W, Mo, or U and an electrolyte (H_2SO_4) is maintained in a porous cathode chamber and d.c. is passed through the cell. The oxide should be insol. in the electrolyte. The cathode

may be made of Ni-Cr alloys and the anodes of Pb or C. The anode is preferably surrounded with a metal which it is desired to oxidize and which oxidizes in preference to the anode. If it is desired to reduce the oxides to metallic form, the final reduction is obtained by heating the product in H_2 .

- 1533 Perrine, J. O. "A Spectrographic Study of Ultra-Violet Fluorescence Excited by X-Rays." *Phys. Rev.* (2), 22, 48-57(1922).

In order to photograph the spectrum, the specimens were placed in front of the slit of a Fuess single-prism quartz spectrograph and exposed to x rays from a Coolidge Tube at 12 cm. Various exposures were tried. One or more visible bands of fluorescence were found for the uranyl salts, but no ultraviolet bands are reported. The uranyl salts investigated were ammonium uranyl chloride, barium uranyl acetate, cesium uranyl chloride, cadmium uranyl acetate, lead uranyl acetate, lithium uranyl acetate, mercuric uranyl acetate, potassium uranyl acetate, rubidium uranyl acetate, rubidium uranyl sulfate, silver uranyl nitrate, strontium uranyl acetate, thallous uranyl sulfate, and uranyl tellurate.

- 1534 Raiteri, L. "On the Optical Properties of Some Important Substances in Microchemistry." *Atti reale accad. nazl. Lincei* (5), 31, I, 112-16(1922).

The index of refraction for $NaUO_2(OAc)_3$ is given as $n_{535} = 1.5082$, $n_D = 1.5044$, and $n_{671} = 1.5003$, and the use of this double acetate in microanalysis is also discussed.

- 1535 Rosenheim, A. and Trewendt, G. "Complex Uranyl Hypophosphites." *Ber.* 55B, 1957-60(1922). In studying the analogies of H_3PO_2 and its salts to H_2SO_3 and its salts, cryst. complex cpds. were isolated which proved to be completely analogous to the complex UO_2 sulfites investigated by Kohlschütter (*Ann.* 311, 1(1900)). On slowly adding a soln. of 4 moles NaH_2PO_2 to a M soln. $UO_2(NO_3)_2 \cdot 6H_2O$ and protracted shaking of the first sepg. oil with the soln., the oil yields yellow microprisms of $UO_2(H_2PO_2)_2$. A trihydrate form of the same was obtained by treating 1 mole of nitrate with 2 moles of NaH_2PO_2 , sepg. the oil and shaking it with a soln. of 2 moles each of NaH_2PO_2 and H_3PO_2 . It is brighter yellow than the anhyd. salt. $UO_2(H_2PO_2)_2$ is nearly insol. in H_2O but readily sol. in solns. of both $UO_2(NO_3)_2$ and of NaH_2PO_2 apparently in consequence of formation of both cationic and anionic complexes. Differently hydrated salts were obtained by varying the proportions of $UO_2(H_2PO_2)_2$ and NaH_2PO_2 . The following salts were obtained in cryst. form and analyzed: of the series $R(UO_2)_2(H_2PO_2)_5Na(4.5 \text{ and } 6H_2O)$; K; NH_4 ; and guanidinium, CN_3H_6 , ($2H_2O$). Of the series $RUO_2(H_2PO_2)_3$ the Na salts ($3.5 \text{ and } 5H_2O$) were obtained when 6 to 8 moles NaH_2PO_2 were added to 1 mole $UO_2(H_2PO_2)_2$. In the same proportions, the other alk. hypophosphites formed only salts of the first series. The clear, deep-yellow solns. of 1 mole $UO_2(H_2PO_2)_2$ with 10, or more, moles of alk. hypophosphites when evapd. in vacuum to syrups gave no crystals, but it is considered probable that they contd. salts of $[(UO_2)(H_2PO_2)_4]^{-2}$.

- 1536 Sarkar, P. B. and Dhar, N. R. "Determination of Manganese Using Permanganate and Investigation of Different Manganites." *Z. anorg. allgem. Chem.* 121, 135-55(1922).

According to this paper, Mn salts added to increase the rate of pptn. cause it to surpass the pptn. of uranyl salts in the sepn. method using $KMnO_4$.

- 1537 Schilow, N. (with investigations by N. Bulygina, L. Lepin, O. Michajlowa, M. Dubinin, S. Wosnessensky, A. Iwanitzkaja, L. Orlowa, and J. Saslawsky.) "Adhesive Powers in Solutions. II. Studies on Adhesion Series." *Z. physik. Chem.* 100, 425-62(1922).

The adsorption behavior of UO_2SO_4 and $UO_2(NO_3)_2$ solns. with mastic sol., iron hydroxide sol., antimony trisulfide sol., and C suspension in tannin soln. is discussed. The vol. contraction for UO_2SO_4 upon formation, expressed as the ratio of molar vols. to the sum of the at. vols., is reported as 1.24.

- 1538 Schoep, A. "On Becquerelite, New Radioactive Mineral." *Compt. rend.* 174, 1240-2(1922).

This is a report on crystal characteristics of an orange mineral associated with pitchblende in Katanga, Belgian Congo. The approx. formula reported is $UO_3 \cdot 2H_2O$.

- 1539 Schoep, A. "On Dewindtite, New Radioactive Mineral." *Compt. rend.* 174, 623-5(1922).
The new canary-yellow mineral found with chalcolite is reported to be of the approx. compn., $4\text{PbO} \cdot 8\text{UO}_3 \cdot 3\text{P}_2\text{O}_5 \cdot 12\text{H}_2\text{O}$.
- 1540 Schoep, A. "On Stasite, a New Mineral Dimorphous with Dewindtite." *Compt. rend.* 174, 875-7 (1922).
Not only is this mineral dimorphous, but it is of identical compn. $4\text{PbO} \cdot 8\text{UO}_3 \cdot 3\text{P}_2\text{O}_5 \cdot 12\text{H}_2\text{O}$, to dewindtite which was reported by Schoep in *Compt. rend.* 174, 623-5(1922).
- 1541 Schoep, A. "Soddyite, New Radioactive Mineral." *Compt. rend.* 174, 1066-7(1922).
Crystal characteristics of pale-yellow mineral of the compn. $12\text{UO}_3 \cdot 5\text{SiO}_2 \cdot 14\text{H}_2\text{O}$, found with curite in Katanga, Belgian Congo.
- 1542 Schoep, A. and Steinkuhler, W. "Estimation of Uranium in the Presence of Phosphoric Acid." *Bull. soc. chim. Belg.* 31, 156-9(1922).
The soln. of $\text{UO}_2(\text{NO}_3)_2$ contg. H_3PO_4 is treated with a HNO_3 soln. of ammonium molybdate which ppts. the H_3PO_4 . The filtrate is made slightly ammoniacal and heated gently without boiling; $(\text{NH}_4)_2\text{S}$ soln. is added until the liq. turns blood-red, due to the formation of sulfomolybdates, and heating is contd. on the water bath until the brown ppt. of U sulfide, which forms after 20 mins, becomes black and granular. The ppt. is collected and washed with a warm dil. NH_3 soln. of $(\text{NH}_4)_2\text{S}$ till free from Mo; it can then be converted into U_3O_8 by ignition in the air and weighed as such.
- 1543 Scott, W. W. "Glacial Acetic Acid Method for Determining Uranium in Carnotite." *J. Ind. Eng. Chem.* 14, 531-2(1922).
Digest 0.5 g carnotite with 20 to 40 cc of 7.5 N HNO_3 , boil gently, evap. to dryness, bake the residue a few mins, and then heat with 25 cc of a mixt. contg. 20 pts. AcOH to 5 pts. HNO_3 . If the ratio of AcOH to HNO_3 is more than 10:1, U is not dissolved appreciably. Filter, evap. the soln. to dryness, and repeat the AcOH treatment. Filter, evap., bake, and dissolve this time in 50 cc of 3 N HNO_3 . Nearly neutralize with NH_4OH , add an excess of $(\text{NH}_4)_2\text{CO}_3$ and filter off the Fe and Al hydroxides. To the filtrate add HNO_3 , boil off CO_2 , and ppt. the U as $(\text{NH}_4)_2\text{U}_2\text{O}_7$ by adding NH_4OH . Filter, wash with 2% NH_4NO_3 soln., ignite, and weigh as U_3O_8 .
- 1544 Siemssen, J. A. "The Triboluminescence of Uranium Salts and Three New Organic Uranium Compounds." *Chem. Ztg.* 46, 450(1922).
Crystals of $\text{UO}_2(\text{NO}_3)_2$, 41 yrs old, showed only a slight triboluminescence compared with a 3-yr-old sample. Crystals of Na_2UO_4 showed no triboluminescence. No explosive phenomena were observed by adding HNO_3 to crystals obtained from various org. solvents. Three salts were obtained by the action of U cpds. on derivs. of pyrazolone but no details are given. These org. cpds. possess a strong antitubercular action.
- 1545 Treadwell, W. D. "Reductions with Cadmium in Volumetric Analysis. II. 1. Titration of Uranium." *Helv. Chim. Acta* 5, 732-43(1922).
When a $(\text{UO}_2)^{+2}$ salt is reduced in a Cd reductor some U^{+3} is formed but this, exposed to air, undergoes so rapid an oxidation to U^{+4} that an electrometric titration can be accomplished with permanganate on the basis of the equation $5\text{U}^{+4} + 2(\text{MnO}_4)^- + 2\text{H}_2\text{O} = 5(\text{UO}_2)^{+2} + 2\text{Mn}^{+2} + 4\text{H}^+$. The results appear to be better when Cd, rather than Zn, is used in the reductor and when the reduced soln. is caught in an open beaker rather than in a flask contg. CO_2 .
- 1546 "Uranium and Its Metallurgy." *J. Iron Steel Inst. (London)* 106, 382(1922).
Of all known metals, U has the greatest at. wt., namely 239, the sp. wt. being 18.7. It has a m.p. of 1800°C , and volatilized more rapidly than Fe. The principal occurrences of U are in Joachimsthal, in the Ore Mountains at Annaberg in Saxony, and in some localities in the United States. The total output of U in 1917 and 1918 was 87.4 and 98.5 tons, resp., with 26.4 and 27.1 g of Ra. Apart from its employment as a source of its associated Ra, U is mainly used as an addn. to steel.

1547 "Uranium and Its Metallurgy." *Rev. minera, met. ing. (Madrid)* 73, 268-9(1922).

This article is similar to that published in *J. Iron Steel Inst. (London)* 106, 382(1922).

1548 Weil, S. and Rozenblumowna, S. "Some Salts of Uranium." *Sprawozdania Prac Państwowego Inst. Farm. No. 1*, 1-12(1922).

Basic α -phenylcinchoninate of U^{+4} , $U(C_9H_5NPhCOO)_2 \cdot 3H_2O$, was obtained in a hot alk. soln. of cinchophene and UCl_4 as a greenish-brown powder. Uranyl α -carboxyhydroxyphenylcinchoninate, $UO_2(C_{17}H_9O_5N) \cdot 4H_2O$, was formed as a red ppt. from $UO_2(OAc)_2$ and lithinium α -salicylcinchoninate in aq. soln. Basic α -(carboxyhydroxyphenyl) cinchoninate, $(UOC_{17}H_9O_5N) \cdot H_2O$, was found to be a greenish-brown ppt., uranium sulfosalicylate, $U[C_6H_3OHSO_3 \cdot COO]_2$, a green ppt. and uranyl salicylate, $UO_2[C_6H_4OHCOO]_2 \cdot 5H_2O$, obtained from salicylic acid and uranyl acetate in a hot aq. soln., small needles of an orange-rose color. Other salts identified were

uranium salicylate, $U \left(C_6H_4 \begin{array}{c} O \\ \diagup \quad \diagdown \\ COO \end{array} \right) \cdot 4H_2O$; uranyl salt of guaiacol,

$UO_2[C_6H_4OCH_3O]_2$, obtained from K salt of guaiacol and $UO_2(OAc)_2$ in aq. soln. as a brown ppt.; basic β -naphthalenesulfonate of uranium, $UO(C_{10}H_7SO_3)_2$, obtained from a hot alk. soln. of β -naphthalenesulfonic acid and UCl_4 , acidified with HCl as a greenish ppt.; uranyl *p*-aminobenzene arsonate, $UO_2[NH_2C_6H_4 \cdot AsOOHO]_2 \cdot H_2O$, obtained from Na *p*-aminobenzene arsonate (atoxyl) and $UO_2(OAc)_2$ in aq. soln. as a red ppt., insol. in H_2O ; uranyl methyl arsonate, $UO_2CH_3AsO_3 \cdot 1\frac{1}{2}H_2O$, a yellow ppt.; uranyl *p*-hydroxy-*m*-nitrobenzene arsonate, $UO_2[NO_2OHC_6H_3 \cdot AsOOHO]_2 \cdot 2H_2O$, a yellow powder; uranyl *m*-nitroarsanilate, $UO_2[NH_2NO_2 \cdot C_6H_3 \cdot AsO_3H]_2 \cdot 2H_2O$, a greenish-yellow ppt.; and the basic uranyl salt of dihydroxydiaminoarsenobenzene, $[NH_2C_6H_3OUO_2OHAs]_2 \cdot 5H_2O$, a yellow powder.

1549 Wentzel, G. "Report on the New Results of Roentgen-Spectroscopy." *Naturwissenschaften* 10, 369-81(1922).

Extensive tables are given which include wavelengths for L- and M-series lines in U and many other elements.

PUBLICATIONS LOCATED IN 1923

1550 Aloy, J. and Valdiguie, A. "Oxidations and Reductions Induced by Uranium Salts under the Influence of Light. Antioxidant Action of Phenols." *Compt. rend.* 176, 1229-31(1923).

The common salts of U very readily oxidize O acceptors, such as glucose, in sunlight, violet $U_3O_8 \cdot 2H_2O$ being formed. If a H acceptor, such as methylene blue, is present, it is simultaneously reduced but its color is restored if air is readmitted; a second exposure to light brings about the original reaction again; the U salt plays, in this case, the role of an oxido-reductor ferment. The reaction is as if OH^- were carried to the O acceptor and H^+ to the H acceptor. The addn. of a mono- or dihydric phenol inhibits the oxidation phenomenon, but the phenol itself is probably oxidized to a slight extent, with corresponding formation of a red uranous salt. A short bibliography is given.

1551 Aloy, J. and Valdiguie, A. "Catalysts for Oxidation Provided by the Salts of Copper and Uranium." *Bull. soc. chim. France* (4), 33, 572-6(1923).

The reduction-oxidation properties of U cpds. are discussed.

1552 Auger, P. and Dauvillier, A. "The Existence of New Lines - Doublets of the Sommerfeld Type, Excluded by the Selection Principle - in the L Series of the Heavy Elements." *Compt. rend.* 176, 1297-8(1923).

Observations of the spectra of Ta, W, Os, Ir, Pt, Au, and U show for each the existence of the combination lines M_4L_1 and M_5L_1 , whose wavelengths are given, which correspond to a variation of zero in the azimuthal quantum number. The line M_4L_1 forms a doublet of the Sommerfeld-type with β_{11} .

- 1553 Becker, K. and Ebert, F. "Roentgen Spectroscopy and Metal Compounds." Z. Physik 16, 165-9(1923).

X-ray photographs of U in powder form did not give enough information to make an exact calcn. of the crystal structure. It is pointed out, however, that U probably is not regular.

- 1554 Blanchetiere, A. "On a Method for the Determination of Sodium." Bull. soc. chim. France (4), 33, 807-18(1923).

$\text{NaMg}(\text{UO}_2)_3(\text{OAc})_9 \cdot 9\text{H}_2\text{O}$ is nearly insol. in 95% alc. and the use of this triple salt in Na analysis is discussed.

- 1555 Bohr, N. "The Structure of the Atom." Nature 112, 29-44(1923). (Nobel Lecture in Physics, for 1922. tr. by F. C. Hoyt.)

Information is general, but the position of U in the scheme is shown.

- 1556 Bohr, N. and Coster, D. "Roentgen Spectra and the Periodic System of the Elements." Z. Physik 12, 342-74(1923).

A compilation of the K-, L-, M-, N-, and O-level x-ray spectrum lines for U is included. These were obtained from previous measurements found in literature.

- 1557 Bridgman, P. W. "The Effect of Pressure on the Electrical Resistance of Cobalt, Aluminium, Nickel, Uranium, and Cesium." Proc. Am. Acad. Arts Sci. 58, No. 4, 151-61(1923).

The pressure coeff. of resistance, between 0 and 12,000 kg, at several temps., and the temp. coeff. of resistance between 0 and 100°, at atmospheric pressure, have been detd. For U the temp. coeff. of resistance, between 0 and 100°, was only 0.00230, indicating that the specimen was not of high purity. The av. pressure coeff., at 30°, between 0 and 12,000 kg, was -0.05436. The resistance therefore decreases under pressure as is normal for most metals. The specific resistance of this sample of U, at 0°, was 76.0×10^{-6} . This is high for a metal, being of the order of magnitude of the resistance of liq. Hg or Bi.

- 1558 Brinton, P. H. and Ellestad, R. B. "A Method for the Quantitative Separation of Beryllium and Uranium." J. Am. Chem. Soc. 45, 395-8(1923).

By adding $(\text{NH}_4)_2\text{CO}_3$ to an acid soln. contg. Be^{+2} and $(\text{UO}_2)^{+2}$ in the presence of NH_4Cl and $\text{NH}_2\text{OH} \cdot \text{HCl}$, ppts. are formed which dissolve in an excess of $(\text{NH}_4)_2\text{CO}_3$. By boiling the soln. the greater part of the Be^{+2} is pptd. as basic carbonate. In the filtrate the last traces of Be^{+2} can be removed as hydroxide by acidifying the soln., boiling off dissolved CO_2 , adding more $\text{NH}_2\text{OH} \cdot \text{HCl}$ and making alk. with NH_4OH . If the last treatment is used to ppt. all of the Be^{+2} , a very bulky ppt. is obtained which is hard to wash. By igniting the above 2 ppts. pure BeO is obtained. In the filtrate, the U may be detd. by pptn. with NH_3 as $(\text{NH}_4)_2\text{U}_2\text{O}_7$ after the $\text{NH}_2\text{OH} \cdot \text{HCl}$ has been destroyed by treatment with H_2O_2 , or alk. bromate in acid soln. It is recommended that the $(\text{NH}_4)_2\text{U}_2\text{O}_7$ be ignited to dull redness and weighed as U_3O_8 .

- 1559 Courtois, G. "On the Preparation and Properties of Some Organic Uranium Salts, Especially Uranyl Benzoate and Salicylate." Bull. soc. chim. France (4), 33, 1761-73(1923).

Cryst. uranyl benzoate, $\text{UO}_2(\text{BzO})_2$, was obtained by interaction of aq. BzOH and an aq. suspension of $\text{UO}_3 \cdot \text{H}_2\text{O}$. An acid salt, $\text{UO}_2(\text{BzO})_2 \cdot \text{BzOH}$, is also formed. To avoid using extremely dil. solns., alc. was substituted as a solvent and yellow crystals of $\text{UO}_2(\text{BzO})_2 \cdot \text{EtOH}$ were obtained. A mixt. of alc. and H_2O is a better solvent than either alone and yields $\text{UO}_2(\text{BzO})_2 \cdot \text{EtOH}$ as yellow-white crystals which are easily sol. in H_2O ; the soln. gradually deposits $\text{UO}_2(\text{BzO})_2$. The EtOH salt is sol. in H_2O ,

alc., and CHCl_3 , especially when hot. The CHCl_3 soln. yields $\text{UO}_2(\text{BzO})_2$. The EtOH salt is insol. in C_6H_6 , C_2S , and petroleum ether; with anhyd. Et_2O crystals of $2\text{UO}_2(\text{BzO})_2 \cdot \text{EtOH} \cdot \text{Et}_2\text{O}$ are formed. This cpd. is very stable at room temp. even in vacuum, but yields $\text{UO}_2(\text{BzO})_2$ at 100° . When to the aq. soln. used in the prepn. of $\text{UO}_2(\text{BzO})_2$ a little Et_2O is added, crystals of $\text{UO}_2(\text{BzO})_2 \cdot 2\text{Et}_2\text{O}$ appear. This cpd. is obtained as yellow crystals which slowly lose Et_2O in air, rapidly in vacuum or by heating. While insol. in Et_2O it dissolves in solvents for $\text{UO}_2(\text{BzO})_2 \cdot \text{EtOH}$. $\text{UO}_2(\text{BzO})_2$ is pale yellow, slightly sol. in H_2O . The soln. deposits a basic salt. It is somewhat sol. in EtOH, readily sol. in MeOH, and insol. in most org. solvents. In contact with Et_2O , without dissolving, it yields $\text{UO}_2(\text{BzO})_2 \cdot 2\text{Et}_2\text{O}$. Crystd. at a low temp. $\text{UO}_2(\text{BzO})_2$ gives an unstable hydrate. It is decompd. by heating only slowly until above 150° . At red heat, green U_3O_8 is formed. A concd. aq. soln., either in the dark or in sunlight ppts. a yellow basic salt. In sunlight it does not give a violet ppt. A satd. EtOH soln. in sunlight yields a violet uranous-uranic oxide, which becomes yellow when washed with H_2O in air. On the steam bath an aq. soln. of $\text{UO}_2(\text{BzO})_2$ hydrolyzes with the formation on a basic salt, $\text{UO}_2(\text{BzO})_2 \cdot \text{UO}_3 \cdot \text{H}_2\text{O}$. Concd. aq. solns. of $\text{UO}_2(\text{BzO})_2$ cooled quickly to 5° or lower yield $\text{UO}_2(\text{BzO})_2 \cdot 2\text{H}_2\text{O}$. This hydrate rapidly loses its water at room temp. It is sol. in Et_2O and the soln. deposits $\text{UO}_2(\text{BzO})_2 \cdot \text{Et}_2\text{O}$. When $\text{UO}_3 \cdot \text{H}_2\text{O}$ is heated with fused BzOH , $\text{UO}_2(\text{BzO})_2 \cdot \text{BzOH}$ is formed. This is insol. in Et_2O and is dissocd. by H_2O in which it is sparingly sol. $\text{UO}_2(\text{BzO})_2 \cdot \text{UO}_3 \cdot \text{H}_2\text{O}$ is yellow and cryst., insol. in H_2O and alc. At an elevated temp. an oxide is pptd. When $\text{UO}_3 \cdot \text{H}_2\text{O}$ and salicylic acid and H_2O are heated, yellow-orange $\text{UO}_2[\text{C}_6\text{H}_4(\text{OH})\text{CO}]_2$ is obtained. The mother liquor yields yellow crystals of $\text{UO}_2[\text{C}_6\text{H}_4(\text{OH})\text{CO}]_2 \cdot 2\text{H}_2\text{O}$. The former cpd. forms as yellow-orange plates which are slightly sol. in H_2O , dissolving slowly in EtOH, MeOH, and insol. in Et_2O , CHCl_3 , CS_2 , C_6H_6 , and petroleum ether. They are stable to 150° without change of color. The latter cpd. appears as yellow prisms, sparingly sol. in H_2O , giving a yellow-red soln. which becomes darker when heated and lighter when cooled again. It is readily sol. in EtOH and in MeOH giving a ruby-red soln., sparingly sol. in Et_2O , rather stable in a vacuum and up to 90° . It gradually loses the H_2O and becomes red. Its aq. and alc. solns. are unique among U salts of this type in that they are stable in darkness and in sunlight. If concd. at 100° the soln. becomes deeply red because of a substance of unknown constitution, perhaps a basic salt or an oxide.

1560 Courtois, G. "The Stability of Solutions of Some Organic Uranyl Salts in Darkness and in Light." *Bull. soc. chim. France* (4), 33, 1773-85(1923).

All the salts give more or less fluorescent yellow solns. Satd. aq. solns. were generally used, but occasionally MeOH and EtOH were substituted as solvents, while in some instances the water was freed from air. Formate. $\text{UO}_2(\text{HCO}_2)_2 \cdot \text{H}_2\text{O}$ in the dark and in diffused light in aq. soln. deposits yellow-white crystals of $\text{UO}_2(\text{HCOO})_2 \cdot \text{H}_2\text{O} \cdot \text{UO}_3 \cdot 2\text{H}_2\text{O}$. In sunlight with or without Et_2O , a hydrated violet oxide and the basic formate above are pptd. In the absence of air a yellow-white basic uranic formate are produced and gases, CO and CO_2 , are evolved. Air therefore masks the formation of the uranous cpd., which is in part converted to HCO_2H and in part to the violet cpd. In sunlight in MeOH, $\text{UO}_2(\text{HCO}_2)_2 \cdot \text{H}_2\text{O}$ gives a violet-brown ppt. of hydrated uranous-uranic oxide, not uranous oxide, which is converted, by air, into pale yellow $\text{UO}_3 \cdot 2\text{H}_2\text{O}$. If some of the soln. is poured into boiling water $\text{UO}_3 \cdot \text{H}_2\text{O}$ is formed. Acetate. $\text{UO}_2(\text{AcO})_2 \cdot 2\text{H}_2\text{O}$, dil. and concd. aq. solns. are stable in the dark. In diffused light this concd. soln. yields the pale-yellow basic salt, $\text{UO}_2(\text{AcO})_2 \cdot 2\text{H}_2\text{O} \cdot \text{UO}_3 \cdot 2\text{H}_2\text{O}$. In sunlight an aq. soln. with Et_2O rapidly pptd. the violet oxide, in the absence of Et_2O but with access to air the pptn. occurred somewhat more slowly, while with air-free water as a solvent and in the absence of air the pptn. took place even more slowly. Washed with water in air the violet ppt. became yellow, $\text{UO}_3 \cdot 2\text{H}_2\text{O}$; this is stable in the air but over H_2SO_4 it gives $\text{UO}_3 \cdot \text{H}_2\text{O}$. The violet substance in boiling water gives the yellow monohydrate. All the acetate solns. yield on direct illumination a mixt. of CO_2 and CH_4 . Propionate. $\text{UO}_2(\text{EtCO}_2)_2 \cdot 2\text{H}_2\text{O}$ is stable in dil. and concd. solns. both in darkness and in light. In sunlight the violet oxide is pptd. with the liberation of EtCO_2H and without immediate gas evolution. Later CO_2 and C_2H_6 are slowly eliminated. In MeOH and sunlight it acts like formate giving the violet oxide, which is converted into $\text{UO}_3 \cdot 2\text{H}_2\text{O}$ and by hot water into $\text{UO}_3 \cdot \text{H}_2\text{O}$. Butyrate. Aq. solns. of $\text{UO}_2(\text{PrCO}_2)_2 \cdot 2\text{H}_2\text{O}$ are stable in the dark and in diffused light. In sunlight the violet oxide and PrCO_2H form. A gaseous mixt. of CO_2 and hydrocarbons is

liberated. The violet ppt. is the same as previously noted. The isobutyrate, valerate, and isovalerate have been isolated as dihydrated neutral salts which give aq. solns. behaving as does that of butyrate. Benzoate. Satd. aq. solns. of $\text{UO}_2(\text{BzO})_2 \cdot 2\text{H}_2\text{O}$ slowly deposit small amts. of a yellow basic salt. Exposed to sunlight the soln. never gives the violet cpd., but ppts. the yellow basic salt without the liberation of gas. With Et_2O - H_2O solns. it yields none of the violet cpd., but the yellow cryst. $\text{UO}_2(\text{BzO})_2 \cdot 2\text{H}_2\text{O} \cdot 2\text{Et}_2\text{O}$ which in EtOH gives the violet ppt. Glycolate. Dil. and concd. solns. of $\text{UO}_2[\text{CH}_2(\text{OH})\text{CO}_2]_2$ in the dark yield yellow crystals of $\text{UO}_2[\text{CH}_2(\text{OH})\text{CO}_2]_2 \cdot \text{UO}_3 \cdot \text{H}_2\text{O}$. In sunlight in the presence and in the absence of air a yellow ppt. is formed and a green one, probably uranous formate, is obtained. This soln. has the odor of HCHO and CO_2 is set free. Lactate. $\text{UO}_2[\text{MeCH}(\text{OH})\text{CO}_2]_2$ solns. are very stable in the dark and in diffused light. In sunlight, in air, the soln. becomes green, then brown and yields the violet oxide. In the absence of air a green uranous salt ppts. accompanied by the evolution of CO_2 and the liq. contains AcH and HCO_2H . Quinate. Aq. solns. of $\text{UO}_2[(\text{HO})_4\text{C}_6\text{H}_7\text{CO}_2]_2 \cdot 2\text{H}_2\text{O}$ are stable in the dark. In the sunlight the soln. becomes brown and evolves CO_2 , but no ppt. forms. Salicylates. $\text{UO}[\text{C}_6\text{H}_4(\text{OH})\text{CO}_2]_2$ and $\text{UO}_2[\text{C}_6\text{H}_4(\text{OH})\text{CO}_2]_2 \cdot \text{H}_2\text{O}$ are yellow-orange and yellow, resp. Both give orange-red aq. and ruby-red alc. solns. The aq. solns. are stable in dark and in sunlight. From solns. kept in darkness and those illuminated by sunlight the former is obtained by concn. The mother liquor yields a red product and on cooling a yellow one, the whole on standing being converted into the latter. The alc. solns. are stable in sunlight. These salts are unique in the stability of their aq. and alc. solns. The malonate and succinate are insol. in water and in alc. Oxalate. Aq. solns. of $\text{UO}_2\text{C}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$ are stable in darkness. In sunlight they yield CO and CO_2 and the hydrated violet oxide. The violet cpd. as it is formed here is partially converted into the yellow $\text{UO}_3 \cdot 2\text{H}_2\text{O}$. Tartrates. Aq. solns. of $\text{UO}_2\text{C}_4\text{H}_4\text{O}_6 \cdot 4\text{H}_2\text{O}$ and $\text{UO}_2\text{C}_4\text{H}_4\text{O}_6 \cdot \text{H}_2\text{O}$ are stable in the dark and rapidly reduced in the sunlight. In the absence of air a dull yellow cpd., a basic salt of undetd. constitution, is pptd. and CO_2 is rapidly liberated. In the presence of air the reaction indicated above takes place but the basic salt is ultimately converted into the hydrated violet oxide. Citrate. Aq. solns. of $(\text{UO}_2)_3(\text{C}_6\text{H}_5\text{O}_7)_2 \cdot 6\text{H}_2\text{O}$ are not very stable, even in the dark. They yield a pale-yellow basic salt $(\text{UO}_2)_3(\text{C}_6\text{H}_5\text{O}_7)_2 \cdot 2\text{H}_2\text{O} \cdot 2(\text{UO}_3 \cdot \text{H}_2\text{O}) \cdot 2\text{OH}_2\text{O}$. In sunlight the yellow basic salt is converted into a dull-yellow one, and ultimately yields the violet oxide with the elimination of considerable CO_2 . The aq. solns. of these uranyl salts are stable in the dark, especially the formates, acetate, glycolate, and citrate, which yield definite yellow salts; all except the benzoate and salicylate are reduced by sunlight alone, even when no $[\text{OH}]$ group is present, contrary to earlier claims. Alc. and Et_2O hasten the reduction which ultimately produces a violet cpd., a hydrated uranous-uranic oxide, which is converted by cold water into the dihydrated uranic oxide, $\text{UO}_3 \cdot 2\text{H}_2\text{O}$. In the absence of air the formate, glycolate, and lactate yield green uranous salts. Reduction is generally accompanied by gas evolution; usually CO_2 is present. The formate and oxalate yield CO . Other fatty acid salts yield hydrocarbons. The salts of aromatic acids are more stable. The salicylate in either aq. or alc. solns. is unchanged by exposure to sunlight. The benzoate yields the violet cpd. in alc. The phenolic group seems to act as a stabilizer.

- 1561 Curie, M. S. "Action of Red and Infrared Rays on Photoluminescent Substances." J. chim. phys. 20, 292-307(1923).

It is reported that red and infrared light have no effect on the photoluminescence of uranyl cpds.

- 1562 Darmois, E. "Polarimetric Observations on Tartar Emetic, Uranyl Tartrate and Uranyl Malate." Compt. rend. 177, 49-51(1923).

The rotation- NaOH concn. curve upon addn. to uranyl tartrate showed a sharp max. rotation at the point where the Na was equiv. to 1 tartaric acid nucleus. A second cpd. contg. 2 Na probably existed but was unstable in dil. soln. The data confirmed those of Itzig (Ber. 34, 3822(1901)), and indicated that uranyl tartrate is a complex acid. The action of NaOH on uranyl malate gave results similar to those of the tartrate.

- 1563 Davis, C. W. Uranium. Washington, U. S. Government Printing Office, 1923. (U. S. Bur. Mines. Bull. No. 212, p.199-237.)

This is a general paper which includes a bibliography. (See item 1582 of this bibliography.)

- 1564 Dushman, S. "Electron Emission from Metals as a Function of Temperature." Phys. Rev. (2), 21, 623-36(1923).

The thermionic work function for at. surfaces of U on W wire, made by impregnating the wire with U oxide, was found to be 3.28.

- 1565 Eastman, E. D. "The Mass Effect in the Entropy of Substances." J. Am. Chem. Soc. 45, 80-3(1923).

The at. entropy for U at 25° is calcd. by an approx. formula which is proposed to be more accurate than that of Lewis and Gibson (J. Am. Chem. Soc. 39, 2554-81(1917). The value reported is 10.5 E.u/g atom.

- 1566 Feigl, F. "Spot Tests and Color Reactions as Methods of Microchemical Work." Mikro-chemie 1, 4-20(1923).

The usefulness of spot tests and color reactions for the detection of small quantities of substances is pointed out and specific directions are given for the detection of Hg, Pb, Bi, Cu, Cd, As, Sb, Sn, Co, Ni, U, Zn, Cr, Al, Mn, Ce, and PO₄.

- 1567 Fernandes, L. "Heteropoly Compounds of Gallic Acid with Molybdic, Tungstic, and Uranic Anhydrides." Gazz. chim. ital. 53, 514-20(1923).

Gallic acid was treated with 3 heavy oxides. When a soln. of K gallate is treated with insufficient or the calcd. amt. of MoO₃ (0.5 mole) and heated on the water bath the soln. becomes blood-red. When more concd. K gallate is used, the excess gallate seps. first and then dark-red K monogallomolybdate is obtained. When K gallate and MoO₃ are used in equimol. amts., K digallomolybdate was obtained. By using 3 mols. of MoO₃ with 2 moles K gallate a complex was obtained. K pyrouranate (freshly pptd. from uranyl chloride and KOH) treated with 2 moles of K gallate sepd. the UO₂ analog C₁₄O₁₂H₈K₂U. In attempting to obtain K digallouranate difficulty was encountered. With 3 moles of K Pyrouranate and 2 moles K gallate the UO₂ complex analogous to the Mo complex was obtained.

- 1568 Goldschmidt, V. M. and Thomassen, L. "Crystal Structure of Natural and of Synthetic Oxides of Uranium, Thorium, and Cerium." Videnskapsselskapets-Skrifter. I. Mat.-naturv. Klasse, Kristiania No. 2, 48p.(1923).

The minerals pitchblende, bröggerite, cleveite, and thorianite, and the pure oxides UO₂, UO₃, U₃O₈, ThO₂, and CeO₂ were studied. Debye-Scherrer diagrams were made by means of rays from a Hadding-Siegbahn metallic Roentgen tube with Al windows, the source of rays being an Fe anticathode. App., methods of work and of calcn. are described in detail. The results are shown in 18 tables. Detailed descriptions are given of the minerals and of the methods used in prepg. the oxides. UO₂, ThO₂, and CeO₂ are isomorphous, the metallic atoms being arranged in face-centered cubic lattices. Three different geometrical possibilities exist for the arrangement of the O atoms, the most probable being that of the fluorite type. The cryst. structure of U₃O₈ is essentially different from that of UO₂, and the crystals do not belong to the isometric system. UO₃ was obtained only in the amorph. state. Cleveite, bröggerite, and thorianite have a definite cryst. structure, with at. arrangement corresponding to the original crystal lattice. The structure of these 3 minerals corresponds to that of isomorphous mixts. of UO₂, ThO₂, some CeO₂, and eventually to the dioxide of U-Pb. Therefore, bröggerite and the other varieties of uraninite do not belong to the spinel group. Lattice dimensions (a × 10⁻⁸ cm) were thorianite 5.57, bröggerite 5.47, cleveite 5.47, and UO₂ 5.47. Cleveite, which is rich in UO₃, is transformed to U₃O₈ by heating to 800°. Bröggerite, after heating, has the structure of UO₂. Pitchblende from Joachimsthal contains cryst. material of the isometric system in a strongly dispersed condition. The U atoms are arranged in face-centered cubes with edges 5.42 to 5.45 × 10⁻⁸ cm, therefore, smaller than those of pure UO₂, perhaps in

consequence of isomorphic replacement of U by an atom of smaller vol. Probably the taking up of an excess of O_2 in the crystn. of UO_2 is in its geometrical relation comparable to the taking up of an excess of F atoms in yttrifluorite. It is noteworthy that minerals so strongly radioactive and so old as bröggerite and thorianite can entirely or largely keep their original at. arrangement, notwithstanding for example bröggerite, perhaps one out of 8 U atoms is transformed into Pb.

- 1569 Guy, W. G. and Russell, A. S. "The Short-Lived Radioactive Products of Uranium." J. Chem. Soc. **123**, 2618-31(1923).

Chemical sepn. methods for U and its daughters as well as phys. data are included.

- 1570 Hess, F. L. "Radium, Uranium, and Vanadium." Mineral Ind. **32**, 593-609(1923). Sources, production, technology, and uses are discussed.

- 1571 Hjalmar, E. Roentgenspektroskopische Messungen; Beiträg zur Kenntnis der Roentgenspektren. Dissertation, Univ. of Lund. 1923.

On p. 17 of this paper there are some measurements of the M-level lines in the x-ray spectrum of U. A no. of N- and O-series lines are also reported and discussed.

- 1572 Hjalmar, E. "Roentgen Spectroscopic Measurements. Contribution to Knowledge of Roentgen Spectra." Z. Physik **15**, 65-109(1923).

A brief review of the Bohr theory and an outline of the structure of Roentgen spectra are given. A diagram of energy levels of the heavier atoms shows 1 K level, 3 L, 5 M, 7 N, 5 O, and 3 P levels. The K- and L- spectral series have been most thoroughly investigated and new results for the M and N lines are given. Measurements on the M spectra of Dy, Ho, Er, Yb, Lu, Ta, W, Pt, Au, Tl, Pb, Bi, Th, and U are presented in tables. Similar results on the N series of Bi, Th, and U follow. In many cases the stronger lines are shown to be complex. Many new lines have been found and placed in the general scheme of Roentgen spectra. They confirm the validity of the combination principle and permit calcns. of the energy of certain N, O, and P levels.

- 1573 Holladay, J. A. and Cunningham, T. R. "Experiments Relative to the Determination of Uranium by Means of Cupferron." Trans. Am. Electrochem. Soc. **43**, 329-39(1923).

U^{+4} may be quant. pptd. with cupferron from solns. contg. 4 to 8% H_2SO_4 . Al, Ca, Mg, Zn, and P remain in soln. The ppt. $U(C_6H_5N_2O_2)_4$ may be quant. converted by ignition to U_3O_8 . V is pptd. with U and is sepd. by dropping the cupferron ppt. into an Erlenmeyer flask, treating with H_2SO_4 and HNO_3 and evapg. to dryness. Successive portions of HNO_3 destroy the carbonaceous matter, the acid is then expelled, and V detd. by titration with $KMnO_4$. Exptl. results show the limits of acidity for complete pptn., the completeness of conversion of $U(C_6H_5N_2O_2)_4$ to U_3O_8 by ignition, and the sepn. of U from Al, Ca, Mg, and P by regulation of the acidity. U and V may be sepd. and detd. in the presence of Al, Ca, Mg, Fe, and P by having the U, V, and Fe in the hexa-, penta- and tervalent forms, resp. Pptn. is effected with cupferron in a 12% H_2SO_4 soln. The cupferron is destroyed by HNO_3 and the U reduced by passage through a Jones reductor. U is again pptd. in 6% H_2SO_4 soln. and ignited to U_3O_8 .

- 1574 Hunter, M. A. and Jones, A. "The Reduction of Some Rare Metal Chlorides by Sodium." Trans. Am. Electrochem. Soc. **44**, 23-30(1923).

The success which had attended the production of metallic Ti (J. Am. Chem. Soc. **32**, 330(1910); Original Communications of the 8th International Congress of Applied Chemistry **2**, 125(1912)) led to the belief that other metals might be prepd. in coherent form by the reduction of the anhyd. chlorides by Na. The method has been tried out with the chlorides of Be, Cr, U, V, and Zr with varying degrees of success. With the limited quantities of the chlorides which have been prepared on a laboratory scale, the authors have succeeded in obtaining Be, Cr, and Zr in a more or less granular form; but with U and V, metallic powders only with varying degrees of purity have been produced.

- 1575 Hüttig, G. F. and Kurre, B. "The Hydrates of Molybdenum Trioxide." Z. anorg. allgem. Chem. **126**, 167-75(1923).
The heats of formation of various U hydrates from the oxides and H_2O were calcd. to be $UO_3 \cdot 1/2H_2O$ (13,290 cal.), $UO_3 \cdot H_2O$ (23,400 cal.), $UO_3 \cdot 1\frac{1}{2}H_2O$ (31,740 cal.), and $UO_3 \cdot 2H_2O$ (39,240 cal.).
- 1576 Jander, G. and Reeh, K. "Volumetric Analysis of Phosphoric Acid Using Uranyl Acetate." Z. anorg. allgem. Chem. **129**, 302-05(1923).
The use of $UO_2(OAc)_2$ in the gravimetric detn. of H_3PO_4 is discussed.
- 1577 Jaubert de Beaujeu, A. "Study of X-Ray Luminescence." J. phys. radium (6), **4**, 257-67 (1923).
With uranyl salts the most pronounced luminescence is obtained with double salts. Bands for the materials investigated are charted.
- 1578 Lewis, E. P. "Phosphorescence Caused by Active Nitrogen." Nature **111**, 599-600(1923).
There are notes on the phosphorescence of U nitrate and U ammonium fluoride.
- 1579 Longchambon, H. "Spectral Study of the Triboluminescence of Substances." Compt. rend. **176**, 691-3(1923).
Tartaric acid, $CdSO_4$, U nitrate, and F are studied and in each case the spectrum of triboluminescence coincided with the N_2 band spectrum. The triboluminescence of these 5 substances, very different in chem. constitution and crystal structure, is thus shown to be due to the same phenomenon, an efflu-
vium in N_2 or air.
- 1580 Ludewig, P. and Lorensen, E. "Utility of Normal Radium and Uranium Solutions for Emanation Measurement." Z. Physik **13**, 284-91 (1923).
The paper commences with descriptions of the prepn. of N Ra and U solns., which is followed by an investigation of their utility and constancy, exptl. details and tables of data being included. If the Ra content of the U solns. is assumed to be proportional to the activity, then from the tables, the soln. corresponds to 3.65×10^{-9} g Ra. Exptl. agreement between the std. solns. of the Physikalisch-Technischen Reichsanstalt and of the Freiberg Radium Institute is found to be within 0.5%. Soln. temp. is found to have no effect on the emanation measurement. During the course of a year the solns. do not appear to deteriorate.
- 1581 Minich, J. "The Determination of Residual Nitrogen in Blood." Biochem. Z. **142**, 266-73 (1923).
The use of $UO_2(OAc)_2$ in the pptn. of albumen is mentioned.
- 1582 Moore, R. B., Lind, S. C., Marden, J. W., Bonardi, J. P., Davis, C. W., and Conley, J. E. Analytical Methods for Certain Metals, Including Cerium, Thorium, Molybdenum, Tungsten, Radium, Uranium, Vanadium, Titanium, and Zirconium. Washington, 1923. 325p. (U. S. Bur. Mines Bull. No. 212)
The most important methods for the detn. of the above rare metals in ores, alloys, and metallurgical products have been examined in detail, and certain modifications tending to greater accuracy or more expeditious execution are described, together with, in some cases, new methods or combinations of procedures as used at the Bureau of Standards. The first part of the book deals with methods for the quant. sepn. and estn. of the metals in admixture, and subsequent chapters discuss fully the analytical details for each element, together with an extensive bibliography.
- 1583 Moore, R. W. "Preparation of Metallic Uranium." Trans. Am. Electrochem. Soc. **43**, 317-28(1923).
A method for the prepn. of metallic U in a very pure state is described, also a method of fusing the metal to form buttons or small pigs which may be rolled down to give thin sheets. Reduction of carefully purified UCl_4 with Na in vacuum produces U powder with 99.8% purity which can be fused

in vacuum by an electric arc. The smooth surfaces of U metal were found to be considerably oxidized upon standing in air for 2 to 3 days.

1584 Moser, L. "The Determination and Separation of the Rarer Metals from Other Metals. III. The Separation of Uranium from Titanium, Iron, and Aluminium." *Monatsh.* **44**, 91-5(1923).
To sep. U from Al it is best to add 2.5 vols. of 2N $(\text{NH}_4)_2\text{CO}_3$ soln. Insol. $\text{Al}(\text{HO})_3$ and sol. $(\text{NH}_4)_2\text{UO}_2(\text{CO}_3)_3$ are formed. To sep. U from Ti it is best to ppt. the Ti as H_2TiO_3 from a soln. contg. $(\text{SO}_4)^{-2}$ and made nearly neutral by adding KBrO_3 . First ppt. the U and Ti with NH_4OH and weigh as TiO_2 and U_3O_8 . Fuse with NaKCO_3 and dissolve the melt in cold, dil. HCl . Add methyl orange and neutralize with NaOH . Add 1.5 g KBrO_3 and 0.5 g K_2SO_4 . Dil. to 200-250 cc, boil 30 min and filter off the H_2TiO_3 ppt. To det. U, Ti, and Al in the presence of one another, first ppt. with CO_2 -free NH_4OH . Ignite in a Pt crucible in an elec. furnace. Weigh the U_3O_8 , TiO_2 , and Al_2O_3 . Fuse with NaKCO_3 and ppt. H_2TiO_3 ppt. with NH_4OH and add to 3 times as much 2N $(\text{NH}_4)_2\text{CO}_4$ soln. as is theoretically necessary. Heat to dissolve all the U and filter off the $\text{Al}(\text{OH})_3$ ppt. To remove adsorbed U, dissolve in HCl and repeat the treatment with $(\text{NH}_4)_2\text{CO}_3$. Ignite and weigh the Al ppt. as Al_2O_3 . Det. the U by difference, or make the filtrate acid, boil off all CO_2 and ppt. with CO_2 -free NH_4OH . Ignite and weigh as U_3O_8 . To det. U, Ti, Fe, and Al, first det. the total wt. of Fe_2O_3 , U_3O_8 , TiO_2 , and Al_2O_3 after pptn. with NH_4OH . Fuse with NaKCO_3 and dissolve the melt in HCl . Treat with an excess of $(\text{NH}_4)_2\text{CO}_3$. In the combined filtrates, det. U as above described. Dissolve the Ti, Al, and Fe ppt. in 3.3 N H_2SO_4 and ppt. first the Fe and then the Ti by the thioallic acid method. Det. the Al by difference.

1585 Müller, E. and Flath, A. "Electrometric Determination of Vanadium and Uranium Alone, Together, and in the Presence of Iron." *Z. Elektrochem.* **29**, 500-08(1923).

U and Fe can be titrated electrometrically in the presence of one another, a break in the titration curve showing the oxidation of U from U^{+4} to U^{+6} and another break the oxidation of the Fe. When V and U are both reduced by Zn, 3 end points are obtained and best at 80° . The first corresponds to the oxidation of V from V^{+2} to V^{+3} ; the second from V^{+3} to V^{+4} and the oxidation of U from U^{+4} to U^{+6} ; and the third V^{+4} to V^{+5} . When Fe, V, and U are all together they can also be detd. by reduction with Zn and titrating with KMnO_4 in acid soln. Titrating hot, the first end point is the oxidation of V from 2 to 3; the second end point represents the oxidation of the V from 3 to 4 and of the U from 4 to 6; then a third end point is best obtained cold and represents the oxidation of the Fe. Finally another hot titration shows the oxidation of V from 4 to 5.

1586 Nuzum, F. R. and Rothschild, L. L. "Experimental Uranium Nephritis. A Chemical and Pathological Study." *Arch. Internal Med.* **31**, 894-909(1923).

The induction of nephritis in the rabbit with U and the resultant acid intoxication and disturbed renal function are discussed. Acetone and diacetic acid appeared very early in the urine of these animals and was proceeded by a disturbance in the acid-base equil. of the blood, which was the first evidence of departure from normal.

1587 Pascal, P. "On the Hexametaphosphates." *Compt. rend.* **177**, 1298-1300(1923).
A brief note is included on uranyl hexametaphosphate.

1588 Porlezza, C. "Observations on the Use of Potassium Ferrocyanide in Analysis." *Ann. chim. applicata* **13**, 48-53(1923).

In the analysis of U minerals by the method of Fresenius and Hintz (*Z. anal. Chem.* **34**, 437(1895)) either during the pptn. of $\text{U}_2[\text{Fe}(\text{CN})_6]_3$ or during filtering, a light-blue ppt. often forms, even in the absence of Fe or Cu, in acid soln. (cf. Fusinieri and Tarugi, *Atti VI Congress internaz. chim. appl. Rome* **116** (1906) and Tarugi, *Rend. soc. chim. ital.* **2**, (1910)). This is proved to be due to the same general phenomenon characteristic of $\text{K}_4\text{Fe}(\text{CN})_6$ in acid soln., indicating that the methods of Fresenius and Hintz (*loc. cit.*), Browning, Ohlmüller, and Spitta (*Untersuchung u. Beurteilung des Wassers u. Abwassers*, IV ed. 139, Berlin, 1921) and Porter and Browning, *J. Am. Chem. Soc.* **43**, 111-14(1921); are unreliable under certain conditions.

- 1589 Reeh, K. and Jander, G. "The Volumetric Determination of Uranyl Compounds." Z. anorg. allgem. Chem. 129, 293-301(1923).

In attempting to reduce uranyl salt with Zn, the usual difficulties were encountered but when a German-Al coin was used and the reduced soln. titrated with KMnO_4 , excellent results were obtained. To 100 cc of soln. contg. about 0.2 g of U, in a 400 cc Erlenmeyer flask, add 20 cc of concd. H_2SO_4 and heat just to boiling. Close the flask with rubber stopper fitted with an improved Bunsen valve and a rod to which is attached a glass basket of 10 to 15 cc capacity. This basket can be made from the bottom of a test tube perforated with many holes. Place several pieces of Al in the basket and reduce the hot soln. out of contact with the air. After an hour or longer, raise the stopper, add a little NaHCO_3 soln., wash off the glass basket and its contents and titrate with 0.1N KMnO_4 . The reactions involved are as follows: $3(\text{UO}_2)^{++} + 2\text{Al} + 12\text{H}^+ \rightarrow 3\text{U}^{+4} + 2\text{Al}^{+3} + 6\text{H}_2\text{O}$; $5\text{U}^{+4} + 2(\text{MnO}_4)^- + 2\text{H}_2\text{O} \rightarrow 2\text{Mn}^{++} + 5(\text{UO}_2)^{++} + 4\text{H}^+$.

- 1590 Rideal, E. K. and Norrish, R. G. W. "The Photo-Chemistry of Potassium Permanganate. Part I. Application of the Potentiometer to the Study of Photo-Chemical Change." Proc. Roy. Soc. (London) A. 103, 342-66(1923).

Uranyl nitrate gave pos. results when examined for photoactivity using the potentiometer method.

- 1591 Riss, W. "Quantitative Separation of Uranium from Thorium and the Rare Earths in Pitchblendes by Means of Sodium Thiosulfate." Chem. Ztg. 47, 765-6(1923).

Dissolve the sample in HNO_3 and remove the silicious residue in the usual way. Evap. the filtrate to dryness several times to remove the excess acid. Finally rinse into a beaker and carefully neutralize with NH_4OH . To ppt. Th, add an excess of $\text{Na}_2\text{S}_2\text{O}_3$, boil 10 min and allow to stand 24 hrs. If sufficient $\text{Na}_2\text{S}_2\text{O}_3$ was added, the ppt. settled promptly after the boiling and is of a dirty, yellow-gray color. The supernatant liq. should be a very pale yellow and be nearly water clear. After standing some time, a further pptn. takes place and the soln. is turbid but clears again on standing. The ppt. is reddish-yellow when first thrown down, but quickly becomes light yellow and finally grayish-yellow owing to pptn. of S. The ppt. contains all the Th, the greater part of the U, and small quantities of rare earth such as Ce^{+4} . It is advisable to have the soln. very dil. and to wash the ppt. thoroughly with dil. $\text{Na}_2\text{S}_2\text{O}_3$ soln. The ppt. must also be dissolved in HCl and the above treatment repeated in order to remove the Ce. Dissolve the second ppt. in HCl and ppt. Th with $\text{H}_2\text{C}_2\text{O}_4$ leaving U in soln. Ignite and weigh as ThO_2 . To det. U it is necessary to remove the $\text{H}_2\text{C}_2\text{O}_4$ by heating with H_2SO_4 . In the filtrate from the original Th ppt., det. the other rare earths by pptn. in the usual way. Fe is pptd. with $(\text{NH}_4)_2\text{CO}_3$ and the U with NH_4OH .

- 1592 Rosseau, E. F. Activating and Sterilizing Yeast, etc. Dec. 17, 1923. (British Patent 226,534)

A soln. of a "resonating substance" (a substance capable of preserving or storing "photochem. intensity" imparted to it), such as a salt of U, Mn, or Fe, is added to a ferment to sterilize or activate it. Such a substance can also be used to set up photocatalytic reactions in solns. of sugar or formalin, after subjecting the salt first to ultraviolet rays.

- 1593 Schoep, A. "On the Chemical Formula for Uraninite." Bull. soc. chim. Belg. 32, 274-81 (1923).

The discussion is primarily concerned with Katanga pitchblende. The analytical methods applied and their results are given in moderate detail.

- 1594 Schoep, A. "On Parsonsite, New Radioactive Mineral." Compt. rend. 176, 171-3(1923). A new yellow-colored mineral found in Katanga, Belgian Congo, associated with chalcocite is reported. The approx. formula is given as $2\text{PbO} \cdot \text{UO}_3 \cdot \text{P}_2\text{O}_5 \cdot \text{H}_2\text{O}$. Optical data are presented.

- 1595 Schoep, A. "The Uraniferous (Radioactive) Minerals of Belgian Congo: Becquerelite, Curite, Soddyite, Chinkolobwite, Kasolite, Dewindtite, and Parsonsite." Bull. soc. belg. géol. paléontol. hydrol. 33, 169-97(1923).

Most of the data given here have been published previously. In addn., however, detailed accounts of analytical methods employed for these uranium minerals are given.

- 1596 Steinkuhler, W. "On the Pitchblende (Uraninite) from the Belgian Congo." Bull. soc. chim. Belg. 32, 233-8(1923).

Appearance, compn., and methods of sepn. of component metals are discussed.

- 1597 Steinkuhler, W. "Contribution to the Study of the Torbernite from Cornwall ($\text{CuO} \cdot 2\text{UO}_3 \cdot \text{P}_2\text{O}_5 \cdot 8\text{H}_2\text{O}$)." Bull. soc. chim. Belg. 32, 253-5(1923).

The method and results of analysis of the mineral are given.

- 1598 Steinkuhler, W. "On the Torbernite from Katanga. ($\text{CuO} \cdot 2\text{UO}_3 \cdot \text{P}_2\text{O}_5 \cdot 8\text{H}_2\text{O}$)." Bull. soc. chim. Belg. 32, 270-2(1923).

Density (3.84 at 17°C), compn., properties, and methods of analysis are given.

- 1599 Valdigue, A. and Aloy, J. "Catalytic Oxidation with Salts of Copper and Uranium." Bull. soc. chim. France (4), 33, 572-6(1923).

In the absence of O_2 , U salts in the presence of light effect simultaneous oxidation and reduction as do oxido-reductases. $\text{UO}_2(\text{OAc})_2$ soln. does not act upon glucose or methylene blue, but if a $\text{UO}_2(\text{OAc})_2$ soln. is exposed to sunlight in a vacuum with 1% glucose (O_2 acceptor) and methylene blue (H_2 acceptor), the latter is decolorized and the glucose is partly oxidized. On the introduction of air, the blue reappears, and may again be destroyed by exposure to sunlight. H_2O is apparently decompd., the H^+ reducing the methylene blue, and the $(\text{OH})^-$ oxidizing the glucose. The energy necessary to the reaction is derived from the sunlight. Alc., aldehydes and sugars act as O_2 acceptors, but not phenols.

- 1600 Vernadsky, W. J. "Mendelevite, New Radioactive Mineral." Compt. rend. 176, 993-4(1923). This is a report of crystal data on a yellow to green UO_2 - or UO_3 - bearing mineral found near Uluntuj.

- 1601 von Wartenberg, H., Broy, J., and Reinicke, R. "The Reduction of Scarcely Reducible Metal Oxide with Hydrogen." Z. Elektrochem. 29, 214-17(1923).

UO_2 was found to be stable to H_2 even at high pressure (25 atms.) and high temp. (m.p. of W).

- 1602 Wick, F. G. "Effect of Pressure upon Optical Absorption." Proc. Am. Acad. Arts. Sci. 58, 557-73(1923).

This work was done with a modified form of Bridgman's app. Several salts of Nd and some salts of Er, Pr, Yt, U, and Co, and glass and synthetic ruby were investigated. In general an increase in pressure produces changes in adsorption spectra similar to those produced by the lowering of temp. or the decreasing of concn. A decrease of about 10% in vol. resulted from the highest pressures used, 4000 atm. There must be more than 1 type of mechanism concerned in the changes in adsorption bands; for the magnitudes, directions, and kinds of change vary (a) with the materials examd., (b) with the different bands of the same material, and (c) with the environmental factor (temp., pressure, concn.) changed.

- 1603 Widdowson, W. P. and Russell, A. S. "The Relative Activities of Radioactive Substances in an Unchanged Primary Uranium Mineral." Phil. Mag. (6), 46, 915-29(1923).

Pitchblende was the mineral used in the investigation. A method for the prepn. of pure U_3O_8 for comparison is given.

PUBLICATIONS LOCATED IN 1924

- 1604 Ahmad, N. "Absorption of Hard γ -Rays by Elements." Proc. Roy Soc. (London), A, 105, 507-19(1924).

Expts. are reported on the adsorption of hard γ and x rays by many elements including U. The total absorption coeff. relative to an atom is given by the equation $U = 1.68 \times 10^{-25}Z + 1.60 \times 10^{-31}Z^4$ (the first member is the scattering absorption coeff., the second the true absorption coeff., $Z = \text{at. no.}$). The absorption of U at. for an electron is $U_e = 3.028 \times 10^{-25}$.

- 1605 Aloy, J. and Valdiguie, A. "Metals as Oxidation Catalysts." Bull. soc. chim. France (4), 35, 792-4(1924).

The authors have extended Bertrand's work on the catalysis of the conversion of hydroquinone to quinhydrone by Mn to a study of the influence of U on the same reaction. Agitation of a soln. of 3% hydroquinone with 2% $\text{UO}_2(\text{OAc})_2$ for 18 to 24 hrs resulted in a copious pptn. of quinhydrone. The same results were obtained with salts of Mn, Fe, Cu, and V, but salts of other common metals were without action. This was attributed not to the absence of oxidation but to insufficient sensitiveness of the quinhydrone formation. Addn. of NH_4Cl to hydroquinone soln. gave a reagent which was extremely sensitive to oxidizing influences.

- 1606 Balarev, D. "The Role of Water in the Reactions of Solid Substances. II." Z. anorg. allgem. Chem. 136, 216-20(1924).

U_3O_8 and BaO were found to react quite violently when heated to 328° . The temp. at which the reaction begins apparently depends upon how tightly the mixt. is compacted, but cannot begin any higher than 360° .

- 1607 Balarev, D. "The Thermal Decomposition of Some Acid Phosphates and Some Oxides." Z. anorg. allgem. Chem. 134, 75-8(1924).

The acid phosphates of Na, K, Rb, Cs, Ca, and Ba and UO_3 were studied with reference to the effect of the ext. pressure on the temp. of decompn. The decompn. temp. was found to vary with the pressure for all of the above substances except Na_2HPO_4 and UO_3 . The decompn. was studied by means of temp.-time curves obtained when heat was applied at a const. rate. The breaks in these curves indicated the occurrence of endothermic reactions.

- 1608 Baur, E. "Photolysis of Uranyl Oxalate." Z. physik. Chem. 111, 315-8(1924).

In 1917 it was suggested that the photolysis of oxalic acid corresponds with the equation $\text{H}_2\text{C}_2\text{O}_4 + h\nu = \text{H}_2\text{O} + \text{CO} + \text{CO}_2$, but subsequently the view was expressed that the reaction is di-quantic, glyoxylic acid being formed as an intermediate product. In view of the results of Buchi, the author now concludes that the oxalic acid ion is directly decompd. into CO and CO_2 with the absorption of 1 light quantum. It is also probable that formate photolysis likewise requires 1 quantum and is represented as follows:

- 1609 Beindl, C. Hydrocyanic Acid. April 29, 1924. (U. S. Patent 1,492,193)

U is proposed as a catalyst in the formation of HCN from N_2 , H_2 , and CO.

- 1610 Beindl, C. Hydrocyanic Acid. April 29, 1924. (U. S. Patent 1,492,194)

This process is basically the same as that recorded in U. S. Patent 1,492,193 (1924).

- 1611 Brinton, P. H. and Ellestad, R. B. "Modified Method for the Determination of Uranium in Carnotite." *Ind. Eng. Chem.* 16, 1191-2(1924).

Digest enough ore to correspond to 0.1 to 0.2 g U_3O_8 with 30 cc 7N HNO_3 , and evap. to dryness carefully. Take up the residue in 10 cc concd. HNO_3 and 100 cc water. Heat until only insol. gangue remains undissolved. Nearly neutralize with NH_4OH and add 1 g of dissolved $Pb(NO_3)_2$. Neutralize all free acid and add 10 g solid $(NH_4)_2CO_3$ in excess. Add 25 cc concd. NH_4OH , stopper tightly, and shake vigorously. Unstopper, heat for 5 min at 80° with frequent shaking, and then cool to room temp. Filter and wash with dil. $(NH_4)_2CO_3$ soln. Add 0.5 cc concd. $(NH_4)_2S$ soln. to filtrate and a few cc Et_2O . Heat gently until a ppt. of PbS settles. Filter, boil off excess sulfide, add HCl and expel CO_2 by boiling. Add HNO_3 and boil to remove free S. Neutralize with NH_4OH , add slight excess HNO_3 and ppt. U from boiling soln. by carefully adding 1.5N NH_4OH . Filter, ignite and weigh. Dissolve the impure U_3O_8 in hot HNO_3 and neutralize the dild. soln. with $(NH_4)_2CO_3$ added in excess. Filter off and weigh any ppt. Deduct this from the orig. wt. of impure U_3O_8 .

- 1612 Buchi, P. F. "Quantum Sensitiveness of Uranyl Oxalate Photolysis." *Z. physik. Chem.* 111, 269-314(1924).

The photolysis of oxalic acid in the presence of uranyl salts is to be attributed to the decompn. of the nonionized mols. of uranyl oxalate ($UO_2C_2O_4$), or of the complex ions $[UO_2(C_2O_4)_2]^{++}$. When oxalic acid is present in excess of the equimolar ratio, the velocity of decompn., is independent of the concn. of the oxalic acid, and is approx. const. If the proportion of oxalic acid is smaller, the sensitiveness to light is, however, approx. proportional to the concn. of the oxalic acid. The great stability of the complex is indicated (a) by the quant. equality of the velocity of decompn. for systems of uranyl sulfate, nitrate, and oxalate in the presence of oxalic acid, (b) by the permanence of the complex on the addn. of O_2 , HCl , H_2SO_4 , and $HCOOH$. The photolytic decompn. follows Einstein's law, 1 absorbed light quantum decomp. 1 mol. of oxalic acid. In the initial stages of the decompn. of uranyl formate in H_2SO_4 soln. 1 absorbed light quantum decomposes about 0.7 mol. of formic acid.

- 1613 Cachemaille, A. S. Extracting Refractory Metals. July 7, 1924. (British Patent 238,663) Oxides such as those of Zr, U, Th, V, Ta, and Cr are heated in an inert atm. with $BaCl_2$ and Na or with another halide of an alk. or alk. earth metal and an alk. metal other than that in the halide. Details for the prepn. of Zr are given.

- 1614 Cachemaille, A. S. Obtaining Refractory Metals from Their Oxides. July 7, 1924. (British Patent 238,347)

This is a method for the prepn. of U metal powder from oxide using alk. earth oxides or halides, especially Ca. UCl_4 (or a double halide) may be used.

- 1615 Canneri, G. and Fernandes, L. "The Analytical Separation of the Rare Earths from Uranium. Alkaline Uranylsalicylates." *Gazz. chim. ital.* 54, 770-3(1924).

The sepn. of U from rare earths by pptg. with an alk. oxalate is not satisfactory because some U is carried down (Nilson, *Ber.* 15, 2520(1882)) and because the rare earth is not completely pptd. Since U tends to form stable heteropoly cpds. with hydroxy-org. acids it was attempted to use these in the sepn. The uranyl tartrates (Itzig, *Ber.* 34, 3822(1901)) were not suited. Salicylic acid was used for the sepn. as follows with La and U: The hot weakly acid soln. was treated with excess salicylic acid. NH_4OH was then added drop by drop until the soln. became red but not in excess because the soln. must remain acid. If it becomes alk., acidity is restored with more salicylic acid. A small excess of concd. $(NH_4)_2C_2O_4$ soln. is added; the soln. is boiled; the ppt. allowed to settle and filtered off and washed with boiling $(NH_4)_2C_2O_4$ soln. The oxalate is calcined and weighed. The filtrate contg. U is acidified with concd. HCl , cooled, filtered to remove the main part of the salicylic acid, the ppt. washed with cold H_2O and the soln. evapd. to dryness and ignited on a sand bath to remove org. matter. The residue is taken up with HCl , boiled, filtered, and NH_4OH added, drop by drop, to ppt. NH_4 pyrouranate. A satisfactory sepn. was obtained with known solns. Na pyrouranate

heated with salicylic acid soln. seps., on cooling, Na uranyl salicylate, $\text{UO}_2 \left[\text{C}_6\text{H}_4 \begin{array}{c} \text{O} \\ \diagup \quad \diagdown \\ \text{CO}_2\text{Na} \end{array} \right]_2$, as orange-red needles. The corresponding K, $\text{UO}_2 \left[\text{C}_6\text{H}_4 \begin{array}{c} \text{O} \\ \diagup \quad \diagdown \\ \text{CO}_2\text{K} \end{array} \right]_2 \cdot 10\text{H}_2\text{O}$ and $(\text{NH}_4)^+$, $\text{UO}_2 \left[\text{C}_6\text{H}_4 \begin{array}{c} \text{O} \\ \diagup \quad \diagdown \\ \text{CO}_2\text{NH}_4 \end{array} \right]_2 \cdot 13\text{H}_2\text{O}$ salts were obtained in the same way. These cpds. resemble similar ones with Mo.

1616 Carobbi, G. "Supposed Isomorphism of Uranyl Compounds with Those of the Isomorphogenic Metals of the Magnesium Group." *Atti reale accad. nazl. Lincei* (5), 33, I, 228-31(1924). Exptl. support cannot be obtained for Groth's suggestion (*Chemische Krystallographie*, II, 483) that NH_4 uranyl sulfate dihydrate, which de La Provostaye (*Ann. chim. phys.* (3), 5, 47-51(1842)) showed to be monoclinic, may belong to the same group as the triclinic cpds., $\text{MnK}_2(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$, etc., and that cpds., e.g., $\text{K}_2(\text{UO}_2)(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$, isomorphous with those of the well-known series (Mg, Fe, Zn, Co, Ni) - (K, Rb, Cs, Tl, NH_4) $_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$ may exist.

1617 Clark, G. L. "The Excitation, Reflection, and Utilization in Crystal-Structure Analyses of Characteristic Secondary X-Rays." *J. Am. Chem. Soc.* 46, 372-84(1924). The spectrum from 010 planes of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ (rhombic) showing L-series W characteristic lines is given. From this it is found, together with 100 and 001 spectra, that the unit parallelepiped contains 4 mols., is face-centered and has the W lattice parameters $d_{100} = 13.01$, $d_{010} = 11.45$ and $d_{001} = 7.93 \times 10^{-8}$ cm.

1618 Colani, A. "An Acid Uranyl Acetate." *Bull. soc. chim. France* (4), 35, 1305-07(1924). A uranyl acid acetate, $\text{UO}_2(\text{OAc})_2 \cdot 2\text{HOAc} \cdot 2\text{H}_2\text{O}$, was prepd. by adding, in small portions to 500 cc boiling glacial AcOH, as much powd. $\text{UO}_3 \cdot \text{H}_2\text{O}$ as would dissolve (12 g). When it fails to dissolve readily, cease adding the oxide, boil for a few mins, cool, and decant. Yellow crystals deposit, macroscopically resembling $\text{UO}_2(\text{OAc})_2$. They are air-dried and saved in an airtight container. They decompn. in air with liberation of AcOH and formation of $\text{UO}_2(\text{OAc})_2 \cdot 2\text{H}_2\text{O}$. Analyses and proof of the formation of the acid acetate are also given.

1619 Dilthey, W. and Rauchhaupt, O. "Additive Compounds of Metallic Salts and Doubly Unsaturated Aromatic Ketones." *Ber.* 57B, 309-10(1924). UO_2Cl_2 and dibenzalacetone give the cpd. $\text{UC}_{34}\text{H}_{28}\text{O}_4\text{Cl}_2$, which is golden yellow and m. with decompn. at 264° . Dianisalacetone gives the cpd. $\text{UC}_{38}\text{H}_{36}\text{O}_8\text{Cl}_2$, as violet-red leaflets which m. 258° .

1620 Dolejšek, V. "The N Series of the X-Ray Spectra." *Z. Physik* 21, 111-19(1924). Values for the N, O, and P levels have been obtained for U, Th, and Bi.

1621 Durand, J. F. "Researches on the Formation of Metallic Acetylides." *Bull. soc. chim. France* (4), 35, 1141-4(1924). No reaction was found for U and C_2H_2 when the temp. was raised as high as 500° .

1622 Eder, J. M. and Valenta, E. *Atlas typischer Spektren*. (2nd ed.) Vienna, 1924. Page 61 contains some good photographs of the U spectrum between 750 and 260μ . Page 118 gives photographs of the spark spectrum of U.

- 1623 Feigl, F. "Capillary Chemical Processes in Spot Reactions." Kolloid-Z. 35, 344-5(1924). Examples of spot reactions on filter paper selected from previous work and important in analysis are given. The following elements have been detected in the presence of each other when the ratio of the amts. present were, Al:Fe = 1:197; U:Fe = 1:92; Al:Cr = 1:36.4; Bi:Cu:Pb:Hg = 1:84:53:30; P:H₂O (sol. of P₂O₅) = 1.460,000.
- 1624 Foote, P. D. "Nitrogen and Uranium." Nature 114, 789(1924). It is suggested that the N₂ found in U ores is the result of occlusion rather than production.
- 1625 Gudden, B. "The Range of the α -Rays from U_I and U_{II}." Z. Physik 26, 110-16(1924). In order to test Geiger and Nuttall's formula, $\log \lambda = A + B \log R_0$, connecting the range R₀ in cm with λ the disintegration const./sec, it is important to determine the range where the disintegration const. is small, as in the case of U_I. The author has studied the pleochroitic halos in blue Wolsendorf fluorspar and finds that they differ from the halos of mica and hornblende, in which the α rays deepen the color throughout their range. With the Wolsendorf fluorspar the coloration is confined to the end of the range. The radioactive nucleus is surrounded with concentric dark, spherical shells, and in sections concentric rings appear, one for each of the radioactive elements concerned. The breadth of these lines depends mainly on the dimensions of the particle of radioactive material concerned. A figure shows the dimensions of the rings for U_I, U_{II}; Io, Ra, Po, RaEm, RaA, and RaC, with three photographs showing the actual observed halos. The innermost ring is due to U_I and U_{II}, and the line is about twice as broad as those due to the other elements. It is possible to deduce the equiv. range in air in cm for these two elements from the position and breadth of this ring, the results being 2.76 cm for U_{II} and 2.68 cm for U_I. Geiger's calcd. values are 2.91 cm and 2.53 cm, so that there is a large discrepancy. The uncertainty in the author's figures is less than 1%. The life of U_{II} is about fifty times as large, according to this, as was previously supposed.
- 1626 Hendrix, B. M. and Bodansky, M. "The Relation of Acidosis and Hyperglycemia to the Excretion of Acids, Bases, and Sugar in Uranium Nephritis." J. Biol. Chem. 60, 657-76(1924). Extensive tables and 19 references are included.
- 1627 Hess, F. L. New and Known Minerals from the Utah-Colorado Carnotite Region. Washington, U. S. Government Printing Office, 1924. 25p. (U. S. Geol. Survey Bull. No. 750-D, or No. 750, p.63-78)
- This paper includes information on the description, location, and compn. of vanoxite and rauvite which are new V-U minerals. Discussions also included on metatorbernite, tyuyamunite, and zippeite from Utah.
- 1628 Hirata, H. "Constitution of the X-Ray Spectra belonging to the L-Series of the Elements." Proc. Roy. Soc. (London), A., 105, 40-60(1924). The many tables of data presented include wavelengths and other values for the L lines of U. One table lists 16 U lines in the L series.
- 1629 Hofmann, K. A. and Dolde, A. "Acceleration of Oxygen-Hydrogen Catalysis by an Oxygen Carrier and by an Alternating Current." Ber. 57B, 1969-76(1924). The Pt pole can reduce dissolved substances which are readily reducible and diffusion of O₂ need not take place to the pole. This sets up an equil. PtH $\rightarrow$ reduction product = oxidation product - O₂. The intermediate steps may take place very rapidly. With pure H₂ and Pt the following reductions were practically complete in N H₂SO₄: Ti⁺⁴ $\rightarrow$ Ti⁺³, U⁺⁶ $\rightarrow$ U⁺⁴, Fe⁺³ $\rightarrow$ Fe⁺⁺, and V⁺⁵ $\rightarrow$ V⁺³.
- 1630 Holmes, W. C. "Photochemical Decomposition of Oxalic Acid in the Presence of Uranium Salts." Am. Dyestuff Repr. 13, 188, 197-8(1924). In the presence of U salts, (COOH)₂ is decompd. by light, the reaction serving as an effective chem. photometer. The residual acid at the conclusion of the exposure may be detd. by titration with permanganate. The influence of the concn. of the U salts, concn. of the acid, rate of action during exposure, activity of different rays and several other factors were detd. by Holmes in collaboration with Gibbs in 1910.

- 1631 Jander, W. "On the Preparation of Pure Uranium." Z. anorg. allgem. Chem. **138**, 321-9 (1924).

Reduction of UO_2 by means of Ca at 95 to 1250° yields U with at most 0.09% O as impurity, if the reduction is carried out in an iron crucible lined with CaO. When an unlined crucible is used, Fe contaminates the product. The yield amts. to only 2.7%.

- 1632 Lang, R. J. "The Ultra-Violet Spark Spectra of Some of the Elements." Trans. Roy. Soc. London, A, **224**, 371-419(1924).

A vacuum grating spectrograph, which is described, was used to photograph the spark spectra of some of the elements between the approx. 2000 and 200A in the extreme ultraviolet. In the tables are recorded the vacuum wavelengths measured in A and the corresponding wave numbers for the elements C, Ca, Ti, V, Cr, Mn, Co, As, Mo, Cd, Sn, Sb, Te, Ce, Pt, Au, Tl, Pb, Bi, and U.

- 1633 Ludewig, P. and Lorensen, E. "The Applicability of Normal Radium and Uranium Solutions for Emanation Measurements. Part II." Z. Physik **21**, 258-63(1924).

The former investigation has been contd. for a second yr, when the solns. then employed have been found not to lose their utility even after being used 9 times. During the two yrs they have remained const. within 2%. The pressure dependence of the ionization of the γ radiation of a Ra prepn. and of the α radiation of an emanation has now been experimentally investigated. This observed dependence has been used for the calcn. of the amt. of an emanation. A table of data is included.

- 1634 Lundell, G. E. F. and Knowles, H. B. "The Use of Cool Solutions in the Jones Reductor." Ind. Eng. Chem. **16**, 723-4(1924).

Expts. at the Bureau of Standards show that the reduction of $(\text{UO}_2)^{++}$ succeeds equally well when the solns. are at room temp. as when hot. There is probably no danger from H_2O_2 being formed as had been feared but it is well to keep air out of the reductor because of its oxidizing effect. The reduction period can be reduced to 2 min and 1% H_2SO_4 or 3 to 15% HCl can be used instead of 5% H_2SO_4 by boiling. The reduction succeeds with 0.2 N solns. as well as with more dil. ones. A column of Zn-Hg measuring 23 cm is satisfactory. Zn freshly amalgamated with 5% Hg or with 1% Hg and activated by passing a sulfate soln. contg. 6 mg of Pt, is recommended for the reductor.

- 1635 MacNider, W. deB. "A Review of Acute Experimental Nephritis." Physiol. Revs. **4**, 595-638(1924).

This review paper contains a discussion of nephritic conditions resulting from U, Cr, Hg, and other materials taken into the body.

- 1636 Major, R. H. "The Excretion of Creatinine in Uranium Nephritis." J. Lab. Clin. Med. **9**, 701-04(1924).

- 1637 Meyer, R. J. and Nachod, H. "The Sulfate of Quadrivalent Uranium." Ann. **440**, 186-99(1924). $\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$ can be purified as follows: Treat the slightly acid soln. with H_2S to remove impurities, ppt. the sulfide with NH_4SH , ignite the ppt. to U_3O_8 , dissolve the latter in HNO_3 and H_2SO_4 , evap. to remove excess acids and cryst. the pure sulfate from H_2O . Reduction is best done electrolytically in a soln. contg. twice the theoretical amt. of H_2SO_4 , with Hg cathode and a C rod as anode, and a current of 3 to 5 amp. The reduced soln. turns finally to a dark fluorescent greenish-violet color. The concd. solns. are stable. From solns. slightly acid with H_2SO_4 $\text{U}(\text{SO}_4)_2 \cdot 8\text{H}_2\text{O}$ sepd. at temps. between 0 and 75°, but from strong acid solns., at temps. between 0 and 70° only $\text{U}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ was obtained. $\text{U}(\text{SO}_4)_2 \cdot 8\text{H}_2\text{O}$ is transformed to $\text{U}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ at 68°, loses 6 mols. of H_2O at 100°, 7.5 mols. at 200° and is anhyd. between 290 and 300°. The soly. of $\text{U}(\text{SO}_4)_2 \cdot 8\text{H}_2\text{O}$ in 0.1 N H_2SO_4 varies from 6.61 g $\text{U}(\text{SO}_4)_2/100$ g soln. at 15.5°, to 29.93 g at 60.0°, while that of $\text{U}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ decreases from 13.68 g at 22.7° to 6.93 g at 80.0°. The soly. curves indicate a transition point near 26° but none was found.

- 1638 Nagaoka, H. and Sugiura, Y. "Distribution of Electric Field in Metal Arcs and the Stark Effect Observed in Arcs of Silver, Copper, Magnesium, Chromium, Nickel, Cobalt, Iron, and Ten Other Metals." Sci. Papers Inst. Phys. Chem. Research (Tokyo) 2, 139-67(1924).
A method of stabilizing metal arcs for investigation of the Stark effect of spectral lines is described. If capacity of over 1 F and large self-inductance is introduced between the electrodes, and a 500 v, d.c. generator is used, an arc of 7 cm can be steadily maintained with C as cathode and metal as anode. The potential drop along the arc is examined; the electrodes are found to be the seats of strong elec. fields due to the presence of an elec. double layer which is formed when the current surpasses a crit. value; in different metals, fields of 20×10^4 to 6×10^4 v/cm are obtained. The Stark effect was studied by photographing the spectra of these stabilized arcs, the results are given in tables and plates for the following elements: Ag, Cu, Mg, Cr, Ni, Co, Fe, V, U, Al, Sn, Pb, Bi, Zn, Cd.
- 1639 Nagaoka, H. and Sugiura, Y. "Distribution of Electric Field in Metal Arcs and the Stark Effect Observed in Arcs of Silver, Copper, Magnesium, Chromium, Nickel, Cobalt, Iron, and Ten Other Metals." Japan. J. Phys. 3, 45-73(1924).
This article is similar to that published in Sci. Papers Inst. Phys. Chem. Research (Tokyo) 2, 139-67 (1924).
- 1640 Pauling, L. and Dickinson, R. G. "The Crystal Structure of Uranyl Nitrate Hexahydrate." J. Am. Chem. Soc. 46, 1615-22(1924).
Orthorhombic crystals of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ were investigated by means of spectral photographs of the Mo K radiation and Laue photographs, and the results interpreted with the aid of the theory of space groups. The unit parallelepiped contains 4 mols., has the dimensions $d_{100} = 13.15$, $d_{010} = 8.02$, and $d_{001} = 11.42$ A., and is end-centered on (001). The space group symmetry is V_h^{17} with U atoms at $(0, u, 1/4)$ $(0, u, 3/4)$ $(1/2, 1/2 + u, 1/4)$ $(1/2, 1/2 - u, 3/4)$, where $u = 0.13$. Other atoms are not placed. Preliminary results of Clark which gave essentially the same cell dimensions are criticized.
- 1641 Russell, A. S. "Need for the Redetermination of the Atomic Weights of Uranium, Thorium, and Radium." Nature 114, 717-18(1924).
For reasons based on mass numbers, the at. wt. of at least one of the elements U, Th, or Ra is shown to be incorrect. Russell suggests that the at. wt. of all three be redetd.
- 1642 Rutherford, E. and Chadwick, J. "Further Experiments on the Artificial Disintegration of Elements." Proc. Phys. Soc. (London) 36, 417-22(1924).
It is reported the α bombardment of U produces no protons.
- 1643 Rutherford, E. and Chadwick, J. "The Bombardment of Elements by α -Particles." Nature 113, 457(1924).
No effect was found on bombarding U with α particles.
- 1644 Schoep, A. "On the Crystalline Form of Becquerelite and of Schoepite; on Their Chemical Composition and on Polymorphism of the Hydroxide of Uranium $\text{UO}_3 \cdot 2\text{H}_2\text{O}$." Bull. soc. chim. Belg. 35, 88-95(1924).
A full description of schoepite, which is reported to be $\text{UO}_3 \cdot 2\text{H}_2\text{O}$, is given. It is reported to be identical to becquerelite. The crystal polymorphs of $\text{UO}_3 \cdot 2\text{H}_2\text{O}$ are then discussed at length.
- 1645 Schoep, A. "On the Chemical Composition of Fourmarierite." Bull. soc. chim. Belg. 33, 558-62(1924).
This is a description and identification of a mineral of the approx. composition $\text{PbO} \cdot 5\text{UO}_3 \cdot 10\text{H}_2\text{O}$. Analytical results on a number of samples are included.

- 1646 Schoep, A. "Dumontite, New Radioactive Mineral." Compt. rend. 179, 693-5(1924).
Brief optical and chem. data are given on mineral associated with torbernite found near Chinkolobwe, Belgian Congo. The approx. formula given is $2\text{PbO} \cdot 3\text{UO}_3 \cdot \text{P}_2\text{O}_5 \cdot 5\text{H}_2\text{O}$.
- 1647 Schoep, A. "Skłodowskite, New Radioactive Mineral." Compt. rend. 179, 413-15(1924).
A new citron-yellow mineral found near Chinkolobwe, Belgian Congo, of the approx. formula, $\text{MgO} \cdot 2\text{UO}_3 \cdot 2\text{SiO}_2 \cdot 7\text{H}_2\text{O}$, is reported. Optical and chem. data are included.
- 1648 Sidgwick, N. V. "The Behaviour of the Simple Halides with Water." J. Chem. Soc. 125, 2672-4(1924).
 UF_6 is one of the materials discussed.
- 1649 Tomiček, O. "The Application of Titanous Chloride in Potentiometric Titrations. IV. The Estimation of Oxidizing Cations." Rec. trav. chim. 43, 798-807(1924).
A potentiometric detn. of U is discussed which is said to be very good. The U^{+6} is reduced using TiCl_3 soln. at 55 to 65° with all air excluded in a soln. contg. not more than 2% HCl and some K-Na tartrate.
- 1650 van Arkel, A. E. "Crystal Structure and Physical Properties." Physica 4, 286-301(1924).
The crystal structure of the oxides was in the regular system (fluorite type); ZrO_2 with $d_{100} = 5.08$ A.; ThO with $d_{100} = 5.26$ A.; UO_2 with $d_{100} = 5.48$ A.; SrF_2 with $d_{100} = 5.86$ A.
- 1651 Vernadsky, W. and Chamié, C. "On a Pseudomorph of Curite." Compt. rend. 178, 1726-8 (1924).
A discussion of the lead uranyl hydrated oxides discovered in the Belgian Congo is given.
- 1652 Voelcker, J. A. "Pot Culture Experiments, 1923." In [Annual] Report of the Rothamsted Experiment Station, 1923-4. Harpenden, Eng., Imperial Bureau of Soil Science. 1924(?).
Expts. on the effect of U cpds. on wheat indicated that, with the doubtful exception of a 0.1% dose of $\text{Na}_2\text{U}_2\text{O}_7$, U has no good effect and in most forms was actually harmful.
- 1653 Vogel, J. L. F. "Notes on Alloy Metals Used in Alloy Steels." J. Soc. Chem. Ind. 43, 365-9 (Trans.)(1924).
This is a discussion of the metals which are alloyed with steel for special purposes, and a comparison of them with other metals which have a deleterious action on the steel when present in excessive quantities. The elements employed in special steel manuf. are Ti, Zr, C, Si, V, Cr, Mo, W, U, Mn, Co, and Ni. These metals for the most part form exceedingly hard carbides in the steel, which are uniformly distributed through the matrix. Al is also used, but rather as a reagent for removing O than for any other purpose. The elements which have a bad effect on the steel are Cu, Sn, Sb, Bi, P, As, and S. The only common factor about the useful alloy metals is their high m.p., Mn being the only one which melts substantially lower than Fe. The uses and amts. of each metal permissible in each case are discussed.
- 1654 Voigt, A. and Biltz, W. "On the Electrolytic Conductivity of Fused Chloride." Z. anorg. allgem. Chem. 133, 277-305(1924).
The chlorination of a mixt. of 30 g of pure UO_2 and 6 g of sugar charcoal at bright-red heat is reported to produce UCl_4 . If the reaction tube is tilted slightly the melt material will run out. It is said that the UCl_4 can be freed of UCl_5 by distn. The UCl_4 solidifies at 567° and will melt to give a dark-red liq. The cond. values found for UCl_4 were reported to vary linearly with temp. The b.p. of UCl_4 is reported as 618°.

1655 Wawilow, S. J. "The Fluorescence Yield of Dye Solutions." *Z. Physik* **22**, 266-72(1924). Results on fluorescence yield in U glass are included for comparison.

1656 Weigand, E. "On the Total Radiation of the Illuminating Element of the Nernst Lamp at Different Temperatures." *Z. Physik* **30**, 40-9(1924).
The absorption power of U_3O_8 is said to be 0.76 for 0.65μ radiation.

PUBLICATIONS LOCATED IN 1925

1657 Aloy, F. J. and Valdiguie, A. "Changes Induced by Sunlight in the Presence of Uranic Compounds." *Bull. soc. chim. France* (4), **37**, 1135-40(1925).
When various org. cpds. are mixed with 5% U salt solns. in glass tubes and exposed to sunlight for a few hrs, the ease with which a violet ppt. of $U_3O_8 \cdot 2H_2O$ is formed, serves as a std. of comparison of their relative stability. The discoloration of methylene blue is another test of reducing power. Substances with satd. C-C linkages in general were most resistant to catalytic decompn. by U salts. Aldehydes gave pos. results, but ketones were resistant to change. Ethylenic cpds. gave abundant violet ppts.

1658 Anderson, W. T. Jr. and Robinson, F. W. "The Oxalic Acid-Uranyl Sulfate Ultra-Violet Radiometer." *J. Am. Chem. Soc.* **47**, 718-25(1925).
The photochem. decompn. of aq. $H_2C_2O_4$ soln. sensitized by UO_2SO_4 has been investigated by Mathews and Dewey, *J. Phys. Chem.* **17**, 216(1913). The authors have studied this reaction exhaustively, and find that it possesses the desired characteristics for an ultraviolet radiometer. It is a simple reaction, easily followed, proceeds with a moderate velocity, is readily reproduced, and is sensitive throughout the range of ultraviolet emitted by a quartz mercury arc, and to the ultra-violet alone. Two stock solns. are employed: (1) 6.3 g pure $H_2C_2O_4$ crystals and 4.27 g $UO_2SO_4 \cdot 3H_2O$ are dissolved in 1 l of distd. water; (2) a 0.1 N soln. of $KMnO_4$ soln. is prep'd., to be standardized against the $H_2C_2O_4$. 25 cc of soln. (1) are exposed to the radiation in a transparent fused-quartz vessel, and after a definite time titrated against soln. (2). The result may then be stated in mg $H_2C_2O_4$ decompd. or may be expressed in ergs; e.g., with the above solns., and under certain specified conditions, 1 mg $H_2C_2O_4$, decompd. in 30 min, corresponds to 4.84×10^5 ergs/sec for the complete ultraviolet. The method is of sufficient accuracy for ordinary detns., does not require frequent calibrations, is not affected by vibration and magnetic disturbances, and requires no correction for visible and infrared radiations. The temp. coeff. is only 1.035 for an interval of $10^\circ C$.

1659 Andrews, L. W. "The Uranato-Malate Complex." *Proc. Iowa Acad. Sci.* **32**, 299-320(1925).
The enhancement of the optical activity of malic acid by uranyl salts has been studied. The uranato-malate complex, to which this high polarizing power is due, has been isolated as an NH_4 salt, $UO_2 \cdot C_4H_3O_5NH_4$, in 2 forms, with $1/2$ and 2 mols. of H_2O , resp., and as a Ba salt. The formula $O \cdot UO_2 \cdot O_2C \cdot CH_2 \cdot CHCO_2M$ probably expresses the constitution of the uranato-malic complex. The formation of this complex by the action between $UO_2(OAc)_2$ and Na malate takes place slowly. The optical activity of the mixt. increases on standing. Three to 10 hrs usually is required to reach a max. At high diln., there is a diminution of the specific rotatory power of such mixts. This phenomenon is explained by the hydrolytic dissocn. of the active complex. A rigorous quant. concordance is shown to exist between the observations and the theoretical dissocn. formula. The consts. in question have been detd. The molar rotatory power of the nonhydrolyzed uranato-malate complex is computed to be $4038 V^\circ$ as detd. in a 200 mm tube at 20° . The relation between amt. of malic acid/100 cc and rotatory power (at 20° , 200 mm tube, in V°) is represented by the expression: $p = 0.033192 V + 0.006 V$. A table is presented showing for each V° the corresponding malic acid %. The d. of $UO_2(OAc)_2$ solns. have been detd. and found to be approx. expressed by $p = 179.2(d - 1)d$, in which p is g salt/100 cc and d. is at 25° . The conditions for the successful application of the results to the

analytical estn. of malic acid in the absence and presence of citric acid, are reported. A method for the detn. of U polariscopically using excess Na malate is outlined.

- 1660 Baur, E. "Photolysis of Methylene Blue, Sensitized by Zinc Oxide." Trans. Faraday Soc. **21**, 627-9(1925).

The concept that photolysis is a mol. electrolysis is illustrated for the photolysis of HOAc sensitized by $(\text{UO}_2)^{++}$, and AgNO_3 and methylene blue sensitized by ZnO.

- 1661 Bayle, E., Fabre, R., and George, H. "The Study of Fluorescence and Its Applications." Bull. soc. chim. France (4), **37**, 89-115(1925).

Fluorescence of const. intensity was produced by exposing the substance to ultraviolet light of 3650 Å., transmitted through a glass filter composed of SiO_2 50, K_2O 16, BaO 25, and NiO 9%. Curves are given for U nitrate which show the relative intensities of the fluorescence for the different wave-lengths as detd. by a spectrophotometer. The observation of the curve is recommended for a detn. of traces of many substances.

- 1662 Berger, G. "The Photocatalytic Effect of Neutral Salts." Rec. trav. chim. **44**, 47-67(1925). Reaction of uranyl formate is a purely ionic reaction. The data are given in detail and discussed at length. It was found that in ionic reactions there is a large salt effect, while in reactions between neutral components there is a small salt effect. In the higher salt concns. a secondary action of the electrolyte was observed in addn. to the general retarding of the reaction by the activity effect. This secondary effect retards or accelerates the reaction, depending upon whether the light-sensitive complex is pos. or neg. and is superposed upon the general effect. The consequences of the applicability of the activity theory to light reactions on the mechanism of reactions is discussed.

- 1663 Berghman, A. G. "The Hydration Water of Crystalline Compounds." Zhur. Russ. Fiz. Khim. Obshchestva **56**, 177-232(1925).

The purpose of the paper was to furnish evidence of the analogy between vapor tension and the elec. potential of metals. The theoretical and exptl. aspects of vapor-tension methods as applied to the study of hydrates are discussed. Van Bemmelen's method, being the most reliable and expedient, was used for the study of vapor tensions at 15° of 16 systems (anhyd. salt - water) including $\text{Ca}(\text{UO}_2)_2(\text{PO}_4)_2$, $\text{Cu}(\text{UO}_2)_2(\text{PO}_4)_2$, and $\text{Co}(\text{UO}_2)_2(\text{PO}_4)_2$. Conclusions: cryst. hydrates have 2 vapor tensions. The one which is usually observed and detd. represents the vapor tension of the efflorescent crystals. The other is considerably lower (1/70 as great for CdSO_4) and belongs to the intact crystals.

- 1664 Britton, H. T. S. "Electrometric Studies of the Precipitation of Hydroxides. IV. Precipitation of Mercuric, Cadmium, Lead, Silver, Cupric, Uranic, and Ferric Hydroxides by Use of the Oxygen Electrode." J. Chem. Soc. **127**, 2148-59(1925).

Although it is not certain that this order represents the actual basic strength of the hydroxides, it can be said that these hydrion concns. underlie many of the reactions of the various sepns. which are used in analytical chem.

Hydrion concn.	Metal ion.
10^{-11}	Mg^{++}
10^{-9}	Ag^+ , Mn^{++} , La^{+3} , Hg^{++}
10^{-8}	Ce^{+3} , Co^{++} , Ni^{++} , Cd^{++} , Pr^{++} , Nd^{++} , Yt^{++} , Sa^{++} , $\text{Fe}^{++}(?)$, $\text{Pb}^{++}(?)$
10^{-6}	Zn^{++} , Be^{++} , Cu^{++} , Cr^{+6}
10^{-5}	Al^{+3}
10^{-4}	U, Th
10^{-3}	Sn^{++} , Zr^{++} , Fe^{+3}

The ppt. obtained by adding NaOH to $\text{UO}_2(\text{NO}_3)_2$ soln. was chiefly hydroxide and not $\text{Na}_2\text{U}_2\text{O}_7$ as often stated. Significant changes in color were observed in the titration of uranyl and ferric salts which can be best explained by the colloid theory.

- 1665 Canneri, G. "Double Sulfates and Chromates of Guanidine with the Bivalent and Tervalent Metals." *Gazz. chim. ital.* **55**, 611-15(1925).

The double sulfates of guanidine $(\text{CN}_3\text{H}_5)_2 \cdot \text{H}_2\text{SO}_4 \cdot \text{R}'' \text{SO}_4 \cdot 6\text{H}_2\text{O}$ (in which $\text{R}'' = \text{Mg, Zn, Cd, Fe, Ni, Co, Mn, Cu, and UO}_2$) were obtained by crystg. at room temp., solns. obtained by dissolving the component salts in equimol. amts. in the min. amt. of H_2O .

- 1666 Canneri, G. and Fernandes, L. "Complex Sulfites and Thiosulfates of the Rare Earths." *Gazz. chim. ital.* **55**, 440-53(1925).

H_2SO_4 in forming complex metallo-sulfurous anions gives rise to 2 series of heteropoly cpds.—the uranyl sulfites and the molybdosulfites—the structure of which is known and fully reviewed here. In the prepn. of the uranyl sulfites the rare-earth hydroxide was suspended in the smallest possible quantity of H_2O and SO_2 passed to satn., giving the bisulfite. An aq. suspension of NH_4 pyrouranate was satd. with SO_2 giving a limpid liq. The 2 solns. were united and heated moderately at reduced pressure. The complex seps. as a yellow ppt. that was filtered off and washed with EtOH and Et_2O . These salts are insol. in H_2O , EtOH , and Et_2O , but sol. in dil. acids with the evolution of SO_2 . The product thus obtained failed to give a definite cpd. It appeared to be a mixt. from which the constituents could not be sepd. The hydroxide and the pyrouranate were then suspended in H_2O and satd. with SO_2 and enough H_2O was added for complete soln. This was then crystd. by heating on a H_2O bath in a current of SO_2 . These products resembled the others and had a variable compn. These results show the influence of temp. and pressure on these solns. of uranyl sulfites satd. with SO_2 and the sepn. of addn. products that vary in compn. depending on the SO_2 content and the component in excess. The successful procedure follows: the rare-earth bisulfite was prepd. as before and added to an aq. soln. of UO_2SO_4 . The mixt. was allowed to crystallize by slow evapn. in vacuum at room temp. The product resembled those obtained before but had a const. compn. $(\text{UO}_2)_5(\text{SO}_3)_3\text{R}_2 \cdot 3.15\text{H}_2\text{O}$ ($\text{R} = \text{La, Ce, Nd, Pr}$, all of which were obtained) and by analogy with the result of Kohlschutter (*Ann.* **144**, 1(1900)) may be constituted thus: $\text{O}_3\text{S}:\text{R} \cdot \text{SO}_3 \cdot \text{UO}_2 \cdot \text{SO}_3 \cdot \text{UO}_2 \cdot \text{SO}_3 \cdot \text{UO}_2 \cdot \text{SO}_3 \cdot \text{UO}_2 \cdot \text{SO}_3 \cdot \text{UO}_2 \cdot \text{SO}_3 \cdot \text{R}:\text{SO}_3$.

- 1667 Colani, A. "Study of Uranyl Oxalate." *Bull. soc. chim. France* (4), **37**, 856-61(1925). Action of heat. Courtois' results in obtaining $\text{UO}_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$ from the trihydrate by heating to const. wt. at 100° are confirmed. Rehydration results upon exposure to air. Soly. in water. (g of anhyd. salt/g water) 11° , 0.45; 20° , 0.50; 50° , 1.00; 75° , 1.65; 100° , 3.06. Soly. in acids. Uranyl oxalate is fairly stable in dil., but readily decompd. in strong acid solns. Tables are given for HCl , H_2SO_4 , HNO_3 , H_3PO_4 , and $\text{H}_2\text{C}_2\text{O}_4$. Action of salts. Double salts with alk. are obtained by boiling with concd. solns. and crystg.

- 1668 De, R. "Uranium X: Its Extraction and Estimation." *J. Sci. Assoc. Maharajah's Coll.* **2**, 43-52(1925).

A method is described for the sepn. of UX from uranyl salt, a modification of McCoy's method being employed for the estn. of this substance by comparison with the β activity of U_3O_8 .

- 1669 Dieke, G. H. and van Heel, A. C. S. "The Difference in the Fluorescence and the Absorption Spectrum of Uranyl Salts." *Verslag Gewone Vergader. Afdeel. Natuurk. Nederland. Akad. Wetenschap.* **34**, 652-3(1925).

Whereas UO_2 salts fluoresce with a group of bands of const. freq. difference, the absorption spectrum has a similar group with smaller difference. The authors explain this by assuming the existence of 2 sets of energy levels in the UO_2 group, one for the normal state, the other for the excited state.

- 1670 Dieke, G. H. and van Heel, A. C. S. "On the Difference of the Fluorescence and Absorption-Spectra of the Uranyl Salts." *Proc. Koninkl. Akad. Wetenschap. Amsterdam* **28**, 953-4(1925). This paper is an English translation of that published in *Verslag Gewone Vergader. Afdeel. Natuurk. Nederland. Akad. Wetenschap.* **34**, 652-3(1925).

1671 Duval D'Adrian, A. L. Reducing Metallic Oxides. Jan. 13, 1925. (U. S. Patent 1,523,103)
A metallic oxide such as one of Co, Ni, W, U, Cr, Mo, Zr, V, Ta, or Th is mixed with C and the mixt. formed into electrodes between which an arc subsequently is produced to reduce the oxides to metal without the substantial production of slag.

1672 Fernandes, L. "The Coordination Valence of Two Hydroxy Groups in Ortho Position. I. Complexes of Pyrocatechol and Pyrogallol with the Acids of the Molybdenum Group." Gazz. chim. ital. 55, 424-40(1925).

In this paper cpds. of MoO₂, WO₃, and UO₃ with pyrocatechol and pyrogallol are described. The free acids of these complexes are unstable while the salts are quite stable. These complex acids are mostly weak and with alk. metals or Tl they give acid salts; with org. bases they give disubstituted well-crystd. salts. A series of salts contg. 1 mol. of the phenol and another having 2 mols. for each mol. of MoO₃ was obtained. The 1st contains 1 mol. H₂O but the 2nd does not. The constitution of the series is represented thus:

Ti, guanidine, pyridine, etc., Ph = aromatic org. cpds. contg. 2 OH groups in the o-position to each other. Among the cpds. besides pyrocatechol and pyrogallol that form such colored complexes are hydroxyhydroquinone, 1, 2- and 2, 3-naphthols, etc., also alizarin, adrenaline, pyrocatecholaldehyde. In cpds. having 3 OH groups the 3rd OH does not show a coordination valence. The 1st type of cpds. is obtained easily by heating and successive evapn. of solns. contg. stoichiometric amts. of the phenol and inorg. salt. The 2nd type was usually more difficult to prep. In aq. soln. cpds. of the 1st type are usually obtained; a large excess of the phenol is required to give the 2nd. In EtOH soln. this excess is not required. The mass action effect of the H₂O in this reaction is visualized by the equil.:

The fact that the H₂O is only eliminated from these salts of the 1st type with difficulty indicated that it is probably H₂O of constitution. The salts of pyrocatechol are more stable than those of pyrogallol. Uranyl sulfate uranate with the calcd. amt. of pyrocatechol and then C₅H₅N pptd. pyridine pyrocatecholaquouranate,

pyrocatechol is present pyridine dipyrocatecholaquouranate,

salts. Pyridine dipyrogallol uranate was prepd. from uranyl sulfate, excess pyrogallol, and C₅H₅N.

1673 Fernandes, L. "On the Coordination Valence of Two Hydroxy Groups in Ortho Position. I. Complexes of Pyrocatechol and of Pyrogallol with the Acids of the Molybdenum Group." Atti reale accad. nazl. Lincei (6), 1, 439-43(1925).

The information presented in this paper is similar to that published in Gazz. chim. ital. 55, 424-40 (1925).

- 1674 Fernandes, L. "The Isomorphism between Quadrivalent Uranium and Zirconium." Atti reale accad. nazl. Lincei (6), 2, 182-6(1925).

In this paper the cpds. $\text{Zr}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ and $\text{U}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ which crystd. in the rhombic system like the corresponding Ce and Th salts, were studied. These 4 salts of Zr, U, Ce, and Th constitute an interesting isomorphous series capable of giving solid solns. in a relatively vast range and this isomorphism serves to explain the frequently relatively high U content of Zr minerals. Probably hafnium sulfate is also isomorphous with the 4 above cpds.

- 1675 Friederich, E. "Some Previously Unknown Properties of Simple Compounds, and Remarks on the Kinds of Solid States." Z. Physik 31, 813-27(1925).

The electrical resistivity in ohms/mm² is reported for UO_2 (blue), UO_2 (brown), and U_3O_8 as 30×10^3 , 26.5×10^6 , and 42×10^6 , resp. The author classifies cryst. solids in the following groups: noble-gas lattice where electrons are not involved, e.g., solid Ar; mol. lattice where electrons are involved in holding atoms together to form a mol. but not in holding mols. together, e.g., solid CO; ion lattice which shows electrolytic cond., e.g., NaCl; atom lattice without cond. e.g., SiC; atom lattice with a free valence electron, e.g., MoC and metals; atom lattice with cond. due to kernal electrons, e.g., CdO; atom lattice with both kinds of cond., e.g., Pb.

- 1676 Friederich, E. and Sittig, L. "Preparation and Properties of High-Melting Lower Oxides." Z. anorg. allgem. Chem. 145, 127-40(1925).

UO_2 (brown in H_2 and blue in N_2) was prepd. from U_3O_8 . It is reported to have a hardness of about 5 and m. from 2500 to 2600°. The elect. resistance was very high.

- 1677 Gaschler, A. "The Transmutation of Uranium into Uranium-X." Nature 116, 396-7(1925).

A thin layer of U oxide, which had been freed from radioactive by-products when placed on one Hg electrode of an exhausted tube and treated repeatedly for 30 hrs with an electric current, gave a relatively strong and increasing radioactivity due to the production of UX. The U oxide after the above treatment had a radioactivity varying from 1.4 to 20 times that of an equal weight of oxide in equil. with its disintegration products.

- 1678 Grumbach, A. and Schlivitch, S. "Variation of the Surface Tension of Liquids under the Influence of Radiation." Compt. rend. 181, 241-3(1925).

By placing a drop of certain liqs. in a horizontal capillary tube, and exposing one meniscus to light from a Hg arc, increased surface tension was estd. by the speed of motion toward the light end, which is of the order of 1 to 2 mm/hr. Aq. solns. of $\text{UO}_2(\text{NO}_3)_2$ showed the phenomenon.

- 1679 Hahn, O. "The Isotopes of Uranium." Z. anorg. allgem. Chem. 147, 16-23(1925).

From measurements of the range of α rays of U, the practical at. wt. of a mixt. of U_I and U_{II} yielded 237.92. The direct value is, however, about 238.2. This high at. wt. cannot be explained by the presence of only two isotopes.

- 1680 Hedvall, J. A. "Contribution to the Knowledge of the Complex Uranyl Carbonates." Z. anorg. allgem. Chem. 146, 225-9(1925).

Uranyl carbonate is not known in the free state. Among the complex uranyl carbonates, the K, Na, and NH_4 salts have been previously described. On adding to a soln. of NH_4 uranyl carbonate a soln. of a salt contg. a heavy metal, a complex may be obtained contg. both the uranyl group and the heavy metal. Ag, Hg^+ , Hg^{++} , Cu, Pb, Cd, Zn, Fe^{++} , Ni, Co, Ba, and Sr give a complex carbonate; Mg, Ca, Al, and Mn do not.

- 1681 Herasymenko, P. "Reduction of Uranyl Salts with a Dropping Mercury Cathode." Chem. Listy 19, 172-9(1925).

The first reduction potential obtained in the electrolysis of UO_2SO_4 with the dropping Hg cathode corresponds to the change $\text{U}^{+6} \rightarrow \text{U}^{+5}$, the change of potential for tenfold diln. being on the av. -0.056 v. The mechanism of the reaction may be: $(\text{UO}_2)^{++} + 2e = \text{UO}_2$ followed by $\text{UO}_2 + (\text{UO}_2)^{++} = (\text{UO}_2\text{O}_4)^{++}$. Quinquevalent U is known to exist in UCl_5 . Polarization curves show that U is not reduced to lower valencies until the cathodic polarization becomes much higher than that necessary for the first stage. They exhibit characteristic max. of intensity of the polarizing current accompanying regularly the first stage of reduction. Certain electrolytes minimize the formation of these max., probably facilitating the adsorption of the products of electrolysis at the cathode.

- 1682 Heusler, O. Zur Kenntnis des Gleichgewichts bei der Reduktion von Chromesquoxyd und Urandioxyd mittels Dohlenstoffs, sowie bei der Einwirkung von Stickstoff auf Urancarbide. Dissertation, Univ. of Frankfurt am Main, 1925.

This paper confirms the opinions that U carbide obtained by the reduction of U cpds. with C has the formula UC_2 , as previously suggested by Lebeau. The effect of N_2 on the cpd. is investigated.

- 1683 Isnard, E. "Uranyl Cacodylate." Bull. sci. pharmacol. 32, 131-2(1925).

$\text{UO}_2[(\text{CH}_3)_2\text{AsO}_2]_2$ is prepd. by treating a soln. of $\text{UO}_2(\text{NO}_3)_2$ with $\text{Na}(\text{CH}_3)_2\text{AsO}_2$. The ppt. thus formed is filtered, washed free of sol. matter and dried, then it appears as a greenish-white powder which is decompd. by heat without melting. It is insol. in H_2O and in AcOH ; sol. in HCl , the soln., when treated with an alk., yields a mixt. of alk. uranate and cacodylate. Uranyl cacodylate triturated with olive oil is less reactive to alk. solns. The As content by the Kohn-Abrest method was 27.63% (theory 27.5%).

- 1684 Isnard, E. "Uranic Combinations of Hexamethylenetetramine." Bull. sci. pharmacol. 32, 659-61(1925).

An attempt was made to combine $(\text{CH}_2)_6\text{N}_4$ with $\text{UO}_2(\text{NO}_3)_2$ to form a substance having antisiphilitic properties. The result was not altogether successful.

- 1685 Kahler, H. "Band Spectra of Coupled Systems." Phys. Rev. (2), 25, 717(1925).

The spectra of the crystals contg. U oxide consist of bands in the blue side of the spectrum having approx. const. freq. intervals and associated bands in the longer wavelength region with a different freq. interval. It is shown that such results are to be expected when the cross-product terms involving the quantum numbers of the nuclear and electronic vibrations are taken into consideration. The effect of coupling is shown to lead to a formula which represents the data of Henri on the spectra of polyatomic gases.

- 1686 Kahler, H. "The Band Spectra of Crystals and Complex Gases." Proc. Natl. Acad. Sci. U. S. 11, 266-9(1925).

A discussion of the data on U obtained by Nichols in 1919 is included.

- 1687 Koblic, O. "Oxidimetric Titration of Uranium." Chem. Listy 19, 1-3(1925).

When salts of U^{+6} are reduced with the usual metallic reducing agents, the greater part of the U is converted into U^{+4} , but there is always a certain amt. of a deriv. of a lower oxide produced. Pb, in the presence of HCl , quantitatively reduces UO_2Cl_2 to UCl_4 , which, after addn. of MnSO_4 and H_2SO_4 , may be titrated with KMnO_4 with good results.

- 1688 Korczyński, A. and Kierzek, L. "Catalysts for the Synthesis of Indoles According to Fisher." Gazz. chim. ital. 55, 361-9(1925).

It was detd. that PhNHNH_2 decomp. at 150° in the presence of small amts. of Ni, Co, or Cu powder and salts like CoCl_2 , NiCl_2 , CrCl_3 , and UCl_6 . Derivs. of PhNHNH_2 (mainly phenylhydrazones) were also studied. PhNHNH_2 was heated to 150 to 170° with 10% of its weight of anhyd. NiCl_2 , CoCl_2 , and

ZnCl_2 and powd. Cu, Fe, Ni, Co, Zn, Al, W, Ti, U, and Mo. NH_3 was formed and in the distillate C_6H_6 , PhNH_2 , and tar were found. The metals were less active in this decompn. than the salts and also showed a graded effect.

1689 Lobanow, M. "Quadrivalent Uranium Compounds." *Roczniki Chem.* 5, 437-48(1925). The following cpds. of U^{+4} are prepd. by the addn. of the appropriate acid in the requisite proportions to acid solns. of uranic sulfate: the basic iodate, $\text{UO}(\text{IO}_3)_2$; normal iodate, $\text{U}(\text{IO}_3)_4$; acid iodate, $\text{U}(\text{IO}_3)_4 \cdot 2\text{HIO}_3$, basic powders; the secondary phosphite, $\text{U}(\text{HPO}_3)_2 \cdot 4\text{H}_2\text{O}$; acid phosphite, $\text{UHPO}_3 \cdot 2\text{H}_2\text{PO}_3 \cdot 2.5\text{H}_2\text{O}$; hypophosphite, $\text{U}(\text{H}_2\text{PO}_2)_4$; acid hypophosphite, $\text{U}(\text{H}_2\text{PO}_2)_4 \cdot \text{H}_3\text{PO}_2$; basic cyanoplatinate, $\text{UO}(\text{Pt}(\text{CN})_6)_4 \cdot 4\text{H}_2\text{O}$, all stable cryst. substances; basic chloroacetate, $\text{UO}(\text{CH}_2\text{ClCO}_2)_2 \cdot 2.5\text{H}_2\text{O}$, unstable (readily changing to uranyl chloroacetate, $\text{UO}_2(\text{CH}_2\text{ClCO}_2)_2$); basic dichloroacetate, $\text{UO}(\text{CHCl}_2\text{CO}_2)_2 \cdot 2\text{H}_2\text{O}$ (readily oxidizing to uranyl dichloroacetate); tartrate, $\text{U}(\text{C}_4\text{H}_4\text{O}_6)_2 \cdot 2\text{H}_2\text{O}$; citrate, $\text{U}_3(\text{C}_6\text{H}_5\text{O}_7)_4$; basic cinnamate, $\text{UO}(\text{C}_6\text{H}_5\text{CH}:\text{CHCO}_2)_2 \cdot \text{H}_2\text{O}$, and basic salicylate, all green, amorph. powders.

1690 Lorenz, R. and Herz, W. "The Knowledge of Vapor Pressure Curves of Salts." *Z. anorg. allgem. Chem.* 143, 336-42(1925).

The vapor pressures of the halides of the alk. metals and Ag, Hg, Tl, Ge, Sn, Pb, (CrO_2) , and U are in agreement with the formulas previously developed. The constant for TaF_5 varies between wide limits. The value of q from Dühring's law of corresponding b.p. for the salts Cu_2Cl_2 , Cu_2Br_2 , and Cu_2I_2 is twice as great as that calcd. from $T/\text{O}_1 = q$. This variation, the authors suggest, may be due to the complexity of these molecules. TlF shows the reverse phenomenon.

1691 Lundell, G. E. F. and Knowles, H. B. "The Determination of Uranium." *J. Am. Chem. Soc.* 47, 2637-44(1925).

Contrary to prevailing prejudices, the volumetric method for detg. U is accurate provided a cool, acid soln. is passed through a Jones reductor and sufficient time is allowed for atmospheric oxidation before titration with KMnO_4 . The reduction is then to U^{+4} . The soln. should contain 1% or less U and 5% of H_2SO_4 . Similarly the gravimetric method of pptg. with NH_4OH and weighing as U_3O_8 is accurate but it is advisable to add macerated paper pulp; there is no need for special ignition in H_2 or in O_2 . A residue of U_3O_8 can easily be tested volumetrically by titrating with KMnO_4 after dissolving in HF and H_2SO_4 and adding H_3BO_4 .

1692 Mai, H. Ueber Wolframsäure-Brenzkatechin (Pyrogallol) sowie ueber Uranyl-salicylsäure-Verbindungen. Dissertation, Univ. of Würzburg, 1925.

Two disalicylate cpds. of $(\text{UO}_2)^{++}$ have been prepd. with the complex ion $[\text{UO}_2(\text{C}_6\text{H}_4\text{OCO}_2)(\text{NO}_3)]^-$. These are a quinolinium salt, brick-red microcryst. powder, and a pyridinium salt, red powder or narrow tablets. Both of these are reported to be sol. in water and insol. in alc. The yellow pyridinium salt of the trisalicylate has also been prepd.

1693 Maracineanu, S. "Special Effects of Sunlight on the Radioactivity of Lead and Uranium." *Comp. rend.* 181, 774-6(1925).

The substances were either exposed directly to the sun's rays, or a lens was employed to conc. them to a focus on the surface. The small irregular variation previously observed by Mme. Curie in the activity of U is greatly increased in U oxide powder when this is exposed to sunlight, rising sometimes to 50% of the original activity. Curves are given showing the variations from day to day.

1694 Marden, J. W. —assigned to Westinghouse Lamp Co. *Uranium*. Jan. 13, 1925. (British Patent 246,147)

In order to obtain ductile U, a double salt of U is prepd. and reduced with Ca in the presence of CaCl_2 . The resulting powder is then heated in an induction furnace to obtain a ductile, coherent mass.

- 1695 Moss, J. E. and Knapp, A. W. "A Chemical Method for the Standardization of Ultra-Violet Light." J. Soc. Chem. Ind. (London) **44**, 453-6(1925).

This paper includes a discussion of the use of the photolytic reaction between uranyl salts and $\text{H}_2\text{C}_2\text{O}_4$ as an actionometer. Information is included on the influence of temp. on the reaction.

- 1696 Pil, A. "Coagulation by Uranyl Salts." Natuurw. Tijdschr. (Belg.) **7**, 17-18(1925).
A 5% gelatin soln. with KBr coagulates on addn. of $\text{UO}_2(\text{NO}_3)_2$ or UO_2Cl_2 . KBr can be replaced by NaCl, KI, or BaCl_2 ; the uranyl salts by themselves do not cause coagulation. Only traces of halide are necessary for the effect.

- 1697 Rakshit, J. N. "Contraction on Solution of Various Substances in Water and Ethyl Alcohol." Z. Elektrochem. **31**, 97-101(1925).

The contraction on solns. of $\text{UO}_2(\text{AcO})_2 \cdot 3\text{H}_2\text{O}$ and many other salts was measured at various concns. Contraction = (vol. of solute + vol. of solvent) - (vol. of resulting soln.). The contraction increases with concns. in most cases. It is assumed that the solvent and the solute form cpds. similar to crystd. hydrates. This association is at a min. in satd. solns. and increases with diln. until the mols. of the solute decomp. by hydrolysis or ionization. Contraction on soln. increases with increase in association between the mols. of the solute and the solvent and simultaneously decreases as the solute mols. dissoc. upon diln.

- 1698 Raynaud, A. "On Uranyl Oxalate (Answer to M. Colani)." Bull. soc. chim. France (4), **37**, 1375-6(1925).

This paper corrects earlier information which the author had published; it is now reported that $\text{UO}_2\text{C}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$ loses $2\text{H}_2\text{O}$ upon heating for 10 hrs at 100 to 120° , and the third mole only when heated at 250° for another 4 hrs. This reaction is reversible, the first $2\text{H}_2\text{O}$ being taken up rapidly by the anhyd. salt while the third mole is taken up very slowly.

- 1699 Réchou, G. "Spectrographic Study of the K Series of the Heavy Elements." Compt. rend. **180**, 1107-08(1925).

The K series of the heavy elements have been photographed for the elements Ta, W, Os, Ir, Pt, Au, Tl, Pb, Bi, and U. Precision measurements of the lines are given in tabular form.

- 1700 Robinson, H. R. "X-Ray Terms and Intensities." Phil. Mag. (6), **50**, 241-50(1925).

The results are given of the detn. of the magnetic spectrum of the electron emission from U, Th, Au, As, Mn, and Ti upon subjecting them to X radiation, an intense beam of $\text{CuK}\alpha_1$ rays was used.

- 1701 Rowell, S. W. and Russell, A. S. "Oxidation of Ethyl Ether to Oxalic Acid in Presence of Uranyl Nitrate." J. Chem. Soc. **127**, 2900-2(1925).

Et_2O (60 g) with 60 g $\text{UO}_2(\text{NO}_3)_2$ and 20 to 60 g H_2O , when exposed to bright sunlight for 24 hrs, will give up to 12 g of $\text{UO}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$. In certain expts. a light-yellow basic oxalate, $\text{U}(\text{OH})_4 \cdot \text{UO}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O} (?)$, was formed. When $\text{UO}_2(\text{NO}_3)_2$ in Et_2O is neutralized so that a ppt. is not quite formed and exposed then to sunlight for a few hrs, a black or greenish-black slimy ppt. of $\text{U}(\text{OH})_4$ results. A suggested mechanism of this reaction is given.

- 1702 Russell, A. S. and Evans, D. C. "Determination of Metals Dissolved in Mercury. Rapid Method of Purifying Mercury." J. Chem. Soc. **127**, 2221-30(1925).

The detn. of U in Hg and its sepn. are discussed.

- 1703 Sandonnini, C. "Actions in the Presence of Carbon." Atti reale accad. nazl. Lincei (6), 2, 427-32(1925).

The catalytic action of powd. C is studied, since it is a good absorber of many kinds of radiation, to det. its influence on processes sensitive to light. The C used was especially prep'd. as described and contained only traces of SiO_2 . The $(\text{CO}_2\text{H})_2$ soln. of known titer was boiled under a reflux condenser in transparent quartz. The illumination came from an arc lamp 15 cm from the flask. After illuminating 3 hrs the $\text{H}_2\text{C}_2\text{O}_4$ solns. were unchanged. The addn. of C was without effect. When 0.01 g UO_2SO_4 was added to 100 cc $\text{H}_2\text{C}_2\text{O}_4$ soln. 10 to 12% was decompd. in 3 hrs. $\text{UO}_2\text{SO}_4 + \text{C}$ gave a decompn. of only 6 to 7%.

- 1704 Schror, J. "Contribution to the Measurement of Röntgen Standards." Ann. Physik (4), 80, 297-304(1925).

Various measurements on the L-series α_2 , α_1 , β_1 , β_2 , and γ_1 lines in the U spectrum are given.

- 1705 Someya, K. "The Use of Liquid Amalgams in Volumetric Analysis. II. Oxidometric Determination of Tungsten, etc., with the Aid of Lead and Bismuth Amalgams." Z. anorg. allgem. Chem. 145, 168-80(1925).

By heating Zn, Pb, or Bi with Hg and cooling, a mixt. of solid and liq. amalgams is easily obtained and by means of a separatory funnel, the liq. amalgam can be sepd. These liq. amalgams are preferred to the amalgamated Zn commonly used in a Jones reductor. By means of liq. Pb-Hg in acid soln., $(\text{UO}_2)^{++}$ can be reduced to U^{+4} , and titrated with KMnO_4 . With liq. Bi-Hg, $(\text{WO}_4)^{--}$ is reduced quantitatively to W^{+4} .

- 1706 Steubing, W. "A Simple Spectroscopic Device for Work in the Visible and Ultraviolet Spectrum." Physik. Z. 26, 329-31(1925).

The prepn. of a plate coated with fluorescent material is described. Uranyl fluoride-ammonium fluoride, to be used for visual examn. of dispersion, focus and brightness of spectrographs throughout the visible and ultraviolet spectrum to 1850 Å, was used.

- 1707 Stobbe, H. and Farber, E. "Photodimers of Some γ -Ketopentadiene Derivatives." Ber. 58B, 1548-53(1925).

The authors have now found that the colorless bis-dibenzalacetone,

is obtained (although in small yield on account of tarry by-products) from the orange-yellow cpd. $2\text{PhCH:CHCOCH:CHPh} \cdot \text{SnCl}_4 \cdot \text{C}_6\text{H}_6$ in C_6H_6 suspension by the action of the UO_2 or Sn salts or by their increased absorption of the longer wavelengths. Di-*p*-anisalacetone resinifies on heating or exposure to light in alc., its UO_2Cl_2 cpd. and violet-red SnCl_4 cpd. are rather stable toward light, merely undergoing a slight resinification.

- 1708 Stoner, E. C. and Martin, L. H. "The Absorption of X-Rays." Proc. Roy. Soc. (London), A, 107, 312-31(1925).

This paper gives information on the mass absorption coeff. of U (as U_3O_8), relative to Al, for various wavelengths. The product of L_1 , L_2 , and L_3 absorption coeffs. to the L edge is reported as 4.

- 1709 Thibaud, J. "Characteristic β -Ray Spectra and Their Photoelectric Effect." J. phys. radium (6), 6, 82-98(1925).

The method used in studying the penetrating γ rays of Ra, MsTh, and RdTh consisted in exposing a narrow, thick band of some element to the γ rays and observing the β particles emitted by the element or secondary radiator. The stream of β particles is deflected by a strong magnetic field into arcs of different parameters depending on the velocities of the β particles. On a photographic plate placed in the path of the β rays, images of the source are formed where the particles of different speeds strike

the plate, thus constituting a β -ray spectrum of the secondary radiator. The β -ray spectra of U, Pb, Pt, W, Ce, Sb, Ag, and Cu, thus excited, are tabulated, and it is seen that the β rays are displaced toward higher velocities with decreasing at. no. If to the homologous lines of the β -ray spectra of these elements the energy of the corresponding K absorption is added, the results so obtained will be const., verifying the photoelectric law of Einstein. On comparing the β rays excited by γ rays with the characteristic β -ray spectra of the elements it is found that they are identical. The energy of exciting γ ray is found by adding the energy of a β ray and the energy of the at. level in which it originates. Applying this principle to the observed β rays of the foregoing elements has made it possible to det. 24 monochromatic γ rays in the spectra of the radioactive members of the Ra and Th families. These are presented in comprehensive tables.

- 1710 van Heel, A. C. S. "Considerations on the Energy Levels of Uranyl Compounds." Communs. Phys. Lab. Univ. Leiden, Supplement No. 55B to Nos. 169-80, 7-40(1925).

The fluorescence and absorption spectra of various uranyl cpds. have been classified as arising from transitions between various energy states or levels. To each level is assigned a group of three quantum nos. m, n, p, which, when used as coeffs. of the recurring const. freq. differences sepg. the spectrum bands, give the position of the level in the energy diagram. The spectra thus analyzed are those of uranyl potassium chloride, uranyl potassium sulfate, and autunite.

- 1711 van Heel, A. C. S. "Monochromatic Excitation of Fluorescence." Verslag Gewone Vergader. Afdel. Natuurk. Nederland. Akad. Wetenschap. 34, 654-6(1925).

It has been found previously that the fluorescence spectrum of autunite (Ca uranyl phosphate) consists of 8 bands, each built up of 5 components, separable at low temps. A const. difference: $\Delta(1/\lambda) = 820$, was found between corresponding components. The absorption spectrum of similar structure had $\Delta(1/\lambda) = 710$.

- 1712 Vortmann, G. and Binder, F. "The Use of Uranous Sulfate in Volumetric Analysis." Z. anal. Chem. 67, 269-76(1925).

$U(SO_4)_2$ is fairly stable in aq. soln. toward atmospheric oxidation and is not oxidized readily by H_2O_2 and I_2 . $U(SO_4)_2$ is, therefore, a moderately strong reducing agent which can be used for the titration of Fe^{+3} in the presence of molybdic acid and for the indirect titration of substances which are capable of oxidizing Fe^{++} . To prep. the std. soln., dissolve 50 g UO_2SO_4 in 200 cc of water, make strongly acid with H_2SO_4 and reduce on the water bath with granulated Zn. Dil. the soln. to make it approx. 0.1 N and standardize against $KMnO_4$. Kept in the dark, the titer of a soln. changed to about 0.75 of its original value after standing 26 days. Procedures are given for the titration of Fe^{+3} , evaluation of pyrolusite, detn. of HNO_3 , $HClO_3$, and H_2CrO_4 . The results given are accurate to about 0.5%.

PUBLICATIONS LOCATED IN 1926

- 1713 Allen, S. J. M. "The Absorption of X-Rays of Wave-Length down to .08 A." Phys. Rev. (2), 27, 266-76(1926).

Mass absorption coeffs. μ/ρ are given for U for wavelengths of 0.095 to 0.164 A. The crit. absorption wavelength, λ_c , is reported to be 0.105 A for U.

- 1714 Allen, S. J. M. "The Absorption of X-Rays from $\lambda = .08$ to 4.0 A." Phys. Rev. (2), 28, 907-22(1926).

This paper gives the calcn. of the true mass absorption coeff., τ/ρ , the formula $\tau/\rho = C^n$ with the const. $C = 110$ to 120 , $n = 2.6$ for the region of the M series and $C = 9$ to 10 , $n = 2.92$ for the region of the N series for the case of U.

- 1715 Allmand, A. J. and Reeve, L. "The Photochemical Decomposition of Aqueous Oxalic Acid Solutions." J. Chem. Soc. 2834-51(1926).

The effect of uranyl salts in this reaction is briefly discussed.

- 1716 Aloy, J., Valdigue, A., and Aloy, R. "Transformations Induced by Solar Light in the Presence of Uranium Compounds. Characteristic Reactions of Strychnine, Morphine, Codeine, and Formol." Bull. soc. chim. France (4), 39, 792-5(1926).

Strychnine, in H_2SO_4 is unaffected by the addn. of small amts. of UO_3 or acetate. But on exposure to sunlight the soln. becomes violet, as a result of oxidation. This method may be used for the detection of 1×10^{-5} part of strychnine. Solns. of codeine, or morphine, in acid soln. are unaffected by the addn. of UO_3 , but on exposure to sunlight a deep blue appears. None of the common alkaloids gives a similar reaction. This blue coloration may be obtained with codeine and morphine by using a soln. of the uranylacetate which alone has been exposed to the sunlight. This is due to the formation of HCHO. The addn. of HCHO to a soln. of codeine in H_2SO_4 with U or Fe acetates in the absence of sunlight gives an intense blue coloration.

- 1717 Auger, V. and Longinescu, J. N. "Uranium Orange and Uranium Red." Compt. rend. 182, 970-2(1926).

Uranium red and orange are "amorphous" salts of a complex thiouranic acid. The acid anion shows a valency of 5 in forming the red ppt. with an alk. ion, and 3 in forming orange with an alk. or red with a Ba ion. The formula of the acid is $U_5O_{16}S_2H_6$ or $U_{10}O_{31}S_4H_{10}$. The salts decomp. in mineral acids, and dissolve slowly but completely in alk. carbonates.

- 1718 Barthe, L. and Dufilho, E. "The Determination of Sodium in Many Substances." Compt. rend. 182, 1471(1926).

The use of the pptn. of the complex Mg Na uranyl acetate in the detn. of Na is discussed.

- 1719 Biltz, W. and Klemm, W. "On the Electrical Conductivity and the Molecular State of Fused Salt." Z. anorg. allgem. Chem. 152, 267-94(1926).

This paper discusses the electrical cond. in the mol. state of fused U chlorides. Considerable data are given for UCl_4 .

- 1720 Boissevain, C. H. "The Effect of Beta-Rays on Bacterial Growth." Am. Rev. Tuberc. (2), 14, 172-6(1926).

It is shown that tubercle bacilli grow on a synthetic culture medium when K is replaced by an equal radioactive amt. of Rb. Some growth occurs after substitution of U, but no growth occurs after substitution of Cs, Na, or Li. It is suggested that the beta rays emitted by K, Rb, and U are necessary for bacterial growth. V can replace Fe in the synthetic medium, but it cannot replace K. Tubercle bacilli were cultivated through several generations on a medium containing Rb and V instead of K and Fe without losing their virulence.

- 1721 Bowen, E. J. and Watts, H. G. "The Photolysis of Acetaldehyde and of Acetone." J. Chem. Soc. 1607-12(1926).

Information is given on the quantum yield of the reactions of the two materials in the presence of UO_2SO_4 .

- 1722 Colani, A. "The System Uranyl Nitrate-Nitric Acid-Water." Bull. soc. chim. France (4), 39, 1243-5(1926).

A study of the system $\text{UO}_2(\text{NO}_3)_2\text{-HNO}_3\text{-H}_2\text{O}$ at 25° confirmed that there are but 3 hydrates, with 2-, 3-, and 6- H_2O , resp.

- 1723 Coomans, R. "A Critical Study of Methods for the Determination of Uranium." Ing. chim. 10, 213-47(1926).

The following conclusions are based on exptl. work described in the article. Electrolysis (cf. Smith and Wallace, J. Am. Chem. Soc. 20, 279(1898)) in HOAc soln. gives accurate results with a Pt dish, and can be used for sepg. U from alk. and alk. earths; but the use of Pt electrodes is not advisable owing to great danger of losses in washing the deposit and it is hard to get deposits on const. compn. NH_4OH ppts. U rapidly and quantitatively, as $(\text{NH}_4)_2\text{U}_2\text{O}_7$, but it should be free from CO_2 as $(\text{NH}_4)_2\text{UO}_4$ is sol. in alk. carbonates. Filtration is facilitated by presence of 5 to 10 g NH_4NO_3 , and also by boiling to render the amorph. ppt. cryst. Redn. to UO_2 by heating in illuminating gas is difficult but works fairly well if a Pt crucible is used. In the pptn. with $(\text{NH}_4)_2\text{S}$, $(\text{NH}_4)_2\text{CO}_3$, and alk. carbonates must be absent; addn. of too large an excess of $(\text{NH}_4)_2\text{S}$ sometimes gives a brownish-red instead of black ppt., due to soly. of the UO_2S in the $(\text{NH}_4)_2\text{CO}_3$ contd. in the $(\text{NH}_4)_2\text{S}$; the presence of considerable $\text{Na}_2\text{S}_2\text{O}_3$ causes the formation of a red sulfide; presence of NH_4Cl or of NH_4NO_3 facilitates pptn. of UO_2S and reduces its soly. Complete pptn. is obtained by adding $(\text{NH}_4)_2\text{HPO}_4$ in the presence of NH_4NO_3 and NH_4AcO . The main advantage of the method over pptn. with NH_4OH is the use of a smaller factor. Titrations are best carried out at 80 to 90° on the water bath, and in dil. HOAc solns. as the results are affected by free mineral acids but the sensitiveness of the titrations varies inversely as the proportion of acetates, as the latter retard pptn. of the U by $\text{K}_4\text{Fe}(\text{CN})_6$. The P_2O_5 soln. must be standardized against std. U soln. under the same conditions as the detns. are carried out, as the results are affected by the vol. and acidity of the titrated soln., concn. of the indicator, temp., and titration end point. The end point of the reaction between very dil. $\text{NaNH}_4\text{HPO}_4$ and U acetate is quite fugitive. An exhaustive study of titration with KMnO_4 under various conditions showed it to be quite unreliable. The essential point in the iodometric method is the neutralization of the soln. before addn. of KI and KIO_3 and distn.; the method cannot be applied directly as described in Ber. 1, 189(1904). Lack of time prevented exhaustive investigation of this point.

- 1724 Dominguez, R. "Note on Arteriosclerosis in Rabbits Caused by Some Samples of Uranium Nitrate." Science 64, 407-08(1926).

- 1725 D'yachkovskii, S. I. "Synthesis and Properties of Uranium Colloids." Ukrain. Khim. Zhur. 2, 340-52(1926).

Stable colloidal suspensions have been prepd. by hydration of insol. U salts. Analyses of the progressive hydration products point to the formation of complex intermediate cpds. during the process. Complete hydration is obtained after continuous dialysis in running water. Dehydration leads to coagulation of the sol. resulting in the pptn. of a hydrate of uranic acid. When hydration is incomplete the ppt. formed on coagulation corresponds with $\text{Na}_2\text{U}_2\text{O}_7$. In either case on treatment with H_2O , a colloidal soln. is again formed. The whole synthesis can be represented: $n\text{Na}_2\text{U}_2\text{O}_7 \rightleftharpoons [\text{Na}_2\text{U}_2\text{O}_7, \text{H}_2\text{UO}_4]_{n-1} \rightleftharpoons [\text{H}_2\text{O}(\text{UO}_3)_2\text{UO}_2(\text{OH})_2]_n \rightleftharpoons [\text{UO}_2(\text{OH})_2]_{n+1}$, the equil. being disturbed if $\text{Na}_2\text{U}_2\text{O}_7$ or uranic acid is removed from the reaction. The particles have a neg. charge and their velocity in an electric field corresponds with a charge of 1.984×10^{-8} e.s.u. The d. of the sol. is 7.45 and the size of the particles varies from 1.144×10^{-15} to one μ , the system is polydisperse. The effects of HCl , BaCl_2 , and AlCl_3 on the coagulation were studied. The sign of the charge changes after treatment with AlCl_3 .

- 1726 Fernandes, L. "The Coordination Valence of Two Hydroxyl Groups in *o*-Position. II. Complexes of Hydroxyhydroquinol of 1,2-Dihydroxynaphthalene and of Protocatechualdehyde with Acids of the Molybdenum Group." Gazz. chim. ital. **56**, 416-24(1926).
Uranyl sulfate, hydroxyhydroquinol, and hot C_5H_5N gave a cryst. ppt. of pyridine hydroxyhydroquinol aquouranate,
 $UO_3 \left[\begin{smallmatrix} C_6H_6O_3 \\ H_2O \end{smallmatrix} \right] \begin{smallmatrix} C_5H_5NH \\ H \end{smallmatrix}$, which is maroon. In a similar way cryst. pyridine 1,2-dihydroxynaphthalene aquouranate, $[(UO_3)(C_{10}H_6O_2)(H_2O)](C_5H_5NH)H$, which is brick-red, was obtained. Complexes contg. 2 mols. of the org. OH cpd. could not be prepd., for an addn. of C_5H_5N to solns. contg. uranyl salts with excess hydroxyhydroquinol or 1,2- $C_{10}H_6(OH)_2$, red sirupy liquids were obtained which could not be crystd.
- 1727 Free, O. "Investigation of the Zirconium in Colorado Pitchblende." Phil. Mag. (7), **1**, 950-60(1926).
Analytical results and methods used on the mineral are given.
- 1728 Friman, E. "Precision Measurements in the L Series of the Elements Tungsten to Uranium." Z. Physik **39**, 10-11(1926).
- 1729 Friman, E. "Precision Measurements in the L Series of the Elements from Tungsten to Uranium." Z. Physik **39**, 813-27(1926).
The lines α_1 , β_2 , and γ_1 of the L series of W, Ir, Pt, Au, Hg, Tl, Pb, Bi, Th, and U were remeasured with a precision exceeding 10 times that hitherto used for these lines. The wavelength data are tabulated. A description of the x-ray spectrometer and the method of adjusting it are given.
- 1730 Glaser, H. "Complex Metal Phosphites and Pyrophosphates. I. Alkali Uranyl Phosphites and Pyrophosphates." Z. anorg. allgem. Chem. **153**, 140-4(1926).
From UO_2SO_4 or $UO_2(NO_3)_2$ solns. and satd. alk. phosphite solns. the following dialkali uranyl-sec-phosphites were prepd.: $K_2[UO_2(HPO_3)_2]$, $(NH_4)_2[UO_2(HPO_3)_2]$, and $Na_2[UO_2(HPO_3)_2]$. All are yellow; the color intensity and the soly. in H_2O decrease in the order listed. Similarly, satd. $Na_4P_2O_7$ soln. and $Li_4P_2O_7$ suspension upon boiling yield, resp., di-Na uranyl pyrophosphate, $Na_2[UO_2P_2O_7]$, and di-Li uranyl pyrophosphate, $Li_2[UO_2P_2O_7]$. The K and NH_4 salts could not be obtained.
- 1731 Goggin, J. F., Cronin, A. J., Fogg, H. C., and James, C. "Metallic Uranium." Ind. Eng. Chem. **18**, 114-16(1926).
Preliminary attempts to reduce U oxide to metallic U by means of Ca in a steel bomb placed in an evacuated steel tube, and heated, are described. The U obtained was in the form of a powder, owing to the preventing, by the infusible CaO, of coalescence of the reduced globules of metal. Subsequent expts. were carried out on UCl_4 , the prepn. of which is described. A fused button of U was obtained, contaminated with Fe (U = 99.31%, Fe = 0.57%, C = 0.09%). The Ca used was the source of the impurities, and by sublg., it was sufficiently purified to yield, when used to reduce a further quantity of UCl_4 , a clean silvery, fused mass of U contg. 0.01% of Fe.
- 1732 Hahn, O., Erbacher, O., and Feichtinger, N. "Regularity of Precipitation and Absorption in Very Small Amounts of Substance and Their Relation to the Radioactive Precipitate Rule." Ber. **59**, 2014-25(1926).
The sepn. of radioactive elements including U and its daughters is discussed.

- 1733 Heusler, O. "The Equilibrium for the Reduction of Chromium Sesquioxide and Uranium Dioxide with Carbon, also the Action of Nitrogen on Uranium Carbide." Z. anorg. allgem. Chem. 154, 353-74(1926).

It is possible to measure the equil. between solid and gaseous phases by means of an externally cooled, internally heated elec. vacuum furnace in cases where the temp. is so high that an externally heated reaction chamber is not permissible. The study of such equil. is limited to systems in which the gaseous reaction component is a permanent gas and the solid phase only slightly volatile at the temps. used. Suitable systems were found in the reduction equil. of Cr_2O_3 and UO_2 with C to the corresponding carbides. With Cr_2O_3 and C over the range of 1480 to 1800° the CO pressure increases from 18 to 760 mm Hg. The equil. was calcd. from the integral equation for the reaction isochor for const. heat tone with good agreement for Cr_2O_3 , less so for UO_2 . The energy consumption for the liberation of 1 mol. CO was calcd. for UO_2 to be 87,300 cal., the av. abs. temp. being 1940°. The action of N_2 on UC_2 apparently proceeds in 3 stages of equil., as follows: (1) $5\text{UC}_2 + \text{N}_2 \rightleftharpoons \text{U}_5\text{N}_2 + 10\text{C}$; (2) $\text{U}_5\text{N}_2 + \text{N}_2 \rightleftharpoons \text{U}_5\text{N}_4$; and (3) $3\text{U}_5\text{N}_4 + 4\text{N}_2 \rightleftharpoons 5\text{U}_3\text{N}_4$. U_3N_4 is identical with that of Kohlschütter but U_5N_4 and U_5N_2 are new cpds. Both are characterized by their soly. in dil. HCl where the total N goes into soln. as NH_3 , and they are distinguished from each other by the amt. of H_2 evolved. Lebeau's formula of UC_2 for U carbide was confirmed.

- 1734 Holmes, A. and Lawson, R. W. "Radioactivity of Potassium and its Geological Significance." Phil. Mag. (7), 2, 1218-33(1926).

The radioactive characteristics of Rb, K, U, and Th, and the geological significance of the radioactivity of K, are discussed. The radioactivity of Rb has no geological significance.

- 1735 I. G. Farbenindustrie A.-G. Destructive Hydrogenation. Aug. 7, 1926. (British Patent 295,948) This process specifies the use of U or its cpds. with elements of the second group of the periodic table as catalysts in the destructive hydrogenation of carbonaceous materials.

- 1736 I. G. Farbenindustrie A.-G. Destructive Hydrogenation. Aug. 7, 1926. (British Patent 295,949) This process specifies the use of U or its cpds. with Al or its cpds. as catalysts in the destructive hydrogenation of carbonaceous materials.

- 1737 McLennan, J. C., McLay, A. B., and Smith, H. G. "Atomic States and Spectral Terms." Proc. Roy. Soc. (London), A. 112, 76-94(1926).

The Heisenberg-Hund theory of spectral terms is briefly reviewed. Without going into the math. development, 14 rules which serve as a basis for the method of detg. the lowest spectral energy levels involved in the structure of the arc spectrum or in that of any spark spectrum are given. The procedure to be followed in calcg. the term types corresponding to a given electron configuration is illustrated by notes on the spectra of C, N, O, Ne, Ti, Ni, Zr, Hf, Th, Nd, U, W, and a table is given showing the electronic configurations and lowest spectral levels for each of the 92 chem. elements.

- 1738 MacNider, W. deB. "The Protection of the Kidneys against the Injury from Uranium Nitrate in the Presence of Sodium Bicarbonate." J. Metabolic Research 7-8, 1-28(1926).

It is reported that animals poisoned with U show hepatic degeneration similar to that seen with mercury poisoning. The degeneration is parallel to the degree of acidosis rather than the dose.

- 1739 Marden, J. W. — assigned to Westinghouse Lamp Co. Reducing Refractory Metal Oxides. Oct. 12, 1926. (U. S. Patent 1,602,542)

Powd. U metal is prepd. by reduction of its cpds. at about 600° in an inert atm. using Mg powder or filings.

1740 Meyer, Julius and Kasper, E. "Compounds of Uranic Acid with Sulfuric and Selenic Acids." *Z. anorg. allgem. Chem.* **155**, 49-65(1926).

Heteropoly acids were formed from selenic acid (cf. Meyer and Moldenhauer) and uranic acid. Repeated concn. of 32 g uranyl nitrate + 10 g selenic acid in vacuum (until all the HNO_3 is expelled) yielded 60% of a cpd. $\text{H}_2[\text{UO}_3(\text{SeO}_4)] \cdot 2\text{H}_2\text{O}$ (I), which is cryst., yellow-green, hydr., water and alc. sol., and ether insol. Transport expts. showed the complex anion; Se and U appeared at the anode in concd. soln. (60 g to 30 cc water); in dil. soln. UO_2 migrates toward the cathode and uranyl selenate is formed. From 32 g uranyl nitrate and 15 g selenic acid 2-selenic acid-uranic acid $\text{H}_6[\text{UO}_4(\text{SeO}_4)_2] \cdot 2\text{H}_2\text{O}$ (II) was formed by the same process; the properties are similar. 3-Selenic, 2-uranic acid, $\text{H}_6[\text{UO}_2(\text{UO}_4)(\text{SeO}_4)_3] \cdot 7\text{H}_2\text{O}$ (III) was formed from 32 g uranyl nitrate and 20 g selenic acid as before (55% yield). An Et_2O soln. of $\text{UO}_2(\text{NO}_3)_2$ on dropwise addn. of concd. selenic acid at low temp., gives on rubbing of the oily drops formed, a yellow salt, being acid (III). The sulfuric-uranic acids corresponding to (I-III) are known, efforts for prepn. of more of them were unsuccessful. Salts were prepd.: $\text{KH}[\text{UO}_3(\text{SeO}_4)] \cdot 1\text{H}_2\text{O}$ from 1 g acid (I) + 1.8 g K_3SeO_4 in a little H_2O , heated to 100° , yield 20%, little sol., yellow-brown powder. Two g (I) in water-free ether suspension, dry NH_3 being passed through, formed the NH_4 salt, deep yellow, little sol. From acid (II) are derived $\text{K}_2\text{H}_4[\text{UO}_4(\text{SeO}_4)_2] \cdot 1\text{H}_2\text{O}$ prepd. by Sendtner (*Ann.* **195**, 325(1879)), $\text{K}_2\text{H}_4[\text{UO}_4(\text{SeO}_4)_2] \cdot 2\text{H}_2\text{O}$ by evapn. of 2 g K_2SeO_4 + 1.5 g H_2SeO_4 + 4 g uranyl nitrate (yellow-green, water and alc. sol., 50% yield); $\text{K}_2[\text{UO}_2(\text{SeO}_4)_2] \cdot 1\text{H}_2\text{O}$ is formed in impure form from 1 g K_2SeO_4 + 3 g $\text{K}_2\text{H}_4[\text{UO}_4(\text{SeO}_4)_2] \cdot 1\text{H}_2\text{O}$ in a little H_2O , slightly acidified, for 60% (60 hrs standing) or better after 6 hrs at 80° . $\text{K}_2\text{H}_4[\text{UO}_4(\text{SeO}_4)_2] \cdot 3\text{H}_2\text{O}$ from 3 g of the $2\text{H}_2\text{O}$ salt + 3.5 g K_2SeO_4 in a little water, at 75° for a few min, yield 70%, yellow, microcryst., slightly water sol. The complex nature of the cpds. is plainly shown by the occurrence of the time reactions. Of acid (III) $\text{K}_2\text{H}_4[\text{UO}_2(\text{UO}_4)(\text{SeO}_4)_3] \cdot 1\text{H}_2\text{O}$ was formed from 3.2 g KUO_4 + 10 g selenic acid by evapn. in vacuum, yield 30%, yellow, easily H_2O sol. Salts of an unknown acid are formed: $\text{Na}_4\text{H}_2[\text{UO}_3(\text{SeO}_4)_3] \cdot \text{H}_2\text{O}$ from 5.5 g selenic-uranic acid + 8 g Na selenate in a little H_2O , slightly acidified, evapd., light yellow, easily H_2O sol., yield 60%. $\text{Na}_4(\text{NH}_4)_2[\text{UO}_3(\text{SeO}_4)_3] \cdot 10\text{H}_2\text{O}$ by treatment of the last salt with gaseous NH_3 in dry Et_2O , microcrystals, orange-yellow, little H_2O sol., 100% yield. Salts of $\text{H}_6[\text{UO}_4(\text{SO}_4)_2]$ were isolated: $\text{K}_2\text{H}_4[\text{UO}_4(\text{SO}_4)_2] \cdot 2\text{H}_2\text{O}$ from 2.5 g K_2SO_4 + 6.5 g sulfuric-uranic acid in a little H_2O and evapn., green fluorescent crystals, easily H_2O sol., 50% yield; $\text{KH}_5[\text{UO}_4(\text{SO}_4)_2]$ from 5 g KUO_4 in 7 g H_2SO_4 evapd., pale yellow-green crystals, H_2O sol., 30% yield; $(\text{NH}_4)_4\text{H}_2[\text{UO}_4(\text{SO}_4)_2] \cdot 3\text{H}_2\text{O}$ from 2 g uranic-sulfuric acid in dry Et_2O with NH_3 , yellow, microcryst., slightly H_2O sol., 100% yield. Of the following salts the acid is unknown: $\text{K}_4\text{H}_2[\text{UO}_3(\text{SO}_4)_3] \cdot 6\text{H}_2\text{O}$ from 10 g uranyl nitrate evapd. with concd. H_2SO_4 , then dissolved with 10 g K_2SO_4 , acidified and concd., green fluorescent needles, H_2O sol., structure proved by transport. On treatment of this salt with gaseous NH_3 under dry Et_2O , yellow, microcryst. $(\text{NH}_4)_2\text{K}_4[\text{UO}_3(\text{SO}_4)_3]$ was formed, slightly H_2O sol. The original has several printer's errors in the formulas.

1741 Müller, R. H. "The Quantum Sensitivity of the Lactic Acid-Uranyl Sulfate Decomposition." *Biochem. Z.* **178**, 77-8 (1926).

The photochem. decompn. of lactic acid and Na lactate to acetaldehyde in the presence of UO_2SO_4 has been studied from the point of view of its quantum yield. Direct measurement of the radiation, assuming a wavelength of 4025 Å. As the center of the photochem. band, yields 1.05 quanta/mol., which corresponds with 0.99 quanta/mol. as detd. from the light energy with the aid of $\text{H}_2\text{C}_2\text{O}_4 - \text{UO}_2\text{SO}_4$. The latter is, thus, a suitable actinometer, especially for reactions where the U salts play a catalytic or an oxidizing role.

- 1742 Nagaoka, H. and Futagami, T. "Comparison of the Spectra of Radon with those of Uranium and Thorium." Proc. Imp. Acad. (Tokyo), 2, 390-4(1926).

The lines of Rn found by Rutherford and Boyd and other investigators are compared with those found for U and Th preps. A large no. of lines are common to these spectra, particularly in the region of short wavelengths, and there is little doubt that the lines of radon are observable by spark or arc discharge with the metals or cpds. of Th and U. Owing to the different conditions of excitation the intensities show no parallelism.

- 1743 Nagaoka, H. and Futagami, T. "Helium Lines in the Spectra of Uranium and Thorium." Proc. Imp. Acad. (Tokyo), 2, 324-7(1926).

During the various transformations occurring in U or Th preps., α particles are ejected which, by acquiring electrons, become He atoms. He lines may, therefore, be expected to appear in the spectra of such preps. Furthermore, in the case of α particles combining with electrons, the conditions of excitation of the lines are rather different from those of the electric discharge in a Geissler tube, and it is possible that lines not normally found in the spectrum of He may be present in the spectra of U and Th. Some of these lines known only by calcn. were deciphered, particularly in the U spectrum. A noteworthy feature is the appearance of doublets suggesting an electric or magnetic field such as might easily be imagined if the lines arise from ejected α particles collecting electrons in their passage through the atom.

- 1744 Nagaoka, H. and Futagami, T. "Lines of Transformation Products of Uranium and Thorium in the Spectra of These Elements." Proc. Imp. Acad. (Tokyo), 2, 318-23(1926).

An attempt to identify the spectral lines of the transformation products of U and Th in the spectra of these elements by making use of the fact that isotopes have the same spectra is described. For example, RaC, RaE, AcC, and ThC are isotopic with Bi, and if the spectrum of Bi is compared with those of ordinary U and Th, the line 3067.8 is found to be common to all. It is pointed out that care must be exercised in arriving at these common lines, as the spectrum lines are sufficiently numerous to make accidental coincidence not improbable.

- 1745 Nagaoka, H. and Futagami, T. "Ultra-violet Arc Spectrum of Freshly Prepared Uranium Oxide." Proc. Imp. Acad. (Tokyo) 2, 533-5(1926).

No definite conclusion as to the U spectrum can be drawn until more perfect means of purifying the sample can be developed. A large number of lines from the radioactive decay products were found.

- 1746 Nichols, E. L., and Slattery, M. K. "Uranium as an Activator." J. Optical Soc. Am. 12, 449-66(1926).

Traces of a cpd. of U, when brought by fusion into solid soln. in NaPO_3 , KPO_3 , borax, NaF , or CaF_2 render the substance luminescent under photo or cathode excitation. There is a definite optimum proportion for each solvent which gives the max. brightness. The spectra of these solid solns. consists of several bands, each of which is made up of numerous overlapping and semisubmerged components, but the spectral structure is distinctly different from that of the uranyl salts.

- 1747 Palit, C. C. and Dhar, N. R. "Action of Nitric Acid on Metals in Presence of Catalysts." J. Phys. Chem. 30, 1125-33(1926).

U nitrate was one of the catalysts added for trial on a large number of metals.

- 1748 Pennetti, G. "Action of Some Photodynamic Substances on Extract of Lymph Glands, Insulin and Adrenalin." Arch. intern. pharmacodynamie 32, 360-72(1926).

Solns. were prepd. contg. adrenalin plus one of the following photodynamic substances: eosin, erythrosin, methylene blue, quinine hydrochloride, or $\text{UO}_2(\text{OAc})_2$. As long as the solns. contg. eosin and erythrosin were kept in the dark the adrenalin showed its usual action, but after exposure to light it showed none of its characteristic effect. The other photodynamic substances did not show this destructive action on adrenalin. Similar expts. with an extr. of lymph glands were neg. The presence of photodynamic substances had no effect on the hypoglycemic activity of insulin. Expts. were conducted with radiation of different wavelengths, including ultraviolet. The literature is reviewed.

- 1749 Perrin, F. "Fluorescence of Long Duration of Solid and Dissolved Salts of Uranium." Compt. rend. 182, 929-31(1926).

The long-lasting luminescence of uranyl salts is not a phosphorescence but a fluorescence. The life of the excited state follows the law $t = t_0/p$, where p is the yield. The luminescence of dissolved uranyl salts is not lasting because p is small. Uranyl sulfate dissolved in an excess of pure H_2SO_4 gives a strong fluorescence of yield only $1/4$ or $1/5$ that of the cryst. salt. t is about 5×10^{-4} sec or almost $1/4$ that in the crystal. The fluorescence of dissolved uranyl salts may be suppressed by addn. of halogen salts, org. acids, etc. A trace of HCl or alc. suffices to diminish greatly that of uranyl sulfate in pure H_2SO_4 . This is explained as being due to deactivation without light emission.

- 1750 Porlezza, C. and Donati, A. "Spectrographic Identification of Some Elements and the Possibility of Their Determination by Means of the Arc Spectrum. II. Uranium." Ann. chim. applicata 16, 622-36(1926).

In the present work the spectrographic behavior of U in very small quantities in the green-violet region was studied. SiO_2 , $\text{Ca}_3(\text{PO}_4)_2$ and gneiss (occurring in Lurisia autunite) were used as diluents, calcined mixts. being prepd. The min. % of U in each of these which could still be identified spectroscopically were detd., the results of which are described and tabulated in detail. For a given diln., the lines were most visible with SiO_2 as a diluent, and in this case U could still be detected at 0.05% U_3O_8 concn. With U-free autunite to which U in known concn. was added, the limit of sensitivity was about 0.1% U_3O_8 , which is of particular significance because of the potential value of the method in the examn. of U-bearing minerals. With $\text{Ca}_3(\text{PO}_4)_2$ the limit of sensitivity is about 0.5% U_3O_8 . Comparative detns. of U in natural minerals (carnotite) show that the spectrographic method gives results conforming with those by chem. analysis.

- 1751 Rosenheim, A. (investigations by S. Frammer, H. Gläser, and W. Händler) "On Complex Metal Phosphite and Pyrophosphate." Z. anorg. allgem. Chem. 153, 126-42(1926).

In the first section which shows work by H. Gläser on alkali uranyl phosphite and pyrophosphate, it is reported that $\text{Na}_2\text{UO}_2(\text{HPO}_3)_2$ can be prepd. by adding a sol. uranyl salt dropwise at room temp. with violent shaking to a concd. soln. of sodium phosphite until complete satn. occurs. A deep yellow microcryst. ppt. of sodium uranyl phosphite is obtained after a few hrs. The crystals are well formed and after washing in cold water may be dried in air on porcelain. They are slightly sol. in water, less sol. than the corresponding K and NH_4 salts. $\text{K}_2\text{UO}_2(\text{HPO}_3)_2$ can be obtained in the same manner as the Na cpd. It is reported to be slightly more sol. than either the corresponding Na or NH_4 cpd. The NH_4 analog was also prepd. $\text{Li}_2\text{UO}_2\text{P}_2\text{O}_7$ is prepd. from a suspension of $\text{Li}_4\text{P}_2\text{O}_7 \cdot 8\text{H}_2\text{O}$ added dropwise to a soln. of $\text{UO}_2(\text{NO}_3)_2$ and shaken. A yellow soln. results which, when boiled, will yield a microcryst. ppt. The prepn. of $\text{Na}_2\text{UO}_2\text{P}_2\text{O}_7$ in the wet way is described. Uranyl nitrate or sulfate soln. is added to a satd. $\text{Na}_4\text{P}_2\text{O}_7$ soln. until the ppt. obtained just barely redissolves upon shaking. This soln. must be kept cool. Upon boiling, a deep yellow ppt. is obtained which redissolves on cooling. The soln. is therefore filtered while hot and washed with boiling water. After drying in air the residue has the compn. $\text{Na}_2\text{UO}_2\text{P}_2\text{O}_7$. Like the ammonium cpds., $\text{K}_2\text{UO}_2\text{P}_2\text{O}_7$ cannot be produced in an aq. soln. of Na or Li cpds.

1752 Russell, A. S. "Passivity, Catalytic Action and Other Phenomena." Nature **117**, 47-8(1926). U is reported to have the ability to absorb certain gases in moderate extent and to catalyze their reaction. The ability to dissolve H_2 is discussed.

1753 Russell, A. S. "Volumetric Determination of Uranium, Vanadium, Copper, and Iron in Uranium Ores." J. Soc. Chem. Ind. (London) **45**, 57-60T(1926).

(I) To the soln. contg. these elements, add enough H_2SO_4 to make the concn. of acid about 6 N. Shake with 3% Zn amalgam until the lavender color due to bivalent V is not further changed in intensity, decant the reduced soln. into a flask, wash the amalgam, and allow 30 sec for the oxidation of U^{+3} to U^{+4} .

Pour the soln. into an excess of 0.1N $KMnO_4$, heat to 80° and titrate the excess permanganate with std. uranous soln. Assume the oxidation by $KMnO_4$ to be of V^{++} to V^{+5} , U^{+4} to U^{+6} , and Fe^{++} to Fe^{+3} .

(IIa) To the hot soln. which has just been titrated with uranous soln., add NH_4OH until a permanent ppt. just fails to form. Cool to room temp., add 5 g KI and a suspension of some freshly pptd. Cu_2I_2 to act as catalyzer. After 3 min titrate the liberated I_2 with $Na_2S_2O_3$. This gives the Fe and V, each being reduced 1 valence. (IIb) To the original soln. which has been fully oxidized but not treated with Zn-Hg, add KI and continue as in (IIa). This gives the Fe, V, and Cu, each element experiencing 1 valence change. (III) Acidify and oxidize another portion of the original soln. as in (I), add H_3PO_4 and a few drops of a satd. soln. of diphenylamine in concd. H_2SO_4 and titrate with a std. $FeSO_4$ soln. to the disappearance of the blue. This gives the V, reduced from a valence of 6 to 5. In the absence of V, the analysis is simpler. By procedure (I), the U and Fe are detd., by (IIa) the Fe alone, and by (IIb) the Cu and Fe. Procedure III is unnecessary in this case. To test a ppt. of U_3O_8 to see if $1/3$ of the U is U^{+4} add 0.6 g of the oxide to 150 cc of 6N H_2SO_4 at 80° and an excess of $KMnO_4$ over that needed to oxidize the U^{+4} to U^{+6} . When the oxide has all dissolved, titrate the excess $KMnO_4$ with std. $FeSO_4$ soln.

1754 Schror, J. "Contribution to the Measurement of Roentgen Standards." Ann. Physik (4), **80**, 297-304(1926).

Precision measurements in the K and L series of lines in the Roentgen spectra of 25 elements are presented. Five L lines were measured for U.

1755 Scott, A. F. "A Relationship between Atomic Numbers and the Properties of Ions in the Crystal Lattice. II. The Characteristic Frequency and the Constant." J. Phys. Chem. **30**, 577-94(1926).

The magnitude of the vibrational freq. depends on the electron affinity, this calcn. for U was made with the modified formula and the vibrational freq. found to be 3.4×10^{12} .

1756 Scott, A. F. "A Relationship between Atomic Numbers and the Properties of Ions in the Crystal Lattice. III. The Metallic State—A Preliminary Study." J. Phys. Chem. **30**, 1009-30(1926).

The smallest half interval of the U atom in the crystal lattice is given as 1.5 A.

1757 Smith, S. C. Lead Salts. Oct. 20, 1926. (British Patent 289,105)

Pure Pb salts of the acids of Ac, Sb, Cr, W, Mo, or U are prepd. from $PbCl_2$ by satg. boiling H_2O with $PbCl_2$ and NaCl, pouring the soln. into an almost equal vol. of cold H_2O , removing the pptd. $PbCl_2$, and washing it with H_2O , and then maintaining this $PbCl_2$ in suspension in a hot or boiling H_2O soln. of a salt of the metal acid. (Canadian Patent 283,213(1928) contains a similar process.)

- 1758 Someya, K. "The Use of Liquid Amalgams in Volumetric Analysis. IV. The Reducing Action of Bismuth Amalgam, the Reduction of Uranium and the Use of the Dichromate Titration." Z. anorg. allgem. Chem. **152**, 368-81(1926).

The results of the studies with U are of particular interest. To test the results, the U content of soln. was detd. gravimetrically and the following improvement on the directions given by Lundell and Knowles is suggested. To ppt. $(\text{NH}_4)_2\text{U}_2\text{O}_7$, add methyl orange to the H_2SO_4 soln. of the uranyl salt, instead of the methyl red, add enough NH_4OH to turn the color orange and digest 10 min at 100° . Then complete the neutralization, filter, ignite, and weigh. Previous investigators have titrated U either by attempting to reduce to U^{+4} or U^{+3} . Lundell and Knowles recommended the former type of method, accomplishing a partial reduction to U^{+3} by means of the action of Zn-Hg on the cold soln. and then shaking in air for 5 min to bring it all back to U^{+4} . Others have had difficulty in getting good results by reducing farther. It is now found that a very smooth reduction to U^{+4} takes place by treating the acid soln. with Hg-Bi. The soln. should be about 6 to 10 N in H_2SO_4 or HCl and after the reduction an equal vol. of H_2O should be added and the soln. titrated with $\text{K}_2\text{Cr}_2\text{O}_7$, using diphenylamine as indicator. If, however, Zn-Hg is used in 2 to 6N HCl, the U is reduced to U^{+3} ; in this case the diphenylamine should not be added until the titration is well under way, on account of the instability of U^{+3} and its likelihood of reacting with the indicator. When U and Ti are present together it is possible to det. the content of each by making 2 reduction expts. With Bi-Hg each element is reduced 1 valence but with Zn-Hg the U is reduced farther.

- 1759 Someya, K. "The Use of Liquid Amalgam in Volumetric Analysis. V. Determination of Phosphoric Acid with Uranyl Acetate." Z. anorg. allgem. Chem. **152**, 382-5(1926).

To 100 cc of soln. contg. not more than 0.1 g of P_2O_5 add 25 cc of 30% HOAc, heat to boiling and add 10 to 40 cc of 0.1N $\text{UO}_2(\text{AcO})_2$ reagent, 5 to 25 cc more of N NH_4OAc and 5 to 25 cc more of HOAc. Cool somewhat, dil. with an equal vol. of H_2O , add filter-paper pulp and filter. Wash the ppt. with 2% NH_4OAc until the filtrate gives no test for U with $\text{K}_4\text{Fe}(\text{CN})_6$. Dissolve the ppt. in HCl and reduce in 6 to 10N HCl with Bi-Hg, whereby the reduction takes place only to U^{+4} or in 2 to 6N HCl with Zn-Hg which reduces the U to U^{+3} . Dil. the soln., if necessary, so it contains at least 50 cc H_2O for every 30 cc of concd. HCl, and titrate with $\text{K}_2\text{Cr}_2\text{O}_7$ using diphenylamine as indicator. No indicator correction is necessary but it is best not to add indicator until the titration with dichromate is well under way in the Zn-Hg reduction.

- 1760 Suzuki, T. "Experimental Production of Uranium Nephritis by Injection of Uranium into Rabbits." Arb. anat. Inst. Tôhoku Imp. Univ. No. 12, 169-81(1926).

- 1761 Tammann, G. and Rosenthal, W. "On the Origin of Normal Uranate in the Heating of UO_3 with Metal Oxides." Z. anorg. allgem. Chem. **156**, 20-6(1926).

It is reported that the thermal decompn. of UO_3 begins at 600° and is complete at 865° . The reaction product is first green and then black forming U_3O_8 as an end product. The table below shows the reactivity of UO_3 with metal oxides when heated at 600° , i.e., raised to that temp. twice in 10 min and when equal molar amts. of powd. starting materials are used. The reactions usually result in the evolution of heat and formation of uranates. No effect was found when UO_3 was heated with BeO , La_2O_3 , CeO_2 , and MoO_2 .

Initial materials	Temp. at which reaction begins, °C	Conversion in wt. %		Color	
		UO ₃	Oxide	Initial mat'l.	Final prod.
Li ₂ CO ₃ + UO ₃	380	11.0	10.0	Light yellow	Yellowish orange
Ag ₂ O + UO ₃	150	75	--	Green	Brown
CaO + UO ₃	160	38.9	39.2	Light yellow	Yellow
BaO + UO ₃	240	42.15	40.9	Light yellow	Yellow orange
SrO + UO ₃	125	49.8	48.2	Light yellow	Orange
MgO + UO ₃	--	20.3	21.2	Light yellow	Yellow
ZnO + UO ₃	200	35.8	34.7	Light yellow	Yellow
CdO + UO ₃	425	64.9	64.5	Grayish yellow	Orange yellow
HgO + UO ₃	175	63.7	61.9	Yellowish red	Orange yellow
CuO + UO ₃	340	78.5	79.1	Green	Brown
PbO + UO ₃	375	67.8	67.5	Light yellow	Red
CoO + UO ₃	230	64.1	--	Green	Dark green
MnO + UO ₃	450	66.4	--	Yellowish green	Green
NiO + UO ₃	340	29.3	30.1	Yellowish green	Green
Al ₂ O ₃ + UO ₃	450	35.2	34.8	Light yellow	Yellow
Cr ₂ O ₃ + UO ₃	230	37.7	--	Green	Green
Fe ₂ O ₃ + UO ₃	--	15.7	--	Reddish brown	Brown
V ₂ O ₃ + UO ₃	290	88.6	--	Light green	Green

- 1762 Tananaeff, N. A. and Pantschenko, G. A. "Detection of Titanium and of Uranium by Means of Spot Tests." *Z. anorg. allgem. Chem.* 150, 163-6(1926).

If a drop of Ti sulfate soln. is brought into contact on filter paper with a drop of dihydroxynaphthalene-disulfonic acid soln. an intense brown coloration is obtained which serves to detect 0.005 mg TiO₂ in a drop. The color is a little weakened by addn. of SnCl₂, which reagent prevents interference by Fe⁺³ and (UO₂)⁺⁺. For (UO₂)⁺⁺ a suitable test is the ferrocyanide reaction. To test for Ti and U in the presence of one another, a suitable soln. can be obtained from an ore by fusing with K₂S₂O₇ and with a little H₂O. Neutralize a drop of the soln. with NH₄OH and extrg. add a drop of Na₂S soln., mix with an excess of concd. (NH₄)₂CO₃ soln., and filter. Ti(OH)₄, together with various sulfides, will be on the filter and the U will pass into the filtrate. Moisten a filter paper with the filtrate and then with a drop of ferrocyanide soln. To test for Ti, add some SnCl₂ to the original soln., warm gently, and transfer a drop of the clear soln. to a filter paper that has been touched with dihydroxynaphthalenedisulfonic acid soln. Other methods of applying these tests are also given.

- 1763 Tananaeff, N. A. and Pantschenko, G. A. "The Spot Method for the Detection of Titanium and Uranium." *Ukrain. Khim. Zhur.* 2, 43-7(1926).

This paper contains information similar to that reported in *Z. anorg. allgem. Chem.* 150, 163-6(1926).

- 1764 Wawilow, S. J. and Lewschin, W. L. "The Relations between Fluorescence and Phosphorescence in Solid and Liquid Materials." *Z. Physik* 35, 920-36(1926).

The fluorescence and phosphorescence of U glass is briefly discussed.

- 1765 Woodruff, J. C. and Bloomfield, G. — assigned to Commercial Solvents Corp. *Methanol Synthesis*. Oct. 25, 1926. (British Patent 279,378)

In prepg. catalysts for MeOH synthesis, ZnO may be stirred into an aq. soln. contg. Cr nitrate, Fe(NO₃)₃ and ZnCl₂ and the mass evapd. and heated to decomp. the nitrates, the product then crushed and treated with an aq. soln. of ZnCl₂ and allowed to harden spontaneously. Other similar examples also are given and reference is made to the use of oxides of Zn, Mg, Cd, Cr, V, W, U, Zr, Ti, Al, Mn, Mo, Th, and Ce (as difficultly reducible oxides) which may be used with more easily reducible oxides such as those of Cu, Ag, Fe, Ni, and Co.

- 1766 Zeehuisen, H. "Increase in Rate of the Isolated Frog Heart in Relation to Temperature, K, U, and Adrenalin." Arch. néerland. physiol. 11, 135-7(1926).
Expts. designed to establish the ratio between the amts. of K, U, and adrenalin necessary to produce the same increase in rate in isolated heart are described. The results were also related to the temp. factor.

PUBLICATIONS LOCATED IN 1927

- 1767 Abelous, J. E., Aloy, J., and Valdigue, A. "Transformations Caused by Sunlight in the Presence of Uranium Salts and by Ultraviolet Rays on Various Carbohydrates." Compt. rend. soc. biol. 96, 1385-6(1927).

Insolation of the common sugars, sucrose, glucose, levulose, and lactose in 2% soln., for several hrs caused no appreciable change. If 25 cc of a 2% soln. of a common sugar is added to 2 cc of a 2% soln. of a U salt, and the tube is exposed to a bright light, the yellow color of the soln. is changed to green, or in case of $\text{UO}_2(\text{AcO})_2$ a violet ppt. forms in a few min. Levulose and sucrose react most rapidly. Aldehydes, especially HCHO , are among the products. Inulin is more readily attacked by this treatment than starch or glycogen.

- 1768 Allin, E. J. "The Under-Water Spark Spectra of Various Metals." Trans. Roy. Soc. Can. (3), 21, III, 231-5(1927).

Emission and absorption lines are given for W, Te, and Th. No reversed lines were observed for U, but a perfectly continuous, intense spectrum without either absorption or emission lines in it was given. The underwater spark spectrum of U should be a useful source of continuous radiation in the ultraviolet. Wavelength tables accompany the paper.

- 1769 Aloy, J., Valdigue, A., and Aloy, R. "Chlorophyll Assimilation and Uranium Salts." Bull. soc. hist. nat. Toulouse 56, 259-65(1927).

U oxalate is decompd. by light, producing CO_2 and CO but no formaldehyde. Other reactions are considered.

- 1770 Andant, A. and Rousseau, E. "The Resonating Power of Some Metallic Salts in Solutions Irradiated by Filtered Light from a Mercury Arc." Compt. rend. 185, 202-03(1927).

The phenomenon of resonance previously obtained with Mn salt irradiated with filtered light from a Hg arc is not an isolated fact, since the same phenomenon has now been observed with salts of Mg, Na, K, and U.

- 1771 Angeletti, A. "Separation of Titanium from Uranium." Ann. chim. applicata 17, 53-4(1927). Cupferron is just as useful in sepg. Ti from U as it has recently been shown to be in sepg. Zr from U and with Ti also it offers a method superior to previous ones. The method is based on the fact that cupferron ppts. quantitatively the compd. $[\text{Ph}(\text{NO})\text{NO}]_4\text{Ti}$ from acid solns. of Ti, the procedure being the same as that already described for Zr. Sepn. of Ti and U can be carried out in either of 2 ways; (1) pptn. of Ti with cupferron and of U in the filtrate with NH_4OH , or (2) division of the soln. in 2 parts, detn. of Ti in 1 part and pptn. by NH_4OH in the other part of Ti and U together, with ignition to $\text{TiO}_2\text{-U}_3\text{O}_8$. As with Zr, high results are obtained by the 2nd procedure and the 1st is usually preferable. Quant. data show the precision by the 1st procedure, both when excess Ti and when excess U are present.

- 1772 Arean, M. "Action of Rare-Earth Elements on Plants." Rend. accad. sci. fis. mat. (Soc. reale Napoli) (3), 33, 37-9(1927).

In expts. on excised, defoliated shoots of Alternanthera spatulata, certain rare-earth elements stimulated the regeneration of roots and leaves. Salts of U induced abundant root and leaf formation in 2 days, when added in very dil. concn. to a Pfeffer nutrient soln. Zr and Be were almost equally

effective with U, while W, Ce, and Rb produced like results in 3, 4, and 5 days. Mo was almost ineffective and V was always toxic. Controls to which K, Mg, Ca, or NH_4 salts were added in like diln. were much slower in response.

- 1773 Atanasiu, I. A. "Electrometric Titration of the Uranyl Ion with Potassium Ferrocyanide." *Bul. Chim. Soc. Române Chim.* **30**, 77-81(1927).

The results obtained in the electrometric titration of $(\text{UO}_2)^{++}$ with $[\text{Fe}(\text{CN})_6]^{-4}$ are affected by the other anion present. The break in the e.m.f. curve is not sharp, except in the presence of alc., when $(\text{UO}_2)_2\text{-Fe}(\text{CN})_6$ is formed.

- 1774 Auriat, G. "Pathological Anatomy of Nephritis, Experimentally Produced by Uranium, with and without Edema." *Compt. rend. soc. biol.* **96**, 111-14(1927).

- 1775 Bailey, K. C. "The Effect of Radon on the Solubility of Lead Uranate." *Phil. Mag.* (7), **4**, 404-07(1927).

Holmes has suggested that the difference between the ests. of geol. time, based on the Pb-Th ratio and the Pb-U ratio, may be due to the fact that PbUO_4 is practically insol. The author has studied the effect of Rn on the soly. of PbUO_4 and finds that, under the influence of this gas, the uranate was sol. in a soln. of NaCl. It results from this that it is doubtful if any differential removal of Th-Pb as compared with U-Pb can be assumed during geol. periods.

- 1776 Bale, A. *Metal Compounds of Azo Dyes*. Sept. 17, 1927. (British Patent 297,331)
Cpds. of azo dyes contg. metals such as Cr, Cu, Fe, Mn, Ni, Co, V, U, Ti, Sn, or Al (in which mols. of the same or of different dyes are united by the metal) are prepd. by treating a metal cpd. of one of the azo dyes with the same or a different azo dye capable of fixing metal or by treating a mixt. of different azo dyes with metallizing agents. Several examples are given of dyes suitable for use on wool, silk, leather, or cotton or for coloring varnishes.

- 1777 Berg, R. "The Formation of Metal Complexes by Means of o-Hydroxyquinoline and the Analytical Application." *J. prakt. Chem.* (2), **115**, 178-85(1927).

Just as NH_3 unites with cations to form complex ions, so does o-hydroxyquinoline. These complex ions, form salts which are in many cases insol. in alk. solns. or in solns. acid with HOAc. In solns. alk. with NaOH, only Cu, Cd, Zn, Mg, and bivalent Fe are pptd. by o-hydroxyquinoline. In HOAc and NH_3 solns., the pptn. reaction is not so specific but still may prove of service in some cases. Thus, in HOAc solns. contg. NaOAc, it is possible to det. Zn, Cd, Al, Bi, Mn, U, Fe, Ni, and Co and in NH_3 soln. Mg. In most cases pptn. by o-hydroxyquinoline is a very sensitive reaction. As a rule the ppts. are yellow or greenish-yellow but the uranyl salt is reddish-brown. Pptn. takes place also in the presence of tartrates. The compn. of the salts is very simple; the H of the OH group is replaced by one valence of metal although, in accordance with the Werner theory, a minor valence may be regarded as connecting the metal with the N atom of the quinoline radical. The ppts. may be weighed after drying at 100° or at 140° in case water of crystn. is present or they can be ignited carefully with added oxalic acid and weighed as the metal oxide. The most convenient method of analysis, however, is to dissolve the ppt. in dil. HCl or H_2SO_4 and det. the liberated hydroxyquinoline bromometrically by means of 0.1 N $\text{KBrO}_3\text{-KBr}$ soln.

- 1778 Berg, R. and Wurm, O. "On the Salt of Cadmium and Bismuth Halides with Organic Bases and Their Analytical Application. (I. Communication)." *Ber.* **60**, 1664-71(1927).

It is reported that naphtholquinolinium uranyl thiocyanide can be obtained by treating naphtholquinoline with a HNO_3 or H_2SO_4 soln. of uranyl salts in the presence of $(\text{CNS})^-$.

- 1779 Biltz, W. and Müller, H. "Systematic Affinity Principles. XLI. On Uranium Oxide." Z. anorg. allgem. Chem. **163**, 257-96(1927).

UO₃ was prepd. from UO₄·xH₂O as an orange amorph. material. U₃O₈ prepd. below 800° is moss green; above that temp. it is black. UO₂ is brown or dark brown-violet. The system UO₃-U₃O₈ is fully discussed. The direct inversion of U₃O₈ into UO₃ is probable in minerals, it is proved for the preps. The observed pressures are not equil. pressures, but are near to them. The system UO₃-U₃O₈ is reversible. A discussion of the mol. vol. and the relation between color and cryst. form is included.

- 1780 Bruzs, B. "Corresponding States for the Entropy of Elements." J. Phys. Chem. **31**, 681-5 (1927).

Data are included for U which show that the entropy at the m.p. is 22 units for the liq. phase.

- 1781 Classen, A. and Danneel, H. Quantitative Analyse durch Elektroanalyse. Berlin, 1927.

Discussions of the detn. of U by electrochem. methods are included. The most favorable concns. of U in soln. are given. For this kind of detn., the accuracy is said to be restricted by the relative amts. of cations present. The sepn. of U from other elements, particularly from the first and second group metals, is also discussed.

- 1782 Colani, A. "Study of the System: Uranyl Acetate-Acetic Acid-Water at 25°." Bull. soc. chim. France (4), **41**, 1291-3(1927).

Solid UO₂(OAc)₂ in the presence of its satd. aq. soln. is slowly decompd. in the dark to the basic salt UO₂(OH)₂·UO₂(OAc)₂·3H₂O. If a soln. of UO₂(OAc)₂ is evapd. to dryness, the residue dissolved in hot H₂O, and the process repeated 4 times, the stable salt 2UO₂(OH)₂·UO₂(OAc)₂ is obtained. By treating UO₂(OAc)₂ with HOAc the salt UO₂(OAc)₂·2HOAc·2H₂O is obtained. Values are given showing the compn. of the solid phase when solns. contg. varying amts. of the acetate and AcOH are allowed to hydrolyze at 25°. The max. soly. of UO₂(OAc)₂·2H₂O is 7.24 g for a soln. contg. 0.59 g HOAc to 100-g soln.

- 1783 Colani, A. "Study of the Systems: Uranyl Nitrate-Alkali Nitrate-Water at 25°." Compt. rend. **185**, 1475-6(1927).

A study of the equil. of UO₂(NO₃)₂·6H₂O and NaNO₃ in H₂O at 25° showed that it was impossible to obtain a double nitrate of UO₂ and Na in the cold in aq. soln. Similarly, it was found impossible to obtain a double nitrate of UO₂ and K. In the system UO₂(NO₃)₂·6H₂O - NH₄NO₃ - H₂O at 25° there are 3 solid phases, viz., UO₂(NO₃)₂·6H₂O, (NH₄)₂UO₂(NO₃)₄·2H₂O (new) and NH₄NO₃. The double salt, obtained by crystn. from cold HNO₃ (d. 1.33), is well crystd., slowly deliquesces and is decompd. in cold H₂O.

- 1784 Colani, A. "Study of the Systems: Uranyl Sulfate-Alkali Sulfate-Water at 25°." Compt. rend. **185**, 273-5(1927).

The soly. curve of the system UO₂SO₄ - (NH₄)₂SO₄ - H₂O shows the existence of the following solid phases; UO₂SO₄·3H₂O, (NH₄)₂(UO₂)₂(SO₄)₃·5H₂O, (NH₄)₂UO₂(SO₄)₂·2H₂O, and (NH₄)₂SO₄. The existence of the cpd. (NH₄)₂(UO₂)₂(SO₄)₃·5H₂O had not been previously noted; but Morton and Bolton in Chem. News **28**, 50(1873) showed the existence of the anhyd. cpd., and Burger and Rimbach in Inagural Dissertation, Univ. of Bonn, p. 46(1904) reported the prepn. of the corresponding hydroxylamine salt. The soly. curve of the system UO₂SO₄ - K₂SO₄ - H₂O shows the existence of the following solid phases: UO₂SO₄·3H₂O, K₂(UO₂)₂(SO₄)₃·5H₂O (new), K₂UO₂(SO₄)₂·2H₂O, and K₂SO₄. The soly. curve of the system UO₂SO₄ - Na₂SO₄ - H₂O shows the existence of the following solid phases: UO₂SO₄·3H₂O, Na₂UO₂(SO₄)₂·3H₂O, Na₄UO₂(SO₄)₃·H₂O (new), which is the only one of the salts of this series which exists in the cold (in presence of an excess of Na₂SO₄), and Na₂SO₄·10H₂O. The curves for the first two systems are given; those of the third system were published later with the details of the expts. The curves seem to indicate that at 25° the cpds. obtained act as true double salts.

1785 Craver, A. E. Aromatic Aldehydes. July 26, 1927. (U. S. Patent 1,636,855)
Pseudocumene mixed with 8.3 times as much air is passed through a W oxide. U oxide and Ta oxide also may be used as catalysts in similar oxidations to produce aldehydes from cpds. such as o-xylene, m-xylene, p-xylene, mesitylene, p-cymene, or o-chlorotoluene. The time of contact specified is about 0.3 to 0.4 sec.

1786 Cuy, E. J. "Ionic Sizes and Their Relationship to Crystal Structure Type, Solid Solution and Double Salt Formation and the Stabilities of Hydrates and Ammoniates." J. Am. Chem. Soc. 49, 201-15(1927).

Interatomic distance in UO_2 (2.37 Å) and assumed radius for U^{+4} (1.22 Å) are reported. The structure type (I) and the ratio of at. radii (0.94) are also reported for UO_2 .

1787 Denis, W. and Reed, L. L. "A Study of the Influence of Kidney Function on the Concentration of Certain Non-Protein Sulfur Compounds in the Blood." J. Biol. Chem. 73, 41-50(1927).

In dogs poisoned with $\text{UO}_2(\text{NO}_3)_2$ it was found that the concn. of inorg. sulfates and of the neutral S fraction of blood was directly dependent on vol. of urine excreted.

1788 Dreisch, T. "The Infrared Absorption by Colored Glass and Salt Solutions." Z. Physik 40, 714-24(1927).

The absorption spectrum of U glass is investigated. The position of the absorption lines in the infrared and red regions are discussed. The presence of complex uranyl ions in the glass are mentioned.

1789 Dushman, S., Dennison, D., and Reynolds, N. B. "Electron Emission and Diffusion Constants for Tungsten Filaments Containing Various Oxides." Phys. Rev. (2), 29, 903(1927).

The emission phenomena are similar to those observed with thoriated W filaments. The values of A and b, resp., in the thermionic emission equation are 3.2, 33,000 for U. Data are also given for the diffusion consts. and heat of diffusion of U, Th, Ce, Zr, and Y.

1790 Dyson, G. M. "Radium and Uranium: Extraction, Properties, and Uses." Chem. Age (London) 17, 25-7(met. section)(1927).

1791 Fernandes, L. "Complexes of Uranyl with Polyphenolic Acids." Atti reale accad. nazl. Lincei (6), 6, 102-06(1927).

Previous expts. have indicated that with 2 OH groups in o-position, uranyl complexes are very stable, whereas with an OH group near a CO_2H group, the complexes are usually less stable. Further, to establish this hypothesis and to det. whether the stability is independent of the org. nucleus and depends solely upon the no. and the position of the OH and CO_2H groups, complexes of uranyl and o-hydroxynaphthoic acid were prepd. As a further addn. to knowledge of these cpds., complexes of protocatechuic acid were prepd. and found to be so stable that they are not decompd. by excess concd. alk. hydroxides. The o-hydroxynaphthouranates were prepd. by adding o-hydroxynaphthoic acid to N uranyl acetate soln., neutralizing the soln. with the carbonate of the particular base and allowing the product to crystallize from the red soln. obtained. Under these conditions the complexes always contain 2 mols. of org. acid/mol. of $(\text{UO}_2)^{++}$ and are derived from the acid $[\text{UO}_2(\text{C}_{10}\text{H}_8\text{OCOO})_2]\text{H}_2$. On the other hand, in weakly acid solns. and with a large excess of uranyl acetate, there sepd. yellow crystals of the type: $[\text{UO}_2(\text{C}_{10}\text{H}_8\text{OCOO})_{\text{OH}}]\text{H}_2$, which possess a much less complex structure. K o-hydroxynaphthouranate,

$[\text{UO}_2(\text{C}_{10}\text{H}_8\text{OCOO})_2]\text{KH}$, is black. Na o-hydroxynaphthouranate, $[\text{UO}_2(\text{C}_{10}\text{H}_8\text{OCOO})_2]\text{NaH}\cdot 4\text{H}_2\text{O}$, is a gray-maroon color. Guanidine o-hydroxynaphthouranate, $[\text{UO}_2(\text{C}_{10}\text{H}_8\text{OCOO})_2](\text{CH}_5\text{N}_3)\text{H}$ is prepd. by adding guanidine nitrate to hot satd. K o-hydroxynaphthouranate; it is dark red. Ba o-hydroxynaphthouranate, $[\text{UO}_2(\text{C}_{10}\text{H}_8\text{OCOO})_2\text{O}]\text{Ba}$ is prepd. by adding BaCl_2 to boiling K o-hydroxynaphthouranate; it is yellow-ochre in color. K monohydroxynaphthouranate, $[\text{UO}_2(\text{C}_{10}\text{H}_8\text{OCOO})_{\text{OH}}]\text{KH}$, prepd. like K o-hydroxynaphthouranate except that the K_2CO_3 added was of such quantity as to leave the soln. slightly

acid. It is yellow and gives red solns. in water as a probable result of an equil. with K_2O -hydroxynaphthouranate. Guanidine protocatechuicuranate, $[(\text{UO}_3(\text{C}_6\text{H}_3\text{O}_2\text{COO}))(\text{CH}_5\text{N}_3)\text{H}]$, is prepd. by adding guanidine carbonate to a hot soln. of protocatechuic acid and $\text{UO}_2(\text{OAc})_2$ until neutral. Aniline protocatechuic uranate, $[\text{UO}_3(\text{C}_6\text{H}_3\text{O}_2\text{COO})](\text{PhNH}_2)\text{H}\cdot 3\text{H}_2\text{O}$ is prepd. by adding alc. PhNH_2 to a soln. of $\text{UO}_2(\text{OAc})_2$ and protocatechuic acid and heating for a long time; it is brick-red. K protocatechuicuranate, $[\text{UO}_3(\text{C}_6\text{H}_3\text{O}_2\text{COO})]\text{KH}\cdot\text{H}_2\text{O}$ is prepd. from K_2CO_3 and a soln. of uranyl acetate and protocatechuic acid; it is maroon. Guanidine diprotocatechuicuranate, $[\text{UO}_2(\text{C}_6\text{H}_3\text{O}_2\text{COO})_2](\text{CH}_5\text{N}_3)\text{H}\cdot 12\text{H}_2\text{O}$ is prepd. by adding $\text{UO}_2(\text{OAc})_2$ (much less than the stoichiometric quantity) to hot concd. protocatechuic acid, and then adding a small proportion of guanidine carbonate and chilling; it is a lustrous yellow and relatively unstable.

- 1792 Gaviola, E. "A Fluorimeter. Apparatus for Measurement of the Time of Dying of Fluorescence." *Z. Physik* **42**, 853-61(1927).

This paper reports the duration of the fluorescence of uranyl glass.

- 1793 Gaviola, E. and Pringsheim, P. "The Question of Transition by Fluorescence to Phosphorescence." *Z. Physik* **43**, 384-93(1927).

By comparison of fading times it is reported that U glass shows only phosphorescence while solid uranyl salts show both phosphorescence and fluorescence and solns. of uranyl salts, only fluorescence. The duration of the fluorescence of uranyl nitrate and uranyl sulfate is reported.

- 1794 Ghosh, J. C. and Mitter, B. N. "Extinction Coefficients of Mixtures of Uranyl Nitrate and Organic Acids in the Ultra-Violet, as Experimental Evidence in Favor of the Formation of Unstable Intermediate Compounds." *Quart. J. Indian Chem. Soc.* **4**, 353-66(1927).

Extinction coeffs. of mixts. of $\text{UO}_2(\text{NO}_3)_2$ and formic, acetic, propionic, succinic, glycolic, and mandelic acids were measured with the aid of a rotating sector photometer (Adam-Hilger) and quartz spectrograph. The coeffs. were higher for the mixts. than for the sep. substances. It was assumed that the mass law held, and a math. treatment is given the data and a theory evolved. This theory explains in most cases the exptl. data on coeffs. of mixts., assuming equil. and a definite value for the mol. extinction coeff. for each wavelength for the intermediate complex. In a homologous series K diminishes with each additional CH_2 in a definite ratio, increases 12 times as a H of CH_3 is replaced by COOH , and in the case of monobasic acids, replacement of H of CH_3 by OH increases K 2.5 times.

- 1795 Ghosh, J. C. and Mukherjee, J. "Photochemical Oxidation of Leuco-Malachite Green by Means of Uranyl Nitrate in Chloroacetic Acid Solution." *Quart. J. Indian Chem. Soc.* **4**, 343-52(1927).

The oxidation of the leucobase of malachite green by means of $\text{UO}_2(\text{NO}_3)_2$ is purely a photochem. phenomenon. The reaction rate varies directly as the light intensity and as the concn. of $\text{UO}_2(\text{NO}_3)_2$. The spectral region 478 to 410 $\mu\mu$ is the most eff. radiation in bringing about the chem. change. The inverse of reaction rate plotted against the inverse of the concn. of leucobase is a straight line in accord with the equations of Cairo and of Turner.

- 1796 Ghosh, S. and Dhar, N. R. "Studies in Adsorption. XVII. Influence of Concentration of a Sol on Its Coagulation by Electrolytes." *J. Phys. Chem.* **31**, 187-206(1927).

Sols of $\text{Sn}(\text{OH})_4$ (+), MnO_2 (-), $\text{Al}(\text{OH})_3$, V_2O_5 , $\text{Th}(\text{OH})_4$, S(Veimarn), and Au, follow the general diln. rule, in that the greater the concn. of sol the greater the amt. of electrolyte necessary for coagulation. Sols which do not follow the rule are Sb_2S_3 , Prussian blue, gum dammar, and gambage. Uranium ferrocyanide sol is on the border line. Metallic Ag sol is abnormal and when coagulated by univalent electrolytes and MnO_2 (+) when coagulated by AgNO_3 and CuCl_2 .

- 1797 Ghosh, S. and Dhar, N. R. "Adsorption. XVIII. Coagulation of Sols by a Mixture of Electrolytes and the Phenomena of Positive and Negative Acclimatization." J. Phys. Chem. **31**, 649-80(1927).

Positively charged Th hydroxide sol does not show ionic antagonism when coagulated by a mixt. of KBrO_3 and K_2SO_4 . Negatively charged V_2O_5 sol behaves normally when coagulated by KCl and BaCl_2 . Negatively charged U ferrocyanide sol behaves slightly abnormally when coagulated by a mixt. of KCl and BaCl_2 , but it develops well-marked ionic antagonism when coagulated by KCl and $\text{K}_4\text{Fe}(\text{CN})_6$. This antagonism is more marked with the dil. sols of U ferrocyanide than with concd. sols. This is caused by the preferential adsorption of ferrocyanide ions by the U ferrocyanide sol. Sols of Al hydroxide, V_2O_5 , and Au do not appreciably show the phenomenon of pos. acclimatization when coagulated by the slow addn. of such electrolytes as KCl , $\text{K}_2\text{C}_2\text{O}_4$, $\text{K}_4\text{Fe}(\text{CN})_6$, BaCl_2 , etc. Expts. on adsorption support the authors' view and show the inadequacy of the views of Freundlich, Bancroft, and Weiser on acclimatization. The cutting down of the adsorption of a pptg. ion due to the presence of another seems to be a general phenomenon. Abnormal diln. effect, abnormal behavior when coagulated by mixts. of electrolytes of widely varying pptg. powers, the phenomenon of pos. acclimatization and the decrease in the viscosity of a sol when small quantities of electrolytes are added, are intimately connected and are mainly due to the adsorption of an ion carrying the same charge as the sol.

- 1798 Gillam, A. E. and Morton, R. A. "A Comparison of Certain Methods for Determining the Ultra-Violet Intensity of a Light Source." J. Soc. Chem. Ind. (London) **46**, 417-20(1927). This paper discusses the absorption spectrum of mixts. of oxalic acid and uranyl salts, particularly the sulfate, chloride, and acetate. The use of this photolytic reaction as an actinometer is also discussed.

- 1799 Hager, K. "Uranyl-Acetyl (Benzoyl) Acetone Compounds." Z. anorg. allgem. Chem. **162**, 82-6(1927).

The prepn. and characteristics of the following cpds. are described: NH_4 triacetylacetone uranate, $\text{UO}_2(\text{CH}_3\cdot\text{COCH}_2\cdot\text{CO}\cdot\text{CH}_3)_3\text{HNH}_3$, methylaminotriacetylacetone uranate, and aniline triacetylacetone uranate. All are easily sol. in Me_2CO , MeOH , and EtOH , and difficulty sol. in Et_2O and H_2O . They are orange-yellow, the same as the following preps.: uranyl diacetylacetone-1-pyridine and same with dibenzoylacetone-1-pyridine, $\text{UO}_2(\text{C}_{10}\text{H}_9\text{O}_2)_2\cdot\text{C}_6\text{H}_6\text{N}$; sol. in MeOH , less so in alc. and Et_2O , insol. in H_2O .

- 1800 Hakomori, S. "The Reactions of Several Metallic Ions in the Presence of Tartaric Acid." Science Repts. Tôhoku Imp. Univ., First Ser., **16**, 841-59(1927).

The reactions of several metallic ions in the presence of tartaric acid are investigated by means of the absorption spectrum, elec. cond., rotatory power, ultramicroscopic observation and colloid-chem. treatment. Ni, Co, U^{+6} in neutral soln., Pb in alk. soln., Cu in acid, neutral or NH_4OH soln. form complex salts contg. 1 atom of metal and 1 mol. of tartaric acid. Sb^{+5} in acid soln. forms a salt contg. 2 atoms of metal and 1 mol. of tartaric acid. Slight evidence of the formation of similar salts is given by the elec. cond. and rotatory power in the case of Zn, by the absorption spectra in the case of Mn.

- 1801 Haussler, A. Esters of Pyrroacemic Acid. Jan. 11, 1927. (U. S. Patent 1,614,195) A lactic acid ester is volatilized and the vapors are dehydrogenated by the action of O_2 to form aliphatic esters of pyrroacemic acid. V_2O_5 , Mo or U oxides, Cu or Ag vanadates, molybdates, uranates, Pb or Ni chromates, etc., may be used as catalysts.

- 1802 Hayashi, O. "Experimental Alburminuria." Proc. Imp. Acad. (Tokyo) **3**, 625-36(1927). In exptl. nephritis in Japanese toads produced by Cr, U, or cantharidin, protein passes through the glomeruli and the tubules as well as plasma protein. In other expts. with toads, cats, and rabbits, when egg white injected into lymph sac or circulation is being excreted, plasma-protein appears in the urine, but its elimination ceases almost altogether with the egg white. Long-continued injection of egg white fails to induce protein to pass through the tubules besides the glomeruli. It is concluded that the elimination of egg white through the kidney under normal conditions does not impair kidney parenchyma.

1803 Herzer, H. Beiträge zur Kenntnis der Nitride. Dissertation, Univ. of Hannover, 1927.
The heat of formation of U nitride contg. 3.5% N is 68.5 kcal/g at. wt. of N.

1804 Holmes, A. "The Effect of Radon on the Solubility of Lead Uranate." Phil. Mag. (7), 4, 1242(1927).

This is a discussion of points of difference in papers by the author in Phil. Mag. (7), 1, 1055-74(1926) and K. C. Bailey in Phil. Mag. (7), 4, 404-07(1927).

1805 Kano, N. "Application of Liquid Amalgams to Volumetric Analysis. IV. The Use of Cadmium Amalgam." Science Repts. Tôhoku Imp. Univ., First Ser., 16, 701-06(1927).

Liq. Cd-Hg can be prepd. similarly to Zn-Hg except that the tube receiving the reduced amalgam should contain dil. H_2SO_4 rather than boiled H_2O . An atm. of CO_2 is essential in the detn. of U with Cd-Hg although inadvisable with Zn-Hg.

1806 Kano, N. "Application of Liquid Amalgams to Volumetric Analysis. VI. Potentiometric Titration of Iron, Molybdenum, Uranium, Vanadium and Titanium." Science Repts. Tôhoku Imp. Univ., First Ser., 16, 713-18(1927).

Solns. of Fe, Mo, U, V, and Ti were separately reduced by Zn-Hg and titrated with KMnO_4 , the end point being detd. potentiometrically. The results agreed closely with the theoretical values. Moreover, when Fe^{+3} and Ti^{+4} are present together, it is easy to det. the complete oxidation of the reduced Fe^{++} and Ti^{+3} separately by a single titration as each end point is shown potentiometrically. The total vol. of the soln. should be kept small in work of this kind.

1807 Kikuchi, S. "Application of Liquid Amalgams to Volumetric Analysis. V. The Estimation of Iron, Titanium, Uranium, and Methylene Blue." Science Repts. Tôhoku Imp. Univ., First Ser., 16, 707-12(1927).

If an acid soln. contg. $(\text{UO}_2)^{++}$ and Fe^{+3} is reduced with liq. Cd-Hg, U^{+4} and Fe^{++} are formed. If such a reduced soln. is titrated with std. KMnO_4 soln., both elements are oxidized back to the original condition but if ferric alum is used only the U is oxidized. If an acid soln. contg. Ti^{+4} and $(\text{UO}_2)^{++}$ is reduced by Cd-Hg at 60° and then one portion is titrated with KMnO_4 the content of both elements is obtained whereas titration of another portion with std. I_2 soln. is a measure of the Ti alone. Instead of carrying out the analysis in this way, the entire soln. can be titrated with KMnO_4 , reduced again, and then titrated with I_2 .

1808 Kleeman, R. D. "The Internal Energy, Maximum Work, and Free Energy of the Elements." J. Phys. Chem. 31, 1669-73(1927).

Values for the max. work (-1915 cal.) and the int. energy (1376 cal.) of U are given.

1809 Ladenburg, R. "Magnetism and the Periodic System." Z. physik. Chem. 126, 133-52(1927).

Discussion includes the paramagnetism of U^{+4} based on the electronic structure of the ion.

1810 Lifschitz, J. and Hooghoudt, S. B. "Investigation on the Becquerel Effect. I." Z. physik. Chem. 128, 87-109(1927).

Photolysis information on the $\text{U}^{+4}/\text{U}^{+6}$ couple is included.

1811 Lorah, J. R. "Uranium Oxide Colors and Crystals in Low Temperature Glaze Combinations." J. Am. Ceram. Soc. 10, 813-20(1927).

- 1812 Mack, J. E. and Cork, J. M. "X-Ray K-Absorption in Elements W(74) to U(92) and K-Screening Numbers." *Phys. Rev.* (2), 30, 741-6(1927).

Values are recorded for the K-absorption edges of elements 74, 76 to 83 inclusive, 90, and 92. Absorption is noted; it is due apparently to the material of the slit. An attempt is made to detn. Sommerfeld's screening nos. for the K shell from empirical data, on the assumption that the first term screening no. is a linear function of the at. no.

- 1813 MacNider, W. de B., Helms, S. T. and Helms, S. C. "The Course of Uranium Nitrate Intoxications in Pregnant Dogs." *Bull. Johns Hopkins Hosp.* 40, 145-59(1927).

Eleven pregnant dogs aged 18 mos. to 4 yrs and in different stages of gestation were studied for 4 days in metabolism cages to establish their normals and to exclude the presence of any pre-existing nephritis. Following the subcutaneous injection of 4 mg of uranium nitrate/kg of body weight, the observations were cont. Dogs that died were autopsied and the livers and kidneys studied microscopically. Results showed that dogs intoxicated by uranium nitrate during gestation develop changes in blood and urine and may show a clinical course resembling certain major toxemias of pregnancy. In the dogs which died, a liver injury was induced which was out of proportion to renal injury.

- 1814 Marden, J. W. — assigned to Westinghouse Lamp Co. *Metallurgical Method*. Oct. 25, 1927. (U. S. Patent 1,646,734)

A reduction and isolation method for U, Th, Zr, Ti, V, Ta, and W is given. The pure oxide is obtained by ignition of a pure cpd. such as the oxalate. The chloride is prepd. by direct Cl_2 treatment, it is then mixed with Na and CaCl_2 in a reaction bomb and heated to reduce the chloride to metal.

- 1815 Marden, J. W. — assigned to Westinghouse Lamp Co. *Uranium, Zirconium, Tungsten, Thorium, or Other Rare Metals*. Nov. 15, 1927. (U. S. Patent 1,648,954)

U metal or a U-Al alloy can be obtained by Al reduction of a mixt. of U salt and Al powder (in large excess). U metal may be obtained by distg. off the Al in an inert atm.

- 1816 Mauriac, P. and Traissac, F. J. "Contribution to the Study of Characteristic Cloudiness of the Liner in the Course of Experimental Uranium Nephritis." *Compt. rend. soc. biol.* 97, 81-4(1927).

Rabbits were used in the expts. Graphs are presented showing liner effects.

- 1817 Mauriac, P. and Traissac, F. J. "Study on the Elimination of Phenolsulfonophthalein in Experimental Nephritis from Uranium." *Compt. rend. soc. biol.* 97, 79-81(1927).

- 1818 Nakazono, T. "Application of Liquid Amalgams to Volumetric Analysis. II. Estimation of Vanadium and Uranium." *Science Repts. Tôhoku Imp. Univ., First Ser.*, 16, 687-93(1927).

The liq. Zn-Hg previously described is capable of reducing V^{+5} to V^{++} in an atm. of CO_2 if the reduction is continued for at least 3 min to remove the effect of the trace of O_2 left in the reductor. KMnO_4 can be used to oxidize the V back to V^{+5} or the soln. after being reduced can be oxidized to V^{+4} state by Ag_2SO_4 and then titrated with KMnO_4 . In this case it is not necessary to replace the air in the reductor with CO_2 . With U, without removal of the air, the soln. can be reduced by shaking 30 secs and the resulting U^{+4} oxidized back to U^{+6} by KMnO_4 .

- 1819 Nakazono, T. "Uses of Amalgams in Volumetric Analysis. XII. Potentiometric Titration of Molybdenum, Iron, Titanium, Uranium and Vanadium by Means of Metallic Electrodes." *J. Chem. Soc. Japan* 48, 17-26(1927).

Two kinds of the electrodes, (A) Pt-Ir and Pt and (B) Pt-Ir and Hg-plated Cu, were found better than any other tried. In using (A), the e.m.f. rises only at the end point, but falls again promptly, while with (B) the variation of e.m.f. can be observed at every stage of titration, and no sudden depression of voltage takes place after the end point has passed. The conditions of potentiometric titration for each of the above elements when titrated with KMnO_4 , KBrO_3 , Br_2 , or Fe^{+3} were investigated, and the differential titration of solns. contg. 2 elements with these reagents was also accomplished successfully.

- 1820 Nichols, E. L., Howes, H. L., and Wilber, D. T. "On Transformation Spectra." J. Optical Soc. Am. 14, 205-22(1927).

The luminescent effect of U salts and sodium phosphates are discussed.

- 1821 Ogiu, K. "Pharmacological Studies of Uranium." Folia Pharmacol. Japon. 5, 44-57(1927).
The drug employed is a neutral sodium uranium tartrate. U acts chiefly on the central nervous system, especially on the respiratory and vasomotor centers. In frogs, respiration is slowed and weakened, and motor paralysis follows. In mice and rabbits, respiration is at first accelerated. Larger doses cause convulsions followed by a flaccid paralysis as well as slowed respiration, death occurring by cessation of respiration. No particular injury to the heart is observed. In rabbits an enormous increase of blood pressure is seen, due to stimulation of the vasomotor center. With very large doses, however, the blood pressure may suddenly sink to the zero line. Rabbits nearly always display albuminuria and glycosuria, with marked diminution of urea output. No noteworthy effects of U are observed on the isolated frog heart, the vessels of the rabbit ear or frog leg, the isolated rabbit intestine and uterus, or frog muscle-nerve prepn. At autopsy, after a rapidly lethal poisoning, the chief findings are considerable hemorrhage in the lungs and mucus membranes of the gastrointestinal tract and numerous ecchymoses in various visceral organs. But in subacute or chronic U poisoning a bloody serous fluid is found in the abdominal cavity and there is a degeneration of the liver and kidneys.

- 1822 Papish, J. and Hoag, L. E. "The Detection of Uranium by a Photoluminescence Test." Proc. Natl. Acad. Sci. U.S. 13, 726-8(1927).

The optical emission spectrum of U, while rich in lines, cannot be depended upon for the detection and identification of this element. But if U is used as activator upon NaF as base, a vivid-yellow luminescence is produced which can be used for the detection of very small quantities of U. A d.c. of 15 to 30 amps made between soft-core C electrodes can serve as a source of light. A quartz lens will bring the light to a focus and a "Violet Ultra" filter can be placed in the path of the light so that a band of light in the near ultraviolet region is produced, limited by $\lambda = 3300$ and 3850 . A bead of NaF fused in the loop of a fine Pt wire, when free from activators, should not luminesce when placed in the light. If, however, the bead is reheated, or moistened with water, and pressed against powd. material contg. U, it will show luminescence when held in the light of the arc. KF is not quite so sensitive but can be used for quantities such as the chemist is likely to meet. Nb appears to be the only element likely to be confused with U in this test. It produces luminescence of a greener hue and less intense. TiO_2 , SiO_2 , and columbic acid form complex fluorides with NaF which cannot take the place of NaF in the test but this difficulty can be overcome by using more NaF. The procedure can be varied by using a 4000-v condensed Fe spark without the intervention of a quartz lens and ultraviolet filter.

- 1823 Pauling, L. "The Sizes of Ions and the Structure of Ionic Crystals." J. Am. Chem. Soc. 49, 765-90(1927).

This paper contains a discussion of the cryst. structure of UO_2 . An empirical calcn. of the radius of the U^{+4} ion in the crystal lattice yields 0.97 A. For UO_2 of the fluorite-type structure, the lattice ratio is reported as 0.69.

- 1824 Pokrowski, G. I. "Observations on Light Dispersion in Suspensions." Z. Physik 41, 493-506(1927).

U suspensions were among those investigated.

- 1825 Rentschler, H. C. and Marden, J. W. — assigned to Westinghouse Lamp Co. Coherent Uranium. Nov. 15, 1927. (U. S. Patent 1,648,962)

U powder is pressed into a compact body in a closed vessel, removed from the vessel in N_2 or other inert atm., and while protected by the inert gas, is placed in a vacuum furnace which is then evacuated. The U compact is heated at a rate so as to cause occluded gas to be expelled slowly. After the gas is removed, the temp. is raised to whiteness and the U is sintered.

- 1826 Saito, S. "The Estimation of Phosphoric Acid by Means of Uranyl Salts." Science Repts. Tôhoku Imp. Univ., First Ser. 16, 739-43(1927).
 $\text{UO}_2\text{NH}_4\text{PO}_4$ can be obtained in an easily filtrable condition by adding a hot soln. of $\text{UO}_2(\text{OAc})_2$ contg. considerable HOAc to a hot soln. of phosphate likewise contg. HOAc . Thus 2 to 10 cc portions of std. Na_2HPO_4 solns. contg. 10.44 g $\text{P}_2\text{O}_5/1$ were mixed with 15 to 30 cc of 30% HOAc and 30 to 70% of H_2O before pptg. Similarly, to 10 to 40 cc portions of 0.1N $\text{UO}_2(\text{OAc})_2$ solns., 5 to 25 cc of 30% HOAc , 5 to 20 cc of N NH_4OAc and 5 to 50 cc of H_2O were added. The boiling solns. were mixed, allowed to stand 10 min, dild. with an equal vol. of hot water and allowed to stand another 10 min before filtering. The ppt. was drained by suction, washed until no more U was present in the washings, dissolved in hot 3N H_2SO_4 , reduced with liq. Zn-Hg in the presence of air and the resulting U^{+4} oxidized back to $(\text{UO}_2)^{++}$ by 0.1N KMnO_4 . The results obtained with 0.02 to 0.10 g of P_2O_5 showed agreement within 0.2 mg of P_2O_5 in every case.
- 1827 Schilz, W. E. Eine Revision des Atomgewichts des Urans. Analyse des Uranochlorids. Munich, 1927.
- 1828 Schoep, A. "Detection and Analysis of Secondary Uranium Minerals." Chimie industrie 17, Special No., 179-81c(1927).
 The technique of the detn. of U in its acid soln. minerals and the identification of secondary U minerals by the Becke method are outlined.
- 1829 Smith, J. D. M. "The Electronic Structure of Atoms. Part I. The Periodic Classification." J. Chem. Soc. 2029-38(1927).
 Uranium is one of the elements discussed.
- 1830 Someya, K. "On the Color of Chromium, Vanadium, and Three-Valent Uranium Ions." Z. anorg. allgem. Chem. 161, 46-50(1927).
 Aq. solns. of U^{+3} are reported to be a purple-red. This color is attributed to the complex which is usually formed rather than to the ion itself.
- 1831 Someya, K. "On the Color of Chromium, Vanadium, and Three-Valent Uranium Ions." Science Repts. Tôhoku Imp. Univ., First Ser. 16, (I), 411(1927).
 This paper contains information similar to that reported in Z. anorg. allgem. Chem. 161, 46-50(1927).
- 1832 Tammann, G. and Hinnuber, J. "On the Solubility of Metals in Mercury and the Potentials of Very Dilute Amalgams." Z. anorg. allgem. Chem. 160, 249-70(1927).
 The soly. of Cr, Mo, W, U, Mn, V, As, and Sb in Hg was detd. by an electrochem. method which cannot be described in a brief abstract. It is shown that within a natural group of the periodic system, soly. increases with at. wt. The soly. of U in Hg at 18° is reported to be $1.4 \times 10^{-4}\%$.
- 1833 Thews, K. B. Treating Ores of Uranium, Vanadium and Radium. May 27, 1927. (U. S. Patent 1,495,538)
 Finely divided ores contg. V, U, and Ra or any of these are treated with H_2 , CO, CH_2O , C_2H_4 , sugar or other nonsolvent reducing reagent and an acid such as HCl to sep. the values from the gangue. Zn may be added to produce H_2 from HCl.
- 1834 van Aubel, R. "On the Presence of Uraninite Crystals in the Uraniferous Deposits of Kasolo (Katanga)." Compt. rend. 185, 586-8(1927).
 The paper contains a description of some fine crystals of uraninite found, and a note that U carbonate minerals seem to be missing.
- 1835 Van Nitsen, R. "Uranium Salts in Certain Tropical Diseases." Rev. méd. hyg. tropical. 19, 113-20(1927).

- 1836 von Hevesy, G. and Böhn, J. "The Quantitative Determination of Tantalum by Roentgen Spectrochemical Means." Z. anorg. allgem. Chem. **164**, 69-80(1927).

This paper contains a brief note on the microchem. detection of U by the x-ray spectroscopic method.

- 1837 von Kurelec, V. R. "The Position of the Absorption Bands of Potassium Permanganate and Uranyl Nitrate in Various Colorless Solvents." Biochem. Z. **180**, 65-84(1927).

In aq. solns. of KMnO_4 and $\text{UO}_2(\text{NO}_3)_2$ there is one absorption line in common (487 m μ) which in different solvents shifts toward the red in KMnO_4 and toward the violet in $\text{UO}_2(\text{NO}_3)_2$. In solvents of homologous series the adsorption band of KMnO_4 shifts more to the red with increasing no. of C atoms and that of $\text{UO}_2(\text{NO}_3)_2$ shifts less to the violet; in other words, through the increase in C atoms of the solvent the band is forced more to the red in both solns.

- 1838 Watanabe, S. "Gaseous Metabolism of the Kidney in Experimental Nephritis." Tokyo Igakkwai Zasshi **41**, 2088-2113(1927).

The author has investigated the changes of the consumption of kidney during the course of exptl. nephritis produced by U or cantharidin. Rabbits were prepd. after Barcroft and Brodie's method. For the blood-gas analysis, Plesch's const. temp. app. modified by Tamura and Miwa was used. The O_2 consumption of kidney was detd. both at the earlier and later stages of U poisoning (subcutaneously, 0.005 to 0.008 g/kg), i.e., the former being the stage at which there was a marked albuminuria but no detectable morphological change, while at the latter the well-known marked pathological changes in the tubules took place. Directly after an injection of U, the O_2 consumption of kidney did not indicate any difference from its normal conditions, but in 4 to 20 hrs after the injection (i.e., during the earlier stage), its O_2 consumption increased from its normal value of 0.045 to 0.065 cc to 0.09 to 0.13 cc/g/min. In 40 to 70 hrs after the injection, the absorption of O_2 in kidney showed a marked decrease to 0.02 to 0.007 cc/g/min. At this stage the morphological changes in the tubules were distinct. During the early stage of the augmented O_2 consumption the quantity of urine excreted showed at times tendencies to increase, but this was not invariable. During the next state, in which distinct histological changes set in and O_2 consumption greatly diminished, the urine excretion also decreased considerably. These results led the author to conclude that no appreciable increase in consumption of O_2 seems to occur during the diuresis caused by kidney stimulants such as caffeine or an urinary substance such as urea, while the diuresis caused by kidney irritants such as uranium, involves a marked increase in O_2 consumption.

- 1839 Wawilow, S. J. and Lewschin, W. L. "Correction to Our Article: The Relations between Fluorescence and Phosphorescence in Solid and Liquid Media." Z. Physik **44**, 539(1927).

New results indicate that U salts in the solid state show only phosphorescence and no fluorescence, in contrast with the results obtained with other phosphorescent substances.

- 1840 Wawilow, S. J. and Lewschin, W. L. "A 'Phosphorescent' Liquid." Naturwissenschaften **15**, 899-900(1927).

The duration of fluorescence for UO_2SO_4 soln. at room temp. is reported. The time of fluorescence is said to decrease with an increase in concn., for an increase in temp. of soln., and the fading which is obtained is said to follow an exponential log curve.

- 1841 Weiland, R. and Hager, K. "Compounds of Sexivalent Uranium with Aromatic Hydroxy Acids." Z. anorg. allgem. Chem. **160**, 193-208(1927).

It appears from a number of investigations that complex U cpds. in which the COOH group is directly attached to the U atom are yellow, while those in which the OH group is attached to the U atom are orange. Yellow and orange complex cpds. may be obtained with salicylic acid, depending upon the cation cpds., strong bases being orange and weak bases yellow. The colors are of different shades, depending upon the content of water of hydration. The latter depends upon the temp. of the soln. from which the cpd. crystallizes. The prepn. and the characteristics of the following cpds. are described: pyridine uranyl salicylic methyl ester, $\text{UO}_2(\text{OC}_6\text{H}_4\text{COOCH}_3)_2 \cdot 1 \text{ py}$ (red); aniline disalicylatouranate,

[$\text{UO}_2(\text{OC}_6\text{H}_4\text{COO})_2$] $\cdot\text{H}_2\cdot\text{H}_2\text{N}\cdot\text{C}_6\text{H}_5$ (red); piperidine disalicylatouranate, [$\text{UO}_2(\text{OC}_6\text{H}_4\text{COO})_2$] $\cdot\text{H}_2\cdot\text{NC}_5\text{H}_{11}$ (red); pyridine trisalicylatouranate, [$\text{UO}_2(\text{OOC}\cdot\text{C}_6\text{H}_4\text{OH})_3$] $\cdot\text{H}\cdot\text{py}\cdot\text{H}_2\text{O}$ (yellow); NH_4 tribenzoatouranate, [$\text{UO}_2(\text{OOC}\text{C}_6\text{H}_5)_3$] $\cdot\text{NH}_4$ (yellow); NH_4 tri-*p*-hydroxybenzoatouranate, [$\text{UO}_2(\text{OOC}\text{C}_6\text{H}_4\text{OH})_3$] $\cdot\text{NH}_4\cdot 3\text{H}_2\text{O}$ (yellow); aniline tri-*p*-hydroxybenzoatouranate, [$\text{UO}_2(\text{OOC}\cdot\text{C}_6\text{H}_4\text{OH})_3$] $\cdot\text{H}\cdot\text{NH}_2\text{C}_6\text{H}_5\cdot 4\text{H}_2\text{O}$ (yellow); *o*-toluidine tri-*p*-hydroxybenzoatouranate, [$\text{UO}_2(\text{OOC}\cdot\text{C}_6\text{H}_4\text{OH})_3$] $\cdot\text{H}\cdot\text{NH}_2(\text{CH}_3)\text{C}_6\text{H}_4\cdot 3\text{H}_2\text{O}$ (yellow); pyridine tri-*p*-hydroxybenzoatouranate, [$\text{UO}_2(\text{OOC}\cdot\text{C}_6\text{H}_4\text{OH})_3$] $\cdot\text{H}\cdot\text{py}\cdot 3\text{H}_2\text{O}$ (yellow); piperidine tri-*p*-hydroxybenzoatouranate, [$\text{UO}_2(\text{OOC}\cdot\text{C}_6\text{H}_4\text{OH})_3$] $\cdot\text{H}\cdot\text{NC}_5\text{H}_{11}\cdot 3\text{H}_2\text{O}$ (yellow); piperidine tri-*m*-hydroxybenzoatouranate, [$\text{UO}_2(\text{OOC}\cdot\text{C}_6\text{H}_4\text{OH})_3$] $\cdot\text{H}\cdot\text{py}\cdot 7\text{H}_2\text{O}$ (yellow); aniline tri-*m*-hydroxybenzoatouranate, [$\text{UO}_2(\text{OOC}\cdot\text{C}_6\text{H}_4\text{OH})_3$] $\cdot\text{H}\cdot\text{NH}_2\text{C}_6\text{H}_5$ (yellow); triethylamine trisalicylatouranate, [$\text{UO}_2(\text{OOC}\cdot\text{C}_6\text{H}_4\text{OH})_3$] $\cdot\text{H}\cdot\text{NH}_2(\text{CH}_3)\text{C}_6\text{H}_4$ (yellow); *m*-nitraniline trisalicylatouranate, [$\text{UO}_2(\text{OOC}\cdot\text{C}_6\text{H}_4\text{OH})_3$] $\cdot\text{H}\cdot\text{NH}_2(\text{NO}_2)\text{C}_6\text{H}_4$ (yellow); tolylenediamine trisalicylatouranate, [$\text{UO}_2(\text{OOC}\cdot\text{C}_6\text{H}_4\text{OH})_3$] $\cdot\text{H}\cdot(\text{NH}_2)_2(\text{CH}_3)\cdot\text{C}_6\text{H}_3$ (yellow); K trisalicylatouranate, [$\text{UO}_2(\text{C}_7\text{H}_5\text{O}_3)_3$] $\cdot 9(13)\text{H}_2\text{O}$ (yellow); NH_4 trisalicylatouranate, [$\text{UO}_2(\text{C}_7\text{H}_5\text{O}_3)_3$] $\cdot\text{NH}_4\cdot 9(13)\text{H}_2\text{O}$ (yellow); Ba trisalicylatouranate, [$\text{UO}_2(\text{C}_7\text{H}_5\text{O}_3)_3$] $\cdot\text{Ba}_2\cdot 10(14)\text{H}_2\text{O}$ (orange); methylamine trisalicylatouranate, [$\text{UO}_2(\text{C}_7\text{H}_5\text{O}_3)_3$] $\cdot\text{H}\cdot\text{CH}_3\text{NH}_2\cdot 5\text{H}_2\text{O}$ (orange); and guanidine trisalicylatouranate, [$\text{UO}_2(\text{C}_7\text{H}_5\text{O}_3)_3$] $\cdot\text{H}\cdot\text{N}_3\text{H}_5\text{C}\cdot 6\text{H}_2\text{O}$ (orange).

1842 Yamaguchi, T. "Venous Edema in Healthy Dogs and in Dogs with Diseased Kidneys." *Tôhoku J. Expt. Med.* 9, 73-110(1927).

After exposing the femoral artery and vein the hemoglobin, serum albumin, and chloride content of both artery and vein were examined and then compared with hemoglobin, serum albumin, and NaCl values of animals treated with either cantharidin or U nitrate according to whether the author desired to damage the glomerular or the tubular structures. The conclusions were: Conc'n. of the blood remained unchanged for at least 3 hrs, when exposure of the femoral artery and vein was performed under influence of morphine without disturbance to the circulation. Manipulations causing pain were responsible, as a result of generalized angiospasm, for conc'n. of arterial and venous blood was found best when the blood was examined soon after the induction of congestion. Permeability of the capillary wall for albumin was limited. In the dog treated with U nitrate the development of venous congestive edema varied slightly. The tissue tension was able to accommodate itself to conditions. In the U-treated animals there was also evidence of permeability of the capillary wall. In dogs treated with cantharidin tissue damage was greater, while those treated with U showed greater vascular damages.

1843 Yant, W. P. and Hawk, C. O. "The Activity of Various Metals and Metal Oxide Catalysts in Promoting the Oxidation of Methane by Air." *J. Am. Chem. Soc.* 49, 1454-60(1927).

An investigation of the catalytic effect of UO_3 on the oxidation of methane in air is reported. An eff. of about 10.7%, or of the same order as Pt black and Ni, was found. The UO_3 was obtained by 325° ignition (4 hrs) of $(\text{NH}_4)_2\text{UO}_4$.

PUBLICATIONS LOCATED IN 1928

1844 Allison, S. K. "An Experimental Study of the Relative Intensities of X-Ray Lines in the L-Spectrum of Uranium." *Phys. Rev.* (2), 31, 916(1928).

This is an abstract of paper presented at the March 3, 1928 meeting of the American Physical Society at Berkeley, Calif. The full paper is published in *Phys. Rev.* (2), 32, 1-11(1928).

1845 Allison, S. K. "An experimental Study of the Relative Intensities of X-Ray Lines in the L-Spectrum of Uranium." *Phys. Rev.* (2), 32, 1-11(1928).

The relative intensities of 17 lines in the L spectrum of U have been measured. Changes in the app. are described which reduce the magnitude of the corrections to be applied. The variation of the intensity of U I_α with voltage has been studied and may be closely represented by $I = C(V - V_0)^{1.8}$, and

with less accuracy by $I = [C(V - V_0)/V_0 - \log(V/V_0)]$. The observed results at 52.8 kv have been extrapolated to the relative intensities at voltages very much greater than the crit. voltages. Important results are: (1) The lines $\gamma_3\gamma_2$ and $\beta_3\beta_4$, known in other elements to deviate from the sum rule predictions, have equal intensities in U although a ratio 2:1 is predicted. (2) The lines $\gamma_6\beta_5$ are 17 times more intense in U than in W presumably because of the filling of the 5 orbits in the intervening elements. (3) The lines $\gamma_4\gamma_5$ which are present in the W spectrum are absent in the U and Th spectra. It is shown that if the second function above holds for electron collisions in which the velocity of the impinging electron is great compared to the velocities of the electrons in the atom, the relative intensities of lines of a multiplet under these conditions are equal to the product of the transition probability by the statistical wt. of the initial state with only a slight correction. The relative intensity results at 52.8 kv and at high voltage are α_1 2.4, 2.4; α_2 11, 11; α_3 100, 100; η 0.83, 1.0; β_6 1.6, 1.6; β_2 28, 28; β_4 3.2, 4.1; β_7 0.4, 0.4; β_5 6.4, 6.4; β_1 40.5, 49.4; β_3 3.3, 4.2; γ_5 0, 0; γ_1 9.7, 12; γ_2 1.1, 1.5; γ_3 1.1, 1.4; γ_6 1.8, 2.2; γ_4 0, 0.

1846 Anderson, W. T., Jr. and Bird, L. T. "The Measurement of Ultra-Violet Quanta by Fluorescence Photometry." Phys. Rev. (2), 32, 293-7(1928).

This paper contains an est. of the quantum yield of monochromatic ultraviolet light in the production of fluorescence in uranyl cpds.

1847 Barber, H. H. and Kolthoff, I. M. "A Specific Reagent for the Rapid Gravimetric Determination of Sodium." J. Am. Chem. Soc. 50, 1625-31(1928).

A procedure is described for pptg. and weighing Na as $\text{NaZn}(\text{UO}_2)_3(\text{OAc})_9 \cdot 6\text{H}_2\text{O}$; the influence of some cations and anions are mentioned. The triple acetate is reported to form tetrahedrons easily sol. in H_2O which can be pptd. by alc. Loss in wt. (dehydration) on drying is discussed. Other anions forming similar salts which are noted are K and Li.

1848 Baur, E. "4. Process: Photochemical. On Sensitive Photolysis." Z. Elektrochem. 34, 595-8(1928).

This paper discusses the photochem. reduction of uranyl cpds. The use of $(\text{UO}_2)^{++}$ as a catalyzer in photochem. processes is also discussed.

1849 Beck, G. "Thermodynamic Aspects of the Constitution of Compounds of Tervalent and Multivalent Elements." Z. anorg. allgem. Chem. 174, 31-41(1928).

The application of the logarithmic construction equation $kQ = 546(\log V - \log V_e)$ where Q = heat of formation, to cpds. of trivalent and multivalent elements is studied. Values of k are given in a table for the halides, oxides, sulfides, and sulfates of various metals. The normal value for the halides is found to vary from 0.57 to 0.60. For the sulfates the group Al, Fe, In, Cr with k about 0.30 form alums; the group Tl, Sb, Bi, Mn with k 0.55 to 0.62 are in general quantitatively hydrolyzed; the rare earths with k about 0.12 probably have a different ion lattice. The relation between electron configuration, chem. behavior, and values obtained for k is discussed for many cpds. It is shown that the sulfates of Th and U on the one hand and Zr and Ce on the other hand are thermodynamically equiv. and therefore show similar complex salts. Detns. of d . and measurements of the heat of formation of some of these cpds. are made. Q in kcals is given for $\text{Ce}(\text{SO}_4)_2$, 103.5; $\text{Th}(\text{SO}_4)_2$, 115.5; $\text{U}(\text{SO}_4)_2$, 78; UO_2SO_4 , 50, ZrCl_4 , 142; TeBr_4 , 57; LaF_3 , 402; and other salts.

1850 Biltz, W. and Fendius, C. "Molecular and Atomic Volumes. XIX. The Densities of Uranium, Tungsten, and Molybdenum Chlorides." Z. anorg. allgem. Chem. 172, 385-94(1928). The

difficulties in the prepn. of each of the chlorides are noted. In some cases the amt. of impurity was detd. and the d . extrapolated. The pycnometer detns. were accurate to several tenths of a per cent. The following ds. were found at 25°: $\text{UCl}_4 = 4.854$; $\text{UCl}_3 = 5.440$; $\text{WCl}_6 = 3.520$; $\text{WCl}_5 = 3.875$; $\text{WCl}_4 = 4.624$; $\text{WCl}_2 = 5.436$; $\text{MoCl}_5 = 2.928$; $\text{MoCl}_3 = 3.579$; $\text{MoCl}_2 = 3.714$. For cpds. with more than 3 Cl, the at. vol. of Cl varies from 16.0 to 16.5, agreeing with that of free Cl, at. vol. 16.5.

- 1851 Biltz, W. and Fendius, C. "Systematic Affinity Principle. XLVIII. The Heats of Formation of UCl_4 , UCl_3 , and UO_3 ." *Z. anorg. allgem. Chem.* 176, 49-63(1928).

The heats of formation of UCl_3 and UCl_4 were detd. by an indirect method from the difference in the heats of soln. of the chlorides and that of the metal in 8N HCl. An ice calorimeter was used for the calorimetric measurements. The values found were: $\text{U} + 2\text{Cl}_2 \rightarrow \text{UCl}_4 + 251$ cal and $\text{U} + 3/2\text{Cl}_2 \rightarrow \text{UCl}_3 + 213$ cal. The heat of reaction for the oxidation of UCl_3 and UCl_4 to a U^{+6} cpd. by a soln. of FeCl_3 in HCl, or by a soln. of ICl_3 , was compared with the heat of soln. of UO_3 in the same media. Based on the values obtained for the heats of formation of UCl_3 and UCl_4 , the heat of formation of UO_3 is 294 cal. A comparison of these results with those obtained for other metal shows that U is less noble than Fe and has about the same affinity for Cl as has Th.

- 1852 Bishop, W. B. S. "The Occurrence of Lead in the Egg of the Domestic Hen. Part 1." *Med. J. Australia* 1, 480-8(1928).

The occurrence of Pb, U, and Li in the egg are reported.

- 1853 Bose, D. M. and Bhar, H. G. "Investigations on Paramagnetism—The Magnetic Moments of the Ions of the Elements of the Transition Groups." *Z. Physik* 48, 716-21(1928).

The magnetic susceptibilities of various salts of the elements of the transition groups were measured with a Curie balance, and the no. of Weiss magnetons associated with each metallic ion was computed. U^{+6} is reported to be diamagnetic. The moment of $\text{U}^{+4} = 12.1$. The interpretation of these results in terms of Hund's theory and of Bose's modification of Hund's theory is discussed, and tables are given in which exptl. and computed values are compared.

- 1854 Cartledge, G. H. "Studies on the Periodic System. I. The Ionic Potential as a Periodic Function." *J. Am. Chem. Soc.* 50, 2855-63(1928).

The so-called ionic potential method is used to calc. the relation between radius, charge, and structure of the ions of U.

- 1855 Chamot, E. M. and Bedient, H. A. "Uranyl Acetate as a Reagent in Microscopic Qualitative Analysis." *Mikrochemie* 6, 13-21(1928).

In applying the uranyl acetate test for Na the best procedure consists in evapg. the soln. to be tested on a microscope slide until a dry film is formed, placing a drop of the reagent close to the edge of the film, and drawing a Pt wire through the drop, and across the film. The formation of isotropic tetrahedra indicates the presence of Na; fine clusters of hairlike crystals the presence of the alk. earths or of Pb; tetragonal prisms K, Rb, Cs, Ag, Tl or NH_4 , square plates Ba and orthorhombic plates or prisms Mn, Mg, Zn, Cd, Fe (ferrous), Ni, Co or Cu. The presence of Na together with a member of the last-named group results in the sepn. of monoclinic triple acetates in the form of polysynthetic twins of somewhat indefinite chem. compn. In the absence of metals other than alk. the formation of Na Zn uranyl acetate is probably the most sensitive test for the presence of Na; so sensitive is this reaction that silica object slides should be used to avoid possible contamination from Na of the ordinary glass slide.

- 1856 Colani, A. "Study of Systems: Uranyl Nitrate, Alkali Nitrate, Water, at 25°." *Bull. soc. chim. France* (4), 43, 194(1928).

The systems $\text{NaNO}_3\text{-UO}_2(\text{NO}_3)_2\text{-H}_2\text{O}$, $\text{KNO}_3\text{-UO}_2(\text{NO}_3)_2\text{-H}_2\text{O}$, and $\text{NH}_4\text{NO}_3\text{-UO}_2(\text{NO}_3)_2\text{-H}_2\text{O}$ are investigated. Diagrams of the systems and tables of data are included.

- 1857 Colani, A. "A Study of Uranyl Sulfate." *Bull. soc. chim. France* (4), 43, 754-62(1928).

By crystg. UO_2SO_4 from mixts. of H_2O and H_2SO_4 at 25° a no. of salts were obtained, the formation of which was essentially dependent on the concn. of H_2SO_4 . The solid phases were dried in vacuum and weighed. The following cpds. were found: $\text{UO}_2\text{SO}_4\cdot 3\text{H}_2\text{O}$, $\text{UO}_2\text{SO}_4\cdot 2\text{H}_2\text{O}$, $(\text{UO}_2\text{SO}_4)_2\cdot \text{H}_2\text{SO}_4\cdot 5\text{H}_2\text{O}$, $\text{UO}_2\text{SO}_4\cdot \text{H}_2\text{SO}_4\cdot 2\text{H}_2\text{O}$, and $\text{UO}_2\text{SO}_4\cdot \text{H}_2\text{SO}_4\cdot 0.5\text{H}_2\text{O}$. The systems $\text{UO}_2\text{SO}_4\cdot \text{H}_2\text{O}$ and $(\text{NH}_4)_2\text{SO}_4$, K_2SO_4 , and Na_2SO_4 were likewise studied at 25°.

- 1858 Coustal, R. "On the Permanent Luminescence of Certain Crystallised Uranium Salts." Compt. rend. 187, 1139-40(1928).

The luminosity of the U salts is visible only if the eye is made sensitive by being in a darkened room for 30 min or more. The luminosity is independent of time and of temp., and infrared light has no effect on it. It is greatest for the sulfate, less for the nitrate, less again for the acetate, and for others too feeble to be observed. Calcns. show that the energy of the α particles is more than sufficient to account for the luminosity.

- 1859 Cowell, S. J. "The Influence of Dietetic Factors on the Intensity of Symptoms Produced During Acute Experimental Nephritis." Brit. J. Exptl. Path. 9, 164-71(1928).

Young rabbits fed on a diet composed solely of cabbage are much less susceptible to the toxic effects of small doses of U than those receiving a mixed diet composed of cereals and a limited amt. of green food. This protective effect of cabbage appears to be more marked in summer than in winter. Attempts were made to isolate some fraction of the cabbage which might afford protection when added to a cereal diet. A concd. watery extr. showed such an effect, whereas an alc. extr. showed none.

- 1860 Daehr, H. Zur Kenntnis der Peruransäure und Peruranate. Berlin, 1928.

- 1861 Dominguez, R. "Effect on the Blood Pressure of the Rabbit of Arteriosclerosis and Nephritis Caused by Uranium." Arch. Path. 5, 577-606(1928).

Observations on pathologic processes and blood pressure in 52 rabbits subjected to intoxication by U are reported. Some of these animals received Pb, Ra or V in combination with the U or before it was administered. Fourteen additional rabbits served as controls for the administration of the Pb, U, and V. Pos. results were obtained only in animals which received U. The lesions consisted of (1) arteriosclerosis of the medial calcification type, involving the aorta, pulmonary artery, and aortic branches; (2) renal tubular necrosis, with and without calcification of the small vessels and of the Bowman's capsules; (3) necrosis and calcification of the muscular coat of the stomach, and (4) necrosis and calcification of the striated muscles. The blood pressure was studied in 32 rabbits by means of the van Leersum method (about 40,000 blood pressure readings). The following conclusions are reached: Changes in blood pressure do not occur in intoxication caused by Ra, Pb, and V. The blood pressure in chronic intoxication with U becomes lower or, in general, remains unaltered. Nephritis of all degrees, from acute swelling to granular contraction, caused by U, is not accompanied by high blood pressure. A severe arteriosclerosis (medial calcification type) of the aorta and main arteries may develop without any elevation of the blood pressure. Conversely, severe arteriosclerosis of the aorta and main arteries is not necessarily accompanied by a high blood pressure. These expts. do not support the mechanical theory of arteriosclerosis. Calcification of Bowman's capsules, with slight calcification of the small vessels of the kidney, is not necessarily followed by a rise in blood pressure. One animal, in which the calcification of the small vessels of the kidney and the glomerular destruction were pronounced, developed a pathologically high blood pressure. The results obtained agree with the idea of an intimate relationship between the vascular app. of the kidney and high blood pressure.

- 1862 Duparc, L. and Rogovine, E. "On a New Indicator for the Volumetric Determination of Phosphoric Acid." Helv. Chim. Acta 11, 598-9(1928).

The paper includes a discussion of the end point of the detn. of H_3PO_4 (especially in urine) with $UO_2(OAc)_2$. An orange color with sodium salicylate is reported to be good.

- 1863 Eitel, H. "On a Sensitive Method of Uranium Detection and Localization of Uranium in Animal Organisms in Uranium Poisoning." Arch. exptl. Path. Pharmacol. 135, 188-93(1928).

The presence of U in dilns. of 1:500,000 could be demonstrated by measuring the fluorescence of the metal in certain portions of the spectrum by means of the Manauer ultraviolet analytical lamp. U nitrate was injected into guinea pigs and rabbits and deposition in various organs was studied. Deposition occurs only in the cortex of the kidney. The heart, liver, lungs, small intestines, muscle, and skin were U free.

- 1864 Fendius, C. Zur Volumchemie und Verwandtschaftslehre der Uran-, Wolfram-, und Molybdanchloride. Leipzig, 1928.
- 1865 Fenner, C. N. "Analytical Determination of Uranium, Thorium and Lead, as a Basis for Age-Calculations." Am. J. Sci. (5), 16, 369-81(1928).
Detailed directions are given for the detn. of U, Th and Pb in radioactive minerals such as euxenite, polycrase, samarskite, and monazite.
- 1866 Garnier, M., Schulmann, E., and Marek, J. "Toxicity of Uranium Nitrate from Subcutaneous Injection in the Rabbit." Compt. rend. soc. biol. 99, 269-71(1928).
A marked albuminuria precedes death, which occurs on the 5th to 6th day. The rabbit excretes more albumin for its wt., than does the dog. The lethal dose is greater for the rabbit than for the dog. Oliguria and N retention occur.
- 1867 Garnier, M., Schulmann, E., and Marek, J. "Development of Albuminuria in Nephritis Caused by Uranium Nitrate in Dogs." Compt. rend. soc. biol. 98, 285-7(1928).
- 1868 Garnier, M., Schulmann, E., and Marek, J. "Habituation of Dog to Large Doses of Uranium Nitrate." Compt. rend. soc. biol. 99, 707-09(1928).
- 1869 Gaspar y Arnal, T. "A Study of Molybdates, Nitrophosphomolybdates, Tungstates, and Phosphotungstates and Their Reactions." Anales soc. españ. fís. quím. 26, 435-45(1928).
Reactions of these cpds. with $(\text{UO}_2)^{++}$, which might be useful in analysis, are tabulated with similar data for many other ions.
- 1870 Govaerts, P. "Pathogenesis of Edema in Acute Uranium Poisoning." Bull. acad. roy. méd. Belg. (5), 8, 33-45(1928).
Eleven rabbits were given daily 7 mg U nitrate subcutaneously, and from the 2nd day of the expt., 80 to 100 cc salt soln. or H_2O by gastric catheter. They developed the classical acute U nephritis and a variable amt. of "edema" in the pleural cavity and uremia. In U edema the fluid was coagulable, with protein content high (12 to 28 g/l), including fibrinogen, globulins, and albumins. The osmotic pressure of proteins was 5 to 11 cm H_2O . Such a fluid is obviously a toxic exudate, comparable in no way with the edema of human chronic nephritis or cardiac diseases. The chief factor of its occurrence is the increased permeability of the endothelial walls. The rabbits studied were divided into 2 groups: (1) When salt soln. was given every day, anuria took place early. The urine output during the whole expt. was less than the H_2O intake. The vol. of edema was large. (2) When H_2O was given every day, the anuria was, as a rule, less complete. Some animals had a urine output larger than the H_2O intake and the vol. of edema was small. Others had a scanty diuresis, distinctly below the H_2O intake and the edema was accordingly large. The conclusions are that 2 conditions, a local and a general one, must be considered. The former alone is sufficient to bring about edema, is to be found in the increased permeability of the capillary walls (U poisoning) or in a discrepancy between the osmotic pressure of proteins and the capillary pressure. Where such a local condition exists, a certain amt. of edema develops, but the vol. of fluid will be small or large according to the H_2O content of the whole organism. As the renal function, especially the H_2O output, may be affected by independent stimuli or by anatomical conditions, the vol. of edema may vary without the local factors being altered.
- 1871 Harkins, W. D. "The Synthesis of Atoms, the Whole Number Rule, and the Periodic System of the Atomic Species." Chem. Revs. 5, 371-435(1928).
A discussion is included concerning the freq., stability, and life period of U in comparison with other elements.

1872 Hayashi, O. "Experimental Albuminuria." Tokyo Igakkwai Zasshi 42, 398-436(1928).
Tamura's method was used to study the paths of elimination of egg albumin, intravenously injected, in Japanese toads. Normally it is excreted through the glomeruli only; but in kidneys damaged by long saline perfusion, by Cr, U, or cantharidin it escapes through the wall of the tubule also. When excreted through the glomeruli of normal toads it is accompanied by plasma proteins. That this does not indicate damage to the kidney is shown by the fact that plasma protein excretion does not outlast that of egg albumin. Similar results were obtained with cats and rabbits.

1873 Hein, F. and Ritter, W. "On the Applicability of Quartz-Lamp Analysis of Mixtures of Solid Substances." J. prakt. Chem. (2), 119, 368-70(1928).

The effect of various materials on extinguishing the fluorescence of uranyl nitrate is reported.

1874 Helfgott, A. L. "On the Total Radiation of Metals." Z. Physik 49, 555-86(1928).

The ratio of total radiation of U metal to a black body is said to be particularly large when it is compared to other substances. Exptl. data are reported.

1875 Herasymenko, P. "Electroreduction of Uranyl Salts by Means of the Mercury Dropping Cathode." Trans. Faraday Soc. 24, 272-81(1928).

Current-voltage "polarization" curves are registered automatically by means of a special photo-registering app., the polarizing voltage being plotted as abscissa and the corresponding current as ordinate. The curves obtained show that the reduction of uranyl salts at the Hg dropping cathode proceeds in 2 stages. The first stage is represented by $U^{+6} + e = U^{+5}$, the first reduction potential being independent of acidity and dependent only on the concn. of uranyl ions. The 2nd stage corresponds to the process $U^{+5} + e = U^{+4}$, and the 3rd stage $U^{+4} + e = U^{+3}$. After the 3rd stage, increase in cathodic potential produces still another increase of current on the polarization curve, which is due to H_2 evolution. The 2nd reduction potential is very sensitive to neutral salts (KCl, $MgCl_2$), from which it is concluded that U^{+5} readily forms complexes. The 3rd potential is almost unaffected by changes of concn. of neutral salts.

1876 Herasymenko, P. "Maxima on the Current-Voltage Curves. II. The Maxima on the Polarization Curves of Uranyl Salt Solutions." Trans. Faraday Soc. 24, 267-72(1928).

Addn. of indifferent salts such as KCl, NaCl, $MgCl_2$, and $AlCl_3$ to uranyl salt solns. diminishes the elec. resistance and strongly suppresses the intensity of the max. reduction current. The added salts have practically no effect on the final const. value of current, even if the max. is entirely suppressed; this final current is a satn. current due to diffusion of the reducible matter to the cathode. The suppression of the current by added salts depends only on the total no. of elec. charges in soln., so that equiv. quantities of ions of different valencies produce the same effect. Electrocapillary measurements, made by the drop-weight method altered in such a manner that the drops are weighed directly in soln., show that during the increase of current the cathode potential varies only slightly with the polarizing voltage, while the decrease in current is accompanied by a sudden jump in polarization of the cathode. The sudden decrease of current is explained by the formation of an interfacial film of soln., exhausted uranyl ions, preventing adsorption.

1877 Hirai, K. "Influence of Thorium and Uranium Salts on Nitrogen-Fixation by Azotobacter." Proc. 1st Intern. Cong. Soil Sci. 1927-3, 154-9(1928).

U salts increased N fixation and reproduction. Th had little, if any, effect.

1878 Hönigschmid, O. and Schilz, W. E. "Revision of the Atomic Weight of Uranium. Analysis of Uranous Chloride." Z. anorg. allgem. Chem. 170, 145-60(1928).

UCl_4 is prepd. by heating UO_2 with C in a current of Cl_2 , subld. twice and melted in an atm. of N_2 to liberate the dissolved Cl_2 . 19 detns. of the ratio $UCl_4/4Ag$ and 18 of $UCl_4/4AgCl$ gave the at. wt. of U = 238.14.

- 1879 Hunter, W. C. "Experimental Study of Acquired Resistance of the Rabbit's Renal Epithelium to Uranyl Nitrate." *Ann. Internal Med.* **1**, 747-89(1928).

The exptl. work of Gil y Gil has been repeated and confirmed. Preliminary expts. showed that 0.001 g of U subcutaneously or 0.0005 g intravenously, each representing $\frac{1}{2}$ the lethal dose for rabbits, regularly kills normal proximal convoluted tubular epithelium. Complete regeneration occurs in 2 weeks. Differences in morphology and staining readily distinguish the new epithelium from the original. Ample time for regeneration was allowed between the periodically increased injections. Only those animals surviving the last injection sufficiently long for fresh necrosis to appear in the persisting original tubular cells and less than the time required for new regeneration to begin are included in the series. A high degree of acquired resistance to U is evidenced by lack of microscopic changes in the regenerated epithelium after giving 54 to 96 times the amt. known to kill the original cells in the same tubules. Intravital staining indicated that the regenerated tubules were patent. Qual. chem. tests and biol. expts. proved that chronic U kidneys were able to excrete the metal in greater quantities than acutely damaged organs. The acquired resistance may be due either to the cells detoxicating the poison or to preventing its combination with their proteins. In rabbits long-cont. repeated administration of U leads to marked chronic glomerulo-tubular lesions with secondary contraction.

- 1880 Jaeger, R. "Current Standard of Uranium Oxide." *Z. Physik* **52**, 627-36(1928).

An air condenser contg. U_3O_8 will furnish a const. satn. current, which can be varied from zero to 5×10^{-10} amp by means of a diaphragm. The std. is especially adapted to the use of compensation methods.

- 1881 Jette, E. and West, W. "Studies on Fluorescence and Photosensitization in Aqueous Solution. II. Fluorescence in Aqueous Solution." *Proc. Roy. Soc. (London)*, **A. 121**, 299-312(1928).

A detailed examn. of the effect of ions on the fluorescence of aq. solns. of quinine bisulfate, uranine, and UO_2SO_4 is reported. The intensity of fluorescence was measured by a balanced photoelectric cell method. For these substances the extinguishing effect is associated with the anion, Ag^+ being the only cation with an appreciable effect. Li^+ , Na^+ , K^+ , Rb^+ , Mg^{++} , Hg^{++} , and La^{+3} salts were examined. The order of the anions is $I^- > CNS^- > Br^- > Cl^- > (C_2O_4)^{--} > (OAc)^- > (SO_4)^{--} > (NO_3)^- > F^-$. The series is identical with the deformability series of the anions, as measured by mol. refraction and dispersion and is closely related to the Hoffmeyer series.

- 1882 Khlopin, V. G. and Kaufman, L. E. "Volumetric Determination of Vanadium, Iron, and Uranium with Titanium Salts." *Zhur. Priklad. Khim.* **2**, 91-108(1928).

Salts of Ti^{+3} reduce V^{+5} , Fe^{+3} , and U^{+6} in acid soln. in the following order: V^{+5} to V^{+4} , Fe^{+3} to Fe^{+2} , U^{+6} to U^{+4} , and V^{+4} to V^{+3} . V^{+5} is titrated with 0.05 to 0.10N Ti^{+3} , $K_3FeC_6N_6$ and Fe^{+3} being used as indicators, Fe^{+3} is detd. by the method of Knecht and Hibbert, KCNS being used as indicator, and U^{+6} is titrated with Neublau G(C) as indicator. All titrations are made in an atm. of CO_2 .

- 1883 Kishi, Y. "Experimental Studies on Indican Formation (in Uranium Nephritis)." *Tôhoku J. Exptl. Med.* **12**, 75-80(1928).

- 1884 Kordes, E. "The Eutectic Freezing Point Lowering in Binary Mixtures. III. Communication." *Z. anorg. allgem. Chem.* **168**, 177-88(1928).

$UO_2(NO_3)_2$ is one of the cpds. examined.

- 1885 Laissus, J. "Cementation of Ferrous Alloys by Uranium." *Rev. mét.* **25**, 50-7(1928).

Cementation with U results in the formation of a eutectic structurally similar to that produced by cementation with C. It greatly increases the surface hardness of mild steel, both as cemented, and especially after quenching; it yields a product taking a fine polish which tarnishes with difficulty in air; and it retards corrosion by 18° Bé HNO_3 .

- 1886 Laurence, G. C. "Ranges of the α -Particles of Uranium I and II." Phil. Mag. (7), 5, 1027-38 (1928).

The ranges of the α particles of U_I and U_{II} were detd. by the Wilson cloud-chamber method, with modifications for the small activity of the radioactive material. The method was satisfactorily checked by its application to the range of α from Po. The ranges at 150°C and 760 mm Hg were found to be: U_I , 2.73 cm; U_{II} , 3.28 cm, with a probable error of less than 1%. From the range of U_{II} its decay const. was calcd. to be 1.7×10^{-12} sec. $^{-1}$, or a half-life of 13,000 yrs.

- 1887 Lindberg, E. "Measurements of the M Series in the Roentgen Spectra of the Elements from Uranium to Gadolinium." Z. Physik 50, 82-96(1928).

A careful survey has been made of the M series of the elements from U(92) to Gd(66) including Re(75) and Hf(72). A Seigbahn vacuum spectrometer was used, and the results cover the wavelength interval from 2.5 to 11.5 Å. The wavelength measurements for each element are listed in comprehensive tables, as are also values of V/R and $\sqrt{V/R}$ derived from them.

- 1888 Lorenz, R. and Woolcock, J. "Decomposition Pressure of Nitrides." Z. anorg. allgem. Chem. 176, 289-304(1928).

The action of N_2 upon Ti, Ta, Mo, Zr, U, and B is studied, neg. results being obtained with Ti, Ta, Mo, and Zr. In the system U-N it is shown that N_2 pressure in equil. with substances contg. U and N increases with increasing N content. The equil. is studied at 1280 and 1480°, with pressures ranging from 2.5 to 676 mm at 1280° as absorbed N increased from 0.0992 to 0.9230 g at./g at. U. At the higher isotherm, a smaller N content is obtained at a given pressure than at 1280°. The cpds. U_5N_4 and U_5N_2 are obtained only if the furnace is quickly cooled from higher temps. Products with lower N content are regarded as solns. of nitride in the metal.

- 1889 Marden, J. W. —assigned to Westinghouse Lamp Co. Rare Metal Powders. Feb. 14, 1928. (U. S. Patent 1,659,209)

This is a method for the prepn. of U metal powder from oxide using alk. earth oxides or halides, especially Ca and Mg. UCl_4 or double halides may be used.

- 1890 Martini, A. "A New Metallic Nitrosophenylhydroxylamine Internal Complex and Its Application to Microchemical Analysis." Anales asoc. quim. argentina 16, 117-24(1928).

Cupferron is a very sensitive specific reagent for U and Ba, and can be used for the detection of Cu, Cd, Ca, and Sr. The details of the detection procedure for Cd, Ca, and Sr are given.

- 1891 Mauriac, P. "Contribution to the Study of Experimental Chronic Nephritis in the Rabbit." Compt. rend. soc. biol. 99, 322-3(1928).

A technique for producing chronic nephritis in the rabbit by means of U nitrate is described.

- 1892 Meyer, S. "Relation between the Atomic Weights of Uranium, Radium, RaG, and Helium." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse. Abt. IIa 137, 599-606(1928).

The author makes use of Aston's detn. of the at. wt. of He, which, for the neutral atom, gives 4.00216, and Hönigschmid and Schilz's value for U, 238.14. He calcs. the at. wts. of Ra and of radium lead, taking into account the loss of mass due to the ejection of α and β particles, and that due to emission of energy. When the facts that "uranium" is really a complex of U_I with from 3 to 4% AcU, and that radium lead is a complex of RaG + AcD in about the same proportion are considered, the calcd. and observed values for RaG are almost identical, but the value calcd. for Ra is almost 0.1 higher than the exptl. value of Hönigschmid. The difficulties in obtaining a correct value for the at. wt. of Ra are pointed out, and a new detn. is considered necessary.

1893 Milhorat, A. T. and Deuel, H. J., Jr. "The Mechanism of the Glycosuria of Acute Uranium Nephritis." Proc. Soc. Exptl. Biol. Med. 25, 294-5(1928).

The glycosuria occurring in acute U nephritis is accompanied by a blood sugar level that is normal or slightly below the pre-U level, and must, therefore, be of renal origin. Following cessation of the glycosuria there is an anuria, partial or complete, when the blood sugar increases. Microscopically, the kidney of glycosuria shows tubular degeneration and intact glomeruli; the kidney of anuria and of no glycosuria shows severe damage to both tubules and glomeruli. The findings agree with Richard's views of kidney physiology.

1894 Misciattelli, P. "Separation of Thorium and Uranium by Means of Ether." Atti reale accad. nazl. Lincei (6) 7, 1019-24(1928).

The literature shows a difference of opinion on whether U and Th may be sepd. by means of Et_2O . In order to help solve the problem, the solys. of $\text{UO}_2(\text{NO}_3)_2$ and $\text{Th}(\text{NO}_3)_4$ in Et_2O , have been measured.

Compn. of upper layer			Compn. of lower layer		
$\text{UO}_2(\text{NO}_3)_2$ %	$\text{Th}(\text{NO}_3)_4$ %	Et_2O %	$\text{UO}_2(\text{NO}_3)_2$ %	$\text{Th}(\text{NO}_3)_4$ %	Et_2O %
22	0	78	-	-	-
22.5	1.02	76.48	40.1	0.52	59.38
24	3.5	72.57	48.3	15.6	36.1
24	3.43	72.50	43	20	37
19.2	4.5	76.3	12	40	48
18	5	77	-	-	-
16.5	5.6	77.90	13	27	60
12.2	7	81	9	30	61
8.2	8.3	82.5	7	26	67
3	8	89	1.8	48.5	39
0	5.8	94.2	-	-	-

A small amt. of Th increases the soly. of U. The satd. soln. contains 24% U salt, 3.4% Th salt. The variation of the satd. soln. with temp. is shown below.

Temp. %	Compn. of soln.			Compn. of soln.		
	$\text{UO}_2(\text{NO}_3)_2$ %	$\text{Th}(\text{NO}_3)_4$ %	Et_2O %	$\text{UO}_2(\text{NO}_3)_2$ %	$\text{Th}(\text{NO}_3)_4$ %	Et_2O %
0	24	3.43	72.57	48.3	15.6	36.1
16	17.7	1.7	80.6	28.2	20.4	51.4
19	10.5	0.4	89.1	39.2	15	46.8
20	8.78	-	91.22	15.5	26	58.5
22	8	-	92	13.2	23	63.8
25	7.37	-	92.63	12.2	30	57.8

Therefore, at 20° it is possible to sep. the two, providing the Et_2O is satd. with U salt.

- 1895 Mukerji, B. K. and Dhar, N. R. "The Mechanism of Photo-Sensitization and Photo-Inhibition from the Point of View of Absorption Spectra." J. Indian Chem. Soc. 5, 411-15(1928).

The absorption spectra have been photographed of the various constituents of systems which react or are inhibited from reacting in the presence of photocatalysts. The photosensitizing reactions examined include reduction of Fehling's soln. in the presence of $\text{UO}_2(\text{NO}_3)_2$ and FeCl_3 ; of oxalic and chromic acids in the presence of MnSO_4 and H_2SO_4 ; CuSO_4 and $\text{K}_2\text{C}_2\text{O}_4$ in the presence of $\text{UO}_2(\text{NO}_3)_2$ and of FeCl_3 . The reactions examined from the point of view of photoinhibition include formic and chromic acids in the presence of MnSO_4 ; oxidation of benzaldehyde in the presence of hydroquinone or phenol. A study of the spectrograms shows that the addn. of U or Fe salts to mixts. reacting photochemically causes an increase in light absorption by the entire reacting system and that in the presence of photoinhibitors no such increase in absorption occurs.

- 1896 Müller, R. H. "Studies on Fluorescence and Photosensitization in Aqueous Solution. III. Photosensitization and Fluorescence." Proc. Roy. Soc. (London), A. 121, 313-17(1928).

The quantum eff. for the photolysis of $\text{H}_2\text{C}_2\text{O}_4$ in the presence of $(\text{UO}_2)^{++}$ approaches unity at a ratio of $\text{H}_2\text{C}_2\text{O}_4 : (\text{UO}_2)^{++}$ of 1:1 and remains const. for higher ratios. The fluorescence of UO_2SO_4 , which was measured with a photoelectric cell, diminished with increasing addns. of $\text{H}_2\text{C}_2\text{O}_4$, reaching zero at the same mol. ratio. The rate of decompn. of the $\text{H}_2\text{C}_2\text{O}_4$ is diminished by the addn. of ions, in the order $\text{I}^- > (\text{CNS})^- > \text{Br}^- > \text{Cl}^-$ in the same order as the fluorescence of UO_2SO_4 is affected by ions. The same order holds for the inhibition by these ions of Eder's reaction sensitized with Fe^{+3} .

- 1897 Perrin, F. and Delorme, R. "Measurement of Duration of Fluorescence of Solid Uranyl Salts and of Their Solutions." Compt. rend. 186, 428-30(1928).

In order to measure the duration of emission of the uranyl salts a phosphorometer, consisting of a phosphoroscope, with disks of the Becquerel type was built. For a simple fluorescence, the luminescence, after an instantaneous lighting, should decrease exponentially. A drawing of the app. and a table of the results of tests on solids and solns. are given. The av. life, with UO_2SO_4 in H_2SO_4 , decreases as well as the fluorescent power, when the concn. increases, when the temp. is raised, or when water is added.

- 1898 Phillips, M. L. "Visible Radiation Characteristics of Incandescent Oxides." Phys. Rev. (2), 32, 832-9(1928).

Energy radiated in the visible part of the spectrum of various oxides and their mixts. when heated to red brightness between 1400 and 2000° K., by means of cathode-ray bombardment and gas-air and oxygas flames, was measured by an optical pyrometric method. The oxides investigated were those of U, Ce, La, Nd, Er, Yt, Zr, Th, Al, Be, Mg, and mixts. of thoria with 1% ceria (the Welsbach mantle mixt.), 1% and less of urania, 1% neodymia, and 1% MgO. These were either pressed or fused to ensure good surface conditions. In general, linear relations were found between the log of the red-blue intensity ratio and the reciprocal of the brightness temp. and between the log of cp/unit surface area and the log of the brightness temp. Different modes of heating gave different radiation curves for the same oxide. Tables are given of the cp/cm² and the relative blue brightness temps. of 1400, 1500, 1600, 1700, 1800, 1900, and 2000° K.

- 1899 Phillips, M. L. "Visible Radiation Characteristics of Incandescent Oxides." J. Franklin Inst. 206, 537-8(1928).

"Urania" was one of the oxides investigated.

- 1900 Rentschler, H. C. and Ulrey, C. I. — assigned to Canadian Westinghouse Co. Electron-Emission Material. May 15, 1928. (Canadian Patent 280,167)

U and U alloys are proposed as electron-emitting materials.

- 1901 Roll, J. "Detection of Vanadium (Uranium and Titanium)." Z. anal. Chem. **74**, 342-5(1928). The customary method for the detection of V, i.e., the examn. of the filtrate after treatment with $(\text{NH}_4)_2\text{S}$, is held to be unsatisfactory. It is preferable to ppt. V along with Fe, Al, and Cr as the meta-vanadate of these metals. U and Ti will, if present, be also found in the ppt. The washed ppt. is treated with a hot soln. of NaOH when V and Al are removed as Na_3VO_4 and NaAlO_2 , resp. The presence of V is confirmed by treating a portion of the acidified filtrate with H_2O_2 . The residue, insol. in NaOH, is treated with a hot soln. of Na_2CO_3 . The presence of U in the filtrate is confirmed by adding a few cc of a $\text{K}_4\text{Fe}(\text{CN})_6$ soln. and neutralizing with HCl.

- 1902 Schulmann, E. and Marek, J. "Research on Locally Produced Edema. Experimental Action of Several Nephrotoxic Substances." Compt. rend. soc. biol. **99**, 272-3(1928).

U nitrate, KCrO_4 , and HgCl_2 were administered to rabbits. An induced local edema was then rapidly absorbed. The authors conclude that at present there is no theory of edema which answers all questions which arise.

- 1903 Sen, K. C. "The Prevention of Precipitation of Some Metal Hydroxides from Solution by Sugars." Z. anorg. allgem. Chem. **174**, 61-74(1928).

Cane sugar causes the peptization of the hydroxides of Zr, La, Y, and U, when their pptn. from soln. by alk. is attempted. Lactose and dextrose cause peptization of Zr and U, while levulose is effective with Zr, U, and Y. The action of the sugars is specific. The min. amt. of a sugar necessary to prevent pptn. depends on the vol. of soln. and amt. of alk. The smaller the total vol. and the greater the alky., the smaller is the amt. of sugar necessary for peptization. Time also plays an important part. The influence of neg. ions is also appreciable.

- 1904 Sieverts, A. "Remark on the Fluoride of Bivalent Uranium." Z. anorg. allgem. Chem. **170**, 191-2(1928).

This paper discusses the misprint found in the paper by Giolitti and Agamennone and identifies the cpd. shown as $\text{UOF}_2 \cdot 2\text{H}_2\text{O}$.

- 1905 Sieverts, A. and Müller, E. L. "The Peracids of Uranium, Tantalum, and Niobium." Z. anorg. allgem. Chem. **173**, 297-312(1928).

Peruranic acid may be prepd. either by addn. of excess 3% H_2O_2 soln. to a soln. of $\text{UO}_2(\text{NO}_3)_2$ or by treating UO_3 with H_2O_2 . Similar Ti and Nb acids are also reported. The acids are finely divided white and yellow powders. The properties of the various acids are also investigated.

- 1906 Slaterry, M. K. "Fluorescence and Solid Solution." Proc. Natl. Acad. Sci. U. S. **14**, 777-82 (1928).

A discussion on the effects of $(\text{UO}_2)^{++}$ and U^{+6} in producing luminescence and cathode luminescence in various salts is included.

- 1907 Smith, S. C. Lead Salts. Sept. 11, 1928. (Canadian Patent 283,213)

The process described is similar to that found in British Patent 289,105(1926).

- 1908 Stoklasa, J., Penkava, J., et al. "Biology of Uranium." Biochem. Z. 194, 55-77(1928).
The action of U on the metabolism of bacteria, seed germination, transpiration, and the development of plants in culture media and in vegetation vessels was studied, as well as the physiological effects of the different types of U rays on the germination and development of plants. Minute quantities of U ($0.00000.25$ to 0.0000125 g atom/l, that is, 2×10^{-7} and 9×10^{-7} mc) increase the metabolism of bacteria. U in dil. solns. stimulates and solns. of higher concn. (more than 0.005 g atom/l) depress the germination of legumes. It increased the transpiration of plants in culture media. In small quantities (0.0014 to 0.0042 g U/l) it promotes photosynthesis, CO_2 assimilation, and the formation of new living cells. N assimilation by roots is also increased. In the dark, the same quantities of U depress these processes. Similar favorable effects of U on plants in vegetation vessels were observed. The β and γ rays combined, and the γ rays alone depress the development of roots and cotyledons, but photosynthesis is stimulated. γ rays stimulate in small doses, but kill in larger doses.
- 1909 Straub, W. "Uranium Nephritis and Uranium Poisoning." Arch. exptl. Path. Pharmacol. 138, 134-5(1928).
Uranyl nitrate, 0.01 g, produced albuminuria in rabbits at the time fluorescence showed in the glomerulus. U was excreted during the first 2 days after U poisoning, then the urine was albumin free. It is reported that the liver is an important site for U deposition when the material is taken into the body.
- 1910 Swingle, W. W. "Relief of Parathyroid Tetany by Injections of Uranium Nitrate." Proc. Soc. Exptl. Biol. Med. 25, 466-8(1928).
This is a preliminary paper. See Physiol. Zool. 1, 496-507(1928) for further data.
- 1911 Swingle, W. W. "The Relief of Parathyrod Tetany by Injections of Uranium Nitrate." Physiol. Zool. 1, 496-507(1928).
Recent studies have shown that slight changes in the acid-base equil. shifting in the reaction of the blood toward the acid side, exert a profound effect upon the tetany of parathyroid insufficiency. U nitrate is a powerful nephrotoxic agent, and when injected into normal or parathyroidectomized dogs produces a marked acid intoxication. The acidosis appears to be due to retention of $(\text{PO}_4)^{-3}$ and $(\text{SO}_4)^{-2}$ and probably also some organic acid. Parathyroidectomized dogs exhibiting violent tetany symptoms have a normal acid-base equil. Following injection of U as nitrate, the CO_2 capacity, CO_2 content, and pH of the blood drop, and accompanying the shift of the reaction of the blood to the acid side, the tetany symptoms disappear. The dog remains free from tetany for a week or ten days, plays about in normal fashion and eats heartily. Tetany again supervenes when the acid-base equil. returns to normal. The serum Ca increases slightly following injection of U. The answer to the question why changing the reaction of the blood toward the acid side brings about cessation of tetany symptoms and small increases in the serum Ca is probably that the increased pH renders the serum Ca (a certain fraction of it) more diffusible and also takes care of any excess of P which may be present by stimulating its excretion.
- 1912 Tissier, M. and Bénard, H. "Microcolorimetric Estimation of Uranium Salts. Application to the Estimation of Sodium Following the Technic of Blanchetiere." Compt. rend. soc. biol. 99, 1144-6(1928).
The object was to det. the influence of the reaction of the medium, the concn. of the ferrocyanide, and the concn. of the UO_2 salts on the intensity of the brown color produced by the reaction between ferrocyanide and $(\text{UO}_2)^{++}$. The triple acetate of Na, Mg, and UO_2 was used. In concns. of 0.04 to 5.0% HOAc in the medium, the intensity of coloration was independent of pH. The coloration is not produced in an alk. medium. With 0.2% solns. of the U salt a 1% soln. of $\text{K}_4\text{Fe}(\text{CN})_6$ is the optimum concn. With a 1% soln. of $\text{K}_4\text{Fe}(\text{CN})_6$ and 2% HOAc in the medium the intensity of coloration varied directly as the concn. of the U salt. By converting the Na to the triple acetate, this method may be used in the quant. detn. of Na according to the method of Barrenscheen and Messiner.

- 1913 van Heel, A. C. S. "Some Experiments on Fluorescence." Communs. Phys. Lab., Univ. Leiden No. 187, 3-14(1928?).

The fluorescence and absorption spectra of autunite and potassium uranyl sulfate have been observed at liq.-air and liq.-H₂ temps. A cryostat for use in obtaining low-temp. spectra is described.

- 1914 Wawilow, S. J. "Theory of Extinction of Photoluminescence in Uranyl Salt Solutions." Z. Physik 50, 52-7(1928).

By mathematical treatment of a uranyl salt mol. as a Brownian particle, a previous empirical formula, $t = \alpha(\eta/c)$, is confirmed, where t is the av. time between activation of a mol. and its first extinguishing collision; η , viscosity; and c , concn. of the soln.; and α is a const. Approx. values for α are given. The author accounts for a discrepancy of 50 times between his theoretical and empirical results by solvation.

- 1915 Wawilow, S. J. and Lewschin, W. L. "The Nature of the Photoluminescence of Uranyl Salts." Z. Physik 48, 397-425(1928).

The fading of the glow of uranyl salt crystals, U glasses and liq. solns. obeys generally the law $I = I_0 e^{t/r}$. Only when the exciting light is short-wave ultraviolet, a second fading process can be detected in a few substances. In every case investigated, only phosphorescence was present. With solns., the temp. and the concn. are the more important factors of the fading duration. The exponential law is always obeyed, and the initial intensity, j_0 , remains const. In general the fading and the extinction depend on the viscosity of the soln. The light is always unpolarized. It is assumed that the photoluminescence of the uranyl salts represents the radiating transition of the metastable state of the excited mol. Several phenomena connected with the disappearance of the luminescence are quantitatively accounted for by means of this assumption.

- 1916 West, W., Müller, R. H., and Jette, E. "Studies on Fluorescence and Photosensitization in Aqueous Solution. I. Introduction." Proc. Roy. Soc. (London), A 121, 294-8(1928).

Certain ions suppress the fluorescence of various chemically dissimilar cpds. in aq. soln. in a definite order, which is identical with the order of the ionic deformabilities. Also, when a photochem. sensitizer is fluorescent, the fluorescence is diminished by the addn. of the reactant; moreover, the addn. of ions suppresses the sensitizing power of a fluorescent sensitizer in the same order as it suppresses the fluorescence. Finally, a nonfluorescent sensitizer is affected in the same way by the addn. of ions. The whole group of phenomena can be simply explained in terms of the hypothesis of "collisions of the second kind," and parallels similar phenomena found in gaseous fluorescence and sensitization. The fluorescent mol. assumes a higher energy state by the absorption of light; it may become deactivated by reradiation (fluorescence) or by transfer of its energy by collision with ions, causing polarization of the ions (extinction by ions), or it may polarize the mol. with which it collides so completely as to disrupt it. This explanation is applied to (UO₂)⁺⁺ materials.

- 1917 Whitney, C. "Capillary Permeability in Acute Uranium Nephritis." J. Path. Bact. 31, 699-704(1928).

A new method is offered for testing the permeability of the capillaries, by comparing the rate of transference of typhoid agglutinin from the blood to the tissue fluids in normal rabbits and in rabbits with U nephritis. In the latter there is decreased permeability evident within 18 to 24 hrs of administration of the drug. It is probable, therefore, that the effect on the capillaries is a direct rather than a secondary effect of the kidney degeneration. The state of decreased permeability persists throughout the period in which it is possible to produce edema by the administration of excess fluid.

PUBLICATIONS LOCATED IN 1929

- 1918 Allison, S. K. "Resolution of the Line $L\beta_2$ into Its Diagram Components and the Relative Widths of Some X-Ray Spectrum Lines." *Phys. Rev.* (2), 34, 176-80(1929).

The measurement of the $L\beta_{15}$, or doublet component, of the $L\beta_2$ line for the x-ray spectrum of U is given.

- 1919 Allison, S. K. "Separation and Relative Intensity of the Diagram-Components of the $L\beta_2$ Line by Means of the Double X-Ray Spectrometer." *Phys. Rev.* (2), 33, 1090(1929).

The investigation includes the $L\beta_2$ line of U. This is an abstract of a paper presented at the April 18 to 20, 1929 meeting of American Physical Society in Washington, D. C. See also *Phys. Rev.* (2), 34, 176-80(1929) which is similar to this paper.

- 1920 Andrieux, J. L. [Electrolysis of Metallic Oxides Dissolved in Fused Boric Acid and in Fused Borates (Tungsten, Molybdenum, Zinc).] (Thesis) Paris, Masson et Cie., 1929.

To obtain the boride of a metal the author electrolyzes a mixt. of borate and of fluoride of the metal. In this way 17 borides have been prepd., 10 to which are new: CaB_6 , SrB_6 , BaB_6 , ThB_6 , Zr_3B_4 , Cr_3B_2 , MnB , and the new borates CeB_6 , LaB_6 , NdB_6 , GdB_6 , YB_6 , ErB_6 , YbB_6 , TiB_6 , BV_2 , and UB_4 . Among the metals produced are Zn, W, and Mo.

- 1921 Andrieux, J. L. "Research on the Electrolysis of Metallic Oxides Dissolved in Boric Anhydride or in Melted Borates. New Methods for Preparing Amorphous Boron, Borides, and Several Metals." *Ann. chim.* (10), 12, 423-507(1929).

This paper discusses UB_4 . This material may be obtained by electrolyzing, at about 5 v and 23 amp, a mixt. of U_3O_8 and B_2O_3 using alk. earth oxides and fluorides as fluxing agents. Temps. of about 1000° are necessary for the prepn. of UB_4 . The crystals which are prepd. have a metallic appearance and may be purified with dil. HCl. UB_4 will scratch quartz and topaz and will dissolve in HF and HCl. It will reduce concd. H_2SO_4 forming SO_2 and S. It is readily dissolved by HNO_3 and concd. H_2O_2 . It will decomp. in the presence of fused hydroxides, carbonates, and alk.-hydrosulfates, and react vigorously with peroxides.

- 1922 Asahina, T. and Dono, T. "Molecular Compounds between Diketopiperazine and Some Heavy Metals." *Z. physiol. Chem.* 186, 133-6(1929).

By mixing hot solns. of glycine anhydride with salts of heavy metals and evapg. to incipient crystn., the following cpds. were obtained in cryst. form: $C_4H_6N_2O_2 \cdot 2HgCl_2$, $C_4H_6N_2O_2 \cdot UO_2Cl_2 \cdot 1.5H_2O$, $C_4H_6N_2O_2 \cdot UO_2(NO_3)_2$, and $C_4H_6N_2O_2 \cdot CdCl_2$. All of these are insol. in org. solvents, but sol. in H_2O with sepn. into their components.

- 1923 Atkinson, R. d'E. and Houtermans, S. G. "On the Quantum Mechanics of α Rays." *Z. Physik* 58, 478-96(1929).

Calcn. of nuclear radius of U_I is made assuming various quantum numbers for the energy block. The radius lies between 9.28 and 10.13×10^{-13} cm. The distance of the max. potential from the center of the nucleus is reported to be 14.28×10^{-13} cm.

- 1924 Barber, H. H. and Kolthoff, I. M. "Gravimetric Determination of Sodium by the Uranyl Zinc Acetate Method. II. Application in the Presence of Rubidium, Cesium, Potassium, Lithium, Phosphate or Arsenate." *J. Am. Chem. Soc.* **51**, 3233-7(1929).

It is reported that small amts. (0.1 g) of Cs and Rb do not interfere; interfering K may be removed by alc. ammonium perchlorate; Li may be removed with NH_4F ; a magnesia mixture is used to remove interfering $(\text{PO}_4)^{-3}$ and $(\text{AsO}_4)^{-3}$. Brief notes on $\text{UO}_2\text{Zn}(\text{Li, K, or Na})(\text{OAc})_x$ are included.

- 1925 Baur, E. "Formulae for Sensitized Photolysis." *Helv. Chim. Acta* **12**, 793-806(1929).
The quantum yield and mechanism of the photolysis of uranyl formate is discussed as is information on the photochem. reduction of uranyl cpds. The use of $(\text{UO}_2)^{++}$ as a catalyzer in photochem. processes and the photolytic reaction between uranyl salts and iodides is also discussed.

- 1926 Baxter, G. P. "Thirty-Fifth Annual Report of the Committee on Atomic Weights. Determinations Published during 1928." *J. Am. Chem. Soc.* **51**, 647-54(1929).

The study on U is reviewed. The series of expts. is briefly discussed and the results tabulated. The value accepted for U is 238.14.

- 1927 Beck, G. "The Energetic Structure of the Molecule." *Z. anorg. allgem. Chem.* **182**, 332-42 (1929).

This paper discusses the connection between the thermochem. properties of UCl_4 and the mol. structure of the material, particularly as applied to the amines. The total energy change of the electronic rearrangement when UCl_4 is obtained from the elements is reported to be 930 kcal. For UCl_3 the value has been calcd. to be 824 kcal.; for UO_3 , 1020 kcal.; and for UO_2 , 695 kcal.

- 1928 Botolfsen, E. "The Preparation of Pure Uranium." *Bull. soc. chim. France* (4), **45**, 626-7 (1929).

The oxide U_3O_8 is reduced to metal when heated with purified Ca in an evacuated iron vessel. An excess of the reducing agent is used, and the excess is removed by subln. above the m. p. of Ca in vacuum. The reduced product is sieved, washed with H_2O , then with 2% HOAc, and finally with alc. and Et_2O . The resulting powder is stated to contain 99.95% U.

- 1929 Briscoe, H. V. A. and Robinson, P. L. "Inorganic Chemistry." In *Annual Report on the Progress of Chemistry, 1928*. London, Chemical Society, 1929.

The paper includes notes on recent work on the at. wt. of Cs, Ag, Er, Ti, Sb, and U.

- 1930 Bucciardi, G. and Bisceglie, V. "Modifications of the Contractile Activity and the Structure of Isolated Fragments of Embryonic Chicken Heart by Quantitative Variations of the Composition of the Nutrient Liquid." *Arch. intern. physiol.* **31**, 272-309(1929).

U acetate in 0.85% NaCl shows excitation if the concn. is 0.2% or lower. This salt dissolved in H_2O or hypotonic solns. produces depression rather than excitation. Culture of heart fragments in plasma and hypertonic solns. contg. excess CaCl_2 and KCl is difficult for the cell elements are reduced in vol. and irregular in form. U acetate prevents a culture from developing migration. If migration is in process then U brings about profound changes, such as the formation of vacuoles and fat droplets and nuclear changes which rapidly destroy the culture.

- 1931 Caley, E. R. "A New Qualitative Reagent for Sodium." *J. Am. Chem. Soc.* **51**, 1965-9(1929).

The reagent is a soln. of $(\text{UO}_2)^{++}$ and Co^{++} acetates in HOAc; the pptn. of triple salts with Na^+ , K^+ , and Li^+ is discussed. The application of this method to the usual qual. analysis scheme is described.

- 1932 Caley, E. R. and Foulk, C. W. "A Gravimetric and Colorimetric Method for the Direct Determination of Sodium." J. Am. Chem. Soc. 51, 1664-74(1929).

This method uses pptn. of $\text{NaMg}(\text{UO}_2)_3(\text{OAc})_9 \cdot 6\frac{1}{2}\text{H}_2\text{O}$, which can be either dried and weighed or dissolved in H_2O for colorimetric comparison. Notes are included on characteristics of ppt., effects of reagent excesses, and interference of other ions.

- 1933 Colani, A. "The Determination of the State of Oxidation of Some Insoluble Phosphates." Bull. soc. chim. France (4), 45, 621-3(1929).

Advantage is taken of the fact that FeO , Mo_2O_3 , and UO_2 readily reduce oxidation mixts. which are used to effect the soln. of the insol. phosphates of these oxides. The unreduced portions are titrated as usual and hence the % of the oxides present is detd. Fusion of the phosphates with $\text{Na}_4\text{P}_2\text{O}_7$ and subsequent titration with KMnO_4 give good results with FeO and UO_2 . These volumetric methods agree well with the gravimetric and show the formulas of the oxides to be $\text{P}_2\text{O}_5 \cdot \text{FeO}$, $3\text{P}_2\text{O}_5 \cdot \text{Mo}_2\text{O}_3$, $2\text{P}_2\text{O}_5 \cdot \text{UO}_2$, and $2\text{P}_2\text{O}_5 \cdot 3\text{UO}_2 \cdot \text{UCl}_4$. The latter cpd. can be detd. only by the fusion method.

- 1934 Colani, A. "A Study of Uranyl Formate." Bull. soc. chim. France (4), 45, 624-6(1929).

The concn. and existence of uranyl formate in the system uranyl formate-formic acid- H_2O at 25° in the absence of sunlight is discussed. Values for the soly. expressed as wt. % UO_3 and total formic acid are given. A discontinuity in the curve at a UO_3 value of 1.15 and formic acid value of 44.85 indicates the existence of an acid salt. The salt could not be isolated. When formic acid vapor was used, $\text{UO}_2(\text{HCO}_2)_2 \cdot \text{H}_2\text{O}$ absorbs 10.4% by weight of H_2O . If 12.1% were absorbed it would correspond to an acid salt $\text{UO}_2(\text{HCO}_2)_2 \cdot \text{HCO}_2\text{H} \cdot \text{H}_2\text{O}$. The neutral salt and the basic uranyl formate were also investigated particularly as regards the formation in concd. aq. solns. of the neutral salt. The basic salt is said to be less sol. and more stable in aq. soln. than is the neutral salt. It is also more sol. in formic acid, its soly. increasing with the concn. of acid.

- 1935 Das-Gupta, P. "Use of Phenolic Acids in the Detection, Separation, and Estimation of Metals. II. Colorimetric Detection and Estimation of Uranium." J. Indian Chem. Soc. 6, 763-76(1929).

The addn. of tannic, gallic, or resorcylic acid followed by NaOAc produces a marked coloration, which is more sensitive than the Na salicylate test hitherto regarded as most sensitive. The best results were obtained with gallic acid. To the neutral soln. of $(\text{UO}_2)^{++}$ add 2 cc of 1% gallic acid soln. and 1 cc of 5% NaOAc soln. In 10 cc of the test, as little as 23 γ/cc can be detected.

- 1936 Das-Gupta, P. "Use of Phenolic Acids in the Detection, Separation, and Estimation of Metals. III. Gravimetric Estimation of Uranium." J. Indian Chem. Soc. 6, 777-9(1929).

To 10 to 20 cc of $(\text{UO}_2)^{++}$ soln. contg. the equiv. of 0.007 to 0.14 g of U_3O_8 , add 2 cc of 2% tannic acid soln. for each 12 mg of U. The addn. of the reagent will produce a deep-brown coloration. Heat to boiling and to the hot soln. add ammoniacal NH_4OAc soln. until the upper liq. is clear. Filter, wash with 2% NH_4NO_3 soln. made slightly ammoniacal, ignite, and weigh as U_3O_8 .

- 1937 Delorme, R. and Perrin, F. "The Duration of Fluorescence of Solid Uranyl Salts and Their Solutions." J. phys. radium (6), 10, 177-86(1929).

Uranyl salts and certain of their solns., excited by blue light, exhibit enduring green fluorescence, which decays exponentially; $I = I_0 e^{-t/r}$. The quantity, r , representing the av. life of the mols. in the excited state, has been detd. at ordinary temp., and at that of liq. air. The measurements were made on solid salts and on solns. in H_2SO_4 and HPO_3 . The fluorescence of the solns. has a duration of the same order as that of the crystals. It is concluded that the luminescence of uranyl salts is a simple fluorescence of long duration, due to spontaneous shifting between the normal state and a state of almost metastable electronic activation of the group $(\text{UO}_2)^{++}$.

1938 Dorabialska, A. "Use of an Adiabatic Microcalorimeter for Measurements of Rates of Flow of Heat of Uranium, Thorium and Radioactive Minerals." Roczniki Chem. 9, 494-503(1929).
An adiabatic microcalorimeter was constructed and applied to measurements of thermic effects of 10^{-4} to 10^{-5} cal/g/hr. The method is based on the use of the substance studied as an inner calorimeter which causes the radioactive substance to heat itself. The measurements being adiabatic, the heat evolved during a desired time can be accumulated. This allows measurement of very small rates of flow of heat. In this case the duration of expts. was 6 to 24 hrs. It is possible to calc. the rate of flow of heat Q cal/g due to the radiation of the substance studied according to $Q = c \cdot \Delta t$ where c is the sp. ht. of the substance and Δt the increase of temp. of the calorific system/hr. The functioning of the app. was investigated in measurements of rates of flow of heat due to the radiation of U_3O_8 , ThO_2 , and pitchblende. The results are in agreement with calcs. and investigations of other authors. 6.37×10^{-5} cal/hr/g was obtained for the rate of pitchblende. That gives for the rate of flow of heat of 1 g U in radioactive equil. of 1.10×10^{-5} cal/hr.

1939 Dorabialska, A. "Measurement of Heat Emission of Uranium, Thorium, and Radioactive Minerals by Means of the Adiabatic Calorimeter." Bull. intern. acad. polon. sci. Classe sci. math. nat. A. 8, 487-96(1929).

This paper contains information similar to that reported in Roczniki Chem. 9, 494-503(1929).

1940 Enskog, D. "Magnetism and Nuclear Structure." Z. Physik 52, 203-20(1929).
The contradictory results of measurements of the radius of the U nucleus are explained on the basis of a magnetic-field distribution in the nucleus as well as by the application of wave mechanics. The potential barrier is calcd. to be approx. 30×10^6 ev at 0.7×10^{-12} cm from the center of the nucleus.

1941 Frola, E. "On Experimental Toxic Nephritis in Hydronephrosis." Pathologica 21, 109-15 (1929).

Rabbit kidneys rendered hydronephrotic and subjected to doses of U nitrate from 0.5 to 1.0% were studied, and it is concluded that the kidney of the hydronephrotic animal which had not been operated on presents lesions analogous to those of the controls except that there is hypertrophy. The kidney operated on, besides the characteristic lesions of hydronephrosis, showed glomerular lesions due to the U nitrate, but in a degree lighter than those of the controls. Around the convoluted tubules it was difficult to decide how much is to be attributed to intoxication and how much to hydronephrosis. It is impossible to exclude a toxic action albeit a light one, due to the U nitrate. The hydronephrotic animals show an increased resistance to U poisoning, as is seen histologically in fewer changes than in the controls.

1942 Gamburzeff, G. A. "Diffusion of Photoluminescence with Repeated Absorption and Radiation Processes." Z. Physik 55, 533-45(1929).

The diffusion of photoluminescence in uranyl cpds. by repeated absorption and irradiation processes is reported to cause a change in the fading law.

1943 Gaspar y Arnal, T. "Notes on Molybdates, Nitrophosphomolybdates, Tungstates, and Phosphotungstates." Ann. chim. anal. chim. appl. (2), 11, 97-103(1929).

With a 5% aq. soln. of Na molybdate, $(UO_2)^{++}$ gave a light-yellow ppt. which is sol. in HNO_3 and darkened by adding NH_4OH . With a satd. soln. of NH_4 molybdate, no reaction was obtained. A yellow ppt. which became more brilliant upon the addn. of NH_4OH was obtained with $(UO_2)^{++}$ and a soln. of Na nitrophosphomolybdate (Na_2HPO_4 , Na molybdate, and HNO_3). With a soln. of Na tungstate (5%) $(UO_2)^{++}$ yields a ppt. which is slowly formed, sol. in HNO_3 and insol. in NH_4OH . The effect of alc. on these reactions, and their application to qual. analysis is discussed. A large number of non-U ions was also tested.

- 1944 Germann, F. E. E. and Frey, P. R., "The Hydrates of Uranyl Nitrate, Their Respective Vapor Pressures and the Relative Stability of the Lower Hydrate." J. Colo.-Wyo. Acad. Sci. 1, No. 1, 54(1929).

This paper is an abstract. Hydrates contg. 2, 3, and $6\text{H}_2\text{O}$ were found.

- 1945 Germuth, F. G. "Detection and Identification of Specific Cations with Sodium Alizarinsulfonate Reagent." Am. J. Pharm. 101, 46-52(1929).

The value of sodium alizarinsulfonate as a qual. reagent for U, Pt(ic), Sn(ic), Ti(ous), Al, Bi, Fe(ic), Cr(ic), Cu(ic), Hg(ic), and Tl is shown in tables.

- 1946 Ghosh, J. C. "On the Mechanism of Starting Photochemical Changes in Fluorescent Electrolytes." Z. physik. Chem. B. 3, 419-26(1929).

Contributions are made to data on the mechanism of the $\text{U}^{+6}/\text{U}^{+4}$ potential at the Pt electrode.

- 1947 Goldschmidt, V. M. "Crystal Structure and Chemical Constitution." Trans. Faraday Soc. 25, 253-83(1929).

This paper discusses the cryst. structure of U oxides in relation to their chem. compn. along with the cpds. of many other metals. Empirical calcns. of the radius of U^{+4} in the crystal lattice yields 1.05 A.

- 1948 Guempel, O. "Heterogeneous Equilibria in Mixtures of Water, Ether, and a Metallic Salt." Bull. soc. chim. Belg. 38, 443-77(1929).

The following systems were studied and represented in triangular diagrams: (1) $\text{H}_2\text{O}-\text{Et}_2\text{O}-\text{UO}_2(\text{NO}_3)_2$, (2) $\text{H}_2\text{O}-\text{Et}_2\text{O}-\text{ZnI}_2$, (3) $\text{H}_2\text{O}-\text{Et}_2\text{O}-\text{CdI}_2$. The corresponding binary systems also were studied.

- 1949 Guimaraes, D. "The Separation of Uranium from Zirconium, Tantalum, Niobium, Titanium, Iron, Manganese, Lead, Tin, Copper, Nickel, and Chromium." Ann. acad. brasil. science. 1, 198-200(1929).

- 1950 Hadding, A. and van Aubel, R. "On the Structure of Crystalline Uraninite from Katanga (Belgian Congo)." Compt. rend. 188, 716-17(1929).

A brief description of the crystals with extensive tabulated data are given.

- 1951 Herz, W. "Entropy and Vibration Frequency of Elements." Z. anorg. allgem. Chem. 177, 116-18(1929).

The vibrational freq. of U as calcd. from the Lindeman formula is 3.13×10^{12} . The relationship between the vibrational freq. and entropy is also discussed.

- 1952 Herz, W. "On the Knowledge of Solid Elements." Z. anorg. allgem. Chem. 180, 284-6(1929).

Tabulated data includes values of entropy (15.37), and sp. ht. (0.0280) for U with calcns. of $\sqrt[3]{s}$ and $S/\sqrt{s}$.

- 1953 Kolthoff, I. M. "Application of Uranyl-Zinc Acetate as a Reagent for the Quantitative Determination of Sodium." Chem. Weekblad 26, 294-8(1929).

The prepn. of Na, Zn, $(\text{UO}_2)^{++}$ acetate and its use in analysis for Na is discussed.

- 1954 Krüger, D. and Tschirch, E. "The Microchemical Detection of Acetic Acid." Microchemie 7, 318-26(1929).

A pure U formate suitable as a reagent for HOAc can be obtained by treating a soln. of 10 g of cryst. U nitrate in 500 cc H_2O with a slight excess of NH_3 , washing the ppt. with hot water and treating with pure formic acid. The resulting material is a light-yellow fine cryst. powder easily pptd. from soln.

- 1955 Lindberg, E. "X-Ray Spectrometric Measurements of the M-Absorption Spectra of the Elements Uranium to Tungsten." Z. Physik **54**, 632-42(1929).
The absorption edges M_V , M_{IV} , and M_{III} have been measured for the elements U, Th, Bi, Pb, Tl, Hg, Au, Pt, and W using the latest type of Siegbahn vacuum spectrograph. There is a systematic deviation of the calcd. from the observed values, particularly in the case of the M_{IV} and M_V . The D/R values for the N levels of the above elements have been calcd. from the values for the M-absorption edges and the earlier detd. M-emission spectra.
- 1956 Lundell, G. E. F. and Knowles, H. B. "Use of 8-Hydroxyquinoline in Separations of Aluminum." Bur. Standards J. Research **3**, 91-6(1929). (Research Paper R.P. 86)
Al may be sepd. from U in soln. using 8-hydroxyquinoline in an excess of $(NH_4)_2CO_3$. The Al is quantitatively pptd. while the U remains in soln.
- 1957 MacNider, W. deB. "Development of Chronic Nephritis in Dog by Uranium Nitrate." J. Exptl. Med. **49**, 387-409(1929).
This is a study of kidney tubule damage from U poisoning.
- 1958 MacNider, W. deB. "Functional and Pathological Response of Kidney in Dogs Subjected to Second Subcutaneous Injection of Uranium Nitrate." J. Exptl. Med. **49**, 411-33(1929).
- 1959 MacNider, W. deB. "The Nephrotoxic Action of Repeated Injections of Uranium-Nitrate in the Dog. A Functional and Pathological Study." Am. J. Physiol. **90**, 441-2(1929).
- 1960 MacNider, W. deB. "Urine Formation During Acute and Chronic Nephritis Induced by Uranium Nitrate." Am. J. Med. Sci. **178**, 449-69(1929).
- 1961 Malitzky, W. P. and Tabakajew, W. A. "On the Microchemical Detection of Sodium Using Zinc Uranyl Acetate." Microchemie **7**, 334-6(1929).
The study includes the statement that $NaZn(UO_2)_3(OAc)_9$ exists as the hexahydrate rather than the 9-hydrated material reported in the earlier literature.
- 1962 Marden, J. W. —assigned to Westinghouse Lamp Co. Uranium and Its Alloys. Sept. 24, 1929. (U. S. Patent 1,728,940)
This is a process for the production of U powder from U oxide, UCl_4 , or double U halides with Ca, $CaCl_2$, and $ZnCl_2$. A U-Zn alloy will occur as a coarse powder. The Zn may later be removed by distn.
- 1963 Marden, J. W. —assigned to Westinghouse Lamp Co. Uranium-Zinc Alloys. Sept. 24, 1929. (U. S. Patent 1,728,942)
A cpd. such as U oxide is simultaneously reduced and alloyed with Zn.
- 1964 Marden, J. W., Thomas, T. P., and Conley, J. E. —assigned to Westinghouse Lamp Co. Refractory Metals Such as Uranium and Thorium. Mar. 5, 1929. (U. S. Patent 1,704,257)
In order to obtain metals such as U or Th from their difficultly reducible oxides, the latter are heated to a reacting temp. with Ca or other alk.-earth metal and an alk.-earth metal halide such as $CaCl_2$.
- 1965 Marsh, J. K. "The Rare Earths Associated with Uraninites." Phil. Mag. (7), **7**, 1005-11(1929).
Sepn. of the rare earths from the major constituents of the mineral, and the spectrographic examn. of the mineral is discussed. Several samples were examined.
- 1966 Maydel, J. "The General Formula for the Calculation of Atomic and Molecular Heat as Well as the Specific Heat of Elements in the Solid State." Z. anorg. allgem. Chem. **178**, 113-45 (1929).
A small amt. of information on U is included.

1967 Menes, B. Ueber Komplexverbindungen des vierwertigen Urans. Berlin, 1929.

1968 Messini, M. "On the Toxicity of Certain Salts of Uranyl." Biochim. therap. sper. 16, 120-4 (1929).

The rapidly and slowly fatal dose of uranyl sulfate, acetate, and nitrate was detd. on rabbits, by intra-venous injection. With the rapidly lethal dose the animals died of respiratory failure, with the late fatal dose, of glomerular nephritis. The order of toxicity is: sulfate, nitrate, acetate (corresponding to their hydrolytic disson.). With all salts there is a marked diminution of toxicity with dil. solns. For the sulfate there is a notable difference between the immediately lethal dose (0.5 to 1.3 mg) and the remotely fatal dose (0.00023 mg). Phosphates did not exert any demonstrable antidotal effect.

1969 Misciattelli, P. "Separation of Thorium from Uranium by Means of Ether." Phil. Mag. (7), 7, 670-4(1929).

To throw light on the divergent results obtained in the use of Et_2O for the analytical sepn. of U and Th, the anhyd. ternary system $\text{UO}_2(\text{NO}_3)_2$ - $\text{Th}(\text{NO}_3)_4$ - Et_2O is examined, and it is shown that the conditions for the Th not to be dissolved are that the temp. must be above 20°C and the uranyl salt sufficient to sat. the Et_2O soln.

1970 Montignie, E. "Action of Ultraviolet Rays on Mineral Compounds. Second Communication." Bull. soc. chim. France (4), 45, 708-09(1929).

Potassium uranate (for which no formula is given) is not attacked when irradiated for 1 hr with ultraviolet rays. When U_3O_8 is treated with ultraviolet light and placed in contact with a photographic plate a strong effect will be found as long as 5 days after irradiation.

1971 Moser, L. and Brukl, A. "Determination and Separation of Rare Metals from Other Metals. XV. Quantitative Analysis of Gallium." Monatsh. 51, 325-33(1929).

To sep. U and Ga, add to the neutral soln. contg. 0.01 to 0.3 g of Ga, H_2SO_4 to make the soln. 2N and bring the vol. to 200 to 300 cc. At room temp. add a 6% soln. of cupferron, using 6 times as much as there is Ga present. Filter off the ppt. through a paper filter in a Pt cone and finally apply gentle suction. The first filtrate usually comes through turbid. Add 1 to 2 cc more of reagent and filter through the same filter. If the filtrate remains clear for 2 hrs the complete pptn. of Ga is assured. Wash with small portions of 2N H_2SO_4 and drain each time by gentle suction. When free from chloride, ignite and weigh as Ga_2O_3 . Evap. the filtrate to fumes and det. U in a std. manner. The U must all be present as U^{+6} . The absence of reducing agents is necessary since U^{+4} forms a ppt. with cupferron.

1972 Neogi, P. and Bhattacharyya, R. C. "Further Action of Magnesium Amalgam on Nitrates and Its Action on Nitrous Acid, and Salts of the Oxyacids of Sulfur and the Halogens." J. Indian Chem. Soc. 6, 333-40(1929).

U hyponitrite was prepd. (impure) by treating $\text{UO}_2(\text{NO}_3)_2$ soln., cooled in an ice salt bath with 5% Mg amalgam. The temp. was maintained below 5° . The ppt. formed was filtered off and the treatment with Mg amalgam repeated until the soln. was free of nitrate or nitrite. The soln. did not contain hydroxylamine or hyponitrite. The washed ppt. was dissolved in dil. HOAc (1:15) giving a soln. contg. hyponitrite. The HOAc soln. of the ppt. after standing at ordinary temps. in the air to decomp. the hyponitrite gave a reddish-brown ppt. of $\text{Ag}_2\text{U}_2\text{O}_7$ on the addn. of AgNO_3 . Yellow PbU_2O_7 was obtained by treating the soln. with $\text{Pb}(\text{NO}_3)_2$.

- 1973 Perrin, F. "The Fluorescence of Solutions: Molecular Induction, Polarization and Duration of Emission and Photochemistry." Ann. phys. (10), 12, 169-275(1929).

The exptl. characteristics which define fluorescence and their theoretical significance are reviewed. The essential difference between fluorescence and phosphorescence does not reside in the persistence of the emission; from this point of view, the shortest persistences were fluorescences, the longest were phosphorescence. The author considers fluorescence to be associated with simple passage of mols. (having absorbed incident rays of light) from an excited state of int. instability. The author also gives reasons why the prolonged luminescence of U salts should be considered a simple fluorescence and indicates how such durations of elementary luminescence can be interpreted on the basis of wave mechanics. Intensity of luminescence follows an exponential function of the time. The emission is between 10^{-7} and 10^{-6} sec for solid salts which have a brilliant luminescence; lowering the temp. increases the duration of the emission very little.

- 1974 Petri, L. "Pathological Effects of Uranium Radiation on Olea europaea." Phytopath. Z. 1, 45-8(1929).

Olive plantlets only a few days old were subjected to radiation from U oxide, and the results on growth and on activity in terms of lessened transpiration are given and interpreted to indicate a lowering of the life activity of the living plant due to the irradiation.

- 1975 Picon, M. "Action of High Temperatures on Several Metallic Sulfides." Compt. rend. 189, 96-8(1929).

It is reported that US_2 starts to dissoc. in vacuum at 1300° . The material was heated to 1800° . Crystals of US_2 were prepd. according to the method of Colani.

- 1976 Pierce, W. C., Leviton, A., and Noyes, W. A., Jr. "Photochemical Studies. VIII. The Photochemical Decomposition of Malonic Acid both in the Presence and Absence of Uranyl Sulfate." J. Am. Chem. Soc. 51, 80-9(1929).

The authors find that, at least in the early stages of the reaction, the products of decompn. are almost exclusively CO_2 and $HOAc$, both in the presence and in the absence of the catalyst. With unvaried malonic acid concn., increase in the UO_2SO_4 concn. causes the rate to approach an approx. const. value. For av. wavelength $250\text{ m}\mu$, the quantum eff. of the uncatalyzed reaction is $0.73 (\pm 0.25)$; for the catalyzed reaction at av. wavelength $290\text{ m}\mu$, the quantum eff. is $0.27 (\pm 0.02)$; at av. wavelength $320\text{ m}\mu$, it is $0.025 (\pm 0.04)$. With const. concn. of UO_2SO_4 , the reaction rate increases with increase in the concn. of malonic acid and is found to be proportional to the cube root of the latter. No evidence is found to indicate the existence of a light-sensitive complex, nor does it seem that ionization plays an important part.

- 1977 Pierce, W. C. "Photochemical Studies. IX. Uranyl Sulfate as Sensitizer for the Photochemical Decomposition of Oxalic and Malonic Acids." J. Am. Chem. Soc. 51, 2731-8(1929).

The sensitized photochem. decompn. of malonic acid by UO_2SO_4 has a temp. coeff. of 1.13 ± 0.02 . The analogous decompn. of oxalic acid has a temp. coeff. of unity. The rate of the process varies with the concn. of UO_2SO_4 and with the concn. of malonic acid and approaches a const. value. The variation is most pronounced when the molar ratio of malonic acid to UO_2SO_4 is less than unity; for concns. when this ratio is greater than 1 the variation in the rate is small. It is commented that the oxalic and malonic acid decompns. are of similar mechanisms despite the differences in temp. coeffs. and quantum efficiencies. Two mechanisms have been postulated: (1) complex ion decompn.; (2) collisions of the second kind between $(UO_2)^{++}$ in an activated state and acid mols.

- 1978 Pribyl, E. "Anisotonia in Nephritis Provoked by Uranium Nitrate." Compt. rend. soc. biol. 102, 402-04(1929).

It is reported that in U poisoning the excretion of NH_3 increases whereas the excretion of urea decreases.

- 1979 Pringsheim, P. and Yost, M. "On the Raman Effect in Some Water Solutions." Z. Physik **58**, 1-6(1929).

This paper contains a discussion of the Raman spectrum of UO_2SO_4 soln. and a comparison of the freqs. found with those of the fluorescence bands. The theory of spectrums is applied and the nuclear vibration of the inactive uranyl ion is measured as is the corresponding freq. difference in the absorption spectrum.

- 1980 Rosenheim, A. and Daehr, H. "On Uranium Tetroxide Dihydrate." Z. anorg. allgem. Chem. **181**, 177-82(1929).

U tetroxide prep'd. from $\text{UO}_2(\text{NO}_3)_2$ or $(\text{NH}_4)_2\text{UO}_2(\text{C}_2\text{O}_4)_2$ soln. by 30% H_2O_2 and dried at room temp. corresponds to $\text{UO}_4 \cdot 3\text{H}_2\text{O}$. At 100° $\text{UO}_4 \cdot 2\text{H}_2\text{O}$ is obtained. Heating over 100° does not yield a pure UO_4 . The cryst. form of the dihydrate is discussed in some detail.

- 1981 Roy, S. "Influence of Light on Some Colloids." J. Indian Chem. Soc. **6**, 431-40(1929).
Sols. of $\text{Sn}(\text{OH})_4$, $\text{Al}(\text{OH})_3$, $\text{Th}(\text{OH})_4$, and HgS become unstable toward uni- and bivalent ions on exposure to light. Sols. of As_2S_3 , Sb_2S_3 , U ferrocyanide, and $\text{Cu}_2\text{Fe}(\text{CN})_6$ are stabilized toward uni- and bivalent electrolytes by short exposures to light but become unstable on long exposure. Long exposures of sols. of Sb_2S_3 , HgS and U ferrocyanide to light produce coagulation without the addn. of an electrolyte. Sols. exposed to light have a higher cond. than those kept in the dark.

- 1982 Rutherford, E., Aston, F. W., Chadwick, J., Ellis, C. D., Gamow, G., Fowler, R. H., Richardson, O. W., and Hartree, D. R. "Discussion on the Structure of Atomic Nuclei." Proc. Roy. Soc. (London), **A. 123**, 373-90(1929).

This paper contains a discussion of the small effects on potential barrier in the U nucleus which result from the α particles emitted on the basis of "tunnel effect." "Tunnel effect" discussion appears to have originated in this paper.

- 1983 Scagliarini, G. and Pratesi, P. "Rapid Method for Determination of Iron and Uranium." Ann. chim. applicata **19**, 85-90(1929).

The method depends on the reaction $2\text{Fe}^{+3} + \text{Cu} - 2\text{Fe}^{++} + \text{Cu}^{++}$. Dil. the neutral soln. contg. 0.05 to 0.3 g of Fe as sulfate to 200 cc in a flask having a stopper provided with a Bunsen valve and with a glass rod to which can be fastened a Cu spiral. Then add 20 cc concd. H_2SO_4 . Heat the soln. to boiling, lower the Cu into the liq. and boil for 10 min. Then raise the Cu spiral, cool, dil to 500 cc, and titrate with KMnO_4 . In a similar way Cu has been found to reduce U^{+6} to U^{+4} , but 20 to 45 min boiling with Cu is advisable. When U and Fe are both present, det. both together in one sample; in another, ppt. Fe as sulfide and det. U in the filtrate.

- 1984 Schreiner, E., Frivold, O. E., and Ender, F. "Freezing-Point Measurements in Very Dilute Solutions of Strong Electrolytes in Cyclohexanol." Phil. Mag. (7), **8**, 669-80(1929).

This paper reports the investigation of the depression of the freezing point of cyclohexanol when $\text{UO}_2(\text{OAc})_2$ is present, as a test of the Debye-Hückel theory.

- 1985 Slattery, M. K. "Uranium as an Activator. II." J. Optical Soc. Am. **19**, 175-86(1929).

The expts. were made with a view to confirming the striking relation in the location of the submerged bands found when spectroscopic measurements were made of the fluorescent emission of various dil. solid solns. of $(\text{UO}_2)^{++}$. A no. of colorless fusible salts were tried in the hope of finding others giving bright resolved spectra similar to that of NaF. The results observed with NaF and LiF contg. dissolved UO_3 are tabulated, and, in general, it was found that many of the fluorescent prepsns. seem to have spectra similar to the uranyl salts, differing only in that a shorter wavelength is necessary for excitation. It is found that those fluxes which produce luminescence are those which have marked transparency in the ultraviolet. The best fluxes appear to be the NaF and LiF, not only in brightness, but in resolution and in the fact that their spectra can be arranged in sets of const. freq. intervals. It is thought that in the case of the soln. in fluorides, the uranyl group is definitely broken down and that the emission effects are due to U itself as an activator.

- 1986 Stowell, E. Z. and Redeker, H. E. "The Role of Hydrogen in the Oscillating Arc." Phys. Rev. (2), 34, 978-83(1929).

Expts. show that an oscillating arc between a U cathode and a Cu anode in an atm. of H_2 yields an intense continuous oscillation.

- 1987 Vanino, L. and Preen, M. "A Communication on the Preparation of Luminophors." J. prakt. Chem. (2), 123, 85-8(1929).

With U as an activator, Al_2O_3 shows a yellow-brown fluorescence under the influence of cathode rays.

- 1988 Wdowiszewski, H. "Progress in Analytical Chemistry of Metals During 1926." Przemysł Chem. 13, 53-60(1929).

A review with bibliography of new methods for Sb, As, Be, Cr, Sn, Zn, Al, Cd, Mn, Cu, Mo, Ni, Pb, Hg, U, V, W, and Fe is given.

- 1989 Wilke-Dorfurt, E. and Schliephake, O. "New Antipyrine Addition Compounds of Metal Perchlorates." Z. anorg. allgem. Chem. 183, 301-10(1929).

Uranyl pentaantipyrine perchlorate of the probable compn. $UO_2(COC_{10}H_{12}N_2)_5(ClO_4)_2$, was obtained by mixing a uranyl soln. at room temp. with aq. solns. of antipyrine and NH_4ClO_4 . The complex salt is reported to melt at 194 to 196°, decomp. at 270° and be sol. in H_2O to the extent of 0.46 g/100 cc. Many other similar salts (penta- and hexaantipyrine chlorates) were prepd. with other metallic ions.

PUBLICATIONS LOCATED IN 1930

- 1990 Ato, S. "Analysis of the Aluminum Group." Sci. Papers Inst. Phys. Chem. Research (Tokyo) **14**, 287-311(1930).

The procedure recommended by Noyes was tested and found faulty. To overcome the difficulties encountered, the following procedure is recommended: Dil. the soln. contg. cations of the Al-Fe groups to 50 cc, add pure 6N NaOH soln. until neutral and 5 cc in excess. Introduce 1 to 5 g of Na_2O_2 in small portions with stirring, add 5 cc of 3N Na_2CO_3 and boil about 5 min. Dil. to 100 cc and filter promptly. Cool the filtrate under running water and make it about N in HOAc by adding 5 to 7 cc of glacial HOAc. Boil 3 to 5 min and filter. The ppt. contains Ti and the filtrate contains Al, Be, Zn, Cr, U, and V. Heat the filtrate to boiling, add 10 to 20 cc of 3N $\text{Pb}(\text{OAc})_2$ soln., boil 1 to 2 min and allow to stand for a short time. The ppt. contains V and Cr and the filtrate contains Al, Be, Zn, and U. To sep. Zn from Al, Be, and U in the filtrate, add an excess of NH_4OH to ppt. Al, Be, and U, boil and filter. Dissolve the ppt. produced in 4 cc of 6N HNO_3 and 80 cc H_2O . Sat. with H_2S and filter off any PbS. Evap. the filtrate to dryness, add 15 cc of 7.5N HNO_3 and 30 cc of Et_2O . Sep. the layers which form after shaking, evap. the aq. layer to dryness and repeat the extrn. with HNO_3 and Et_2O to remove all U. Evap. the Et_2O soln. to dryness, to the residue add 3 cc of 6N HNO_3 and 30 cc of Et_2O and shake in a separatory funnel. Evap. this Et_2O soln. almost to dryness, transfer the residue to a small test tube contg. 1 cc of satd. NaCl soln., add 1 to 2 drops of 6N HCl and some $\text{K}_4\text{Fe}(\text{CN})_6$; a dark-red ppt. is formed if U is present.

- 1991 Barbieri, G. A. "On the Chromatic Reactions of Molybdenum Octa-Cyanide." Atti. reale accad. nazl. Lincei (6), **12**, 148-53(1930).

When a 2% aq. soln. of $\text{UO}_2(\text{OAc})_2$ is combined with $[\text{Mo}(\text{CN})_8]^{-4}$ a reddish-brown color will be obtained. This reaction is not obtained with $[\text{Mo}(\text{CN})_8]^{-3}$.

- 1992 Behouneq, F. "A Communication on Experiments on the Influence of Radioactive Decomposition." Physik. Z. **31**, 215-24(1930).

The activities of UO_3 and U_3O_8 are considered.

- 1993 Biltz, W. "On Molecular and Atomic Volumes. 29. Three Orders in the Law of Combining Volumes of Solids." Z. anorg. allgem. Chem. **193**, 321-50(1930).

Tabular information is given on UO_3 , UCl_3 , UCl_4 , UO_2 , and $\text{UO}_2 \cdot 2\text{H}_2\text{O}$.

- 1994 Breit, G. "Possible Effects of Nuclear Spin on X-Ray Terms." Phys. Rev. (2), **35**, 1447-51 (1930).

This paper is a math. discussion in which the nuclear spin of U and values calcd. from it are presented. Correction factors and a brief discussion of the x-ray spectrum for U is included.

- 1995 Cattelain, E. "Hydroxyquinoline and Its Usefulness in the Determination of Certain Cations." J. pharm. chim. (8), **11**, 484-96(1930).

The chem. nature and synthesis of the reagent and the chem. compn. and properties of its cpds. with metals are reviewed. The pptg. behavior of hydroxyquinoline in 2% alc. soln. toward salts of 23 metals in either HOAc-NaOAc, tartro-ammoniacal or tartro-alk. medium is tabulated, also the sensitiveness of pptn. for Cu, Mg, Zn, Cd, Al, Bi, U, Mn, Fe^{+3} , Co, and Ni. The use in qual., gravimetric and volumetric analysis and sepn. of the metals is then briefly reviewed. A list of 23 references is added.

- 1996 Chatterjee, N. P. "The Composition of Intermicellar Liquid and the Precipitation of Colloid Solutions of Uranium Ferrocyanide." Kolloid-Z. **52**, 214-19(1930).

The concns. of salts, expressed in gram atoms, necessary to coagulate a very stable U ferrocyanide sol. follow $\text{Th} > \text{Al} > \text{UO}_2 > \text{Ag} > \text{BaCl}_2 > \text{Ba}(\text{OH})_2 > \text{H} > \text{NH}_4 > \text{Na}$. Addn. of $\text{K}_4\text{FeC}_6\text{N}_6$ as a protective colloid increased the coagulation concn. Diln. of the sol. changes the coagulation concns. by changing the K and FeC_6N_6 concns. in the micellar liquid.

1997 de Jong, W. F. "The Crystal Structure of Sodium Uranyl Acetate." *Physica* 10, 101-08(1930). X-ray spectrography of regular $\text{Na}_2\text{UO}_2(\text{C}_2\text{H}_3\text{O}_2)_3$ with Fe_α rays gave the symmetry group T^4 with the atoms arranged according to the NaClO_3 type; UO_2 takes the place of Cl and $(\text{C}_2\text{H}_3\text{O}_2)$ takes the place of O. The basis edge is $a = 10.690 \pm 0.005$ Å; the Wyckoff parameters are u_{Na} about 0.1, $u_{\text{UO}_2} = 0.44$ and for the acetate groups $x = 0.3$, $y = 0.6$, $z = 0.4$. The calcd. d. is 2.57 (found 2.562).

1998 Driggs, F. H. "Electrolytic Production of Thorium and Uranium." *Eng. Mining J.* 130, 119-20(1930).

Metallic U is prepd. by converting the nitrate to K uranium fluoride and then adding to a molten bath of CaCl_2 and NaCl where it is electrolyzed. The process is somewhat similar to the electrolysis of alumina to metallic Al. Metallic Th is obtained in a similar manner from the nitrate. A diagram indicates the differences in the 3 types of fused baths used in electrolysis: Al, Mg; Ca, Ba, Be, and U; Th. The deposit on the cathode consists of a spongy mass of metal interspersed with CaCl_2 and NaCl from the bath. The metal is purified by leaching out these salts with water, washing, and drying in vacuum. The powd. metal is solidified by either melting or sintering in a high vacuum. These metals need not be melted to make them workable. U or Th after heat treatment can be cold-rolled, hammered, or drawn to almost any extent. Th is very soft, and U is of about the same hardness as a normalized steel (0.1%). Other properties are noted.

1999 Driggs, F. H. "The Electrolytic Production of Thorium and Uranium." *Eng. Mining World* 1, 477-8(1930).

The production of Th and U at the Research Laboratories of the Westinghouse Lamp Company, by the electrolysis of fused salts is described. The salt in the case of U is "green salt," obtained from U nitrate, added to a molten bath of Ca and NaCl. A salt obtained from Th nitrate is used in the case of Th. The U bath is obtained by treating U nitrate with KF, HF, and formic acid in the presence of ultraviolet light to obtain K uranium fluoride, which is then dissolved in a fused mixt. of Ca and NaCl. Electrolysis at 700 to 800° C affords a loosely adherent powd. U deposit on the cathode. This deposit is collected and fused in a high vacuum to obtain the coherent metal.

2000 Driggs, F. H. and Lilliendahl, W. L. "Preparation of Metal Powders by Electrolysis of Fused Salts. I. Ductile Uranium." *Ind. Eng. Chem.* 22, 516-19(1930).

The prepn. of U powder by electrolysis of UF_4 in fused Ca and NaCl. The powder was fused to a coherent mass in an evacuated high-freq. induction furnace. A chem. analysis showed 0.06% C, 0.05% Fe, and 0.01% Si to be the only impurities present.

2001 Freed, S. and Kasper, C. "Paramagnetism Independent of the Temperature and the Existence of Electronic Isomers in Polyatomic Ions." *J. Am. Chem. Soc.* 52, 4671-9(1930).

The variation of susceptibility between room temp. and that of liq. air has been studied for the ions $(\text{UO}_2)^{++}$, $(\text{WO}_4)^{--}$, $(\text{Cr}_2\text{O}_7)^{--}$. The susceptibility of $(\text{UO}_2)^{++}$ decreases slightly but uniformly with temp. The others showed no variation within exptl. error. A discussion based on Van Vleck's deductions from quantum mechanics is given.

2002 Frers, J. N. "On a Natural Periodic System for Nonionic Compounds." *Z. anorg. allgem. Chem.* 186, 145-53(1930).

A number of double U cpds. (with alk. metals) are considered in the so-called 93, 94, and 95 groups. The cpds. are U halides, uranyl halides, and two U oxides.

2003 Garnier, M. and Marek, J. "Variations of Toxicity of Uranium Nitrate in Subcutaneous Injections in Rabbits." *Compt. rend. soc. biol.* 102, 978-81(1930).

2004 Garnier, M. and Marek, J. "Limits of Tolerance of Rabbits to Subcutaneous Injections of Uranium Nitrate." Compt. rend. soc. biol. 103, 1077-80(1930).

2005 Genaud, P. "Study of the Excretion of Several Urinary Constituents in Normal Dogs and Nephritic Dogs as a Function of Different Diets." Compt. rend. soc. biol. 104, 548-9(1930). Variations in urine vol., glucose, Cl, urea, NH_3 , creatinin, uric acid, and albumin are reported for normal dogs and dogs made nephritic with $\text{UO}_2(\text{NO}_3)_2$.

2006 Genaud, P. "Study of the Quantitative Variations of Several Chemical Constituents of the Blood in Normal Dogs and Nephritic Dogs as a Function of Different Diets." Compt. rend. soc. biol. 104, 550(1930).

This report indicates that blood cholesterol in the dog is double after poisoning with $\text{UO}_2(\text{NO}_3)_2$ when the dog has been kept on a diet of bread. When the diet was bread and meat the cholesterol concn. was unaffected.

2007 Guisande, L. S. "A General Analytical Procedure for the Toxicological Detection of the Metallic Elements, Including Thallium, Uranium and Vanadium." Arch. med. legal (Lisbon) 3, 205-18(1930).

The tissues are treated with H_2SO_4 and HNO_3 . The fat is sepd. out and the HNO_3 removed by evapn. The insol. residue is examined for Ag Cl and sulfates of Ba, Sr, and Pb. Groups I and II are pptd. by H_2S , the filtrate is tested for Tl with KI, then Na_2S is added to ppt. Ni, Co, Fe, Mn, U, Zn, Al, Cr, and V. The remainder of the procedure is according to the usual methods of qual. analysis.

2008 Hansen, H. "The Coordination Properties of Halides Near the Point of Volatilization, with Determinations of Structure for the Halides AX_4 ." Z. physik. Chem., B. 8, 1-26(1930). The crystal structures of ZrCl_4 and of UCl_4 were investigated by the powder method. ZrCl_4 has the same lattice (D-11) as SnI_4 . UCl_4 has another structure, the details of which were not detd. The different types of crystal lattices and the frequent polymerization of the vapor mols. of the halides of elements belonging to the first 4 groups of the periodic system are discussed. The formation of mols. like Al_2Cl_6 is explained by energy relations without peculiar types of binding. Polymer mols. are possible when the energy of dissocn. is relatively large as compared to the heat of evapn.

2009 Heany, J. A. —assigned to Arcturus Radio Tube Co. Alloy of Uranium and Molybdenum. May 20, 1930. (U. S. Patent 1,759,454)

Powder metallurgical techniques are used to prep. a Mo-U alloy of not over 5% U which is suitable for electron-emitting filaments.

2010 Idei, S. "The Precise Measurements of the L-Group of the X-Rays in the Heavy Elements." Science Repts. Tôhoku Imp. Univ., First Ser. 19, 559-639(1930).

Complete results are presented of the measurements of the wavelengths of the x-ray lines in the L group for the elements Ta(73) and U(92). The wavelengths of the stronger lines detd. by Firman and Wennerlof were used as stds. Siegbahn's tube spectrometer was used throughout the expts. The differences in the values of ν/R for the energy levels, $[\text{L}_\text{I}\text{L}_\text{II}]$, $[\text{L}_\text{I}\text{L}_\text{III}]$ and $[\text{L}_\text{II}\text{L}_\text{III}]$ have been calcd. from the data given by the emission lines and are compared with the values obtained from the measurements of the absorption edges. The correlation of the exptl. data with the process of atom building has been attempted by the method of the modified Moseley curves. Regularities in the orders of the intensities as a function of the at. no. are discussed.

2011 Ipat'ev, V. N. and Muromtzev, B. "Displacement of Metals and Their Oxides from Solutions of Their Salts by Hydrogen at High Temperatures and Pressures. The Action of Hydrogen on Metal Nitrates." Ber. 63B, 160-6(1930).

As a result of the reduction of the anion, it is possible to convert the nitrates of metals in soln. into the corresponding oxides and a few may even be reduced to the free metal by H_2 at 250 atms. pressure and 200 to 300°. The products formed depend somewhat on the character of the material of which the

retaining bomb is constructed. $\text{UO}_2(\text{NO}_3)_2$ gives UO_3 , U_3O_8 or UO_2 , according to temp. conditions and whether the bomb is of gold or quartz.

- 2012 Kahane, E. "Determination of Sodium by the Uranyl Method." Bull. soc. chim. France (4), 47, 382-404(1930).

A very complete discussion of the method, first described by Strong in 1884, is given together with considerable analytical data which suggest the following modifications of the procedure. As reagent, dissolve 32 g of $\text{UO}_2(\text{OAc})_2$ crystals and 100 g of $\text{Mg}(\text{OAc})_2$ crystals in 300 cc of water, 20 cc of AcOH and 500 cc of 90° alc. by heating on the water bath. When the salts have dissolved, dil. with water to 1 l. and allow to stand for some time before filtering. The pptn. of the Na should take place in the cold and to the nearly neutral soln. 2.5 cc of the above reagent should be added for each mg of Na present. After about an hr the ppt. of $3\text{UO}_2(\text{OAc})_2 \cdot \text{Mg}(\text{OAc})_2 \cdot \text{NaOAc} \cdot 8\text{H}_2\text{O}$ can be filtered off, washed first with a little of the reagent and finally 2 or 3 times with 95% alc. Dried at a temp. below 125°, it contains 1.5% Na and by strong ignition, 2.474% Na. Good results can be obtained after drying or igniting. It is also possible to det. the UO_2 content by dissolving in acid, reducing with Al and titrating with KMnO_4 , in which case the milliequiv. wt. of Na is 3.98 mg. Phosphate must be absent.

- 2013 Kargin, V. A. "Kinetics of Reactions between Colloids." Zhur. Fiz. Khim. 1, 691-701(1930). Similarly charged sols. of UO_3 and V_2O_5 react with each other forming a colloidal complex $\text{UO}_3 \cdot 2\text{V}_2\text{O}_5$. Spectrophotometric measurements of the velocity of reaction indicate zero order with a large period of induction. The reaction takes place between the dissolved portions of colloidal acid, forming a colloidal complex, rather than between particles.

- 2014 Katô, S. "On the Absorption Spectra of Salt Solutions. III. The Absorption Spectra Due to the Cations." Sci. Papers Inst. Phys. Chem. Research (Tokyo) 13, 49-58(1930).

To det. the effect of the character of the cation on the absorption, the visible and infrared selective absorption bands of aq. solns. of various cpds. were observed. The metal constituents of the cpds. investigated were Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Cb, Mo, Ru, Rh, Pd, W, Os, Ir, Pt, and U. No selective absorptions were observed when these elements entered into the cpds. with their max. valencies; but with lower valencies selective absorption was observed in the visible and infrared, though weak as compared with that in the ultraviolet. The explanation is that the max. valencies occur in oxyacid salts in which the outermost s and d electrons are shared with the O atoms in forming the acid radicals, thereby leaving for the ions exclusively no electrons in the incomplete shells; whereas in the ions of lower valency there are d electrons in the incomplete shells, the transitions of which between the normal and next higher energy states give rise to the selective absorption.

- 2015 Kimura, K. "Variations in the Exchange of Material between Blood and Tissue during Experimental Over-Ventilation in Normal and Pathological Tissue Conditions." Tôhoku J. Exptl. Med. 15, 199-235(1930).

In U poisoning, the alteration in blood chem. is the same as in cantharidinized tissues but less marked.

- 2016 LeBlanc, M. and Sachse, H. "Electron Conductivity of Solid Oxides of Varying Valencies." Ber. Verhandl. sächs. Akad. Wiss. Leipzig, Math.-phys. Klasse 82, 153-8(1930).

The cond. of UO_2 varied from 2.4×10^{-4} ohms⁻¹ at 20° to 7×10^{-7} at 500°; of U_3O_8 from 10^{-7} at 20° to 2.4×10^{-3} at 500°. The cond. of UO_3 was about 5×10^{-8} at 400°. Cpds. like UO_3 and NiO , of which the outer electrons are satd., are poor conductors, while the presence of free electrons increased cond.

- 2017 Leighton, W. G. and Forbes, G. S. "Precision Actinometry with Uranyl Oxalate." J. Am. Chem. Soc. 52, 3139-52(1930).

Reinvestigation of the photolysis of certain uranyl oxalate solns. in 9 approx. monochromatic radiations, with elaborate radiometric and analytical precautions, shows that the gross quantum yield, ϕ at 25° for a soln. 0.01M in UO_2SO_4 and 0.05M in $\text{H}_2\text{C}_2\text{O}_4$ varies between 0.60 at 254 mμ to 0.58 at

435 m μ , with a min. of 0.49 at 366 m μ . These values are about one-half of those usually adopted at the present time. The value of ϕ is diminished by Na₂SO₄ or NaOH and by H₂SO₄, in spite of the fact that the first two enhance total absorption. The temp. coeff. $\phi_{t+10} : \phi_t$ is $1.03 + 0.035$ between 10 and 25°, both at 366 and at 313 m μ . If the light presumably absorbed by uncombined UO₂SO₄ is subtracted before calcg. ϕ for solns. contg. no great excess of H₂C₂O₄, ϕ becomes nearly independent of their concns. These calcns. support the view that the photolyte is (UO₂HC₂O₄)⁺ or UO₂C₂O₄ or some optical cluster equiv. to one of these and render it improbable that the photolysis depends mainly on collisions of the second kind between excited (UO₂)⁺⁺ and H₂C₂O₄. Detailed suggestions are given for actinometry in monochromatic and polychromatic light, the limitations of the latter being indicated.

2018 Leone, G. "Estimation of Cholesterol and Nitrogen in Experimental Nephrosis from Uranium Acetate." Rass. terap. patol. clin. (Naples) 2, 1-14(1930).

2019 McLennan, J. C., Howlett, L. E., and Wilhelm, J. O. "Electrical Conductivity of Certain Metals at Low Temperatures." Trans. Roy. Soc. Can. III (3), 23, 287-306(1930).
Temp. resistance measurements were made between room temp. and 2.2°K on the metals Mo, Ta, Hf, U, Ti, W, Mg, Zr, Nb, and a thin film of Pb on Zn; also on "misch metal" and the eutectic alloy of Cd and Sb on Na-Pb cpd. probably Na₂Pb₅. Mo, Hf, U, Ti, W, Mg, and Zr gave normal temp-resistance curves at very low temps. Ta became superconducting at 4.2°K as did also Nb but this was probably due to Ta as impurity. Pb and Na₂Pb₅ become superconducting at the same temp. as pure Pb.

2020 McLennan, J. C. and McKay, R. W. "Crystal Structure of Uranium." Trans. Roy. Soc. Can. III (3), 24, 1-2(1930).
An x-ray analysis of the cryst. structure of metallic U was made by the powder method. The calcd. spacings are for a body-centered cubic arrangement with the side of the unit cell equal to 343×10^{-8} cm. The lines corresponding to the (2,2,2) and (0,0,4) planes were not observed. The d. is 19.6 as calcd. from the data obtained.

2021 Maisin, J. and Picard, E. "Study of the Radio-Sensitivity of Normal Tissues and Tumors. Experimental Study." Rev. belge sci. méd. 2, 328-35(1930).
Of 2 groups each of 5 tumor-bearing mice, 1 was intravenously injected twice a wk for 6 wks with a colloidal U-Th-ionium mixt.; both groups received during the 2nd wk of injections 3 irradiations of 1500 r each, or 4500 r in all. In the uninjected mice the development of the tumor was temporarily checked by irradiation, but afterward resumed, generally increasing then until death. In the injected mice the tumors were generally resorbed inside of 3 wks without prejudice to the health of the animal.

2022 Marden, J. W. and Rentschler, H. C. —assigned to Canadian Westinghouse Co., Ltd. Fused Uranium. Nov. 4, 1930. (Canadian Patent 305,418)
Anhydrous KU fluoride is reduced by Mg in vacuum at a temp. sufficient to remove the products of the reaction and fuse the U. The metallic U may be formed into suitable shapes for x-ray targets, wire, filaments, and electrodes.

2023 Mauriac, P. "Experimental Nephritis from Uranium Salts in the Rabbit and in the Dog." Arch. intern. pharmacodynamie 39, 345-70(1930).
In rabbits, U nitrate produces an acute nephritis; large doses are followed by oliguria; smaller doses by a transient polyuria. Chloride excretion is normal; albuminuria, not marked; red blood cells are found in the urine. Uremia precedes death with acidosis, an increase in residual N, and decreased phenolsulphonaphthalein excretion. Eight-day-interval injections of the same dose, the amt. which is fatal in 4 to 6 days if injected daily, are tolerated by rabbits. Animals with chronic poisoning live a long time but have low resistance to infections. Symptoms of chronic nephritis are albuminuria and glycosuria without increase of blood sugar (resulting from liver damage and lowered renal

threshold). In spite of normal blood N, the rabbits are very sensitive to small doses of urea. Milk diets produce increased blood N, and small doses of sugar easily produce hyperglycemia; apparently kidney function is altered. In dogs, chronic nephritis with albuminuria, glycosuria, hypercholesterolemia, retention of urea, and acidosis is produced by U salts. Poisoning alters the elimination of urea, creatine, and chlorides. Histological study shows that the loops of Henle are damaged. The lesions are more diffuse according to the period of poisoning. A typical renal sclerosis is never seen. The liver sections show the hepatic cells infiltrated with mast cells.

2024 Mauriac, P. and Servantie, L. "Experimental Azotemia and Milk Diet in the Rabbit Having Chronic Uranium Nephritis." Compt. rend. soc. biol. 105, 921-3(1930).

2025 Maydel, I. "The General Formula for the Calculation of Atomic or Molecular Heat as Well as the Specific Heat of Elements and Their Compounds in the Solid State." Z. anorg. allgem. Chem. 186, 289-323(1930).

General information is given on the calcn. of sp. ht. and molar ht. for U cpds. The at. ht. of U in various of its cpds. is calcd.

2026 Meissner, W. and Voigt, B. "Resistance of Pure Metals at Low Temperature. Measurements Using Liquid Helium. XI." Ann. Physik (5), 7, 892-936(1930).

The specific resistivity of U, which is probably not very pure, is reported as 4×10^{-4} ohm.

2027 Messini, M. and Poli, A. "Relations between Glycemia and Phosphorus in Blood under Effects of Uranyl Salts and Extracts of Thymus Gland." Boll. soc. ital. biol. sper. 5, 982-4 (1930).

Injections of $\text{UO}_2(\text{OAc})_2$ are followed by a diminution of blood P, accompanied in a 1st stage by an increase of glucose without glycosuria, whereas, in a 2nd stage, glycosuria occurred. Thymus extracts lowered blood P and increased blood glucose.

2028 Messini, M. and Poli, A. "Research on the Variations of Glycemia in Relation to Diminution of Phosphorus in Blood." Clin. med. ital. (2), 61, 421-2(1930).

The relations between blood sugar and blood P, following injection of $\text{UO}_2(\text{OAc})_2$ and thymus extracts, were studied in rabbits (15 expts. reported). Intravenous injection of $\text{UO}_2(\text{OAc})_2$ diminished the concn. of inorg. P in the blood and simultaneously provoked hyperglycemia, a primary phase without, and a secondary phase with glycosuria with signs of renal lesion and following oliguria and anuria. The 1st set of expts. indicate that, contrary to current opinion, $(\text{UO}_2)^{++}$ should not be counted among the substances causative of hyperglycemia without glucosuria, since hyperglycemia without glycosuria is constantly observed under suitable technical conditions. The thymus expts. support the theory of the anti-insulinic function of the thymus.

2029 Misciatelli, P. "The System: Uranyl Nitrate-Ether-Water between 0° and 20° ." Gazz. chim. ital. 60, 839-42(1930).

The binary systems: $\text{Et}_2\text{O}-\text{H}_2\text{O}$, $\text{UO}_2(\text{NO}_3)_2-\text{Et}_2\text{O}$ and $\text{UO}_2(\text{NO}_3)_2-\text{H}_2\text{O}$ are already known. A method of prepn. of anhyd. $\text{UO}_2(\text{NO}_3)_2$ was developed, viz., by distg. its mixt. with N_2O_5 and drying the residue in a current of dry air at 110° . Incipient decompn. of the anhyd. salt is obvious from a change in color to orange-yellow. No basic salts are formed in this thermal decompn. The data for the isotherms at 0 and at 20° are given in tables and triangular diagrams, which must be consulted for the quant. values.

2030 Misciatelli, P. "The Decomposition Tension of Anhydrous Uranyl Nitrate and of Anhydrous Thorium Nitrate." Gazz. chim. ital. 60, 882-5(1930).

Anhyd. $\text{UO}_2(\text{NO}_3)_2$ was prepd., not by the method of Mardetos (Bull. soc. chim. France 11, 244(1912)) or of de Forcrand, but by treating $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ with liq. N_2O_5 by the procedure used by Guntz and Martin with $\text{Mn}(\text{NO}_3)_2$ and $\text{Cu}(\text{NO}_3)_2$. The app. is described and illustrated. According to the

literature of pure anhyd. $\text{Th}(\text{NO}_3)_4$ has not been prepd. except in an expt. by Kolb, which could not be repeated. A product contg. only 0.6% excess N_2O_5 and no H_2O was obtained. The tensions corresponding to the equil. $\text{Th}(\text{NO}_3)_4 \rightleftharpoons \text{ThO}_2 + 4\text{NO}_2 + \text{O}_2$ and $2\text{UO}_2(\text{NO}_3)_2 \rightleftharpoons 2\text{UO}_3 + 4\text{NO}_2$ were measured by the dynamic compensation method of Centnerswer and Krustinson. Following are the temps. and the pressures (mm of Hg), resp.: $\text{UO}_2(\text{NO}_3)_2$, 87°, 95; 131°, 157; 141°, 119; 150°, 340; 160°, 540; $\text{Th}(\text{NO}_3)_4$, 124°, 82; 134°, 119; 145°, 119; 161°, 359. The same results were obtained with partially decompd. nitrates and with those contg. only 4% N_2O_5 . Therefore in this thermal decompn., basic salts are not formed and 2 phases are present in the systems at equil., viz., anhyd. nitrate and oxide. From the decompn. tensions the hts. of decompn. can be calcd. by the approx. formula of Nernst. For $\text{UO}_2(\text{NO}_3)_2$, Q has a mean value of 39,442 and for $\text{Th}(\text{NO}_3)_4$ a mean value of 81,828.

- 2031 Moser, L., Neumayer, K., and Winter, K. "The Determination and Separation of the Rarer Metals from Other Metals. XIX. New Methods for the Separation of Titanium from Other Elements." *Monatsh.* 55, 85-97(1930).

Ti can be sepd. quantitatively from Al, U, Cr, Be, Zn, Ni, Co, Ba, Sr, and Ca by boiling the slightly acid chloride soln. with NaBr and BaBrO_3 from 20 to 30 mins. If Cr is present the pptd. TiO_2 is ignited and fused with Na_2CO_3 and a little KNO_3 , the melt is extrd. with H_2O , the soln. boiled with HCl, and pptn. repeated. From Al, Fe, Cr, U, Zn, Ne, Co, and Mn, TiO_2 may be sepd. by pptn. with $(\text{NH}_4)_2\text{CO}_3$ in the presence of sulfosalicylic acid or by treatment of the sulfate soln. with NH_4OH to faint opalescence, addn. of 10 cc of H_2SO_4 , 40 cc of 10% tannin soln., H_2O to 400 cc, and 20% antipyrine soln. until the orange ppt. coagulates. The ppt. is collected, washed with dil. antipyrine soln., ignited, and weighed as TiO_2 . Details are given of methods for the detn. of the other metals in the filtrate from the Ti ppt.

- 2032 Olsson, F. "Complex Uranyl Fluorides." *Z. anorg. allgem. Chem.* 187, 112-20(1930). UO_2F_2 forms double salts with fluorides of such org. bases as pyridine, quinoline, alkylamines, aniline, dimethyl aniline, diethyl aniline and triethylsulfine. These are of 3 different types: $\text{MUO}_2\text{F}_3 \cdot n\text{H}_2\text{O}$ (I), $\text{M}(\text{UO}_2)_2\text{F}_5 \cdot n\text{H}_2\text{O}$ (II) and $\text{M}(\text{UO}_2)_3\text{F}_7 \cdot n\text{H}_2\text{O}$ (III), where M is a monoacid org. base. Cpds. of the first type are analogous to Bolton's Na uranyl fluoride, but the other 2 types are new, the ratio of M to U being equal to or less than 1. Aniline gives poorly sol. complexes of type I; dimethyl aniline, trimethylamine, tetramethylammonium and triethylsulfine give fluorides of type II; and trimethylpyridine gives fluorides of type III. On the other hand, pyridine, quinoline, tetraethylammonium, trimethyl-p-tolylammonium and diethylaniline each give cpds. of types I and II. Propylamine gives 2 fluorides of types I and III. For the prepn. of these complex fluorides, uranyl nitrate, $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, is dissolved in H_2O , treated with a little 40% HF and a weak HF soln. of the basic fluoride is then added. The double salt generally seps. in a short time as a yellow, cryst. powder, slightly sol. in H_2O as well as in HF and usually stable in the air. The aniline and dimethyl aniline salts are less stable than the others, changing to a greenish-gray color. Heating brings about decompn. with the formation of green to black U_3O_8 . Soly. is greater in dil. HCl, H_2SO_4 and HNO_3 than in H_2O .

- 2033 Rascanu, R. "Amines of Uranium." *Ann. sci. univ. Jassy* 16, 32-56, 459-96(1930). The prepn. and properties of the following cpds. with pyridine, quinoline, 2-methylquinoline, antipyrine (Ap), pyramidone (Pm), and phenacetin (Pn) are described: $[\text{UO}_2 \cdot \text{C}_5\text{H}_5\text{N}](\text{NO}_3)_2$; $[\text{UO}_2 \cdot \text{C}_5\text{H}_5\text{N} \cdot \text{H}_2\text{O}](\text{NO}_3)_2$; $[\text{UO}_2 \cdot \text{C}_9\text{H}_7\text{N} \cdot \text{H}_2\text{O}](\text{NO}_3)_2$; $[\text{UO}_2 \cdot \text{C}_{10}\text{H}_9\text{N} \cdot \text{H}_2\text{O}](\text{NO}_3)_2$; $[\text{UO}_2 \cdot \text{Ap}_2](\text{NO}_3)_2$; $[\text{UO}_2 \cdot \text{Ap}_2]\text{Cl}_2$; $[\text{UO}_2 \cdot \text{Ap}_2]\text{Br}_2$; $[\text{UO}_2 \cdot \text{Ap}_2]\text{SO}_4 \cdot 4\text{H}_2\text{O}$; $[\text{UO}_2 \cdot \text{Pm}_2](\text{NO}_3)_2$; $[\text{UO}_2 \cdot (\text{C}_5\text{H}_5\text{N})_2]\text{Cl}_2$; $[\text{UO}_2 \cdot \text{Pm}_2](\text{NO}_3)_2$ (dark red and light red forms); $[\text{UO}_2 \cdot \text{Pm}_2]\text{Cl}_2$; $[\text{UO}_2 \cdot \text{Pm}_2 \cdot \text{H}_2\text{O}]\text{Cl}_2 \cdot \text{H}_2\text{O}$; $[\text{UO}_2 \cdot \text{Pm} \cdot \text{H}_2\text{O}]\text{Cl}_2$; $[\text{UO}_2 \cdot \text{Pm} \cdot \text{H}_2\text{O}]\text{Cl}_2 \cdot 2\text{H}_2\text{O}$; $[\text{UO}_2 \cdot \text{Pm}]\text{Cl}_2$; $[\text{UO}_2 \cdot \text{Ap}_2](\text{OAc})_2$; $[\text{UO}_2 \cdot \text{Ap} \cdot \text{H}_2\text{O}]\text{C}_2\text{O}_4$; $[\text{UO}_2 \cdot \text{Pn}_2](\text{NO}_3)_2$; $[\text{UO}_2 \cdot \text{Pn}_2]\text{Cl}_2$; $[\text{UO}_2 \cdot \text{Pn}_2(\text{H}_2\text{O})_2]\text{Cl}_2$; $[\text{UO}_2 \cdot \text{Pn}_2(\text{H}_2\text{O})_3]\text{Cl}_2$; $[\text{UO}_2 \cdot \text{Pn}_2(\text{H}_2\text{O})_2]\text{Cl}_2 \cdot 2\text{H}_2\text{O}$; $[\text{UO}_2 \cdot \text{Pn}_3]\text{Cl}_2$; $[\text{UO}_2 \cdot \text{Pn} \cdot 2\text{H}_2\text{O}]\text{C}_2\text{O}_4$; $[\text{UO}_2 \cdot \text{Pn}_4]\text{Br}_2$; $[\text{UO}_2 \cdot \text{Pn}_4(\text{H}_2\text{O})_7]\text{Br}_2$.

- 2034 Robinson, H. R. and Young, C. L. "New Results of the Magnetic Spectroscopy of X-Ray Electrons." *Proc. Roy. Soc. (London)*, A. 128, 92-114(1930).
Intensity (on an arbitrary scale), velocity v/R , and origin are given for lines observed from Bi, U, Pb, Au, Ce, Ag, Mo, Zr, Sr, As, and Cu. Unfiltered AgK radiation was used. The relative intensities of secondary cathode-ray groups are shown graphically. The results are discussed with relation to the newer theories.
- 2035 Sandstrom, A. "Roentgenspectroscopic Measurements of the L Absorption of Elements 74(Tungsten) to 92(Uranium)." *Z. Physik* 65, 632-55(1930).
To obtain the wavelength of the L-absorption edge with high precision, a Siegbahn spectrometer was used and the absorbing material brought between the slit and the photographic plate. The suitable size of the absorption layer has been calcd. so that the intensity difference on both sides of the edge is a max. A value of 755.9 X.U. was obtained for U.
- 2036 Sandstrom, A. "On the Origin of the L-Absorption Series of the Heavy Elements." *Z. Physik* 66, 784-9(1930).
Uranium is one of the elements discussed.
- 2037 Shpolsky, E. "Inhibition and Mechanism of Photochemical Reaction in Eder's Solution." *Nature* 126, 647-8(1930).
The action of x rays on Eder's soln. in the presence of $\text{UO}_2(\text{NO}_3)_2$ and $\text{UO}_2(\text{OAc})_2$ is described.
- 2038 Vasil'eva, L. A. "Precipitation of Barium Sulfate in the Presence of Salts of Thorium and Uranium." *Uchenye Zapiski Kazan. Gosudarst. Univ. im. V. I. Ul'yanova-Lenina* 90, 15-26 (1930).
When BaSO_4 is pptd. by adding Ba^{++} to an acid soln. contg. $(\text{SO}_4)^{--}$, the ppt. will contain Th and U if Th^{+4} and $(\text{UO}_2)^{++}$ are present in the original soln. There is some evidence that $(\text{UO}_2)^{++}$ forms a solid soln. in BaSO_4 and that complex sulfates of Ba, Th, and UO_2 are formed.
- 2039 von Grosse, A. "The Basis of Chemical Atomic Weight." *Z. physik. Chem. B*, 10, 395-6(1930).
Values for the at. wt. of U calcd. on the basis of $\text{O} = 16$, $\text{O}^{16} = 16$, $\text{H} = 1$, and $\text{He}^4 = 4$ yield 238.14, 238.17, 236.33, and 238.01 resp.
- 2040 von Hevesy, G. and Wagner, O. H. "The Distribution of Thorium in Animal Organisms." *Arch. exptl. Path. Pharmacol.* 149, 336-42(1930).
The distribution of subcutaneously injected Th, studied in normal and in tumor-bearing mice, showed no selective preference of Th for carcinomatous tissues. The same is true of Pb, but Bi showed selective preference for carcinomatous tissue, sustaining the findings of H. Kahn. The order of the heavy metals in the liver and kidneys is as follows, ascending order for liver, descending for kidneys: U, Au, Hg, Pb, As^{+5} , Th, As^{+3} , Ag, and Cu.
- 2041 Vrede, J. "On Detectors." *Physik. Z.* 31, 323-32(1930).
 UO_2 and U_3O_8 are reported to be nonconductors.
- 2042 Zahradníček, J. "Relativistic L Doublets in Roentgen Region." *Z. Physik* 60, 712-15(1930).
U is one of the elements for which the screening factor, s , is given.

PUBLICATIONS LOCATED IN 1931

- 2043 Allison, S. K. and Andrew, V. J. "An Experimental Test of the Ionization Chamber Method of Measuring the Relative Intensities of X-Ray Spectrum Lines." Phys. Rev. (2), 38, 441-53 (1931).

Measurements are reported on the relative intensities of the U L lines $\alpha_1 : \beta_1 : \gamma_1 = 100 : 36.7 : 10.9$. These measurements were taken by means of an ionization chamber filled with various gases and measured at low potentials.

- 2044 Andrieth, L. F. and Nelson, H. W. "Electrodeposition of Metals from Non-Aqueous Solvents." Chem. Revs. 8, 335-52(1931).

No deposition was found in a pyridine soln. of UO_2Cl_2 on Pt metal.

- 2045 Baur, E., Ouellet, C., and Wäckerlin, E. "Desensitization (Retardation of Photolysis) in Uranyl Formate and Potassium Ferrioxalate." Z. wiss. Phot. 30, 88-94(1931).

The rate of photolysis of uranyl formate in the presence of foreign substances has been measured and compared with the calcd. figures using the equation $v_1/v_0 = 1/(1 + bU)$, where v_1 and v_0 are the photochem. reaction velocities in presence and absence, resp., of $(\text{UO}_2)^{++}$, and U is the uranyl concn. Expts. with $\text{K}_3\text{Fe}(\text{C}_2\text{O}_4)_3$, when the results are corr. to const. intensity of activating light, show a const. reaction velocity up to 30% decompn., in agreement with Allmand and Webb.

- 2046 Beard, L. C., Jr. and Reiff, O. M. "Application of Oxalic Acid-Uranyl Acetate Actinometer to Measurement of Sunlight Intensity in Connection with Photochemical Changes in Gasoline." Ind. Eng. Chem. Anal. Ed. 3, 280-1(1931).

The characteristics of the oxalic acid decompn. in the presence of $(\text{UO}_2)^{++}$ are discussed and applied.

- 2047 Biltz, W. and Meisel, K. "The Zero-Point Volume of Elements." Z. anorg. allgem. Chem. 198, 191-203(1931).

A value of 12.6 is given for the zero temp. vol. of U.

- 2048 Bourcet, P. "The Utilization of Some Laboratory Residues." Bull. sci. pharmacol. 38, 365-72(1931).

Practical methods are described for the recovery of the following substances which accumulate as residues in some labs.: Ag, citric acid, I, Mo, phosphomolybdate, Au, Pt, and U.

- 2049 Brull, L. and Fanielle, G. "Renal Origin of Glycosuria from Uranium Nitrate." Compt. rend. soc. biol. 108, 1163-5(1931).

- 2050 Cohn, W. M. "The Appearance of Continuous Spectra on Cathode-Ray Bombardment. IV. Investigations on Thorium and Other Elements in the Presence of Gases." Z. Physik 72, 392 422(1931).

The continuous spectrum previously obtained in high vacuum is also shown by electron bombardment of Th, U and Po at air pressures of 10^{-3} mm Hg. It is independent of the anode material but not shown by other metals. It appears only above a certain threshold potential, remains after heating the radioactive materials with cathode-ray bombardment but not after other kinds of heating. It does not appear if the cathode is coated with oxide or carbide.

- 2051 Collins, W. D., Baxter, G. P., Farr, H. V., Freeman, J. V., Rosin, J., Spencer, G. C., and Wichers, E. "Recommended Specifications for Analytical Reagent Chemicals." Ind. Eng. Chem. Anal. Ed. 3, 221-4(1931).

This paper contains a discussion of the tests and specifications of purity for uranyl nitrate reagents.

- 2052 Corin, F. "Absorption Spectra of Some Minerals of the Belgian Congo." Ann. soc. sci. Bruxelles. B. 51, 148-53(1931).

An account, with wavelengths, of the absorption spectra of thin slices and powders of various monazites, xenotimes, and uraniferous minerals, and their dependence on the crystal orientation with respect to the direction of vibration of polarized light. A bibliography of spectroscopic applications to petrography is appended.

- 2053 Costeanu, N. D. and Cocosinschi, A. S. "Studies in Filtered Ultra-Violet Light." Bul. Facultăţ. Ştiinţe Cernăuţi, 5, 169-75(1931).

The expts. were made with a filter passing rays between 4000 and 3000 Å. The fluorescent light of uranyl salts gives clear bands generally with 5 lines, while that of the other 118 substances investigated gave only faded regions in the spectrum. The color of the fluorescence of each substance is stated. An explanation of the different behaviors of ZnO is offered.

- 2054 Djatschkowsky, S. J. "Temperature and Stability of Colloidal Solutions." Kolloid-Z. 54, 278-84(1931).

It is reported that the curve of the surface tension of a 1% UO_2 sol. as a function of temp. shows a max. at 30 to 40°. The stability of this sol. is examined over the range 10 to 70°.

- 2055 Driggs, F. H. — assigned to Westinghouse Lamp Co. Metal Hydrides Such as Uranium Hydride. Aug. 4, 1931. (U. S. Patent 1,816,830)

U hydride is formed by heating U metal powder in H_2 to above 225° under a pressure of H_2 above that of the decompn. of the hydride at the temp. used. Hydrides of Zr, Th, Ti, and HF may be prepd. in a similar manner.

- 2056 Driggs, F. H. — assigned to Westinghouse Lamp Co. Metal Hydrides. Dec. 8, 1931. (U. S. Patent 1,835,024)

The surface of a metal body such as coherent metallic U is converted to hydride (suitably by heating in H_2). The hydride is subjected to thermal decompn., and the process is repeated until conversion of the entire metal body has been effected. The app. is described.

- 2057 Driggs, F. H. and Marden, J. W. — assigned to Westinghouse Lamp Co. Rare Refractory Metals. Sept. 1, 1931. (U. S. Patent 1,821,176)

For obtaining metals such as W, Mo, Cr, and U, electrolytic decompn. is effected in a fused bath of dissociable cpds. of the refractory metals and a material such as CaCl_2 .

- 2058 Eisner, G. "Resuscitating Action of Portions of Plants and Their Juices on Apparently Fatal, Subacute Uranium Poisoning." Biochem. Z. 232, 218-28(1931).

- 2059 Ewing, D. T. and Wilson, M. "Electrometric Titration of Uranium with Ceric Sulfate." J. Am. Chem. Soc. 53, 2105-10(1931).

If a hot, acid soln. of $(\text{UO}_2)^{++}$ is reduced by Zn-Hg in a Jones reductor and the reduced soln. is kept in an atm. of N_2 , it can be titrated with $\text{Ce}(\text{SO}_4)_2$ soln. and 2 inflection points found on the e.m.f. curve. The 1st corresponds to the oxidation of U^{+3} to U^{+4} and the 2nd to oxidation to $(\text{UO}_2)^{++}$. The titration succeeds best in 2% H_2SO_4 ; with more concd. acid the state of equil. is approached more slowly after each addn. of oxidant. The titration also succeeds in HCl soln., preferably with 2N acid for the 1st end point and with 4N acid for the 2nd. When Fe^{++} is present together with U^{+3} , 3 end points can be obtained. The U is best calcd. by the distance between the 1st and 2nd points, and the Fe is shown by the distance between the 2nd and 3rd.

- 2060 Furman, N. H. and Schoonover, I. C. "Volumetric Determination of Uranium. Potentiometric Titration of Reduced Uranium Solutions with Ceric Sulfate or with Potassium Permanganate. Application of the Differential Method." *J. Am. Chem. Soc.* **53**, 2561-7(1931).

The statements in the literature concerning the reduction of $(\text{UO}_2)^{++}$ solns. with Zn are somewhat conflicting, but the present investigation shows that, beyond question, the U is reduced by amalgamated Zn at room temp. below U^{+4} . In the potentiometric titration, with KMnO_4 or $\text{Ce}(\text{SO}_4)_2$ as oxidizer, an end point is noticed when the U is all converted to U^{+4} and another when the oxidation to $(\text{UO}_2)^{++}$ is complete. The differential method of potentiometric titration as well as the usual method gave good results.

- 2061 Garnier, M. and Marek, J. "Albuminuria Caused by Subcutaneous Injection of Uranium Nitrate." *J. physiol. path. gén.* **29**, 752-66(1931).

Urine of dogs and rabbits contain const. but minimal traces of albumin. Pathological albuminuria rapidly follows subcutaneous injection of $\text{UO}_2(\text{NO}_3)_2$, but the intensity bears no direct relation to the size of the dose. Careful acclimatization enables each species to tolerate very large injections of the salt. It is suggested that the albuminuria may arise from alteration in the serum proteins rather than a nephrotoxic action of the U. Albuminuria thus might be a cause rather than a consequence of some types of nephritis.

- 2062 Garnier, M. and Marek, J. "Chronic Intoxication Caused by Daily Injections in Rabbit." *Compt. rend. soc. biol.* **107**, 938-40(1931).

This paper reports that 0.5 mg/kg/day of sol. U salts given to male rabbits subcutaneously caused death in 5 to 7 days, whereas larger doses were required to kill females. The complex changes produced by chronic poisoning are discussed.

- 2063 Garnier, M. and Marek, J. "Effects of Repetition of Same Dose in Subcutaneous Injection in Rabbits." *Compt. rend. soc. biol.* **107**, 99-102(1931).

Study of resistance of male and female rabbits to chronic and semichronic U poisoning. The complex pathological and symptomatological changes are discussed.

- 2064 Garnier, M. and Marek, J. "Effect of Increasing Subcutaneous Doses of Uranium Nitrate in the Rabbit." *Compt. rend. soc. biol.* **108**, 651-4(1931).

- 2065 Gough, J. "Mitochondrial Changes in Experimental Oxalate and Uranium Nephritis." *J. Path. Bact.* **34**, 423-8(1931).

With the method of Gough and Fulton for the demonstration of mitochondria, intravenous injections of $\text{Na}_2\text{C}_2\text{O}_4$ and $\text{UO}_2(\text{OAc})_2$ into rabbits produced morphological changes in the mitochondria of the renal epithelium within a few mins. of the injection. In U poisoning, replacement of the mitochondrial filaments by large, scattered, spherical bodies was characteristic. This change was indicative of more severe and permanent cell degeneration.

- 2066 Groves, R. and Russell, A. S. "Preparation and Some Properties of Amalgams of Titanium, Uranium, and Vanadium." *J. Chem. Soc.* 2805-14(1931).

Ti was deposited on Hg at 0.2 g/hr from 7% TiCl_2 in 2N HCl by 5 amp/cm². U was deposited at 0.5 g/3 hr from UO_2SO_4 in 2N H_2SO_4 plus additional acid, at 6 amp/cm². V was deposited at 0.5 g/4 hr from Na_3VO_4 soln. in 2N H_2SO_4 at 4 to 5 amp/cm². Important factors are high c.d. at the cathode, sepn. of cathode and anode liq., and an eff. system of cooling. The min. detectable catalytic effect of 1% Zn-Hg covered with 2N H_2SO_4 is given by 10^{-6} g Ti, 10^{-5} g U or 10^{-5} g V when dissolved in 200 g of Hg. Deposition of 10^{-5} to 10^{-6} g of Ti, U and V on Zn-Hg and of Ti and U on Sn-Hg, Cu-Hg and on Hg by shaking acidified solns. of salts with Hg was demonstrated by catalytic action. U is most easily deposited, V most difficult. The order of removal of metals from Hg has been found to be Zn, Cd, Mn, Tl, Sn, Pb, Ti, V, Bi, Cu, Fe, Mo, U, Co, Hg, Ni, W.

- 2067 Hägg, G. "Regularity in Crystal Structure of Hydrides, Borides, Carbides, and Nitrides of the Transition Elements." Z. physik. Chem. B 12, 33-56(1931).

It is reported that the U ats. in UC_2 form a face-centered tetragonal lattice having an axial ratio $c:a$ of 1:20. In the interstices the C ats. are located pair-wise in such a manner that the long axis of the pair is parallel to the edge of the cube.

- 2068 Haitinger, M. "A Powerful Fluorescence Microscope." Mikrochemie 9, 430-40(1931).
The use of the microscope in the detn. of U and many other elements is discussed. A number of plates is included.

- 2069 Hakomori, S. "The Reaction of Hydrogen Peroxide with Some Metallic Ions. III. The Effects upon the Potential and the Photographic Action of Hydrogen Peroxide Exerted by the Presence of One of Several Metallic Acids and Its Stabilizer, as Well as by the Change in Its Concentration." Technol. Repts. Tôhoku Imp. Univ. 607-26(1931).

In the absence of a stabilizer, it was necessary to plate a Pt electrode with Pd black at a very low c.d. to obtain satisfactory potentials. Results are satisfactory when the H_2O_2 was 0.4M; inferior at 0.1M; unsatisfactory at 0.02M. Titanic acid increased the p.d. 0.0195 v; molybdic acid, 0.1080 v; vanadic acid, 0.3107 v; uranic acid, 0.0047 v; and chromic acid, 0.480 v. The partial vapor pressure of H_2O_4 is reduced in the presence of metallic acids.

- 2070 Hakomori, S. "Reactions of Several Metallic Ions in the Presence of Organic Acids." Science Repts. Tôhoku Imp. Univ. First Ser. 20, 736-63(1931).

The reactions of the ions of Mo, Ti, V, Fe, Cr, Al, Cu, Ni, Co, U, Bi, Pb, Zr, and Mn in the presence of oxalic, citric, malic, and succinic acids were investigated by means of absorption spectra, elec. cond., ultramicroscope, colloid-chem. treatment and colorimetry. The formation of a complex salt is established in certain cases. The intensity of the yellow coloration from the reaction of molybdic acid and H_2O_2 is increased by the presence of citric, tartaric, or succinic acid. The acids had no influence on the color reactions of Ti and V with H_2O_2 .

- 2071 Harkins, W. D. "The Periodic System of Atomic Nuclei and the Principle of Regularity and Continuity of Series." Phys. Rev. (2), 38, 1270-88(1931).

A discussion of the odd-even problem in isotopic wt. is included. The He, U, Be, and Li series are discussed.

- 2072 Herlinger, E. "The Cross Section of Atoms and Ions in Crystals. I." Z. Krist. 80, 465-80 (1931).

Geometrical values for U in various cpds. are given.

- 2073 Hirsh, F. R., Jr. "The Satellites of M-Series X-Ray Lines." Phys. Rev. (2), 38, 914-24 (1931).

Some measurements are reported on the satellites of the α and β spark lines of U. It is reported that $\alpha_2 = 3914.6$, $\alpha_1 = 3901.0$, $\alpha^I = 3892.0$, $\alpha^{II} = 3884.3$, $\alpha^{IV} = 3869.0$, $\beta = 3708.0$, $\beta^I = 3701.1$, $\beta^{II} = 3693.3$, and $\beta^{III} = 3683.1$.

- 2074 Hüttig, G. F. and Neuschul, W. "On the Relationship between the History of Zinc Oxide and Its Capability of Absorbing Organic Dyes." Z. anorg. allgem. Chem. 198, 219-32(1931).

Information is included on the absorption of organic dyes on solid UO_3 .

- 2075 Hymas, F. C. "The Correlation of Certain Photochemical Reactions and Wave-Length of Light. Part I." J. Soc. Chem. Ind. (London) 50, 81-3(1931).

This paper contains a comparison of the decompn. of $H_2C_2O_4$ by light in the presence of uranyl salts and KI. Graphs are given on the work with UO_2SO_4 and $H_2C_2O_4$.

2076 Jacobsen, J. C. "On Absorption and Scattering of γ Rays." Z. Physik **70**, 145-58(1931). This paper discusses the relative absorption and scattering of γ rays from Ra and MsTh by aq. solns. of $\text{UO}_2(\text{NO}_3)_2$.

2077 Kargin, V. A. "Kinetics of Reactions between Colloids. I. Formation of Uranium-Vanadium Complexes." Z. anorg. allgem. Chem. **198**, 79-87(1931).

The V_2O_5 sol. was prepd. by the action of HCl on NH_4 vanadate and subsequent peptization of the ppt. by washing with water. The UO_3 sol. was similarly prepd. from NH_4OH and $\text{UO}_2(\text{NO}_3)_2$. Both sols. were purified by dialysis. Gradual addn. of V_2O_5 sol. to UO_3 sol. produces a red coloration which passes into yellow upon heating; when sufficient V_2O_5 has been added to bring the compn. to the proportion $\text{UO}_3 \cdot 2\text{V}_2\text{O}_5$, the addn. of more V_2O_5 gives a red color, which is unchanged by heating. The absorption spectra and electrometric-titration curves show that $\text{UO}_3 \cdot 2\text{V}_2\text{O}_5$ is a definite complex distinct from the original sols. Following the formation of $\text{UO}_3 \cdot 2\text{V}_2\text{O}_5$ spectrophotometrically (at a wavelength of 578 $\text{m}\mu$) showed that the reaction has an induction period (2 to 4 hr), after which it is of the zero order. If the reaction took place between colloidal particles, the concn.-time (c-t) curve would be exponential. Since the c-t curve is linear, the reaction takes place between those portions of the 2 sols. that are in true soln. The induction period is shortened by diln. of the reacting sols., raising of the temp., or introduction of a UO_3 - V_2O_5 mixt. that has already passed the induction period.

2078 Klemm, W. "On Physical Methods in Chemical Laboratories. XVIII. The Meaning of Magnetic Measurements in Chemical Problems." Z. angew. Chem. **44**, 250-9(1931).

The magnetic susceptibility of $(\text{UO}_2)^{++}$ and its relationship to temp. is discussed. Measurements between 70°K and room temp. show a very slight increase.

2079 LeBlanc, M. and Sachse, H. "The Electron Conductivity of Solid Oxides with Different Valencies." Physik. Z. **32**, 887-9(1931).

A marked difference in electric cond. was found for the different valencies of elements, as detd. from the specific cond. of the oxides at 20°, depending upon the No. of electrons available. Thus the cond. of UO_3 was not measurable; U_3O_8 was 10^{-7} and UO_2 was 10^{-5} ohm $^{-1}$. Many other oxides were measured.

2080 Lindberg, E. "M and N Series." Nova Acta Regiae Soc. Sci. Upsaliensis (4), **7**, No. 7, 7-74(1931).

M-Emission spectra of U, Th, Bi, Pb, Tl, Au, Pt, Ir, Os, Re, W, Ta, and Hf were studied; the difference in wavelength for a doublet is approx. const. for different elements. M-Absorption spectra of U, Th, Bi, Pb, Tl, Hg, Au, Pt, and W were also studied.

2081 Luyckx, A. "Potentiometric Titration of Uranium with Potassium Permanganate." Bull. soc. chim. Belg. **40**, 269-83(1931).

This is a critical study of the accepted procedure. It shows that at low temp., with high acidity, some U^{+3} is present. The customary procedure of titrating in weakly acid soln. at 80° is justified. The only modification presented is an electrolytic reduction of the UO_2SO_4 to take the place of the customary Zn reduction, but this is not advocated as a preferred method.

2082 MacNider, W. deB. "The Morphological Basis for Certain Tissue Resistance." Science **73**, 103-05(1931).

This is a study of kidney changes in U poisoning both from a structural and functional standpoint. This is a brief descriptive paper.

- 2083 Martin, J. and Krchma, I. J. —assigned to Commercial Solvents Corp. Esters of Primary Alcohols. Aug. 4, 1931. (U. S. Patent 1,817,898)

In forming esters such as EtOAc from EtOH, catalysis are used contg. initially a metal uranyl carbonate, such as that of Ba, and Ag carbonate.

- 2084 Martin, J. and Krchma, I. J. —assigned to Commercial Solvents Corp. Esters of Primary Alcohols. Aug. 4, 1931. (U. S. Patent 1,817,899)

This patent describes the production of an ester by passing the vapor of a primary alc. at pressures up to 200 atms. and temps. 200 to 450° over catalysts consisting primarily of Ba uranyl carbonate, Ag carbonate, Cu carbonate, and Al hydroxide.

- 2085 Martini, A. "On the Microchemical Detection of Sodium Using Uranyl Acetate." Mikrochemie 9, 422-3(1931).

The test is carried out as follows: To 1 drop of the Na salt soln. (1:100) add a little NH_4 carbonate powder and a drop of satd. HOAc soln. of $\text{UO}_2(\text{OAc})_2$. When the effervescence is over, add a drop of pyridine and examine under the microscope for the presence of the characteristic octahedra.

- 2086 Matula, V. A. "Determination of Uranium in Pitchblende." Chem. Obzor 6, 124-6(1931). Gravimetric sepn. of U from other elements of analytical group No. 3, especially phosphates, is difficult and the results are not always accurate. A convenient and reliable method for detg. U and Fe in parallel is the potentiometric titration by means of TiCl_3 ; the presence of other elements of group 3 and of phosphates does not interfere. The pitchblende is decompd. by heating with HNO_3 , treated with H_2S , and filtered, and the filtrate oxidized by the addn. of Cl_2 water. The cations of the third group are pptd. by NH_4OH , and the ppt. thus obtained is dissolved in HCl, and in this soln. U and Fe are detd. titanometrically.

- 2087 Mauriac, P. and Servantie, L. "Experimental Azotemia Caused by Milk Diet in Rabbit with Chronic Nephritis from Uranium Nitrate." Compt. rend. soc. biol. 105, 921-3(1931).

- 2088 Ouellet, C. "Desensitization of Photolysis of Uranyl Formate." Helv. Chim. Acta 14, 936-66(1931).

Photolytic desensitization of uranyl formate is due to a simultaneous oxidation-reduction reaction, and is based upon the general principle

where S = catalytic agent that renders a nonsensitive substance sensitive by absorbing an energy quantum and polarizing, D = a desensitizer that inhibits the action of S by depolarization. The photolysis of formic acid sensitized by a uranyl ion is given by the equation

Expts. were conducted to show the relation of velocity of photolysis and concn. of desensitizers, N. A soln. of HCOOH was mixed in equal quantities with 0.1M UO_2SO_4 dissolved in 2N H_2SO_4 . For desensitizers KCl, NaI, FeCl_2 , VOSO_4 , V_2O_5 , hydroquinone, CoSO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$, and other cpds. in various concns. were used. The illumination was 7500 luxes produced by an Osram incandescent lamp and freed from infrared and ultraviolet rays. Intensities were measured by means of a thermopile. Hatt's method was used to detn. oxidized HCOOH: $(-d(\text{HCOOH})/dt = d(\text{CO}_2)/dt = d(\text{U}^{+4})/dt)$ and U^{+4} was titrated by KMnO_4 . The velocity of photolysis is compared with data for a soln. not contg. inhibitor. It is shown that: (1) the velocity of photolysis depends upon the concns. of HCOOH and of $(\text{UO}_2)^{++}$. With increased concn. of $(\text{UO}_2)^{++}$ the reaction velocity increases in the

beginning, rapidly, reaches a max., and then decreases. Increased concn. of HCOOH diminishes the effect of the desensitizer but at 25% concn. the velocity is almost independent of concn. (2) The photolysis is strongly desensitized by I^- , Cl^- , Fe^{++} , hydroquinone, $\text{K}_2\text{Cr}_2\text{O}_7$, AgNO_3 , NaNO_2 , KCN , and HgSO_4 ; slightly by CuSO_4 , $\text{Cr}(\text{SO}_4)_3$, NaNO_3 , and KF ; and is not affected by Na_3PO_4 , $\text{NH}_4\text{COOCH}_3$, and MgSO_4 . Oxidation-reduction properties of the desensitizer play an important part. The desensitizer remains unchanged during the reaction. (3) When the concn. of the desensitizer is increased, the effect increases rapidly at the beginning and then more slowly. (4) The effect of desensitizer is strongest when the concn. of photolyte is weakest.

- 2089 Ouellet, C. "Determination of the Uranous Ion in the Presence of Formic Acid." Helv. Chim. Acta **14**, 967-71(1931).

In some studies on photolysis, solns. had to be analyzed which contain U^{+4} , $(\text{UO}_2)^{++}$, HCO_2H , and H_2SO_4 . Such a soln. can be protected from atmospheric oxidation by the addn. of KCl . The U^{+4} after treatment with KCl can be detd. by titration with KMnO_4 if considerable MnSO_4 is added and a correction applied.

- 2090 Patrassi, G. and Rogers, N. W. "Renal Alternations and Manifestations of Immunity in Experimental Intoxications with Uranium." Sperimentale **85**, 259-88(1931).

Injections of U salts directly into one renal artery caused dilatation with thrombosis of the glomerular vessels. These were marked in the injected kidney and less intense in the kidney on the opposite side and were more severe than when the salts were injected intravenously. With large doses there was extensive tubular degeneration. With moderate repeated doses there was tubular degeneration followed by a reinvestment of the tubular lining. In animals which had received repeated subcutaneous doses of very small amts. of U for immunization purposes, the procedures above resulted in mild pathologic renal changes only.

- 2091 Puilkov, A. N. "Method for the Preparation of the Standard Uranium Oxide and the Determination of Its Saturation Current." Zhur. Obschei Khim. **1**, 133-42(1931).

About 300 g of U-V ore was dissolved in dil. HCl . Only 10% silica was left undissolved, contg. Pa and Ac. At the same time Ra, MsTh, RaTh, and partially UX and ionium were sepd. by BaCl_2 . BaSO_4 was pptd. with very dil. H_2SO_4 . Thereupon the ppt. was carefully filtered, the filtrate was treated with $\text{Bi}(\text{NO}_3)_3$ and $\text{Pb}(\text{NO}_3)_2$ and satd. with H_2S ; CuS , Bi_2S_3 , and PbS with adsorbed RaD, RaF, and RaG were filtered off. The heavy metals such as Fe, Mn, U, and V, reduced by H_2S , were oxidized again with Br_2 , pptd. with NH_4OH free from CO_2 , and filtered. The ppt., well washed with distd. water, was treated either with a soln. of $(\text{NH}_4)_2\text{CO}_3$, or HNO_3 , the resulting soln. evapd. to dryness and the $\text{UO}_2(\text{NO}_3)_2$ was extrd. by Et_2O . To be certain that the salt is radiologically pure it was purified according to the method of Widdowson and Russell. It was very difficult to get the green U_3O_8 from which UX_1 was sepd. not more than 24 hr later. The substance was placed in an electro-scope and its current was measured for 3 mo. The increase of UX_1 followed closely the theoretical curve. The satn. current of green U_3O_8 on the surface of 1 cc was detd. afterward.

- 2092 Rao, G. G. and Dhar, N. R. "Studies in Photosynthesis in Tropical Sunlight. Part I. Formaldehyde Synthesis." J. Phys. Chem. **35**, 1418-23(1931).

This is a study of the photosynthesis of formaldehyde from CO_2 using uranyl salts, and others, as catalyst.

- 2093 Răy, P. "Use of Hexamethylenetetramine as Analytical Reagent for Determining the Metals of the Ammonium Group in the Presence of Manganese, Nickel, Cobalt, and Magnesium." Z. anal. Chem. **86**, 13-25(1931).

The "ammonium group" refers to Fe^{+3} , Al^{+3} , $(\text{UO}_2)^{++}$, $(\text{Ti}_2)^{+4}$, and Zr^{+4} . It has been shown previously that these elements can be pptd. at the boiling temp. by adding a 10% soln. of the reagent to the neutral soln. of the above cations in the presence of NH_4Cl . In this paper numerous analytical data are given to show that by this reaction the sepn. from Ni^{++} , Zn^{++} , etc., is better and more convenient than that offered by the BaCO_3 or basic-acetate procedures.

- 2094 Rosenheim, A., Raibmann, B., and Schendel, G. "Complex Pyrocatecholates of Quadrivalent Elements." Z. anorg. allgem. Chem. 196, 160-76(1931).

About 40 complexes of Si, Ti, Zr, Th, and U were prep'd. Besides the inorg. cations, $(\text{H}_2\text{N})_2\text{C}:\text{NH}$, $\text{C}_5\text{H}_5\text{N}$, PhNH_2 , and PhNMe_2 were used. In some cases the org. base replaced some of the water of crystn. in the cpds.

- 2095 Russell, A. S. "Simple Deposition of Reactive Metals on Noble Metals." Nature 127, 273-4 (1931).

U, Ti, W, and Mo are deposited on a Hg surface, as expected according to the Nernst theory of electrode potential, when acidified solns. of their salts are shaken with amalgam. The presence of the very slight concn. of metal is detected by their catalytic effect on the evolution of H_2 from H_2SO_4 solns. by pure Zn. The deposited metals are quite insol. in Hg.

- 2096 Siegbahn, M. Spektroskopie der Röntgenstrahlen. (2nd ed.) Berlin, J. Springer, 1931. Pages 183, 201, 251, 253, 266, 274, and 332 give information on the x-ray spectrum of U.

- 2097 Siegbahn, M. "Selection Rules for the Absorption Spectra of Roentgen Radiation." Z. Physik 67, 567-71(1931).

It seems from the energy diagrams that the M-absorption edge can be calcd. from $M_V = L_{III} - L_{III}M_V$ ($L_{III}M_V$ is the freq. emitted in transitions from level M_V to level L_{III}) but the experimentally measured value differs considerably from the calcd. It is therefore suggested that the electron in the absorption act is not brought to the "surface" of the at. but received in one of the unoccupied O levels. Selection rules identical with those for the emission line are supposed to hold for these transitions. The cases for the elements from W to U are explained in a Grotrian diagram and in tables.

- 2098 Stowell, E. Z. "The Oscillating Arc: Elements of Group VI." Phys. Rev. (2), 37, 1452-7 (1931).

A study is made of the behavior of S, Se, Te, Cr, Mo, W, and U as cathodes in an arc in H_2 . All permit radio-freq. oscillations to occur in a tuned circuit across the arc. The elements of the S group give unsteady oscillations, disintegrate rapidly and form hydrides. The other elements yield steadier oscillations and undergo no chem. action. The character of the spectra in these arcs in both the oscillating and the nonoscillating states is described. A mechanism of the ability of some elements to permit oscillations is suggested.

- 2099 Taylor, N. W. "Activated and van der Waals Adsorption of Ammonia and of Certain Other Gases." J. Am. Chem. Soc. 53, 4458-9(1931).

It is reported that UO_3 is apparently a solid soln. of O in U_3O_8 and that dissoc. starting with $\text{UO}_3.04$ proceeds at 580° (15 min.) to $\text{UO}_2.91$ and hence to $\text{UO}_2.84$ (123 hr).

- 2100 van Heel, A. C. S. "Some Experiments on Fluorescence." Chem. Zentr. I, 2589(1931). This is a summary of a paper published in full and here entered under Communs. Phys. Lab. Univ. Leiden No. 187, 3-14(1928?)

- 2101 Verne, J. "Histologic Lesions of Superior Nervous Centers in Rabbits Caused by Chronic Intoxication." Ann. anat. path. anat. normale méd.-chir. 8, 757-8(1931).

The discussion is based on intraperitoneally injected U salts and a study of the changes found in the int. organs.

- 2102 Wagner, C. and Schottky, W. "Theory of Ordered Mixed Phases." Z. physik. Chem., B. 11, 163-210(1931).

This paper discusses the theory of ordered mixed phases in oxides as exemplified by U_3O_8 .

- 2103 Williams, J. H. "The Natural Widths of Some X-Ray Lines in the L-Spectrum of Uranium." Phys. Rev. (2), 37, 232(1931).

This is an abstract of a paper presented at the December 12 to 13, 1930 meeting of the American Physical Society in Los Angeles, Calif.

- 2104 Williams, J. H. "An Experimental Study of the Natural Widths of the X-Ray Lines in the L-Series Spectrum of Uranium." Phys. Rev. (2), 37, 1431-42(1931).

The half widths at half max. of the rocking curves in parallel positions of the double x-ray spectrometer with calcite crystals reflecting in the 1st order have been investigated as a function of wavelengths. This function is shown to be linear. The rocking curves of $U L\alpha$ in 3 different antiparallel positions of the instrument give a natural width practically independent of the dispersion. The natural widths of $U L\alpha$ and $U L\beta$ show no dependence on voltage. The half widths at half max. of 12 lines in the $U L$ -series spectrum are given. The results are discussed from classical and quantum theory points of view.

- 2105 Williams, J. H. "An Experimental Study of the Natural Widths of the X-Ray Lines in the L-Series Spectrum of Uranium." Phys. Rev. (2), 37, 1692(1931).

This is an abstract of a paper presented at the April 30 to May 2, 1931 meeting of the American Physical Society in Washington, D. C.

- 2106 Yokota, T. "Experimental Investigation of the Hepatic Function in Pregnancy. II. Hepatic Amylase." Japan. J. Obstet. Gynecol. 14, 91-105(1931).

Hepatic amylase was highest in 5 pregnant, lower in 5 puerperal, lowest in 5 nonpregnant rabbits. In 5 cases of P intoxication and 5 or $UO_2(NO_3)_2$ intoxication hepatic amylase rose, then fell, the rise being prolonged in U intoxication. The change in amylase in pregnancy is like that in the early stage of hepatic intoxication. Following Lesser, the author believes that in the early stages of hepatic disturbance and pregnancy the association between liver colloids and amylase is weakened; both pour out into the blood stream, where the amylase stimulates the production of blood sugar. Later the amylase is diminished and its action is enfeebled by cell necrosis, etc. These facts are believed to explain the discrepancy between the action of hepatic toxins on the blood sugar in pregnancy and nonpregnancy.

PUBLICATIONS LOCATED IN 1932

- 2107 Allison, F. "Magneto-Optic Method of Analysis as a New Research Tool." Ind. Eng. Chem. Anal. Ed. 4, 9-12(1932).

A brief note is included on a microchem. method of detg. U using a magnetooptical method.

- 2108 Ballif, L. and Gherscovici, I. "Acid-Base Equilibrium in Experimental Poisoning by Uranium Nitrate in the Dog." Compt. rend. soc. biol. 109, 229-31(1932).

After subcutaneous injection of 0.0006 to 0.05 g/kg of U nitrate into 6 dogs, daily blood detns. were made of the pH, true alk. reserve, plasma and cell Cl, urea, Ca, and P salts. Acidosis and uremia increased as the alk. reserve was reduced; the plasma Cl to cell Cl ratio and Ca varied within normal limits; in the 5 cases in which hypochloremia was coincidental with uremia and acidosis, the alk. reserve was excessively low; and P was increased.

- 2109 Barnes, LeR. L. "The Emission of Positive Ions from Heated Metals." Phys. Rev. (2), 40, 1044-5(1932).

Expts. do not indicate U yields pos. ions upon heating. This is an abstract of a paper presented at the April 28 to 30, 1932 meeting of the American Physical Society at Washington, D. C. (See Phys. Rev. (2), 42, 487-91(1932) for full paper.)

- 2110 Barnes, LeR. L. "The Emission of Positive Ions from Heated Metals." Phys. Rev. (2), 42, 487-91(1932).

Pos. ions were not found when U or Th was heated in the mass spectrograph when a careful search was made.

- 2111 Baur, E. "Disensitizers, Antioxidants, and Antifluorescents." Z. physik. Chem., B. 16, 465-70(1932).

This paper discusses the photochem. reduction of uranyl cpds. The use of $(\text{UO}_2)^{++}$ as a catalyzer in photochem. processes is also discussed. Information on the velocity and directions of photochem. reactions involving U and the activation theory for neutral salts is included.

- 2112 Beck, G. "Energy Consideration of the Valence Field of Ammoniate." Z. anorg. allgem. Chem. 206, 416-24(1932).

This paper discusses the connection between thermochem. properties of UCl_4 and the mol. structure of UCl_4 amines. The cpd. $\text{UCl}_4 \cdot 12\text{NH}_3$ is obtained when liq. NH_3 is condensed over UCl_4 . The material is grayish-white with a greenish cast. Its heat of formation from UCl_4 and liq. NH_3 is 183 kcal. with d. at 18° 2.149, and molar vol. 271.6. The material will lose 4 moles of NH_3 at 100° forming $\text{UCl}_4 \cdot 8\text{NH}_3$ and the color changes to a darker green. Both the 8- and 12- NH_3 cpds. quickly turn brown in air, they are immediately decompd. by water giving a ppt. of dark-brown $\text{U}(\text{OH})_4$. The ignition of the materials at red heat gives a gray-green residue which will dissolve in water yielding a green color and leaving behind a small amt. of black oxide or nitride. The 12- NH_3 material is reported to form ionic crystals. At ordinary temps. 2 to 3 moles of NH_3 are absorbed by UCl_4 from NH_3 gas. The color of the UCl_4 changes with this absorption from dark-brownish-green to light-yellowish-brown.

- 2113 Bigazzi, R. "On a Constant Structural Relation in the Transition of States." Atti reale accad. nazl. Lincei (6), 16, 52(1932).

A discussion of the abs. m.p., at. wt., and d. as related to the constitutional or structural formula of U which can be inferred from the parachor is included.

- 2114 Britton, H. T. S., and Young, A. E. "Electrometric Studies of the Precipitation of Hydroxides. VI. Sexivalent Uranium Chloride Solutions." J. Chem. Soc. 2467-9(1932).

This paper describes the potentiometric (with the quinhydrone electrode) and conductometric titrations with alk. or HCl solns. of UO_2Cl_2 . During the neutralization of the free acid, the soln. remained pale yellow but afterward became intensely yellow until $\text{U}(\text{OH})_6$ (and not Na diuranate) began to ppt. From the results obtained, given in tables and graphs, it is shown that very little of the HCl combines beyond the uranyl stage, and that, in general, UO_2Cl_2 chiefly exists as such in solns. contg. excess of acid.

- 2115 Brull, L. and Fanielle, G. "Experimental Study of Nephritis. Mechanism of Urinary Modifications from Uranium Nephritis." Arch. intern. pharmacodynamie 42, 1-38(1932).

These expts. showed that in the dog the initial symptoms after the injection of 4 or 5 mg of U nitrate were polyuria, with albumin, cylindrical casts, glucose, and modified N retention, followed by an acute nephritis. Later the symptoms were oliguria, with lessening albumin, the glucosuria ceased, but the N retention increased and the animal died from this cause. Expts. in which the blood from poisoned animals passed through the kidneys of normal dogs showed that the albuminuria and glucosuria were purely renal. However the polyuria appeared to be due to changed properties of the blood.

- 2116 Brull, L. and Fanielle, G. "Renal Origin of Uranium Glycosuria." Compt. rend. soc. biol. 108, 1163-5(1932).
- 2117 Caldwell, J. M., Jr. "Renal Sympathectomy in Experimental Renal Disease from Uranium. J. Urol. 28, 323-31(1932).
- 2118 Driggs, F. H. —assigned to Westinghouse Lamp Co. Uranium. Jan. 19, 1932. (U. S. Patent 1,842,254)
U is obtained by electrolysis of a double halogen cpd. of U such as KUF_5 in soln. in a fused bath comprising alk. halogen cpds. such as KF and NaF.
- 2119 Driggs, F. H. and Lilliendahl, C. —assigned to Westinghouse Lamp Co. Uranium. June 7, 1932. (U. S. Patent 1,861,625)
The metal is electrolytically deposited from a fused bath of alk. halides contg. a U^{+4} halide such as KUF_5 .
- 2120 Eldridge, J. A. "Peripheral X-Ray Levels of the Heavy Elements." Phys. Rev. (2), 39, 177(1932).
The transitions take place in the free-gas layer in U. This is an abstract of a paper presented at the Nov. 27 to 28, 1931, meeting of the American Physical Society in Chicago, Ill.
- 2121 Engelder, C. J. and Miller, L. E. "Catalysts for the Oxidation of Carbon Monoxide. I." J. Phys. Chem. 36, 1345-52(1932).
The catalytic effect of TiO_2 on the oxidation of CO at 300° is only slightly increased by the presence of some UO_2 .
- 2122 Forbes, G. S., Kistiakowsky, B. G., and Heidt, L. J. "Apparatus for Quantum Yields of Gas Reactions by Actinometry." J. Am. Chem. Soc. 54, 3246-9(1932).
An app. and method are described for following the photochem. yield in a gas reaction over a period of time using the photochem. of $UO_2C_2O_4$ solns. as an indicator. A probable error of about 5% is estd.
- 2123 Gamow, G. "Radioactive Disintegration and Nuclear Spin." Nature 129, 470(1932).
A discussion of the splitting of the energy levels in the U x-ray spectrum is contained. This splitting is said to be impossible on the basis of nuclear spin. A calcn. of the nuclear radius of U_I is included, 0.95×10^{-12} , which is arrived at by wave mechanics.
- 2124 Garnier, M. and Marek, J. "Phenomenon of Habituation in Experimental Intoxication in Rabbits." Presse méd. 40, 829-32(1932).
It is noticed that there is less retention of urea in rabbits after each new injection of U. However albuminuria and glycosuria become more marked. The death of the exptl. animals is reported to result in the case of massive doses of U, from hepatic lesions and hypoglycemia rather than from nephritic retention of urea.
- 2125 Gérard, T. and Cordier, R. "On the Method of Production of Uranium Nephritis in the Toad." Compt. rend. soc. biol. 109, 59-60(1932).
This paper reports a study on the distribution of U in the kidney by a histological method using $K_4[Fe(CN)_6]$ straining.
- 2126 Gibbs, R. C. "Line Spectra of the Elements. Part I. Early Observations and Systems of Classification. Bibliography I. Papers Published during 1920-1931." Revs. Modern Phys. 4, 278-470(1932).
A review of the recent literature on emission spectra. Page 441 contains the list of references to information on U.

- 2127 Guillery, P. "Electrical and Optical Properties of Semiconductors. XI. Conductivity Measurements on Powders." *Ann. Physik* (5), 14, 216-20(1932).

Measurements of the electrical cond. of UO_3 powders using a new method are given. These values are the same order of magnitude as previous investigations such as those of Guillery and LeBlanc and Sachse.

- 2128 Hecht, F. "On the Analysis of Very Small Quantities of Morogoro Uraninites. A Report on Micro-Mineral Analysis." *Mikrochemie* 10, 45-52(1932).

This paper discusses the microchem. analysis of uraninite for all its constituents.

- 2129 Heidt, L. J. and Daniels, F. "Photochemical Technique. II. Construction and Tests of a Quartz Monochromator." *J. Am. Chem. Soc.* 54, 2384-9(1932).

The photodecompn. of $\text{UO}_2\text{C}_2\text{O}_4$ is discussed. It is reported that the anions combined with $(\text{UO}_2)^{++}$ in the photochem. reaction between the uranyl salt and oxalic acid have very little influence on the quantum yield. Similarly, the addition of MgSO_4 in molar amts. has little influence on the yield.

- 2130 Herszfinkiel, H. and Tolwinska, J. "Separation of Uranium-X from Uranium." *Roczniki Chem.* 12, 426-40(1932).

Suitable adsorbents for UX in aq. $(\text{UO}_2)^{++}$ solns. are $\text{Fe}(\text{OH})_3$, CeF_3 , and BaSO_4 . The adsorption is increased by adding salts which form double cpds. with $(\text{UO}_2)^{++}$, as NaF , NH_4HCO_3 , and K_2CrO_4 . These salts diminish the concn. of $(\text{UO}_2)^{++}$, but do not combine with Th. Addn. of $\text{Na}_4\text{P}_2\text{O}_7$ and $\text{NH}_4)_2\text{C}_2\text{O}_4$ causes min. adsorption, since these salts combine with both $(\text{UO}_2)^{++}$ and Th^{+4} . Better results are obtained by adding finely divided $\text{Fe}(\text{OH})_3$ or BaSO_4 to the soln. than by pptg. them in presence of the $(\text{UO}_2)^{++}$ salt.

- 2131 Hettich, A. and Steinmetz, H. "Piezoelectric Experiments Using the Method of Giebe and Scheibe." *Z. Physik* 76, 688-706(1932).

It is reported that Na uranyl acetate shows negligible piezoelectricity.

- 2132 Hunter, W. C. and Roberts, J. M. "Glomerular Changes in the Kidneys of Rabbits and Monkeys Induced by Uranium Nitrate, Mercuric Chloride and Potassium Bichromate." *Am. J. Path.* 8, 665-88(1932).

By a special staining method (azocarmine) distinct changes, interpreted as evidences of injury, can be demonstrated in the glomerular basement membrane of kidneys damaged by U nitrate (35 rabbit kidneys examined). The lesions in the basement membrane are purely degenerative in character, present in both acute and chronic stages of chemical nephropathies, and appear to be permanent. The renal glomerulus is more vulnerable to poisons than the tubules and fails to develop the same degree of increased resistance toward them. The opinion is advanced that alterations in the basement membrane of the type described may play an important role in the renal disturbances induced by certain metallic salts. Fibrosis and connective tissue hyperplasia are not responsible for the appearance of the glomeruli in chronic U and sublimate nephropathies. The existence of other long recognized glomerular changes demonstrable with ordinary stains is affirmed. U nitrate and HgCl_2 produce more histological alterations in the glomeruli than does $\text{K}_2\text{Cr}_2\text{O}_7$.

- 2133 Irvin, N. M. and Russell, A. S. "The Solubilities of Copper, Manganese and Some Sparingly Soluble Metals in Mercury." *J. Chem. Soc.* 891-8(1932).

The solys. of metals of at. nos. 22 to 29 and of Mo, W, and U in Hg were detd. by prepg. an amalgam of each metal, sepg. the solid from the liq. phase by filtration through sintered Jena glass and analyzing the liq. phase chemically. Only Cu and Mn have solys. greater than 1 in 10^7 their values being 0.0020 and 0.0010%, resp.

- 2134 Ishimaru, S. "Gravimetric Analysis by Means of the Thermobalance. XV. Determination of Copper, Magnesium, Zinc, Cadmium, Aluminum, Bismuth, Iron, Manganese, Titanium, Uranium, Thorium, Lead and Calcium by Means of the So-called Oxine Method." J. Chem. Soc. Japan **53**, 566-73(1932).
Cu, Mg, Zn, Cd, Al, Bi, Fe, Mg, Ti, U, Th, Pb, and Ca were pptd. from solns. by oxine and the dehydration of these ppts. was studied with the thermobalance. Proper temps. for igniting these ppts. are given.
- 2135 Jílek, A. and Kotá, J. "Gravimetric Determination of Beryllium by Means of Guanidine Carbonate and the Separation of Beryllium from Ferric, Uranyl, Thoric, Zirconic, Thallous, Tungstate, Molybdate, Chromate, Arsenate, Antimonite and Cupric Ions. III." Collection Czechoslov. Chem. Commun. **4**, 97-106(1932).
The method used was identical with one previously described. After the addn. of the NH_4 tartrate, it is necessary to add NaOH until the soln. is alk. to Me red when $(\text{VO}_4)^{-3}$ or $(\text{MoO}_4)^{-2}$ is present and then make barely acid before adding the reagent.
- 2136 Jílek, A. and Kotá, J. "On the Separation, by Way of Guanidine Carbonate in Tartaric Medium, of Titanium with Aluminum and Certain Elements of the Analytical Classes II and III." Collection Czechoslov. Chem. Commun. **4**, 412-17(1932).
In sepg. U from Ti with Guanidine carbonate, the value obtained for Ti is usually too high.
- 3137 Jolibois, P. and Cloutier, L. "On the Existence of Basic Phosphates." Compt. rend. **195**, 1027-9(1932).
This paper contains a discussion of a basic U phosphate, but the compn. is not detd.
- 2138 Kelley, K. K. Contributions to the Data on Theoretical Metallurgy. I. The Entropies of Inorganic Substances. Washington, U. S. Bureau of Mines, 1932. 63p. (Bulletin 350)
Values for the entropy at 298.1°K are given for U and U_3O_8 and as many other materials as necessary data was found. Methods of calcn. are discussed and a bibliography of 400 references is included.
- 2139 Küstner, H. "Absorption Jump at the L-Band Heads of the Heavy Elements." Physik. Z. **33**, 46-9(1932).
The author has investigated the elements Ba, La, Ce, W, Au, Hg, Tl, Pb, Th, and U, using his difference method for producing monochromatic x rays. For Au Müller foils of a few μ in thickness were employed; for the other elements filter papers soaked in solns. of their salts and dried were used. The author's results are compared with those of Uber, Backhurst, and Kellström, and fair agreement is obtained.
- 2140 Leone, G. "Physiochemical Constants and Alkali Reserve of Urine and Blood in Experimental Uranium Nephrosis in Dogs." Rass. terap. patol. clin. (Naples) **4**, 336-50(1932).
- 2141 Luchetti, G. "The Action of Uranium Salts on Soil Microorganisms and on Their Functions." Boll. regio ist. super. agrar. Pisa (1), **8**, 571-91(1932).
- 2142 Mangini, A. and Stratta, R. "Some Hydroquinone Complexes. II." Gazz. chim. ital. **62**, 686-99(1932).
This paper discusses the existence of $\text{UO}_2(\text{C}_{10}\text{H}_5\text{O}_2)_2$, known as "carmin lake," which is a salt of hydroxynaphthoquinone. The colors of several uranyl salts of this type are given.
- 2143 Marchesi, F. "Histologic Comparisons between Kidneys of Gravid and Nongravid Rabbits Treated with Uranium Nitrate." Riv. ital. ginecol **14**, 375-402(1932).

- 2144 Martin, J. and Krczma, I. J. —assigned to Commercial Solvents Corp. Catalysts for Preparation of Esters. Aug. 2, 1932. (U. S. Patent 1,869,660)

A catalyst suitable for use in the prepn. of esters from alcs. as in the production of EtOAc, Pr propionate or Et or Bu butyrate consists of Ag or a Ag cpd., a uranyl cpd. of Ca, Ba, Sr, Mg, Zn, Ag, or Pb, and a hydroxide of Al, Th, Zr, or Be.

- 2145 Mauriac, P., Bronstet, P., and Traissac, F. J. "Effect of Insulin on Azotemia and Chloesteremia in Chronic Nephritis Caused by Uranium Nitrate." Bull. acad. méd. (Paris) 108, 1443-5(1932).

This study is on rabbits.

- 2146 Mauriac, P. and Servantie, L. "Variations in Serine-Globulin Ratio in the Blood of Rabbits with Acute Edematous Nephritis Caused by Uranium." Compt. rend. soc. biol. 111, 793-5 (1932).

Hypoproteinemia in rabbits with acute edematous nephritis induced by 1 or more injections of 1 cc of 0.7% U nitrate and daily ingestion of 60 cc NaCl soln. equiv. to 2 g Na, involved a decrease of serine and globulin without marked alteration of the serine-globulin ratio.

- 2147 Mellor, J. W. A Comprehensive Treatise on Inorganic and Theoretical Chemistry. Vol. XII. U, Mn, Ma, Re, Fe (Part 1). New York, Longmans, Green & Co., Inc., 1932.

A comprehensive literature summary on U (with extensive references) is given as chapter 63, p. 1 to 138. This comprehensive work is second only to Gmelin's Handbuch der anorganische Chemie. System 55, 1936, in completeness.

- 2148 Montet, M. "The Action of Radioactivity on the Germination of Bulbs." Compt. rend. 194, 1093-5(1932).

Four hyacinth bulbs exposed every 4 days to measured doses of emanations from radioactive water germinated more quickly the greater the dosage. The growth of the sprouts was also accelerated. Of 10 tulip bulbs placed in earth containing varying proportions of U oxide, the one in 0.5 g/1500 g of earth grew most rapidly while the ones in 5 and 10 g/1500 g grew less rapidly than the control.

- 2149 Montet, M. "Effect of Uranium Radiation on Vegetation." Ann. agron. (2), 2, 278(1932).

- 2150 Montet, M. "Effect of Uranium Radiation on Vegetation." Compt. rend. acad. agr. France 18, 28-30(1932).

- 2151 Muniesa, A. "Renal Lesions in Experimental Uranium Nephritis." Arch. facultad. med. Saragossa 1, 358-90(1932).

- 2152 Neumann, B. "On Sulfuric Acid Catalysis." Z. Elektrochem. 38, 304-11(1932).

It is reported that the catalytic effect of U_3O_8 on the reaction $2SO_2 + O_2 \rightarrow 2SO_3$ is very slight below the formation temp. of U_3O_8 . A portion of the contact material is converted to water sol. UO_2SO_4 .

- 2153 Neumann, B., Kröger, C., and Haebler, H. "The Heats of Formation of the Nitrides. IV. Uranium, Thorium and Lanthanum Nitrides." Z. anorg. allgem. Chem. 207, 145-9(1932).

The heats of nitriding for U, Th, and La were detd. calorimetrically to be 68,460 cal, 77,100 cal., and 71,055 cal., resp./g at. of N_2 .

- 2154 Parratt, L. G. "X-Ray Diffraction from Calcite for Wave-Lengths 1.5 to 5 Angstroms." Phys. Rev. (2), 41, 561-76(1932).

With a specially constructed double-crystal spectrometer, the Cu K α and nine U M lines were experimentally measured and the results compared with calcd. values. Excellent agreement was found.

- 2155 Parsons, A. L. "Crystal Habit of Uranite from Cardiff Township." Univ. Toronto Studies. Geol. Ser. No. 32, 17-18(1932).

- 2156 Pauling, L. and Sherman, J. "Screening Constants for Many-Electron Atoms. The Calculation and Interpretation of X-Ray Term Values, and the Calculation of Atomic Scattering Factors." Z. Krist. 81, 1-29(1932).

The scattering factor of U for x rays is thoroughly discussed as is the electron arrangement, particularly in the O, P, and Q levels, in the atom.

- 2157 Pochettino, A. "On the Hallwachs Effect in Compounds of Elements Having Double Valences." Atti reale accad. nazl. Lincei (6), 15, 505-09(1932).

UO₃ is reported to show a smaller photoelectric effect than UO₂.

- 2158 Rentschler, H. C., Henry, D. E., and Smith, K. O. "Photo Electric Emission from Different Metals." Phys. Rev. (2), 40, 1045(1932).

A method for making U films and the results of photoelectric work function measurements are included. The measurement is somewhat higher than the value of Dushman, Phys. Rev. (2), 21, 623-36(1923).

This is an abstract of a paper presented at the April 28 to 30, 1932 meeting of the American Physical Society in Washington, D. C. See Rev. Sci. Instruments 3, 794-802(1932) for more complete report of this work.

- 2159 Rentschler, H. C., Henry, D. E., and Smith, K. O. "Photoelectric Emission from Different Metals." Rev. Sci. Instruments 3, 794-802(1932).

This paper describes a method of prepg. photoelectric cells from metal wire by sputtering. The photoelectric work functions for solid U, Th, Zr, and Ca are reported to be higher than the thermionic work functions for monomolecular films of the same metals on W.

- 2160 Rosenheim, A. and Daehr, H. "Peruranates." Z. anorg. allgem. Chem. 208, 81-94(1932). By simultaneous action of alk. and H₂O₂ on solns. of uranyl salts, peruranates are obtained. The following were prepd.: Na₂U₂O₁₀·4H₂O, Na₄UO₈·8H₂O, Na₄UO₈·9H₂O, K₂UO₆·3H₂O, K₄UO₈·4H₂O, K₆U₂O₁₃·10H₂O, (NH₄)₂UO₁₀·5H₂O, (NH₄)₂U₂O₁₀·3H₂O, (NH₄)₆U₂O₁₃, and (CN₃H₆)₄UO₈. Structural formulas are given for these cpds.

- 2161 Rosenheim, A., Hakki, M., and Krause, O. "Permolybdates and Pertungstates and the Structure of Perchromates." Z. anorg. allgem. Chem. 209, 175-203(1932).

The structure of the perchromates, permolybdates, pertungstates and peruranates was discussed, and the following structural formula is thought probable for the peruranates:

- 2162 Rosenheim, A. and Kelmy, M. "Compounds of Quadrivalent Uranium." Z. anorg. allgem. Chem. 206, 31-43(1932).

The wide analogy between U and Th cpds. is demonstrated by prepn. of the following U cpds., from a weakly acid soln. of U(SO₄)₂·8H₂O: UCl₄·10H₂O, (C₅H₆N)₂UCl₆·2H₂O, U(HCO₂)₄, (NH₄)₄[U(CO₃)₄]·6H₂O, U(OH)₂(HCO₂)₂·2H₂O, U(CH₃CO)₄, H₂[U₂(C₂O₄)₅]·8H₂O, U(C₂O₄)₂·6H₂O, (NH₄)₄H₂[U₂(C₂H₄O₂)₇]·6H₂O, K₄H₂[U₂(C₆H₄O₂)₇]·3H₂O, (CN₃H₆)₆[U₂(C₆H₄O₂)₇]·14H₂O, (C₅H₆N) U(C₆H₄O₂)₂OH·4H₂O, (C₂N₄H₅)[U(C₆H₄O₂)₂OH]·2OH₂O, (CN₃H₆)₆[U(CO₃)₅]·4H₂O, (CN₃H₆)₅[U(CO₃)₃(OH)₃]·5H₂O,

$(\text{NH}_4)_4[\text{U}(\text{SO}_3)_4]$, $\text{Na}_6[\text{U}_2(\text{SO}_3)_7] \cdot 2\text{H}_2\text{O}$, $\text{K}_6[\text{U}_2(\text{SO}_3)_7] \cdot 12\text{H}_2\text{O}$, $\text{CN}_3\text{H}_6[\text{U}(\text{SO}_3)_2\text{OH}] \cdot 2\text{H}_2\text{O}$, $\text{Na}_4[\text{U}(\text{P}_2\text{O}_7)_2] \cdot 8\text{H}_2\text{O}$. The following new Th cpds. were likewise prepd: $(\text{NH}_4)_4[\text{Th}(\text{SO}_3)_4] \cdot 6\text{H}_2\text{O}$ and $(\text{CN}_3\text{H}_6)_5[\text{Th}(\text{CO}_3)_3(\text{OH})_3] \cdot 5\text{H}_2\text{O}$. The structural characteristics of these cpds. are discussed, and it is believed that they can be explained only by polynuclear formulas. They are too complicated to correspond to the simple rules of the classical Werner's theory.

2163 Schloemer, A. "Luminescent Compounds." J. prakt. Chem. (2), **133**, 51-9(1932).

Detailed directions are given for the prepn. of a no. of luminescent substances and particularly of ZnS, Ca, tungstate, molybdate, vanadate, and uranate. The color and light intensities (measured in terms of Lenard's scale) are recorded for a no. of these cpds. Zn silicate and the silicates of alk. and alk. earth metals of a luminescent character can be prepd. by the addn. of min. amts. of Cu and Mn. Cpds. of tungstic, molybdic, vanadic, and uranic acids with the oxides of the alk., alk. earths and a few other metals were systematically investigated by mean of cathode rays.

2164 Schneider, F. "Beneficial Action of Renotrat in Experimental Uranium Nephritis." Arch. exptl. Path. Pharmacol. **166**, 55-61(1932).

2165 Scott, W. W. (and Blain, M. H.) "Determination of Uranium in Carnotite Ore. Glacial Acetic Acid Method." Ind. Eng. Chem. Anal. Ed. **4**, 244(1932).

This article contains a discussion of the analysis of carnotite, particularly as regards the estn. of the U contd. in the ore. A comparison of the analyses using this HOAc method and the lead vanadate method of Low is given.

2166 Sucksmith, W. "Magnetic Susceptibilities of Some Paramagnetic Substances." Phil. Mag. (7), **14**, 1115-26(1932).

An app. for measuring susceptibilities between -183 and 470° is described. The temp. variation for Yb_2O_3 , Nd_2O_3 , Sm_2O_3 and Eu_2O_3 follows Van Vleck's theory. The paramagnetism of MoCl_5 , MoCl_3 , $\text{U}(\text{SO}_4)_2$ and UCl_4 is probably due to spin moment only.

2167 Tashiro, T. "Application of Liquid Amalgams to Volumetric Analysis. VI. Determination of Molybdenum, Vanadium, Titanium, Iron and Uranium by Means of Iodate Methods." J. Chem. Soc. Japan **53**, 13-17(1932).

If a molybdate is treated with Zn-Hg, the Mo is reduced to Mo^{+3} . Addn. of ICl oxidizes the Mo^{+3} to Mo^{+5} and the liberated I_2 can be oxidized back to ICl by means of KIO_3 . For the titration, 0.025M KIO_3 is recommended and CCl_4 is used to show the presence of I_2 . A similar procedure is recommended for detg. V, Ti, and U. $(\text{UO}_2)^{++}$ is reduced to U^{+4} and oxidized back to U^{+6} .

2168 Tashiro, T. "Application of Liquid Amalgams to Volumetric Analysis. XVII. Differential Iodate Titrations by Means of Zinc and Bismuth Amalgams." J. Chem. Soc. Japan **53**, 51-3 (1932).

The amalgam method permits the detn. of 2 metals in soln. In a mixt. of Ti^{+4} and $(\text{UO}_2)^{++}$ salts, a reduction to Ti^{+3} and U^{+3} can be accomplished with Zn-Hg and the KIO_3 titration carries Ti^{+3} back to Ti^{+4} and U^{+3} to U^{+4} . Reduction with Bi-Hg reduces Ti^{+4} to Ti^{+3} but only carries the $(\text{UO}_2)^{++}$ to U^{+4} .

2169 Tropesch, H. "Catalysts for High-Pressure Hydrogenation of Phenols and Hydrocarbons." Fuel **11**, 61-6(1932).

Twenty-two chem. cpds. were tested for catalytic activity in the high-pressure hydrogenation of cresol. Tests were made in a rotating, chrome-steel autoclave contg. 200 cc of cresol with 5% catalyst. The retort was heated from 20 to 465° in 1 hr; this caused the pressure to rise from 80 to 220 kg/cm^2 ; (these pressures are approx., considerable variation was noted). Generally the reaction was completed after heating 1 hr at the max. temp. Yields of liq. hydrocarbons amounting to 78.1% of the cresol used were obtained. The activities of the cpds. tested were as follows: (1) good, MoS_3 ,

WS₃, CoS, MoO₃, Ni(OH)₂; (2) moderate, NiS, ZnCl₂, Al(OH)₃, V₂O₅, Cr(OH)₃, UO₃, Co(OH)₂; (3) ineffective, WO₃, ZnO, Fe(OH)₃, FeS.

- 2170 van der Lingen, G. W. D. "The Solubility of Uranyl Zinc Acetate in Alcohol of Different Strengths." Analyst 57, 376-7(1932).

Soly. detns. show that the alc. concn. is of considerable importance in the colorimetric detn. of Na as uranyl Zn Na acetate. 0.132 g of the triple acetate dissolves in 100 cc of abs. alc. and 0.967 g in 100 cc of 50% alc.

- 2171 Volkl, A. "Electrical and Optical Properties of Semiconductors. V. On a Process of Measurement of Electrical Conductivity of Powders." Ann. Physik (5), 14, 193-215(1932). Measurements of the electrical cond. of UO₃ powders using a new method are given. These values are the same order of magnitude as the previous investigations of Guillery and LeBlanc and Sachse.

- 2172 von Grosse, A. (expts. by P. Kronenberg). "On the Uranium Preparation for Isotope Determination." Z. anorg. allgem. Chem. 204, 184-6(1932).

In the prepn. of UF₆ from metallic U or U carbide and fluorine, it is recommended that a liq. fluorine trap be placed in front of the reaction train contg. the U and that a second container in the train should contain anhyd. CaCl₂. This material will react with F₂ to give CaF₂ and free Cl₂. Some of the properties of UF₆ are discussed. The crystals of the material are described as colorless and water clear.

- 2173 Wahlin, H. B. "The Emission of Positive Ions from Metals." Phys. Rev. (2), 39, 183(1932). It is reported that when a W wire is covered with UO₂ and heated to about 1800°, various pos. ions will be emitted. U⁺ and (UO)⁺ are among them. This is an abstract of a paper presented at the November 27 to 28, 1931, meeting of the American Physical Society in Chicago, Ill.

- 2174 Yoe, J. H., "Some Observations on Reactions Between Certain Metallic Ions and the Ammonium Salt of Aurintricarboxylic Acid." J. Am. Chem. Soc. 54, 1022-3(1932). The reaction of (UO₂)⁺⁺ with the reagent is described and reported not to interfere with the "Aluminon" detection of Al.

PUBLICATIONS LOCATED IN 1933

- 2175 Allison, F. and Goslin, R. "Isotopes of Uranium, Thorium, and Thallium." Phys. Rev. (2), 43, 49-50(1933).

The magnetooptic method shows 8 isotopes for each of the 3 elements examined. This method, and hence, these results, have been since proved to be invalid.

- 2176 Bodansky, M., Sahyun, P. F., and Blish, E. "Experimental Fetal Nephritis." Proc. Soc. Exptl. Biol. Med. 31, 7-13(1933).

The injection of small amts. of U acetate into pregnant animals (6 dogs, 16 rabbits, and 1 cat) resulted in nephritis in the fetuses. Marked dilatation of the convoluted tubules, suggestive of cystic kidney, was a frequent occurrence in the new born, especially in the puppies. This was apparently due to partial obliteration of the collecting tubules from compression by proliferating connective tissue.

- 2177 Brackett, F. P., Jr. and Forbes, G. S. "Actinometry with Uranyl Oxalate at $\lambda = 278, 253$, and $208 \text{ m}\mu$." *J. Am. Chem. Soc.* **55**, 4459-66(1933).

The photolysis of $\text{UO}_2\text{C}_2\text{O}_4$, using a Zn spark, has been investigated, with elaborate radiometric and analytical precautions, and the quantum yield at $208 \text{ m}\mu$ measured. The gross quantum yield ϕ at $27^\circ \pm 2^\circ$ for a soln. 0.01M in UO_2SO_4 and 0.05M in $\text{H}_2\text{C}_2\text{O}_4$ is found to be 0.48 ± 0.01 at $208 \text{ m}\mu$, while a redetn. of the gross quantum yields at $253 \text{ m}\mu$ and $278 \text{ m}\mu$ gives values of 0.63 ± 0.03 and 0.59 ± 0.01 , resp. After correction for light absorbed by uncombined $\text{H}_2\text{C}_2\text{O}_4$, and for the unsensitized photolysis of this acid, the quantum yield, with $\lambda = 208 \text{ m}\mu$, is considerably higher than at the lower freqs. The $\text{UO}_2\text{C}_2\text{O}_4$ actinometer should be especially valuable for photochem. work in the region of $\lambda = 208 \text{ m}\mu$, and the precautions necessary for work in this part of the spectrum are emphasised. The results obtained for ϕ_{253} and ϕ_{278} agree closely with those obtained by Leighton and Forbes, thus indicating that the two thermopiles used and the $\text{UO}_2\text{C}_2\text{O}_4$ actinometer integrate, in an equiv. manner, both periodically intermittent and const. radiations.

- 2178 Brull, L. and Roersch, C. "Uranium Nephritis. Production of Polyuria and Renal Vasodilation in 2 Donors." *Compt. rend. soc. biol.* **114**, 919-20(1933).

- 2179 Cloutier, L. "The Precipitation of the Basic Salts of Lead and the Metallic Phosphates." *Ann. chim.* (10), **19**, 5-77(1933).

When the method of Lienau was used to prep. Na uranyl phosphate in the low $\text{NaO-P}_2\text{O}_5$ ratios only UO_2HPO_4 was observed.

- 2180 "Electrolysis of Rare Metals." *Metal Ind. (London)* **42**, 168(1933).

A description is given of a new continuous method of electrolysis for the production of U, Tl, Ta, and other rare metals. For the production of Th a cathode is inserted in a bath of NaCl and KCl contg. some K Th fluoride, and replaced by a new one when powd. Th about 1 in. thick has been deposited.

- 2181 Ephraim, F. "Optical Investigations on Uranium Compounds." *J. Indian Chem. Soc.* Prafulla Chandra Ray Commemoration Volume **243-50**(1933).

The shift in the position of lines in the absorption spectra of polar U cpds. of all valencies with changing anion indicates that, like the rare-earths, U has an incomplete lower electron orbit which is probably the "O" orbit. Covalent cpds. give only band spectra.

- 2182 Ephraim, F. and Mezener, M. "The Absorption Spectra of Uranium Compounds." *Helv. Chim. Acta* **16**, 1257-72(1933).

In addn. to the rare earths U is the only element that in numerous cpds. exhibits line absorption spectra. Wavelengths are presented of the absorption lines that appear in the reflection spectra of various cpds. of 3-, 4-, and 6-valent U at temps. of 18° and -190° . Differences in the spectra attributable to temp., type of cpd., and effect of solvent, are pointed out. Attempts to prep. uranates of the heavy metals through digestion of uranyl salts with the hydroxides of the heavy metals are described.

- 2183 Fabrikant, W. "The Dependence of the Intensity of Fluorescence on the Wavelength of the Exciting Radiation." *Physik. Z. Sowjetunion* **3**, 567-73(1933).

Detns. were made of the intensity of fluorescence of a crystal of U nitrate and of org. solns., when exposed to monochromatic light of wavelength 3660, 3131, or 2534 Å. As required by Einstein's law, the quotient, intensity of fluorescence divided by amt. of absorbed light energy, was found proportional to λ for the incident light. Deviations from this rule, as observed by others, are qualitatively explained.

- 2184 Fankuchen, I. "Crystal Structure of Potassium Uranyl Acetate." Phys. Rev. (2), **44**, 327 (1933).

The crystals exhibit dimorphism. The forms are tetragonal and are body-centered with equal unit cell vols. having 16 mols. per cell. Lattice dimensions and space groups are given. This is an abstract of a paper presented at the June 19 to 24, 1933, meeting of the American Physical Society in Chicago, Ill.

- 2185 Fankuchen, I. "Crystal Structure of Sodium Uranyl Acetate." Phys. Rev. (2) **43**, 1048(1933). This is an abstract of a paper presented before the American Physical Society Meeting April 27 to 29, 1933 at Washington, D. C.

- 2186 Frankenburger, W. "The Present Status of the Theory of Ammonia Catalysis." Z. Elektrochem. **39**, 818-20(1933).

This is a reply to Kröger and a correction for the heat of formation of U_3N_4 which is between 15 and 25 kcal/g at. of N_2 instead of 68.5 kcal as previously stated.

- 2187 Frere, F. J. "Addition of 8-Hydroxyquinoline by Thorium and Uranium 8-Hydroxyquinolates." J. Am. Chem. Soc. **55**, 4362-5(1933).

$Th(C_9H_6NO)_4 \cdot C_9H_6NOH$ is pptd. from Th salts by 8-hydroxyquinoline, without H_2O of crystn.; it loses 1 mole of 8-hydroxyquinoline at 160 to 170°. So likewise, $UO_2(C_9H_6NO)_2 \cdot C_9H_6NOH$ is prepd. which loses 8-hydroxyquinoline at 200°.

- 2188 Garnier, M. and Marek, J. "Experimental Uranium Nephritis." Gaz. méd. France 482-3 (1933).

- 2189 Goldschmidt, V. M., Hauptmann, H., and Peters, C. "Rare Elements in Rock Analysis." Naturwissenschaften **21**, 362-5(1933).

Methods for the detn. of the "rare" elements in rocks (Be, B, Sc, Ga, Ge, Y, Sn, Cs, La, Pb, Th, Hf, Nb, Ta, As, and U) are discussed.

- 2190 Goldschmidt, V. M., and Peters, C. "The Concentration of Rare Elements in Coal." Nachr. Ges. Wiss. Göttingen, Math. physik. Klasse 371-86(1933).

The coals varied widely in their contents of the elements, the lower-ash coals usually showing higher concns. of the rare elements. Data are given on the % of SiO_2 , Al_2O_3 , Fe_2O_3 , MnO , MgO , CaO , Na_2O , K_2O , P_2O_5 , and SO_3 found in coal ashes and the occurrence therein of La, Ba, Pb, Cu, Zn, Se, Cd, I, Hg, As, Bi, V, and U. In the combustion of the coal the oxides of some elements may be volatilized; hence, the ash will contain little or none of such elements. The results are discussed in relation to the possible sources of the elements found and the geochem. processes of their concn. in the coal. For the highest values the concn. factors given varied from 1600 to 2800 for Ge to 10 for Sn; for av. values from 30 to 150 for Be to 4 for Sn. The heavy elements in the coal ashes probably came from minerals, especially the sulfides of the metals; the rare elements came more from biol. sources, the foliage of plants, trees and humus materials. Many references are given.

- 2191 Goto, H. "Importance of Hydrogen-Ion Concentration for the Estimation and Separation of Metals by the Oxine Method." J. Chem. Soc. Japan **54**, 725-40(1933).

The pH at which pptn. starts, the range during which it is complete and that above which no ppt. is formed were detd. experimentally. The range found for $(UO_2)^{++}$ is 4.1 to 8.8. Many other ions were also investigated. At pH = 12 to 13, the ppts. of Al, Ni, Mn, Ti, $(UO_2)^{++}$, Th, and Bi redissolve.

- 2192 Hecht, F. "Quantitative Total Analysis of Ceylon Thorianites." Mikrochemie **12**, 193-204 (1933).

This paper discusses the microchem. analysis of thorianite for all of its constituents. A large amt. (27 to 30%) of U_3O_8 was found to be present. The analytical scheme is given in diagram form as well as being discussed. A table showing the compn. of the thorianites examined is included.

- 2193 Hecht, F. and Reich-Rohrwig, W. "Quantitative Microanalysis of Uranites." Mikrochemie **12**, 281-92(1933).

Complete details are given, including drawings of the app. used, of the procedure followed in detg. 15 constituents in 28 to 47 mg portions of 4 samples of uranite. The analyses were carried out in duplicate and the agreement was good. The summations varied from 98.33 to 101.18%.

- 2194 Izawa, S. "Luminescence by Cathode Rays. I. Study of Chromium and Other Elements as Activators for Aluminum Oxide." J. Soc. Chem. Ind. Japan **36**, (Suppl. binding), 43-4(1933).

The metals were mixed in concns. of 10^{-1} to 10^{-5} with purified Al_2O_3 , heated to $1300 \pm 50^\circ$ for 1 hr and cooled quickly. When excited in a Braun tube by cathode rays under 4000 v the addn. of U yielded a faint yellow-brown luminescence.

- 2195 Jones, H. D., Goslin, R., Crane, K. D., and Johnston, G. B. "Some Quantitative Studies of the Localization of Uranium in the Principal Organs of Rabbits during the Course of Uranium Intoxication by Use of the Magneto-Optic Method." Am. J. Physiol. **105**, 693-6(1933).

Known quantities of U nitrate were injected subcutaneously into the abdominal walls of fasted rabbits. The animals were sacrificed successively. The quantities of U found in the various organs of the body, blood, and urine of each animal were then detd. quantitatively at definite intervals from 1 to 24 hr after injection. The magnetooptic method has been used to advantage in the quant. detn. of U in the blood, urine, kidney, spleen, urinary system, and liver and the results tabulated. No U was found in the bile or gall bladder. From 1 to 50% (av. 20%) of the total U was found in the liver and from 6 to 39% (av. 23%) in the kidney. U is excreted through the kidney during the first 24 hr. None of the metal was found in a control animal.

- 2196 Jones, H. D., Hughes, R. C., and Johnston, G. B. "A Study of the Effects of Agave Concentrate in the Treatment of Experimental Nephritis Induced in Animals. II. Nephritis Induced in Dogs by the Use of Uranium Nitrate." J. Pharmacol. Exptl. Therap. **48**, 25-48 (1933).

A uniformly acute U nephritis was produced in 2 groups of dogs. Group 1 received 4 mg and group 2, 2 mg of U nitrate/kg body wt. Each group was subdivided into 2 groups, a control group receiving only U nitrate and a group which received U nitrate followed by agave conc., per os, at definite intervals. The course of the U nephritis was followed in each group by changes in kidney function, blood, and urine analyses throughout the entire expt. At death or time of sacrifice, pathological studies were made of the kidneys. Seven of the 10 control animals of group 1 died. Five of the 16 animals which received both the U nitrate and agave conc. in group 1 died. The functional changes of all control animals and the kidney pathology are in close agreement with MacNider. The functional changes and the pathology of those animals receiving both the nitrate and the agave conc. showed a marked improvement over those of the controls.

- 2197 Kangro, W. and Jahn, R. "Action of Chlorine on Metallic Oxides." Z. anorg. allgem. Chem. **210**, 325-36(1933).

Commercial U_3O_8 is noticeably attacked by Cl_2 at about 300° . The product, which is UO_2Cl_2 , is deposited in the form of yellow crystals.

- 2198 Kashtanov, L. I. "Uranium Tetrachloride, Tungsten Hexachloride and Molybdenum Pentachloride in Organic Synthesis." *Zhur. Obsheĭ Khim.* 3, 229-33(1933).
Previous work has shown that the cpds. of $TiCl_4$ with ethers and esters decompose in PhH, one of the 2 radicals of the ether or ester being substituted for the H of PhH with the formation of mono- or di-derivs. Cpds. with UCl_4 , WCl_6 , and $MoCl_5$ decomp. in a manner analogous to those with $TiCl_4$, e.g., $PhCH_2OEt$ in PhH gives mono- and disubstituted PhH. Iso-AmOAc and Iso-AmOBz do not decomp. in the presence of UCl_4 although AcCl and BzCl do. PhBz could not be prepd. from $BzOCH_2Ph$ and UCl_4 although the $PhCH_2$ radical does react with PhH to give mono- and di-derivs. UCl_4 (25 g), 200 cc PhH and 10.5 g AcCl, heated on a steam bath till evolution of HCl ceases, give a brown soln. which, shaken with several portions of H_2O , dried with $CaCl_2$, the PhH distd. off, and the fraction boiling at 199 to 203° collected and redistd., gave 20.6% of PhAc. Similarly 20 g UCl_4 , 200 cc PhH and 13.3 g $PhCH_2Cl$ gave 12.3 g Ph_2CH_2 , 2.7 g p- and m- $C_6H_4(CH_2Ph)_2$, 1.1 g of a hydrocarbon of high mol. wt., and 3.2 g of a liq. tar. UCl_4 (17.5 g), 200 cc PhH and 13 g BzOH gave 22% PhBz and 8 g BzOH extd. from the reaction mixt. by washing with 50% NaOH. UCl_4 (20 g), 200 cc PhH and 15 g $PhCH_2OEt$ gave 12.5 g Ph_2CH_2 , and 2.5 g p- and m- $C_6H_4(CH_2Ph)_2$. UCl_4 (25 g), 250 cc PhH and 28 g $BzOCH_2Ph$ gave 15.6 g BzOH, 13 g of crude PhBz, and 2.9 g of p- and m- $C_6H_4(CH_2Ph)_2$. UCl_4 (15 g), 200 cc PhH and 15 g iso-AmOBz gave 14 g of unchanged iso-AmOBz; iso-AmOAc likewise was unattacked.
- 2199 Kolthoff, I. M. and Lingane, J. J. "The Volumetric Determination of Uranium with Potassium Dichromate as Reagent and the Application of the Method to the Indirect Titration of Minute Quantities of Sodium." *J. Am. Chem. Soc.* 55, 1871-6(1933).
 U^{+4} is titrated with $K_2Cr_2O_7$ using diphenylamine sulfonate as indicator. A simple method for detg. small amts. is given. The indirect detn. of Na by estn. of U in Na, Mg, uranyl acetate gives satisfactory results, and is especially advantageous for small quantities of Na.
- 2200 Komura, E. "Experimental Morphologic Studies on the Habituation of Kidney Tissue toward Kidney Poison." *J. Chosen Med. Assoc.* 23, 564-601(1933).
About 200 white rats were divided into 4 series, of which 1 was kept as control, while the remainder were poisoned with $HgCl_2$, U nitrate, or chromic acid, and the resistance of the kidney to subsequent poisoning tested. U and $HgCl_2$ raised resistance, not specifically alone, but to each other. Chromic acid, owing to the exptl. conditions, did not give the same results. The granuloid [sic] structure of the renal tissue responded differently to different poisons, being capable of most severe injury from $HgCl_2$, and in general best protected by previous treatment with it. In cases in which the preliminary treatment protected against any apparent injury, the controls showed severe damage; and, even when injury was evident in both exptl. and control animals, the former were much less severely damaged, and the injury was localized in the proximal parts. The severity of the final injury was in proportion to the size of the final dose. Apparently the effect of previous treatment is to increase greatly the amt. of later-given poison which can be excreted in a given time, and, by better conservation of the granuloid structure, to reduce the amt. resorbed.
- 2201 Lewis, S. J. "Uranium as a Source of Continuous Ultra-Violet Radiation." *Chemistry Industry* 464-5(1933).
Electrodes of U, particularly ductile U, tungsten steel, and Al under water as sources of continuous spectra were studied.
- 2202 MacNider, W. deB. "Acquired Resistance of Altered Type of Liver Epithelium to Uranium Nitrate and to Chloroform." *Proc. Soc. Exptl. Biol. Med.* 30, 238-41(1933).
- 2203 Martin, J. and Krchma, I. J. —assigned to Commercial Solvents Corp. *Catalysts for Preparing Esters.* Nov. 28, 1933. (U. S. Patent 1,937,284)
Catalysts initially comprising metal uranyl carbonates such as those of Ca, Sr, Ba, Mg, Zn, Ag, or Pb and Ag carbonate are used for promoting reactions such as the production of EtOAc from EtOH.

- 2204 Martin, J. and Krcma, I. J. —assigned to Commercial Solvents Corp. Catalysts for Preparing Esters. Nov. 28, 1933. (U. S. Patent 1,937,285)
The process outlined in this patent is similar to that shown in U. S. Patent 1,937,284 except that the catalysts mentioned are prepd. from metal uranyl cpds., a Ag. cpd. such as the carbonate, and a cpd. of Cu, Ni, Fe, or Co such as Ni carbonate.
- 2205 Massaut, C. "Mode of Formation of Cerobrospinal Fluid (Action of Uranium Nitrate)." Arch. intern. physiol. 37, 310-16(1933).
- 2206 Massaut, C. "Mode of Formation of Cerobrospinal Fluid (Action of Uranium Nitrate)." Compt. rend. soc. biol. 114, 921-2(1933).
- 2207 Mauriac, P. and Servantie, L. "Experimental Production of Hypercholesterolemia in Rabbits with Chronic Uranium Nephritis." Compt. rend. soc. biol. 114, 1105-08(1933).
- 2208 Mayr, C. "Determination and Separation of Zinc from Metals of the Ammonium Sulfide Group as Sulfide by the Use of Chloroacetic Acid Buffer." Z. anal. Chem. 92, 166-74(1933).
The sepn. of Zn from U is discussed, and it is said to be equally successful when H_2S is added in a chloroacetic soln. which is buffered with $(OAc)^-$, as when it is added in a $(CNS)^-$ solution.
- 2209 Meyer, W. "The Electric Conductivity of Inorganic Material with Electronic Conduction." Z. Physik 85, 278-93(1933).
Cond. measurements at various temps. lead to the following results: The cond. of satd. cpds. decreased proportionally to the no. of atoms of metalloid nature (WO_3 , ZnO , CdO , TiO_2) in the crystal lattice, while the reverse is true of unsatd. cpds. (CuI , Cu_2O , NiO , CoO , UO_2).
- 2210 Meyer, W. "Electrical Conductivity of Uranium Dioxide and its Use as a Series Resistance." Z. tech. Physik 14, 126-8(1933).
The resistance of UO_2 over the range 22 to 327° is given. From the magnitude of the resistance and the temp. coeff., but chiefly on account of the invariability of its electric consts. in vacuum or reducing or indifferent gases, this substance is suitable for use as a series resistance and for current-regulating purposes with an Fe- H_2 resistance.
- 2211 Miyamoto, S. "Heterogeneous Chemical Reactions in the Silent Electric Discharge. VIII." J. Chem. Soc. Japan 54, 1223-32(1933).
The reactions between H_2 and $UO_2(NO_3)_2 \cdot 6H_2O$ under silent discharge was studied. NH_4NO_3 , $U(NO_3)_4$, $U(OH)_4$, NO_2 , and NH_4NO_2 were found to be the reaction products.
- 2212 Pfeiffer, P., von Müllenheim, S., and Quehl, K. "Hexaaquo Salts of Bivalent Metals." J. prakt. Chem. (2), 136, 249-56(1933).
The prepn. of the Hg and U hexaaquo and -ammino salts of β -naphthalene sulfonic acid, and of the Cd, Ni, Zn, and Cu salts of camphor- β -sulfonic acid and α -bromocamphor- π -sulfonic acid and their ethylene diamine salts is described. The formula $[Hg(OH_2)_6](OSO_2C_{10}H_7)_2$ is representative for all of the complexes except $[Cu(OH_2)_6](OSO_2C_{10}H_{15}O)_2 \cdot H_2O$ which contains the extra H_2O . The coordination-theoretical aspects are discussed.
- 2213 Purdom, E. G. and Cork, J. M. "Wave-Lengths of Certain M-Series Lines by the Ruled Grating." Phys. Rev. (2), 44, 328(1933).
This is an abstract of a paper presented at the June 19-24, 1933 meeting of the American Physical Society in Chicago, Ill. See Phys. Rev. (2), 44, 974-6(1933) for paper in more complete form.

- 2214 Purdom, E. G. and Cork, J. M. "The Measurement of X-Ray Emission Wave-Lengths in the M-Series by Means of the Ruled Grating." Phys. Rev. (2), 44, 974-6(1933).

Abs. measurements of some of the lines of the M level of the x-ray spectrum of U are reported. The values found are $M_{\beta} = 3723 \text{ \AA}$ and $M_{\alpha} = 3911 \text{ \AA}$.

- 2215 Rascanu, R. "The Influence of Substitution on the Coordination Number." Ann. sci. univ. Jassy 17, 70-7(1933).

Complex amines were prepd. from the amine and anhyd. $\text{UO}_2(\text{NO}_3)_2$ in AmOH. Cpds. were prepd. with acetanilide (Acet) and Me acetanilide (Ex); $\text{UO}_2\text{Acet}_3(\text{NO}_3)_2 \cdot n\text{H}_2\text{O}$, where $n = 0, 4, 5$ or 6 ; $\text{UO}_2\text{Ex}_2\text{R}_2$, where $\text{R} = \text{NO}_3, \text{Cl}$ or Br . When the Ac group in acetanilide was replaced by the Me, Et, Ph, or benzal groups, no cpds. were formed. Evidently the coordination no. is affected by groups substituted in the amine.

- 2216 Rascanu, R. "Influence of the 'Nitrosyl' Group on the Formation of Amines." Ann. sci. univ. Jassy 17, 130-48(1933).

All attempts to combine PhNMe_2 and PhNEt_2 with UO_2 salts failed. By the direct addn. of 1 mole (or with $\text{UO}_2(\text{NO}_3)_2$, 1 and 2 moles) or 4- $\text{ONC}_6\text{H}_4\text{NMe}_2$ or 4- $\text{ONC}_6\text{H}_4\text{NEt}_2$ with 1 mole each of various $(\text{UO}_2)^{++}$ salts in suitable solvents (AmOH, EtOH, or H_2O , depending on the conditions), the following cpds. were obtained: p-nitrosodimethylaniline uranyl nitrate, $[\text{UO}_2(4\text{-ONC}_6\text{H}_4\text{NMe}_2)](\text{NO}_3)_2$, amorph., dark-yellow, explosive; bis(p-nitrosodimethylaniline) uranyl nitrate, $[\text{UO}_2(4\text{-ONC}_6\text{H}_4\text{NMe}_2)_2](\text{NO}_3)_2$, orange-red, explosive; the corresponding chloride, brick-red; bromide, orange-red; sulfate, reddish-orange; p-nitrosodimethylaniline uranyl acetate, dark-chestnut or greenish-chestnut; corresponding oxalate, olive-yellow; p-nitrosodiethylaniline uranyl nitrate, $[\text{UO}_2(4\text{-ONC}_6\text{H}_4\text{NEt}_2)](\text{NO}_3)_2$, olive-green, explosive; bis-(p-nitrosodiethylaniline) uranyl nitrate, stable, pearly, red or orange crystals; corresponding chloride, orange; bromide, brick-red; sulfate, orange-yellow; p-nitrosodiethylaniline uranyl acetate, dark-yellow; corresponding oxalate, dark-yellow. Most of these salts are insol. in H_2O , but dissolve on addn. of acids.

- 2217 Rascanu, R. "Complex Compounds of Nitroso- and Bromo-Antipyrine." Ann. sci. univ. Jassy 18, 72-97(1933).

The following complex salts, among others, are described (N = nitroso-, B = bromo-antipyrine): $[\text{UO}_2 \cdot \text{N}_4](\text{NO}_3)_2$; $[\text{UO}_2 \cdot \text{B}_2](\text{NO}_3)_2$; $[\text{UO}_2 \cdot \text{B}_2]\text{Cl}_2$; $[\text{UO}_2 \cdot \text{B}_2]\text{Br}_2$. All are decompd. by boiling H_2O , the UO_2 cpds. being more stable than the others investigated.

- 2218 Rathery, F., Debienne, Mrs., and du Jassoneix, B. "Humoral Disturbances in Experimental Nephritis." Compt. rend. soc. biol. 112, 1652-4(1933).

U nitrate was used as the nephrotoxic agent.

- 2219 Rây, P. and Bose, M. K. "Quinaldic Acid as an Analytical Reagent. Determination and Separation of Copper, Zinc, Cadmium and Uranium. Colorimetric Determination of Iron." Z. anal. Chem. 95, 400-14(1933).

Just as 8-hydroxyquinoline has been used for detg. Mg, Al, Cu, Cd, Zn, etc., the Na salt of α -quinaldic acid can be used for the quant. pptn. of Cu, Cd, Zn, and $(\text{UO}_2)^{++}$, and for the sepn. of Cu from Cd, P, As, Pb, Ni, Co, Mn, etc. To det. $(\text{UO}_2)^{++}$, after 5 to 7 g of NH_4Cl has been added to the neutral soln., add 2 to 5 ml. of 2N H_2SO_4 to the soln. contg. 10 to 50 mg of $(\text{UO}_2)^{++}$ in a vol. of about 150 ml. Heat to boiling and add dropwise the 3.5% soln. of the reagent in H_2O . Filter (with pulp if necessary) through a Gooch crucible, dry at 125° and weight.

- 2220 Richtmyer, F. K. "X-Ray Satellites of High Atomic Number Elements." Phys. Rev. (2), 44, 605-09(1933).

The x-ray lines, $L\alpha_1$ and $L\alpha_2$, are examd. for satellites in the range Ta(73) to U(92). Two satellites are found, $L\alpha^{\text{IX}}$ extending from Au(79) to U(92) and $L\alpha^{\text{X}}$ from Os(76) to Bi(83); these are apparently unrelated to the satellites in the range $36 < Z < 54$. $L\beta_2$ is also found to have 2 satellites, one extending from Ta(73) to U(92), the other having a slightly greater range. These also may be new lines.

- 2221 Roersch, C. "Ammonia in Urine of Uranium Nephritis in Dog." Compt. rend. soc. biol. 114, 1356-7(1933).
- 2222 Roersch, C. "Vasomotor Properties of Blood in Uranium Nephritis. Study on Spleen Inter-calated between 2 Donors." Compt. rend. soc. biol. 114, 1354-5(1933).
- 2223 Rosenthaler, L. "Brief Microchemical Contribution. VIII." Mikrochemie 13, 83-4(1933). Micrographs of Na uranyl acetate and Ag uranyl acetate are included. One of the sections deals with the detection of Na with $\text{UO}_2(\text{OAc})_2$. (See Mikrochemie 14, 267(1934) for correction.)
- 2224 Sato, T. "Detoxicating Hormone of Liver (Yakriton). Uranyl Nephritis in Individuals with Different Liver Power of Detoxication. Evidence of Close Relation between Liver and Kidney." Tôhoku J. Exptl. Med. 20, 399-407(1933).
- 2225 Sato, T. "Effect of Detoxicating Hormone of Liver (Yakriton) on Uranyl Nephritis." Tôhoku J. Exptl. Med. 20, 408-19(1933).
- 2226 Schoeller, W. R. and Webb, H. W. "Investigations into the Analytical Chemistry of Tantalum, Columbium and Their Mineral Associates. XXV. Separation of Uranium from Tantalum, Columbium and Titanium." Analyst 58, 143-7(1933).
- Like the earth acids and the rare earths, U is pptd. completely by the addn. of tannin to a neutralized tartrate soln. contg. NH_4OAc and NH_4Cl . It is also pptd. from oxalate soln. by tannin in the presence of a slight excess of NH_3 . U, like Zr, Th, Al, and Fe can be sepd. from Ta, Nb, and Ti by adding tannin to the faintly acid oxalate soln. half satd. with NH_4Cl . In tartaric hydrolysis, U interferes with the normal pptn. of Nb.
- 2227 Stephenson, R. J. "The Fluorescence Yield from the L_{III} Level of Uranium." Phys. Rev. (2), 43, 527-33(1933).
- The ratio of the no. of fluorescence quanta emitted from the L_{III} level of U to the total no. of incident quanta absorbed in this level is detd. to be 0.67. The relative intensities of the α and β lines in the fluorescence spectra of Mo and U have been found to agree with values found for the characteristic spectra. The at. absorption coeff. for U has been detd. across the L_{III} discontinuity; the ratio of coeffs. on the short- and the long-wave sides is 2.27.
- 2228 Takita, S. "Influence of X-Ray Irradiation upon Uropoietic System. II. Influence of Roentgen Irradiation upon Experimental Nephritis." Japan. J. Obstet. Gynecol. 16, 207-24(1933).
- The exptl. cantharidin and U nephritis, x-ray irradiation hastened and intensified recessive degeneration in the tubular system, congestion of the blood vessels, albuminuria, and decrease in quantity of urine.
- 2229 Thibaud, J. "A Study of the Physical Properties of the Positron." Compt. rend. 197, 915-17 (1933).

Uranium was found to emit positrons under bombardment by γ rays from a Rn tube.

- 2230 Tomaschek, R. and Deutschbein, O. "Connection between the Emission and Absorption Spectra of the Rare Earths in the Solid State." Z. Physik **82**, 309-27(1933).

The absorption spectrum is compared with the emission spectrum of a no. of ions embedded in inert material. Some principal lines are common to both spectra, though no emission has been found in the short-wave region. The influence of temp. and inert material is also stated. The $K_2SO_4-UO_2SO_4$ system was investigated in the infrared region.

- 2231 Traissac, F. J. "The Lesions of the Liver in Experimental Intoxication of the Rabbit by Uranium Nitrate." Compt. rend. soc. biol. **112**, 875-6(1933).

Studies are reported of the effects of U on the liver. Vaculation and necrosis of many cells occur with proteolysis and a regression of the periphery of the acinus. The metabolism of the cells is reported to be disturbed.

- 2232 Volmar, Y. and Mathis, —. "A Study of the Inhibiting Action of Certain Ions on the Fluorescence of the Uranyl Ion and Its Applications to Inorganic Chemical Analysis." Bull. soc. chim. (France) **(4)**, **53**, 385-92(1933).

The quenching influence of a large no. of ions on the fluorescence of $(UO_2)^{++}$ was studied. For those ions shown to be active in quenching, the limiting concn. for extinction was detd. The extreme sensitivity of the method allows its use as a very precise method of analysis for active ions. It is possible to det. more active ions in mixts. with less active ones.

- 2233 Western, F. "Atomic Weights of Radioactive Substances, Actinouranium, and Geologic Time." Bull. Univ. Pittsburgh **30**, 295-302(1933).

Available data for and against the 1-isotope hypothesis of the origin of the Ac series, i.e., that it runs

$U^{235} \xrightarrow{\alpha} UY \xrightarrow{\beta} Pa \rightarrow \dots Pb^{207}$ and not $U^{239} \xrightarrow{\alpha} ? \xrightarrow{\beta} ? \xrightarrow{\beta} U^{235}$, etc., as before (the 2-isotope hypothesis), are examined. There is no trace of the β -ray emitting elements required by the latter. Assuming, as seems probable, the Ac branching ratio to be 0.03 to 0.04, the decay const. and half-life of U^{235} , deduced separately from brögerite and uraninite, are in substantial agreement as required. So far as it goes the evidence favors the first theory, but more is required. At. wts. of radioactive elements are most accurately deduced by calcn. from those of Pb isotopes.

- 2234 Williard, H. H. and Young, P. "Ceric Sulfate as a Volumetric Oxidizing Agent. XIV. Indicator Methods for the Standardization and Use of Ceric Sulfate." J. Am. Chem. Soc. **55**, 3260-9(1933).

U^{+6} can be converted to U^{+4} using ceric sulfate at 50° in dil. soln. Titration with 0.01N $Ce(SO_4)_2$ soln. is reported with 1 drop ferrous o-phenanthroline as indicator. With careful manipulation, this procedure yields very accurate results.

- 2235 Wilson, H. A. "The Disintegration Energies of Radioactive Nuclei." Phys. Rev. **(2)**, **44**, 858-9(1933).

The exptl. detn. of the total disintegration energy for U yields values approx. 20% higher than theory. The value shown for U is 43×10^6 ev.

- 2236 Wilson, T. A. "Crystal Structure of Uranium." Physics **4**, 148-52(1933).

A method capable of resolving x-ray powder photographs derived from crystals of low symmetry is described. U has the space group C_{2h}^3 of the monoclinic system, with 2 atoms/cell. The cell is $a = 2.829$ A, $b = 4.887$ A, $c = 3.308$ A; $a:b:c = 0.5791:1:0.6771$; $d = 19.05$. U atoms seem to be prolate spheroids having 3.425 A as the major axis, and 2.826 A as the minor.

- 2237 Wu T.-Y. and Goudsmit, S. "Low States of the Heaviest Elements." Phys. Rev. (2), 43, 496(1933).

Calculation of energy of the 5f, 6d, 7s, and 7p states of the atoms built upon the Rn core show that the energies depend chiefly on the degree of ionization and very little on nuclear charge from $Z = 92$ to 89. The configurations to be expected are given for the lowest states of Ac, Th, Pa, and U. In U the 5f state begins to be prominent; this indicates that the element 93 probably contains at least one 5f electron and is possibly the beginning of a series of elements similar to the rare earths in their relation to the periodic table, though different in chemical properties.

- 2238 Yokota, T. "Experimental Investigation of the Hepatic Function in Pregnancy. III. Autolysis of the Liver." Japan. J. Obstet. Gynecol. 16, 45-56(1933).

The autolysis of the minced livers of 10 pregnant rabbits was much more intense than that in livers from 11 nonpregnant rabbits; the livers from 9 puerperal rabbits showed higher autolysis than the livers of nonpregnant rabbits but less than pregnant rabbits, diminishing toward normal with time. U, which does not act primarily on the liver, excited autolysis even in comparatively large quantities. When histologic change was slight, autolysis was excited; when necrosis was present, autolysis decreased. The autolysis of pregnant and puerperal livers from this point of view resembled that in hepatic intoxication induced by artificial poisons.

- 2239 Yokota, T. "Experimental Investigation of the Hepatic Function in Pregnancy. IV. On Erepsin of Liver." Japan. J. Obstet. Gynecol. 16, 57-63(1933).

Erepsin was found in the livers of 27 rabbits, including nonpregnant and pregnant animals and those poisoned with P or U, with no marked difference among them.

- 2240 Yokota, T. "On Renal Autolysis in Pregnancy." Japan. J. Obstet. Gynecol. 16, 74-82(1933).

The autolysis of the kidneys of normal nonpregnant rabbits was much more intense than the autolysis of the rabbit liver, stomach, ovary, and uterus observed by the author and by others. The action was most intense in the pH range of 3.6 to 5; it was more intense in the kidneys of pregnant than of nonpregnant rabbits, less intense and gradually declining in puerperal kidneys. U promoted renal autolysis somewhat more in small than in large quantities.

PUBLICATIONS LOCATED IN 1934

- 2241 Abrams, R. K. "Use of Liquid Amalgams in Volumetric Analysis." J. Proc. Sydney Tech. Coll. Chem. Soc. 6, 46-58(1934).
The work of the Japanese scientists is reviewed, the theory is explained with directions for the detn. of Fe, Mo, V, W, U, Ti, and Cr. A suitable reduction app. is shown. Very little time is required for a reduction, accurate results are obtained, the amalgams can be used repeatedly, often one reducible metal can be detd. in the presence of another, and it is not usually necessary to correct for impurities present in the reducing amalgam.
- 2242 Arneil, A. "Influence of Various Metallic Oxides as Catalysts in Promoting the Oxidation of Methane by Means of Copper Oxide." J. Soc. Chem. Ind. (London) 53, 89-92(1934).
An app. similar to that of Campbell and Gray was used to det. the effect of adding 4% U_3O_8 and other oxides at temps. ranging from 200 to 750°. The % CH_4 oxidized was plotted against temp. Fe_2O_3 was most effective, reducing the initial temp. of complete oxidation by 200°.
- 2243 Audrieth, L. F. and M. T. Schmidt. "Fused 'Onium' Salts as Acids. I. Reactions in Fused Ammonium Nitrate." Proc. Natl. Acad. Sci. U.S. 20, 221-5(1934).
 UO_3 was found to react with fused NH_4NO_3 forming $UO_2(NO_3)_2$, NH_3 , and H_2O .
- 2244 Bambacioni-Mezzetti, V. "Action of Uranium Chloride and of Gamma Rays on the Geotropical Sensibility of Roots." Atti soc. ital. progresso sci. 22, No. 3, 56-7(1934).
Solns. of UCl_4 at concns. greater than $2 \times 10^{-3}M$ inhibit the growth of Vicia sativa and disturb the geotropism of the small roots.
- 2245 Bancroft, W. D. and Gould, L. P. "The Hydrols." J. Phys. Chem. 38, 197-211(1934).
A discussion is included on the weakening of phosphorescence in solns. of uranyl salts by the hydration of the ion in soln.
- 2246 Bashilov, I. Y. "Treatment of Uranium-Containing Solutions with Metallic Iron." Redkie Metal. 3, No. 2, 25-33(1934).
Solns. remaining from the production of Ra were treated with scrap Fe to ppt. Cu. With an acidity of approx. 0.5N, Cu free from U was pptd. The acidity was then reduced to 0.1N and at a temp. of 90° U free from Cu pptd. The author states that the poor results obtained in commercial work with this method were due to poor control of acidity and other factors which can be corrected easily.
- 2247 Baur, E. "On Electrolytic Desensitizing." Z. Elektrochem. 40, 184-8(1934).
This paper discusses the photochem. reduction of UO_2SO_4 .
- 2248 Bennett, W. R. "Volumetric Determination of Uranium in Highly Ferriferous Ores." J. Am. Chem. Soc. 56, 277-80(1934).
Large quantities of Fe can be deposited electrolytically upon a Hg cathode and thus sepd. from small quantities of U, Ti, and V. U cannot be detd. accurately when Ti is present by reduction with Zn and titration with $KMnO_4$. The method recommended consists in decomp. the ore with H_2SO_4 and HF taking up the residue in dil. H_2SO_4 , fusing any unattacked mineral with $KHSO_4$, pptg. the Fe, Ti, Al, UO_2 , etc., with NH_4OH , dissolving the ppt. in H_2SO_4 , pptg. the Fe electrolytically and the Ti with cupferron, evapg. to H_2SO_4 fumes and decomp. excess cupferron with the aid of HNO_3 , removing excess HNO_3 by strong fuming, dilg., reducing with a Jones' reductor, and titrating with $KMnO_4$.
- 2249 Binet, L. and Marek, J. "Therapy of Experimental Uranium Nephritis by Subcutaneous Injections of Carbon Dioxide." Compt. rend. soc. biol. 116, 911-13(1934).

- 2250 Brull, L. "Experimental Study of the Mechanism of Urinary and Blood Modifications from Nephritis from Uranium Nitrate. I. Polyuria." Arch. malad. reins org. génito-urin. 8, 569-78 (1934).

U nitrate produced in dogs a polyuria often followed by oliguria and death. Crossed circulation expts. proved that this polyuria is due, not to purely renal mechanism, but to a vasodilator factor in the blood. A hyperemia was manifest not only in the kidney but in other organs, e.g., the spleen, but was not necessary to the prodn. of the polyuria.

- 2251 Brull, L., Lambert, J., and Roersch, C. "Acidosis in Experimental Uranium Nephritis. Renal Excretion of Bases and Acids." Compt. rend. soc. biol. 115, 182-4(1934).

- 2252 Brull, L. and Roersch, C. "On the Mechanism of Acidosis in Experimental Uranium Nephritis." Biochem. J. 28, 1513-15(1934).

The acid-base balance was studied in 3 nephritic dogs after injection of U nitrate, food material, urine, feces, and blood being analyzed for acids and bases. Acidosis sets in even while the inorg. and org. acid output is increased, without a relative loss of fixed bases. The acidosis cannot be explained merely by retention, and must be due either to overproduction or lack of combustion of org. acids.

- 2253 Chappeau, M. "The Combustion of Ethyl Alcohol in the Rabbit in the Course of Several Intoxications (Intoxication by Uranium Nitrate and by Phosphorus)." Compt. rend. soc. biol. 116, 889-90(1934).

- 2254 Chernichov, I. and Guldina, E. "Colorimetric Estimation of Uranium in Low-Grade Ores." Z. anal. Chem. 96, 257-63(1934).

Digest 0.5 g of the ore with 20 cc of 7.5N H_2SO_4 and 5 cc of 6N HCl for 30 min at the boiling temp. Dil. to 50 cc and filter off the insol. residue. Ppt. the sesquioxides by adding NH_3 water (free from carbonate) together with 4.5 cc of 3% H_2O_2 . Filter and wash the ppt. with hot 3% $(\text{NH}_4)_2\text{SO}_4$ soln. contg. a few drops of NH_4OH . Dissolve in a little hot 1% (by vol.) H_2SO_4 . Electrolyze the soln. with a cathode of Hg at 4 to 5 amp to remove Fe. In the electrolyzed soln. (not over 100 cc in vol.) ppt. Al and U again with NH_4OH and H_2O_2 . Dissolve the washed ppt. in 3% H_2SO_4 . Add 6N NH_4OH until a slight turbidity results, and dissolve this in as little H_2SO_4 as possible. Dil. to 40 cc, add 5 cc of 6N AcOH and 15 cc of 0.33M Na_2HOP_4 soln. Heat to boiling and add a little Al^{+3} if not already present so that the uranyl phosphate ppt. will coagulate. After 10 min filter, wash with N NH_4NO_3 soln., dissolve in hot 0.2% H_2SO_4 , make up to 100 cc, and match the color produced on treating an aliquot part of the soln. with 10% $\text{K}_4\text{Fe}(\text{CN})_6$ soln. with that obtained similarly with known quantities of U.

- 2255 Colani, A. "Combinations of Uranyl Oxalate with Oxalates of the Alkaline Earths." Compt. rend. 198, 1510-12(1934).

Varying amts. of $\text{UO}_2\text{C}_2\text{O}_4$, an alk. earth oxalate, and H_2O were agitated at const. temp. (15 or 50°) and the supernatant liq. analyzed. With CaC_2O_4 , no cpd. was formed. The soly. curves corresponded to $\text{UO}_2\text{C}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$ and $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$; the transition points were at 0.469 g $\text{UO}_2\text{C}_2\text{O}_4$ and 0.012 g CaC_2O_4 (per 100 g soln.) at 15°, and 1.07 g and 0.044 g at 50°. With SrC_2O_4 , a cpd., $\text{UO}_2\text{Sr}(\text{C}_2\text{O}_4)_2 \cdot 4\text{H}_2\text{O}$, was formed and the curves corresponded to $\text{UO}_2\text{C}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$ and $\text{SrC}_2\text{O}_4 \cdot \text{H}_2\text{O}$; transition points were at 0.771 g $\text{UO}_2\text{C}_2\text{O}_4$, 0.164 g SrC_2O_4 , and 0.59 g and 0.163 g, for 15°; 2.10 g and 0.521 g, and 1.45 g and 0.477 g, for 50°. With BaC_2O_4 , the curves represented $\text{UO}_2\text{C}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$, $\text{BaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$, $\text{BaUO}_2(\text{C}_2\text{O}_4)_2 \cdot 5\text{H}_2\text{O}$ and $\text{Ba}_2\text{UO}_2(\text{C}_2\text{O}_4)_3 \cdot 7\text{H}_2\text{O}$. Transition points for 15° were at 0.563 g $\text{UO}_2\text{C}_2\text{O}_4$, 0.0072 g BaC_2O_4 ; 0.140 g $\text{UO}_2\text{C}_2\text{O}_4$, 0.0592 g BaC_2O_4 ; 0.0449 g $\text{UO}_2\text{C}_2\text{O}_4$, 0.0306 g BaC_2O_4 ; for 50° at: 1.622 g $\text{UO}_2\text{C}_2\text{O}_4$, 0.370 g BaC_2O_4 ; 0.443 g $\text{UO}_2\text{C}_2\text{O}_4$, 0.211 g BaC_2O_4 , 0.239 g $\text{UO}_2\text{C}_2\text{O}_4$, 0.130 g BaC_2O_4 .

- 2256 Colani, A. "Combinations of Uranyl Oxalate with Oxalates of the Alkaline Earths." Bull. soc. chim. France (5), 1, 1376-9(1934).

This paper contains information similar to that reported in Compt. rend. 198, 1510-12(1934).

- 2257 Devèze, R. "Amino Acids and Ammonium in Acute Uranium Nephritis in Dogs, Rabbits and Rats. Compt. rend. soc. biol. 117, 1111-12(1934).
- 2258 Dienert, F. and Villemaine, F. "Photochemical Reactions. Phosphorous and Hypophosphorous Acids and Uranyl Salts." Compt. rend. 199, 1113-14(1934).
An acid (H_2SO_4) mixt. of solns. of Na hypophosphite and UO_2SO_4 remains unchanged in darkness, but exposed to light rapidly (begins after 2.5 min in diffused daylight) deposits a green colloidal ppt. contg. 54.5 to 56% U and 15.75 to 17.5% P, which is hypophosphite with some phosphite and phosphate, mixed with sodium phosphate and $\text{U}(\text{SO}_4)_2$.
- 2259 Einecke, E. and Harms, J. "Progress in the Analytical Chemistry of the Rare Metals III." Z. anal. Chem. 99, 113-29(1934).
Methods for detg. Zr and U are reviewed.
- 2260 Elasser, W. M. "Binding Energy in the Uranium-Radium and Thorium Radioactive Families." Compt. rend. 199, 46-8(1934).
A derivation is given of the binding energy in the nucleus of U_I and U_{II} from disintegration energy values.
- 2261 Ellsworth, H. V. and Osborne, F. F. "Uraninite from Lac Pied des Monts, Saguenay District, Quebec." Am. Mineral. 19, 421-25(1934).
- 2262 Emmerie, A. "The Reducing Properties of Ascorbic Acid. A Color Reaction with Selenous Acid and with Gold Chloride and the Precipitation of Ascorbic Acid with Lead Acetate." Acta Brevia Neerland. Physiol. Pharmacol. Microbiol. 4, 141-5(1934).
This is a review of recent investigations on the reducing properties of ascorbic acid. Solns. contg. 1 mg of ascorbic acid/cc gave an orange-red color with selenous acid (5% soln. in water), and a brownish-red with $\text{UO}_2(\text{OAc})_2$. The limit of both reactions was at about 0.01 mg of ascorbic acid/cc.
- 2263 Fankuchen, I. "Crystal Structure of Ammonium Uranyl Acetate." Phys. Rev. (2), 45, 563(1934).
A face-centered lattice with 16 mols. in the elemental crystal is found. Space groups and dimensions are reported. This is an abstract of a paper presented at the Feb. 23 to 24, 1934, meeting of the American Physical Society in New York City.
- 2264 Forbes, G. S. and Heidt, L. J. "Optimum Composition of Uranyl Oxalate Solutions for Actinometry." J. Am. Chem. Soc. 56, 2363-5(1934).
Solns. of $\text{UO}_2\text{C}_2\text{O}_4$ were compared as an actinometer with a std. soln. of 0.01M UO_2SO_4 and 0.05M $\text{H}_2\text{C}_2\text{O}_4$ previously studied. If $\text{UO}_2\text{C}_2\text{O}_4$ is substituted for the UO_2SO_4 in this "standard" or its tenfold diln. the problem of purification is greatly simplified and the quantum yields remain unchanged. The more dil. solns. have advantages at shorter wavelengths. The quantum yield remains unchanged (except at $\lambda = 208 \text{ m}\mu$) in a soln. contg. 0.005 moles of $\text{UO}_2\text{C}_2\text{O}_4$ and 0.0025 moles of $\text{H}_2\text{C}_2\text{O}_4/1$.
- 2265 Foucry, J. "Determination of Hexamethylenetetramine by Precipitation of the Double Uranyl Sulfate of Hexamethylenetetramine." J. pharm. chim. (8) 20, 168-70(1934).
The double salt $\text{UO}_2\text{SO}_4 \cdot \text{H}_2\text{SO}_4 \cdot \text{A}$ ($\text{A} = (\text{CH}_2)_6\text{N}_4$) is obtained by pptg. a soln. of hexamethylenetetramine in the presence of excess of H_2SO_4 and (UO_2). The reagent used is a soln. of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ 10 g in a cooled mixt. of 66° H_2SO_4 30 cc and 95% alc. 170 cc. To test for urotropine, add to 2 cc aq. soln. of urotropine 2 cc of the reagent. With 20 mg urotropine/1., a characteristic cryst. ppt. is formed; it is very slightly sol. in H_2O contg. free H_2SO_4 , insol. in 50% alc. contg. H_2SO_4 , insol. in 95% neutral alc. and in Et_2O . In very dil. soln. of urotropine, the ppt. forms within 10 min. For the detn. of urotropine in concns. not above 5 g/l, add an equal vol. of the reagent; after 1 hr decant through a tared filter, transfer the ppt. upon it with a small quantity of 50% alc. contg. 5% by vol. of 66° H_2SO_4 , wash the ppt. free from H_2SO_4 with 95% alc., then twice with anhyd. Et_2O and dry in an oven at 80 to 100° for 10 min.

The wt. $\times 0.232$ = the wt. of urotropine in the quantity taken. Accurate results were obtained with all pharmaceutical preps. examined; mineral or org. acids do not cause a disturbance. A mixt. of neutral (NH_4) salt and neutral soln. of HCHO , resulting in acidity, is not pptd. by the reagent unless the soln. is previously rendered alk. A similar behavior is shown by the quinone reagent for amines.

- 2266 Francis, M. and Tchong D.-T. "Actinium-Uranium Bifurcation Ratio." Compt. rend. 198, 733-5(1934).

The U and Pa were sepd. from three samples of Belgian Congo pitchblende and one of Colo. carnotite. The thin layers were prepd. by crushing in the usual way; by ultrasonic pulverization; and (for U only) by electrolysis of aq. $\text{UO}_2(\text{NO}_3)_2$ at 60° in presence of HOAc and NH_4OAc and conversion of the resultant hydrate to U_3O_8 at 700° . The ratio of the ionization currents averaged 0.023 with good agreement between individual measurements; this gives a bifurcation ratio of 4.

- 2267 Gleditsch, E. and Foeyn, E. "The Actinium-Uranium Ratio in Radioactive Minerals." Compt. rend. 199, 412-14(1934).

By a modification of Boltwood's method, whereby the sepn. of Th and ionium is facilitated, the Ac/ionium ratio for bröggerite was found to be 0.246, for uraninite 0.237 to 0.246, and for cleveite 0.241 to 0.246, av. 0.243; from these values, if the ionium/U ratio is assumed to be 0.53, the % of ActU is 4.12 of the U. If Ac is derived from an isotope of U its period cannot differ much from that of U_I . (cf. Francis and Tchong-da-Tchang.)

- 2268 Gratias, O. A. "Half-Value Period of Uranium II." Phil. Mag. (8), 17, 491-6(1934).

The half-value period of U_{II} has been measured and found to be 1.7×10^5 yr. The discrepancy between the two most recently detd. measurements of the decay const. has been accounted for by using both an electrolytic method combined with a valve amplifier, and an ionization method using a Lindemann electrometer.

- 2269 Hagi-Paraschiv, A. and Cimino-Béranger, E. "Research on Creatinine in Experimental Nephritis in Rabbits." Compt. rend. soc. biol. 117, 124-6(1934).

Using rabbits poisoned with U nitrate, (1 mg of more per kg in each animal), creatinine and alk. reserve were detd. and found to diminish in parallel fashion.

- 2270 Hecht, F. "Quantitative Methods of Microanalysis with Special Reference to the Gordonia Uranite." Am. J. Sci. (-), 27, 321-42(1934).

The app. and methods for the microanalysis of minerals are described. The analysis of pitchblende is described in detail, and the results obtained in the analysis of Gordonia uraninite are given.

- 2271 Hecht, F. and Krafft-Ebing, H. "Microanalysis of Uraninite. Control by Means of Standard Solutions." Mikrochemie 15, 39-54(1934).

The methods used in the analysis are described fully, and the results obtained in detg. PbO , Fe_2O_3 , Al_2O_3 , rare earths, ThO_2 , U_3O_8 , CaO , MgO in synthetic mixts. show that the values obtained by microanalysis are reasonably accurate.

- 2272 Henstock, H. "The Solubilities of Metal and Ammonium Salts of Various Organic Acids in Methyl Alcohol and Acetone." J. Chem. Soc. 1340-3(1934).

Soly. data given for uranyl acetate is probably for Na uranyl acetate. Values reported are: at 15° , 0.74 g/100 g in MeOH and 2.37 g/100 g in acetone.

- 2273 Hulsmann, O. and Biltz, W. "The Thermal Expansion of Some Compounds and Its Estimation by Means of the Grüneisen Rule." Z. anorg. allgem. Chem. 219, 357-66(1934).

The coeff. of expansion and the d. of UCl_4 and other salts were detd. at 19° , -78° , and -195° and the relations extrapolated to abs. zero. The error in measuring was less than 0.1%. The vols. of many cpds. at abs. zero could be estd. with an accuracy of 1% by means of the Grüneisen rule.

- 2274 Insley, H. and Glaze, F. W. "Some Optical and Crystallographic Properties of the Alkali Zinc Uranyl Acetates." Bur. Standards J. Research **12**, 471-4(1934). (Research Paper No. 672)
The prepn. of the cryst. Zn uranyl acetates of Na, Li, and K is described. Na and Li form tabular monoclinic crystals with b as the long dimension; both exhibit cyclic twinning. For the Na crystals, $\alpha_{\text{Na}} = 1.475 \pm 0.002$; $\gamma_{\text{Na}} = 1.480 \pm 0.002$, with $\gamma = b$, and $2V = 25^\circ$ approx. For the Li crystals, $\alpha_{\text{Na}} = 1.495 \pm 0.002$; $\gamma_{\text{Na}} = 1.503 \pm 0.002$. X-ray photograms show complete solid miscibility between the Na and Li salts. K forms prismatic holohedral tetragonal crystals with $e_{\text{Na}} = 1.487 \pm 0.002$; $w_{\text{Na}} = 1.477 \pm 0.002$.
- 2275 Jacoby, M. and Eisner, G. "Substances from Higher Plants and Enzymes Which are Effective in Uranium Poisoning." Biochem. Z. **268**, 322-5(1934).
The effect of diet differences on the susceptibility of animals to U poisoning is discussed.
- 2276 Jolibois, P. "Electrolysis of Saline Solutions with the Electrodes Kept in an Upper Layer of Distilled Water." Compt. rend. **199**, 706-08(1934).
The electrolyte is poured (by means of a siphon with tap and entrance funnel at its highest point) into 2 beakers so as to form layers below pure H_2O already there, the electrodes (Pt) are inserted in this H_2O , the cathode being enclosed in a porous diaphragm. At a p.d. of 300 v solns. of salts of Cu, Ni, Ag, Zn, Mg, U, and Th give deposits of the resp. hydrated oxide on the diaphragm; NaNO_2 gives a soln. of HNO_2 in the anolyte.
- 2277 Kasai, M. "Application of Liquid Amalgam to Volumetric Analysis. XIX. Estimation of Calcium and Sodium." J. Chem. Soc. Japan **55**, 242-3(1934).
Ca can be pptd. in ammoniacal soln. as Ca molybdate and the Mo detd. as above. Na can be pptd. as the uranyl Zn acetate and the U titrated.
- 2278 Keller, F. and Lehmann, W. R. "Determination of Dielectric Constants of Chemically Defined Substances." Z. Physik **88**, 677-82(1934).
Only a few chemically well-defined substances could be found for which such measurements are possible and have not yet been made. Values for oxides of Al, Hg, Pb, Sn, Ta, U, Zr, and W and for Na_3PO_4 , Na_2HOP_4 , NaH_2AsO_4 , KH_2AsO_4 , Na_3AsO_4 , K_3AsO_4 , SrCl_2 , TeCl , PbCl_2 , and K_2S were obtained by investigating them in the form of powder pressed into plates.
- 2279 Kitajima, I. "Studies on Potentiometric Titration of Organic Precipitates. I. Estimation of 8-Hydroxyquinoline, Anthranilic Acid and the Metals Precipitable by These Two Compounds." J. Chem. Soc. Japan **55**, 884-6(1934).
Estn. of 8-hydroxyquinoline and anthranilic acid can be made accurately by the potentiometric titration with HBrO_3 . Since the titration can be made in the presence of Cu, Cd, Al, Mn, Zn, Fe, Ni, Co, Ca, Mg, or U, and anthranilic acid in the presence of Ni, Cu, Zn, and Co, indirect estn. of these metals is possible by the titration of hydroxyquinoline or anthranilate pptns. in the presence of HCl .
- 2280 La Rocca, V. "Alterations of Retina in Experimental Toxic Nephrosis." Arch. Ophthalmol. (Chicago) **12**, 509-17(1934).
This study includes the use of U acetate as a nephritic agent.
- 2281 Lawrence, R. W. "Magnetic Susceptibilities of the Ions of Uranium in Aqueous Solution." J. Am. Chem. Soc. **56**, 776-83(1934).
A modified Gouy method was used to det. the magnetic susceptibilities of the ions $(\text{UO}_2)^{++}$, U^{+3} , $(\text{UO})^{++}$, and U^{+4} in aq. solns., with H_2O and NiCl_2 as magnetic stds. The effect of varying pH on the susceptibilities of the quadrivalent ions was also studied. On the assumption that Curie's law is applicable to the solns., the exptl. magnetic moments for the ions in Bohr magnetons are 2.945 for $\text{U}(\text{ClO}_4)_4$, 2.95 for $\text{U}(\text{SO}_4)_2$, 2.97 for UCl_4 , 2.73 for $\text{UO}(\text{ClO}_4)_2$, 3.22 for UCl_3 , and 3.17 for $\text{U}_2(\text{SO}_4)_3$. These results are compared with those calcd. from spectroscopic data according to various assumptions.

- 2282 Lay, H. "Absorption Coefficients for Roentgen Rays." Z. Physik 91, 551-5(1934).

This paper discusses the mass absorption coeff. of U for γ rays. A discussion is included on the partial absorption in the L region and in the M region of the x-ray spectrum of U. A description of the photographic method of detg. fluorescence yield is given for L and M levels and the results for the M level is approx. 6%.

- 2283 Lévy, J. "On the Experimental Habituation to Several Poisons." Bull. soc. chim. biol. 16, 631-709(1934).

This is a review paper discussing particularly the development of resistance to U poisoning. A bibliography of 375 references is included.

- 2284 Marden, J. W. "The Production and Utilization of Thorium and Uranium." Trans. Electrochem. Soc. 66, 39-47(1934).

Two methods have been found to give a sufficiently pure and stable metal powder for sintering and working. The working properties of the two metals are discussed. Three principal uses found for these metals are described. The photoelectric properties of Th and U are used in measuring restricted portions of the ultraviolet spectrum. Th has proved particularly useful in glow-discharge lamps. Both metals have been used in x-ray tubes, and in certain conditions may come to be of considerable commercial importance.

- 2285 Mentzer, J. H. "Effect of Diuretics on Rabbits during Recovery Stage from Acute Uranium Nephritis." J. Pharmacol. Exptl. Therap. 52, 246-58(1934).

- 2286 Modell, W. and Travell, J. "Role of Lipoid in Renal Tubule of Cat in Uranium Nephritis." Anat. Record 59, 253-63(1934).

- 2287 Montignie, E. "Study of Some Uranyl Salts." Bull. soc. chim. France (5), 1, 410-11(1934).
By treating $\text{UO}_2(\text{NO}_3)_2$ with phenylhydrazine a yellow, unstable ppt. is obtained which is converted to $\text{UO}_2(\text{OH})_2 \cdot \text{H}_2\text{O}$ in contact with air after washing. With hexamethylenetetramine, yellow $(\text{NH}_4)_2\text{UO}_4 \cdot \text{H}_2\text{O}$, insol. in H_2O and sol. in dil. acids, is prepd. With antipyrine, yellow $\text{C}_{11}\text{H}_{12}\text{N}_2\text{O} \cdot \text{UO}_2(\text{NO}_3)_2 \cdot 10\text{H}_2\text{O}$ is prepd. which is sol. in warm H_2O . The yellow ppt. of $\text{C}_4\text{H}_8\text{N}_2\text{UO}_2 \cdot 2\text{H}_2\text{O}$, prepd. from piparazine, is insol. in H_2O and sol. in dil. acids on warming K xanthogenate formed a reddish-brown compd. which could not be extd.; such a compd. was also formed with K sulfoguaiacolate. Thiosinamine is decompd. by $\text{UO}_2(\text{NO}_3)_2$ to NH_3 and $\text{C}_3\text{H}_5\text{CNC}$.

- 2288 Mueller, G. W. "Uranium Dioxide Resistors." AEG Mitt. 267-70(1934).

The W lamp filament and the Fe wire in H_2 have a pos. temp. coeff. To meet the demand for a convenient neg. temp. coeff. resistor, the UO_2 resistors were developed. The ohmic resistance is practically const. even after many thousand hrs of service. The UO_2 unit is mounted in a lamp bulb filled with N_2 or other suitable gas. Units for currents as low as 0.1 amp and as high as 30 amp are available. The voltage range is 115 to 380 v. During operation, the UO_2 attains a temp. of about 300° . The resistors are particularly useful when connected in series with any electric device which ordinarily "overshoots" where the circuit is closed. The cold ohmic resistance of the UO_2 drops to about 1/50 of its value during 0.5 to 30 sec (depending upon size) after the circuit is closed. This slow drop in resistance may be practically utilized in operating a magnetic relay.

- 2289 Patent Treuhand Gesellschaft für elektrische Glühlampen m.b.H. Resistances. April 26, 1934. (British Patent 409,174)

An electric resistance with a neg. temp. coeff. and for use particularly with Fe-H resistors is prepd. from UO_2 .

- 2290 Prins, J. A. "X-Ray Diffraction in Ionic Solutions." *Physica* **1**, 1171-3(1934).
Solns. of heavy ions in H_2O in M proportions of 1:5 to 1:100 were examd. with $Cu K\alpha$ radiation, the x-ray beam striking the surface of the soln. at a 3° angle. Satd. solns. of $Th(NO_3)_4$ or $UO_2(NO_3)_2$ show a ring, shifting to a smaller angle and becoming fainter with increased diln. The "superarrangement" is thereby indicated to be of the liq. type beyond that of H_2O itself.
- 2291 Revéze, R. "Organic Acids in Acute Uranium Nephritis in Dogs, Rabbits, and Rats." *Compt. rend. soc. biol.* **117**, 1113-14(1934).
- 2292 Roersch, C. "Acidosis in Experimental Uranium Nephritis. Excretion of Bases and Acids by Kidneys Intercalated between 2 Donors." *Compt. rend. soc. biol.* **117**, 81-3(1934).
- 2293 Roersch, C. "Ammonia Excretion by Healthy Kidneys Placed in Neck of Dogs with Experimental Uranium Nephritis." *Compt. rend. soc. biol.* **117**, 79-81(1934).
- 2294 Rosenthaler, L. "Correction." *Mikrochemie* **14**, 267(1934).
This is a correction to statements made on the detection of Na with $UO_2(OAc)_2$ in *Mikrochemie* **13**, 83-4 (1933).
- 2295 Ruark, A. E. and Western, F. "Radium-Uranium Ratio and the Number of Actinouranium Isotopes." *Phys. Rev.* (2), **45**, 69-70(1934).
The Ra-U ratio, V, is given by $E(1-\frac{1}{2}\eta B)/Z$ where $2E$ and Z are resp. the numbers of α particles/sec/g U or Ra; B is essentially equal to the actinium "branching" ratio; and η is the number of actinouranium isotopes. Data on V, E, Z, and B are considered in order to determine whether $\eta = 1$ or 2. The results speak strongly in favor of the existence of only one actinouranium isotope.
- 2296 Sachs, I. "Effect of Ephedrine in Pathogenesis of Nephritis Due to Uranium." *Arch. exptl. Path. Pharmacol.* **176**, 248-54(1934).
- 2297 Schmidt, J. "On the Decomposition by Carbides in Presence of Water or Dilute Acids." *Z. Elektrochem.* **40**, 170-4(1934).
In the discussion of the decompn. of H_2O by UC_2 , the correspondence to the decompn. resulting from CaC_2 action indicates that although only C_2H_2 would be expected because of the C-C bonds, the yielding of higher hydrocarbons is probably due to a change in valence for the U during the decompn.
- 2298 Shvemberger, V. and Gordon, V. "Methods of Preparation and Some Properties of Octachloronaphthalene. II. Chlorination of Naphthalene with Gaseous Chlorine." *Zhur. Obshechi Khim.* **4**, 529-51(1934).
The comparative catalytic activity of inorg. Cl carriers in the direct exhaustive chlorination of $C_{10}H_8$ to $C_{10}Cl_8$ was studied by the velocity of the reaction. The expts. were made under exactly similar conditions with 25 g of pure, resubld. $C_{10}H_8$, dry Cl_2 and 2% of a catalyst (as the metal or the corresponding amt. of chloride) with a complete exclusion of sunlight and at the lowest possible temp. and atmospheric pressure. The most effective Cl carriers are $AuCl$ ($AuCl_3$), $AlCl_3$, $TiCl_3$, $(TiCl)$, $ZrCl_4$, $SbCl_3$, $BiCl_3$, $TeCl_2$, $(TeCl_4)$, $FeCl_3$. Slightly less but still adequately effective, is UCl_4 . Many others were tried and found to be ineffective.
- 2299 Siegbahn, M. and Magnusson, T. "On the Spectroscopy of Very Soft Roentgen Rays. III." *Z. Physik* **88**, 559-92(1934).
Information is included on the O lines of the x-ray absorption spectrum of U. Electron transitions are also discussed.
- 2300 Spence, H. S. "Radium, Uranium, and Vanadium." *Mineral Ind.* **43**, 516-24(1934).
Statistics and uses are discussed. A bibliography is given.

- 2301 Takeno, R. "Application of Liquid Amalgams to Volumetric Analysis. XVIII. Estimation of Iron, Titanium, Molybdenum and Uranium by Means of Ceric Sulfate." J. Chem. Soc. Japan **55**, 196-8(1934).

Fe and Ti were reduced by means of Zn-Hg and then oxidized with $\text{Ce}(\text{SO}_4)_2$. The oxidation proceeds quantitatively and can be used as a means of titration. Diphenylamine serves as indicator. To det. Mo and U, an excess of $\text{Ce}(\text{SO}_4)_2$ was added to the solns. and the excess was titrated back with FeSO_4 , with methyl red as indicator.

- 2302 van Arkel, A. E. "Preparation of High Melting Metals by Thermal Dissociation of Their Compounds. II. Properties of the Metals Obtained." Metallwirtschaft **13**, 511-14(1934).

Th, U, V, and Cr are very ductile when prepd. by thermal disson., W, however, is ductile only when prepd. in single-crystal form, and B and Si are always brittle.

- 2303 Volmar, Y. and Mathis, —. "Analytical Applications of the Inhibition of the Fluorescence of Uranyl Salts When Certain Ions are Present." Bull. soc. chim. France (5), **1**, 1266-9(1934).

A reagent composed of $\text{UO}_2(\text{NO}_3)_2$, H_2SO_4 , and H_2O can be used for testing the purity of various pharmaceutical preps. If they are pure they will not prevent the characteristic fluorescence of UO_2 salts but if impurities of a certain kind are present, the failure of fluorescence to appear under excitation indicates the presence of impurity. The quantity of some of these substances can be detd. by measuring the vol. of reagent required to produce a soln. that will show fluorescence.

- 2304 von Hevesy, G. and Lay, H. "Fluorescent Yield of X-Ray Emission." Nature **134**, 98-9(1934). The fluorescent yield of the L emission of a great no. of elements and the K-emission yields for several were detd. by a photographic method. The results show an increase of 6 to 45% in the fluorescent yield of the L radiation from Zr(40) to U(92). K-radiation yield is much greater than L radiation of the same wavelength. The M radiation of U is 6%. The K radiation of K, the L radiation of Ag and the M radiation of U, are all of about the same wavelength, and yield fluorescence in the ratio 18:10:6, resp.

- 2305 Weekers, R. "Renal Origin of Albuminuria in Uranium Nitrate Nephritis." Compt. rend. soc. biol. **117**, 817-18(1934).

This paper reports grafting expts. on kidneys of dogs poisoned with U. The glycosuria found in the poisoning is reported from the results to be chiefly renal.

- 2306 Weekers, R. "Renal Origin of Glycosuria in Experimental Uranium Nephritis." Compt. rend. soc. biol. **115**, 1393-5(1934).

The degree of albuminuria in U poisoning provides an excellent measure for the severity of damage to the kidneys. Proof of the renal original of the albuminuria is given in transfusion expts. which are reported. Grafting expts. were also conducted on poisoned dogs.

- 2307 Western, F. and Ruark, A. E. "Half-Life of Actinouranium." Phys. Rev. (2), **45**, 628-9(1934). Values of the half-life of AcU are obtained from data on a Morogoro pitchblende and a uraninite from Great Bear Lake, analyzed by von Grosse and Marble, resp. Computations were made with two extreme values, 0.03 and 0.04, for the Ac "branching ratio," β . Half-life values in 10^8 years are:

β	0.03	0.04
Morogoro	3.23	4.54
Great Bear Lake	4.65	6.21
Mean from 4 minerals	3.38	4.45

- 2308 Wilson, T. A. "The Unit Cell of Uranium Calculated from X-Ray Powder Method Data." Phys. Rev. (2), **43**, 781-2(1934).

- 2309 Yokayama, M. "Uranium Habituation in Rabbits." Trans. Soc. Path. Japon. **24**, 289-91(1934).

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- 2310 Barac, G. "Diazo Reaction in Acute Uranium Nephritis in Dog." Compt. rend. soc. biol. **118**, 1250-1(1935).

- 2311 Barac, G. "New Studies on Determination of Phenols in Blood and Urine by Diazo Reaction in Acid Medium. Application in Uranium Nephritis." Rev. belge sci. méd. **7**, 699-703(1935).

- 2312 Bhatnagar, S. S., Kapur, P. L., and Verma, N. R. "Magneto-Optical Rotation of Uranyl Salts." J. Indian Chem. Soc. **12**, 514-18(1935).

The mol. rotations of uranyl chloride, nitrate, and sulfate were found to be 1.22 ± 0.6 , -5.85 ± 0.4 , and -8.5 ± 0.5 , resp., giving a value of -8.0 ± 0.6 for the uranyl ion in the first 2 cases and -11.46 ± 0.5 with the sulfate ion. Complete analysis showed the formulas of the salts to be UO_2Cl_2 , $\text{UO}_2(\text{NO}_3)_2$ and $2\text{UO}_2\text{SO}_4 \cdot \text{H}_2\text{SO}_4 \cdot 5\text{H}_2\text{O}$.

- 2313 Binet, L. "Acute Nephritis (Therapeutic Experiment)." In Lecons de Physiologie Médico-Chirurgical. Paris, Masson et Cie, 1935. p.117-24.

In rabbits poisoned with 3 mg U nitrate/kg, injections of physiological or hypotonic NaCl were without benefit. As the alk. reserve fell as low as 12 to 15 vol. %, therapeutic attempts were made to maintain it. Among 12 rabbits receiving 40 cc of NaHCO_3 soln. and 12 receiving 100 cc of CO_2 gas subcutaneously, 9 of each group survived, as against 100% mortality in the controls.

- 2314 Bridgman, P. W. "Compressibilities and Electric Resistance under Pressure, with Special Reference to Intermetallic Compounds." Proc. Am. Acad. Arts Sci. **70**, 285-317(1935).

Detailed results are given on the compressibilities and the changes in resistances under pressures up to 12,000 kg/cm^2 at 30 and 75° for a large no. of cpds. Corr. earlier results on Al, Cu, Co, Ca, Ge, Au, Pb, Mo, nichrome, Ni, Pd, Pt, Ag, Sr, Ta, and U also are given.

- 2315 Brintzinger, H. and Eckardt, W. "Oxalato Compounds." Z. anorg. allgem. Chem. **224**, 93-6 (1935).

The ionic formula, for the ion in aq. soln., was established by means of dialysis coeff. for $[\text{UO}_2(\text{C}_2\text{O}_4)_2]^{--}$. The oxalato ions that had trivalent central ions or the bivalent central ions TiO^{++} , VO^{++} , and UO_2^{++} have, in aq. soln., the compn. indicated by the analyses of their solid cpds. Ions that had bivalent metallic ions or Th^{+4} as central ions have, in aq. soln., a weight exactly double that corresponding to analyses of their solid cpds., and the oxalato ion of Zr has 4 times this weight. Whenever the ionic weight of a complex oxalato ion, in aq. soln., deviates from that of the simplest assumable ion, it is always a whole multiple of the wt of the simplest ion, usually twofold. This is found also to apply to complex sulfato ions.

- 2316 Brull, L. "Mechanism of Glycosuria and Albuminuria in Experimental Uranium Nephritis." Arch. maladies reins org. génito-urin. **9**, 83-9(1935).

- 2317 Brull, L. "Reversibility of Acidosis from Acute Nephritis from Uranium Nitrate." Compt. rend. soc. biol. **118**, 811-12(1935).

It is suggested that acidosis found in U poisoning is due to a reduced ability of the body to catabolize acid. It is probably closely connected with the changes brought about in the N metabolism.

- 2318 Brull, L. and Hairs, E. "Experimental Uranium Nephritis. Action of Insulin on Acidosis." Compt. rend. soc. biol. **118**, 1632-4(1935).

The changes in alk. reserve of U-poisoned dogs, with and without insulin addn., are shown.

- 2319 Bunte, K. and Lang, A. "The Influence of Catalysts on the Thermal Decomposition of Paraffin Hydrocarbons." Gas Wasserfach 78, 73-80, 98-101(1935).

In cracking oils in the carbureted-water-gas process, the aim is to secure a high thermal yield of high-Btu gas with a high CH_4 content, and this investigation was made to det. the effect of various catalysts and atms. Cracking expts. were made with a paraffin oil and pumice and U oxide catalysts at 600, 700, 800, 900, and 1000°, and with the other catalysts at 800 and 900°. U oxide was the best catalyst, giving highest yields of CH_4 and its homologs and the highest thermal yield of gas. The next highest yields were given by broken pottery, pumice, and coke, these being nearly equal to one another in value. Ni caused too great decompn. of the oil to H_2 . Addns. of alk. to the U oxide failed to increase its eff., and no catalyst was found that gave the desired high CH_4 yields. Much more satisfactory results were secured by cracking in a H_2 atm.

- 2320 Buttgenbach, H. "A Uranium Sulfate from Katanga." Bull. Inst. roy. colonial belge 6, 449-55 (1935).

The Kalsolo ore is remarkably pure, qual. tests having shown the presence of only UO_2 , SO_3 , H_2O , and no traces of Pb, Ca, or Cu. It is insol. in H_2O , but easily sol. in acids. The U is present as $2\text{UO}_2\text{SO}_4 \cdot 7\text{UO}_2(\text{OH})_2 \cdot 18\text{H}_2\text{O}$. When heated to 115° the mineral acquires a beautiful orange color; it is completely dehydrated at 175°, turns brown at 300° and dark green or black at red heat. The radioactivity, detd. electroscopically, is 1.5 times that of UO_3 .

- 2321 Buttgenbach, H. "A Uranium Sulfate from Katanga." Chimie industrie 35, 79(1935). This is a condensation of the paper published in Bull. Inst. roy. colonial belge 6, 449-55(1935).

- 2322 Chatterjee, N. P. "Coagulation of Ferrocyanide Sols Containing Varying Amounts of Potassium Ferrocyanide." J. Indian Chem. Soc. 12, 671-85(1935).

This describes an extension of previous work to sols of Prussian blue, and of U, Al, Cu, Zn and Cd ferrocyanides. Concns. of chlorides expressed as milliequiv./l necessary to coagulate Prussian blue follow the series $\text{K} > \text{Ba} > \text{Ag}(\text{NO}_3) > \text{Al} > \text{Th}$. The other sols were pptd. in presence of varying amts. (0.05 to 1000 milliequiv.) of $\text{K}_4\text{FeC}_6\text{N}_6$. Amt. of KCl necessary increased generally with increase in amt. of $\text{K}_4\text{FeC}_6\text{N}_6$. At high concns. the effect was irregular. Sols were prepd. by pptn. and then alternate washing and centrifuging until peptization occurred. Coagulating concn. was detd. by finding the least concn. of salt necessary to produce a clear supernatant liq. upon centrifuging for 8 min, the sol with electrolyte. Data and curves are given.

- 2323 D'yachkovskii, S. I. and Ivanova, M. F. "Uranium Colloids." Zhur. Obshchei Khim. 5, 638-42 (1935).

Two new methods of prepn. were studied. In the first, 2 to 90 cc of 0.1N $\text{UO}_2\text{CO}_3 \cdot 2(\text{NH}_4)_2\text{CO}_3$ was added to 50 cc of 0.1N tartaric acid. The mixt. contg. 60 cc of the U soln. had max. opalescence and min. viscosity; (a) was max. for mixts. contg. 40 to 60 cc of the U soln., while n increased with the amt., reaching a const. value at 60 cc. This would indicate cpds. of U and tartaric acid. The elec. cond. increased with time when the mixts. were kept in the dark. The viscosity, in general, decreased; after 40 days, the mixt. contg. 60 cc of U soln. had the min. viscosity. Exposure of the mixts. to light caused rapid decompn. of the org. cpds., as shown by the color change from yellow to brown, cond. decrease, and eventual pptn. after 2 months. The ppts. were peptized by water. Evapn. of freshly prepd. mixts. yielded glutinous residues. Hence the mixts. were lyophilic sols. Another series of mixts. was prepd. with UO_3 , tartaric acid, and NaOH as the variable components. Stable sols resulted from small amts. of UO_3 and a slight excess of NaOH. Larger amts. of NaOH caused pptn. This was graphically illustrated by plotting the compn. of the mixts. on a triangular diagram. The sols. showed a faint Tyndall cone and on evapn. left amorph. sticky residues. Hence, the sols were lyophilic. The photosensitivity of the U tartrate cpds. is a property common to the org. cpds. of radioactive elements. The catalytic effect of light is due to the additional energy added by the photons.

- 2324 Eck, M. and Desbordes, J. "Comparative Amount of Azotemia and Indoxylemia in Experimental Hepatonephritis Provoked by Uranium." Bull. soc. chim. biol. 17, 344-7(1935).

2325 Fankuchen, I. "Crystal Structure of Sodium Uranyl Acetate." Z. Krist. 91, 473-9(1935). $\text{NaUO}_2(\text{C}_2\text{H}_3\text{O}_2)_3$ is cubic, space group $T^4 - P^2_1$. The unit-cell size is 10.670 ± 0.001 A., with 4 mols. On the basis of packing considerations and symmetry, the OAc groups are located approx. and are assumed to be planar and sym. Parameters are as follows; (1) atoms in special positions, U, 0.428 ± 0.002 ; O, 0.55 and 0.31 ± 0.02 ; Na, 0.81 ± 0.03 ; (2) atoms in general positions, O_I $0.26, 0.46, 0.84$; O_{II} $0.32, 0.48, 0.62$; C, $0.33, 0.45, 0.74$; Me group $0.44, 0.35, 0.77$. These values, obtained by the rotation method, differ somewhat from the powder-photograph results of De Jong.

- 2326 Francis, M. and Tchong, D-T. "Preparation of Thin Layers of Urano-Uranic Oxide by Electrolysis." Compt. rend. 200, 1024-7(1935).

The oxide is deposited on a horizontal Pt cathode with the anode in the form of a stirrer, from a soln. contg. 10 mg. U_3O_8 (as nitrate), 2.25 cc N HOAc and 2 cc 1N NH_4OH , made up to 15 cc with EtOH, at 60° . The deposit is washed with alc. and heated in an electric furnace. Adherence is good if the thickness of the deposit is < 0.2 mg/cm². The arrangement is calcd.

- 2327 Francis, M. "Electrolytic Method of Preparing Thin Layers of Urano-Uranic Oxide." Compt. rend. 201, 473-4(1935).

The method applied to insufficiently purified $\text{UO}_2(\text{NO}_3)_2$ does not give a pure deposit of U_3O_8 . With a more concd. soln. of the impure salt the radioactivity of the first few mg of deposit is very much greater than that of U_3O_8 , and presence of Pa, Ra, and Po, as well as of nonradioactive elements and ionium and UX was proved (cf. Colley). These deposits were very difficult to remove from the Pt cathode; cleaning with strong acid only spread the Pa and Po more uniformly over the whole disk.

- 2328 Ghosh, J. C., Narayanamurthi, D. S., and Roy, N. K. "The Photochemical Oxidation of Mandelic Acid by Methylene Blue with Uranyl Nitrate as Photosensitizer." Z. physik. Chem. B. 29, 236-46(1935).

The reaction was studied at 4360, 3660, 3130, 3340, and 2540 A. The exptl. results are represented by

$$dx/dt = I_0 K_4 (M) / N h \nu (k_2 + k_4 (M)) - (1 + k_3 (U)) / (k_2 + k_4 (M)),$$

where I_0 is the light absorbed by $(\text{UO}_2)^{++}$, (M) and (U) are the concns. of mandelic acid and $(\text{UO}_2)^{++}$, resp. Values of k_2 and k_3 are taken from the investigation of the photoluminescence of uranyl salts reported earlier, and the results are in good agreement with experience.

- 2329 Haberlandt, H., Karlik, B., and Przibram, K. "Fluorescence of Fluorite. IV. The Detection of Uranium in Fluorites and the Low-Temperature Fluorescence." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse, Abt. IIa, 144, 135-40(1935).

While suitable heating will destroy the low-temp. fluorescence of fluorites due to rare earths, some fluorites possess a weak greenish-blue fluorescence on cooling after most intensive heating. Examn. of the spectra of this fluorescence suggested U as the cause, and it was found that synthetic CaF_2 with added U gave the same fluorescence. Comparison of the photometric curves of the natural fluorite and the synthetic CaF_2 with added U showed them to be identical. From U-band intensities of the natural compared to the synthetic with known U content, the U content of the Wolsendorf fluorite was found to be 7.5×10^{-6} and of the Weardale fluorite 1.8×10^{-6} U/g. Further observations on low-temp. fluorescence of fluorites leads to the restatement of the earlier rule of Haberlandt. The yellowish-green low-temp. fluorescence of Yb appears the more frequently and the more dominantly the nearer the fluorite occurs to acid eruptive rocks.

- 2330 Hecht, F. "Counting α Particles from Uranium." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse, Abt. IIa, 144, 213-15(1935).

An account is given of the detn. of the weight of U in the two samples of U oxide used in another investigation.

- 2331 Henkel, P. and Klemm, W. "Magnetochemical Investigations. XII. The Magnetic Behavior of Some Liquid Fluorides." Z. anorg. allgem. Chem. 222, 70-2(1935).

The specific magnetic susceptibility and the mol. susceptibility as found, and as computed by the Angus method are listed for a no. of fluorides. For UF_6 values of +0.12, +43, and about -70 are reported.

- 2332 Hernegger, F. and Karlik, B. "Uranium Content of Sea Water." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse, Abt. IIa, 144, 217-25(1935).

A known amt. of the substance under examn. is fused with NaF on a loop of Pt wire so as to form a bead precisely similar to a series of std. beads of NaF contg. known amts. of U (10^{-10} to 10^{-6} g). The fluorescent spectrum of such beads, produced by illumination with a Hg lamp, is photographed with suitable exposure (blackening is inversely proportional to U content for amts. 10^{-8} to 10^{-6} g), using a spectrograph and microphotometer. By this means the U content of sea water on the west coast of Sweden was detd. as 0.36 to 2.3×10^{-6} g/l.

- 2333 Highriter, H. W. and Lilliendahl, W. C. "Embrittlement of Uranium by Small Amounts of Aluminum and Iron." Metals Technol. 2, Tech. publ. no. 630(1935).

It was found that a small amt. of Al (0.2%) or Fe (0.5%) makes U brittle. Both impurities are usually present in considerably smaller amts. Carbide, i.e., U carbide (0.08%), does not affect the ductility of U.

- 2334 Highriter, H. W. and Lilliendahl, W. C. "Embrittlement of Uranium by Small Amounts of Aluminium and Iron." Trans. Am. Inst. Mining Met. Engrs. 117, 381-6(1935).

The cause of the embrittlement of electrolytic U is investigated. Serious embrittlement is caused by the presence of 0.2% Al, while 0.5% Fe produces moderate embrittlement. Small amts. of carbide do not affect the ductility. The source of the impurities was the graphite crucible used for the electrolysis.

- 2335 Hirst, H. and Alexander, E. "Intensity Ratios of the Fluorescent X-Ray Emission Lines in the L-Region and Their Dependence on the Voltage." Phil. Mag. (7), 19, 918-27(1935).

The L-emission lines of W, Tl, and U were investigated. For lines originating from the same electron level the intensity ratios are independent of the tube voltage. The other ratios reach max. values at from 3 to 4 times the excitation voltage. The ratios are the same whether the lines are excited by cathode rays or by x rays.

- 2336 Ishibashi, M. and Harada, Y. "Electrolytic Determination of Uranium and Its Recovery from the Filtrate of Sodium Magnesium Uranyl Acetate Precipitation." J. Chem. Soc. Japan 56, 1234-6(1935).

Add Br_2 to the filtrate from Na Mg uranyl acetate. Filter again and ppt. U with NH_3 . Dissolve the ppt. in dil. HOAc, add $(\text{NH}_4)_2\text{CO}_3$ and alc. Electrolyze at 60 to 70° at 6 v.

- 2337 Ishimaru, S. "Separation and Determination of Metal and Phosphate Ions in the Presence of One Another. II." Science Repts. Tōkoku Imp. Univ., First Ser. 24, 493-516(1935).

Analytical procedures are given for the sepn. of Mg, Al, Zn, Fe, Mn, Ni, Co, Cu, Cd, Bi, Th, Ti, U, V, and W, from P_2O_5 by pptn. with 8-hydroxyquinoline in tartrate solns. contg. HOAc, $(\text{NH}_4)_2\text{C}_2\text{O}_4$, $\text{CH}_3\text{-CONH}_4$, or excess of NH_4OH .

- 2338 Jacoby, M. "Composition of Residual Nitrogen in Experimental Uranium Poisoning." Biochem. Z. 281, 198-9(1935).

Rabbits intoxicated with U nitrate showed higher, sometimes remarkably higher, nonprotein nitrogen; the urea N fraction was always greater than normal. The values correspond to Nonnebruch's azotemia I. The kidney is not the sole, but a certain, primary point of attack in U poisoning.

- 2339 Kapur, P. L. and Verma, M. R. "Anomalous Magnetic Rotation of Uranyl Nitrate." Current Sci. (India) **3**, 419(1935).

Uranyl nitrate shows a neg. Faraday effect with a mol. magnetic rotation of 5.2. Uranyl nitrate and TiCl_4 are the only diamagnetic substances that show a neg. rotation.

- 2340 Kogler, F. "The Determination of Sodium Using Sodium-Magnesium-Uranyl-Acetate." Angew. Chem. **48**, 561-5(1935).

Kahane's method for Na detn. was tested. Small amts. of K interfere with Na detn. although NH_4 and Ca salts, even when present in large excess, do not. Bad results are obtained in the presence of $\text{Ba}(\text{ClO}_4)_2$. A procedure is described in which K is removed with HClO_4 and the interfering ions with alk. earth salts, which, if necessary, may be repptd. by $(\text{NH}_4)_2\text{C}_2\text{O}_4$ and NH_3 . Considerable explanatory data are presented along with 5 references.

- 2341 Lal, J. B. and Dutt, S. "Metallic Uranium in Organic Synthesis." J. Indian Chem. Soc. **12**, 389-94(1935).

Friedel-Crafts reaction with U powder gave small yields of biphenyl from C_6H_6 and PhBr or PhCl, and PhI. No reaction took place between CHCl_3 and C_6H_6 but 0.9 g of Ph_3CH was produced by refluxing 30 g of C_6H_6 with 12 g of PhCHCl_2 in the presence of 4 g of U dust for 8 hr. By heating a mixt. of 15 g of PhCCl_3 and 50 g of C_6H_6 with U for 8.5 hr at 115 to 128° and distg. the reaction mixt. 4.2 g of Ph_2CCl_2 and 1.2 g of Ph_3CCl were isolated. Similarly from C_6H_6 with AcCl and BzCl small yields of AcPh and BzPh were recovered. The reaction was unsuccessful with mixts. of CCl_4 and C_6H_6 and PhI and PhNH_2 . Attempts to carry out Ullmann's reaction in the presence of U were not encouraging. No result was obtained with CCl_4 and only small yields resulted on refluxing PhBr, PhCl, PhI, $\text{ICH}_2\text{CH}_2\text{CO}_2\text{H}$, mixts. of $\text{BrCH}_2\text{CO}_2\text{Et}$ and AcOEt, PhOH and PhBr, and $\text{ClCH}_2\text{CO}_2\text{Na}$ and anhyd. NaOAc with U powder. More satisfactory results were obtained in Zincke's reaction. By the action of PhCH_2Cl on C_6H_6 dried over Na, in the presence of U, 40% of pure Ph_2CH_2 was formed in addn. to symtriphenylethane and a mixt. of *o*- and *p*-dibenzylbenzenes. A small amount of a S-yellow hydrocarbon, m.p. 71°, was also recovered. Treatment of PhOEt and PhOMe with PhCH_2Cl gave 80% yields of *p*-ethoxydiphenylmethane and 53% anisylphenylmethane, together with some dibenzylanisole. Reformatsky's reaction with a mixt. of 12 g of AcPh, 17 g of $\text{BrCH}_2\text{CO}_2\text{Et}$ and 70 cc of dry C_6H_6 in the presence of 35 g of U dust gave a feeble reaction on warming. A crystal of I was added and after refluxing for 10 hr over an oil bath at 120 to 130°, the reaction mixt. was decompd. with ice-cold dil. HCl. The washed and dried C_6H_6 layer was fractionally distd. at reduced pressure and yielded 2.4 g of phenylmethylhydroxypropionic ester. An unsuccessful attempt was made to make a Grignard reagent from U and PhBr.

- 2342 Lal, J. B. "Metallic Uranium in Organic Synthesis. II." J. Indian Chem. Soc. **12**, 616-21(1935). The action of PhCH_2Cl on MePh, PhOH, *p*- $\text{MeOC}_6\text{H}_4\text{OMe}$ and on the higher hydrocarbons, such as C_{10}H_8 , acenaphthene and Ph_2 , in the presence of metallic U has been investigated and the various isometric mono- and dibenzyl derivs. have been isolated and characterized. Attempts were also made to prep. hexanitrobiphenyl from picryl chloride and 4,4-dinitrobiphenyl from *p*- $\text{O}_2\text{NC}_6\text{H}_4\text{Cl}$. It was found that U cannot be used as a neutral reducing agent in either aq. or aq. alc. solns. since attempts to reduce Ph_2CO , *p*- $\text{O}_2\text{NC}_6\text{H}_4\text{Me}$, and 2,4,6-(O_2N) $_3\text{C}_6\text{H}_3\text{OH}$ were unsuccessful. A mixt. of *p*- $\text{MeOC}_6\text{H}_4\text{OMe}$ (16 g), PhCH_2Cl (10 g), and U (3 g) was gradually heated to 70°. After the vigorous evolution of HCl the product was heated at 110 to 120° for 4 hr. The material was extd. with benzene and the filtered, washed, dried, and evapd. ext. was fractionated, yielding 12.6 g (66.3%) of benzylquinol di-Me ether, b. 353-5°, and 0.8 g of rhombic crystals, m. 104-5°. Similar condensation of PhCH_2Cl (16 g) with PhOH (21 g) gave *o*- and *p*-benzylphenols (3 g and 18.7 g), together with 2.2 g of *p*-benzylphenol benzyl ether, b. 365-7°. A mixt. of 25 g of PhCH_2Cl , 46 g of MePh and 4 g of U yielded 20 g of *p*- $\text{PhCH}_2\text{C}_6\text{H}_4\text{Me}$ and 11 g of dibenzyltoluene but no bibenzyl was formed. Condensation of PhCH_2Cl with C_{10}H_8 gave α - and β -benzyl-naphthalene. None of the 3 α -, β -, and γ -dibenzyl-naphthalenes could be isolated from the higher boiling fractions. Acenaphthene gave 5-benzylacenaphthene together with β -benzylacenaphthene, m. 45-6°; picrate, m. 101-2°. The α - and β -benzylbiphenyls, m. 44-5 and 51-6°.

- 2343 MacNider, W. deB. "Acquired Resistance of Liver Cells to the Toxic Action of Uranium Nitrate." Proc. Soc. Exptl. Biol. Med. **32**, 791-3(1935).

This paper discusses the results of subcutaneous U nitrate administration in dogs. The fatal dose is reported for the av. dog to be slightly greater than 2 mg U/kg.

- 2344 MacNider, W. deB. "The Resistance of Fixed Tissue Cells to the Toxic Action of Certain Chemical Substances." Science **81**, 601-05(1935).

Tissue resistance is usually conceived as due to the activity of wandering cells, or to the production of specific immune bodies. Little or no consideration has been given to the resistance which may be acquired as a repair process secondary to injury on the part of fixed tissue cells. Dogs are given 2 mg/kg of U nitrate subcutaneously, develop a moderate grade of injury to renal epithelium and to liver epithelium. Such slight injury is followed by repair of these tissues with a normal type of cell. A repair process with this type of cell fails to impart to these organs any protection against U. If dogs are intoxicated with 4 mg/kg, a severe injury develops in both the kidney and the liver which is repaired by an abnormal atypical, flattened type of cell which is frequently syncytial in its structure; the epithelium of the kidney then becomes resistant to the same amt. or a larger amt. of U nitrate, and also to HCCl_3 . In senile dogs that have acquired naturally, for some unknown cause, an abnormal type of hepatic epithelium, this epithelium is resistant to U and HCCl_3 .

- 2345 Martin, E. and Sciclounoff, F. "Action of Dextrose Solutions on Development of Experimental Uranium Nephritis." Compt. rend. soc. biol. **118**, 752-4(1935).

- 2346 Montignie, E. "A study of Some Tellurates." Bull. soc. chim. France (5), **2**, 864-6(1935). Various aq. solns. were treated with aq. Na_2TeO_4 to give ppts. $\text{UO}_2(\text{NO}_3)_2$ gave yellow gelatinous $\text{UO}_2\text{TeO}_4 \cdot 2\text{Na}_2\text{TeO}_4 \cdot 4\text{H}_2\text{O}$. This and ppts. with other non-U salts were sol. in dil. acids.

- 2347 Ostroumov, E. A. "Determination of Uranium, Vanadium and Iron in the Presence of Each Other." Zavodskaya Lab. **4**, 754-7(1935).

The volumetric detn. of U, V and Fe in a mixt. is made in 3 aliquot parts of the soln. V is detd. by the Hamner method; V and Fe are detd. by the Zimmermann-Reinhardt method; U, V, and Fe are detd. by Someya's method as modified by Duimov and Volodina. By substituting H_2SO_4 for HCl in the last procedure, the results are improved.

- 2348 Panchenko, G. A. "Iodometric Determination of Titanium, Uranium, Molybdenum and Vanadium in the Presence of Iron by Means of Liquid Amalgams." Zhur. Priklad. Khim. **8**, 361-5 (1935).

Ti, U, Mo, and V are reduced by means of a Zn-Hg in HCl and H_2SO_4 soln. of Ti^{+3} , U^{+3} , Mo^{+3} , and V^{++} . The latter are oxidized with I_2 to the next valency. Fe is reduced with Zn-Hg only to Fe^{++} and it does not react in acid solns. with I_2 . Thus, Ti, U, Mo, and V can be titrated without sepg. Fe. This method is particularly suitable for detns. in Fe alloys and minerals high in these metals.

- 2349 Polonovski, M., Bizard, G., and Boulanger, P. "Ammonia Formation in Renal Cells in Uranium Nephritis in Dogs." Compt. rend. soc. biol. **118**, 989-90(1935).

- 2350 Prins, J. A. "Molecular Arrangement and X-Ray Diffraction in Ionic Solutions." J. Chem. Phys. **3**, 72-80(1935).

Aq. solns. of heavy ions were examd. with Cu $\text{K}\alpha$ radiation. The x-ray diffraction patterns of satd. solns. of $\text{Th}(\text{NO}_3)_4$ and $\text{UO}_2(\text{NO}_3)_2$ consist mainly of a pronounced ring, which shifts to smaller angles and becomes fainter with diln. This indicates a more or less regular arrangement of ions in the liq., which is called superarrangement to distinguish it from the arrangement with smaller periodicity of the H_2O mols. Both are "liq. type" arrangements. The superarrangement expands and becomes diffused with diln.

- 2351 Prins, J. A. and Fonteyne, R. "Diffraction of X-Rays in Some Solutions." Physica 2, 1016-28 (1935).

Previous work of the authors is confirmed and extended. In addn. to the cases already reported of $\text{Th}(\text{NO}_3)_4$ and $\text{UO}_2(\text{NO}_3)_2$ it appears that a "superarrangement" of the cations at least is present with ThCl_4 , UO_2Cl_2 , $\text{La}(\text{NO}_3)_3$, $\text{Ni}(\text{NO}_3)_2$, ZnCl_2 , ZnI_2 , NiCl_2 . Some of the multivalent anions seem to show a superarrangement. With univalent cations or anions no superarrangement could be found. A rule summarizing the results is given.

- 2352 Rentschler, H. C. and Henry, D. E. "The Photoelectric Threshold of Uranium, Calcium, and Thorium Treated with Limited Amounts of Oxygen." Phys. Rev. (2), 47, 807(1935).

This is an abstract of a paper read before the American Physical Society. At a meeting of the Optical Society the authors reported a shift in the photoelectric threshold toward the longer wavelength when a surface of pure Th is allowed to react with a small amt. of O_2 . U and Ca are found to possess this same property. The photoelectric work-functions for these O-treated surfaces agree remarkably well with the thermionic work-functions obtained by Dushman in J. Inst. Metals 30, 542, (1923) for activated W filaments contg. oxides of these metals. The amt. of O_2 required for best results depends on the area and thickness of the active coating. The threshold shift is definitely obtained before the interaction with the O_2 is complete. Excessive amts. of O_2 again completely destroy the photoelectric activity in all cases.

- 2353 Roersch, C. "Contribution to the Study of Experimental Nephritis. Mechanism of Acidosis." Arch. intern. physiol. 40, 329-56(1935).

This study of U nitrate nephritis in the dog sought to det. the relative importance, in producing acidosis, of alternations in NH_3 secretion, the loss of fixed base, and the accumulation of acids in the blood. In the entire animal it is found that the kidney loses a large part of its ability to secrete NH_3 and that the acidosis does not stimulate NH_3 formation. Crossed circulation expts. are used in which a normal donor and a nephritic donor are connected in turn to the kidney of a normal animal. These show that the nephritic blood is not toxic and it augments the formation of NH_3 by the normal kidney. It is concluded therefore that the hypoammonuria of nephritis is due to lesions of the cells of the kidney. By the same method it is found that the inorg. acid of the nephritic blood is quite variable from one expt. to another and is in no case sufficient to account for the acidosis. The org. acids of both the blood and urine are considerably increased. It is concluded that the production of these acids from the disintegration of protein is responsible for the acidosis, which amts. to about 0.3 pH units.

- 2354 Ruark, A. E. and Maxfield, F. A. "X-Ray Levels of Radioactive Elements with Applications to Beta and Gamma-Ray Spectra." Phys. Rev. (2), 47, 107-14(1935).

Tables of x-ray energy levels for U in terms of international ev, are given as calcd. from emission lines and outside levels which are derived from optical data.

- 2355 Schiedt, R. "Counting α -Particles from Uranium." Sitzber Akad. Wiss. Wien, Math.-naturw. Klasse, Abt. IIA 144, 175-211(1935).

A detailed description of an app. incorporating electrometer valves for counting the α particles from U is given. The no. emitted/sec/g U_I was found to be $1.264_5 \times 10^4 \pm 0.70\%$, corresponding to a decay const. of U_I of $1.567_3 \times 10^{-10} \text{y}^{-1} \pm 0.70\%$.

- 2356 Schleicher, A. "Qualitative Microanalysis by Electrolysis and Spectrography." Z. anal. Chem. 101, 241-54(1935).

The method described, which is exceedingly delicate, is based on a preliminary electrolysis of about 0.1 cc of soln. with a feeble current. The soln. is placed on the lid of a Pt crucible which serves as anode during the electrolysis. As cathode, a very thin piece of Cu wire or a tiny rod of spectrographically pure C serves. After the electrolysis the Pt lid is removed and replaced as anode by a piece of the same material as the cathode, and the residue and soln. are evapd. in the elec. arc. The vapor between the electrodes is examd. in the spectrograph. The electrolysis is carried out first in acid and then in ammoniacal soln. The most characteristic lines which serve for the detection of Ag, Hg, Bi, Pb,

Tl, Cd, Zn, In, Mo, V, Sn, Sb, As, Te, Se, Re, Au, Pt, Ga, Ge, Ni, Co, U, Mn, Fe, Cr, and Al are indicated. The spectra are obtained partly by the volatilization of deposited metal but also partly by the volatilization of salts in soln.; results are obtained under conditions such that there is no electrodeposition of metal. The procedure is described fully.

- 2357 Schoep, A. and Billiet, V. "Crystal Lattice of Uraninite." Ann. soc. géol. Belg. Bull. 58, 198-206(1935).

- 2358 Shibata, Y. and Harai, K. "Studies on the Absorption Spectra of the Solutions of Colored Metallic Salts at Low Temperatures." J. Chem. Soc. Japan 56, 1-18(1935).

Absorption spectra of 12 salts including $\text{UO}_2(\text{NO}_3)_2$, in various org. solvents were taken at room temp. as well as at low temp. (-60 to -80°). The spectra of the acetone solns. of CoCl_2 , CoBr_2 , and of $\text{UO}_2(\text{NO}_3)_2$ at low temps. show many bands.

- 2359 Sumegi, S. "Experimental and Morphological Investigation on Complex Hepatic Symptoms of Tumorous Animals." Frankfurt. Z. Path. 48, 398-406(1935).

Poisoning tumor-bearing animals with cantharidin induces a phase of the complex in which the kidney lesions dominated. Poisoning with U nitrate induces another phase in which the liver damage dominates. Partial resection of the liver does not induce these changes. Terminally, HCCl_3 poisoning represents the severest form of the symptom complex.

- 2360 Takahashi, S. "Influence of Changes in Volume of Liquid in Blood on Amount of Circulating Blood in Normal and Pathologic Conditions. Influence of Infusions of Sodium Chloride in Animals Poisoned with Uranium." Tôhoku J. Exptl. Med. 25, 531-49(1935).

- 2361 Takahashi, S. "Influence of Changes in Volume of Liquid in Blood on Amount of Circulating Blood in Normal and Pathologic Conditions. Changes Following Infusion of Rubber Solution in Animals Poisoned with Uranium." Tôkoku J. Exptl. Med. 25, 550-63(1935).

- 2362 Takahashi, S. "Influence of Changes in Volume of Liquid in Blood on Amount of Circulating Blood in Normal and Pathologic Conditions. Influence of Venesection in Animals Poisoned with Uranium." Tôhoku J. Exptl. Med. 26, 60-72(1935).

- 2363 Tixier, L., Eck, M. and Desbordes, J. "Comparative Amounts of Blood and Tissue Nitrogen Retention in Experimental Hepatonephritis Due to Uranium Nitrate in Rabbits." Bull. soc. chim. biol. 17, 893-6(1935).

- 2364 van Aubel, R. "Crystalline Uranite from Kasolo-Shinkolobwe, Katanga." Ann. soc. géol. Belg. Pubs. relat. Congo Belge 58, 42-48(1935).

- 2365 Weekers, R. "Glycosuria in Uranium Nephritis and Its Modifications in Course of Experimental Hypoglycemia Produced by Insulin." Compt. rend. soc. biol. 118, 1252-3(1935).

- 2366 Weekers, R. "Metabolism of Sugar in Course of Experimental Nephritis Produced by Uranium Nitrate." Compt. rend. soc. biol. 118, 1254-5(1935).

- 2367 Young, R. S. "Certain Rarer Elements in Soils and Fertilizers and Their Role in Plant Growth." Cornell Univ. Agr. Expt. Sta. Mem. No. 174, 1-70(1935).

Analyses of 53 samples of fertilizers obtained from 14 manufacturers and distributors showed that As, Ba, B, Br, Cr, Cu, I, Pb, Mn, Sr, Ti, and V, were present in determinable amts.; traces of Li, Sn, and Zn were detected in few samples. effect of 35 rarer elements added to Merrimac coarse sandy loam in 5 concns., (2000, 500, 100, 10, and 0.1 ppm) on the growth of timothy receiving a pure-fertilizer mixt. of N, P, and K, was investigated. Mo was found to be stimulating to timothy at the highest concn. employed Sb, Ba, Bi, Br, Ce, Mn, Sr, W, U, and Yt were beneficial at 500 ppm.

- 2368 Zhirov, N. F., Get'man, T. E., and Matenko, E. Y. "The Preparation of Phosphorescent Substance. IX. X-Ray Luminophores." *Zhur. Priklad. Khim.* 8, 848-63(1935).

The characteristic feature of the x-ray luminescence is the absence of org. x-ray luminophores. The vitreous state of many luminophores and x-ray luminophores is not confined to the limits of the theory of the deformation of crystal lattices. It is assumed that in addn. to the accepted chain structure of the centers characteristic for the vitreous luminophores there also exists an activator in the form of an association of org. mols. or colloidal particles of free elements. The structure of the vitreous luminophores can be explained by means of the theory of deformation of the lattice of the crystal luminophores occurring through an orientation of the mols. through the influence of the activator as well as through the effect of light. Among the U cpds. the highest x-ray luminescence was observed with $\text{UO}_2\text{F}_2 \cdot 4\text{NH}_4\text{F}$. The yields and the qualities of the latter are improved by pptg. with alc. This permits the prepn. of a finely crystd. product with good x-ray fluorescence properties. The K and Na salts have similar properties. In their intensity the uranyl fluorides are inferior in the following decreasing order: Zn_2SiO_4 , $\text{BaPt}(\text{CN})_4$, $\text{UO}_2\text{F}_2 \cdot 4\text{NH}_4\text{F}$, $\text{UO}_2\text{F}_2 \cdot 4\text{KF}$, $\text{UO}_2\text{F}_2 \cdot 4\text{NaF}$. The last two salts have no practical value. $\text{UO}_2\text{F}_2 \cdot 4\text{NH}_4\text{F}$ is fluorescent in silent discharges in the presence of air (at atmospheric pressure). Forty-three references are given.

PUBLICATIONS LOCATED IN 1936

- 2369 Axt, M. "Volumetric Determination of Uranium." *Ing. chim.* 20, 23-9(1936).
To 100 ml of soln. contg. 0.5 g of $(\text{UO}_2)^{++}$ salt in 2% H_2SO_4 , add 10 to 15 ml of filtered Zn-Hg (15 g Zn in 500 g Hg) and shake for 3 min. Filter through cotton and pass air through the soln. for 5 to 10 min. Add 10 ml of 20% $\text{Fe}_2(\text{SO}_4)_3$ soln. and titrate with 0.1N KMnO_4 .
- 2370 Bachelet, M. "Precipitation of Uranium with Ferric Hydroxide." *Compt. rend.* 203, 69-71 (1936).
The process depends on pptn. of $\text{Fe}(\text{OH})_3$ from a soln. of $\text{UO}_2(\text{NO}_3)_2$ (best contg. 200 g/l) to which Fe^{+3} has been added, by rather less than the equiv. amt. of NH_3 (0.1394M for the above soln.). The pptn. is completed by boiling. The $\text{Fe}(\text{OH})_3$ is then dissolved in hot aq. HCl, concd., and poured into a large excess of $(\text{NH}_4)_2\text{CO}_3$ soln. contg. a $(\text{NH}_4)_2\text{S}$, thereby causing pptn. of the Fe, while U and UX pass into soln. as double carbonates. The soln. after concn. by boiling, is acidified with HCl, boiled, and filtered from pptd. S. The filtrate contg. only U and UX is pptd. with NH_3 , and the ppt. calcined to U_3O_8 . The yield in UX is 85 to 95%.
- 2371 Benedetti-Pichler, A. A. and Spikes, W. F. "Methods of Separation in the Aluminum-Chromium Group." *Mikrochemie Festchrift von Hans Molisch* 36-41(1936).
The sepn. of Be, Zn, and U as recommended by Noyes and Bray is often defective, and in complicated mixts. these elements often escape detection. Several schemes were tried to overcome the difficulties. An attempt was made to sep. Be and Zn in a buffered acetate soln. by treatment with 8-hydroxyquinoline; the method is excellent when U is absent but this element ppts. with Zn. The 2nd scheme tried called for pptn. of ZnS in a buffered soln. and in this way very small quantities of Zn could be detected except that about 1% of Be ppts. with the Zn. A 3rd scheme was the attempt to ppt. Be by means of an excess of NH_3 which should keep all the Zn in soln. but does not. Finally a scheme of analysis was adopted which depends first upon the extn. of AlCl_3 with Et_2O and identification as $\text{CsAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$. Then the residual soln. contg. Zn and Be is made basic with NaOH. Zn is deposited electrolytically and identified as $(\text{Zn}, \text{Cu})\text{Hg}(\text{CNS})_4$. In the soln. remaining after electrolysis, any U present is removed by evapg. to dryness and extg. with CHCl_3 and Be is confirmed by the quinalizarin test.
- 2372 Billiet, V. "Uranotil." *Natuurw. Tijdschr. (Belg.)* 18, 79(1936).
- 2373 Billiet, V. "Uranotil and Sklodowskite." *Natuurw. Tijdschr. (Belg.)* 18, 284-301(1936).

2374 Cauchois, Y. "L α Satellites of Hf, Ta, Re, Bi, Th, and U." Compt. rend. **202**, 2068-9(1936). In addn. to the nondiagram lines of Hg and Pt already observed, such lines, identified as α^x , α^{ix} and α' have been measured for Hg, Ta, Re, Bi, Th, and U. These facts are inconsistent with Coster and Kronig's theory.

2375 Chen, G. "Microdetermination of Sodium by the Uranyl Zinc Acetate Method and the Titration of Uranium with Cadmium as the Reductant." J. Lab. Clin. Med. **21**, 1198-1202(1936).

Add to 1 cc of the sample, which should contain 0.04 to 0.2 mg Na, 0.5 cc abs. EtOH and 3 cc of the freshly filtered UO_2 -Zn acetate reagent. After 1 to 2 hr, centrifuge, pour off the supernatant liq. wash the pptd. Na- UO_2 -Zn acetate once with 3 cc of glacial HOAc satd. with the triple salt and once with Et_2O . Dissolve the ppt. in 1 cc N H_2SO_4 , insert a Cd stick sharpened at one end to fit the tip of the centrifuge tube and carry out the reduction of the $(\text{UO}_2)^{++}$ for 20 min in a boiling water bath. Cool and titrate the U^{+4} with 0.02N KMnO_4 soln. To prep. the pptg. reagent, dissolve 10 g of $\text{UO}_2(\text{AcO})_2$ in 50 cc boiling H_2O contg. 2 cc glacial HOAc. Mix with soln. prepd. by dissolving 30 g $\text{Zn}(\text{OAc})_2$ in 50 cc H_2O contg. 1 cc glacial HOAc. Heat the mixt. to boiling and filter before use.

2376 Claësson, H. "Some New Investigations upon the L Series of Uranium." Z. Physik **101**, 499-508(1936).

A bent crystal is used as a transmission grating and with this a new detn. is made for the wavelengths of the previously known L lines of the U spectrum. The lines are measured with reference to known K lines. In addn. a no. of new quadrupole and weak dipole lines are observed. The results are discussed with reference to the actual term levels.

2377 Clark, A. R. "Test Tube Flame Test Applied to the Rare Elements." J. Chem. Education **13**, 383-4(1936).

The method of applying the test is described and the sensitivity of Li, Rb, Cs, Au, Be, Sc, In, Tl, Ti, Ge, Mo, U, Se, I, Ru, Rh, Pd, Ir, Os, and Pt is given.

2378 Déribéré, M. "Some Interesting Cases of Fluorescence. I. Fluorescent Minerals." Ann. chim. anal. chim. appl. **18**, 117-19(1936).

Autunite-uranite minerals are among those studied.

2379 Fankuchen, I. "The Structure of Silver Uranyl Acetate." Z. Krist. **94**, 212-21(1936).

$\text{AgUO}_2(\text{C}_2\text{H}_3\text{O}_2)_3 \cdot \text{H}_2\text{O}$ is body-centered tetragonal, with $a = 12.98 \text{ \AA}$, and $c = 2810 \text{ \AA}$, and $Z = 16$. The space group is $\text{C}_{4h}^2 - \text{I}_1^4 \text{a}$. Fourier projections were used to det. parameters as follows: U, $X = 0.210$ and $Y = 0.025$; for Ag, $x = 0.175$ and $y = 0.225$. The structure is a distorted version of that for Na uranyl acetate. On the basis of packing considerations approx. coordinates for the O ats. are derived.

2380 Ghosh, J. C., Banerjee, T. and Bhatta, B. "The Photooxidation of Succinic Acid by Methylene Blue with Uranyl Salts as Sensitizers." Z. physik. Chem. **B32**, 163-7(1936).

The photochem. reaction between succinic acid and methylene blue in the presence of $(\text{UO}_2)^{++}$ was studied at 3660 $\text{\AA}$. The effects of pH of the soln., concn. of succinic acid, intensity of the incident light, and temp. were investigated. Only half the collisions between excited $(\text{UO}_2)^{++}$ and the acid mol. are effective for reaction.

2381 Ghosh, J. C. and Ray, B. B. "The Photochemical Oxidation of Mandelic Acid by Bromine with Uranyl Salts as Ultraviolet Sensitizers." Z. physik. Chem. **B32**, 158-62(1936).

The photochem. oxidation of mandelic acid by Br_2 was studied in CCl_4 soln. below 3130 $\text{\AA}$. where the action is photosensitized by $(\text{UO}_2)^{++}$. The results are in complete agreement with earlier work if it is assumed that each quantum absorbed by $(\text{UO}_2)^{++}$ causes the decompn. of 1 Br_2 mol. into atoms.

- 2382 Ghosh, J. C. and Ray, B. B. "Oxidation of Chloroacetic Acid by Potassium Permanganate at Wave Lengths 366 m μ and 436 m μ with Uranyl Salt as Photosensitizer." J. Indian Chem. Soc. **13**, 1-10(1936).

The course of the reaction was followed by observing the change in concn. of KMnO_4 . The concn. in the reaction cell was measured by observing the absorption of light at 540 m μ with the aid of a König-Marten spectrophotometer. The velocity of reaction is zero mol. with respect to KMnO_4 . With other factors remaining const., the reciprocal of the velocity of reaction plotted against the reciprocal of the concn. of $\text{ClCH}_2\text{CO}_2\text{H}$ gives a straight line. The velocity of reaction is directly proportional to the intensity of incident radiation. It is also influenced by change in concn. of UO_2SO_4 , according to the following equation $\Delta x/\Delta t = K_0 \cdot (I_{\text{abs. by } \text{UO}_2^{++}})/(1 + 9.08 [\text{UO}_2]^{++})$ when the concn. of $\text{ClCH}_2\text{CO}_2\text{H}$ is 0.1M.

- 2383 Gmelin, L., ed. Gmelin's Handbuch der anorganischen Chemie. System 55. Uran und Isotope mit einem Anhang über Transurane. (8th ed.) Berlin, Verlag Chemie, 1936.

This is the outstanding literature survey on U. It should be available to all carrying out research on this element and its cpds. (An English translation by I. C. O'Brien and C. Feldman of a large portion of this book is available as USAEC report TID-82 and its supplementary pages.)

- 2384 Gurevich, M. M. and Chakhov, L. "Absolute Efficiency of Fluorescence of Uranyl Potassium Sulfate." Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 509-13(1936).

The quantum eff. of fluorescence of K uranyl sulfate due to excitation by long-wave ultraviolet ($\lambda = 0.370 \mu$) must be taken equal to unity. Medium-thin screens of powd. K uranyl sulfate reflect about 30% of the incident long-wave ultraviolet; their light eff. is about 200 lm/w of the incident ultraviolet and about 270 lm/w of absorbed energy. The use of fluorescent substances similar to K uranyl sulfate permits the following increases of light eff.: black body ($T = 3000^\circ\text{K}$) up to 20%; high-pressure Hg tube up to 50%; low-pressure Hg tube up to 200%. Uses for the increased light eff. are suggested.

- 2385 Hartmann, W. "Electrical Investigation of Oxide Semiconductors." Z. Physik **102**, 709-33(1936). Measurements are made upon the effect of perturbing centers in Al_2O_3 and Ta_2O_5 and upon the Hall effect in UO_2 and CuO to explain the cond. of these oxides. The effect of temp. upon the electric cond. is studied. The mechanism of the cond. in UO_2 is due to hole cond. and this is proved by observations of Hall effect. The mobility of the charge carriers is less than that in CuO .

- 2386 Hecht, F. and Krafft-Ebing, H. "New Method for the Gravimetric Separation of Quadrivalent from Sexivalent Uranium. I." Z. anal. Chem. **106**, 321-30(1936).

By means of $\text{Na}_2\text{H}_2\text{P}_2\text{O}_6$, U^{+4} can be pptd. in dil. acid soln. as hypophosphate while U^{+6} will remain in soln. The hypophosphate ppt. can be ignited, the residue dissolved in HNO_3 and the H_3PO_4 removed by treatment with $(\text{NH}_4)_2\text{MoO}_4$. In the filtrate from the phosphomolybdate ppt., the excess Mo can be removed by treatment with oxine in dil. H_2SO_4 soln. and then in the filtrate the U, which is now present as $(\text{UO}_2)^{++}$, can itself be pptd. as oxine salt by buffering the soln. with NH_4OAc .

- 2387 Hönigschmid, O. and Wittner, F. "Revision of the Atomic Weight of Uranium." Z. anorg. allgem. Chem. **228**, 289-309(1936).

Analysis of UBr_4 and UCl_4 gave a value of 238.07 ± 0.02 for the at. wt. of U.

- 2388 Ikhteyman, I. M. "Role of Disturbances of Kidney Function in Genesis of Fatigue. Experimental (Uranium) Nephritis." Med. Zhur. (Ukraine) **6**, 1005-12(1936).

- 2389 Jolibois, P. and Fouretier, G. "A Basic Salt in the Uranium Sexivalent Series." Compt. rend. **203**, 1263-5(1936).

Although a soln. of $\text{UO}_2(\text{NO}_3)_2$ dissolves sufficient UO_3 to produce $2\text{UO}_3 \cdot \text{N}_2\text{O}_5$, UO_2SO_4 soln. will dissolve only enough to form $1.6\text{UO}_3 \cdot \text{SO}_3$, the soln. contg. 74.3 g/l UO_3 . If H_2SO_4 be added to such a soln. and the cond. plotted against the total amt. present the only break in the curve occurs for UO_2SO_4 . This salt, though nominally basic, has an acid reaction; it is therefore suggested that it, and the other uranyl

salts, are really complex acids similar to chromosulfuric and phosphomolybdic acids, a view supported by the fact that $\text{UO}_2(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}$ dissolves as such in Et_2O (cf. Lebeau).

- 2390 Joos, G. and Duhm, B. "The Isotope Effect in the Line Absorption Spectrum of Uranyl Nitrate." Nachr. Ges. Wiss. Göttingen Math.-physik. Klasse, Fachgruppen II (2), 2, 123-6(1936).

The displacements of absorption lines of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ due to replacement of H by D are measured at temps. of 20 and 83°A. All lines are displaced toward shorter wavelengths by 2 Å on the av. The sepn. of about 718 cm^{-1} between homologous lines of individual groups remains unchanged. This freq. is ascribed to $(\text{UO}_2)^{++}$. The distances between lines of a given group decrease to a small extent, the sepn. between lines are ascribed to a vibration between the $(\text{UO}_2)^{++}$ and the neighboring H_2O . A common blue displacement of all lines is observed due to change of temp. from 20 to 83°A. All observed displacements are much smaller than in the case of chrome alum previously investigated by the authors in which the adsorption was due to an at. ion.

- 2391 Khlopin, V. G. and Gerling, E. K. "Some Fluorine Compounds of Quadrivalent Uranium and the Possibility of the Determination of Uranium as the Fluoride." Zhur. Obschei Khim. 6, 1701-14 (1936).

When $\text{U}(\text{SO}_4)_2$ is electrolyzed in HF soln. in the presence of NH_4F , quant. pptn. of $\text{UF}_4 \cdot \text{NH}_4\text{F} \cdot \text{O} \cdot 5\text{H}_2\text{O}$ occurs. The method can be used for the quant. sepn. of U^{+4} from U^{+6} , Fe^{+3} , and V^{+3} in mixts. contg. not more than 30% of the wt. of U as V. The ppt. probably has the structure

If $\text{U}(\text{SO}_4)_2$ is electrolyzed in dil. HF without the presence of NH_4F ,

is obtained. When this is dried at 100 to 105° it becomes $\text{UF}_4 \cdot 1.5\text{H}_2\text{O}$. If electrolysis takes place in 1:1 HF, $\text{UF}_4 \cdot \text{O} \cdot 5\text{H}_2\text{O}$ is obtained.

- 2392 Kroll, W. "Deformable Rare Metals, Vanadium, Thorium, and Uranium." Z. Metallkunde 28, 30-3(1936).

Recent work on the prepn. of the rarer metals by thermal dissocn. of their halides and by reduction of oxides and halides with alk. or alk. earth metals is critically reviewed. Attempts to obtain V by reduction of the pentoxide with Ca in the presence of Ca and Ba chlorides yielded only a semicolloidal powder which could not be pressed into workable shapes; a second reduction of the powder under similar conditions yielded a powder which could be sintered in vacuum in a high-freq. furnace to a product which could be cold-worked. Workable Th was prepd. in a similar way; both metals are attacked and embrittled by heating in contact with Ba chloride, but can be heated in borax without deleterious effect. U was prepd. by reduction of U_3O_8 with Ca under a fused chloride slag; part of the metal was colloidal and pyrophoric, but the remainder was sintered and worked successfully although it tended to crack and oxidize along the cracks.

- 2393 MacNider, W. deB. "Acquired Resistance of Fixed Tissue Cells to Chemical Injury (Produced by Uranium Nitrate and Chloroform)." Southern Med. J. 29, 1189-94(1936).

It is reported that in animals tolerant to U there is a resistant epithelium in the liver.

- 2394 MacNider, W. deB. "Acquired Resistance of Fixed Cells Morphologically Altered through Processes of Repair. Liver Injury Induced by Uranium Nitrate; Type of Epithelial Repair Which Imparts to Liver Resistance Against Subsequent Uranium Intoxication." J. Pharmacol. Exptl. Therap. 56, 359-72(1936).

This paper discusses the results of subcutaneous U nitrate administration in dogs. The fatal dose is reported for the av. dog to be slightly greater than 2 mg U/kg.

- 2395 MacNider, W. deB. "Acquired Resistance of Fixed Cells Morphologically Altered through Processes of Repair. Resistance of Liver Epithelium Altered Morphologically as Result of Injury from Uranium, Followed by Repair, to Hepatotoxic Action of Chloroform." J. Pharmacol. Exptl. Therap. **56**, 373-81(1936).
- 2396 Mayor, H. A. The Properties of Metallic Uranium. PhD. dissertation, Univ. of Oxford, 1936. The at. ht. of U, measured between 30 and 60° abs, is in agreement with theory. At higher temps, however, the measured values increase above the theoretical value, and appear to continue to increase, reaching the value of 6.7 cal at 60°C.
- 2397 Melnichenko, V. D. "Role of Disturbances of Kidney Function in Genesis of Fatigue. Morphologic Changes in Kidneys Following Administration of Uranium Nitrate." Med. Zhur. (Ukraine) **6**, 1015-23(1936).
- 2398 Neuburger, M. C. "Lattice Constants for 1936." Z. Krist. **93**, 1-36(1936).
U is one of the materials for which values are reported.
- 2399 Öholm, L. W. "Diffusion of Uranyl Salts in Water." Finska Keminsamfundets Medd. **45**, 142-8(1936).
At various normalities, the diffusion const. at 20° is for UO_2Cl_2 , 0.700 at 0.1, 0.679 at 0.25, 0.666 at 0.5, 0.674 at 1.0, 0.681 at 2.0; for $\text{UO}_2(\text{NO}_3)_2$, 0.687 at 0.1, 0.670 at 0.25, 0.661 at 0.5, 0.664 at 1.0, 0.670 at 2.0; for UO_2SO_4 , 0.434 at 0.1, 0.416 at 0.25, 0.405 at 0.5.
- 2400 Ostroumov, E. A. "A New Method of Precipitating Uranium and Its Separation from the Alkaline Earth Metals by Means of Pyridine." Z. anal. Chem. **106**, 244-8(1936).
By means of pyridine, U can be pptd. completely as $\text{H}_2\text{U}_2\text{O}_7$ which can be ignited and weighed as U_3O_8 . The use of pyridine in place of NH_3 , which has been used hitherto, has 2 advantages: the base is so weak that it does not form a carbonate or uranate and there is less danger of incomplete pptn. or contamination with alk. earth carbonate. To accomplish the pptn. of $\text{H}_2\text{U}_2\text{O}_7$, add a little methyl red indicator to the slightly acid soln. and introduce 20% pyridine soln. until 10 ml more than enough has been added to make the soln. neutral to the indicator. Heat on the hot plate until the soln. clears and add more pyridine if the soln. becomes acid to the indicator. Wash the ppt. with 3% NH_4NO_3 soln. contg. a little pyridine. The presence of NH_4Cl or NH_4NO_3 is favorable but large quantities of $(\text{NH}_4)_2\text{SO}_4$ prevent pptn. When $(\text{SO}_4)^{--}$ is present it is necessary to add pure pyridine (30 to 40 ml for 0.1 g U_3O_8) in place of the 20% soln. The method is excellent for sepg. U from alk. earths.
- 2401 Palmqvist, S. "Preparation of Crystalline Uranyl Ammonium Phosphate." Kgl. Fysiograf. Sällskap. Lund, Förh. **6**, 43-9(1936).
The refractive index is reported.
- 2402 Parks, W. G. and Katz, J. "Vapor-Phase Catalytic Oxidation of Organic Compounds. Toluene." Ind. Eng. Chem. **28**, 319-23(1936).
The catalytic activity of 16 different cpds. and mixts. in the vapor-phase oxidation of toluene to produce BzH and BzOH is reported. The temp., concn. of vapor, and time of contact were varied over a wide range with each catalyst. The best results were obtained with a mixt. of UO_2MoO_4 and B_4C at 575° with a primary space velocity 420, secondary space velocity 1010, air-hydrocarbon ratio 1.38 by wt., and vol. of catalyst 19.3 cc. The yield of BzH on the basis of toluene vaporized was 20%/pass. A simplified commercial app. is suggested.

- 2403 Peyronel, G. "The Structure of Uranium Pyrophosphate, UP_2O_7 ." *Z. Krist.* **94**, 311-12(1936). UP_2O_7 has the same type of structure as the pyrophosphates of Si, Ti, Zr, and Hf. The unit cube has $a = 8.61 \pm 0.01$ A.; calcd. d. = 4.288.
- 2404 Pitzer, E. C., Gordon, N. E., and Wilson, D. A. "Reduction of Uranyl Ion in the Uranyl Oxalate Actinometer." *J. Am. Chem. Soc.* **58**, 67-70(1936).
The relative rates of the decompn. of $H_2C_2O_4$ and the reduction of $(UO_2)^{++}$ in the photolysis of $UO_2C_2O_4$ actinometer solns. were studied. Cupferron can be used to sep. $(UO_2)^{++}$ and U^{+4} in dil. solns. The rate of reduction of $(UO_2)^{++}$ is small until just enough $H_2C_2O_4$ remains to form $UO_2C_2O_4$, when it rapidly increases. The presence of H_2SO_4 has no effect on the relative rates. The photolyte in the actinometer is a complex, $H_2C_2O_4 \cdot UO_2C_2O_4$, which ionizes as a strong dibasic acid. The equil. const. for the reaction $[UO_2(C_2O_4)_2]^{--} \rightleftharpoons UO_2C_2O_4 + (C_2O_4)^{--}$ is 1.23×10^{-5} .
- 2405 Politzer, M. "Lipid Metabolism in Experimental Uranium Nephritis." *Arch. farmacol. sper.* **62**, 70-6(1936) Aug. 1.
- 2406 Rentschler, H. C. and Henry, D. E. "Effect of Oxygen upon Photoelectric Thresholds of Metals." *J. Optical Soc. Am.* **26**, 30-4(1936).
The effect of O_2 on the change of photoelec. sensitivity with wavelength was studied for Th, U, Ca, Ba, Cs, Zr, Ti, Fe, Ni, Ag, and Au. With Th, U, Ca, and Ba, small amts. of O_2 shift the threshold to longer wavelengths. Excess O_2 forms the metallic oxide and destroys the photoelec. sensitivity except for very short wavelengths.
- 2407 Richards, A. N., Westfall, B. B., and Bott, P. A. "Inulin and Creatinine Clearances in Dogs with Notes on Some Late Effects of Uranium Poisoning." *J. Biol. Chem.* **116**, 749-55(1936).
Plasma clearances of injected inulin and creatinine as studied in 11 dogs were found to be the same under all ordinary exptl. circumstances. A dog previously poisoned with U excreted inulin at a faster rate than creatinine. This was interpreted to mean a back diffusion of creatinine, possibly owing to the tubular damage.
- 2408 Salvini, A. "Renal and Hepatic Lesions from Uranium Nitrate Poisoning in Normal and Ovariectomized Rabbits. Comparative Histologic Study." *Ginecologia* **2**, 846-69(1936).
- 2409 Schoeller, W. R. and Webb, H. W. "Investigations into the Analytical Chemistry of Tantalum, Columbium, and Their Mineral Associates. XXX. Observations on Beryllium." *Analyst* **61**, 235-41(1936).
A study is made of the fate of Be in important analytical operations. Some recently published methods are discussed, and an alternative procedure is presented for sepg. Be from U. Tannin pptn. from oxalate solns., half satd. with NH_4Cl , seps. Ti, Nb, and Ta from Be as well as from Zr, Th, Al, and U, etc. Up to the present time, tartrate and acetate solns. have not proved entirely suitable media for quant. tannin pptn. U can be sepd. quantitatively from Be by pptn. of the former with $K_4Fe(CN)_6$ in a neutral soln. contg. 0.1 g U_3O_8 in 100 ml and 2 g of NH_4Cl . The ppt. produced by adding 0.3 g of $K_4Fe(CN)_6$ is slimy, but with the addn. of a little filter-paper pulp it can be filtered.
- 2410 Schoeller, W. R. and Webb, H. W. "Investigations into the Analytical Chemistry of Tantalum, Columbium, and Their Mineral Associates. XXXII. Observations on Phosphorus, Vanadium, and a Tannin Precipitation Series." *Analyst* **61**, 585-90(1936).
In oxalate soln. which is half satd. with NH_4Cl , Ta, Nb, and Ti are pptd. by tannin completely with Zr, Th, Al, U, and Be remaining in soln. A similar procedure can also be used to sep. V from tannin, it was found necessary to omit the neutralization with NH_4OH , and this leaves the soln. sufficiently acid to prevent complete pptn. of Nb. By combining the operations of "tartaric hydrolysis," tannin pptn. and the pyrosulfate tannin procedure, it is possible to get a good sepn. of V from Nb. The ranges of acidity at which Nb and V ppt. with tannin overlap, so that it is impossible to sep. V and Nb with tannin alone. The

order in which pptn. with tannin takes place is Ta, Ti, Nb, V, Fe, Zr, Hf, Th, U, and Al. Just where Cr belongs in the series is not yet known. In every case, it appears to be impossible to sep. 2 adjacent members of the series by tannin pptn. except by an elaborate system of repeated crystn.

- 2411 Shemyakin, F. M., Adamovich, V. V., and Pavlova, N. P. "Gravimetric Determination of Vanadium and Uranium with Ammonium Benzoate and Cinnamate." Zavodskaya Lab. 5, 1129-31 (1936).

For detn. of U, 3.5 to 4 cc of 0.05N NH_4 -benzoate contg. 1 cc of 10% NH_4OH soln. is added to each cc of 0.05N U_3O_8 . The 2 solns. are separately boiled before mixing. After 2 min of stirring, the ppt. is filtered off and washed with 2% NH_4NO_3 and treated with NH_4OH until basic to litmus. After drying, it is ignited for 20 to 30 min and weighed.

- 2412 Shibata, Y. and Nakai, T. "The Absorption Spectra of Some Metallic Salts at Higher Temperatures." J. Chem. Soc. Japan. 57, 166-72(1936).

The absorption spectrum of 0.05M urea soln. of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ was taken at 145 to 150°. It shows 11 absorption bands.

- 2413 Shoji, T. "Influence of Merbaphen on Renal Permeability to Creatinine Following Uranium Poisoning." Tôhoku J. Exptl. Med. 29, 8-16(1936).

- 2414 Spacu, P. "The Ammoniates of Uranium VI and Uranium IV Chlorides." Z. anorg. allgem. Chem. 230, 181-6(1936).

Liq. NH_3 and UO_2Cl_2 react at -78° and form $\text{UO}_2\text{Cl}_2 \cdot 10\text{NH}_3$. The latter decomps. with rising temp. and forms $\text{UO}_2\text{Cl}_2 \cdot 5\text{NH}_3$ at -40° , $\text{UO}_2\text{Cl}_2 \cdot 4\text{NH}_3$ at 0° , $\text{UO}_2\text{Cl}_2 \cdot 2\text{NH}_3$ at 34.8° , and $\text{UO}_2\text{Cl}_2 \cdot \text{NH}_3$ at 110.8° . UCl_4 combines under similar conditions with 12NH_3 from -78 to -62° , with 10NH_3 to -42° , with 6NH_3 to -30° , with 5NH_3 to 34.8° , with 4NH_3 to 110.8° , and with 3NH_3 to 184° . The heats of formation of these cpds. are inversely proportional to the valency.

- 2415 Strauss, K. H. "Compensation by Uranium in Cosmic-Ray Ionization Measurements." Z. Physik 100, 237-49(1936).

This paper describes a simple method of using the ionization due to U to compensate cosmic-ray ionization in long period measurements with an ionization chamber. An ionization chamber was fitted up in turn with this arrangement and with a modification of the orthodox electrical compensation method, and a comparison was made of the accuracy of the detn. of cosmic-ray intensity variations over long periods by the two methods. It is concluded that the U compensation method affords the greater accuracy.

- 2416 Weekers, R. "Action of Uranium Nitrate on Insulin Hypoglycemia and Hypophosphatemia and on Glycolysis of Blood." Compt. rend. soc. biol. 122, 78-80(1936).

U poisoning does not affect insulin hypoglycemia or hypophosphatemia; nor does it affect blood glycolysis in 1:1000 concns.

- 2417 Weekers, R. "Renal Lesions as Cause of Increased Urinary Excretion of Phosphorus in Course of Experimental Uranium Nitrate Intoxication." Compt. rend. soc. biol. 121, 866-8(1936).

- 2418 Weekers, R. "Study of Hepatic Glycogen in Relation to Mechanism of Glycosuria in Experimental Uranium Nephritis." Compt. rend. soc. biol. 121, 868-70(1936).

- 2419 Weekers, R. "Uranium Nephritis; Origin of Glycosuria, Phosphaturia and Albuminuria. Action of Uranium Nitrate on Enzymes." Arch. intern. pharmacodynamie 54, 423-74(1936).

- 2420 Westenberg, L. "Preparation of Kahane's Uranyl Reagent from Residues." Verslag. Landbouwk. Onderzoek. E. No. 42, 358-60(1936).

The author recommends the following method which takes much less time than that of Kahane. Distil off alc., dil. with tap water and treat with NH_4OH in a high cylinder. Wash the yellow NH_4 uranate by decantation, being careful to keep the cylinder covered during settling, filter and dry. Rub 23.5 g of the uranate with H_2O in a mortar to a thin sirup and transfer to a 1-l, volumetric flask, add 28 g MgO and about 500 cc of H_2O , boil off most of the H_2O , add carefully 102 g HOAc , then 500 cc 90% alc. by vol. and fill up to the mark. After standing 1 to 2 days it is ready for use.

PUBLICATIONS LOCATED IN 1937

- 2421 Binet, L. and Jaulmes, C. "Therapeutic Value of Sodium Bicarbonate in Acidosis in Uranium Intoxication. Experiments with Goldfish." Médecine 18, 690-8(1937).

- 2422 Braune, H. and Pinnow, P. "The Molecular Structure of a Few Inorganic Fluorides from Electron-Diffraction Experiments." Z. physik. Chem. B35, 239-55(1937).

Electron-diffraction expts. indicate that UF_6 , WF_6 , and probably also MoF_6 have rhombic symmetry. Other fluorides were also investigated.

- 2423 Brintzinger, H. and Jahn, F. "The Combination in Solution of the Separate Particles of Sodium Uranyl Acetate, Sodium Zinc Uranyl Acetate and Sodium Magnesium Uranyl Acetate." Z. anorg. allgem. Chem. 231, 342-4(1937).

The dialysis coeffs. and ion wts. are given for the various complex ions and cpds. Application to the qual. and quant. analysis for Na is discussed.

- 2424 Brintzinger, H. and Jahn, F. "Single-Shelled Malonate Complexes in the Dissolved State." Z. anorg. allgem. Chem. 235, 115-19(1937).

The ion wts. of various malonate complexes were detd. by dialysis. These included the complex ions with V, Cr, Mn, Co, Pr, Nd, Vo, (UO_2), Th, Fe, Ni, Cu, Mg, Zn, and Cd. The results demonstrate the great similarity between the malonate complexes and the oxalate complexes. The existence of double-shelled complex anions with malonates of bivalent central ions is shown. The structure of the complex ions is discussed.

- 2425 Brintzinger, H. and Jahn, F. "Cyano Complexes of the Ions of Vanadium⁺³, Chromium⁺³, Manganese⁺³, Vanadyl⁺⁺, Uranyl⁺⁺, and Manganese⁺⁺ in the Dissolved State." Z. anorg. allgem. Chem. 235, 244-6(1937).

By detn. of the dialysis coeffs., the ion wt. was calcd. for the complex $[\text{UO}_2(\text{CN})_6]^{--}$ and the others which were generally similar.

- 2426 Cauchois, Y. "L α Satellites of Some Heavy Elements and Rare Earths." Compt. rend. 205, 519-21(1937).

The lines η of Gd, and α_1 , α_2 , and η of Dy were remeasured, and one or more of α' , α^x , α^x_{II} ; α^{ix} , α^y , α^z_I , α^z_{II} , and α^z_{III} measured for Sm, Gd, Dy, Ta, Re, Pt, Au, Hg, Bi, Th, and U.

- 2427 Cernatescu, R. and Poni, M. "Metallic Salts of Cyclic Diamines." Ann. sci. univ. Jassy (I) 23, 196-201(1937).

The salts were prepd. by mixing Et_2O solns. of salt with toluylenediamine or naphthylene and washing the ppt. with Et_2O . $3m\text{-MeC}_6\text{H}_3(\text{NH}_2)_2 \cdot \text{UO}_2(\text{NO}_3)_2$, a yellow salt, was prepd. Similarly, $2o\text{-MeC}_6\text{H}_3(\text{NH}_2)_2 \cdot \text{UO}_2(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}$, a maroon-violet salt, was prepd. The latter decomps. at 130° , losing H_2O at 115 to 120° to yield the former.

- 2428 Chretien, A. and Kraft, J. "Uranyl Phosphites." *Compt. rend.* 204, 1736-8(1937). Conductometric examn. of mixed solns. of $(\text{UO}_2)(\text{AcO})_2$ and H_3PO_3 indicate as the only cpd. UO_2HPO_3 . This salt is pptd. slowly as a yellow jelly which crystallizes very slowly to $\text{UO}_2\text{HPO}_3 \cdot 2\text{H}_2\text{O}$. It is sol. in excess H_3PO_3 , but no acid salt is formed. Exposed to the Hg lamp it is rapidly reduced to the neutral U^{+4} phosphite.
- 2429 Clark, G. L. and Coe, W. S. "Photochemical Reduction with X-Rays and Effects of Addition Agents." *J. Chem. Phys.* 5, 97-105(1937).
X rays and ultraviolet light caused different reactions in solns. of UO_2SO_4 with $\text{H}_2\text{C}_2\text{O}_4$.
- 2430 Curie, I. and Savitch, P. "Radioactive Elements from Uranium by Bombardment with Neutrons." *J. phys. radium* (7), 8, 385-7(1937).
The results of bombarding U with neutrons were re-examined. Products of periods 59 min, 2.7 days, and 16 and 23 min was confirmed, the existence of the other periods 10 and 41 sec, 2.2 min, 2.5 and 5.7 hr was not disproved. By examining the radiation after eliminating that due to UX by passage through 0.5 mg/cm^2 Cu, and chem. examn. of the product, a 3.5 hr isotope of Th was found, probably formed by emission of an α particle, $\text{U}^{238} + n \rightarrow \text{Th}^{235}(3.5 \text{ hr}) + \text{He}^4$. By passing the β rays from the 2 and 16 min and 3.5 hr products through Cu sheets of varying thicknesses, it is concluded that at least some have an energy of 6 mev. All these results are most simply explained by assuming production of isomeric elements.
- 2431 Drobkov, A. A. "The Influence of the Radioactive Elements Uranium, Radium, Thorium, and Actinium on the Yield of Plants." *Doklady Akad. Nauk S.S.S.R.* 17, 229-32(1937).
The yields of the vegetative mass and of the seeds of pea plants grown in H_2O culture contg. Hellrigel's mixt. plus B₁₀ were increased 86.27 and 182.35%, respectively, by the addn. of 10^{-11} g Ra to 6 l H_2O . The Ra content of the roots and stalks of the plants increased greatly. This amt. of Ra was optimum. As the Ra dose increased, the yield of both roots and vegetative mass decreased gradually, but doses of 10^{-8} g/6l H_2O were not lethal. From 3-yr expts. the author concludes that radioactive elements are necessary nutrient substances for plants, that the radioactive elements U, Ra, and Th cannot replace the other radioactive elements. Whether or not Ra, Th, and U can replace each other has not been detd.
- 2432 Fleck, H. R. "Precipitation of Metals by Means of 8-Hydroxyquinoline (Oxine). II. Effect of pH on the Precipitation of Cadmium, Tungsten, and Uranium from Acetate Solutions." *Analyst* 62, 378-83(1937).
A table is given which shows the approx. pH of 18 mixts. of HOAc with water and with NaOH soln. over a pH range of 3.6 to 13.2. Pptn. of Cd with oxine is complete at pH = 5.66 to 14.58. Pptn. of W as $\text{WO}_2 \cdot (\text{C}_9\text{H}_6\text{ON})_2$ is complete at pH = 4.95 to 5.65. U ppts. as $\text{UO}_2(\text{C}_9\text{H}_6\text{ON})_2$ at pH = 5.71 to 9.81. On the basis of these results it should be possible to effect sepns. of W from Cd, U from W, or Mo and other combinations of Cd, W, and U from some other metals.
- 2433 Ghosh, J. C., Banerjee, T., and Mukherjee, S. K. "Photochemical Reactions with Some Inorganic Colloids as Active Agents under the Influence of Light in Various States of Polarization. I. Tungstic Acid, Molybdic Acid, Chromic Tungstate, etc., as Photoactive Agents; Optical Properties of These Sols; Circular Dichroism in the Ultra-Violet." *J. Indian Chem. Soc.* 14, 495-518(1937).
Measurements of absorption of plane and circularly polarized light were made on sols of molybdic acid, chromic hydroxide, uranic acid, tungstic acid, and chromic tungstate after maturing in the dark, unpolarized light of wavelength 366 $\text{m}\mu$, plane polarized light, l-circularly polarized light, and d-circularly polarized light. Uranic acid sols showed no significant differences between l- and d-polarized light.

- 2434 Ghosh, J. C., Banerjee, T., and Bose, J. C. "Photochemical Oxidation of Glucose by Methylene Blue with Uranic Acid Sol. as Photosensitizer." J. Indian Chem. Soc. **14**, 597-602(1937).
The quantum eff. in this reaction is 0.97. The reaction is of zero order with respect to methylene blue. The velocity is proportional to the intensity of light absorbed and is practically independent of the concn. of uranic acid sol.
- 2435 Ghosh, J. C., Banerjee, T., and Bose, J. C. "Photochemical Reduction of Uranic Acid Sol. by Sodium Tartrate." J. Indian Chem. Soc. **14**, 559-63(1937).
The velocity const. was unimolecular and the quantum eff. was 0.55 to 0.72. The temp. coeff. was 1.1 to 1.2.
- 2436 Gleditsch, E. and Bakken, R. "The Determination of UO_2 and UO_3 in Different Layers of a Single Crystal of Uranite." Mikrochim. Acta **1**, 83-6(1937).
Dissolve 50 mg of mineral in hot, concd. H_2SO_4 and titrate the UO_2 with KMnO_4 after dilg. Then reduce with a Jones reductor and det. the total U content by KMnO_4 titration. The ratio of UO_2/UO_3 is greatest in the core of the mineral and slowly diminishes toward the outside.
- 2437 Goto, H. "Importance of Hydrogen-Ion Concentration for the Estimation and Separation of Metals by the Oxine Method." Science Repts. Tôhoku Imp. Univ., First Ser. **26**, 391-413(1937).
The pH is of great importance for the pptn. of various ions with 8-hydroxyquinoline. The results obtained by numerous expts. are as follows, the first no. after the symbol of the element is the lowest pH at which pptn. takes place, the second no. is the min. value for perfect pptn. and the third no. (if given) is the pH above which no pptn. takes place: Al 2.8, 4.2, 12.3; Zn 2.8, 4.4; Cd 4.0, 5.4; Ni 2.8, 4.6, above 13.2; Mn 4.3, 5.9 above 12.3; Co 2.8, 4.2; Ti 3.5, 4.8, 12.0; U 3.1, 4.1, 12.1; Th 3.7, 4.4, 12.5; Pb 4.8, 8.4; Ca 6.1, 9.2; Mg 6.7, 8.2; Fe 2.4, 2.8; Cu 2.2, 2.7; Bi 3.5, 4.8, 12.9.
- 2438 Jacob, C. W. and Warren, B. E. "Crystal Structure of Uranium." J. Am. Chem. Soc. **59**, 2588-91(1937).
From x-ray powder photographs metallic U is found to be orthorhombic with $a:b:c = 2.852:5.865:4.945 \text{ \AA.}$, $Z = 4$ and $d. \text{ calcd.} = 18.97$. The space group is V_h^{17} and the atoms are in 4 equiv. positions on twofold axes Oy_4^1 with $y = 0.105 \pm 0.005$. The structure is unique; it may be considered as a deformed hexagonal close-packed structure with 4 neighbors of each atom closer than the other 8, indicating a tendency to form 4 covalent bonds. The bond directions are not tetrahedral. The structure together with the relatively high elec. resistance suggests that U is only pseudometallic.
- 2439 Kal'kind, Y. S. and Desarev, V. V. "Catalytic Oxidation of Some Aromatic Compounds." Zhur. Obshchei Khim. **7**, 879-81(1937).
The behavior of C_{10}H_8 derivs., pyridine, quinoline, and of carbazole, when admixed with air, or air enriched in O_2 , and passed at 400 to 600° over V_2O_5 (90%) U oxides (10%) catalyst, deposited on pumice, is studied and the stability of different nuclei detd., $\alpha\text{-BrC}_{10}\text{H}_7$ oxidized at 400° gives only BzOH and traces of phthalic acid. $\alpha\text{-O}_2\text{NC}_{10}\text{H}_7$, and α - and $\beta\text{-H}_2\text{NC}_{10}\text{H}_7$, at 420°, give only phthalimide and a small amt. of phthalic acid. $\beta\text{-HOC}_{10}\text{H}_7$ at 420° gives only BzOH. These results indicate that the unsubstituted nucleus is more stable in all cases studied. Pyridine oxidized at 430 to 600°, gives some unchanged pyridine, the remainder completely decomp. to H_2O , CO_2 , NH_3 , and N oxides. Quinoline is oxidized with great difficulty. At 400° it remains unchanged, at 420 to 430° it behaves like pyridine while at 500°, with air contg. 10% O_2 , it explodes. Carbazole remains unchanged at 400 to 500°, while at 600° it partially undergoes complete combustion, at times with explosive violence.
- 2440 Kelly, K. K. Data on Theoretical Metallurgy. VIII. The Thermodynamic Properties of Metal Carbides and Nitrides. Washington, U. S. Bureau of Mines, 1937. (Bulletin No. 407)
Thermodynamic data relating to metal carbides and nitrides are collected and discussed. Pertinent data are difficult to obtain experimentally and are rare; this fact necessitates frequent use of approximations and assumptions. CH_4 and NH_3 also are included because some of the reactions considered involve Ca,

Cr, Co, Fe, Mn, Mo, Ni, Si, Na, Th, Ti, W, U, V, and Zr. The nitrides include those of Th, Ti, U, V, Zr, and other metals. A bibliography of 108 references is included.

- 2441 Krusch, P. *Die metallischen Rohstoffe, ihre Lagerungsverhältnisse und ihre wirtschaftliche Bedeutung. Heft I.-Vanadium, Uran, Radium.* Stuttgart, Ferdinand Enke, 1937. 148p.

This volume is of great interest to the metallurgist owing to the very exact and detailed description of the occurrence, manufacture, use, market conditions, world production, and price of V. As is generally known, V is becoming more and more important to the steel industry. For English readers, the extensive descriptions of the ore deposits in Southwest Africa, the Transvaal, Rhodesia, and Australia may be one of special interest.

U, which, together with its companion Ra, is dealt with in the second part of the volume, has not become of any great practical importance in the production of alloys, though it has aroused the interest of investigators for a long time.

- 2442 Larson, H. W. "Xylose Tolerance of Rabbits with Uranium Nephritis." *J. Lab. Clin. Med.* **22**, 117-25(1937).

- 2443 Lewschin, W. L. "Investigation of the Absorption Spectra and Luminescence of the Uranyl Salts and of Their Solutions." *Izvest. Akad. Nauk S.S.S.R. Ser. Fiz.* No. 2, 185-206(1937).

The luminescence spectra of uranyl salts and their solns. were studied by methods of visual and photographic spectrophotometry. Their absorption spectra in the blue and violet were studied by the method of fluorescence and photographically. Usually the absorption spectra were mirror images of the emission, the positions and intensities of the bands being influenced by the nature of the anion and not by the solvent. Increase of temp. diminished the intensity of the luminescence and caused the bands to fuse together. The abs. values of the coeffs. of absorption of the uranyl salts are very small, but increase as much as 3-fold with the salts in soln. See *Acta Physicochim. U.R.S.S.* **6**, 661-88(1937) for English language version.

- 2444 Lewschin, W. L. "A Study of the Absorption Spectra and Luminescence of the Uranyl Salts and of Their Solutions." *Acta Physicochim. U.R.S.S.* **6**, 661-88(1937).

This is an English language version of the paper originally published in *Izvest. Akad. Nauk S.S.S.R. Ser. Fiz.* No. 2, 185-206(1937).

- 2445 MacNider, W. deB. "Persistence with Certain Modifications of Acquired Resistance of Fixed Tissue Cells to Injury (Produced by Uranium Nitrate)." *Trans. Assoc. Am. Physicians* **52**, 195-7(1937).

- 2446 Meitner, L., Hahn, O., and Strassmann, F. "Disintegration of Uranium by Neutrons." *Z. Physik* **106**, 249-70(1937).

The details of the three methods by which U can be disintegrated by neutrons are investigated.

For measurements of the energy required to effect the different disintegrations it is deduced that the first two requires fast neutrons while the third requires neutrons having thermal energy. No resonance

levels are observable in the energy range between thermal energies and the full neutron energy. The third disintegration is a typical resonance process, requiring neutrons with an energy of 25 ± 10 v. The absorption coeff. for the resonance neutrons is $3 \text{ cm}^2/\text{gm}$. Using a cloud chamber, the max. energy of the electrons released from EkaRe during its 16-min decay is shown to be more than 3×10^6 v. The collision area of the neutrons responsible for process (2) is given as $1.6 \times 10^{-25} \text{ cm}^2$. Using the observed decay values and the total activity it is deduced that processes (1) and (2) are of comparable probability. The collision area for fast neutrons for the combined processes is measured as $3.5 \times 10^{-25} \text{ cm}^2$. No α -particle disintegration is observed in any of the three processes.

- 2447 Meyer, W. and Neldel, H. "A Relation between the Energy Constant e and the Quantity Constant a in the Conductivity-Temperature Formula for Oxide Semiconductors." Z. tech. Physik 18, 588-93(1937).

Data are given for TiO_2 , ZnO , Fe_2O_3 , and U_2O_3 .

- 2448 Meyer, W. and Neldel, H. "A Relation between the Energy Constant e and the Quantity Constant a in the Conductivity-Temperature Formula for Oxide Semiconductors." Physik. Z. 38, 1014-19 (1937).

The information included in this paper is similar to that published in Z. tech. Physik 18, 588-93(1937).

- 2449 Milhorat, A. T. and Deval, H. J., Jr. "Urine in Acute Uranium Nephrosis; Mechanism of Glycosuria." Arch. Internal Med. 60, 77-87(1937).

In U poisoning, evidence is presented that glycosuria ends as anuria begins.

- 2450 Miller, C. F. "Tannic Acid in Analysis." Chemist-Analyst 26, 38-9(1937).

The tests for Ti, Fe, Cb, Ta, Ag, Au, U, Hg, HVO_3 , H_2MoO_4 , and H_3PO_4 , as recommended by Schoeller and his coworkers, are reviewed.

- 2451 Montignie, E. "Some Uranyl Salts." Bull. soc. chim. France (5), 4, 1142-4(1937).

$\text{UO}_2(\text{ClO}_3)_2$ could not be prepd. from UO_2SO_4 and $\text{Ba}(\text{ClO}_3)_2$ because the soln. hydrolyzes on evapn. KIO_4 forms $(\text{UO}_2)_2\text{I}_2\text{O}_9$ with $\text{UO}_2(\text{NO}_3)_2$ in the cold, but at elevated temps., no definite cpd. is formed. Na_2HPO_3 and $\text{UO}_2(\text{NO}_3)_2$ give UO_2HPO_3 which is readily sol. in dil. mineral acids. When this is heated in air, a grayish residue is formed which gives the reactions characteristic of phosphates when dissolved in HNO_3 . With Zn and H_2SO_4 , PH_3 is evolved. When heated with a concd. soln. of KOH, uranyl phosphate is formed. Ferrous salts give FePO_4 and uranyl phosphate. Br_2 in aq. soln. gives HBr and uranyl phosphate. It is easily hydrolyzed by H_2O , giving H_3PO_3 and hydrated uranyl hydroxide; the H_3PO_3 is then oxidized to H_3PO_4 and uranyl phosphate is finally obtained. The molybdates described by Lancien are not definite cpds., 2 equil. reactions take place between MoO_3 and $\text{UO}_2(\text{NO}_3)_2$.

- 2452 Muench, O. B. "Determination of Uranium, Thorium and Lead in Thucholite." J. Am. Chem. Soc. 59, 2269-70(1937).

The quantities of U, Th, and Pb and their relative proportions in a sample of thucholite were detd. by careful analysis. The Pb was detd. as PbSO_4 with the precaution of recovering traces that were left in soln. by adding a little Cu and pptg. as sulfide with a final pptn. as PbSO_4 . The Th and other rare earths were pptd. by adding $\text{H}_2\text{C}_2\text{O}_4$ to the filtrate from the PbSO_4 detn. and eventually detd. by the peroxide method and also by the iodide method. The U was detd. as U_3O_8 and also as $(\text{UO}_2)_2\text{P}_2\text{O}_7$. The ratio of Pb:U was 0.038 whereas in cryolite from the same mine the ratio was 0.019. In the thucholite itself, considerable variance was noted in the compn. of nodules and of crystals. It is clear that the mineral was or is undergoing alteration and the Pb:U ratio is of very little value with respect to detg. the age of the mineral.

- 2453 Nabeshima, K. "Glutathione Content of Blood and Tissues in Uranium Poisoning and Asphyxia." Okayama-Igakkai-Zasshi 49, 554-5(1937).

- 2454 Nicolau, A. "Thermomagnetic Properties and Constant Paramagnetism of UO_2^{++} in Some Uranyl Salts in Aqueous Solution." Compt. rend. 205, 654-6(1937).
The coeff. of magnetism per g, χ , of the paramagnetic $(\text{UO}_2)^{++}$ was detd. in solns. of $\text{UO}_2(\text{NO}_3)_2$ and UO_2SO_4 of varying concns., and at temps. from 20 to 75°. The results show χ to be independent of temp., but to decrease as concn. increases. This decrease is probably due to formation of complex anions.
- 2455 Nishida, M. "Water Metabolism in Nephritis. Effect of Diuretics on Cutaneous Hydrophilia and on Protein Fractions of Serum in Rabbits with Uranium Nephritis." Kyoto Furitsu Ikadaigaku Zasshi 21, 432-3(1937).
- 2456 Nishida, M. "Water Metabolism in Nephritis. Effect of Diuretics on Chlorine and Calcium Content of Serum and Tissues of Rabbits with Uranium Nephritis." Kyoto Furitsu Ikadaigaku Zasshi 21, 434-5(1937).
- 2457 Ostroumov, E. A. "Separation of Iron, Aluminum, Chromium, Uranium, Zirconium, and Titanium from Manganese, Cobalt, Nickel, Magnesium, Alkaline Earth Metals and Alkalies by Means of Pyridine." Zavodskaya Lab. 6, 16-20(1937).
In the quant. pptn. of 0.1 g of Fe, Cr, Al, U, Zr, and Ti with excess pyridine, the hydrolysis of Zr and Ti with the formation of highly dispersed basic salts is eliminated in the presence of 5 to 10 g NH_4Cl for every 100 cc of the soln. The procedure affords a good sepn. from Mn, Co, Ni, alk. earth metals and alk.
- 2458 Ostroumov, E. A. "Separation of Uranium, Zirconium, and Titanium from Manganese, Cobalt, and Nickel with Pyridine." Ann. chim. anal. chim. appl. 19, 89-93(1937).
A 20% soln. of pyridine can be used to advantage in place of NH_3 soln. for pptg. U, Zr, and Ti. The ppt. is less likely to be contaminated with Mn, Co, and Ni, and a single pptn. is sufficient.
- 2459 Overman, O. R. and Garrett, O. F. "Determination of Sodium. Removal of Phosphorus before Determining Sodium by the Uranyl Zinc Acetate Method." Ind. Eng. Chem. Anal. Ed. 9, 72-3 (1937).
 ZnCO_3 is used to remove the P present. It is reported that only $(\text{Cr}_2\text{O}_4)^{--}$ interferes with the procedure.
- 2460 Pfeiffer, P., Hesse, T., Pfitzner, H., School, W., and Thielert, H. "Inner Complex Salts of the Aldimine and Azo Series." J. prakt. Chem. (2), 149, 217-96(1937).
Refluxing 2.8 g $\text{o-HOC}_6\text{H}_4\text{CHO}$ -ethylenediimine and 4.2 g $\text{UO}_2(\text{OAc})_2 \cdot 2\text{H}_2\text{O}$ in EtOH for 1 hr gives the uranyl complex, $\text{UC}_{16}\text{H}_{14}\text{O}_4\text{N}_2$, with 1 mol. MeOH or $\text{C}_5\text{H}_5\text{N}$, orange-red, unchanged by cold 10% NaOH but immediately decompd. by a hot soln. or by cold concd. H_2SO_4 ; the U salt of $\text{o-HOC}_6\text{H}_4\text{CHO}$ -propylenediimine seps. with 1 mol. EtOH of $\text{C}_5\text{H}_5\text{N}$, orange-red; that of $\text{o-HOC}_6\text{H}_4\text{CHO}$ -trimethylenediimine forms red tablets, stable in cold 10% alk. but decompd. on soln. in AcOH; that of $\text{o-HOC}_6\text{H}_4\text{CHO}$ -diphenylethylenediimine forms orange-red needles with 1 mol. MeOH; $\text{o-HOC}_6\text{H}_4\text{CHO}$ - o -hydroxyphenylimine forms a U salt, with 1 mol. MeOH, red leaflets, or with 1 mol. $\text{C}_5\text{H}_5\text{N}$, brilliant red leaflets; the $\text{C}_5\text{H}_5\text{N}$ is not completely removed on heating 6 hrs at 210°. 2-Hydroxy-1-naphthal-dihydroethylenediimine yields a U salt, with 1 mol. MeOH, orange-red needles, fairly stable to 10% KOH but immediately decompd. by concd. H_2SO_4 or HOAc. The U salt of diphenylethylenediimine forms orange leaflets; that of o -phenylene-diimine forms red-brown needles with 1 mol. MeOH; that of o -hydroxyacetophenoneethylenediimine crystallizes with 1 mol. EtOH or $\text{C}_5\text{H}_5\text{N}$, orange needles. U salt of o -hydroxyacetophenonediphenylethylenediimine, yellow-orange. U salts could not be prepd. from $\text{o-HOC}_6\text{H}_4\text{CHO}$ -tetramethylenediimine, $\text{o-HOC}_6\text{H}_4\text{CHO}$ -pentamethylenediimine, resorcyaldehydeethylenediimine, o -hydroxyacetophenonediphenylethylenediimine, $\text{o-HOC}_6\text{H}_4\text{CHO}$ with benzidine, $\text{o-HOC}_6\text{H}_4\text{CHO}$ with 4,4'-diaminostilbene or the *m*-isomer of $\text{o-HOC}_6\text{H}_4\text{CHO}$ - o -hydroxyphenylimine.

- 2461 Pringsheim, P. "Absorption Spectrum and Photochemical Sensitizing Effect of Uranyl Sulfate in Aqueous Solution." Physica 4, 733-45(1937).

The sensitized photolysis of $\text{H}_2\text{C}_2\text{O}_4$ by UO_2SO_4 cannot be explained on the basis of collisions of the second kind, since the retardation of the process by I^- is too small. The complete absorption spectrum of UO_2SO_4 in aq. soln. is photographed, and the changes in it produced by the addn. of $\text{H}_2\text{C}_2\text{O}_4$ and of KI are measured. From the results, it is deduced that complex formation must be assumed to occur during the photolysis of $\text{H}_2\text{C}_2\text{O}_4$.

- 2462 Pringsheim, P. "Absorption Spectrum of Aqueous Uranyl Sulfate Solutions." Physica 4, 810 (1937).

The author gives 2 photometer curves to supplement the previous article.

- 2463 Pringsheim, P. "The Mirror Symmetry of Fluorescent and Absorption Bands in Solutions." Acta Phys. Polon. 6, 158-62(1937).

UO_2SO_4 solns. were among those studied.

- 2464 Sas, L. "Influence of Administration of Protein on Nitrogenous Components of Dog's Blood Following Experimental Lesions Produced by Uranium Nitrate." Biochem. Z. 290, 304-12 (1937).

- 2465 Schwab, G. M. and Jockers, K. "Inorganic Chromatography." Naturwissenschaften 25, 44(1937). The method of org. chromatography was applied to inorg. ions; the mixt. was poured over the moistened column of adsorbent, then washed down and if necessary "fixed" to insol. cpds. and "developed" to different colors, e.g., by NH_4 sulfide. On Al_2O_3 as adsorbent the order of sepn. is from top to bottom Sb^{+3} , Bi^{+3} , Cr^{+3} , Fe^{+3} , $(\text{UO}_2)^{++}$, Pb^{++} , Hg^{++} , Cu^{++} , Ag^{+} , Zn^{++} , Co^{++} , Cd^{++} , Ni^{++} , Mn^{++} independent of the sol. anion. The sepn. is poor between Fe and $(\text{UO}_2)^{++}$. Addn. of a third ion in some cases facilitates sepn. In NH_3 soln. the presence of amino complexes gives another order of ions. In alk. tartrate soln. the order is still different. Small amts. of admixts. can be traced by the chromatographic method. Measurements of pH indicate that Al_2O_3 acts as an alk. buffer on the soln.

- 2466 Singh, B. and Ahmad, G. "Hydrolysis of Uranyl Salts." J. chim. phys. 34, 351-4(1937). The hydrolysis of uranyl nitrate, sulfate and acetate was calcd. from the e.m.f. of the quinhydrone-calomel cell at 30° . The % hydrolysis at a mol. diln. of 1280 is nitrate 17.54, sulfate 8.50, and acetate 2.13.

- 2467 Stephenson, R. J. "X-Ray Fluorescence Yields." Phys. Rev. (2), 51, 637-42(1937). The x-ray fluorescence yield for the K shell of atoms has been measured for 21 elements ranging from Ni to Sn. The results show an increase in the fluorescence yield with at. no. The fluorescence yields for the L_{III} shell of Pb, Th, and U showed the same increase with at. no.

- 2468 Tsutsumi, S. "Studies of the Promoting Action of a Catalyst Promoter and Carrier. II." J. Chem. Soc. Japan 58, 63-70(1937).

The effect of the calcining temp. upon the gas-absorbing power of the mixts. $\text{Co} + \text{Cu} + \text{U}_3\text{O}_8$ in the range 200 to 300° , and $\text{Co} + \text{U}_3\text{O}_8$ and $\text{Co} + \text{ThO}_2$ in the range 250 to 450° contg. various amts. of diatomaceous earth was studied. The gas used was the mixt. $\text{CO} + \text{H}_2$ in the ratio 1:2. The proper temp. to get the max. absorbing power does not change much with the amt. of diatomaceous earth.

- 2469 Washizu, Y. and Takebe, M. "Effect of Certain Endocrine Preparations and of Sodium Chloride on Specific Gravity of Blood in Rabbits with Experimental Uranium Nephritis." Kyoto Furitsu Ikadaigaku Zasshi 20, 496-7(1937).

- 2470 Yasuda, H. "Changes in Protein Content and Colloid Osmotic Pressure of Blood Flowing to and from Liver Following Injury to Kidneys from Uranium and Cantharidin." Tôhoku J. Exptl. Med. **31**, 456-68(1937).

PUBLICATIONS LOCATED IN 1938

- 2471 Alexander, P. P. "Hydride Process." Metals Alloys **9**, 270-4(1938).
The commercial production of U is discussed.

- 2472 Charonnat, R. "The Constitution of the Streng's Salt." Bull. soc. chim. France (5), **5**, 205-07 (1938).

The structure of this hydrated U, Na, Mg acetate (apparently basic) is discussed.

- 2473 Chrétien, A. and Kraft, J. "Uranyl Orthophosphates." Bull. soc. chim. France (5), **5**, 372-85 (1938).

Both elec. cond. and chem. analysis were used to investigate the cpds. formed by the reaction between $\text{UO}_2(\text{AcO})_2$ and H_3PO_4 and some sol. orthophosphates in aq. soln. (1) The addn. of $\text{UO}_2(\text{AcO})_2$ to a sol. mono-, di- or trimetallic or thiophosphate (Na, K, NH_4 or Ca) gives a neutral double orthophosphate of the type UO_2MPO_4 (M is a univalent metal). (2) With H_3PO_4 , UO_2HPO_4 is formed. With an excess of the reagent, $(\text{UO}_2)_3(\text{PO}_4)_2$ is formed. (3) The neutral uranyl salt is formed directly by the addn. of the $\text{UO}_2(\text{AcO})_2$ soln. to H_3PO_4 . (4) All uranyl phosphates, simple or double, are sol. in H_3PO_4 with the formation of complex ions, which are considerably removed from the perfect state. On diln., a ppt. of UO_2HPO_4 is formed. All the ppts. are hydrated.

- 2474 Chrétien, A. and Oechsel, G. "Acetyl Chloride as a Chlorinating Agent in Inorganic Chemistry." Compt. rend. **206**, 254-6(1938).

An all-glass app. is described for the interaction of AcCl and metallic oxides at the ordinary temp., and in absence of H_2O . Probably the first result is formation of an addnl. cpd., $\text{MO}_n \cdot 2\text{AcCl}$, which rapidly passes into $\text{MO}_{n-1}\text{Cl}_2 \cdot \text{Ac}_2\text{O}$. This is followed by a repetition of the same process. Thus, with UO_3 is obtained $\text{UO}_2\text{Cl}_2 \cdot \text{Ac}_2\text{O}$ as a pale-yellow cryst. powder. From V_2O_5 is obtained VOCl_3 , sol. in AcCl with a blood-red color. MnO_2 at 0° gives a violet soln. of MnCl_4 , which on slight rise in temp., evolves Cl_2 and gives a ppt. of MnCl_2 .

- 2475 Cohn, G. and Hedvall, J. A. "The Effect of Irradiation on Solid Catalyst in Gas Reactions." Z. anorg. allgem. Chem. **239**, 113-25(1938).

Irradiation of alk. earth oxides and sulfides, ZnS , ZnS-CdS , Zn_2SiO_4 , ZnO , UO_3 , and BN phosphors with visible or ultraviolet rays indicates that the irradiation effect on their activity in catalytic gas reactions can be practically disregarded. BN was the only tested system showing any indication of reaction.

- 2476 Conn, G. K. T. and Wu, C. K. "An Investigation of the Raman and Infra-Red Spectra of Certain Uranyl Salts, with Conclusions on the Structure of Uranyl Group." Trans. Faraday Soc. **34**, 1483-92(1938).

The Raman spectra of aq. solns. of $\text{UO}_2(\text{NO}_3)_2$, UO_2Cl_2 , and UO_2SO_4 have been obtained. The infrared absorption spectra of uranyl chloride and acetate have also been studied in the cryst. state from 4μ to 14μ . A discussion of the results and their bearing on the structure of $(\text{UO}_2)^{++}$ is given. In particular, attention is drawn to the fact that care must be taken in correlating the structure of a triatomic group with the no. of "valence electrons," a correlation which has been found to hold for several groups in which the central atom falls in the first short period of the periodic table.

- 2477 Curie, I., Savitch, P. and da Silva, A. M. "Neutron-Induced β Radiation from U." J. phys. radium (7), 9, 440(1938).

By means of a Wilson chamber with a magnetic field, an investigation has been made of the β spectrum from U on bombardment with neutrons. The energy limit of the β spectrum is found to be approx. 3.2 mev, while the max. lies between 0.75 and 1 mev.

- 2478 Delage, B. "Lipoid-Protein System of Serum in Course of Experimental Nephritis Produced by Uranium Nitrate." Compt. rend. soc. biol. 128, 735-6(1938).

- 2479 Delsal, J. L. "Polarimetric and Electrometric Study of Tartaric and Malic Complexes of Tri-valent and Sexivalent Metals." J. chim. phys. 35, 350-66(1938).

Uranyl tartrates and malates are briefly discussed; a bibliography is included.

- 2480 Dempster, A. J. "Atomic Masses of the Heavy Elements." Phys. Rev. (2) 53, 64-75(1938). Comparisons have been made between a series of different at. masses by means of a double-focusing mass spectrograph. The small displacement between the positions of multiply charged ions of one mass and at. of another mass is measured and gives a value for the difference in the packing fractions of the two at. masses. The ion pairs $\text{Sn}^+-\text{U}^{++}$ and $\text{Sn}^+-\text{AcU}^{++}$ were among those compared. Values for the packing fractions were deduced for a no. of elements not including U.

- 2481 Flatt, R. and Hess, W. "The Alleged Existence of Compounds of Bivalent Uranium." Helv. Chim. Acta 21, 525-9(1938).

- 2482 Flatt, R. and Hess, W. "Potassium Uranates." Helv. Chim. Acta 21, 1506-12(1938).

- 2483 Foeyn, E. "Some Relationships Among Uranium Minerals." Skrifter Norske Videnskaps-Akad. Oslo. I. Mat.-Naturv. Klasse No. 4, 60p. (1938).

The crystal structure of some U minerals is discussed.

- 2484 Goto, H. "Fluorescence Analysis. V. Fluorescence Detection. 1." J. Chem. Soc. Japan 59, 547-54(1938).

The change of intensity of fluorescence of uranyl nitrate, rhodamine B, oxine, morin, α -naphthoflavone, cochineal, coeruleine, quinine, acridine, or salicylic acid by the addn. of metallic ions can be used for the detection of the following 21 metals: Ag, Hg, Pb, Tl, Cd, Cu, Bi, As, Sb, Sn, Pt, Au, Se, Te, Mo, Al, Cr, Fe, Mn, Zn, Ni.

- 2485 Goto, H. "Fluorescence Analysis. VI. Fluorescence Detection. 2." J. Chem. Soc. Japan 59, 625-33(1938).

A scheme is given for detecting, by fluorescence analysis, Co, Ba, Sr, Ca, Mg, Na, Be, U, V, Ti, Zr, Li, Th, and W.

- 2486 Hole, W. L., Wright, R. W., and Whalin, H. B. "Recalescence in Uranium." Phys. Rev. (2), 53, 768(1938).

A double recalescence was observed.

- 2487 Hovorka, V. and Sykora, V. "Isatin β -Oxime. New Reagent for Certain Metal Ions." Collection Czechoslov. Chem. Commun. 10, 83-92(1938).

A 1% soln. of the oxime in EtOH gives a reddish or yellow-orange ppt. with Hg^{++} and $(\text{UO}_2)^{++}$ but no ppt. with 16 other cations tested, when present as nitrates. $(\text{UO}_2)^{++}$ gives nearly quant. pptn. from acetate solns.; the ppt. is a clear yellow. Many other ions also ppt. from acetate soln.

- 2488 Hovorka, V. and Sykora, V. "Determination of Uranium by Means of the β -Oxime of Isatin." Collection Czechoslov. Chem. Commun. 10, 182-9(1938).

To the $(\text{UO}_2)^{++}$ soln. contg. the equiv. of 0.002 to 0.3 g U_3O_8 in 50 to 100 ml H_2O at boiling temp., add 5 to 60 ml of a 1% soln. of the oxime in EtOH. Remove from the hot plate and add 5 to 10 ml of 10% NaOAc soln. An excess of both reagents is necessary but the orange-yellow ppt. is not obtained from $\text{UO}_2(\text{NO}_3)_2$ solns. except after buffering with acetate. After 2 to 3 hr filter and wash with 20 to 100 ml hot H_2O . Ignite and weigh as U_3O_8 . Attempts to weigh the ppt. of $\text{UO}_2(\text{C}_8\text{H}_5\text{N}_2\text{O}_2)_2$ after drying at 105 to 110° were not entirely successful as the ppt. adsorbs some of the precipitant. The results of 54 tabulated analyses show that the values are usually a little high but in only 1 expt. was the error greater than 1 mg U_3O_8 . (This paper is also in Chem. Listy 32, 211-15(1938).)

- 2489 Hovorka, V. and Sykora, V. "Determination of Uranium by Means of the β -Oxime of Isatin." Chem. Listy 32, 211-15(1938).

This paper contains information similar to that published in Collection Czechoslov. Chem. Commun. 10, 182-9(1938).

- 2490 Jacob, C. W. and Warren, B. E. "The Crystal Structure of Uranium." Phys. Rev. (2), 53, 108 (1938).

This is a brief abstract of a paper read before the American Physical Society. X-ray powder patterns were made of U, using $\text{Cu K}\alpha$ radiation. By a method involving orthogonal nets in the reciprocal lattice, the pattern was indexed in terms of an orthorhombic cell with axes $a = 2.852$, $b = 5.865$, $c = 5.945$. From the d., there are 4 atoms per unit cell. The space group is $V_h^{17}\text{Cmcm}$, and the atoms are in position 4c. The parameter is detd. from the intensities as $y = 0.105 \pm 0.005$. It can be considered as a deformed hexagon close-packed structure, with 4 nearest neighbors at about 2.8 Å and 8 next nearest at 3.3 Å. The 4 closest neighbors indicate a tendency to form covalent bonds. The U structure is not that of a true metal. The material should be considered as a pseudo metal, such as Sb or Ga. The high electrical resistivity of U is in keeping with the structure deduced. U does not belong in the Cr, Mo, W group.

- 2491 Konaka, Y. "Catalytic Polymerization of Ethylene under Ordinary Pressure. VI. Polymerization Activity of Iron Catalyst." J. Soc. Chem. Ind., Japan 41 (Suppl. binding), 22(1938).

In some expts. on the formation of liq. polymers from C_2H_4 by some Fe catalysts, the catalyst Fe-Cu- U_3O_8 appeared the best in tests for 4 hr at 350°.

- 2492 Kraft, J. "Uranyl Orthoarsenates." Compt. rend. 206, 57-9(1938).

When a soln. of H_3AsO_4 is added to one of $\text{UO}_2(\text{OAc})_2$ a yellow gelatinous ppt. of (probably) $(\text{UO}_2)_3(\text{AsO}_4)_2 \cdot 12\text{H}_2\text{O}$ is obtained, which has the compn. of trögerite. If the acetate is added to the acid in equal molar proportions $\text{UO}_2 \cdot \text{HAsO}_4 \cdot 3\text{H}_2\text{O}$ is obtained, which passes to $(\text{UO}_2)_3(\text{AsO}_4)_2 \cdot 12\text{H}_2\text{O}$ on adding more acetate. On being heated $\text{UO}_2 \cdot \text{HAsO}_4 \cdot 3\text{H}_2\text{O}$ loses its H_2O completely by 140°. No indication of $\text{UO}_2(\text{H}_2\text{AsO}_4)_2$ was obtained. When a soln. of an orthoarsenate is added to one of $\text{UO}_2(\text{OAc})_2$ some $\text{UO}_2\text{MAAsO}_4 \cdot n\text{H}_2\text{O}$ ($M = \text{Na}, \text{K}, \text{NH}_4, \frac{1}{2}\text{Ca}$, or $\frac{1}{2}\text{Cu}^{++}$) is always formed; the Cu^{++} salt, $\text{Cu}(\text{UO}_2 \cdot \text{AsO}_4)_2 \cdot 8\text{H}_2\text{O}$ is identical with zeunerite. The neutral orthoarsenates are all insol. in H_2O , but dissolve in aq. H_3AsO_4 with the formation of complex uranyl-arsenic ions, in which the $(\text{UO}_2)^{++}$ is unaffected by $[\text{Fe}(\text{CN})_6]^{-4}$; on diln., however, $(\text{UO}_2)^{++}$ reappears and $\text{UO}_2\text{HAsO}_4 \cdot 3\text{H}_2\text{O}$ remains, which is appreciably sol. in H_2O . The course of these reactions is different if the acetate is replaced by some other uranyl salt, particularly $\text{UO}_2(\text{NO}_3)_2$.

- 2493 Křepelka, J. H. and Réső, Z. "New Uranyl Salts of Substituted Organic Acids." Collection Czechoslov. Chem. Commun. 10, 559-81(1938).

The properties of 10 new uranyl salts of org. halogen and thio acids are given. α -Chloropropionate, green microcryst. powder, feebly doubly refractive tetragonal needles, sol. in 17 parts H_2O . β -Chloropropionate, green microcryst. powder, isotopic tetrahedra, sol. in 25 parts H_2O . α -Bromopropionate, yellowish green, well developed isotropic cubic crystals, sol. in 35 parts H_2O . β -Bromopropionate, green microcryst. powder, isotropic (combined rhombic octohedra and dodecahedra), sol. in 50 parts

H₂O. β -Iodopropionate, yellow microcryst. powder, strongly doubly refractive crystals, chiefly spherocrystals, the least sol. of the propionates examd., sol. in 80 parts H₂O; of all salts prepd. this one is the least stable. Dibromosuccinate, green powder, minute spherocrystals, elliptical in shape, with not very strong double refraction, insol. in H₂O. Thioglycolate, yellow-green microcryst., doubly refractive needles, sol. in 30 parts H₂O, slight humidity causes its hydrolysis. Thiolactate, greenish microcryst. isotropic crystals, sol. in 40 parts H₂O; the soln. shows anomalous color with a brownish to red tint, owing to hydrolysis. o-Chlorobenzoate gave strong microcryst. yellow-green, spherocrystals which are feebly doubly refractive, and sol. in 240 parts H₂O. p-Bromobenzoate gave microcryst. green, minute rectangular crystals, mixed with lenticular and barrel-like forms, with appreciable double refraction, insol. in H₂O.

- 2494 Kroupa, E. "Microgravimetric Separation of Nickel and Uranium." Mikrochim. Acta **3**, 306-12 (1938).

The detn. of the Pb, Th, and U content of weakly radioactive minerals has been used as a basis of geologic time measurement by the so-called "Pb method." These minerals usually contain a few hundredths of 1% of Ni and U. The sepn. is accomplished with the aid of dimethylglyoxime in an AcOH soln. contg. NH₄OAc. The resulting Ni ppt. can be weighed. The filtrate from the Ni ppt. is evapd. to dryness in a Pt crucible and the residue ignited. The residue is dissolved in HOAc and after properly buffering the soln. the (UO₂)⁺⁺ is pptd. with oxine. The washed oxine ppt. is heated and weighed as U₃O₈.

- 2495 Maloney, A. H. and Burton, A. F. "Colloidal Uranium. I. Toxicity." J. Pharmacol. Exptl. Therap. **63**, 58-64(1938).

In mice and guinea pigs injected subcutaneously with 1, 5, 10, 15, and 20 mg/kg doses of colloidal U and U nitrate, resp., colloidal U proved systemically less toxic than U nitrate. Colloidal U administered in daily doses of 1 mg/kg to kittens produced a gradual weight loss and death in 3 to 4 wks. However, a single dose of 1 to 5 mg/kg was tolerated quite well in all the animals. In dogs 1 mg/kg injected intraven. at intervals of 10 min 5 to 6 times, had no significant effect on the blood pressure or respiration.

- 2496 Montignie, E. "Photolysis of the System Uranyl Sulfate-Potassium Iodide-Water." Bull. soc. chim. France (5), **5**, 564-6(1938).

The photolysis proceeds according to the equations $\text{UO}_2\text{SO}_4 + 2\text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{SO}_4 + \text{UO}_2(\text{OH})_2$ and $\text{UO}_2\text{SO}_4 + 2\text{KI} + \text{H}_2\text{O} + \text{O} \rightleftharpoons \text{K}_2\text{SO}_4 + \text{UO}_2(\text{OH})_2 + \text{I}_2$. The rate of formation of I₂ was detd. in the dark, in sunlight, and under artificial light. The reaction was accelerated by the addn. of 0.1 g NaCl, and was retarded by the addn. of 1 g NaCl.

- 2497 Ostroumov, E. A. "Separation of Iron, Aluminum, Chromium, Uranium, Zirconium and Titanium from Manganese, Cobalt, Nickel, Calcium, Strontium, Barium, Magnesium and the Alkalies by Means of Pyridine." Ann. chim. anal. chim. appl. **20**, 9-12(1938).

- 2498 Pfeiffer, P., Christeleit, W., Hesse, T., and Thielert, H. "Stereo-chemistry of Spiral-like Complex Salts. The Cotton Effect." J. prakt. Chem. (2), **150**, 261-316(1938).

The U salt of propylenediimine is reported to be bright red, (one mol. EtOH included). Data on the optical properties of the salt are also given.

- 2499 Rosenthaler, L. "Analytical Application of Cacotheline." Mikrochim. Acta **3**, 190-2(1938).

The lilac color obtained in the brucine test with cacotheline is due to the formation of a reduction product of the latter. A similar test is obtained with Sn⁺⁺, Ti⁺³, U⁺³, Rh⁺³, and lower oxides of Mo, W, and Cb. The test can also be obtained when the acids of As, Sb, and Te are treated with Zn and HCl but not with selenous acid. H₂Se, Cu₂Cl₂, and Hg₂Cl₂ in the presence of HCl also gives the color, and the same is true of finely divided Hg, FeSO₄ in the presence of H₃PO₄ or fluoride and K₄(Co(CN)₆). Numerous org. cpds. also give the test. Nevertheless the reaction is often of value in distinguishing between certain substances.

- 2500 Shapiro, M. J. "Detection of Small Amounts of Gold, Palladium, and Platinum." Zhur. Priklad. Khim. **11**, 367-8(1938).

The soln. (2 cc) is treated with 5 or 6 drops of starch soln., and 5 to 8 drops of 0.02% aq. I soln. (free from KI); if more than 0.4 γ of Au⁺³, Pd⁺⁺, or Pt⁺⁴ is present, no blue color appears. Co, Ni, Mn, Zn, Fe, Al, UO₂, Cd, Cu, Pb, Sb, As, Bi, Ce, Ta, Nb, Zr, La, Th, W, V, Mo, Te, Se, Os, and Tl do not interfere.

- 2501 Strubl, R. "Polarographic Studies with the Dropping Mercury Cathode. Part LXXV. The Estimation of Uranium and Other Heavy Metals in the Excess of Iron." Collection Czech Chem. Commun. **10**, 466-74(1938).

The reduction potential of Fe⁺³ is so close to that of (UO₂)⁺⁺ that to det. U in the presence of considerable Fe⁺³ it is necessary to reduce the concn. of (UO₂)⁺⁺ to a very small value by forming a complex ion, as otherwise there will be interference and the polarographic waves of U will be hidden. When, in the absence of O₂, a soln. of (NH₄)₂CO₃ is added to a soln. of (UO₂)⁺⁺ and the polarographic curve is registered after each addn. of the carbonate, it will be found that 2 distinct polarographic waves are shown; one, of which the half-wave potential occurs at -0.83 v, corresponds to the reduction from valence 6 to 4, and the other corresponds to the reduction to the bivalent state at -1.45 v. If all Fe⁺³ present is reduced to the Fe⁺⁺, by means of a HCl soln. of NH₂OH, the polarographic detn. can be made for (UO₂)⁺⁺. The NH₂OH in an acid soln. is a good reagent for reducing Cu, Bi, Sb, Sn, Pb, Tl, Cd, Ti, and Zn ions in the presence of Fe⁺³. All ions that are reduced to metal and deposited by the dropping Hg electrode at potentials between 0 and -1.0 v can be detd. polarographically in the presence of Fe. The method appears to be useful for detg. the adsorbed constituents of Fe(OH)₃ ppts.

- 2502 Tananaeff, N. A. and Guntsburg, A. "Fractional Detection of Titanium and Uranium." Zhur. Priklad. Khim. **11**, 364-6(1938).

Treat a soln. under investigation with SnCl₂ (slight excess) while heating to boiling. Filter or decant. Add to the filtrate some chromotropic acid (1,8-dihydroxynaphthalene-3,6-disulfonic acid). The presence of Ti is disclosed by cherry-red or weakly brown color, depending on the concn. of Ti in soln. HNO₃ decolorizes the resulting soln. Treat the soln. contg. U with an excess of NH₄OH and heat to boiling. Filter and treat the residue (without washing with water) with HOAc (2 to 5 cc). To dissolve (NH₄)₂U₂O₇ completely, the residue should be washed several times with the filtrate. Add to the filtrate K₄Fe(CN)₆ soln., if the filtrate is colorless. The presence of U is disclosed by a reddish-brown color. If the filtrate is colored cherry-red (presence of Fe), add dropwise 6N HCl until the disappearance of color. Then add KI soln. and decolorize with just enough Na₂S₂O₃ soln., followed with K₄Fe(CN)₆ soln. If the amt. of U is very small and no Fe is present, then, after treating the sample with NH₄OH, add 1 or 2 drops of FeCl₃ or Fe(NO₃)₃ or Fe₂(SO₄)₃, the Fe(OH)₃ formed on adding NH₄OH coagulates (NH₄)₂U₂O₇. After filtration, treat the residue with HOAc and proceed as above. The residue after removal of U can be tested for Ti as described.

- 2503 Washizer, Y. "Nitrogen Distribution in Plasma Proteins of Rabbit with Experimental Uranium Nephritis." Kyoto Furitsu Ikadaigaku Zasshi **22**, 712-13(1938).

- 2504 Watanabe, T. "Influence of Innervation on Exchange of Gases and Solids through Capillaries. Experiments on Dogs Poisoned with Uranium and Cantharidin." Tôhoku J. Exptl. Med. **34**, 103-32(1938).

- 2505 Weiss, J. "Photosensitising Action and the Fluorescence of Uranium Salts." Trans. Faraday Soc. **34**, 451-6(1938).

The hypothesis of collisions of the second kind being responsible for the quenching of the fluorescence of U salts in soln. does not agree with exptl. facts. The elementary process of quenching, which is identical with the primary process in the photosensitized reactions, consists in an electron transfer (resonance transfer) from the quenching mol. (acceptor) to the excited U ion. The quenching of the U fluorescence by I⁻ and (in the presence of molecular oxygen) the photosensitized formation of I₂, and the sensi-

tized photolysis of formate lactate and oxalate are discussed, and the exptl. facts are found to be in quant. agreement with the above theory. The theory also accounts for the rather peculiar effects observed under conditions when both I^- ions and oxalate are present, which have hitherto not been explained satisfactorily.

PUBLICATIONS LOCATED IN 1939

- 2506 Anderson, H. L., Fermi, E., and Hanstein, H. B. "Production of Neutrons in Uranium Bombarded by Neutrons." Phys. Rev. (2), 55, 797-8(1939).

Quant. measurements gave inconclusive results.

- 2507 Anderson, H. L. and Fermi, E. "Simple Capture of Neutrons by Uranium." Phys. Rev. (2), 55, 1106-07(1939).

Slow neutrons, besides producing fission can also, by simple capture, give rise to U^{239} , a 23-min β emitter. An attempt is made to ascertain the contribution of this process to the capture of thermal neutrons, in order to det. whether this absorption could account for the difference between the total capture cross section and the cross section for fission. The data are not consistent with an interpretation in terms of the single-level formula of Breit-Wigner. The total absorption cross section for thermal neutrons is 3.2×10^{-24} sq. cm. If the total absorption is considerably larger, as reported by Whitaker et al., there must be some other process of absorption to account for the difference.

- 2508 Anderson, H. L., Fermi, E., and Szilard, L. "Neutron Production and Absorption in U." Phys. Rev. (2), 56, 284-6(1939).

An exptl. investigation has been carried out to det. whether more neutrons are emitted from U on bombardment with slow neutrons than are absorbed. An increased activity of about 10% was found, which, it is postulated, corresponds to an emission of 1.5 neutrons/neutron when all effects are taken into account. The possibility of a nuclear chain reaction has been discussed, but no definite conclusion has been reached.

- 2509 Baranov, V. I. "Assimilation of Radioactive Elements by Plants." Doklady Akad. Nauk. S.S.S.R. 24, 951-4(1939).

With Pisum sativum the optimum concn. of U, Ra, and Ac in the nutrient corresponds to a nearly equal no. of ats. decaying in unit time. From expts. with P. sativum, Lactuca sativa, Cucumis sativus, Linum usitatissimum, and Avena sativa with U, Ra, RdTh, or Ac in the nutrient, it was found that the concn. of radioactive elements in the aerial organs is much less (as much as 2 orders of magnitude) than that in the root system; the concn. of radioactive elements is higher in the plant than in the nutrient; radioactive elements are not so easily taken up by plants if supplied in high concn.; and Ac is taken up by plants from higher concn. than the other elements.

- 2510 Barschall, H. H., Harris, W. T., Kanner, M. H., and Turner, L. A. "Penetrating β -Particles from Uranium Activated by Neutrons." Phys. Rev. (2), 55, 989(1939).

Primary β rays with energies higher than 2.9 mev were obtained by irradiating U with fast (~ 3 mev) D + D neutrons. The activity decayed with half-lives of 13 ± 2 sec, 3.5 ± 0.5 sec, and 0.6 ± 0.3 sec.

- 2511 Booth, E. T., Dunning, J. R., and Slack, F. G. "Energy Distribution of Uranium Fission Fragments." Phys. Rev. (2), 55, 981(1939).

A thin layer of U oxide was deposited on Au and served as the central portion of the high-voltage electrode in a parallel-plate ion chamber, which contains A at a sufficient pressure to absorb the total range of the fission particles. When this chamber was exposed to neutrons from a cyclotron the ionization pulses were recorded by an amplifier oscillograph system of tested linearity. The results with the collimated and the uncollimated chamber both show that the fission fragments are divided into at least two major energy groups. The max. energies are about 100 and 72 mev, and the ratio of the masses is about 96/140.

- 2512 Booth, E. T., Dunning, J. R., and Slack, F. G. "Range Distribution of the Uranium Fission Fragments." Phys. Rev. (2), 55, 982(1939).

The range distribution of the U fission fragments in air was studied further with a differential ion chamber. There are two major groups of approx. equal intensity with ranges of ~ 1.5 and 2.2 ± 0.1 cm.

- 2513 Borovskii, I. B. "Methods of X-Ray Spectroscopy." Trudy Vsesoyuz. Konferents. Anal. Khim. 1, 135-42(1939).

X-ray spectral analyses were accelerated considerably by the use of light spectrographs with curved crystals according to the method of Cauchois and Johann. Rapid methods for detecting elements from 29(Cu) to 47(Ag) and from 71(La) to 92(U) and for the rare-earth elements were developed. Detns. are carried out according to the method of equalization of the intensities, and methods for detg. Hf, Nb, Ta, Zn, Sr, Th, U, Ce, La, Nd, Y, and Mn were developed. The detns. differ by from 5 to 20% from the true value. The sensitivity of the method is 0.1 to 0.01 at. %.

- 2514 Bradt, H. "Neutrons from U." Helv. Phys. Acta 12, 553-8(1939).

In detg. the mean secondary neutrons liberated from U on bombardment by fast neutrons, the author retards the liberated neutrons to thermal velocities by surrounding the source with a large tank of H₂O. Metallic In foil was used as a neutron detector with appropriate amplifying and counting app. It was found that the activity in the foil was directly proportional to the d. of the thermal neutrons at the position of the detector. When a correction was applied for the effect of fast neutrons, the no. of secondary neutrons/primary neutron was found to be 2.95 ± 0.5 . The absorption of neutrons by capture in U was neglected.

- 2515 Caley, E. R. and Baker, W. O. "Composition of Lithium and Potassium Salts Precipitated by the Uranyl Acetate Reagents for Sodium." Ind. Eng. Chem., Anal. Ed. 11, 604-07(1939).

Triple acetates, analogous to those of Na, are formed by Li in the presence of uranyl acetate and Mg, Co, Ni, Fe(ous), and Mn. No ppts. were obtained with Cd, Hg, and Cu. Sensitivity studies of these reagents with Na and Li indicate that the triple acetate formed with Cu should be the most satisfactory qual. reagent for Na since the other more sensitive reagents are also sensitive to Li. From concd. K solns. K₂UO₂(OAc)₃ is pptd. by all uranyl acetate reagents for Na.

- 2516 Damianovich, H. "The Chemistry of Helium and Helenoids. Combination of Helium with Uranium by Chemico-Cathodic Activation and Thermal Decomposition of the Complex Formed." Anales asoc. quim. argentina 27, 64-73(1939).

- 2517 Dodé, M., von Halban, H., Jr., Joliot, F., and Kowarski, L. "Energy of Neutrons Liberated by Division of U Nucleus." Compt. rend. 208, 995-7(1939).

300 mg Ra in a block of Be $6 \times 6 \times 2$ cm irradiated a surrounding layer of uranyl nitrate of av. thickness 10 g/cm², the whole being immersed in a vessel contg. 8 l CS₂ in which 200 mg of P had been dissolved. After 6 days irradiation the P was sepd. and its activity examined; this showed that P³² had been formed for which neutrons of energy $> 2 \times 10^6$ ev are necessary. When the expt. was repeated omitting the U only 1/6th the amt. of P³² was obtained. This difference must be due to neutrons produced in the U, and distinct from those incident thereon. As, however, the total energy can increase without an increased no. of neutrons neither expt. is decisive as to the occurrence of a chain reaction.

- 2518 Drobkov, A. A. "Effect of Uranium, Radium and Actinium on the Yield of Peas." Trudy Bio-geokhim. Lab. Akad. Nauk S.S.S.R. 5, 201-04(1939).

Plants were grown on Helriegel's soln. to which H₃BO₃ was added (amt. not given). The av. wt. of dry stems (4.88 g), fruits (0.85 g), and roots (0.56 g) of the plants was detd. before full maturity and served for comparison with the treated series. The treatment with Ra, U, and Ac increased the yield by 204, 104, and 138%, respectively. The weight of the vegetative portion was also increased. The optimal concn. of Ra was 10^{-12} to 10^{-13} %; that of U, 10^{-5} %; and that of Ac, 10^{-11} %. It is known that the soil at plowing and subplowing depth contains about 10^{-10} % Ra. From this it is calcd. that the Ra content of topsoil exceeds the needs of the plants for optimal growth by 3000 times.

2519 Esme, A. "Uranium Compounds and Ceramics." Argile No. 190, 5-7(1939).
Colors and fluorescence of ceramics contg. U are discussed.

2520 Feyel, P. "Acute Experimental Nephritis Due to Uranium Nitrate. Cytophysiologic Study." Ann. anat. path. anat. normale méd. chir. 16, 561-96(1939).

2521 Gibbs, D. F. and Thomson, G. P. "Possible Delay in Emission of Neutrons from U." Nature 144, 202(1939).

Expts. with an intermittent source are described which show that the majority of the neutrons produced in the fission of U appear with a delay of less than 10^{-3} sec.

2522 Glasoe, G. N. and Steigman, J. "Fission Products from Uranium." Phys. Rev. (2), 55, 982-3 (1939).

A further study was made of the radioactivity of the fission products from U irradiated with slow neutrons. When the fission products were collected in cellophane, periods of ~540, 80, 32, 17, and 10 min (shorter periods unresolved) were obtained. The products which passed through 0.5 mil cellophane (1.4 cm air equiv.) showed periods of 380, 35, 17, and 3 min: the 10- and 80-min periods were definitely absent. The gaseous products showed periods of 600, 86, 32, 10, and 5 min, and 35 sec. There are two gaseous products from U, with periods of 35 sec and 5 min. The 86-min period ascribed to Ba^[139] is associated with the longer-period gas; the 17-min period ascribed to Rb^[88] comes from the shorter-period gas. The decay of the products collected in cellophane includes the periods arising from both gases; only the products associated with the shorter-period gas pass through the 0.5-mil foil. The longer-range fission products are assigned to the Kr-Rb-Sr sequence rather than to a Xe-Co-Ba series.

2523 Goldstein, L., Rogozinski, A., and Walen, R. J. "Interaction of Fast Neutrons with U Nuclei." J. phys. radium (7), 10, 477-86(1939).

A source of Po + Be and an ionization chamber filled with H₂ at 35 atms. have been used to study the elastic and inelastic diffusion of neutrons from U. The possibility of using this method to demonstrate the liberation of neutrons from U under bombardment with fast neutrons is discussed. It is concluded that this method of U disintegration is possible, but that too little is known of the inelastically diffused neutrons to allow of the process being detailed. σ_t for neutron diffusion has been found to be 11×10^{-24} cm², which is much greater than that to be expected from an extrapolation from neighboring heavy elements. This implies that chain reactions, if such are possible, could be observed with a mass of U much less than that previously supposed to be necessary.

2524 Goto, H. "Fluorescence Analysis. XIII. Fluorescence Titration Applied to the Amalgam Method. (Application of Liquid Amalgams to Volumetric Analysis. XXIV.)" J. Chem. Soc. Japan 60, 940-4(1939).

Solns. of Ti, Mo, V, U (concn. about 0.1N) are reduced by means of amalgams; Ti, Mo, V, by Zn-Hg; and U by Cd-Hg. The reduced solns. are titrated with KMnO₄ in a vessel of hard glass transparent to ultraviolet light. The end point of the titration is detected by the change of fluorescent color of the fluorescent indicator, produced by excitation with ultraviolet light. Phosphine and rhodamine B are used for Ti and Mo; phosphine is used for V; rhodamine B for U.

2525 Haendler, H. M. and Smith, G. MCP. "Ortho-Quinone Monoxime Inner Complexes." J. Am. Chem. Soc. 61, 2624-6(1939).

Descriptions of the uranyl complexes of phenanthrenequinone monoxime and chrysenequinone monoxime are given.

2526 Hahn, O. and Strassmann, F. "Debris from Disintegration of Uranium." Naturwissenschaften 27, 163-4(1939).

In order to decide between Kr and Rb vs. Xe and Cs in the decompn. products of U and Th the following procedure was followed. The U soln. irradiated with slow neutrons was traversed by an air stream

which takes up the active noble gas. After drying of the air with $\text{Mg}(\text{ClO}_4)_2$ it was passed over active C cooled with CO_2 -EtOH. The C was boiled with acidified H_2O contg. Ba, and the Ba pptd. from the filtrate. In each case the 86-min Ba isotope was found; on working at the most rapid rate an inappreciable amt. of the 14-min Ba was found. Protracted air flow caused a small amt. of the 300-hr Ba to appear. It is concluded that Xe is the intermediate substance since Kr would have produced Sr. No Sr was found. There is Cs in the alkali metals formed; Rb is uncertain. There are 3 alk. isotopes present of less than 8 min, about 35 min, and of fairly long life periods, resp. The active Xe isotope has a very short life, the one from which the 86-min Ba is derived has a life of the order of secs.

- 2527 Heidt, L. J. "Quantum Yields and Kinetics of a Photosensitized Production of Reducing Sugars from Sucrose in Aqueous Solutions of Uranyl Sulfate by Visible and Ultraviolet Light." J. Am. Chem. Soc. **61**, 3223-9(1939).

Quantum yields, ϕ , were calcd. as mols. of sucrose decompd. per photon absorbed by the system. The variation of ϕ with the concn. of sucrose was given by $\phi = a[1 - \exp(-g[\text{sucrose}])]$. The value of ϕ increased when the solns. were not buffered but is independent of the light intensity over a 200-fold range, the temp. between 10 and 35°, the pH between 3 and 6, and the concn. of UO_2SO_4 between 0.0008 and 0.008M. Beer's law was obeyed. The kinetics of the reaction are discussed.

- 2528 Hole, W. L. and Wright, R. W. "Emissive and Thermionic Characteristics of Uranium." Phys. Rev. (2), **56**, 785-7(1939).

Certain properties of clean U in vacuum have been investigated. The following values were found: for emissivity below the m.p. ($\lambda = 0.67 \mu$), 0.51; for thermionic work function, 3.27 ± 0.05 v, with a Richardson A-value of about 6; for m.p., $1,700 \pm 25^\circ\text{C}$; for av. coeff. of linear expansion, 25 to $1,000^\circ\text{C}$, 4×10^{-5} .

- 2529 Hovorka, V. and Sykora, V., "Isonitroso-n-Phenyl-3-Methylpyrazolene as Reagent in Analytical Chemistry." Collection Czech. Chem. Commun. **11**, 70-6(1939).

With $\text{UO}_2(\text{OAc})_2$ or $\text{UO}_2(\text{NO}_3)_2$ a red-orange ppt. is obtained. The pptn. is reported to be quant. in the presence of NaOAc. The calcd. U content of the salt, $\text{UO}_2(\text{C}_{10}\text{H}_8\text{N}_3\text{O}_2)_2$, is 35.31% and the amt. found was 35.24%.

- 2530 In, N, and Ryo, G. "Histologic Changes of Parathyroid and Thyroid Gland in Experimental Uranium-Nephritis." J. Chosen Med. Assoc. **29**, 94-5, 1495(1939).

It is shown that U poisoning affects the action of the parathyroid and thyroid glands.

- 2531 Irvine, J. W. Jr. "Concentrating the Uranium Isotope of Twenty-Three-Minute Half Life." Phys. Rev. (2), **55**, 1105(1939).

$\text{NH}_4\text{UO}_2(\text{AcO})_3$ (30 to 40 g) is dissolved in 100 to 150 cc cold water. The soln. is placed in a 175-cc spherical, soft-glass flask surrounded by paraffin, and is irradiated two hrs with a neutron source (100 mc. Ra + Be). The soln. is poured into 1 l of boiling 1% NH_3OAc soln. A ppt. of a basic uranyl acetate appears in 1 to 3 min; 0.1 g decolorizing C (filter aid) is added, and the soln. filtered through sintered glass. The ppt. is dissolved in hot 5 cc HNO_3 + 20 cc glacial HOAc. Five cc NH_4OAc (1 g/cc) and then a large excess of hot concd. aq. NaOAc are added. The ppt. (1 to 2 g) of $\text{NaUO}_2(\text{AcO})_3$ is filtered, washed with cold glacial HOAc, with Me_2CO , dried, and the activity measured. The 23-min isotope is concd. about 10 times. Additional work showed that element 93, if β -active, has a half-life less than 1 min or greater than 11 hr.

- 2532 Kroupa, E. "Microgravimetric Separation of Zinc and Uranium." Mikrochemie ver Mikrochim. Acta **27**, 1-7(1939).

The Zn is pptd. by H_2S from a soln. contg. NaOAc and slightly acid with $\text{Na}(\text{CH}_2\text{ClCO}_2)$, the ppt. is washed with a similar soln. satd. with H_2S and dissolved in HCl, and the Zn pptd. as ZnNH_4PO_4 , which is dried at 103°C for weighing. The filtrate from the Zn is evapd. oxidized with Br_2 and HCl, and treated with NH_4OAc ; after neutralization with NH_4OH the U is pptd. with oxine and the washed ppt. is dried at 136 to 138°C and weighed.

- 2533 Kuznetsov, V. I. "New Organic Reagents for Inorganic Analysis." Trudy Vsesoyuz. Konferents. Anal. Khim. 1, 81-8(1939).

Monoazo cpds. from cryst. ppts. with Zr and Hf in the presence of mineral acid. A typical precipitant for Zr and Hf is 2-hydroxy-5-methylazobenzene-4-sulfonic acid. One part Zr in 100 million of soln. can be detected. The red soln. of the hydrochloride of anthraquinone-1-azo-4-dimethylaniline forms a blue-violet spot with as little as 0.01 γ of Sn but similar spots are obtained with U, Mo, Au, Zn, Cd, Hg^{++} , Pb^{+4} , Ir, Fe, Ge, and Al. The Sn and U spots alone disappear when moistened with HF.

- 2534 Landenburg, R., Kanner, M. H., Barschall, H. H., and van Voorhis, C. C. "U and Th Fission Produced by Fast Neutrons of Nearly Homogeneous Energy." Phys. Rev. (2), 56, 168-70(1939).

The effective σ_f of the U and Th fission for d+d neutrons of 2.4 mev is detd., and the values $5 \times 10^{-25} \text{ cm}^2$ and $1 \times 10^{-25} \text{ cm}^2$ are found, resp., with an uncertainty of about 25%. The ratio of σ_f for Th and U is shown to be the same within 10% for neutrons of 2.1, 2.4, 2.9 and 3.1 mev av. energy.

- 2535 Lahner, I. "Uranium and Thorium Determinations in Limestone and Dolomite and the Question of the Radioactive Equilibrium in Them." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse Abt. IIa, 148, 149-62(1939).

The U was detd. by its fluorescence and the Th by its emanation. Limestone gave a mean value of $0.3 \times 10^{-7} \text{ g U/g rock}$ and $2.4 \times 10^{-6} \text{ g Th/g}$; for dolomite the values were $4 \times 10^{-7} \text{ g U/g}$ and $1.7 \times 10^{-6} \text{ g Th/g}$. The minerals were from the Austrian Alps. By comparison with the mean value for Ra found by Kroff it can be shown that U and Ra are not in equil. Various reasons for this are discussed.

- 2536 Libby, W. F. "Stability of Uranium and Thorium for Natural Fission." Phys. Rev. (2), 55, 1268(1939).

The half-lives of U and Th for natural fission following neutron absorption are at least 10^{14} years; for natural neutron emission, at least 10^{14} and 5×10^{13} years, resp. The agreement between the U and Th age detns. on old rocks shows that the half-life for any possible natural fission is at least 5×10^9 years.

- 2537 Magnan, C. "Neutrons Emitted During Splitting of U by Neutrons." Compt. rend. 208, 1084-6 (1939).

With an ionization chamber lined internally with U_3O_8 , inside which is 1.5 cm of paraffin, the whole being coated externally with 6 cm paraffin, outside which is placed a source of neutrons (Li + Be), ionization corresponding with arrival of some 170,000 pairs of ions/min was observed. The effect was increased by 40% on trebling the thickness of the U_3O_8 . Various explanations are suggested, one being that ruptures of the U nucleus proceed as a chain reaction, each chain limited to about 50 ruptures; another that showers of about 50 protons are formed.

- 2538 Malatesta, L. "Xanthates of Metals of Group VI." Gazz. chim. ital. 69, 408-16(1939).

A concd. soln. of MeOCS_2K and $\text{UO}_2(\text{NO}_3)_2$ gave the reddish-yellow xanthate in very low yield. The ethyl-, isoamyl-, isopropyl-, propyl-, butyl-, isobutyl-, and cyclohexylxanthates were likewise prepd., ligroin being used to ppt. the crystals from soln. (usually contg. $(\text{OAc})^-$). These cpds. are very readily hydrolyzed, impure, have a U/S ratio of about $\frac{1}{4}$, and a general formula UO_2X_2 , where X is the org. radical.

- 2539 Malatesta, L. "Dithiocarbamates of Metals of the Sixth Group." Gazz. chim. ital. 69, 752-62 (1939).

U^{+4} in soln. does not react with $(\text{R}_2\text{NCS}_2)^-$ but $(\text{UO}_2)^{++}$ forms salts of the form $\text{UO}_2(\text{R}_2\text{NCS}_2)_2$ which are more stable than the corresponding xanthates. Double decompn. of $\text{UO}_2(\text{NO}_3)_2$ and $\text{Et}_2\text{NCS}_2\text{Na}$ in molar soln. ppts. uranyl N,N-diethyldithiocarbamate, $\text{UO}_2(\text{Et}_2\text{NCS})_2$, in low yield. In satd solns. the pptn. is nearly quant., but a ligroin purification is necessary to remove $(\text{OAc})^-$. Uranyl N,N-dipropyldithiocarbamate, uranyl N,N-dibutyldithiocarbamate, uranyl N-ethyldithiocarbamate, and uranyl N-isobutyldithiocarbamate were also prepd. These are red, stable, not decompd. by boiling $\text{C}_5\text{H}_5\text{N}$, decompd. instantly by inorg. or org. acids, and may be recrystd. from H_2O .

- 2540 Meixner, H. "Fluorescence Studies on Secondary Uranium Minerals." Naturwissenschaften **27**, 454(1939).

- 2541 Moerman, N. F. and Kraak, H. H. "The Fluorescence Scheme of Uranyl Salts." Rec. trav. chim. **58**, 34-8(1939).

At -180° the absorption spectrum of uranyl cpds. has one band in common with the emission spectrum. At room temp., however, a new band appears in the absorption spectrum on the red side, having the same wavelength as the dominant band of the emission spectrum, while a new band also appears in the emission spectrum on the violet side, at the same wavelength as the principal absorption band. This behavior can be explained by means of the potential curves showing the energy content on the $(\text{UO}_2)^{++}$ ion as a function of the U-O distance. At -180° absorption starts only from the 00' level. Temp. equil. is reached within 10^{-6} sec.

- 2542 Mouzon, J. C. and Park, R. D. "Delayed γ -Rays from U Activated by Neutrons." Phys. Rev. (2), **56**, 238-41(1939).

A cloud chamber in a magnetic field was operated in conjunction with a source of neutrons in such a way as to observe γ rays emitted during the bombardment of U by neutrons and the no. emitted about $\frac{1}{2}$ sec after bombardment in alternate expansions of the chamber. Although the energy distribution of the γ rays seems to be about the same in the two expansions, the total no. of γ rays emitted during bombardment is considerably greater than those emitted $\frac{1}{2}$ sec after bombardment. This means that more γ rays are obtained which are coincident (or nearly so) with fission than γ rays associated with a period of as much as several sec.

- 2543 Nier, A. O. "The Isotopic Constitution of Uranium and the Half Lives of the Uranium Isotopes. I." Phys. Rev. (2), **55**, 150-3(1939).

A mass spectrographic detn. gave the following abundance ratios: $\text{U}^{238}/\text{U}^{235} = 139 \pm 1\%$; $\text{U}^{238}/\text{U}^{234} = 17,000 \pm 10\%$. No other isotopes were found. By assuming that the Ac series is 4.6% as active as the U, the following decay consts. are computed: U_I , $1.520 \times 10^{-10} \text{ yr}^{-1}$; U_{II} , $2.6 \times 10^{-6} \text{ yr}^{-1}$; AcU, $9.72 \times 10^{-10} \text{ yr}^{-1}$. The corresponding half-lives are, resp., $4.56 \times 10^9 \text{ yr}$, $2.7 \times 10^5 \text{ yr}$ and $7.13 \times 10^8 \text{ yr}$.

- 2544 Ouang, C.-H. "Complex Colloidal Cyanides of Heavy Metals." J. chim. phys. **36**, 62-70(1939). Uranyl cyanide is considered and compared with the corresponding Cu cpd. A polarogram is included.

- 2545 Polaczek, W. "M-Series Absorption Spectra of Au, Tl, Pb, Bi, Th, U, and W." Sitzber. Akad. Wiss. Wien, Math.-naturw. Klasse Abt. IIa, **148**, 81-7(1939).

The M_γ lines of the above elements and in the case of U and Th also M_{IV} were photographically registered, employing a Siegbahn vacuum-spectrograph. A "Seeman" tube with exchangeable anticathodes was used as a source of radiation. The absorption elements were applied in the form of thin foils, 0.4μ to 10μ thick, obtained by std. methods. Photographs, taken with the usual precautions, were measured with a microphotometer.

- 2546 Randall, J. T. and Wilkins, M. H. F. "Luminescence and Photoconductivity of Solids." Nature **143**, 978-9(1939).

A brief description of the luminescence of uranyl- and tungsten-contg. materials is given.

- 2547 Retovsky, R. "The Stimulation of the Germination of Seeds by Uranyl Nitrate." Rozprawy Ceska Akad. Ved Umeni Prazske Trida 2. Math.-Prirod. **49**, No. 12, 31p. (1939).

The stimulation of the germination of poorly germinating seeds was discussed and followed in detail in red-seed wheat. Stimulation expts. with $\text{UO}_2(\text{NO}_3)_2$ were carried out on the grains of wheat, rye, barley, maize and on horse-chestnut seeds. In wheat seed, an optimum stimulation concn. was found to be 0.004 M, with swelling between filter paper in Petri dishes. The increase in germination was up to 20% compared with the controls. With an increasing conc. of $\text{UO}_2(\text{NO}_3)_2$ the individual swelling capacity of the grain declined. The course of the reduction of Te from a soln. of Na tellurate by half-grains is in direct

relation to the faculty of germination and anabiosis. By reduction in the tissues of the germs of the seeds Te is pptd. in a blue form. The endosperm of the grain lacks this capacity. A supplementary reduction of Te in the embryo plant as well as in the endosperm leads to the pptn. of Te in a black form. In this process, an already reduced blue Te remains unchanged. Germs contg. U, Se, and Te likewise germinate and grow. In these cultures dwarf forms were observed; they were found only occasionally in the controls. It was, however, impossible to keep them alive. In the germination and growth of germs overfilled with blue Te, an unequal distribution of the reduced Te into the root parts was observed.

2548 Schrerbina, V. V. "Oxidation-Reduction Potentials as Applied to the Study of the Paragenesis of Minerals." *Doklady Akad. Nauk S.S.S.R.* 22, 503-06(1939).

The oxidation-reduction potentials of 18 ion pairs are given in v for a 1N soln. at 18°, including among others: $V^{+3} \rightarrow V^{+4}$ (+0.40 v); $U^{+4} \rightarrow U^{+6}$ (+0.41 v); $Fe^{++} \rightarrow Fe^{+3}$ (+0.75 v); $Mo^{+5} \rightarrow Mo^{+6}$ (+0.78 v); and $Pb^{++} \rightarrow Pb^{+4}$ (+1.80 v). Any pair is an oxidizer with regard to any other pair of lower pos. potential.

2549 Stamberg, C. J. —assigned to North Shore Coke and Chemical Co. Process of Working Ores of Vanadium and Uranium. Oct. 17, 1939. (U. S. Patent 2,176,610)

This patent describes the recovery of V and U from acid solns. from the leaching of S treated ores (SO_2 , H_2SO_4 , or $(NH_4)_2SO_4$). V is removed by neutralization and oxidation (e.g., $NaClO_3$) so that a ppt. is obtained. Impurities of Fe, Al, and Mg removed as basic sulfates or as hydroxide. U is then pptd. as a Na uranate.

2550 Szilard, L. and Zinn, W. H. "Instantaneous Emission of Fast Neutrons in the Interaction of Slow Neutrons with Uranium." *Phys. Rev.* (2), 55, 799-800(1939).

Approx. two neutrons are emitted instantaneously per U fission; "instantaneous" should mean less than 10^{-14} sec. If there are any delayed neutrons, their no. is much smaller.

2551 Thibaud, J. and Moussa, A. "Rupture of U Nuclei by Neutrons and Liberation of Resultant Energy." *Compt. rend.* 208, 744-6(1939).

Further evidence based on the distribution of energies, range of resultant nuclei in Al, effective λ of U, and effects of slow neutrons as shown by change (or absence thereof) in effect when the irradiating neutrons are passed through screens of Cd and B before falling on the U, is adduced in support of the rupture of the U nucleus into two strongly ionizing nuclei of at. wts. approx. 90 and 150. If Bi, Pb, Tl, Ta, W or Mo undergo rupture, when irradiated with neutrons in presence of paraffin, the probability of their doing so is not more than 1/250th of that for U. Further chem. evidence that one of the elements resulting from rupture of U is Br is described.

2552 von Halban, H. Jr., Joliot, F., and Kowarski, L. "Energy of Neutrons Liberated in the Nuclear Fission of Uranium Induced by Thermal Neutrons." *Nature* 143, 939(1939).

By means of an O-filled ionization chamber, recoil energies of about 2.5 mev were obtained. Neutrons possessing an energy of at least 11 mev are liberated in U irradiated with thermal neutrons.

2553 von Halban, H. Jr., Kowarski, L., and Savitch, P. "Simple Capture of Thermal Neutrons and of Resonance Neutrons by U." *Compt. rend.* 208, 1396-8(1939).

Simple capture of neutrons in U, as distinct from the capture with subsequent fission of the nucleus, produces an isotope of U with subsequent β decay. The σ for this process is measured by comparing it with the σ of gold nuclei, and found to be $(1.3 \pm 0.45) \times 10^{-24}$ cm². There is also a resonance band for this process, and this is found to be remarkably wide. The chance that a fast neutron, in the course of being slowed down should happen to have at one time an energy within this band, is found to be 0.16 ± 0.025 ; this is approximately equal to the ratio of bandwidth to the energy of the band.

2554 Whitaker, M. D., Barton, C. A., Bright, W. C., and Murphy, E. J. "The Cross Sections of Metallic Uranium for Slow Neutrons." Phys. Rev. (2), 55, 793(1939).

The capture, scattering, and total cross sections are 11 ± 3 , 12 ± 3 , and $23.1 \pm 0.5 \times 10^{-24}$ sq. cm., resp.

2555 Zinn, W. H. and Szilard, L. "Emission of Neutrons by U." Phys. Rev. (2), 56, 619-24(1939). Fast neutrons emitted by U under the action of thermal neutrons were studied by using a Ra + Be photoneutron source. The background due to the primary neutrons can be neglected since only a few of the photoneutrons are sufficiently fast to be counted. Data are obtained concerning the energy spectrum of the U fission neutrons by recording photographically by means of a linear amplifier and cathode-ray oscillograph the pulses due to He atoms projected in an ionization chamber. Visual inspection of the record gives an upper limit of the spectrum of 3.5 mev. The no. of neutrons emitted is estd. by analyzing the pulse distribution of H atoms projected by U neutrons in an ionization chamber filled with H₂ and A. The no. found is brought into relationship with the no. of fissions, observed under comparable conditions, in an ionization chamber lined with a thin film of U oxide containing a known amt. of U. In this way it is found that about 2.3 neutrons are emitted/fission. The method used would permit a greater accuracy in the detn. of this no. than the actual accuracy obtained in the present expts. This no., together with σ_f and σ for radiative capture gives the no. of neutrons produced for each thermal neutron absorbed in U.

PUBLICATIONS LOCATED IN 1940

- 2556 Biltz, W., Lehrer, A., and Rahlfs, O. "The Application of the Ammonia-Extraction Procedure to Hydroxides and Hydrated Oxides." *Z. anorg. allgem. Chem.* **244**, 281-316(1940).

Various substances were extrd. with liq. NH_3 at the temp. of solid CO_2 until no more H_2O was removed; the compn. of the remaining material was detd. tensimetrically. The NH_3 removes all except the chemically bound H_2O . $\text{UO}_4 \cdot \text{H}_2\text{O}$ gave a definite hydrate, $\text{UO}_4 \cdot 2\text{H}_2\text{O}$, but showed no NH_3 adsorption. In general, the ability of hydrous oxides to combine stoichiometrically with NH_3 increases from left to right from top to bottom in the periodic table.

- 2557 Birnbaum, N. and Edmonds, S. M. "New Applications of the Silver Reductor. Determination of Uranium and Copper." *Ind. Eng. Chem., Anal. Ed.* **12**, 155-7(1940).

$(\text{UO}_2)^{++}$ in the presence of hot 4N HCl is reduced completely to U^{+4} by the Ag reductor and the reduced soln. can be titrated with $\text{Ce}(\text{SO}_4)_2$ soln. in the presence of o-phenanthroline ferrous complex as indicator. In 2N HCl, Cu^{++} is reduced to $(\text{Cu}_2\text{Cl}_4)^{-}$. Direct titration of the cuprous salt gives low results because of atm. oxidation. If, however, the reduced soln. is run into ferric alum soln., this serves to prevent low results and the soln. can then be titrated with $\text{Ce}(\text{SO}_4)_2$ in the presence of o-phenanthroline ferrous complex. The presence of HNO_3 , Fe, Mo, V, and Cu interfere with the detn. of U by means of the Ag reductor but in the detn. of Cu, the presence of HNO_3 , Zn, Sn, H_3AsO_4 , Bi and Cd do not harm. Otherwise the results are excellent for both detns.

- 2558 Booth, E. T., Dunning, J. R., Grosse, A. V., and Nier, A. O. "Neutron Capture by Uranium (238)." *Phys. Rev.* (2), **58**, 475-6(1940).

The 24-min resonance capture of neutrons by U is due to U^{238} only. The initial specific β activity is 3290 cpm/mg of $\text{U}_3^{238}\text{O}_8$. Enough U_3O_8 to contain 1 mg $\text{U}_3^{238}\text{O}_8$ gave 3240 cpm.

- 2559 Borovskii, I. B., Blokhin, M. A., and Grzhibovskaya, L. A. "X-Rays — Spectroscopic Qualitative and Quantitative Analysis of the Rare Elements." *Izvest. Akad. Nauk S.S.S.R. Sér. Fiz.* **4**, 122-4(1940).

Various ores and minerals were analyzed for the rare elements with the x-ray spectrograph and with a bent crystal (Cauchois-Johann method). For the specially prepd. mixts. of pure elements the relation between the intensity of lines and the concns. of Mn, Cr, Sr, Y, Zr, Nb, Mo, Ce, La, Pr, Nd, Ta, W, Pb, Th, and U was found.

- 2560 Carter, A. H. and Weiss, J. "Transfer of Excitation Energy from Uranium Ions in Solution." *Proc. Roy. Soc. (London)*, **A. 174**, 351-70(1940).

The transfer of electronic excitation energy in soln. has been investigated in the case of the photosensitized decompn. of $\text{H}_2\text{C}_2\text{O}_4$ by U ions, and more detailed information about the mechanism of the energy transfer has been obtained by studying the reaction in the presence of substances (I^- , Br^-) which can act as quenchers of the U fluorescence. New exptl. facts are presented which cannot be explained by any of the previously advanced theories. In particular, widely different relative amts. of the products of decompn. (CO , CO_2 , HCOOH) have been observed with varying concn. of the quenching substances and H^+ in the soln. A theory is discussed based on the electron transfer process between excited U ions and $(\text{C}_2\text{O}_4)^{-}$. The observed complex formation between the reacting ions is interpreted on the basis of a quantum mechanical resonance in the elementary process of quenching. In connection with the above investigation the quenching process of the U fluorescence by I^- has been investigated and the elementary processes involved have been studied experimentally and discussed on a similar theoretical basis.

- 2561 Cauchois, Y. and Manescu, I. "L-Absorption Spectra of U, Pt, and W." Compt. rend. **210**, 172-4(1940).

The L-absorption spectra of U, Pt, and W have been studied. Discontinuities have been measured in the first and second orders at the 201 plane and in the first order at the 100 plane. The results for the wavelengths and energy levels deduced on the basis of the absorption freq. L_{III} found here, are given in tabular form.

- 2562 Coulter, L. V., Pitzer, K. S., and Latimer, W. M. "The Entropies of Large Ions. The Heat Capacity, Entropy and Heat of Solution of Potassium Chloroplatinate, Tetramethylammonium Iodide and Uranyl Nitrate Hexahydrate." J. Am. Chem. Soc. **62**, 2845-51(1940).

Tables of data on $UO_2(NO_3)_2 \cdot 6H_2O$ are given covering temps. from 15 to 300°K.

- 2563 Darnell, M. C. Jr. and Walker, B. S. "Determination of Sodium in Biological Fluids." Ind. Eng. Chem., Anal. Ed. **12**, 242-4(1940).

The color developed with uranyl zinc sodium acetate by sulfosalicylic acid and NaOAc has been studied as a method of detg. Na. The color does not follow Beer's law exactly but it is reproducible and stable to time and temp. The method for detg. Na in biol. fluids involves pptn. of uranyl zinc sodium acetate from EtOH soln., removal of excess precipitant by washing with EtOAc in HOAc and with Et_2O , removal of phosphate as uranyl phosphate, and photoelec. measurement of the color developed by sulfosalicylic acid and NaOAc. Recovery of Na from aq. soln. and from blood serums indicates a max. error of less than 1% for the procedure.

- 2564 Dufke, F., "Skin Disease Catalysis. Iodine Activity and Uranium Therapy." Dermatol. Wochschr. **111**, 1054-8(1940).

- 2565 Ehrke, L. F. and Slack, C. M. "Gettering Powers of Various Metals for H_2 , O_2 , N_2 , CO_2 and Air." J. Applied Phys. **11**, 129-39(1940).

Measurements of the "gettering" or clean-up ability of Al, Mg, Th, U, Zr, Ba, and misch metal (active constituents largely Ce and La) for the common gases were made. In most cases the measurements were quant. and represent gettering powers unassisted by an electric discharge or other source of ions. The effect of temp. on the gettering and keeping properties of several of the getters is given. The superior gettering powers of the diffuse layers produced by vaporizing in the presence of a gas, as compared with those of the bright getter deposits produced in a high vacuum were confirmed. Ba and misch metal were found to be the most active of the materials tried, and the convenient forms in which Ba is now commercially obtainable would seem to make it first choice for most work, though it is not effective in the presence of Hg vapor. Mg and Al showed little activity without the presence of a discharge. Th and U showed considerable activity for H_2 and O_2 but the high temps. needed for flashing make them rather inconvenient to use.

- 2566 Giroto, A. "Scheme for Analysis of Samarskite." Rev. chim. ind. (Rio de Janeiro) **9**, No. 104, 10-12(1940).

Digest 1 g of sample with 5 sep portions of HF. The residue contains rare earths, Th, U^{+4} , Ca, and Mg; the soln. contains Nb, Ta, Ti, Zr, U^{+6} , Fe, and Mn. Fume the residue with H_2SO_4 and treat with $H_2O_2 + HCl$ to dissolve all rare earths. Boil off excess peroxide, neutralize with NH_3 , and sat. with H_2S to get a ppt. which contains PbS and SnS_2 . In this filtrate, remove H_2S by treatment with Br_2 and ppt. rare earths, Th and U with NH_3 , after which Ca and Mg can be detd. as usual. Dissolve the NH_3 ppt. in a little HCl and ppt. any Th or rare earths by boiling with $H_2C_2O_4$. Destroy $H_2C_2O_4$ in the filtrate by heating with HNO_3 , ppt. the U with NH_3 , ignite and weigh as UO_2 and calc. to U_3O_8 . The original filtrate must be analyzed for U and the result added to the U detd. above to obtain total U.

- 2567 Goto, H. "Fluorescence Analysis. V. Fluorescence Detection. 1." Science Repts. Tôhoku Imp. Univ. First Ser. 29, 204-18(1940).

One γ of Ag can be detected by its prevention of the yellowish-green fluorescence of UO_2SO_4 soln. under ultraviolet light. Tl^+ is like Ag in preventing the fluorescence of UO_2SO_4 soln. Tl^{+3} changes the fluorescence of rhodamine B from red to violet; as little as 0.5 γ Tl gives the test. As little as 0.02 γ Bi can be detected by heating CaO in a gas flame, dipping the CaO in a Bi soln. and again heating; a red luminescence is obtained. The white ppt. formed with UO_2 and arsenate gives the test as does phosphate.

- 2568 Goto, H. "Fluorescence Analysis. VI. Fluorescence Detection. 2." Science Repts. Tôhoku Imp. Univ. First Ser. 29, 287-303(1940).

The NaZnUO_2 triple acetate will serve to detect 0.5 γ of Na. Only 0.02 γ of U is necessary to give fluorescence under an arc light in the NaF bead. The tests with the borax bead, with Na_2HPO_4 with cerulean and with cochineal are less sensitive. 0.5 γ of V after reduction with Zn gives a fluorescence test with cerulean, as do Mo and UO_2 cpds. The strong greenish-yellow fluorescence of the triple acetate of Zn, UO_2 and Li can be obtained with 1 γ of Li. The tests with cochineal, oxine, rhodamine B, morin, various beads, and heated CaO are tabulated for 35 different ions.

- 2569 Goto, H. "Fluorescence Analysis. VIII. A Spectroscopic Study of Fluorescence Tests." Science Repts. Tôhoku Imp. Univ. First Ser. 29, 461-7(1940).

Spectrograms are shown of 40 fluorescence tests and the wavelengths of the bands are given. The tests involve the detection of Te, Bi, U, V, Mn, Cd, Al, Zn, Ca, Mg, Vc, Zr, As, Na, Li, Hg, Pb, Sb, Sn, Mo, Sr, Th, and W. The tests were made with fused beads, with oxine cpds., UO_2 or halogen cpds., and with tests involving morin, cochineal, and alkanna.

- 2570 Hackl, O. "A Sensitive and Characteristic Reaction Which is Suitable for Determining Traces of Uranium." Z. anal. Chem. 119, 321-6(1940).

$(\text{UO}_2)^{++}$ reacts with H_2O_2 in a slightly basic soln. to give a yellow coloration, which for small quantities of U is comparable with the Ti test, which, however, is obtained only in an acid soln. As little as 0.2 mg of U suffices to give the test and a colorimetric comparison can be made. Cr must be absent. The test is made conveniently in the aq. ext. obtained after fusion with Na_2CO_3 . There is some interference by Mo, V. and Ce but in most minerals the quantities of these 3 elements present do no serious harm.

- 2571 Haendler, H. M. and Smith, G. McP. "Studies of Inner Complexes." J. Am. Chem. Soc. 62, 1669-72(1940).

Brief absorption spectra data for uranyl complexes with phenanthraquinone monoxime and chrysene-quinone monoxime are given. The double diethanolato absorption spectra of the complexes of each are also noted.

- 2572 Henderson, M. C. "Heat of Fission of U." Phys. Rev. (2), 58, 774-80(1940).

The heat produced during slow neutron bombardment in 13.36 g metallic U was measured on a resistance thermometer. Simultaneously the number of fissions produced in a 54 mg layer of U was counted by an ionization chamber and pulse amplifier. The source of neutrons was the Princeton cyclotron, using the Be+H reaction at 6.5 mev. The U layer gave 40.1 ± 0.2 α /min into 2π solid angle and under slow neutron bombardment gave about 340 fissions/min. At the same time the heat output from the 13 g sample was 40 μw . A method of calcn. was developed that allows for the transient effects of fluctuations in the neutron output of the cyclotron. The weighted av. of 13 runs is 177 mev/fission. The actual kinetic energy of recoil carried by the fission fragments is about 12 mev less than this, $\pm 50\%$, depending upon more precise knowledge of the fission mechanism.

- 2573 Hoffmann, J. "The Detection and Determination of Small Amounts of Uranium in Silicates Including Glass." *Sprechsaal* 73, 153-7(1940).

The process is carried out in 6 steps. Seprn. of the SiO_2 . The SiO_2 must be completely removed since it decomp. the NaF in the subsequent fusion. For this purpose the HCl soln. of the products of the carbonate fusion is evapd. several times on the water bath (not at 120°) and then evapd. with fuming HF. The residue from this treatment is decompd. by fusion with a mixt. of 10 parts Na_2CO_3 and 3 parts borax. The soln. of this melt is combined with the filtrate from the pptn. of the SiO_2 . Pptn. with H_2S . When Mo is present the sulfide pptn. is carried out in the usual manner in a pressure bottle. Pptn. with $(\text{NH}_4)_2\text{S}$. Cr, Mo, Ni, and other ions which interfere with fluorescence must be removed by repeated pptn. Pptn. of the hydroxides. This is done with very pure CO_2 -free NH_3 . In the 2nd pptn. with NH_3 a small amt. of FeCl_3 soln. is added to improve the adsorption of the uranyl ions. Seprn. of the U from the other hydroxides. The other hydroxides are pptd. by treating the HCl soln. with NH_3 in the presence of $(\text{NH}_4)_2\text{CO}_3$. This pptn. is repeated. In order to prevent Ca from going into soln. with the U, the soln. and ppt. are heated for a long time in the 2nd pptn. By this treatment any $\text{NH}_4\text{CO}_2\text{NH}_2$ present as an impurity in the $(\text{NH}_4)_2\text{CO}_3$ is converted into normal $(\text{NH}_4)_2\text{CO}_3$ so that the formation of sol. Ca carbamate is prevented. The U soln. must be evapd. in a Pt dish in the presence of HF. Detn. of the U. 0.5 to 1.0 g of pure NaF is added to the ignition residue in Pt dish. The mixt. is treated with hot water, evapd., dried, ignited and the residue transferred to an agate dish. The U and Na are well mixed by rubbing to obtain a homogeneous mass. A bead is then made from this mass on a Pt. wire. The bluish fluorescence which is produced when this bead is exposed to ultraviolet light is compared with that produced in beads of known U content. U contents of between 1.0 and 0.001 γ can be detd. with an accuracy of 1% U.

- 2574 Katumava, A. "Comparison between Chemical Quantitative Analysis and Histochemical Explanation of Fats and Lipoids in Uranium Nephritis." *Tokyo Igakkwai Zasshi* 54, 34-5 (1940).

- 2575 Kaufman, L. E. "The Application of Pyridine in the Determination of Uranium and in Its Separation from Alkaline Earth Metals." *Zavodskaya Lab.* 9, No. 2, 228-9(1940).

In sepg. small amts. of U from Ca by pptn. with pyridine (according to the method of Ostroumov) it was found that a complete seprn. is obtained only if NH_4NO_3 is added to the soln.; the presence of CO_2 in the reagent has no effect on the detn.; and a large excess of $(\text{NH}_4)_2\text{CO}_3$ ppt. U completely. U is pptd. from the $(\text{NH}_4)_2\text{CO}_3$ soln. by the addn. of NH_4Cl and tannin. This property can be used for the seprn. of U from Fe after alk. earths have been removed. Under the same conditions Th is pptd. rapidly and completely. Ce is pptd. more slowly (after 3 to 4 hr) and requires a large excess of pyridine.

- 2576 Kaufman, L. E. "Separation of Quadrivalent Iodate and Sexivalent Uranium by Means of Potassium Iodate." *Doklady Akad. Nauk S.S.S.R.* 27, 807-08(1940).

U^{+4} was detd. in mixts. of $\text{U}(\text{SO}_4)_2 \cdot n\text{H}_2\text{O}$ or $\text{U}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ (prepd. from uranyl nitrate by a modification of Polesitskii's method) with UO_3 or U_3O_8 by dissolving the mixt. in 25 to 40 ml of 4.5% H_2SO_4 , adding an equal vol. of hot 10% KIO_3 soln. in 10% H_2SO_4 , dilg. the mixt. to twice its vol. with an 0.8% soln. of KIO_3 in 2% H_2SO_4 , cooling, filtering, and washing the ppt. with hot NH_4OH , dissolving in HNO_3 and repptg. the U as NH_4 uranate with NH_4OH and detg. as U_3O_8 . All operations except the pptn. of $(\text{NH}_4)_2\text{UO}_4$ were carried out in a current of CO_2 . The U^{+6} was detd. in the filtrate by methods involving double pptn. with NH_4OH and washing the ppt. with NH_4NO_3 , or, decompn. of the iodate with $\text{H}_2\text{C}_2\text{O}_4$ and pptn. of the U^{+6} with tannin. The results obtained agree with those in which the U^{+4} was detd. by the usual titration method and the U^{+6} by the difference between the total U detd. in the ordinary manner as U_3O_8 and the U^{+4} . The method is suitable also for the detn. of U^{+4} and U^{+6} in U_3O_8 .

- 2577 Kaufman, L. E. "The Use of Tannin for the Separation of Uranium from Some Other Elements." Zavodskaya Lab. 9, No. 1, 106-07(1940).

The methods of Das Gupta and of Schoeller and Webb are compared by analyzing 2 samples of minerals contg. small amts. of ottenite and 1 sample enriched with ottenite. Parallel analyses by the acetate and the tannin methods were made. In the 1st case U and Ca were detd. in the filtrate by direct pptn. of P by tannin and by the ordinary method after the decompn. of HOAc by HNO_3 . In the tannin method, after the sepn. of the ppt. from the oxalate soln., the P content was detd. in the filtrate after its decompn. with HNO_3 . The contents of U_3O_8 , CaO, and P_2O_5 obtained by the acetate and tannin methods in the samples contg. small amts. of ottenite were, resp., U_3O_8 2.37 and 2.07%; CaO 2.02 and 2.75%; P_2O_5 2.0 and 2.55%. In the 2nd sample the resp. contents were U_3O_8 2.14 and 2.28%; CaO 2.24 and 2.32%; P_2O_5 1.1 and 1.22%. The contents in the enriched sample were, resp., U_3O_8 25.1 and 24.3%; P_2O_5 5.38 and 4.9%. Attempts to sep. U from V by the tannin method were unsuccessful.

- 2578 Kazanskii, B. A., Sergienko, S. R., and Zelinskii, N. D. "Contact Cyclization of Paraffinic Hydrocarbons." Doklady Akad. Nauk S.S.S.R. 27, 664-9(1940).

A fraction of synthin, b.p. 83 to 138°, contg. 11.84% unsaturates and having 66.0 aniline point and 10 octane no., was passed over a no. of catalysts at 425 to 500°. Condensates having the following values for % unsaturates, % aromatics, aniline point (max.) and octane no. were obtained with 85% Al_2O_3 and 15% UO_3 (preheated in N_2 to 450°) at 500°, 11.26, 11.40, 56.2, 26, and 62% and Al_2O_3 , 24% Cr_2O_3 , and 14% UO_3 (preheated in N_2 at 475°) at 475°, 9.78, 26.42, 32.3, —.

- 2579 Konaka, Y. "Catalytic Polymerization of Ethylene under Ordinary Pressure. IX. Polymerization Activity of Nickel Catalyst." J. Soc. Chem. Ind. Japan 43, (Suppl. binding) 330(1940).

The effect of Ni catalysts upon the formation of liq. polymers of C_2H_4 was studied. The influence of various metal oxides as promoters of the oil formation also was examined. No significant promoting effects were observed with the oxides of Cr, Mo, and W. A remarkable influence was noticed in the case of U_3O_8 , but there seems to exist an optimum amt. of the catalyst to be added. Al_2O_3 , MgO, and Se oxide did not exert any notable influence upon the promotion of the polymerization activity. ThO_2 shows a good promoting effect, similar to that of U_3O_8 . From the point of activity and life, Ni- ThO_2 - U_3O_8 - Al_2O_3 -kieselguhr (10:1.5:1.0:0.3:15) was found to be the best catalyst; it produced 3.9 cc of the polymer oil from 14.2 l. of C_2H_4 at 240°.

- 2580 Kuznetsov, V. I. and Vasyunia, N. A. "The Reactions of Aminobenzenearsonic Acids with 2-Furaldehyde." Zhur. Obshchei Khim. 10, 1203-09(1940).

When $\text{o-NH}_2\text{C}_6\text{H}_4\text{AsO}_3\text{H}_2$, HCl, and 2-furaldehyde are mixed in dil. aq. soln., a ppt. of the Schiff base, decompd. without melting at 166 to 167°, is obtained. If the soln. is more concd. and the acidity is carefully controlled, a Stenhouse dye, the o,o' -diarsonic acid of hydroxyglutaconaldehyde dianil, $\text{H}_2\text{O}_3\text{AsC}_6\text{H}_4\text{NHCH:CHCH:C(OH)CH:NC}_6\text{H}_4\text{AsO}_3\text{H}_2$ is obtained. This is very unstable, especially in alk. soln., in which the orange color disappears in a few sec. The dye forms colored salts with stannic, Ti, Ar, Hf, Cb, Ta, Th, Sb, Bi, chromic Mo, W, and U ions. These salts can also form if a dil. soln. of the Schiff base mentioned is prepd. and treated with a soln. of the metal. At first the colorless salt of the arsonic acid ppts. and this gradually changes to the red salt of the Stenhouse dye. The reaction can be used as a color test for the metals named, but it is sensitive only to solns. stronger than 0.1 mg/ml. The *m*- and *p*-isomers of $\text{o-NH}_2\text{C}_6\text{H}_4\text{AsO}_3\text{H}_2$ do not form Schiff bases with 2-furaldehyde, but give the Stenhouse dye at once.

- 2581 Lel'chuk, S. L. and Karpov, A. Z. "Synthesis of Acetic Acid Under High Pressure." Prom. Org. Khim. 7, 210-14(1940).

CO was compressed to 300 atm., mixed with MeOH obtained from water gas, the mixt. heated to 300 to 350°, passed through the catalyst, and then through a condenser and receiver while the gases were recirculated. The ratio of CO/MeOH in moles was 0.001. The catalyst consisted of H_3PO_4 + activated charcoal and addns. of CrPO_4 , uranyl nitrate, Ti nitrate, and also $\text{H}_4\text{P}_2\text{O}_7$ + CrPO_4 and phosphomolybdic acid. The catalysts and the yields of HOAc in the condensate were, resp., H_3PO_4 + CrPO_4 , 14.3,

H_3PO_4 + uranyl nitrate 17.30, H_3PO_4 + Ti nitrate 18.2, $\text{H}_4\text{P}_2\text{O}_7$ + CrPO_4 14.4, and phosphomolybdic acid 11.9%. The activity of H_3PO_4 + uranyl nitrate reached max. activity after 12 hr. The catalyst contg. H_3PO_4 and uranyl nitrate yielded 72.45% aromatics.

- 2582 Lewis, D. T. "Gravimetric Determination of Phosphate and Vanadate." Analyst **65**, 560-1 (1940).

This paper reports the detn. of P in phosphates of Na, NH_4 , Ca, and Ba as well as in urine and org. cpds. by pptn. as $\text{NH}_4\text{UO}_2\text{PO}_4$ and weighing as $(\text{UO}_2)_2\text{P}_2\text{O}_7$. The pptn. is accomplished after neutralization to methyl red and addn. of a little HOAc and 2 g of NH_4OAc by the dropwise addn. of 0.1N $\text{UO}_2(\text{OAc})_2$ soln. Before filtering, the mixt. is allowed to stand overnight. Similarly V can be pptd. as $\text{NH}_4\text{UO}_2\text{VO}_4 \cdot 1.5\text{H}_2\text{O}$ and good results are obtained by drying to const. wt. at 105° but concns. exceeding 0.08 g V_2O_5 in 25 ml should be avoided. This V salt does not seem to have been described in the literature.

- 2583 Luchinskii, G. P. "Action of Hydrogen Chloride on Titanium and Uranium Anhydrides." Zhur. Obshchei Khim. **10**, 769-72(1940).

When treated with liq. HCl at low temp. and with HCl gas at 200° to a satn. point, TiO_2 added 2 moles. HCl to form yellow $\text{Ti}(\text{OH})_2\text{Cl}_2$. In the presence of H_2O it formed a trihydrate. Under similar conditions UO_3 added 1 mol. HCl to form $\text{UO}_2(\text{OH})\text{Cl}$ and the dihydrate.

- 2584 Meitner, L. and Frisch, O. R. On the Products of the Fission of Uranium and Thorium under Neutron Bombardment. Copenhagen, Munksgaard, 1940.

- 2585 Meixner, H. "Fluorescence, Optical and Chemical Observations on Uranium Minerals." Chem. Erde **12**, 433-50(1940).

Examn. of U minerals in ultraviolet light classifies them as: I, strongly luminous, (a) the U phosphates, arsenates and sulfates showing an intense yellow-green fluorescence; autunite, uranospinite, uranocircite, uranopilite, β -uranopilite, and U-contg. hyalite, (b) the U carbonates, showing an intense green fluorescence; schrokingerite (dakeite), and uranothallite; II, weakly luminous, showing a brownish to yellowish or greenish fluorescence, carnotite, dewindtite, soddyite, and becquerelite, and some specimens of zippeite, uranotil, β -uranotil, gummite, and torbernite though ordinarily these are nonluminous; III, nonluminous, this class includes the U silicates and U micas of the compn.

$\text{M}^{\text{II}}(\text{UO}_2)_2(\text{XO}_4)_2 \cdot 8-12\text{H}_2\text{O}$ (M = Cu, Fe, Pb, Bi, Mn, or UO_2), X = P, As, V, and also several contg. SO_3 : zeunerite, fritzcheite [probably $\text{Mn}(\text{UO}_2)_2(\text{P, V})_2\text{O}_4 \cdot n\text{H}_2\text{O}$, bassetite, trögerite, phosphuranylite, tyuyamunite ($\text{CaO} \cdot 2\text{UO}_2 \cdot \text{V}_2\text{O}_5 \cdot 4\text{H}_2\text{O}$), walpurgite, betafite, ellsworthite, ianthinite, cuprosklodowskite ($\text{CuO} \cdot 2\text{UO}_3 \cdot 2\text{SiO}_2 \cdot 6\text{H}_2\text{O}$), kasolite, curiite, fourmarierite, uranosphaerite, hatchettolite (U Ca Fe tantaloniobate of the atopite group) and johannite. The results are discussed but no definite connection between fluorescence and compn. is made. Several museum specimens are shown to be wrongly named. Bassetite is not a Ca U mica but probably $\text{Fe}(\text{UO}_2)_2(\text{PO}_4)_2 \cdot n\text{H}_2\text{O}$, and some samples of "autunite" are really trögerite.

- 2586 Meixner, H. "Fluorescence of Uranium Minerals." Mineralog. petrog. Mitt. (2), **52**, 275-7 (1940).

The following relationships were found between chem. constitution and the fluorescence of U minerals in the ultraviolet: phosphates, arsenates, and sulfates showed an intense yellow-green fluorescence when no interfering cations were present. U carbonates showed an intense green fluorescence. The so-called U mica $[\text{M}(\text{UO}_2)_2\text{ZO}_4]_2$ with 8 or 12 H_2O in which M = Ba, Ca, Mn, Cu, Fe, etc., and Z = P or As) fluoresce strongly when M is a light ion of large radius (Ca, Ba); Cu- and Fe- contg. U micas do not fluoresce. All U micas fluoresced intensely after they had been fused in NaF. The fluorescence was destroyed only after the addn. of very large amts. of CuO or Fe_2O_3 .

2587 Müller, A. "Complex Organic Uranyl Compounds." *J. prakt. Chem.* (2), 157, 89-95(1940). Reaction of the Ba salt from 7 g $\text{CO}(\text{CH}_2\text{CO}_2\text{H})_2$ and 21 g UO_2SO_4 gives the bichromate-colored UO_2 salt, $\text{CO}(\text{CH}_2\text{CO}_2)_2\text{UO}_2$ which has an acid and astringent taste. The clear yellow-red aq. soln. does not become turbid on short boiling; in the cold, the aq. soln. reacts with *o*- $\text{HOC}_6\text{H}_4\text{CO}_2\text{H}$ to give the UO_2 salt. The aq. soln. has an acid reaction (litmus) and on addn. of $\text{C}_5\text{H}_5\text{N}$ becomes citron-yellow. In quartz Hg light $\text{CO}(\text{CH}_2\text{CO}_2)_2\text{UO}_2$ in H_2O shows a greenish-yellow fluorescence but not in EtOH; in H_2O in direct sunlight it begins to decomp. in 5 min and gives U_3O_8 in 30 min; in AmOH in sunlight it gives UO_3 ; in $\text{H}_2\text{O} + \text{o-HOC}_6\text{H}_4\text{CO}_2\text{H}$ it is fairly stable. The UO_2 salt of *l*-ascorbic acid is CrO_3 -colored; the red-brown aq. soln. is acid to litmus; addn. of $\text{C}_5\text{H}_5\text{N}$ deepens the color; it shows no fluorescence in H_2O or EtOH; it is not so sensitive to sunlight as $\text{CO}(\text{CH}_2\text{CO}_2)_2\text{UO}_2$ but it still gives a ppt. with $\text{Bz-CH}_2\text{Ac}$ and $\text{Ba}(\text{OH})_2$ in H_2O . When warmed 15 min and treated with UO_2SO_4 it gives the fiery reddish-yellow UO_2 salt of the enol cpd., $[\text{PhC}(\text{:CHAc})\text{O}]_2\text{UO}_2$, with 1 mol. EtOH, the solid salt or the EtOH soln. does not show fluorescence; no ppt. is formed after illumination with sunlight for 1 hr; the aq. soln. is neutral.

2588 Müller, A. "The Constitution of Uranyl Nitrate and Its Solution in Ether." *Ber.* 73B, 1353-8 (1940).

The ultraviolet absorption curves of 0.01, 0.001, and 0.0001 MEt_2O solns. of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ were detd. and found not to obey Beer's law. The data indicate an equil. between the hexahydrate and dihydrate as a function of concn. Review of the literature on dehydration of the hexahydrate shows that $3\text{H}_2\text{O}$ are easily lost, the fourth less readily, while the last two cannot be lost without decompn. The hexahydrate is similar in behavior to the hexahydrate of H_2PtCl_6 , which cannot be dehydrated completely without loss of HCl.

2589 Nakayama, M. "Proteolysis in Liver after Poisoning with Cantharitin and Uranium Nitrate." *Tôhoku J. Exptl. Med.* 38, 545-53(1940).

2590 Schoorl, N. "The Peculiar Behavior of the Sodium Uranyl Triple Acetates." *Rec. trav. chim.* 59, 305-13(1940).

The H_2O content of the Zn-Na and of the Mg-Na uranyl acetates was detd. at 80° over P_2O_5 . Besides the six mols. H_2O commonly attributed to these ppts., the triple acetates take up addnl. water which may correspond to nearly another mol. per mol. of ppt. depending upon the humidity of the surroundings. As a result the wt. of ppt. may vary about 0.25%. The first six moles show an unusually low vapor pressure; when they are removed, the crystal lattice is not broken. The indeterminate quantity in addn. is termed the zeolitic increment. When an H_2O -alc. soln. of the pptg. reagent is used, the amt. of hydration corresponds to about 5 mols. of water and in addn. about 1.5 mols. of alc., rather than to 8 mols. of water reported by Kahane.

2591 Schwab, G. M. and Ghosh, A. N. "Inorganic Chromatography. V. Inorganic Chromatography as an Auxiliary Method in Microanalysis." *Angew. Chem.* 53, 39-40(1940).

A glass tube 1 to 2 mm in diam. and 12 cm long is used to hold the alumina (adsorbent) column. Suction is necessary with this small diam. Expts. with Fe^{+3} and mixts. of Fe^{+3} and Cu^{++} are described. A table is presented giving typical color reactions and limiting concns. for the detn. of Fe^{+3} , Cu^{++} , Co^{++} , Ni^{++} , Tl^+ , $(\text{UO}_2)^{++}$, Ag^+ , Pb^+ , and Cd^{++} . Five references.

2592 Seebach, F. "4,4'-Dihydroxy-3,5,3',5'-tetra(hydroxymethyl)diphenylmethane." *Ber.* 73, 1338-46(1940).

4,4'-Dihydroxy-3,5,3',5'-tetra(hydroxymethyl)-diphenylmethane was obtained by condensation of phenol and HCOH as previously described, and the U salt was found to be deep brown.

- 2593 Shoenberg, D., "Properties of Some Supraconductors." Proc. Cambridge Phil. Soc. **36**, 84-93(1940).

The critical-field curves for pure Al, Ga, Th, and Zn have been measured. An unusually marked supercooling effect is found in Al, and to a much smaller extent in Ga. Ti, Mo, and U have also been investigated; only a minute volume of the Ti specimen used became superconducting at temps. down to 1°A, or in U down to 0.98°A.

- 2594 Steuer, H. "On the Knowledge of the Potentiometric Analysis of Metals of the Ammonium Sulphide Group." Z. anal. Chem. **118**, 385-98(1940).

Satisfactory results are obtained by the potentiometric detn. of U (as $(\text{UO}_2)^{++}$) with TiCl_3 or (as U^{+4}) with $\text{K}_2\text{Cr}_2\text{O}_7$.

- 2595 Strotzer, E. F., Schneider, O., and Biltz, W. "Systematic Study of Affinity. XCIII. Uranium Sulfides." Z. anorg. allgem. Chem. **243**, 307-21(1940).

Four U sulfides were prepd.: US_2 , U_2S_3 , US_3 , and U_4S_3 , the latter 2 for the first time. US_2 , prepd. from UCl_4 and H_2S ; it has a molar vol. of 38.0 cc. If US_2 is heated in a tube with S at 600 to 800° for several days US_3 is obtained as lustrous black leaflets, molar vol. 57.5 cc.; it is slowly attacked by dil. mineral acids, completely sol. in concd. HNO_3 and decompd. by warm concd. H_2SO_4 with pptn. of S. The system US_2 - US_3 was studied tensimetrically; the heat of formation of US_3 , calcd. from the vapor pressure, is 38 kcal/mole. U_2S_3 and U_4S_3 were prepd. by pressure synthesis from pure U filings and S; their presence in the reaction product was established roentgenographically. For the x-ray data cf. Zumbusch.

- 2596 Surodeikin, B. B. "Absorption Spectra of Glasses of Different Compositions and Colored with the Oxides of Copper, Iron, Manganese, Chromium, Cobalt, Nickel, Uranium, and Selenium." Optiko-Mekhan. Prom. **10**, No. 3, 4-9(1940).

Glasses colored with UO_3 (2%) have an absorption similar to NiO glass.

- 2597 Syrokonskii, V. S. and Klimenko, Y. V. "Vanadometric Determinations of Calcium, Lead and Uranium." Zavodskaya Lab. **9**, 1077-82(1940).

Details of procedures are discussed. In detg. U the test soln. is reduced to U^{+4} and titrated with vanadate in the presence of phenylanthranilic acid until the color changes from green to violet.

- 2598 Unkovskaya, U. "Determination of Minute Quantities of Uranium by the Fluorescence Method." Doklady Akad. Nauk S.S.S.R. **29**, 380-3(1940).

U is estd. in the ash of petroleum, in H_2O from oil wells, and in marine ooze. Beads are made in the Pt-wire loop from a mixt. of ash (or suitable U exts.) and NaF. The intensity of fluorescence in ultraviolet light is compared visually with that of 7 std. beads, contg. from 1×10^{-9} to 1×10^{-6} g of U. The displacement of the U/Ra equil. toward Ra is demonstrated.

- 2599 Van Voorhis, C. C. "Preparation of Thin Films of Uranium and Thorium by Cathode Sputtering." Rev. Sci. Instruments **11**, 77(1940).

Very thin Al foil, which was to be sputtered, was shellacked to a geometrically perforated Al plate 0.05 mm thick and covered with a similar Al plate 1 mm thick. This assembly was screwed to a water-cooled Cu plate. Square and round rods of U and Th, resp., were used as cathodes instead of thin ribbons, which warped and localized the discharge at one spot on the foil. The sputtering was done in an A atm. at 0.1 mm. With a half-wave rectified current of 16 to 20 ma at 3000 v a film of $0.1 \text{ mg } \mu/\text{cm}^2$ was deposited in 100 min.

2600 Zumbusch, M. "The Structure of Uranium Subsulfide and of the Subphosphides of Iridium and Rhodium." Z. anorg. allgem. Chem. **243**, 322-9(1940).

Cu_K radiation was used to study a series of preps₁ of Strotzer, et al., contg. U and S. U_4S_3 crystallizes in the cubic system; the space group may be T_1 , T_h , T_d , O_1 , or O_h , with 4 U and 3 S atoms in the unit cell. The shortest U-S distance is 2.75 Å.; the shortest U-U distance is 3.88 Å. Ir_2P and Rh_2P form crystals of the fluorite type with P occupying the Ca position.

PUBLICATIONS LOCATED IN 1941

- 2601 Ageno, M., Amaldi, E., Bocciarelli, D., Cacciapuoti, B. N., and Trabacchi, G. C. "Fission Yield by Fast Neutrons." *Phys. Rev.* (2), **60**, 67-75(1941).
The fission cross section of U was measured for neutrons produced in the following reactions: Rn+Be, D+C, D+D, D+Be, D+B, D+Li. From the fact that the mean σ has about the same value for neutrons of the D+D, D+Be, D+B reactions, it was concluded that the value σ_f remains nearly const. between 1 and 10 mev. For neutrons of the Rn+Be and D+C reactions the fission cross sections seem to be, resp., about $1/5 \sigma_f$ and $1/8 \sigma_f$. Finally, for neutrons of the D+Li reaction the mean $\sigma = 1.4 \sigma_f$. This fact was interpreted by Bohr as due to successive transformations which are possible for energies of the impinging neutrons larger than 10 mev. A similar increase of the fission cross section was observed also in case of Th, in very good agreement with the theoretical prediction by Bohr.
- 2602 Arakatsu, B., Uemura, Y., Sonoda, M., Shimizu, S., Kimura, K., and Muraoka, K. "Photo-Fission of Uranium and Thorium Produced by the γ -Rays of Lithium and Fluorine Bombarded with High-Speed Protons." *Proc. Phys.-Math. Soc. Japan* **23**, 440-5(1941).
Fission cross sections of U and Th nuclei for different γ -ray quanta have been detd. as follows: $\sigma_{U(17)} = 16.7 \times 10^{-27} \text{ cm}^2$ for Li(p, γ) γ rays; $\sigma_{Th(17)} = 7.2 \times 10^{-27} \text{ cm}^2$ for Li(p, γ) γ rays; $\sigma_{U(6.3)} = 2.2 \times 10^{-27} \text{ cm}^2$ for F(p, γ) γ rays; $\sigma_{U(2.2)} \ll 0.005 \times 10^{-27} \text{ cm}^2$ for RaC γ rays. The exptl. method is described.
- 2603 Bommer, H. "Magnetochemical Investigations. XL. The Magnetic Behavior of Metallic Uranium and Uranium Tetrachloride." *Z. anorg. allgem. Chem.* **247**, 249-58(1941).
Metallic U, free from Fe, was prepd. by reducing UCl_4 with K and its magnetic susceptibility was measured over the range 90 to 488°K. U shows temp.-dependent paramagnetism. The curve of $1/x$ vs. T is not linear; hence, the magnetic moment cannot be specified on the basis of the Curie-Weiss law. The course of this curve corresponds to the behavior of antiferromagnetic materials. The at. susceptibility at room temp. is 620×10^{-6} abs. unit. The Th-U series does not fit in with the previously given rule concerning the magnetic behavior of the transition elements. Above room temp. UCl_4 follows the Curie-Weiss law, with $\theta = 50^\circ$ and a moment of 2.7 Bohr magnetons. Below 20° at. bindings appear and the values of $1/x$ lie above the straight line detd. by the exptl. points above 20° .
- 2604 Bryant, W. M. D., Mitchell, J., Jr, Smith, D. M., and Ashby, E. C. "Analytical Procedures Employing Karl Fischer Reagents. VIII. The Determination of Water of Hydration of Salts." *J. Am. Chem. Soc.* **63**, 2924-71(1941).
Data are given for the successful detn. of the amt. of H_2O of hydration of $\text{UO}_2(\text{OAc})_2 \cdot 2\text{H}_2\text{O}$ by the use of the Karl Fischer reagent.
- 2605 Douville, F., Duval, C., and Lecomte, J. "The Symmetry of the Modes of Vibration of Metallic Oxalates. Studies with Infrared Absorption Spectra." *Compt. rend.* **212**, 697-700(1941).
Absorption max. from 1660 to 550 cm^{-1} are reported for oxalates including those of U^{+4} and $(\text{UO}_2)^{++}$. The maxima are classified as strong, medium, or weak. The simple oxalates have 5 principal regions of absorption: 665 , 720 to 740 , 750 to 800 , 1200 to 1300 , and 1500 to 1600 cm^{-1} . The complex oxalates have absorption max. at 550 to 580 , 800 to 900 , 1200 to 1300 , 1090 to 1240 , and 1200 to 1375 cm^{-1} . The simple oxalates have 12 modes of vibration; 5 are infrared active, 6 are permitted by the Raman effect, and one is forbidden by both. Vibrations due to $(\text{C}_2\text{O}_4)^{--}$ are very similar to those due to N_2O_4 . The complex oxalates do not have centers of symmetry.
- 2606 Dozzi, D. L. "Origin of Blood Amylase and Blood Lipase in Dog. Relation between Blood Amylase and Urinary Amylase Following Induction of Uranium Nephritis." *Arch. Internal Med.* **68**, 232-40(1941).

- 2607 Freeman, D. H. and Lions, F. "1-Hydroxyacridine as a Chelate Compound." J. Proc. Roy. Soc. N. S. Wales 74, 520-6(1941).

1-Hydroxyacridine (1-acridol of benzoxine) has been shown to possess properties similar to 8-hydroxyquinoline (oxine) and 4-hydroxybenzothiazole by virtue of its tendency to form coordination complexes similar in type to those of oxine. Thus, treatment of dil. aq. solns., contg. NaOAc-HOAc of the salts of metals with 2% alc. 1-acridol soln. led to ppts. of the insol. metallic complexes. Ca^{++} and $(\text{UO}_2)^{++}$ yield complexes from neutral soln. sol. in dil. HOAc-NaOAc soln. while the Ba^{++} , Ca^{++} , Mg^{++} , complexes are pptd. from alk. soln. and are likewise sol. in dil. HOAc-NaOAc soln.

- 2608 Gant, D. H. T. and Krishnan, R. S. "Deuteron-Induced Fission in U and Th." Proc. Roy. Soc. (London), A. 178, 474-92(1941).

Nuclear fission of U and Th under bombardment by deuterons of about 9 mev. has been investigated both qualitatively and quantitatively by the use of the active-deposit technique. The following results have been obtained: The range of the fission fragments from both U and Th is about 2.3 cm in air. The decay curve agrees in scale and shape with that which would be expected from a complex mixture of radioactive bodies. The active deposit has been examined for emission of β rays, positrons, γ and X rays, α particles and neutrons; the radiations are found to bear a general similarity to those resulting from neutron-induced fission. Some of the radioactive bodies have been isolated by chem. methods; some correspondence with the products of neutron-induced fission is shown. The ratio of the fission cross sections for 9-mev deuterons and (Li+D) neutrons has been measured. The excitation function has been studied. The exptl. data obtained are compared with calcns. based on Bohr and Wheeler's treatment of the mechanism of the process.

- 2609 Geyer, B. P., Haendler, H. M., and Smith, G. McP. "Preparation and Properties of Some Phthiocol Inner Complexes." J. Am. Chem. Soc. 63, 3071-5(1941).

Phthiocol possesses antihemorrhagic activity and is the yellow pigment of the human tubercle bacillus. Inner complexes were prepd. in a study of the relation between color and constitution and because they might be of therapeutic value. $\text{UO}_2(\text{AcO})_2$ gives 87% of the uranyl salt as dark violet-black micro-crystals. This salt is stable at 200° and stable in the presence of weak acids but is immediately decompd. with liberation of phthiocol by HCl; NaOH also decomp. the salt with formation of the Na salt. Prepd. in MeOH the 4-coordinated salt crystallizes in a solvated condition; when heated at 150° , the solvent is liberated. The salts when first formed invariably contain phthiocol, which can be removed by subln. The absorption spectra max. are ($m\mu$) 490, 1630. No regularity exists between the displacement of the max. and any property of the metal, such as its at. no. or position in the periodic system. The actual color is due, not so much to the metal present, as it is to the chelation of phthiocol with the metal and inclusion of the latter in a spiral ring system.

- 2610 Hauffe, K. "Electric Conductivity of U Oxides." Z. physik. Chem. B. 48, 124-30(1941).

With regard to the theory of mixed phases with defective arrangements the electric cond. of UO_2 and U_3O_8 in the range 800 to 1000°C was detd. at varying pressures of O_2 . In the pressure ranges measured the cond. was found to be independent of O_2 pressure in both cases. The energy increment ΔE in the formula for the temp. function of cond., $K = ke^{-\Delta E/RT}$, was found to be 5 kcal for the U_3O_8 phase between 700 and 900°C .

- 2611 Haxby, R. O., Shoupp, W. E., Stephens, W. E., and Wells, W. H. "Photo-Fission of U and Th." Phys. Rev. (2), 59, 57-62(1941).

Fission of U and Th has been observed to be produced by irradiation with γ rays. σ for this photo-fission produced by the γ ray from F bombarded with protons has been measured.

- 2612 Heimbrecht, M., Zumbusch, M., and Biltz, W. "Systematic Study of Affinity. XCV. Uranium Phosphides." Z. anorg. allgem. Chem. **245**, 391-401(1941).

The cpds. UP, UP₂, and U₃P₄ were obtained by pressure synthesis at 800 to 900° from mixts. of U + P or UP_n + P. All preps. were gray. UP₂ was very resistant to HCl but was dissolved by HNO₃. U₃P₄ dissolved in HCl with the evolution of PH₃. UP was intermediate between the other 2 in its resistance to HCl. All preps. were analyzed tensimetrically. The following heat effects were calcd.: $6UP_2(s) - 2U_3P_4(s) + P_4(g) - 52 \text{ kcal}$; $\frac{1}{2}U_3P_4 + P(\text{white}) - \frac{3}{2}UP_2 + 10 \text{ kcal}$. X-ray patterns of the preps. were detd. The structure of UP₂ was not detd. The mol. vols. calcd. are UP₂ = 35, UP_{1.33} = 28, UP = 27.

- 2613 Hoffman, J. "The Fixing of Uranium by Living Fresh-Water Algae." Naturwissenschaften **29**, 403-04(1941).

It was established by means of fluorescence that algae growing in fresh water contg. U($10^{-6}\gamma/1$) will accumulate U. The algal ash contained $9.1 \times 10^{-4}\%$ U.

- 2614 Hoffmann, J. "Uranium in Human Organism." Wien. klin. Wochschr. **54**, 1055(1941).

- 2615 Hoffmann, J. "Uranium Traces in Karlsbad Salt." Arch. Pharm. **279**, 29-36(1941).
The weak fluorescence found is reported to be due to U.

- 2616 Holman, R. L. "Acute Necrotizing Arteritis, Aoritis, and Auriculitis Following Uranium Nitrate Injury in Dogs with Altered Protein." Am. J. Path. **17**, 359-75(1941).

During expts. designed to det. whether heavy metal poisoning is influenced by altering the plasma protein level it was observed that 8 of 10 dogs subjected to alterations in their plasma proteins by plasmapheresis or plasma injections and then given U nitrate subcutaneously, showed necrotizing arteritis when they died 8 to 17 days later. One of 8 dogs survived the early phase of the expt. and showed healed lesions in the pulmonary artery when it was sacrificed 11 mos. later. Control dogs, maintained on the same diet and receiving the same dosage of U nitrate (5.0 mg kg) but not subjected to plasmapheresis or plasma injections, failed to show any arterial lesions. The lesions affected principally the elastic arteries, the commonest sites being the aorta, sinuses of Valsalva, pulmonary arteries and the endocardium of the left auricle. These lesions are strikingly absent from the parenchyma of organs other than the heart and lungs. Essentially, the lesion is an acute necrotizing arteritis usually most marked in the intima but not infrequently involving all 3 coats. Polymorphonuclear neutrophils predominate in the cellular response. Ca deposition in the necrotic areas is frequent. Sometimes thromboses occur. Some of the lesions have a resemblance to those of periarteritis nodosa and rheumatic arteritis.

- 2617 Jacobsen, J. C. and Lassen, N. O. Deuteron-Induced Fission of Uranium and Thorium. Copenhagen, Munksgaard, 1941.

- 2618 Jacobsen, J. C. and Lassen, N. O. "Deuteron-Induced Fission of Uranium and Thorium." Kgl. Danske Videnskab. Selskab. Mat.-fys. Medd. **19**, No. 6, 24p.(1941).

Deuteron bombardment of U and Th in the cyclotron produced appreciable nos. of fissions for deuteron energies between 8.0 and 9.5 mev. The fission fragments were collected on foils and their β activity was measured. A subsidiary expt. was performed to measure the β activity per fission fragment. From this and the known integrated deuteron flux the σ_f was evaluated to be ~ 0.02 barns at 9.0 mev for both U and Th agreeing fairly well both in abs. value and in energy-dependence with the Bohr theory. Deviations from the theoretical curve in the case of U may be due to the isotope U²³⁵.

- 2619 Kaprowski, H. and Uninski, H. "Amount of Ammonia in Blood of Dogs with Uranium Nephritis." Rev. brasil. biol. **1**, 253-62(1941).

- 2620 Kurokawa, M. and Takenake, Y. "Formation of Propylene by Dehydrogenation of Propane." J. Soc. Chem. Ind. Japan **44**, (Suppl. binding), 45-7(1941).

The optimum temp. for dehydrogenation of C_3H_8 is 600 to 650°. Various catalysts were tested. UO_3 gave the best results. A catalyst composed of 0.2 CuO and 0.8 UO_3 at 600° gave 15.4% C_3H_6 , 2% C_2H_4 , and 8.3% H_2 . Cr_2O_3 exhibits a greater reversible activity than UO_3 . A gas contg. 16.1% C_3H_6 and 13.1% C_2H_4 , passed over Cr_2O_3 at 450 or 500°, contained 11.5 and 12.7% C_3H_6 and 4.6 and 6.2% C_2H_4 , whereas over UO_3 there was practically no change in its compn.

- 2621 Kuznetsov, V. I. "Color Reactions for Thorium, Uranium and Other Elements." Doklady Akad. Nauk S.S.S.R. **31**, 898-900(1941).

On treatment with 2-(o-arsonophenylazo)-p-cresol, 1-(o-arsonophenylazo)-2-naphthol-3,6-disulfonic acid, 1-(o-arsonophenylazo)-2-naphthol-6,8-disulfonic acid, and 3-(o-arsonophenylazo)-4,5-dihydroxy-2,7-naphthalene-disulfonic acid, resp., in (a) neutral or slightly acid soln. and (b) in the presence of HCl, U gives (a) orange, (b) yellow; (a) pink-orange, (b) orange-yellow; (a) brownish-yellow, (b) yellow; (a) blue, (b) orange-red.

- 2622 Lecomte, J. and Freymann, R. "Infrared Absorption Spectra of Uranium Salts." Bull. soc. chim. France (5), **8**, 622-5(1941).

By examn. of a score of U salts in the powder state the results of Conn and Wu are confirmed by the presence of bands at $850\text{ cm}^{-1}(\nu_3)$ and $920\text{ cm}^{-1}(\nu_1)$, which are characteristic of the UO_2 group. A third band ν_2 at 210 cm^{-1} is indicated by a combination band at 1130 cm^{-1} . The existence of a UO_3 group is indicated by bands at 890, 1020, and 1090 cm^{-1} .

- 2623 MacNider, W. deB. "Acquired Resistance of Fixed Tissue Cells Morphologically Altered Through Processes of Repair. Physical Modifications of Cells Associated with Development of Resistance to Certain Chemical Agents Acquired Resistance (after Injury with Uranium Nitrate) of Kidney to Bichloride of Mercury." J. Pharmacol. Exptl. Therap. **73**, 186-99(1941).

This paper reports that 4 mg/kg sol. U salt administered subcutaneously will produce subacute nephritis in animals. Considerable discussion on renal damage from U poisoning is included. The changes in epithelium and convoluted tubules in dogs are discussed.

- 2624 Martini, A. "New Contributions to Microanalysis. IX." Pubs. inst. invest. microquim., Univ. nacl. litoral (Rosaria, Arg.) **5**, No. 5, 97-100(1941).

A soln. contg. 1.25% sparteine and 12% NH_4SCN reacts with $(UO_2)^{++}$ and $(In)^{+3}$ to give characteristic crystals. Sensitivities reported are 0.01 and 0.05 γ , resp.

- 2625 Martini, A. "Course in Qualitative Microanalysis." Pubs. inst. invest. microquim., Univ. nacl. litoral (Rosario, Arg.) **5**, No. 5, 121-44(1941).

Std. tests for C, Ti, Zr, Th, Bi, Sb, As, Ta, Cb, V, and U are described and discussed.

- 2626 Melkov, V. G. and Sverdlov, Z. M. "Luminescence Method for Detecting Uranium Minerals and Ores." Doklady Akad. Nauk S.S.S.R. **31**, 361-2(1941).

- 2627 Myer, W. and Berg, H. "Uranium Dioxide as a Material for Electrical Resistances." (tr. from Tech. wiss. A. C. K. Abhandl. (?) Osram-Konzern III) (Gt. Brit. Ministry of Aircraft Production R.T.P. Translation 2477) (ca. 1941) 3p. (OTS Cat. No. PB-53019)

UO₂ is reported to have proved more suitable than many other substances as an electrical resistance material with a high neg. temp. coeff. of resistivity. The high value of temp. coeff. in combination with the other advantages mentioned make UO₂ particularly suitable for series resistances in the suppression of high switching surges. A no. of practical applications are outlined briefly. The specific resistance of the material is discussed. Illustrations are included.

- 2628 Niessner, M. and Dorkisch, F. "Microchemical Test Procedures for the Investigation of Glasses." Glastech. Ber. 19, 33-9(1941).

Microanalytical procedures for the detection and qual. sepn. of Co, Ni, Mn, U, Cr, Fe, Cu, Au, Se, and Ce are presented in detail. The procedures were chosen on the basis of simplicity and speed. The effect of interfering elements has been examined in individual tests to avoid errors.

- 2629 O'Brien, T. D. "Report on the Preparation of Uranium Hexafluoride." May 21, 1941. 13p. (NRL-P-1744)

This is a report of UF₆ prepn. by F₂ treatment of U metal, 10% Ni-90% U alloy, and anhyd. UF₄. The metal and alloy gave good yields and required no preliminary treatment. UF₄, however, must be dry. Dehydration was accomplished in vacuum at 150°C. UF₄ to UF₆ conversion required 250°C treatment. (The exptl. work reported was carried on by R. R. Miller, W. C. Lanning and T. D. O'Brien.)

- 2630 Repman, B. R. "A New Indicator for Titrimetric Determination of Phosphates." Lab. Prakt. (U.S.S.R.) 16, No. 1, 27-9(1941).

Na-2,5-cresotol reacts with (UO₂(OAc)₂) to form a colored cpd., Na₂(C₈H₆O₃)₂UO₂, which can be used as an indicator for the analysis of phosphates. Place 2 ml of sample and 2 ml of std. soln. (contg. P₂O₅ 0.0025 g/ml) in Philips beakers; add to each, 10 ml of distd. water, 2 ml of Na-2,5-cresotol soln., 1 ml of hexamethylene-tetramine and 0.5 g of KNO₃. Heat to boiling and add from a microburet UO₂(OAc)₂ soln. drop by drop; discontinue the titration after the appearance of turbidity. Heat until the ppt. coagulates and continue the titration until a red color appears. If the vols. of the soln. are not the same add the necessary amt. of H₂O and bring both solns. to the same color by adding UO₂(OAc)₂ soln. Seven references are included.

- 2631 Robuschi, L. "Photohemolytic Action of Photocatalytic Agents." Boll. soc. ital. biol. sper. 16, 552-5(1941).

Blood from rabbits (not albinos) was citrated and exposed at 37° to illumination from a bank of incandescent lamps. FeSO₄ in various concns., UO₂(OAc)₂ 1:100,000, and UO₂(NO₃)₂ 1:500,000 accelerated photohemolysis.

- 2632 Robuschi, L. "Protective Action of Some Substances on Photohemolysis." Boll. soc. ital. biol. sper. 16, 555-6(1941).

Eosin 1:10,000, Bengal rose 1:50,000, and crude chlorophyll 1:100,000 accelerated photohemolysis of washed erythrocytes. Their accelerating effect was abolished by addn. of UO₂(OAc)₂ and UO₂(NO₃)₃ to a final concn. of 1:500 to 1:1000. The hemolytic actions of Na/taurocholate 1:100 to 1:10,000, saponin 1:100 to 1:5000, and dil. chloral hydrate, none of which are photocatalyzed, were also inhibited by UO₂(OAc)₂ and UO₂(NO₃)₂. The possible mechanism of action is discussed.

- 2633 Schreiber, R. E. Investigation of Nuclear Reactions and Scattering Produced by Neutrons. Thesis, Purdue University, June 1941. 156p. (AEC File No. N-1810)

The construction and performance of a neutron generator consisting of a low-voltage arc and an accelerating tube are described. Deuterons are formed by ionization of D_2 in the arc source, focused by an electrostatic lens system, and accelerated by a van de Graaff-type generator. When these ions fall on a target of D_2O ice, neutrons are formed by the (d,d) reaction. A study of the relative activities of the 54-min and the 4.1-hr periods of In is made, showing that the latter period is activated principally by fast neutrons. Absorption measurements give a cross section for resonance neutrons in In which agrees with previous values. Two sep. attempts are made to detect the diffraction of neutrons, using a focusing method. Results are not conclusive because of high background and low intensities, but indicate that the diffraction intensities must be small. The effect of neutron energy on the mode of U fission is investigated, using neutrons from the Be-D and Li-D reactions in the cyclotron, a special ionization chamber, linear amplifier, and recording oscillograph. Plots of the no. of pulses versus recoil energy of the fragments are made. With slow neutrons, an energy distribution of single fragments agreeing with that of former investigations is found. With fast neutrons, three new modes of fission are assumed to exist; highly asymmetrical binary, symmetrical binary, and symmetrical ternary. By applying the law of conservation of momentum, it is possible to calc. the relative masses of the fragments in each case. The results agree with those obtained by using chem. analysis. Using a U layer on a thin supporting foil, measurements on the total ionization are made. These agree with the energies calcd. from the single fragments and correspond with those calcd. theoretically. The energy loss by single fragments which have traversed the supporting foil agrees closely with that calcd. from the cross sections given by Knipp and Teller (Phys. Rev. **59**, 659(1941)). 43 references are included.

- 2634 Sus, A. N. "The Measurement of the Dielectric Constant in the Centimeter Band." Doklady Akad. Nauk S.S.S.R. **33**, 310-12(1941).

By use of the free-wave method of Velasco and Hutchinson (Proc. Phys. Soc. **51**, 679(1939)) the dielectric const. in the cm band was detd. for $UO_2 = 9.5$. The accuracy of the measurements varied from 1 to 5%. For thin materials, the effect of thickness is linear, so that measurements can be made on a single specimen. Further research was designed to extend the method to double layers.

- 2635 Terui, M. "XXXIX. The Influence of Novasurol on the Passage of Congo Red through Uranium-Injured Renal Epithelium." Tôhoku J. Exptl. Med. **41**, 335-40(1941).

In isolated kidney prepn. the tubules of normal kidneys were able to reabsorb Congo red almost completely, but the tubules lost this ability to a large extent after U poisoning. Novasurol counteracted the U effect, apparently increasing the reabsorptive ability of the tubules.

- 2636 Tolmachev, Y. M. "Absorption Spectra of the Vapors of Compounds of Uranium with Chlorine." Zhur. Fiz. Khim. **15**, 392-6(1941).

The absorption spectra of UCl_4 and UCl_5 was studied at various temps. UCl_4 possesses a continuous absorption spectrum. The primary process corresponding to this absorption is, apparently, disson. into UCl_3 and Cl_2 . In the absorption spectrum of UCl_5 there are 2 wide diffuse bands at 2680 and 3750 Å and 2 regions of continuous absorption. No correspondence was found to exist between the absorption spectra of vapors of UCl_4 or UCl_5 and the absorption spectra of any other cpds. of U either in solid state or in soln. It is possible to consider the mols. of UCl_4 , and perhaps of UCl_5 , in the gaseous state as at. mols. rather than ionic.

- 2637 Treadwell, W. D. and Nieriker, R. "Clearly Represented Valence Stages in Aqueous Solution of Metals of the Sixth Secondary Group." Helv. Chim. Acta **24**, 1067-79(1941).

An electrolytic Cd reducer is described and illustrated. It is suitable for reducing dil. titration liqs. without concn. changes; e.g., it is suitable for the prepn. of solns. of Cr^{++} sulfate, U^{+3} sulfate, and U^{+4} and W^{+4} phosphates.

- 2638 Urry, W. D. "Radioactive Determination of Small Amounts of U." Am. J. Sci. **239**, 191-203 (1941).

The detn. of amts. of U of the order of parts per 10 million has usually been carried out by indirect radioactive measurements. Such measurements cannot be employed except when the radioelements are known to be in equil. The sepn. of the U and its isotopes in such small amts. and in a radioactively pure state is accomplished with the use of coprecipitators, the Fe (and Al) of the sample itself being the final carrier agent. The α activity of the U is detd. as a measure of its concn. The method is tested by detg. the ratio of the α activity of the U^{238} to that of the Ra in geol. specimens, where this ratio should be unity. A mean value of 0.98 ± 0.06 for this test substantiates the validity of the method.

- 2639 Van Valkenburgh, H. B. and Crawford, T. C. "Detection of Certain Metals in Minerals and Ores. An Ammonium Hypophosphite Fusion Method." Ind. Eng. Chem., Anal. Ed. **13**, 459-60 (1941).

Place about 0.1 g of the finely powd. material in a small evapg. dish and heat strongly with 2 g of $NH_4H_2PO_2$. The hypophosphite soon begins to decomp., the evolved gases take fire and HPO_3 , $H_4P_2O_7$, NH_3 , PH_3 , H_2 , and H_2O are formed. After 2 min the fusion becomes quiet and the mass has a m.p. of about 60° . The color of the melt, as in the well-known salt of phosphorus bead, or the color resulting from treatment with water or H_2O_2 soln. will serve for detecting Cr, Co, Cb, Mn, Mo, Te, Ti, U, V, and W. V, Cr, and U impart green colors to the melt, but with V, the melt is red when hot. Addn. of water gives a pale soln. which turns pink with H_2O_2 . $(NH_4)_2CO_3$ followed by H_2O_2 gives a yellow-orange color. The results obtained in testing over 30 samples of typical minerals and cpds. are tabulated.

- 2640 Zumbusch, M. "Structural Analogy of Uranium and Thorium Phosphides." Z. anorg. allgem. Chem. **245**, 402-08(1941).

U_3P_4 has a structure completely analogous to that of Th_3P_4 with a lattice const. of 8.197 Å. UP crystallizes in a face-centered cubic lattice with a lattice const. of 5.589 Å. The following interatomic distances in Å were found for U_3P_4 and UP , resp.: U-U 3.83, 3.95; U-P 2.84, 2.79; P-P 3.06, 3.95. Calcd. and exptl. mol. vols. agree well.

PUBLICATIONS LOCATED IN 1942

- 2641 Amrein, W. "Negative Resistances." Schweiz. Arch. angew. Wiss. Tech. **8**, 85-9(1942).

The term "neg. resistance" is applied to resistance with a neg. characteristic. It is shown that with its use a completely resistanceless conductor can be realized. Only solid conductors are discussed, or, more correctly, semiconductors whose resistance varies with temp. (so-called "hot conductors") and which show a neg. characteristic above a certain c.d. Expts. are described, the purpose of which was to attain a limiting freq. of 2000 to 3000 cps. Nonreversible characteristics and low limiting freqs. were obtained with sintered UO_2 (d. = 9.2, sp. heat = 0.26 w sec/ $^\circ$, thermal cond. = 0.062 w/cm/ $^\circ$, Mohr hardness = 6 to 7) which had been pressed into small rods in vacuum. Thin fibers 0.2 mm in diam. and long, thin splinters of sintered oxide rods on which a porcelain glaze was fused were also used. The effect of the neg. resistance developed is shown with the aid of characteristic curves.

- 2642 Aronstam, N. E. "Use of Uranium in Dermatology." Urol. Cutaneous Rev. **46**, 192-4(1942).

- 2643 Aronstam, N. E. "Use of Uranium on Skin Diseases." Indian J. Venereal Diseases **8**, 74-6 (1942) July-Aug.

- 2644 Ato, S. "Separation and Determination of Gallium. VI. The Separation of Gallium from Chromium, Vanadium, and Uranium, and the Determination of Gallium Thus Separated." Sci. Papers Inst. Phys. Chem. Research (Tokyo) 40, 228-34(1942).

Two gravimetric methods for sepg. Ga from Cr, V, and U are given. The first, pptg. Ga as camphorate, removing other elements held by the ppt. by dissolving it and repptg., converting the last ppt. into Ga_2O_3 by ignition, and weighing the oxide, and the second, dissolving a given sample with HCl , extrg. CaCl_2 with Et_2O , removing small quantities of the other elements in the ext. by evapg. the Et_2O , and by pptg. Ga as camphorate from the residual soln., converting the ppt. into the Ga_2O_3 , and weighing the oxide.

- 2645 Benrath, A. "The Solubility of Salts and Salt Mixtures at Temperatures Above 100° . IV." Z. anorg. allgem. Chem. 249, 245-50(1942).

Values are given for $\text{UO}_2(\text{NO}_3)_2$, in %, at 80° , 79; 94° , 80.6; 108° , 82.8; 115° , 84.6; 116° , 85.8; 138° , 86.7; 156° , 87.9; 175° , 90.5; and 187° , 91.6. Decompn. begins at 180° .

- 2646 Bothe, W. and Gentner, W. "The Energy Limit of the Neutrons Produced by the Fission of Uranium." Z. Physik 119, 568-74(1942).

The range of the energy limit detd. by a photographic method and using the $\text{N}^{14}(\text{n}, \alpha)\text{B}^{11}$ reaction is slightly in excess of 10 mev. The exptl. procedure is described.

- 2647 Bowditch, F. T., Greider, C. E., and Ollinger, C. G. "An Analysis of the Uranyl Oxalate Actinometer as Applied to Accelerated Light and Weathering Tests." Am. Soc. Testing Materials Proc. 42, 845-50(1942).

The practical utility of the U oxalate actinometer of the form described by Committee D-11 on Rubber Products is discussed. By studying the spectral sensitivity of decompn. of U oxalate as a function of the spectral-energy distribution of 3 representative sources of radiant energy (sunlight, open-flame Sunshine C arc with Corex-D filter, and enclosed plain C arc), it was found that the actinometer in question cannot be used to compare different sources of energy. As evidence of this, the spectral-energy distribution curves of the 2 arcs at intensities chosen to give identical U oxalate response were found to differ greatly. Therefore the U-oxalate actinometer is useful only for checking the constance of a source of definite spectral compn. Modifications in the method of Committee D-11 with a view to simplifying its use in the ordinary lab. are proposed. The std. procedure specifies 2 cells, but since the relative amts. of energy at different wavelengths depend on the source of energy, a conversion factor for the 2 cells is valid only for the source of energy from which it is derived. Hence, the std. cell should be omitted or its thickness should be that of the operating cell. The difference method of measuring the intensity of ultraviolet radiation below 3350 Å is inadvisable for routine work, because highly erroneous results are obtained unless a large no. of readings are made. If, just before titrating, the soln. is dild. with boiling water and acid, no further heating is necessary, and the precision is practically unaffected. Although undue exposure to room light should be avoided, extreme precaution is unnecessary. Exposure of solns. for several hr 3 ft from a north window on a clear day (Cleveland) caused the $\text{H}_2\text{C}_2\text{O}_4$ to decomp. at the rate of 4 to 5% per hr. The least detectable decompn. was produced by an exposure of 2 to 3 min to strong north light.

- 2648 Brintzinger, H. and Hesse, G. "Copper, Nickel and Uranyl Compounds of Ethylenediaminetetraacetic Acid." Z. anorg. allgem. Chem. 249, 113-18(1942).

A soln. of $\text{UO}_2(\text{OAc})_2$, when treated with solid ethylenediaminetetraacetic acid and boiled, gives a lemon-yellow ppt. of $(\text{UO}_2)_2\text{H}_2(\text{C}_{10}\text{H}_{12}\text{N}_2\text{O}_8) \cdot \text{H}_2\text{O}$. The soly. and general properties of this material are the same as those of the Cu deriv. The UO_2 group gives its usual pptn. reactions. This is evidence that the $(\text{UO}_2)^{++}$ deriv. is a sec. salt while the Cu deriv. and the Ni deriv. are inner-complex cpds; the Cu deriv. and the Ni deriv. have three 5-membered rings in each mol.

2649 Brintzinger, H. and Hesse, G. "Salts and Complex Compounds of Nitrilotriacetic Acid." Z. anorg. allgem. Chem. **249**, 299-307(1942).

Solns. of $\text{UO}_2(\text{AcO})_2$ and $\text{N}(\text{CH}_2\text{CO}_2\text{H})_3$ give a ppt. of $(\text{UO}_2)\text{H}(\text{NC}_6\text{H}_6\text{O}_6) \cdot 5\text{H}_2\text{O}$, decomp. above 180° . This is a true salt, which gives tests for $(\text{UO}_2)^{++}$ ions.

2650 Cauchois, Y. "Sensitivity of the Detection of an Element in the Pure State or in Mixtures by Means of Its X-Ray Spectrum." J. chim. phys. **39**, 161-73(1942).

About 5×10^{-7} to 10^{-10} g of U can be detected by means of the emission spectrum ($\text{L}\alpha$, line 909 x-units). In mixts. with Pd, Pt, and B the sensitivities are 10^{-4} , 1 to 2×10^{-3} , and 10^{-3} U/X, resp. In testing with the x-ray absorption spectra 10^4 to 10^5 times as much pure U is necessary.

- 2651 Char, T. L. R. "Photoreduction of $\text{UO}_2(\text{NO}_3)_2$ by Tartaric Acid." J. Indian Chem. Soc. **19**, 369-76(1942).

Evidence for the existence of $\text{UO}_2(\text{NO}_3)_2$ -tartaric acid complex in soln. is obtained from measurements of optical rotation. The quantum yield of the photoreduction of $\text{U}^{+6} \rightarrow \text{U}^{+4}$ in this complex at $\lambda = 3130$, 4060, and 4360 Å varies from 4.7 to 1.8, decreasing with an increase in λ and with a decrease in concn. of the complex. No difference in velocity of reduction is obtained with d or l circularly polarized light or when d, l, or dl acid is used.

- 2652 Clark, W. E. and Stallings, L. R. "Progress Report on the Investigation of Organic Compounds as Reagents in Analytical Chemistry." Virginia J. Sci. **3**, No. 1, 31(1942).

$(\text{UO}_2)^{++}$ gives a yellow color with furoacetyl-2,5-diethoxyaniline; the reaction is relatively free from interference from other cations.

- 2653 Corin, F. "New Observations on the Inclusions of Pleochroic Haloes." Bull. soc. belge geol. paléontol. hydrol. **50**, 48-61(1942).

The pleochroic halos of inclusions in chlorite schists of Remagne and amphibolites of Libramont are due to U, whereas those of the tonalites of the Hautes-Fagnes region, Belgium, are due to Th. The products of modification of chlorite and amphibole nuclei by the α -radioactive particles exhibit the same color, pleochroism, birefringence, and optical orientation, irrespective of differences in primary mineral compn.

- 2654 Damjanovich, H. "Chemistry of He and Helionides." Proc. Am. Sci. Congr. 8th Congr. 1940. **7**, Phys. Chem. Sci. 137-44(1942).

The author summarizes his 15 years' work which has put in evidence the untenability of the theory of the "nullivalence" of the noble gases and shows the existence of stable complexes of He with metals that have fixed points of decompn.: HeU(60 to 80°), HePt(95 to 100°), HePd(110 to 115°), and HeFe(150°).

- 2655 De Ment, J. and Dake, H. C. Uranium and Atomic Power. New York, Chemical Publishing Co., 1942.

- 2656 Donnelly, G. L. and Holman, R. L. "Stimulating Influence of Sodium Citrate on Cellular Regeneration and Repair in Kidney Injured by Uranium Nitrate." J. Pharmacol. Exptl. Therap. **75**, 11-17(1942).

In the kidney injured by U nitrate the use of Na citrate facilitated repair and regeneration of the injured tubular epithelium and resulted in the recovery of 92% of the animals receiving a lethal dose of U nitrate.

- 2657 Erametsa, O. "Uranyl Chlorate." Suomen Kemistilehti **15**, 1(1942).

$\text{UO}_2(\text{ClO}_4)_2$ was prepd. by reaction of equiv. amts. of $\text{Ba}(\text{ClO}_4)_2$ and UO_2SO_4 in aq. soln., filtration of the BaSO_4 ppt., evapn. of the filtrate in a desiccator and keeping the liq. residue in a cool place. Micro. inspection showed strongly birefringent, small crystals with rounded edges, apparently rhombic as indicated by the linear extinction and the axial figure of the two-axial crystals. $\text{UO}_2(\text{ClO}_4)_2$ dissolves with yellow color in H_2O , alc., Et_2O , and CHCl_3 but is insol. in CS_2 . When recrystn. from alc. was attempted the liq. exploded; recrystn. from CHCl_3 was equally unsuccessful.

- 2658 Feigl, F. and Suter, H. A. "Analytical Use of Sodium Rhodizonate." Ind. Eng. Chem., Anal. Ed. **14**, 840-2(1942).

The freshly prepd. soln. of Na rhodizonate has been used as a reagent for detecting small quantities of Ba and Sr. The behavior of the reagent toward other ions is studied. Colored ppts. with Ag^+ , Hg^+ , Tl^+ , and $(\text{BiO})^+$ are obtained. The same is true of Pb^{++} , Cu^{++} , Hg^{++} , Cd^{++} , Zn^{++} , $(\text{UO}_2)^{++}$, Ba^{++} , and Sr^{++} . Fe^{+3} gives no ppt. but produces a green color.

- 2659 Flatt, R. and Sommer, F. "Titrations with Solutions of Chromous Salt. I. Apparatus for Such Titrations." Helv. Chim. Acta, **25**, 684-94(1942).
 Cr^{++} solns. out of contact with air are very stable and are suitable for the potentiometric titration of many oxidation agents. They can probably be used for detg. Mo, W, U, V, Ti, Sb, Sn, and Bi either alone or in mixts. Here interesting pieces of app. are described by means of which Cr^{++} solns. can be kept indefinitely under an inert gas and potentiometric titrations carried out in an inert atm. The app. is relatively inexpensive and there are very few ground-glass connections.
- 2660 Geyer, B. P. and Smith, G. McP. "Preparation and Properties of Some Perihydroxyquinone Inner Complexes." J. Am. Chem. Soc. **64**, 1649-51(1942).
Inner complexes were prepd. for the purpose of detg., by absorption spectra, the relationship between color and structure of the lakes derived from alizarin and related substances. The absorption was detd. in BuOH with concns. ranging from 0.00003 to 0.00002M. 1.7 g $\text{UO}_2(\text{OAc})_2 \cdot 2\text{H}_2\text{O}$ in 100 ml warm MeOH, added slowly to 0.9 g 1-hydroxyanthraquinone in 300 ml warm MeOH, gives 80% of the UO_2 deriv., which is purple-brown. The absorption max. and values for ϵ are given. This cpd. and other similar derivs. are stable at high temps., but strong acids decomp. them with liberation of 1-hydroxyanthraquinone.
- 2661 Ghetti, L. "Action of Uranium Nitrate on Experimental Rat Sarcoma (Galliera Strain)." Tumori **28**, 387-401(1942).
No beneficial effect could be demonstrated. U nitrate is toxic, especially to the kidney and liver.
- 2662 Hamai, S., Hayashi, S., and Shimamura, K. "Physicochemical Investigations of Catalytic Mechanisms. VIII. Fischer-Tropsch Synthesis of Hydrocarbons with Special Reference to the Durability of Catalyst." Bull. Chem. Soc. Japan **17**, 451-61(1942).
The reaction $\text{CH}_2 \rightarrow \text{C}_2\text{H}_4$ is faster than $\text{CH}_2 \rightarrow \text{CH}_4$. In the normalized reaction the first is predominant under various conditions of stage of reaction, temp., etc., whereas the second is predominant at the initial stage and as the reaction becomes normalized. The second reaction must be prohibited when the reaction mixt., $\text{CO} + \text{H}_2 = (1:2)$, is passed through the catalysts which may be $\text{Co} + 15\% \text{ThO}_2 + 100\% \text{kieselguhr}$, or $\text{Co} + 12\% \text{U}_3\text{O}_8 + 2.8\% \text{Cu} + 100\% \text{kieselguhr}$, each separately, at $190 + 250^\circ$.
- 2663 Hamai, S., Hayashi, S., and Shimamura, K. "Physicochemical Investigations of Catalytic Mechanisms. IX. Fischer-Tropsch Synthesis of Hydrocarbons with Special Reference to Factors Essential to the Particular Catalysts." Bull. Chem. Soc. Japan **17**, 463-77(1942).
The effects of the factors are tabulated, including the compn. of the catalysts (Co , U_3O_8 , Cu , Mn , and kieselguhr), preactivation temp. and reaction temp. for the reaction mixt. of $\text{CO} + \text{H}_2$. The presence of kieselguhr contributes to oil formation but not CH_4 formation. Generally higher temp. promotes the formation of gaseous products, such as CH_4 and CO_2 , and a very small amt. of oil.
- 2664 Heidt, L. J. "Photosensitive Complexes in the Photolysis of Uranyl Oxalate and Their Dissociation Constants." J. Phys. Chem. **46**, 624-30(1942).
Calcns. based on quantum yield, absorption spectra and pH measurements indicate that the photosensitive clusters in soln. of UO_2SO_4 (or oxalate) and $\text{H}_2\text{C}_2\text{O}_4$ (or alkali oxalate) are $[\text{UO}_2\text{H}_2\text{C}_2\text{O}_4]^{++}$, $\text{UO}_2\text{C}_2\text{O}_4$, and $[\text{UO}_2(\text{C}_2\text{O}_4)_2]^{--}$, the ionization consts. of which at 25° are, resp., 0.0027, 0.0000015, and 0.000018 (first) at zero ionic strength. Gross quantum yields and absorption data at 2080 Å are consistent with the calcns. Net quantum yields range from 0.7 to 1 at 2080 Å and from 0.6 to 0.8 at 3130 Å.
- 2665 Hirooka, T., Matsuo, M., Kawaharada, M., and Dei, K. "The Influence of Poison Injection on the Proteolysis of the Digestive Glands." Tôhoku J. Exptl. Med. **42**, 296-308(1942).
Injection of $\text{UO}_2(\text{NO}_3)_2$ soln. produced a marked inhibition of the intestinal peptidase.

2666 Hoffmann, J. "Fluorescence of Human Bone Ash." Biochem. Z. **311**, 247-51(1942).

During the ashing of human and animal bones, a variety of light phenomena was observed. The final ash of bones has a cinnamon- to deep-brown fluorescence. White-ashed bones, such as human vertebra and hip joints, which appear white in daylight, show yellow spots of fluorescence in ultraviolet light. $(\text{PO})^{-3}$, $(\text{CO}_3)^{-2}$, traces of F, Fe, Mn, rare earths, U, Na, and possible organic residues are identified in the brown-fluorescing ash. The U conc. is 1.1×10^{-8} g U/g. The yellow fluorescing spots do not contain $(\text{CO}_3)^{-2}$, Fe, Mn, rare earths, nor organic residues, and have a conc. of 1×10^{-8} U/g. The chem. compn. of the yellow-fluorescing bone ash is considered to be a C-free, heavy metal-free, F-contg. U phosphate, that is, a U-Ca fluorophosphate, which shows a continuous spectrum. The brown fluorescence can be explained by the fact that the fluorescence of U is shifted toward brown in the presence of Mn. The yellow fluorescence is due to U^{+4} and not to U^{+6} .

2667 Hoffmann, J. "Detection of Uranium in Living and Dead Plants." Bodenkunde Pflanzenernähr. **26**, 318-27(1942).

Investigation of plants not growing on volcanic soil showed that they contained U. U is therefore a regular constituent of the plant organism. In the material studied, the U varied between 7×10^{-9} and 2.3×10^{-13} g/g, depending on the variety of plant.

2668 Hoffmann, J. "Occurrence of Uranium in Liver and Spleen of Cattle." Z. physiol. Chem. **273**, 115(1942).

After ashing of the tissue, U was detd. with the fluorescence spectroscopy. Traces were found in the liver and spleen of cattle. Compared with other organs, the liver is relatively rich in U. The author believes that U plays a physiological role in the animal organism.

2669 Hoffmann, J. "A Previously Unknown Radioactive Constituent of Yeast." Biochem. Z. **311**, 311-16(1942).

In ultraviolet light, the fluorescence of bakers' yeast is usually white, though some spots of pale-yellow fluorescence are seen. Yeast was dried, ashed, and treated to sep. cpds. of U. The filtrate, which contained the U as NH_4 uranyl carbonate, was evapd. in a Pt crucible and the residue activated by fusion with NaF. The amt. of yeast ashed was 241 g, and the amount of NaF used to activate the U present, 1 g. Under ultraviolet light, this activated material showed a yellow fluorescence, with the 4 uranyl bands at 555, 577, 602, and 626 m μ . By comparing the strength of the fluorescence with that of known amts. of U, it was found that the yeast contained $1.98 \times 10^{-7}\%$ U. The ash content of the yeast was 0.578%. The occurrence of U is therefore not restricted to chlorophyll-contg. plants.

2670 Hoffmann, J. "U in Quartz Glass and in Glazed and Unglazed Porcelain." Sprechsaal **75**, 214-16(1942).

U is pptd. with the sesquioxide hydrates and sepd. from them by pptn. with $(\text{NH}_4)_2\text{CO}_3$. All filtrates contg. U are evapd. and freed from NH_3 salts. The traces of U are taken up with a soln. of Na_2F_2 . Glass pearls of 25 mg are fused with this Na_2F_2 contg. U. The intensity of their fluorescence is used to det. U. The following U contents in quartz glass and commercial porcelain were found: glass 4×10^{-6} , Berlin porcelain 2×10^{-4} , Meissen 4×10^{-4} , and Bavaria-Rosenthal 2×10^{-3} . The biol. effects of traces of U are discussed.

2671 Holman, R. L. and Hewitt, W. C. "Experimental Necrotizing Arteritis. II. Mercuric Chloride as Effective as Uranium Nitrate in Its Production." Proc. Soc. Exptl. Biol. Med. **49**, 58-62 (1942).

HgCl_2 produced the same injury as U nitrate when used as previously described. The large elastic arteries were most seriously affected.

- 2672 Khlopin, V. G. and Yashenko, M. L. "Physicochemical Properties of the Compounds of U, IV." Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk 87-97(1942).

On the basis of a detailed study of electric cond. and the pH of solns. of F cpds. of U^{+4} of varying over-all compns. in absence of atm. O_2 , the authors conclude that in soln. all three fluorides of U, contg. various amts. of H_2O , give the same product, which may be assigned the formula $UF_4(OH)_2H_2$. On the basis of their behavior in soln., it is impossible to judge the compn. or structure of these cpds. in the solid state. The series of solns. of over-all compn. $UF_4NH_4F \cdot O \cdot 5H_2O$ was subjected to the same study; here it was shown that in soln. the cpd. breaks down into $UF_4(OH)_2H_2$ and NH_3F , and it is, thus, again impossible to judge the structure in the solid state from the data on solns.

- 2673 Komovskii, G. F. and Golovchiner, Y. "An Application of Ionic Roentgen Tubes for Quantitative Spectrographic Analysis." Zhur. Tekh. Fiz. 12, 579-86(1942).

Artificial mixts. and minerals were quantitatively spectrographically analyzed for Ta, W, Nb, Mo, Zr, Hf, Th, U, Pb, Co, Ni, by using a somewhat modified Roentgen tube. The main difference of this tube from the usual tube was the distance between cathode and anode, 15 to 20 mm. At this distance the tube with flat cathode was stable in operation, and produced a wide and diffused focus quite suitable for such an analysis.

- 2674 Kuras, M. "The Reactions of Mercaptazole with Cations. III." Chem. Obzor 17, 41(1942). 2-Mercapto-4-phenylthiazole, m.p. = 168° is sol. in the usual org. solvents, and forms cpds. with Ag^+ , Pb^{++} , Hg^+ , Hg^{++} , Cu^{++} , Cd^{++} , Bi^{+3} , Sb^{+3} , Zn^{++} , Mn^{++} , Au^{+3} , and $(UO_2)^{++}$ which correspond to previously described cpds. of mercaptazole.

- 2675 Lopez, R. C. and Delgado, L. E. "Separation of Cu and U." Anales fís. quím. (Madrid) (5), 38, 40-2(1942).

Prep. a H_2SO_4 soln. of Cu and U contg. about 1% of each metal. If HNO_3 is present, remove it by evapn. To 20 cc of this soln. add 10 cc of 6% (by vol.) H_2SO_4 . To 10 cc of this dil. soln. add about 1 g amalgamated Zn, free from Fe, place in a flask, close by a Bunsen valve, heat gently 15 min, cool, remove the valve, pass a current of air through the soln. for 5 min to eliminate H_2 , filter to remove Zn and Cu, titrate the filtrate with 0.05N $KMnO_4$; 1 cc 0.05N $KMnO_4$ = 5.96 mg U.

- 2676 MacNider, W. deB. "The Aging Process and Tissue Resistance." Sci. Monthly 54, 149-54(1942). Expts. on the kidney and liver are described in which the anesthetic influences the action of certain chems. The quant. response may also be detd. by the age of the animal, and this factor of age may show itself in a structural manner by either facilitating or in part preventing changes of a degenerative nature from developing. Uranyl nitrate may exert its influence by acting on cellular oxidations. This concept assumes that as the animals age the rate of oxidation decreases and therefore the effect of this chem. would be more marked in older animals. Moreover, histological changes, such as the accumulation of stainable lipid material, also occur with age. This factor is related to the ability of Et_2O and $CHCl_3$ to exert their local toxic effect.

- 2677 Martini, A. "New Contributions to Microchemical Inorganic Analysis. IX." Anales asoc. quím. argentina 30, 41(1942).

U salts can be detected by reaction with sparteine thiocyanate; the sensitivity is reported to be 0.1 γ .

- 2678 Pappas, A. C. "Potentiometric Titration of U and Fe with Permanganate." Arch. Math. Naturvidenskap 45, 83-90(1942).

When Fe is absent, the soln. obtained after reduction in a Jones reductor can be titrated for U with $KMnO_4$ with satisfactory results. When Fe is present, there is no sharp break in the titration/e.m.f. curve. This difficulty can be overcome, however, by adding some HOAc just previous to the titration.

- 2679 Pigott, E. C. "Chemical and Physicochemical Analysis of Iron and Steel. Twelve Years' Advancement. II. Papers Describing the Determination of Single Constituents." Metallurgia 27, 80-2(1942).

Analytical methods for Sn, Ti, W, U, V, Zn, and Zr are discussed. 136 references are included.

- 2680 Pigott, E. C. "Qualitative Chemical Tests for Iron, Steel, and Foundry Materials." Iron Steel (London) 15, 196-9(1942).

Methods of quant. analysis were adapted to routine, rapid qual. tests using org. reagents. They may give misleading results unless carried out under the conditions described. Tests are given for Al, As, B, C, Ce, Cr, Co, Cu, Fe, Pb, Mn, Mo, Ni, Nb, P, Se, Si, S, Ta, Te, Sn, Ti, W, U, V, Zn, and Zr.

- 2681 Řetovský, R. "Shortening the Rest Period of the Seed of Aesculus hippocastanum L. Using Uranyl Nitrate." Ber. deut. botan. Ges. 60, 355-66(1942).

Seeds of the European horse chestnut, when collected from under the tree, must undergo a rest period before they will germinate. Membrane impermeability cannot be the important factor, for incision of the shell does not shorten the rest period. However, a bath in dil. $\text{UO}_2(\text{NO}_3)_2$ will bring the rest period to a close. Plants from such treated seeds contain U. The reason for the stimulating effect is not known, but it is believed to be most probably associated with the radioactivity of the metal. The rest period of seeds collected directly from the tree cannot be shortened by U treatment.

- 2682 Robinson, R. A., Wilson, J. M., and Ayling, H. S. "The Activity Coefficients of Some Bivalent Metal Nitrates in Aqueous Solution at 25° from Isopiestic Vapor-Pressure Measurements." J. Am. Chem. Soc. 64, 1469-71(1942).

Osmotic and activity coeffs. are tabulated from isopiestic measurements on the following nitrates: Mg, Sr, Ba, uranyl, Co, Cu, and Cd. The Mg and uranyl nitrate can be treated as completely dissocd. electrolytes.

- 2683 Roffo, A. H. and Luchetta, B. "Modifications of the Blood Picture of Rats Treated with Colloidal Metals." Bol. inst. med. exptl. estud. cáncer (Buenos Aires) 19, 121-34(1942).

In animals treated with various colloidal metals, Fe, which in tissue cultures showed no inhibitory effect on growth, produced an apparent excitant effect, to the extent that the animals showed an increase of erythrocytes and hemoglobin. Au, Pb, Co, and U produced (in animals) lymphopoiesis; in tissue culture, they were inhibitory to growth, the Au and Pb being more intensively so than were Co and U. Ni, which in tissue culture was highly inhibitory, did not affect lymphopoiesis, as was true of Sn and Fe.

- 2684 Rufer, W. "Absorption Measurements on Ultrasonic Waves in Electrolytically Conducting Solutions." Ann. Physik (5), 41, 301-12(1942).

The absorption coeff. of dissolved electrolytes measured at freqs. of 2900 to 8850 kc is a linear function of the concn. Instead of the theoretically predicted proportionality to the square of the freq., a direct proportionality is found. The coeff. relative to H_2O for 1M $\text{UO}_2(\text{NO}_3)_2$ is 3.02. The absorption coeff. of H_2O is $4 \times 10^{-12} \times \nu \text{ cm}^{-1}$. For the same anion, it increases with increasing wt. of cation; for the same cation, generally with the valence of the acid radical presumably because of stronger clustering of H_2O mols. The coeffs. of various ions present are additive.

- 2685 Satyanarayana, B. S. "Fluorescence of the Uranyl Compounds and Raman Spectrum of the Uranyl Ion." Proc. Indian Acad. Sci. A, 15, 414-16(1942).

In order to identify the mode of vibration which modulates the electronic transition giving rise to fluorescence of $(\text{UO}_2)^{++}$, the Raman spectrum of a satd. soln. of UO_2Cl_2 was investigated. It appears on longer exposure that the line found by Conn and Wu at 210 cm^{-1} is a close doublet $197 [2]$ and $226 [2] \text{ cm}^{-1}$ (intensities in brackets). The strongest line at $865 \text{ cm}^{-1} [10]$ is highly polarized and accompanied by a faint line at 853 cm^{-1} . A new line was recorded at $909 \text{ cm}^{-1} [1]$ corresponding to the infrared freq. at 930 cm^{-1} . If the binding between $(\text{UO}_2)^{++}$ and 2Cl^- is electrovalent, it can only account for a splitting of freqs. but not for new lines. Hence we have to assume that $(\text{UO}_2)^{++}$ is bent. The assignments of the

fundamental modes of vibration are $\nu_{\pi} = 865$, $\nu_{\sigma} = 909$, and $b = 211 \text{ cm}^{-1}$. The force const. and the angle O-U-O calcd. by the valence force field theory of Penney and Sutherland are $6.97 \times 10^5 \text{ dynes/cm}$ and 140° , resp. It may be remarked that the x-ray study by Fankuchen leads to the conclusion that the $(\text{UO}_2)^{++}$ group is linear.

- 2686 Schwab, G. M. and Issidoridis, A. "Inorganic Chromatography. VI. Absorption Spectra of Adsorbed Ions." *Z. physik. Chem. B.* **53**, 1-19(1942).

The absorption spectra of Cu, Cr(ic), Ni, and UO_2 ions adsorbed on Al_2O_3 were detd. in reflected light. The position of the band and the absorption coeff. lie between those for the ion in soln. and the hydroxide and closely agree with those for the basic salt. They do not agree with those of the corresponding anhyd. aluminate. The photochem. formation of a U^{+4} cpd. was observed, the kinetics of which were studied.

- 2687 Schwab, G. M. and Issidoridis, A. "A Photochemical Interfacial Reaction." *Ber.* **75B**, 1048-51 (1942).

The layer of adsorbed $\text{UO}_2(\text{NO}_3)_2$ on Al_2O_3 is changed from yellow to brownish green by light; the same phenomenon is observed with ZnO. Adsorption is necessary because the color change is not observed with glass powder, MgO, SnO_2 , SiO_2 , or CdCO_3 , and uranyl aluminate under H_2O is not colored by light. The product is probably $\text{U}_3\text{O}_8 \cdot x\text{H}_2\text{O}$. The probable course of the reaction is discussed.

- 2688 Snell, C. A. Reaction in the Solid State between Monazite and Sodium Carbonate. Dissertation, Brooklyn Polytechnic Institute, 1942.

- 2689 Stahly, E. E. and Hattox, E. M. —assigned to Standard Oil Development Co. Normally Liquid Hydrocarbons from Material Containing Isoparaffins and Monoolefins. Apr. 7, 1942. (U. S. Patent 2,278,677)

For the prodn. of normally liq. acyclic hydrocarbons boiling on the gasoline range and contg. substantial amts. of satd., branched-chain hydrocarbons, a mixt. such as one contg. isobutylene 10.5% and isobutane 89.5% is brought into contact with at least one binary cpd. of U, such as U_3O_8 on bentonitic clay or activated alumina, under alkylation reaction conditions. Several examples with details are given.

- 2690 von Duijn, C., Jr. "Interesting Crystal Formations." *Mikrokosmos* **36**, 16-18(1942).

A microchem. technique is explained for the prepn. of cryst. ppts. of Na uranyl acetate and other materials.

- 2691 von Kiss, A., Csokan, P., and Nyiri, G. "Light Absorption of Polycyclic Inner Complex Compounds. I. Salicylaldehyde-Ethylenediamine Complexes." *Z. physik. Chem. A.* **190**, 65-80(1942).

Extinction curves were obtained for aq. solns. of $\text{Fe}(\text{ClO}_4)_3$ and $\text{X}(\text{ClO}_4)_2$, where $\text{X} = \text{Cu}, \text{Ni}, \text{UO}_2$; aminoacetic acid; and salicylaldehyde and ethylenediamine mixts. as well as their inner complex salts with Na, K, Ca, Ba, Mg, Zn, Cu, Fe, Ni, and UO_2 in abs. alc. soln. at room temp. The results show that in the chlorates the metal ions are completely hydrated. For aminoacetic acid the absorption is due to the central ion and its coordinated binding electrons. For the mixt. and the inner salts the absorption is due to salicylaldehyde and ethylenediamine.

- 2692 von Kiss, A. and Nyiri, G. "The Light Absorption of Polycyclic, Inner Complex Compounds. III. Uranyl Complexes of the Aldimine Series." *Z. anorg. allgem. Chem.* **249**, 340-56(1942).

The absorption curves of 15 uranyl complexes of the aldimine series and their parent materials were measured at room temp. between 700 and 200 μ . The effect of the complex structure in altering the selective absorption of the solvent on the absorption of the complex is discussed.

PUBLICATIONS LOCATED IN 1943

- 2693 Bobey, M. E., Longley, L. P., Dickes, R., Price, J. W., and Hayman, J. M. Jr. "The Effect of Uranium Poisoning on Plasma Diodrast Clearance and Renal Plasma Flow in the Dog." Am. J. Physiol. 139, 155-60(1943).

It is proposed that changes in the nephron occur within a few days after poisoning by uranyl salts. Direct measurement of blood flow show that the circulation of the kidney is not decreased after such injections.

- 2694 Breedis, C., Flory, C. M., and Furth, J. "Alkaline Phosphatase Level in Urine in Relation to Renal Injury." Arch. Path. 36, 402-12(1943).

It is reported that the injection of uranyl nitrate results in the elevation of the urinary phosphatase level and a lowering of the level in the kidney as estd. by staining techniques. Expts. were performed on rats and rabbits.

- 2695 Caley, E. R. and Rogers, L. B. "New Reagents for Sodium." Ind. Eng. Chem., Anal. Ed. 15, 32-6(1943).

The use of uranyl-cupric-acetate reagent in Na detn. in presence of Li is claimed to be more accurate than those used by previous investigators. Aq. and alc. reagents are discussed. Upon pptn. of the triple salts with Na or Li, the ppts. were examined and a discussion of the actual detn. is included. Reagents using in place of acetate, formate, propionate, and butyrate were also investigated.

- 2696 Donnelly, G. L. and Holman, R. L. "Stimulating Influence of Sodium Citrate on Cellular Repair in Kidney Injured with Uranium Nitrate." N. Carolina Med. J. 4, 11-12(1943).

- 2697 Engel, M. and Rohoska, M. "Colorimetric Determination of Uranium." Kém. Lapja 4, 154-6 (1943).

Take a sample of uranyl salt contg. the equiv. of about 28 mg U, dissolve it in H_2O , dil. to 100 ml, and mix. To 3.5 ml of this soln. add 9 ml of reagent contg. 84 mg $K_4Fe(CN)_6$ in 100 ml. Measure the brownish-red color produced by $(UO_2)_2[Fe(CN)_6]$ in a colorimeter. Tables show the extinction values of varying concns. of $(UO_2)^{++}$ solns. obtained with a Lange-Roth colorimeter. The pH of the soln. should be about 6.3.

- 2698 Gnezda, J. "Formation of Colloids by Means of Saturation of All Valence Units." In Festschrift Feier zweijährigen Bestandes Unabhängigen Staates Kroatien, Zagreb. 1943. 26p.

In a previous paper a system of "affinities" and "viravales" was proposed and is here reprinted. In this system 0 has six units, and U twenty-eight, for example. A number of colloidal and complex cpds. were prepd. and structural formulas based on the author's system were derived. Some of those prepd. were $[Fe(NO_3)_3 \cdot UO_2 \cdot 4H_2O]_n$, $[Al(NO_3)_3 \cdot UO_2 \cdot 2H_2O]_n$ ($Al = Fe = 21$), $[(H_2O_4Th_4(NO_3)_4 \cdot UO_2)]_n$, $Th_6(NO_3)_{24} \cdot Pb_2 \cdot 6H_2O$ ($Th = U = 28$). Considerations and examples tending to confirm the author's point of view are presented.

- 2699 Hecht, F. and Grunwald, A. "Determination of Pb, Th, and U in Allanites with Respect to the Geological Measurement of Time." Mikrochemie ver. Mikrochim. Acta 30, 279-96(1943).

Starting with about 1 g of accurately weighed sample, the analysis consists in treating the sample with aqua regia, removing the Si by repeated evap. with HNO_3 and treating the impure SiO_2 with $HF + H_2SO_4$. This treatment is very similar to the conventional attack except that HNO_3 is used rather than HCl because the U is next to be removed by extn. with Et_2O from 60% NH_4NO_3 soln. The NH_4NO_3 extn. is repeated and the $(UO_2)^{++}$ is eventually pptd. with oxine in a buffered $HOAc$ soln. This is merely an outline of the procedure as numerous details require attention but in the hands of an experienced analyst excellent results can be obtained in detg., say 1 mg Pb, 12 mg of Th, and 1.5 mg U in the presence of far greater quantities of Fe, Ce, Al, Si, etc. Several complete analyses are given and the $Pb/(U + 0.36 Th)$ ratios appear to be satisfactory.

- 2700 Hoffmann, J. "The Element Uranium in the Plant and Animal Kingdom and in Human Organism." Biochem. Z. 313, 377-87(1943).

The detn. of U involved: sepn. of the silicic acid; pptn. by H_2S at various pH values; elimination of $(\text{PO}_4)^{-3}$; pptn. of hydroxides with NH_3 in the presence of NH_4 salts; sepn. of U; activation of NaF with U; fluorescence spectroscopic measurements of the U bands. The mold Aspergillus niger contains 6.37×10^{-8} g U/g and its spores, 5.68×10^{-7} g U/g. Concns. of U which are toxic for higher plants stimulate the growth of molds. Hen eggshells contain 2×10^{-7} g U and the α , β , and γ rays given off by the eggs during hatching may be recorded on a photographic plate. The concn. of U in human blood is 4×10^{-10} g/ml, or about 2×10^{-6} g U are present in the total blood of an adult. The g U/g of human tissues are: brain, 1.9×10^{-9} ; kidney (outer part), 5.35×10^{-9} ; kidney (inner part), 1.31×10^{-8} ; seminal vesicles, 2.72 to 3.63×10^{-7} ; ovaries, 3.27×10^{-7} ; prostate, 4×10^{-7} ; adult thyroid, 4.52×10^{-7} ; fetal thyroid, 5.04×10^{-6} ; fetal liver, 4.66×10^{-7} ; fetal spleen, 3.3×10^{-6} . The presence of U in the human fetus shows that it is a bio-element. Fe, Mn, and U, which are present in yeast, molds, and animal tissues, can change their valence under the influence of light and heat waves and have an oxidizing action.

- 2701 Hoffmann, J. "A Further Contribution to the Distribution of U in Plant Material." Bodenkunde Pflanzenernähr. 32, 295-306(1943).

The plant was ashed and treated with 1 g NaF, and U was detd. by fluorescence. White ash of apple seed (Ribston Pepping) contains $5.06 \times 10^{-4}\%$ U or $2.81 \times 10^{-5}\%$ U in seed. Ash of young stem of grape vine in spring when sap formation is rapid contains $8 \times 10^{-7}\%$ U or $4.8 \times 10^{-10}\%$ in green stem. Earthy-white, but in spots olive-colored, ash of skin of grape in fall contains $1.6 \times 10^{-4}\%$ U or $7.29 \times 10^{-6}\%$ U in living skin substance. White, but in spots green, ash of grape seeds contains $2.8 \times 10^{-1}\%$ U or $3.38 \times 10^{-3}\%$ U in seed. Ash of quack grass, Agropyrum repens, contains $1.79 \times 10^{-5}\%$ U or $1.19 \times 10^{-6}\%$ U in leaves and stems. Brown ash of rootstock of quack grass contains $5.73 \times 10^{-5}\%$ U or $3.57 \times 10^{-8}\%$ in root; the root contains 4 times as much as leaves. White, in spots blue-green, ash of potato contains $3.18 \times 10^{-6}\%$ U or $2.71 \times 10^{-8}\%$ U in potato tuber. The potato tuber, which is high in K (isotope 41 = 5%) is lower in U than root of quack grass. The antagonism of U and K isotope 41 is evident. Perhaps this accounts for antagonism of potato and quack grass. Ash of roots and rootlets of dill, Anethum graveolens, contains $1.54 \times 10^{-4}\%$ U or $7.91 \times 10^{-6}\%$ U in root; ash of dill leaves contains $2.95 \times 10^{-4}\%$ U or $1.58 \times 10^{-5}\%$ U in leaves; ash of dill seeds contains $9.56 \times 10^{-5}\%$ U or $7.15 \times 10^{-6}\%$ U in seeds. Ash of roots of celery, Apium graveolus, contains $7.91 \times 10^{-4}\%$ U or $8.91 \times 10^{-6}\%$ U in roots; ash of the tap root $2.96 \times 10^{-4}\%$ U or $1.86 \times 10^{-6}\%$ U in tap root; ash of brown outer layer of tap root contains $3.9 \times 10^{-6}\%$ U or $4.44 \times 10^{-6}\%$ U in outer root. Root extensions have a much higher U content than the root. This may be physiologically significant. Brown ash of leaves of celery contains $2.65 \times 10^{-3}\%$ U or $1.41 \times 10^{-5}\%$ U in leaves. Brown-white ash of root fibers of garlic, Allium sativum, contains $4.17 \times 10^{-3}\%$ U or $1.41 \times 10^{-5}\%$ U in leaves. Ash of bulb skin (garlic) contains $4.38 \times 10^{-4}\%$ U or $3.03 \times 10^{-5}\%$ U of skin; ash of little bulblets contains $2.47 \times 10^{-4}\%$ U or $1.92 \times 10^{-6}\%$ U in bulblets. Brown ash of branch and terminal buds of the mistletoe, Viscum alba, contains $3.73 \times 10^{-4}\%$ U or $6.6 \times 10^{-6}\%$ U of stems; deep-brown ash of leaves contains $5.25 \times 10^{-4}\%$ U or $7.54 \times 10^{-6}\%$ U in leaves; light-green, Mn-contg. ash of berry contains $2.16 \times 10^{-4}\%$ U or $1.9 \times 10^{-8}\%$ U in berry; dark blue-green ash of seed and seed hull contains $6.78 \times 10^{-4}\%$ U or $2.35 \times 10^{-6}\%$ U in seed. The leaves contain both Mn and U, elements susceptible to changes in light, in larger quantities than other organs. Pure-white ash of "Holland pine" branches minus needles contains $4.25 \times 10^{-5}\%$ U or $3.29 \times 10^{-6}\%$ U in branches; yellow-brown ash of needles contains $2.54 \times 10^{-4}\%$ U or $6.43 \times 10^{-6}\%$ U in needles. Green leaves of spring and colored leaves of fall of pear, apricot, and birch were examined for U content. Pear (Triumph Devienne) contained 1.7×10^{-7} g U/g green, 4.76×10^{-8} g U/g colored; apricot (Great Royal) 1.4×10^{-8} g U/g green; 5.03×10^{-9} g U/g yellow; birch 6.5×10^{-6} g U/g green, 1.29×10^{-7} g U/g yellow. This indicates that the U content of leaves decreases before leaves fall. The hardiest plants have greatest U content in leaves. In plants and animals, U is associated with processes in gaseous phase, such as respiration, and in thermal metabolism.

- 2702 Hoffmann, J. "Uranium Concentration in the Following Organs: Hypophysis, Thyroid, Gonads, Adrenals and Pancreas." *Biochem. Z.* 315, 26-30(1943).

Most of the organs were obtained from an 18-yr-old subject who died an unnatural death. The U was detd. by ashing the samples, dissolving the ash in HCl, removing interfering traces of metals, and measuring the fluorescence. The tissues of the body were divided into five groups according to their concn. of U. The concn. of U, expressed in g/g of tissue was: blood, 10^{-10} ; brain, 1.8×10^{-9} ; kidney, 5.0×10^{-9} ; pancreas, 7.5×10^{-9} ; bone marrow, 8.3×10^{-9} ; interior of kidney, 1.3×10^{-8} ; liver, 6.6×10^{-8} ; lungs, 8.2×10^{-8} ; adrenals, 2.1×10^{-7} ; ovaries, 3.3×10^{-7} ; seminal vesicles, 3.6×10^{-7} ; prostate, 4.0×10^{-7} ; thyroid, 4.5×10^{-7} ; spleen, 4.7×10^{-7} ; hypophysis, 1.4×10^{-6} . The concn. of U in the inner kidney was correlated with the concn. of U in the urine, 1.2×10^{-8} g/l. It is suggested that U in the lungs is regulated by the gaseous reactions.

- 2703 Hoffmann, J. "Uranium in Different Nerve and Gland Substances as Well as in the Heart." *Biochem. Z.* 315, 362-5(1943).

The cerebellum of a 9-mo. male infant contained $3.79 \times 10^{-7}\%$ U, while that of a 45-yr-old man contained $4.49 \times 10^{-7}\%$. The cerebellum of the adult subject, thus, contained only $0.70 \times 10^{-7}\%$ more U than that of the infant. The spinal cord of a 1½-mo. infant contained $6.13 \times 10^{-7}\%$ U, while the spinal cord of a fish contained $3.52 \times 10^{-6}\%$. The concn. of U in the infant heart was $1.02 \times 10^{-6}\%$, while that in the heart of a 73-yr-old man was $4.42 \times 10^{-7}\%$. The conc. of U in the parathyroid gland of the 45-yr-old man was $1.33 \times 10^{-6}\%$ and in the testicles, $1.24 \times 10^{-6}\%$. In agreement with previous work the conc. of U in all tissues studied was greater than that of blood, which is about $4 \times 10^{-8}\%$. The human body contains about 0.00001 mg Ra/kg. Ra as well as U may have a part in the life processes.

- 2704 Hoffmann, J. and Garzuly-Janke, R. "Influence of Traces of Uranium on Yeast Cells." *Biochem. Z.* 313, 372-6(1943).

Although all nutritive solns. contg. the essential $(\text{NH}_4)^+$ and $(\text{PO}_4)^{-3}$ ions ppt. U, it is possible to demonstrate its effect on yeast. The toxic effect of U is within the border concns. of 10^{-3} to 10^{-4} , and between 10^{-4} and 10^{-5} U has a stimulating effect on cell division.

- 2705 Holman, R. L. "Experimental Necrotizing Arteritis in Dogs. III. Bilateral Nephrectomy as Effective as Heavy Metal Injury in Its Production." *Am. J. Path.* 19, 147-57(1943).

This study compares the results of U nitrate poisoning and surgery alone and in combination in the production of necrotizing arteritis in dogs.

- 2706 Holman, R. L. "Necrotizing Arteritis in Dogs Related to Diet and Renal Insufficiency. V. Evidence for a Dietary Factor." *Am. J. Path.* 19, 977-91(1943).

Renal insufficiency was produced by injection of U nitrate or HgCl_2 into groups of dogs previously fed an ordinary kennel diet or a std. exptl. diet to which protein contributed 7% of the calorie value. At necropsy only 4 out of 71 dogs with U nephritis and on kennel diets showed necrosing generalized arterial lesions, while 13 dogs out of 21 fed on the std. diet showed decrotizing arterial lesions. It is suggested that a dietary factor was therefore of significance in the production of these arterial lesions during exptl. renal insufficiency. The factor was associated with a low protein content of the diet, but might be a deficiency, a toxic agent, or the result of dietary imbalance.

- 2707 Holman, R. L. "Necrotizing Arteritis in Dogs Related to Diet and Renal Insufficiency. VI. Associated Lesions: Stomatitis, Gastroenteritis and Pancreatic Fat Necrosis." *Am. J. Path.* 19, 993-1004(1943).

In a group of 57 dogs subjected to renal insufficiency by 1 of 3 methods (U nitrate in 33, HgCl_2 in 18, and bilateral nephrectomy in 6) the following lesions were found: (a) acute necrotizing stomatitis in 42 (74%); (b) acute hemorrhagic gastroenteritis in 28 (49%); (c) acute necrotizing arteritis in 24 (42%); (d) acute pancreatic fat necrosis in 11 (19%). The occurrence of all four lesions in dogs subjected to bilateral nephrectomy seems to eliminate heavy metal, per se, from any pathogenic role in the develop-

ment of these lesions. The "irritant" responsibility for the inflammatory reaction in all these lesions appears to be an "internal" one related to the disturbed metabolism associated with renal insufficiency.

2708 Iinuma, H. "Coordination Compounds of Hinokitiol, *o*-Diketone with Seven-Membered Carbon Ring." *J. Chem. Soc. Japan* **64**, 742-6(1943).

Na, Ag, Be, Mg, Zn, Al, Co, Cr, Sb, Th, Ce, V, Mo, W, and U salts of hinokitiol have been synthesized and their properties have been studied.

2709 Isakov, P. M. "Application of Cupferron in Qualitative Chemical Analysis." *Zhur. Priklad. Khim.* **16**, 325-7(1943).

In simplicity, sensitivity, and rapidity, the reaction or test for U with cupferron appears to be especially suited for microchem. detection in analyses not only of pure reagents, but also of mineral materials. In drop or test-tube methods, the cupferron reaction can also be used for detecting V and Fe.

2710 Jolibois, P. "The So-called Uranyl Salts." *Compt. rend.* **217**, 426-8(1943).

The concept of a uranyl radical, which corresponds to no exptl. facts, should no longer be retained. Infrared absorption spectra indicate the presence of UO_3 in so-called uranyl salts in the solid state (Lecomte and Freymann). Electrolysis of solns. of such salts gives no indication of a UO_2 cation. When a UO_2SO_4 soln. is electrolyzed, the cathode reaction comprises evolution of H_2 and deposition of $\text{UO}_3 \cdot 2\text{H}_2\text{O}$ free of H_2SO_4 . This is interpreted as indicating that the "uranyl" cpd. is in reality a basic salt, $\text{U}(\text{SO}_4)_3 \cdot 2\text{UO}_3$. Neither the cond. nor the pH indicates the presence of a normal salt of U^{+6} in soln. (Jolibois and Foureiter). The nonexistence of normal salts of U^{+6} in the solid state and the results of Colani should not be considered as arguments in favor of the idea of a uranyl salt, which was adopted at a time when the oxide UO_2 was confused with the metal.

2711 Kato, M. "Spectroscopic Investigations of Optically Homogeneous Luminescent Substances. II. The Laws of Photoluminescence and Their Application." *Sci. Papers Inst. Phys. Chem. Research (Tokyo)* **41**, 125-60(1943).

The relation between the wavelength of the exciting radiation and the intensity of fluorescence of alk. halide phosphors, U glass, and several fluorescence dye solns. was studied. The emission bands of luminescence centers have the following two characteristics: (a) The intensity distribution of fluorescence spectra is independent of the wavelength of the exciting radiation. (b) The quantum eff. of fluorescence is independent of the wavelength of the exciting radiation, at least within an absorption band consisting of a single electronic state.

2712 Khlopin, V. G. and Gurevich, A. M. "Reduction-Oxidation Potentials in the System $\text{UO}_2\text{SO}_4 - \text{U}(\text{SO}_4)_2$ as Related to the Acidity of the Solution." *Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk* **271**-9(1943).

The e.m.f. of the elements $\text{Pt}/\text{UO}_2\text{SO}_4, \text{U}(\text{SO}_4)_2, \text{M H}_2\text{SO}_4, \text{M H}_2\text{SO}_4, \text{Hg}_2\text{SO}_4/\text{Hg}^+$, and $\text{Hg}^+/\text{Hg}_2\text{SO}_4$ was detd. at $\text{M} = 0.05, 0.508, 1.03$, and 2.75 at 25° . The temp. coeff. of the cells was detd. from 0 to 50° . The normal oxidation-reduction potential of $\text{U}^{+6}/\text{U}^{+4}$ was found to be 0.407 ± 0.003 v. The heat effect of $\text{UO}_2\text{SO}_4 + \text{H}_2 + \text{H}_2\text{SO}_4 = \text{U}(\text{SO}_4)_2 + 2\text{H}_2\text{O}$ was found to be 34 kcal.

2713 Khlopin, V. G. and Gurevich, A. M. "Oxidation-Reduction Potentials in the System $\text{U}(\text{SO}_4)_2 - \text{U}_2(\text{SO}_4)_3$ Depending on the Acidity of the Solution." *Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk* **381**-8(1943).

UO_2SO_4 in H_2SO_4 was reduced by Zn-Hg, and the amts. of U^{+4} and U^{+3} were detd. by potentiometric titration with KMnO_4 . The e.m.f. of the cell $\text{Pt}/\text{U}(\text{SO}_4)_2, \text{U}_2(\text{SO}_4)_3, \text{H}_2\text{SO}_4/\text{H}_2\text{SO}_4, \text{Hg}_2\text{SO}_4/\text{Hg}$ was detd. at H_2SO_4 concns. of $0.05 + 2.75\text{M}$ at 18 to 20° . The oxidation-reduction potential $\text{U}^{+4}/\text{U}^{+3}$ does not vary greatly with changes in acid concn. but does depend on total U concn. The approx. value of the normal oxidation-reduction potential is -0.09 ± 0.02 v.

- 2714 Kieffer, R. and Hotop, W. "Comparison of the Properties of Sintered and Melted Metals and Alloys." *Kolloid-Z.* 104, 208-23(1943).

This is a review, with 12 tables and 27 references, of the d. and electrical and mechanical properties of W, Mo, Ta, Nb, Ti, Zr, Th, V, Cr, U, Cu, Ag, Au, Pt, Ni, Co, Fe, steel, and W carbide-Co, Fe-Ni, Fe-Al, and Fe-Ni-Al-Co alloys.

- 2715 Marchi, L. E. and McReynolds, J. P. "The Stereochemistry of Coordination Number Eight. Optical Activity of Potassium Tetraoxalato-Uranium-IV." *J. Am. Chem. Soc.* 65, 333-5(1943). Directions are given for the resolution of potassium tetraoxalato-uranium-IV. Optical activity in cpds. of elements exhibiting coordination no. 8 is established for the first time by the resolution of $K_4[U-(C_2O_4)_4] \cdot 5H_2O$ into 4 isomers: one d and one l easily racemized modification and one d and one l stable modification by fractional pptn. of the strychnine salt. A partial proof of the structure for cpds. of elements exhibiting coordination no. 18 contg. sym. bidentate groups is made. The data are insufficient to distinguish between the square Archimedean antiprism and the dodecahedron with triangular faces and symmetry V_d .

- 2716 Martin, H. and Eldau, K. H. "The Stability of UCl_5 ." *Z. anorg. allgem. Chem.* 251, 295-304 (1943).

Solid UCl_5 decomps. with measurable velocity at room temp. into UCl_4 and Cl_2 . The course of the reaction can be followed by noting the decoloration of HgI_2 caused by the Cl_2 , and also by detg. the I_2 formed in this reaction. In an atm of N_2 the equil. pressure of Cl_2 at 20° is at least 0.01 mm Hg; at 65° it is at least 0.1 mm. The action of H_2O on UCl_5 seems to be purely hydrolytic; no catalytic effect on the thermal decompn. could be detected. At room temp., undecompd. UCl_5 has a vapor pressure appreciably less than 0.01 mm of Hg.

- 2717 Maurer, W. and Pose, H. "Neutron Emission of the Uranium Nucleus as the Result of Its Spontaneous Fission." *Z. Physik* 121, 285-92(1943).

The half-life for U^{238} is found to be 2.5×10^{15} yrs for spontaneous nuclear fission from measurements made with about 4 kg of U.

- 2718 Miller, C. C. "Qualitative Semimicroanalysis with Reference to Noyes and Bray's System—the Aluminum Group." *J. Chem. Soc.* 72-4(1943).

A scheme of analysis is given for the metals comprising the Al group of Noyes and Bray's system. The proposed method makes possible the detection and approx. estn. of 0.25 to 50 mg of Al, Cr, or Zn, and 0.25 to 10 mg of Be, W, U, or V in mixts. contg. phosphate and a max. of 50 mg of the metal ions. Al and Zn are sepd. from the bulk of the other metals. Al is pptd. as Cs alum, and U, after further sepn., is pptd. as ferrocyanide.

- 2719 Niessner, M. and Korkisch, F. "Microanalytical Methods for Investigation of Glass." *Glass Ind.* 24, 518-19(1943).

The colorimetric technique for detn. of U with $K_4Fe(CN)_6$ is described.

- 2720 Niessner, M. and Hecht, F. "Microanalytical Procedures for the Investigation of Glasses. II." *Glastech. Ber.* 21, 228-30(1943).

Procedures previously reported were rechecked. Tests were run on mixts. in the form of oxides, carbonates, and silicates, an amt. of such mixt. corresponding to about 20 mg of glass being used as a sample. When the compn. of such a mixt. is calcd. as anhyd. oxides it corresponds to the compn. of the glass produced from it. The limit of sensitivity for the detection of U was 50 γ U in 20 mg of glass, even in the presence of Cu.

- 2721 Pose, H. "Spontaneous Neutron Emission of Uranium and Thorium." *Z. Physik* 121, 293-7(1943). Measurements in a mine to avoid the effect of cosmic radiation give a half-life of 3.1×10^{15} yr for U^{238} and 1.7×10^{17} yr for Th^{232} .

- 2722 Safford, H. W. and Kuebel, A. "Preparations and Properties of Ammonium Diuranate." J. Chem. Education **20**, 88-91(1943).

A commercial prepn. from pitchblende and a lab. prepn. from uranyl nitrate are described. Samples prepd. by heating at 100° and by drying over anhyd. CaSO_4 give identical x-ray diffraction patterns. Heating in air to 750° gives U_3O_8 . The cpd. can be identified by appearance, wt. loss, and x-ray pattern. Heating in H_2 to 750° gives UO_2 which is similarly identified. The formula for the original salt is in doubt since U was detd. by a radioactivity-comparison method of low accuracy; that method is described.

- 2723 Satyanarayana, B. S. "Fluorescence of Uranyl Salts." J. Mysore Univ. **4**, 57-61(1943). The fluorescence spectra of uranyl nitrate at room and liq. air temp. are reported. When excited by polarized light the spectra are completely depolarized. A cryst. structure appears essential for the presence of narrow components in the spectrum. The structure of the prominent bands at low temp. is considered to arise from a Stark splitting of levels due to crystal fields. The fusion of these levels at room temp. would account for the observed width of the bands.

- 2724 Tolmachev, Y. M. "The Absorption of Uranyl Salts on Solid Adsorbents." Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk No. 1, 28-34(1943).

$(\text{UO}_2)^{++}$ is reversibly adsorbed by activated C at room temp. from $\text{UO}_2(\text{NO}_3)_2$ soln. in accordance with the Freundlich equation. Its adsorption on schists from Central Asia and the Leningrad region is irreversible and is probably accompanied by chem. reaction. The schists with greater adsorptive power have a higher initial U content. This was probably originally accumulated by adsorption. (This paper has been translated into English by L. Marskák and in that form bears AEC File No. NP-742.)

- 2725 Vacirca, F. "On an Antiuranium Substance 'V Faktor' which Protects the Kidney against Toxic Action of Uranium and Modified Its Excretion." Z. physiol. Chem. **278**, 169-74(1943).

After treatment with formaldehyde, the filtrate of cultures of the diphtheria bacillus, which contains the "V factor" protects exptl. animals against poisoning with U nitrate. If 6 to 8 cc of this factor are injected into a rat 24 to 48 hr before, simultaneously, or within 8 hr after the injection of the min. lethal dose of U, the rat survives. Animals which survive show increased resistance to U for the following 15 to 20 days. The "V factor" promotes the excretion of U by the kidneys, for if 2 mg of U nitrate are injected into an untreated 150-g rat, 1 mg of the nitrate is recovered in the kidneys and 0.3 mg in the urine after 24 hr; under the same conditions, 0.2 mg of the nitrate is recovered in the kidneys and 1.1 mg in the urine of a rat treated with the "V factor."

- 2726 Vacirca, F. "On the Metabolism of Diphtheria Bacillus." Z. Immunitätsforsch. **103**, 188-215 (1943).

The author reports that the filtrate from diphtheria cultures, if properly treated with formaldehyde, will protect exptl. animals against a min. lethal dose (or somewhat more) of U nitrate, whether the treated filtrate is mixed with U salt before injection or injected into another site simultaneously. The effect seems to be produced by an increase of urine production. The active substance is thought to be a polypeptide.

PUBLICATIONS LOCATED IN 1944

- 2727 Devignat, R. "Aeration of Fluid Culture Media. Supplementary Observations." Edinburgh Med. J. 51, 124-30(1944).

If gas that is to be bubbled through culture medium is first washed with KOH, it exerts a manifest attenuating effect on the toxic and pathogenic activities of both aerobic and anaerobic organisms. This property seems to be related to the radioactivity of K. Ca and U do not produce this attenuation. The organisms studied were: Shigella dysenteriae, Pasteurella pestis, Clostridium tetani, and Eberthella typhosa.

- 2728 Donnelly, G. L., Ross, C. J., Meroney, W. H., and Holman, R. L. "Studies on Heavy Metal Poisoning. II. Sodium Citrate Therapy Effective 67 Hours after Uranium Injury." Proc. Exptl. Biol. Med. 57, 75-8(1944).

Nineteen of 20 adult dogs survived a lethal dose of U nitrate (5.0 mg/kg) when large doses of Na citrate (0.23 g/kg/day for 5 to 10 days) were injected intravenously. The citrate injections were as effective when started as late as 67 hrs after the heavy metal as when started immediately. Objections are raised to the currently accepted view that maintenance of the alk. reserve is the mechanism whereby protection is afforded, and the suggestion is offered that Na citrate supplies ions or molecules that keep the vital "citric acid cycle" of carbohydrate metabolism going while recovery takes place.

- 2729 Erametsa, O. "Quinaldic Acid as a Reagent for Thorium." Suomen Kemistilehti B. 17, 30(1944). Quinaldic acid ppts. Th quantitatively in the cold. The ppt. is partially sol. in hot water, completely sol. in an excess of the acid. U salts are also pptd., but not quantitatively, either from hot or cold soln.

- 2730 Faith, W. L. —assigned to Sharples Chemicals, Inc. Maleic and Fumaric Acids and Their Anhydrides. Dec. 19, 1944. (U. S. Patent 2,365,631)

These are produced by controlled catalytic oxidation of haloaliphatic cpds. contg. at least 4 C atoms in a straight chain. The preferred starting cpds. are the mono-, di-, and tri-Cl derivs. of paraffinic or olefinic hydrocarbons with 4 to 8 C atoms, e.g., such as are obtained in commercial chlorination of pentane. Preferred catalysts are the oxides of V, Mo, W, Cr, and U, used (severally or combined) as such or supported on carriers.

- 2731 Feigl, F. "Spot-Reaction Experiments. VIII. Photochemical Reactions." J. Chem. Education 21, 479-84, 506(1944).

Photochem. spot reactions are described. The photolysis of metal oxalates (innermol. or isomol. reduction-oxidation reactions), including $\text{UO}_2\text{C}_2\text{O}_4$ are reported.

- 2732 Flatt, R. and Sommer, F. "Titration With Cr^{++} Solutions. II. Chromometric Determination of W and U." Helv. Chim. Acta. 27, 1518-22(1944).

Place the soln. contg. 50 to 200 mg of W as $(\text{NH}_4)_2\text{WO}_4$ in a titration app., add quickly 40 to 50 ml of concd. HCl, mix, introduce CO_2 for 10 min, heat to 70 to 90° and titrate electrometrically with 0.1M CrCl_2 . A distinct break in the potentiometric titration curve appears when the W is reduced in valence from 6 to 5. H_2SO_4 cannot be used in place of the HCl. When the latter is added, a white turbidity of $\text{WO}_3 \cdot 2\text{H}_2\text{O}$ appears but disappears upon further rapid addn. of concd. acid with stirring. Similar treatment with U^{+6} soln. gives reduction to U^{+4} ; in this case either HCl or H_2SO_4 can be used for acidification.

- 2733 Grummitt, W. E., Guiron, J., Wilkinson, G., and Yaffe, L. The Fission Yields of Ba^{139} and Ba^{140} in Neutron Fission of U^{235} and U^{238} . Oct. 31, 1944. 7p. (NRC-1578)

Thermal and fast neutron fission of U^{235} and U^{238} in natural U was accomplished and values for Ba^{139} and Ba^{140} yields are reported. Resonance fission was found to be small. This information was later published in Can. J. Research B. 25, 364-70(1947).

- 2734 Gustafson, G. E., Koletsky, S., and Free, A. H. "Effect of Sodium Citrate on Uranium Poisoning in Dogs." Arch. Internal Med. 74, 416-23(1944).

Twenty dogs received an intravenous injection of 5 mg of anhyd. $\text{UO}_2(\text{NO}_3)_2$ /kg of body wt. Ten of these dogs served as controls and 10 received Na citrate. Three dogs received an intravenous injection of 230 mg/kg/day of anhyd. Na citrate for 5 days preceding and 5 days following the injection of $\text{UO}_2(\text{NO}_3)_2$. Seven dogs received larger amts. of Na citrate orally. Chem. studies include blood urea nitrogen, urea clearance, blood creatinine, serum chloride, serum CO_2 , and a quant. analysis of the urine for U. Pathological studies included biopsies of the kidneys of both control and citrate-treated dogs at 2, 8, 26, 48, 60, and 72 hr after $\text{UO}_2(\text{NO}_3)_2$. Autopsies were performed on all animals at the time of death or when sacrificed. All kidney sections were studied histochemically by a special staining method which is apparently specific for U. Chem. studies on dogs in the control group showed progressive renal failure. In this group, the tubular necrosis was diffuse and marked. In dogs receiving a large amt. of Na citrate orally, the N retention was min. and the kidney damage to renal tubules relatively slight. The amt. of U excreted by the dogs receiving Na citrate was approx. 4 times greater than for the control dogs. The ability of the citrate animals to excrete U may explain the slight degree of kidney disease.

- 2735 Hoffmann, J. "U and Similar Fluorescences." Z. anal. Chem. 126, 369-73(1944).

Hernegger and Karlik made use of the fluorescence of NaF melts for detg. small quantities of U in sea water. The fluorescence was produced with the aid of an ultraviolet lamp. In a previous paper the author used this fluorescence for detg. traces of U in ppts. In the analytical procedure, U, Zn, Th, and Mn are usually sepd. from the other cations of the third group by means of NH_4OH and $(\text{NH}_4)_2\text{CO}_3$. Th gives slight fluorescence in ultraviolet light but expts. show that under the fluorescence microscope the yellow fluorescence produced by Th does not add itself to that of U. On the other hand, in carrying out the $(\text{NH}_4)_2\text{CO}_3$ sepn. in the presence of a little FeCl_3 some U is likely to be copptd. Ignited Zn salts show fluorescence which interferes somewhat with the U detn. A procedure is given for sepg. traces of Zn from traces of U by means of H_2S . In carrying out the analysis it is always necessary to remember that accurate results in the U detn. are obtained only when less than 10^{-3} mg of U is present.

- 2736 Holman, R. L. and Douglas, W. A. "Studies on Heavy Metal Poisoning. I. The Use of Natural Radioactivity for Tracer Studies on Uranium." Proc. Soc. Exptl. Biol. Med. 57, 72-5(1944).

The α activity of U was utilized for tracer studies of this element in a group of 4 dogs which were injected intravenously with a min. lethal dose of uranyl nitrate (5.0 mg/kg). "Thick films" of the ash from std. dilns. of blood plasma and $\text{UO}_2(\text{NO}_3)_2$ and of urine and $\text{UO}_2(\text{NO}_3)_2$ were "washed," then counted by an ionization chamber operating a linear amplifier and mechanical counter. Calibration curves were made from these results. Unknown samples of blood plasma and of urine were similarly treated and counted. Four hr after intravenous injection of $\text{UO}_2(\text{NO}_3)_2$ soln. practically none of the metal can be detected in the blood plasma. Within the first 24 hr after the intravenous injection approx. 2/3 of the U is eliminated in the urine.

- 2737 Internationale Tabellen zur Bestimmung von Kristallstrukturen. (rev. ed.) Ann Arbor, J. W. Edwards, 1944.

Vol. II contains crystallographic data on many U cpds.

- 2738 Kato, M. "Spectroscopic Investigations of Optically Homogeneous Luminescent Substances. III. The Energy Levels of Luminescence Centers in Some Alkali Halide Phosphors." Sci. Papers Inst. Phys. Chem. Research (Tokyo) 42, 35-48(1944).

The luminescence centers were classified into several types according to the degree of "unstabilization" of their excited energy states. When the center was excited to an energy level by light absorption and yet emitted a fluorescence which did not correspond to that energy level, the excited energy state was designated "perfectly unstabilized," and radiationless transition from that state to some lower state was assumed. When the center emitted few kinds of fluorescence on being excited to a level, the level was called "metastable," and the probability for radiationless transition of the same kind was surmised to exist with such energy level. From centers of this type it was expected that a strong fluorescence of

long duration could be emitted from a metastable excited state; NaCl-Mn crystal and U glass belong to this type.

- 2739 Kroupa, E. "Microgravimetric Separation of Vanadium and Uranium with Subsequent Determination of the Vanadium as Silver Orthovanadate." Mikrochemie ver. Mikrochim. Acta **32**, 245-51 (1944).

To sep. U and V the sepn. of Hect and Grunwald is preferred. The soln. in dil. HNO_3 is satd. with NH_4NO_3 and the $(\text{UO}_2)^{++}$ extd. by shaking with abs. Et_2O . In the Et_2O ext. there is no difficulty in detg. the $(\text{UO}_2)^{++}$ with oxine, after removing the Et_2O , but for the V detn., the presence of large quantities of NH_4NO_3 makes it necessary to heat with HCl , evap., and fume, and then to remove Cl^- by evapg. again with HNO_3 . After this the pptn. with AgNO_3 is easy to accomplish.

- 2740 McBrady, J. J. A Study of Reversible Photobleaching of Uranium Compounds in Homogeneous Solutions. Dissertation, Univ. of Minnesota, 1944.

- 2741 Nag-Chowdhury, B. D., Das, S., and Dasgupta, A. "Investigation on the Radioactive Contents of Certain Indian Minerals." Proc. Natl. Inst. Sci. India **10**, 167-74(1944).

U and Th were detd. by measuring α radiation with a N-filled ionization chamber connected to a modified Dubridge and Brown circuit used with a Moll galvanometer. The current sensitivity of the app. was 2×10^{-15} amp/mm. The circuit could resolve about 30 cpm. Complete details of chamber and circuit are included. With absorbers a and b of different thickness, the counting rates are $n_a = v_a U + w_a \text{Th}$, and $n_b = v_b U + w_b \text{Th}$, in which v_a, w_a, v_b, w_b are the counting rates due, resp., to U g of U and Th g of Th in 1 g of sample. These are combined to give $\text{Th} = (n_a/w_a)(n_b/n_a - v_b/v_a)/(w_b/w_a - v_b/v_a)$; $U = (n_a/v_a)(w_b/w_a - n_b/n_a)/(w_b/w_a - v_b/v_a)$. The quantities n_a and n_b are observed, while v_a, v_b, w_a , and w_b are computed from the tables of Finney and Evans. The minerals analyzed were crushed and screened through 170 mesh. Weighed samples were mixed with weighed quantities of plaster of Paris to reduce the radioactive strength. Thin layers of the mixts. were deposited on Al disks for counting. The following results (in %) were obtained for U and Th, resp.: Ranchi allanite, 0.00166, 0.3004; Gaya columbite, 0.7987, 0.052; Ceylon thorianite, 20.08, 61.94. The last compare favorably with Hönigschmidt's values for a similar sample; i.e., 20.2, 62.7. The method is successful with samples contg. as little as 1 ppm. of U and Th, although with such low concns. very long counting times (15 hr or more) are required.

- 2742 Pant, D. D. and Sakhwalkar, N. D. "Fluorescence Spectrum of Uranyl Fluoride." Proc. Indian Acad. Sci. A, **19**, 135-40(1944).

The green fluorescence of uranyl cpds. originally discovered by Stokes in 1852 has been studied in detail by various workers, but until this time the simpler substances such as uranyl halides were omitted, apparently because of their weak fluorescence. However, as these simple substances are more likely to reveal the mechanism of fluorescence in uranyl cpds., a study of the fluorescence spectrum of UO_2F_2 was undertaken. The salt was placed in a small rectangular glass cell mounted in a slotted Cu rod and immersed in liq. air. Filtered light from an Fe arc was focused on the salt, and fluorescence radiation which did not pass through liq. air was photographed with a glass spectrograph. With an exposure of 9 hr only a few bands were recorded. A total of 17 bands between $16,577 \text{ cm}^{-1}$ and $20,234 \text{ cm}^{-1}$ is explained by the data for 3 vibrational freqs. of $(\text{UO}_2)^{++}$ known from studies of Raman and infrared spectra; viz., valence freq. = 860 cm^{-1} .

- 2743 Pepkowitz, P. "Some Observations on the Photochemical Destruction of Carotene." J. Biol. Chem. **155**, 219-25(1944).

The photochem. destruction of carotene in the presence of chlorophyll requires traces of O_2 . Methylene blue and eriosin also induce a photochem. destruction of carotene, the former being more effective and the latter less effective than chlorophyll. Fluorescein has no effect. $(\text{UO}_2)^{++}$ (uranyl acetate) is a powerful photolytic agent at the optimum mole ratio of 50:1 for U to carotene.

- 2744 Sevchenko, A. N. "Polarization of Photoluminescence of Uranium Glasses." Doklady Akad. Nauk S.S.S.R. 42, 336-40(1944).

The chem. constitution of the glasses (borates, silicates, and phosphates of Na, K, and Ba with about 1% of UO_2 and up to 0.025% Fe and 3% Al), the polarization measured as a function of the wavelength of the exciting light, the decay and yield of the luminescence, the dependence of polarization, yield and decay on the concn. of U, and the polarization of luminescence in various stages of decay are discussed and illustrated by exptl. data shown in 4 tables and 6 figures. The nature of the elementary processes of absorption and emission of luminescence in inorg. U salts is considered. The fine structure of the polarization spectra shows specific properties which characterize the structure of the UO_2 mols. Max. polarization of the luminescence never reaches the max. theoretical limit of 50% and amts. to, at most, 25%, and to only 8% for phosphate glasses. The fact that polarization decreases as decay increases indicates transmission of energy from the excited to the unexcited mols. due to quantum-mechanical resonance. Absorption and emission by U both in glasses and in solns. are due to elec. dipoles. Polarization yield and the mean life of the mols. in the excited state are almost independent of the concn. of U in the glass; this indicates very weak quantum-mechanical resonance between excited and unexcited mols.

- 2745 Sevchenko, A. N. "Polarization of Photoluminescence of Uranium Glasses." Fiz. Zhur. 8, 163-70(1944).

B, B-silicate, basic silicate, and phosphate U glasses were examined. It was found that the polarization depends on the compn. of the glass and on the wavelength of the exciting light, and that it falls off with the decay of the luminescence. This decrease shows that the energy of excitation is transmitted from the excited to the unexcited mols. because of the existence of quantum-mechanical resonance. The absorption and emission of radiation by U in glass and in solns. is due to electric dipoles.

- 2746 Vanossi, R. "Identification of the Uranyl Ion." Anales soc. cient. argentina 137, 3-17(1944). A test is described which serves to detect 5 to 30 γ of U in the presence of other ions. Ext. 0.2 to 0.3 ml of soln. which is 6N in HCl with 1.2 to 1.8 ml of Et_2O to remove Fe and Mo, add excess NH_4CNS and ext. the U with EtOAc . Evap. off the solvent, treat the residue with HNO_3 and ext. the U with Et_2O after adding 1 drop of M ZrOCl_2 soln. if phosphate is present. Wash the Et_2O soln. with H_2O and neutralize with excess KOH. The U is now in the aq. layer. Ext. with EtOAc and to the ext. add 20 to 30 mg of Na diethyldithiocarbamate and HNO_3 to acidic reaction. Add more HNO_3 and test for U with $\text{K}_4\text{Fe}(\text{CN})_6$.

- 2747 Veinberg, T. I. "Influence of the Chemical Composition of Uranyl Glass on Its Photoluminescence." Doklady Akad. Nauk S.S.S.R. 42, 331-5(1944).

- 2748 Wilmer, H. A. "Nephrotoxic Effect of Poisons on Convoluting Tubules in Presence of Hydro-nephrosis of One Kidney. Poisons Studied: Uranium Nitrate, Mercury Bichloride, Racemic Tartaric Acid, and Diethylene Glycol." Arch. Path. 38, 85-9(1944).

In the rabbit after a period of complete urethral obstruction of 5 days or more, the hydronephrotic kidney is protected against the nephrotoxic action of U nitrate, while after a period of only 24 hr the hydronephrotic kidney is protected against severe destruction (and later calcification) by HgCl_2 . It is suggested as a possible explanation that the slower acting protoplasmic poisons - U nitrate and HgCl_2 - are not injurious to the hydronephrotic kidney because they require a concn. found only in the presence of normal filtration-reabsorption, while diethylene glycol and racemic acid are nephrotoxic in the absence of concn. of the glomerular filtrate in hydronephrosis.

PUBLICATIONS LOCATED IN 1945

- 2749 Bechaud, L. J. Jr. Report of Investigation Conducted at Uravan WSP Plant, Uravan, Colorado. March 24, 1945. 42p. (M-3207; Report No. 1608)

Description and results of testwork for the purpose of developing a sand-slime sepn. of acid-treated pulp and to det. what type and size of equipment might be required to wash the sol. Ra, V, and U values from the sands and slimes after the sepn. had been made. Two flow schemes are presented.

- 2750 Bevilotti, V. "Biological Action of Radioactive Substances. VI. Action of Uranium on the Germination of Vegetable Seeds." *Boll. soc. ital. biol. sper.* 20, 558-9(1945).

$UO_2(OAc)_2$ in dilns. of 1:10,000 for several days or in dilns. of 4:1000 for 24 hr stimulated the development of seeds and the growth of the plants. U oxide in the same dilns. had a more marked stimulating effect. More concd. solns. of the acetate inhibited development and growth.

- 2751 Blokhin, M. A. "X-Ray Spectral Analysis and Its Possibilities." *Zavodskaya Lab.* 11, 1069-74 (1945).

A review is given of x-ray spectral analysis of elements beginning with Mg and ending with U and methods are discussed for the analysis of ores, minerals, and products of concg. and metallurgical plants, and for the sepn. of rare elements. Twelve references are given.

- 2752 Carrière, E and Guiter, H. "Volumetric Methods for the Analysis of Complex Salts." *Bull. soc. chim. France* (5), 12, 75-7(1945).

A discussion is given of methods which have been found useful for the rapid detn. of Cr, Mo, Nb, W, V, and U in their complex salts. In most cases the salt is decompd. by treatment with strong mineral acid. Usually treatment of the acid soln. with Na_2CO_3 at the b.p. suffices to remove the cation of the complex salt. For the final detn., titration with $KMnO_4$ after previous reduction with SO_2 , halogen hydride, or Zn is often used. Four types of alk. titration are described: (1) the vol. of std. NaOH required to ppt. a heavy metal is measured; (2) the metal is pptd. as carbonate and the vol. of acid required to dissolve the washed ppt. is detd.; (3) the anion is pptd. with benzidine and the ppt. is calcined or titrated to a phenolphthalein end point; (4) a titration is carried to a definite pH by the choice of an appropriate indicator.

- 2753 Chatterjee, S. D. "On the Spontaneous Emission of Neutrons from the Uranium Nucleus." *Indian J. Phys.* 19, 211-16(1945).

The emission was detected using a B-lined ionization chamber filled with BF_3 . It is suggested that spontaneous fission of U is the cause, and that 3 neutrons are emitted.

- 2754 Cohen, G. N. "Existence and Composition of an Adrenaline-Molybdic Acid Complex." *Bull. soc. chim. biol.* 27, 237-40(1945).

Adrenaline and other diphenols form complexes with certain cpds. of Mo, Cr, V, W, Ti, Ce, (UO_2) , Co, Cu, and Mn. The Mo deriv. is prepd. and characterized.

- 2755 Colbert, W. and Kreidl, N. J. "Unusual Colors Produced by Uranium in Glasses." *J. Optical Soc. Am.* 35, 731-5(1945).

When U is introduced into ordinary soda-lime silicate glasses under oxidizing conditions the familiar fluorescent yellowish glass is obtained. However, nonfluorescent glasses of various colors, yellow, red, brown, and green, can be obtained by introducing U into other types of glass, either under oxidizing or under strongly reducing conditions. The spectral transmission curves of a no. of such glasses (including a red which is insensitive to temp.) are given.

- 2756 Currah, J. E., Beamish, F. E., Allen, W. F., and Bartlet, J. C. Spectrographic Detection of Trace Amounts of Uranium. Determination of Uranium in Manganese Dioxide. National Research Council of Canada, 1945. 5p. (NRC-1628)

Aliquots of the nearly neutral soln. are measured onto the craters of the Ag bottom electrodes, and H_2O is removed by evapn. at 120° . Then, with both electrodes in place and with a 3-mm gap, a current of 4 amp at 220 v is passed for 30 sec. The relative intensities of the U lines at 4090.1 and 4543.6 Å are compared with lines obtained with known quantities of U. To det. U in MnO_2 , dissolve 5 g of sample in $\text{HNO}_3 + 30\% \text{H}_2\text{O}_2$. Heat to destroy excess peroxide, and extr. the 16 to 18 ml of soln. with 10 ml of hexone. Drain off the aq. layer and extr. again with 10 ml of hexone. To the combined extrs., add 3 ml of HNO_3 and 5 or 6 glass beads. Heat for about 30 sec and ignite the hexone that evaps. Continue heating until a black charred mass is obtained. Add about 3 ml of concd. H_2SO_4 and heat to fumes. Cool, and add concd. HNO_3 dropwise to destroy org. matter. Then evap. off all acid, and take up in a little water. Filter, evap. to 0.1 to 0.3 ml and transfer to the pure Ag electrode. Examine the U line at 4543.6 Å. Caution is necessary as hexone- HNO_3 is likely to explode when heated. Representative spectra are shown.

- 2757 Danilov, V. P. "Spectral Absorption of Colored Phosphate Glasses as a Function of Their Structure." Doklady Akad. Nauk S.S.S.R. 48, 109-12, 115-18(1945).

The spectral absorption of some phosphate glasses (principally metaphosphates) colored with Co, Ni, Fe, Mn, Cr, and U was studied systematically by comparing the spectral curves of solns. and glasses. The spectral absorption was found to vary with fusibility. The differences in the absorption spectra are reported to be due to differences in structure between the fusible and refractory glasses.

- 2758 De Ment, J. and Dake, H. C. Uranium and Atomic Power with an Appendix on the Atomic Bomb. Brooklyn, Chemical Publishing Co., 1945. 343p.

- 2759 Dietrich, J. F., Kiehl, S. J., Lyons, M. F., and Staple, E. Determination of Solubility of UF_4 in Various Solvents. Dec. 13, 1945. 7p. (A-3621)

Equil. soly. values at 40 and 60° are reported in solns. of $\text{K}_2\text{Cr}_2\text{O}_4$, H_2SO_4 , Na_2CO_3 , AlCl_3 , $(\text{NH}_4)_2\text{C}_2\text{O}_4$, HCl , NaBF_4 , KBF_4 , $\text{Na}_2\text{B}_2\text{O}_4$, KMnO_4 , and combinations thereof.

- 2760 Fiegl, F., Demant, V., and Erichsen de Oliveira, O. "Hydrogen Cyanonickelate and Its Salts." Anias assoc. quím. Brasil 3, 72-87(1945).

Insol. salts of the form $\text{M}[\text{Ni}(\text{CN})_4]$, where M = Cu, Co, (UO_2) , Mn, Fe, or Zn, were prepd. by pptg. a soln. of $\text{K}_2 \text{Ni}[\text{CN}]_4$ with a sol. salt of M. The (UO_2) salt of this type pptd. with 1 mol. H_2O .

- 2761 Harris, W. E. and Kolthoff, I. M. "The Polarography of Uranium. I. Reduction in Moderately Acid Solutions. Polarographic Determination of Uranium." J. Am. Chem. Soc. 67, 1484-90 (1945).

A polarogram of UO_2Cl_2 in 0.01 to 0.2M HCl shows two distinct reduction waves, the first corresponding with the reduction of U^{+6} to U^{+5} and the second with U^{+5} to U^{+3} . The equation of the first polarographic wave corresponds with an electron transfer of one and the second with an irreversible reduction. The first half-wave potential in 0.01 to 0.1N HCl is -0.18 v ; this value is independent of $(\text{UO}_2)^{++}$ and is scarcely affected by the acidity of the soln. or KCl . The half-wave potential of the second wave is -0.92 v and it is independent of the U and HCl in soln. This independence of acidity of both half-wave potentials indicates that H^+ is not involved in the electrode reactions, and an explanation of this fact has been advanced. The diffusion coeff. of the $(\text{UO}_2)^{++}$ at 25°C is calcd. to be $0.62 \times 10^{-5} \text{ cm}^2 \text{ sec}^{-1}$ corresponding with a mobility of $46.5 \text{ ohm}^{-1} \text{ sec}^2$. Uranous U in 0.1N HCl gives one wave corresponding with the reduction of U^{+4} to U^{+3} and the half-wave potential is equal to that for the second uranyl wave. The diffusion current is proportional to $(\text{UO}_2)^{++}$ concn. in a range between 5×10^{-4} and $4 \times 10^{-3} \text{ M}$ when the first diffusion current is measured at -0.5 v in 0.01 to 0.1N HCl . Use is made of the catalytic effect of U on the polarographic reduction of nitrate. An empirical procedure has been developed for polarographic detn. in a concn. range between 2×10^{-7} and $3 \times 10^{-5} \text{ M}$.

- 2762 Hepler, O. E., Gurley, H., and Simonds, J. P. "Experimental Nephropathies. II. Renal Phosphatase after Poisoning with Mercury Bichloride, Uranyl Nitrate, and Potassium Dichromate." Arch. Path. 39, 133-41 (1945).

All expts. reported in the paper were made on dogs. Change above and below the normal mean occurred in the alk. phosphatase of the blood serum within a period of 8 days after poisoning with HgCl_2 . Doses of $\text{K}_2\text{Cr}_2\text{O}_7$ and of HgCl_2 that caused extensive necrosis of the epithelium of the renal tubules reduced the phosphatase activity of the kidneys. Uranyl nitrate in doses up to 3 mg/100 ml of blood caused marked necrosis of the tubular epithelium but did not reduce the phosphatase activity of the kidneys as detd. by chem. methods; in many animals the poison appeared to increase it. Subnecrotizing doses of all 3 chem. agents increased the activity of phosphatase in the kidneys. The earliest morphologic change in the phosphatase in the epithelium of the proximal convoluted tubules induced by the heavy metal poisons used was diffusion of the enzyme throughout the cytoplasm from its normal location in the brush border. Active phosphatase can still be demonstrated by histochemical methods (Gomori's stain) in the debris of disintegrated necrotic cells of the proximal convoluted tubules.

- 2763 Hepler, O. E. and Simonds, J. P. "Experimental Nephropathies. III. Calcification and Phosphatase in the Kidneys of Dogs Poisoned with Mercury Bichloride, Potassium Dichromate and Uranyl Nitrate." Arch. Path. 40, 37-43 (1945).

Necrosis of the kidneys of dogs induced by chem. agents is frequently accompanied by calcification. The amt. of Ca deposited varies with the agent, the dosage, and the time that elapses between the admission of the poison and the death of the animal. In a group of 28 dogs with comparable degrees of necrosis of the renal tubules, calcification occurred in the kidneys of 100% of those poisoned with HgCl_2 , 45% of those poisoned with uranyl nitrate, and only 22% of those poisoned with $\text{K}_2\text{Cr}_2\text{O}_7$. Phosphatase was not a factor in the deposition of Ca in the kidneys of these dogs.

- 2764 Heymann, W. and Clark E. C. "Pathogenesis of Nephrotic Hyperlipemia." Am. J. Diseases Children 70, 74-82 (1945).

Bilateral and unilateral nephrectomy in dogs regularly produced an increase of total lipids, cholesterol, and phospholipids in their blood serum. No postoperative hyperlipemia was observed after 3 cholecystectomies; however, it was found after 1 of 4 sham operations and after 3 of 5 splenectomies. HgCl_2 , uranyl nitrate, and $\text{K}_2\text{Cr}_2\text{O}_7$ given parenterally to dogs regularly produced an identical reaction. Inasmuch as parenteral adm. of CaCl_2 and mild cauterization of tissues did not cause a hyperlipemic reaction, it can be accepted that the hyperlipemia produced by injecting the above three cpds. was not due to the resultant local irritation. Severe tissue necrosis produced by extensive subcutaneous and intramuscular cauterization, or by parenteral administration of turpentine, croton oil, or CCl_4 did, however, produce definite, temporary hyperlipemia, of the same pattern as that found after injection of the nephrotoxic agents.

- 2765 Hoffpauir, C. L. and Guthrie, J. D. "Reversible Effect of Stannic Chloride on the Rotation of Starch Dispersions." J. Am. Chem. Soc. 67, 1225-6 (1945).

The optical rotation of a starch dispersion in CaCl_2 is appreciably reduced by addn. of SnCl_4 ; the original rotation can be restored by addn. of NaOAc or $\text{UO}_2(\text{OAc})_2$. A similar result is observed with a dispersion of glycogen, whereas the α -rotation of inulin is increased by addn. of SnCl_4 . Reduction of the rotation of starch was not produced by dil. HCl , H_2BO_3 , SbCl_3 , or $\text{Th}(\text{NO}_3)_4$. Typical data are given.

- 2766 Lel'chuk, S. L. "Effect of Promoters in the Catalytic Dehydrogenation of Alcohols to Esters as Related to Their Place in the Periodic Table." Doklady Akad. Nauk S.S.S.R. 49, 652-4 (1945).

The activity of metals and their oxides as promoters for the catalytic dehydrogenation of alcs. to esters over Cu is shown to be related to their position in the periodic system. Data on conversions of EtOH to EtOAc (and acetaldehyde) are summarized. Greatest activity is shown by 0.1% U^{+3} on Cu, with 55.7% conversion to EtOAc .

- 2767 McClintock, L. A. and Friedman, M. M. "Utilization of Antibody for the Localization of Metals and Dyes in the Tissues." Am. J. Roentgenol. Radium Therapy 54, 704-06(1945).

The antigen-antibody reaction has been used to localize metals and dyes combined with antibody, in predetd. sites in tissues. Definite regions in guinea pigs were infiltrated with pneumococcus polysaccharide type I or II. Later, pneumococcus antibody of one of these types, combined with U or with malachite green, was injected into a vein. The animal was destroyed a few mins later and there was always a definite localization of the dye or metal in the tissues at the site of the injection of the corresponding type of pneumococcus. It is evident that the combination between metal or dye and antibody is stable and that the immunologic specificity is not altered.

- 2768 Northup, M. A. "Fluorescent Bead Test for Uranium in Metals. A Critical Study." Ind. Eng. Chem., Anal. Ed. 17, 664-70(1945).

In 1926, Nichols and Slattery noticed that when a trace of U cpd. is used with NaF on a Pt wire, the resulting bead has a vivid lemon-yellow fluorescence under long-wave ultraviolet light. By this test, as little as 0.05 γ of U can be detected. For the test with a mineral contg. 2% of U, only an extremely small specimen is required. Nb alone causes fluorescence which might be mistaken for U. The test is so sensitive that the Pt wire must be clean. Max. brilliance is obtained only if the bead is heated until completely fluid and does not appear until near the room temp. A test bead which is yellow when cold may be viewed with interposition of No. 9860 filter and in doubtful cases a hand spectroscope can be used; the fluorescence spectrum of U in NaF has a narrow band in the yellow-green. A blue filter is convenient to avoid eyestrain for observing the bead during fusion. When Nb is present, traces of U can be sepd. by extrn. of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ with Et_2O . Excess Ce and rare earths interfere but they can be sepd. by the Et_2O extn. Excess SiO_2 , TiO_2 , etc., may suppress the fluorescence but can be removed by extra heating. About 1 mole of U salt in 2000 moles of NaF forms the fluorescent cpd. At low flame temps. any excess remains undissolved but at higher temps. it is converted into Na_2UO_4 . Elements giving colored beads interfere. In its present form the test is not quant.

- 2769 Orban, E. The Standard Potential of the Uranous-Uranyl Sulfate Redox Electrode. Dissertation, Univ. of Maryland, 1945.

- 2770 Pant, D. D. "Analysis of the Fluorescence Bands of the Uranyl Salts." Proc. Indian Acad. Sci. A. 22, 110-21(1945).

From direct exptl. evidence it is concluded that the entire fluorescence spectrum of the uranyl salt series arises out of a transition from a single excited state (designated $^1\gamma_g$) to the several vibrational states of the close ground levels (designated $^1\pi_g$ and X), and that the $^1\pi_g \rightarrow ^1\Sigma_g$ transition is much less favored than the $^1\pi_g \rightarrow \text{X}$ transition. The ν_1 and ν_2 freqs. taking part in the transition agree with those observed in the Raman and X infrared spectra. The vibrational structure of the $^1\pi_g \rightarrow ^1\Sigma_g$ transition resembles that of a forbidden transition, while the structure of the other is that of an allowed one.

- 2771 Pant, D. D. "Some Studies in the Spectra of Single Uranyl Halides and Other Uranyl Salts." Proc. Indian Acad. Sci. A. 22, 95-109(1945).

The fluorescence spectra at liq.-air temp. of cryst. uranyl chloride, uranyl fluoride, and uranyl bromide have been studied for the first time. The spectra of uranyl acetate, nitrate, and sulfate and uranyl potassium sulfate were taken for comparison. Wave nos. are given for observed bands from 15,821 to 20,589 cm^{-1} . Some of the bands are sensitive to temp. The absorption spectra of uranyl chloride and of uranyl fluoride were taken with varying thickness of the absorbing layer. With thick layers (0.6 mm) some bands that are observed in fluorescence can also be obtained in absorption.

- 2772 Perruche, L. "Uranium." Nature, La No. 3098, 309-10(1945).

This is a brief discussion of the properties and uses of U, U minerals, U in the world and in France. The elements in the sixth group are also discussed in general.

- 2773 Randall, J. T. and Wilkins, M. H. F. "The Phosphorescence of Various Solids." Proc. Roy. Soc. (London), A. 184, 347-64(1945).

Phosphorescence-decay studies are correlated with photocond. observations. Pure uranyl salts decay exponentially and are not photoconductors. The luminescence of these salts is a property of excitation states in the coordination group of the uranyl ion, and the transitions are of the forbidden type. Time-phosphorescence data are reported for Mn-contg. phosphors as follows: cadmium silicate, zinc mesodisilicate, cadmium chlorophosphate, cadmium borate, ammonium uranyl phosphate, zinc orthosilicate, zinc beryllium silicate. Photoconduction measurements are given for uranyl acetate, uranyl nitrate, and calcium tungstate.

- 2774 Rivenq, F. "Persalts Obtained by the Action of Hydrogen Peroxide." Bull. soc. chim. France (5), 12, 283-92(1945).

Potentiometric and calorimetric measurements are advanced to indicate the formation of the following: V_2O_7 , CrO_5 , MoO_5 , WO_5 , TiO_3 , and $UO_4 \cdot H_2O_2$, or $V_2O_5 \cdot 2H_2O_2$, $CrO_3 \cdot 2H_2O_2$, $MoO_3 \cdot 2H_2O_2$, $WO_3 \cdot 2H_2O_2$, $TiO_2 \cdot H_2O_2$, and $UO_3 \cdot 2H_2O_2$. The exact valence of the metal in the cpds. is not established.

- 2775 Scott, T. R. and Dixon, P. "Colorimetric Method for the Determination of Uranium in Leach Liquors." Analyst 70, 462-5(1945).

The procedure described is based on the yellow color of $(UO_2)^{++}$ solns., which is proportional to the U concn. over the range 0.15 to 0.75% U_3O_8 . Solns. should be adjusted to within these limits. The max. yellow color is obtained when not less than 10% H_2SO_4 or 4% H_3PO_4 is present. The color measurement is made advantageously with a Zeiss-Pulfrich graduation photometer and cells of 20 mm optical depth. With blue filter S-43, interference by Cu is prevented. The yellow color of Fe^{+3} is partially prevented by adding H_3PO_4 and the same technique is necessary with Cr solns. The probable error of the detn. is $\pm 1.5\%$. The method was studied in solns. from torbernite and autunite ores but is undoubtedly applicable to other ores.

- 2776 Sill, C. W. and Peterson, H. E. Fluorescence Test for Uranium. Washington, U. S. Bureau of Mines, 1945. 6p. (Information Circular 7337)

The detection of U is based on the fact that when a soln. contg. U^{+6} is exposed to short-wave ultraviolet light it fluoresces. Most interfering ions are removed in the prepn. of the sample. Those that remain can be easily eliminated except Ag^+ , Tl^{+3} , and $(MnO_4)^{-}$.

- 2777 Sill, C. W. and Peterson, H. E. "Fluorescence Test for Uranium." Chem. Age (London) 53, 336-9(1945).

This paper contains information similar to that reported in U. S. Bureau of Mines Information Circular 7337(1945).

- 2778 Simonds, J. P. and Hepler, O. E. "Experimental Nephropathies. V. A Comparison of the Toxic Action of Uranium, Mercury and Chromium on the Kidneys." Arch. Path. 40, 362-3(1945).

The usual method of measuring dosage of chem. agents in expts. on animals is to use quantities stated in mg/kg body wt. Perhaps a more accurate comparison of 2 or more poisons could be made if the amt. of each substance injected was proportional to the g.-atom equiv. of the active element in the mol. This system of units is particularly convenient for comparison when definite at. proportions of elements are desired, because g. atoms of all elements contain the same no. of atoms. The same principle can also be applied to a comparison of the degrees of toxicity of any group of poisons when it is known that one ion of the substance is responsible for the toxic effect. The g. atom for the g ion concn. of the known toxic portion of a mol. of poison furnishes a simple method of comparing the relative toxicity of chem. agents when there is a relatively accurate means of comparing their min. and max. effects. Dosage is, of course, only one of the factors that influence the action of a poison.

- 2779 Singer, R., Airey, H. E., Grimmett, L. C., Leech, H. R., and Bennett, R. The Cerium Industry in German Territory Including Reports on Radium and Mesothorium. September 1945. (BIOS Final Report No. 400; AEC File No. NP-39)

The radioactive materials manufactured included U, R, MsTh, and RaTh. A description of the U extrn. plant, Ce and flint manufacture (including operational data) is included, as are the plans of the Treibach works and its Ra extrn. A flow sheet is given.

- 2780 Stroe, A., Bratianu, S., and Aurescu, O. "Studies on the Action of Kidney Extracts of the Nephritic Rabbit, Obtained by Cumulative Injection of Uranium Nitrate, in the Treatment of Scarlet Fever Nephritis." Bull. acad. méd. Roumanie 17, 28-61(1945).

It is known that the kidney, besides its role as a selective filter, produces hormonal substances which are essential for its normal autonomous function. The antitoxic effect of kidney extrs. in the treatment of uremia and renal insufficiency has been reported by many authors. Nephrectomized animals treated with renal extrs. survive hundreds of hr longer than the control animals before they die of uremia. In "blocking" the kidney by induced glomerulo-tubular nephritis, the authors tried to obtain a concn. of antitoxic substances in the renal parenchyma which would be able to act beneficially on cases of nephritis. Nephritis was induced in rabbits by cumulative injections of U nitrate. The histologic examn. of the kidneys revealed the picture of a glomerulo-tubular nephritis with predominance of tubular lesions. The extrs. of these kidneys proved nontoxic in rats. In 35 cases of postscarlatinous glomerulonephritis, glycerine renal extrs. were injected intramuscularly. In some cases, the injection was repeated after 48 hr. The dose was 1 ml for the 1st, and 3 ml for the 2nd injection. The results were excellent; 24 hr after injection of 1 ml, the diuresis increased considerably, albuminuria decreased and eventually disappeared, the urine sediment became free of casts, erythrocytes, and leucocytes, blood pressure became normal, edemas and uremic symptoms cleared up. No untoward side effects were observed in any case.

- 2781 Sutton, J. Determination of Uranium in Uranyl Salts. National Research Council of Canada, 1945. 2p. (NRC-1591)

(UO_2)⁺⁺ sulfate, chloride, and perchlorate (but not the nitrate) can be reduced electrolytically to U^{+4} and then titrated back to (UO_2)⁺⁺ with $\text{Ce}(\text{SO}_4)_2$ in the presence of o-phenanthroline- Fe^{++} [complex] as indicator. From 5 to 100 mg of U can be reduced in 5 to 10 min with a current of 0.5 amp at 3 to 4 v. The electrolytic cell has a Pt anode and an Hg cathode. Any U^{+3} formed is oxidized by drawing a stream of air through the soln. for 5 min before the titration.

- 2782 Terenin, A. N. and Kachur, L. A. "Luminescence in the Catalytic Oxidation of Vapors of Organic Compounds." Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk 271-8(1945).

Photoluminescence persists in the oxyluminescent MgO even at 450°, whereas it ordinarily disappears at much lower temps.; thus, a photoluminescent sample of $\text{K}_2\text{UO}_2(\text{SO}_4)_2$, encased in the same tube as the MgO, was quenched at 200°.

- 2783 Timofeeva, T. V. "Radioluminescence of Potassium Uranyl Sulfate as the Basis for a Low Brightness Standard." Doklady Akad. Nauk S.S.S.R. 47, 554-7(1945).

Mean values of brightness of 1.2×10^{-4} apostilbs (0.1 ml) were obtained for crystals 10 and 30 mm in diam., resp.

- 2784 Veinberg, T. I. "Influence of the Chemical Composition of Uranyl Glass on Its Photoluminescence." Doklady Akad. Nauk S.S.S.R. 46, 351-4(1945).

- 2785 Verducci, P. "Comparative Effect of Radioactivity of Uranium Compounds on Germination and Development of Seeds." Boll. soc. ital. biol. sper. 20, 333-4(1945).

The effect of exposure of grain to irradiation from U nitrate, U sulfate, and uranyl acetate was proportionate to the time of exposure, distance of the seeds from the salts, and free-surface exposed. In germination expts. fewer seeds were altered by exposure to the nitrate. A large no. were altered by the sulfate. The specific changes in growth were discussed.

- 2786 Voronova, L. A. "Determination of Uranium and Thorium by Means of X-Ray Spectra." Zavodskaya Lab. **11**, 1075-7(1945).

Sr was used as the comparison element in detns. of U and Th. Four mixts. consisting of various comps. of U_3O_8 , ThO_2 , and $SrCO_3$ with and without fillers were used to obtain the transition coeff., K, and the mixts. were weighed on a microbalance and carefully mixed in volatile liqs. Approx. 30 x-ray graphs of these mixts. were made and values proportional to the intensity of the lines were detd. The mean values of K for various mixts. of Th and U were, resp., $K(Th/Sr) = 3.0 \pm 0.1$ and $K(U/Sr) = 2.0 \pm 0.1$. These coeffs. were used for a no. of analyses. A comparison of the results with those obtained by chem. analysis showed a good agreement for samples with large contents of U and Th (35 to 50%) as well as for samples with small contents of U and Th (0.1%).

- 2787 Wenger, P., Duckert, R., and Rusconi, Y. "Critical Study of Reagents for Cations. XIV. Reagents for Uranium Cations." Helv. Chim. Acta **28**, 274-8(1945).

For the detection of $(UO_2)^{++}$, 30 reagents were studied and of these 5 are preferred, namely anthranilic acid, 8-hydroxyquinoline, quercetin, Na salicylate, and $K_4Fe(CN)_6$. Anthranilic acid gives crystals which are characteristic under the microscope, oxine gives a reddish-brown ppt., as does quercetin, Na salicylate gives an orange coloration and ferrocyanide gives a brown ppt.

- 2788 Whitman, G. M. —assigned to E. I. duPont de Nemours and Co. Furan. April 17, 1945. (U. S. Patent 2,374,149)

Furfural is converted to furan catalytically in 85 to 90% yield by passing a mixt. of steam and furfural in mole ratio of 2:1 to 6:1, over ZnO , combined with V, Cr, W, Mo, or U oxides at temps. above 200° .

- 2789 Yaffe, L. and Mackintosh, C. E. Fission Yields of Masses 131, 132, 134, and 136 Formed in Neutron Fission of Uranium. March 1, 1945. 5p. (NRC-1572)

Yields of I^{131} , Ba^{140} , Ba^{139} , and I^{134} are calcd. from the results of neutron irradiation of UO_3 in paraffin and graphite. This information was later published in Can. J. Research B. **25**, 371-5(1947).

PUBLICATIONS LOCATED IN 1946

- 2790 Anderson, O. E. and White, H. E. A Report on the Hyperfine Structure in the Arc Spectrum of Enriched Uranium. Mar. 12, 1945. Declassified Sept. 24, 1946. 9p. (MDDC-333)

The hyperfine structure of an enriched sample containing 64% of U^{235} has been investigated. From a study of one visible arc line of which the splitting could be partially resolved, it is concluded that the nuclear angular momentum of U^{235} is either 5/2 or 7/2. The two hyperfine intervals that are resolved do not obey the interval rule for either of these values, but the conclusion is drawn by comparing the intensity of the leading component with the over-all intensity of the line (as judged by the single U^{238} line). (An abstract is also available in Phys. Rev. (2), 71, 911(1947).)

- 2791 Baenziger, N., Wilson, A., and Snow, A. Progress Report of the X-Ray Group for Sept. 1945 - Feb. 1946 [on] Problem Assignment 118. Mar. 1, 1946. 21p. (CC-3255)

The crystal structures of U_6Mn , U_6Fe , U_6Co , U_6Ni , UNi_2 , UNi_5 , UCo , $UFeNi$, $TiCl_2$ and the lattice consts. of $Th_{14}Fe_5$, $Th_{14}Ni_5$, $Th_{14}Co_5$, $ThCo_4$, $ThNi_2$, $ThNi_4$, $ThHg_3$, and Th_2Zn are reported. X-ray-diffraction data on high Be alloys of U, Th, Ce, Ti, Cb, Zr are also given.

- 2792 Barnett, T. B. and Metcalf, R. G. Chapter IV. The Pathological Anatomy of Uranium Poisoning. July 1, 1946. Declassified Aug. 28, 1946. 70p. (MDDC-249)

The principal pathological change in exptl. animals given U cpds. is necrosis of the renal tubular epithelium involving predominantly the proximal convoluted tubule. Evidence is offered which suggests that the region of the junction of the middle and distal thirds of the proximal convoluted segment is damaged exclusively with low doses and first and most severely with higher doses, except in the case of large injected doses where the first damage apparently occurs more proximally. Degenerative changes first appear as early as a few hrs after very large injected doses or as late as 2 to 4 days with moderate and small doses by inhalation and ingestion. The peak of epithelial necrosis is apparently reached within from 3 to 6 days following the initial exposure. In animals surviving the initial injury, epithelial regeneration is observed within 1 to 2 days after the appearance of degenerative changes. Regenerated epithelium may be of one of two types, one of which approaches the normal in form while the other is flattened and atypical. In general, the latter occurs following rather severe damage. There is presented a discussion of the possible significance of these types of epithelium as regards their origin in the nephron. Injury in the acute phase, comprising both degenerative and regenerative processes, produces the greatest over-all change in the kidney in the period from the 5th to the 10th day following the initial exposure. This acute phase has not been observed to recur in animals subjected to repeated daily exposure by inhalation or to diets contg. U. Evidence is offered which suggests that there may be a return to a normal morphological condition following rather severe renal tubular injury in rats which are not reexposed. The changes in the chronic phase of U poisoning, as observed in rats fed uranyl nitrate as 2% of the diet for varying periods up to 2 yrs, are tubular atrophy, dilation, and distortion with an apparent slight increase in intertubular connective tissue and mild interstitial accumulation of chronic inflammatory cells. Such interstitial changes are also frequently observed in dogs and rabbits exposed to U cpds. for 30 days. The results of a preliminary study of acquired tolerance to U in rats are presented. These results indicate that prolonged exposure to U may produce conditions under which injection of an ordinarily damaging dose of U results in no appreciable renal tubular necrosis. Under the conditions of exposure employed, glomerular changes are observed infrequently. Hyperemia and swelling occur occasionally and glomerular necrosis very rarely during the acute stage of U poisoning following very high dosage exposure. Pathological changes in organs other than the kidney which may result from U exposure are as follows: (1) Degenerative changes in the liver cord cells of dogs dying during exposure to high dietary and atmospheric concns. (2) Mucosal and submucosal hemorrhages in the gastrointestinal tract of dogs fed large doses of U cpds. (3) Pulmonary hemorrhage and edema in rabbits dying during exposure to high atmospheric concns. of certain U cpds. Severe pulmonary irritation in animals exposed to high atmospheric concns. of UF_6 is attributable, at least in part, to one of its decompn. products, HF. (This paper is also published in Voegtlin and Hodge,

Pharmacology and Toxicology of Uranium Compounds. New York, New York. McGraw-Hill Book Company, Inc., 1949. Chapter 4.)

- 2793 Bauer, S. H. and Palter, R. Analysis of X-Ray Powder Diffraction Data on Crystalline Uranium Hexafluoride. March 5, 1946. Declassified Oct. 2, 1946. 14p. (MDDC-364)

Two alternate explanations are suggested for the apparent discrepancy between the structure proposed for UF_6 as deduced from x-ray-diffraction work on single crystals and from the electron diffraction investigation of the vapor. The second explanation is based on the premise that the difference may be due to essentially unlike methods of treating the diffraction data. This report analyzes x-ray powder photographs following a scheme parallel to that used in the analysis of the electron diffraction data, to check whether this particular explanation is tenable. This work has not been able to answer the question whether the discrepancy between x-ray and electron diffraction structures arises from the different manner of treating the diffraction data. A further study of the absorption correction and an extension of the pattern to larger s values through the use of Mo or Ag radiation may permit an unambiguous answer to be made. However, judging from the widths of the radial, distribution peaks usually reported for liqs. (-0.6 A) it will not be possible to deduce many details of mol. structure from the analysis of powder data.

- 2794 Bauer, S. H. The Structure of Uranium Hexafluoride as Determined by the Diffraction of Electrons on the Vapor. March 5, 1946. Declassified Oct. 14, 1946. 42p. (MDDC-415)

The model for UF_6 which is in best agreement with the electron diffraction data is a slightly distorted octahedron with 3 U-F bond distances equal to 1.86 A, and 3 U-F bond distances equal to 2.16 A. Each set of three bonds forms a trigonal pyramid, the length of all the base edges being 2.88 A. The fact that this model does not have a center of symmetry is not necessarily inconsistent with the fact that the mol. has no dipole moment large enough to be detectable. The short bonds may be considerably more ionic than the longer ones; indeed, some such postulate must be made in order to explain the nonequivalence of six bonds in UF_4 . (Expected for a coordination no. of 6, the configuration d^2sp^3 gives a symmetrical octahedron; d^3p^3 gives a trigonal antiprism with the possibility of two unequal sets of three bonds.) That this difference in ionic character is enough to compensate for the longer U-F extensions on the opposite side of the mol. appears to be fortuitous. With regard to the Raman, infrared and thermodynamic arguments which favor a more symmetrical structure, it is stated that such conclusions are based on the absence of lines, which actually may be present but are not in a favorable region for observation. However, the discrepancy with the single crystal x-ray results is real. Two alternate explanations are offered: 1. The mol. structure in the solid differs from that in the vapor. One would expect the higher symmetry to occur in the vapor. The reverse is found. 2. The methods of analysis of the diffraction data are quite different for the two investigations. In the x-ray studies reliance is placed on the assumed phase assignments to permit carrying through the Fourier projection. This is followed by a statistical checking of individual spot intensities. In the electron diffraction studied chief reliance is placed in the radial distribution computations, and is followed by a check on diffraction intensities. (This paper is also available in J. Chem. Phys. 18, 27-41(1950).)

- 2795 Benedict, D. and Barron, E. S. G. "The Effect of Uranyl Nitrate on the Respiration of Arbacia Sperm." Biol. Bull. 91, 220(1946).

This is an abstract only.

- 2796 Berkey, W. E., Burhop, E. H. S., Craggs, J. D., Keene, J., and Massey, H. S. W. Measurements of the Absolute Values of the Cross Sections for Ionization of Uranium Tetrachloride and Uranium Hexafluoride by Electrons. Declassified Dec. 31, 1946. 30p. (MDDC-564)

The importance of a knowledge of the abs. values of the cross sections of ionization of UCl_4 and UF_6 by electrons for the understanding of the performance of arcs run in these vapors is pointed out. The exptl. investigation has indicated a value of about $5 \times 10^{-15} \text{ cm}^2$ for the ionization cross section of UCl_4 for electrons of 100 v. From this value an est. has been made of the expected min. threshold pressure for operation of an arc in the vapor of this material. The value of the min. threshold pressure turns out to be about $3.5 \times 10^{-5} \text{ mm of Hg}$. This is appreciably lower than the pressure used in practice, which is about 10^{-3} mm of Hg . The discrepancy of the two values is attributed to the possibility of activation of the filament by U metal. A no. of measurements of the ionization cross section of UF_6 were made, but the results were unsatisfactory due to difficulties in measuring the vapor pressure. (This paper is also published in Guthrie and Wakerling, The Characteristics of Electrical Discharges in Magnetic Fields. New York, McGraw-Hill Book Company, Inc., 1949. Chapter 6.)

- 2797 Bersohn, R. and Brady, E. L. A Chemical Study of Hexavalent Uranium Compounds in Sodium Hydroxide, Sodium Carbonate, and Sodium Bicarbonate Solutions. Mar. 1, 1946. 26p. (MonC-109)

Reactions of U^{+6} cpds. in alk. solns. have been studied. Titrations of U^{+6} solns. with base have been carried out and curves of pH vs. equivs. of base have been obtained. Back titrations with acid yield curves different from those obtained in the forward direction. Supersaturation is conspicuous. NaHCO_3 (0.05M) and Na_2CO_3 (0.20M) are sufficiently strong complexing agents to hold in soln. at 90° at least 2 g/l of U^{+6} . The soly. of U^{+6} in 0.05M NaOH is 3 mg/l and in 12M NaOH increases to 40 mg/l. The soly. of U^{+6} in Na_2CO_3 increases slowly with increasing Na_2CO_3 concn., from 2.3 g/l at 0.05M Na_2CO_3 to 3.7 g/l at 0.40M Na_2CO_3 . The soly. of U^{+6} in NaHCO_3 soln. is almost linear with increasing NaHCO_3 concn.; the concn. of U^{+6} (g-atoms/l) is approx. 0.45 the total NaHCO_3 concn. The ion $[\text{UO}_2(\text{OH})\text{CO}_3]^-$ has been postulated to explain this relationship. A cpd. of the stoichiometric compn. $\text{Na}_2\text{U}_2\text{O}_7$ has been prepd. by igniting $\text{NaUO}_2(\text{OAc})_3$ under special conditions. This cpd. proved to be very slightly sol. in Na_2CO_3 soln. and is apparently not the same phase as that which is in equil. after UO_3 has been shaken with Na_2CO_3 solns.

- 2798 Boaz, H. E., Numerof, P., Potratz, H. A., and Throckmorton, W. H. Chemical and Spectrochemical Analysis of Uranium and Plutonium Materials. Declassified Sept. 10, 1946. 40p. (MDDC-279)

This paper is made up of 5 brief analytical procedures. In each case details on reagents, procedure, and app. are given as well as precautions required. (1) Colorimetric estn. of Au in $(\text{CN})^-$ plating baths. (2) Microvolumetric assay of Pu. (3) Detn. of C and H in Ca metal. (4) Electrolytic detn. of Co in W-carbide-Co Alloys. (5) Fluorimetric estn. of γ amts. of U. The strong greenish fluorescence of $(\text{UO}_2)^{++}$ in ultraviolet light is used as a measure of its concn. in soln. Cooling to the temp. of dry-ice-MeOH mixt. enhances the fluorescence. The U is contd. in either concd. H_3PO_4 or H_2SO_4 since they form a clear glass at this temp. The amt. of U present is estd. by visual comparison of the intensity of the fluorescence of the sample with that of known stds.

- 2799 Booth, H. S., Krasny-Ergen, W., and Heath, R. E. "Uranium Tetrafluoride." J. Am. Chem. Soc. 68, 1969-70(1946).

This paper describes the prepn. of UF_4 from UO_3 and CF_2Cl_2 and includes a diagram of the app. used. The reaction used was

- 2800 Bose, N. H. "Temperature Variation of Intensity of Luminescence under X-Ray Excitation." Indian J. Phys. 20, 21-30(1946).

The variation of intensity of x-ray luminescence with temp. from 30 to 150° for NaCl, NaCl with Cu, KCl, KCl with Cu, KBr, KBr with Cu, uranyl nitrate, naphthalene, and anthracene was obtained, the

measuring instrument being a photocell with amplifying stages. Two types of variation curves were obtained. For the Na and K halides with or without Cu the intensity at first varies slowly. As the temp. is raised, the variation increases, reaching an almost steady value. For KBr with or without Cu only the latter portion of the curve is almost independent of temp. to the m.p. where the intensity falls to zero. The inclusion of Cu does not change their behavior.

- 2801 Boyd, G. E. and Hume, D. N. Analytical Chemistry of the Manhattan Project. Chapter XII. Radiochemical Analytical Methods. Declassified Oct. 3, 1946. 48p. (MDDC-365)

This report discusses the advantages and benefits as a tool to science that radiochemistry offers. The authors discuss the methods and techniques of applied radiochemistry; laboratory practice in the detg. of α , β , and γ radiation; counting techniques; the prepn. of radioisotopes; the use of radioactive indicators in shortening the analysis time required for complex samples; activation methods for the analysis of trace impurities; radiometric methods of analysis; and analysis for U. (This paper is also in Rodden, Analytical Chemistry of the Manhattan Project. New York, McGraw-Hill Book Company, Inc., 1950. Chapter 28.)

- 2802 Brewer, L. Determination of Oxygen in Uranium by Vacuum Fusion. Declassified Sept. 26, 1946. 47p. (MDDC-366)

An app. for analysis of U metal samples for O content is described. Vacuum fusion in a graphite crucible which is insulated by porous C in an all-pyrex glass app. is used to remove O as CO. Temps. over 2000° C are attainable with a 6-kva Ajax converter for induction heating. Successful operation depended upon a preliminary vacuum heating of the C parts at 2100°C to remove hydrocarbon tars so that cracking of the pyrex glass will not occur due to deposits of tar. An operating temp. of 1750 to 1800°C has been found satisfactory for U when using a Pt bath. The Pt bath is the most suitable bath because of its low volatility, its satisfactory C soly., and because of the decrease of "getting errors" due to volatility of reactive metals. Most metals form stable cpds. with Pt and are therefore strongly held by the bath and cannot vaporize and thus react with the escaping CO gas. The degassing temp. is 2000 to 2100°C and the blank has been reduced to as low as 0.3 mm³/min at 1800°C, which allows analysis of samples of 50 to 200 mg size which react completely within two min. Analysis of the std. Ames ingot gave a max. O content of about 45 ppm with a blank of 8 ppm. Analysis of a Westinghouse slab gave a max. O content of 30 ppm.

- 2803 Brickwedde, F. G., Hoge, H. J., and Scott, R. B. The Low-Temperature Heat Capacities, Enthalpies, and Entropies of UF₄ and UF₆. June 10, 1946. Declassified Sept. 30, 1946. 23p. (MDDC-368)

The heat capacity of UF₄ has been measured for 20 to 350° and that of UF₆ from 14 to 370°K. Molar heat capacities have been tabulated at 5° intervals and extrapolated to 0°K. From them, the entropies and enthalpies of the cpds. have been found by integration and tabulated. The triple point temp. of UF₆ was found to be 337.212°K (64.052°C) and the heat of fusion was found to be 19.193 j mol⁻¹. (This paper is also available in J. Chem. Phys. 16, 429-36(1948).)

- 2804 Bright, W. C. Spiral Fission Chambers. Oct. 4, 1945. Declassified July 30, 1946. 20p. (MDDC-91)

Neutron detectors utilizing thin metal foils with fissionable materials are described. Foils are wound into concentric spirals to eliminate supporting plates and bulky insulation. The chambers are characterized by large useful electrode areas, small vol., and very light construction. A method for coating large areas of Al or Pt foil with heavy deposits of U₃O₈ is described.

- 2805 Burgy, M., Pardue, L. A., Willard, H. G., and Wollan, E. O. Energies of the Delayed Neutrons from U²³⁵ Fission Products. Declassified June 14, 1946. 22p. (MDDC-16)

A study of delayed neutron energies from U²³⁵ fission products has been made by measuring recoil proton tracks in a H₂-filled cloud chamber. A sample of U was irradiated in a graphite pile by means of a pneumatic tube, and brought to the cloud chamber for observation. Five different times of irradiation and decay were used so as to give different proportions of the five delayed neutron activities studied. From composite neutron energy distribution curves, the curves for the sep. activities have been obtained. The av. energies lie in the region from 0.2 to 0.8 Mev. There is no simple relation between energy and half-life. (This information is also available in Phys. Rev. (2), 70, 104(1946) as an abstract.)

- 2806 Burke, J. E. The Formation of Uranium Hydride. Nov. 13, 1943. Declassified Sept. 10, 1946. 11p. (MDDC-280)

The effect of temp. on the rate of the reaction $2U + 3H_2 \rightarrow 2UH_3$ has been investigated between 150 and 375°C. The hydride forms most rapidly at 225°C. With unpurified H_2 , an incubation period is found during which no apparent reaction occurs. The incubation period can be eliminated by suitable purifying of the H_2 . In 11 runs in highly purified H_2 , the formula of the product averaged $UH_{3.00}$. (This paper is also available in J. Am. Chem. Soc. 69, 2500-02(1947).)

- 2807 Caley, E. R. and Rogers, L. B. "Behavior of Uranyl Solutions in a Mercury Reductor." J. Am. Chem. Soc. 68, 2202-04(1946).

In solns. contg. HCl in sufficiently high concn., $(UO_2)^{++}$ is almost quantitatively reduced to U^{+4} in the Hg reductor. By use of a small correction factor, this reduction may be applied to the volumetric detn. of U. The possible interference of U should be taken into account when using the reductor for the detn. of certain other elements.

- 2808 Carlson, A. B. The Removal of Uranium Compounds from Cloth. A Laundry Problem. Master's Thesis, Univ. of Rochester, 1946. 77p. (M-3322)

Soap and other common washing agents were ineffective in most cases. Actually, in several instances, soap appeared to remove less U than H_2O alone. From the standpoint of toxicology, $NaHCO_3$ or bi-carbonate with added H_2O_2 , renders contaminated fabric practically free of all toxic U cpds. Those cpds. which are not removed by this treatment are relatively nontoxic. $NaHCO_3$ may be used jointly with soap without impairing its laundering eff. This fact would simplify incorporation of these results in actual laundry practice. Since $NaHCO_3$ is effective in very dil. solns. (0.3 to 0.5%), this agent would not harm the clothing being washed. A 2% soln. of H_2O_2 was employed in all of these studies. This concn. of peroxide will weaken cotton fibers to a certain extent. It would be necessary to test the seriousness of this problem employing std. testing methods. No expts. were performed using more dil. solns. (<2%) of H_2O_2 . It is very likely that much less of this agent would be required in actual laundry practice. At lower concns. of this agent, the harmful effect on cloth would probably be negligible. Although it was not tested, H_2O_2 should be effective in the presence of soap, since soaps are essentially comprised of saturated fatty acids, no reducing agent is present to destroy it. The data presented in Part II are insufficient to state definitely that cationic exchange is the mechanism by which cloth binds U. The data for retention of U by cloth in the presence of (OAc) or citrate buffer are satisfactorily explained by the Freundlich adsorption isotherm. However, on the basis of results reported in the literature and the incomplete expt. described above, it seems quite likely that cationic exchange concepts explain more quantitatively and more completely the results obtained in Part I. A theory employing cationic exchange concepts, which describes the results reported herein, may be outlined as follows: 1. Water-sol. U is bound by acidic groups contributed by pectic substances, which occur in the cellulose mol. as an impurity; the primary reaction being one of exchange between the cations naturally associated with the fibers and U. 2. To remove the bound U from cloth, it is necessary to have a strong complexing agent present with the exchanging cation. The completeness of the exchange is detd. by the nature of the anion, i.e., the U must be bound in a sol., un-ionized or anionic form to obtain 100% exchange.

- 2809 Cauchois, Y. "New Observations of x Emission of Atoms Ionized by Low-Level Transitions." Compt. rend. 222, 1484-6(1946).

The atoms are assumed to be ionized by radiationless transitions between levels. The L satellites due to transitions ($L_{III}M_I$) were observed for U, Bi, Au, Pt, W, Ta, and Ir, and those of the first 4 measured. Satellites were also observed for U and Pb due to $L_{III}N_I$. Measurements on Pt showed a transition due to $L_{II}M_I$ as well as an L transition.

- 2810 Chamberlain, O., Williams, D., and Yuster, P. Half-Life of Uranium 234. Declassified June 26, 1946. 11p. (MDDC-93)

The half-life of U^{234} has been detd. by two independent methods. The first method involves a re-measurement of the relative isotopic abundance of U^{234} and U^{238} in normal U; from this measurement the half-life of U^{234} can be obtained in terms of the known half-life of U^{238} . The value obtained by this method is $2.29 \pm 0.14 \times 10^5$ yrs. The second method involves the detn. of the specific α activity and relative isotopic abundances of several enriched U samples. The value obtained by this method is $2.35 \pm 0.14 \times 10^5$ yrs. Both values for the half-life are somewhat smaller than the currently accepted value of $2.69 \pm 0.27 \times 10^5$ yrs. (This paper is also available in Phys. Rev. (2), 70, 580-2(1946).)

- 2811 Chamberlain, O., Williams, D. and Yuster, P. "Half-Life of Uranium 234". Phys. Rev. (2), 70, 580-2 (1946).

This paper contains information similar to that published as MDDC-93 (1946).

- 2812 Chatterjee, S. D. "Detection of Spontaneous Fission of Uranium Nucleus." Trans. Bose Research Inst. Calcutta 16, 65-77(1946).

Expts. were conducted to test the possibility of spontaneous fission of U due to the tunnel effect as predicted by Bohr and Wheeler. A proportional counter with inner walls coated with U_3O_8 was connected to a low-sensitivity and stable proportional amplifier. This arrangement permits the detection of fission fragments. A series of expts. eliminated other possibilities for the origin of the counts. Calcns. were made giving a half-life for spontaneous fission of 1.3×10^{16} yrs. It is not yet known which isotope of U is responsible for spontaneous fission, but it was concluded that the spontaneous fission cannot be attributed to the daughter element UX_1 . The survey of early work on fission is well prepd. and a good introduction to the topic.

- 2813 Chipman, J. Metallurgy in the Development of Atomic Power. October 1946. Declassified Nov. 25, 1946. 54p. (MDDC-539)

This paper is a historical and technical record of the development, since 1942, of progress in the metallurgy of U and related substances which are of interest in atomic energy work.

- 2814 Claassen, A. and Visser, J. "Determination of Uranium with 8-Hydroxyquinoline (Oxine)." Rec. trav. chim. 65, 211-15(1946).

Hecht and Reich-Rohrwig showed that, after drying at 105 to 110° , the red ppt. produced by oxine and $(UO_2)^{++}$ has the compn. $UO_2(C_9H_6NO)_2 \cdot C_9H_7NO$ but the results obtained by their procedure are too low. The error can be overcome by washing the ppt. with 0.04% oxine soln. instead of with hot water. The excess oxine retained by the ppt. is volatile at 110° . Pptn. is complete at pH = 5 to 9. Contrary to previous statements, the ppt. is not incomplete when tartrate is present. The following procedure is recommended: Neutralize the acidic soln. with NH_4OH until a faint turbidity persists; clear this with a few drops of 2N HCl. If tartrate is present, add NH_4OH to about pH = 6. Add 20 to 25 ml. of 20% NH_4OAc soln. and heat to boiling. Then at a vol. of 100 to 200 ml add 4% oxine soln. until pptn. starts. Stir the hot soln. until the ppt. is cryst. and continue the dropwise addn. of oxine reagent until 0.5 ml has been added for each 10 mg of U present with 4 to 5 ml in excess. Add an equal vol. of 1N NH_4OH to keep the pH above 5. Boil 1 to 2 min, cool to about 40° , and filter into a tared weighing crucible. Wash the ppt. with 0.04% oxine soln. which is 1.5N in AcOH, drain by suction and dry 1 to 2 hrs at 110 to 140° or dissolve the ppt. in 2N HCl and titrate with $KBrO_2$ -KBr soln. The results are excellent.

- 2815 Clark, F. L., Spencer-Palmer, H. J., and Woodward, R. M. Alpha-Ray Analysis of U-Isotopes. Part I. Apparatus. May 4, 1944. Declassified November 1946. 32p. (BR-431)

An app. claimed to count (discriminatively) the α rays from U^{235} as opposed to U^{238} , including an ionization chamber, amplifier, discriminator, pulse analyzer, pulse generator, and power supplies is described. Characteristics, operation calibration, and drawings of the app. are given. The appendix discusses the prepn. of U_3O_8 films by electrodeposition.

- 2816 Coates, J. W. and Crawford, J. W. C. Colored Synthetic Resins. Dec. 2, 1946. (British Patent 582,899)

Colored synthetic resins are obtained when solns. of chelated cpds. of Cr, Mo, U, Mn, Fe, Co, and Nd and β -ketones in cpds. contg. C=C are polymerized in the usual manner. Thus, a red transparent resin is obtained when a soln. of 1.17 g Fe benzoylacetone in 60 cc Me methacrylate and 0.06 g Bz₂O₂ is heated on a H₂O bath for 40 min and then in an oven at 80° for 16 hrs. Cr cpds. yield purple resins. Co cpds. yield violet cpds. The colors are not affected by 100-hr exposure to ultraviolet light.

- 2817 Cohen, G. N. "Existence and Structure of a Complex Adrenaline-Uranyl." Compt. rend. 222, 890-1(1946).

A complex adrenaline-uranyl has been characterized and crystd. Although a probable formula has been attributed to it, the no. of mols. of water of crystn. are not known because of the ease of hydration of the cpd. The suggested formula is UO₂(5,2-R(HO)C₆H₃)₂ where R = MeNHCH₂CH(OH)⁻.

- 2818 Curie, I. "On the Possibility of Studying the Activity of Rocks by Observing Alpha-Ray Tracks in Photographic Emulsions." J. phys. radium (8), 7, 313-19(1946).

An analysis of the no. of rays to be expected from rocks contg. very small quantities of U and Th is given. Possible deductions from the results are indicated. It is concluded that the method may give results not obtainable by other methods but that application of it will be difficult.

- 2819 Currah, J. E. and Beamish, F. E. The Determination of Small Quantities of Uranium in the Presence of Large Quantities of Thorium and Small Quantities of Iron and Copper. June 6, 1945. Declassified March 1946. 8p. (MX-149)

The following report deals with the development of a method for the rapid estn. of small quantities of U⁺⁶ in the presence of relatively large amts. of Th and small amts. of Fe and Cu. The detn. is based on the estn. of the color produced with (SCN)⁻ and (UO₂)⁺⁺. The method reported permits the estn. of 0.05 to 0.80 mg U in the presence of at least 1.25 g Th, 2 mg of Fe and 50 mg Cu/25 ml soln. The interference of Fe is eliminated by reduction with SnCl₂.

- 2820 Currah, J. E. and Beamish, F. E. with Allen, W. F. and Bartlet, J. C. I. The Spectrographic Detection of Trace Amounts of Uranium. II. The Determination of Uranium in Manganese Dioxide. Aug. 27, 1945. Declassified August 1946. 6p. (MX-170)

The report deals with the development of a method for the detection of small quantities of U by means of the spectrograph. An aliquot of sample is evapd. on a "fine" silver rod which is then used as the bottom electrode in a d.c. arc. The upper electrode is also a "fine" silver rod. The sample is excited in the arc at 220 v and 4 amp. for 30 sec. The spectrum is recorded on an Eastman Kodak 33 plate and is developed in Kodak D-19 developer. The approx. amt. of U present may be estd. by visual comparison of various lines with std. spectra which are photographed on the same plate. The std. spectra are produced from material with approx. the same composition as the sample, "salted" with varying amts. of U. The application of this method to the detection of traces of U in reagent grade MnO₂ is discussed and a procedure for analysis is given.

- 2821 Dahl, A. I. and Van Dusen, M. S. The Resistance-Temperature Relation and the Thermo-electric Properties of Uranium. Declassified Sept. 30, 1946. 15p. (MDDC-457)

The resistance-temp. relation for 99.9% U has been detd. over the range 0 to 900°C. The temp. coeff. of electrical resistance, (R₁₀₀ - R₀)/100R₀, for 99.9% U has been found to be 0.00276 for metal annealed at 600°C and 0.00261 for metal annealed at 910°C. The irregularities occurring in the resistance-temp. curve for U have been used as a basis for locating the transformation points. The following transformations are indicated:

On Heating		On Cooling	
$\alpha - \beta$	667°C	$\gamma - \beta$	764°C
$\beta - \alpha$	772°C	$\beta - \alpha$	645°C

The observations on the samples of U are plotted. U is thermoelectrically pos. to Pt on the basis of the generally accepted convention, namely: if, in a simple thermoelectric circuit the current flows from metal A to metal B at the colder junction, A is thermoelectrically pos. to B. The curves indicate that the thermal e.m.f. of U versus Pt increases with temp. with no discontinuities or abrupt changes. The thermoelectric power, de/dt , increases from about $12 \mu v/^{\circ}C$ at $0^{\circ}C$ to about $42 \mu v/^{\circ}C$ at $900^{\circ}C$. The $\alpha - \beta$ transformation in U appears not to affect the thermoelectric properties. This is in marked contrast to the discontinuities in electrical resistance at about 660 and $770^{\circ}C$. (This paper is also available in J. Research Natl. Bur. Standards 39, 53-8(1947).)

2822 DeMent, J. "The Fluorochemistry of Uranium." J. Chem. Education 23, 213-19(1946).
The history and nature of the fluorescence reactions and activating properties of $(UO_2)^{++}$ are reviewed.

2823 DeMent, J. "Locating Uranium with Ultraviolet Lamp." Mining Congr. J. 32, 26-30(1946) May.
Many U-bearing localities have been discovered by use of ultraviolet lamp. Secrecy measures during the war have not permitted publication of methods used on U workings in most of the major localities. In the Great Bear Lake region of Canada, the secondary mineral zippeite shows the presence of pitchblende outcroppings by its bright fluorescence. Two new regions in California have been prospected. Other examples are given. Data on the fluorescence of U minerals, special tests, and a bibliography are included.

2824 DeMent, J. and Dake, H. C. Rarer Metals. Chemical Publishing Company, Inc., Brooklyn, 1946. 393p.

Data are given on history, mineralogy, phys. and chem. properties, cpds., extrn. and prepn., technology, and analysis of 20 metallic elements, ranging from commonly recognized Pt and U down to Hf and Os, excluding metals of rare earths.

2825 Déribéré, M. L'Uranium, la clef et la source des énergies nucléaires. Paris, Éditions Elzévir, c. 1946. 63p.

2826 Deslandres, H. "Compounds of Uranium and Thorium." Compt. rend. 223, 57-9(1946).
The nos. of electrons capable of activation in some catalysts and in some cpds. of U and Th are given.

2827 de Vaucouleurs, G. La conquête de l'énergie atomique. Pt. 1. Des rayons uraniques à la scission de l'uranium. Pt. 2. De la scission de l'uranium à la bombe atomique. Paris, Hermann et Cie, 1946. 114p.

2828 Dounce, A. L. and Flagg, J. F. Chapter I. The Chemistry of Uranium Compounds. July 1, 1946. Declassified Oct. 10, 1946. 160p. (MDDC-422)

The prepn. and properties of some U cpds. important in toxicological work are given. They include UCl_4 , UF_4 , UO_2 , UF_6 , UO_3 , UO_4 , U_3O_8 , $UO_2(OAc)_2$, UO_2F_2 , and $UO_2(NO_3)_2$. An outline of the aspects of the chem. of U cpds. which apply to biochem. and toxicological studies is also included. This outline includes the following topics: (a) The chem. of U^{+6} with particular reference to the formation of complexes with various materials in soln. (b) A brief description of the chem. of U^{+4} with particular regard to a comparison of its chem. with the chem. of U^{+6} . (c) A study of the oxidation-reduction properties of the $U^{+6}-U^{+4}$ system, with particular regard to the effect of complexers, pH, and the role of U^{+5} . (d) Dissocn. consts. of various acetate complexes of U^{+6} and U^{+4} . (e) The problem of polymerization of U cpds. in soln. (This report is also available in Voegtlin and Hodge, Pharmacology and Toxicology of Uranium Compounds. New York, McGraw-Hill Book Company, Inc., 1949. Chapter 1.)

2829 Dounce, A. L. and Tien H.-L. Chapter XIII. The Action of Uranium on Enzymes and Proteins. July 1, 1946. Declassified Oct. 10, 1946. 263p. (MDDC-423)

As a result of the work on the action of U cpds. on enzymes and proteins it can be stated that U^{+6} (the form which is of chief concern in the animal body) probably is not a specific enzyme poison under physiol. conditions in the sense that As or Hg are specific poisons for sulfhydryl enzymes. U^{+6} shows a strong tendency to form very slightly dissocd. complexes under physiol. conditions; e.g., with org. acids and bicarbonate. Since these complexes apparently do not affect enzymes, U probably is not a particularly powerful enzyme poison in the animal body except in special locations such as the kidney tubules, where the resorption of bicarbonate and drop in pH allows sufficient $(UO_2)^{++}$ to accumulate to permit a combination of U^{+6} with enzymes and cell proteins. It is apparently the $(UO_2)^{++}$ which combine with proteins and inhibit enzymes. It has been found that in all cases so far studied, the inhibitory action of U^{+6} on isolated enzymes or enzyme systems increases very sharply as the pH decreases, apparently because of liberation of $(UO_2)^{++}$ from complexes. This point is illustrated in a series of expts. A detailed discussion of the chem. of complexes of U^{+6} is also included. In regard to the combination of U^{+6} with proteins, it can be stated definitely that it combines rather firmly with acid groups of proteins and that it probably can combine only in loose ionic or salt-type linkages with basic groups. Sulfhydryl groups do not combine with U^{+6} . U^{+6} has a very slight or unmeasurable effect in denaturing proteins at a pH range from 6 to 8. The combination of U^{+6} with proteins is sufficiently firm so that some strong complexer such as bicarbonate, citrate, or malate must be used to reverse the combination. The presence of even a small amt. of combined U^{+6} destroys the crystallizability of egg albumin, but crystallizability can be restored by prolonged dialysis with repeated addns. of a strong complexer. The presence of a small amt. of U^{+6} also affects the mobility of plasma proteins in the Tiselius electrophoresis cell. In regard to the problem of transport in the blood stream, it can be stated that U^{+6} is chiefly combined with bicarbonate but also partly with plasma proteins. The lower the plasma bicarbonate content, the more U^{+6} is carried by protein. There is less quant. work on U^{+4} than on U^{+6} , since it has been felt that in case of lung exposure to U^{+4} the material entering the plasma would be U^{+6} rather than U^{+4} . Work on the oxidation-reduction problem has made it fairly clear that the chem. of U in the animal body is chiefly the chem. of U^{+6} for all modes of entry of U except by direct injection. By the latter method U^{+4} can of course be introduced into the body. It has been found that, in general, U^{+4} appears to have a somewhat greater affinity for protein than has U^{+6} and that it is usually a somewhat more severe enzyme poison than is U^{+6} . The latter point is difficult to prove, however, since the U^{+4} might contain small amts. of impurity in the form of other heavy metals which are absent in U^{+6} cpds. The use of U^{+4} in enzyme poisoning expts. is hampered by the insoly. of U^{+4} at pH values in the neighborhood of 7.0 where most enzyme reactions are carried out. U^{+4} has somewhat less tendency to form complexes with bicarbonate than does U^{+6} , and because of this and its apparently greater affinity for protein, it must be carried in the blood stream to a considerable extent in the form of complexes with blood protein after being injected. However, it is also possible that some U^{+4} is carried as colloidal oxide stabilized by plasma protein. These statements are borne out by excretion studies. (Paper is also in Voegtlin and Hodge, Pharmacology and Toxicology of Uranium Compounds. New York, McGraw-Hill Book Company, Inc., 1949. Chapter 13.)

- 2830 Dounce, A. L., Roberts, E., and Wills, J. H. Chapter XIV. Catalasuria as a Sensitive Test for Uranium Poisoning. July 1, 1946. Declassified Aug. 28, 1946. 110p. (MDDC-252)

This report demonstrates that an abnormally high excretion of catalase occurs in the urine of rabbits, dogs, cats, and probably rats after the poisoning of these animals with high or low doses of U cpds., whether administered by parenteral injection or by inhalation. The increase in catalasuria following U poisoning coincides in time with the appearance of demonstrable amts. of protein in the urine. The urinary catalase and protein values go through max. usually from 3 to 6 days after the administration of sol. U^{+6} cpds. by injection. If the U cpd. is administered by inhalation, these max. may be delayed and of longer duration. The catalase max. occur at the time of max. breakdown of renal tubular cells and result from an escape of the enzyme catalase from the damaged cells. An earlier max. has been observed in acute injection expts. which appears within 2 to 3 hrs after the intravenous injection of large amts. of U cpds. The significance of this earlier max. is not certain. The appearance of catalase in the urine after exposure to U cpds. in animals is an extremely sensitive test for kidney tubular damage by U. In rabbits the catalase test is more sensitive than the urinary protein test, and this is probably true in cats also. In the case of dogs the catalase test is more sensitive than the protein test in some animals and less sensitive in other animals. The catalase test is preferable to the phosphatase test because it is more reproducible after repeated doses of U cpds. In general, catalasuria and proteinuria are the most sensitive indicators of the acute stage of tubular damage to the kidneys. The combination of the catalase and protein tests furnishes an advantage over the protein test alone, not so much because of the greater sensitivity but rather because of the greater specificity. The appearance of abnormally high catalasuria is a specific indication of tubular damage to the kidneys, while the appearance of proteinuria may be an indication of glomerular damage alone, or glomerular plus tubular damage. Even in rather severe U poisoning, plasma catalase, because of its high mol. wt., does not filter through the glomerulus. Other agents beside U which attack the tubules such as $HgCl_2$, mapharsen, sodium tartrate, and $K_2Cr_2O_7$ have been found to produce catalasuria. Adrenalin, on the other hand, does produce a slight proteinuria without any catalasuria. The same is true of heavy exercise, fright, and probably alc. (This information is also in Voegtlin and Hodge, Pharmacology and Toxicology of Uranium Compounds. New York, McGraw-Hill Book Company, Inc., 1949. Chapter 14.)

- 2831 Dounce, A. L. The Mechanism of Action of Uranium Compounds in the Animal Body. July 1, 1946. Declassified Aug. 26, 1946. 81p. (MDDC-253)

Bone ash has a remarkable affinity for U. It adsorbs U almost equally well from serum, serum ultrafiltrate, and bicarbonate buffer. With increasing concns. of U in soln. greater quantities of U, but a smaller % of the total U, are taken up by bone ash in a manner described by the Freundlich adsorption isotherm. However, a sharp loss in U from soln. appears to occur at high U concns., due possibly to the pptn. of some insol. U cpd. With increasing concns. of bicarbonate at const. concns. of U, smaller quantities as well as a smaller % of the total U present are taken up by bone ash. With increasing pH, the uptake of U by bone ash decreases. The possible significance of these results in regard to physiological findings is pointed out. U cpds. affect chiefly the soft tissues, but primarily the kidneys. Final U deposition takes place in bone. (This information is also in Voegtlin and Hodge, Pharmacology and Toxicology of Uranium Compounds. New York, McGraw-Hill Book Company, Inc., 1949. Chapter 15.)

- 2832 Dygert, H. P., LaBelle, C. W., Laskin, S., Pozzani, U. C., Roberts, E., Rothermel, J. J., Rothstein, A., Spiegl, C. J., Sprague, G. F. Jr., and Stokinger, H. E. Chapter X. Toxicity Following Inhalation. July 1, 1946. Declassified Sept. 23, 1946. 496p. (MDDC-376)

This account summarizes the toxicologic data obtained from exposure of animals to the inhalation of U dusts. Presented also, are specific recommendations for some simple measures for the protection of the worker against dust hazards based on results of tests of respiratory protective devices. The information is presented in a technical manner and is intended to be of service to toxicologists, medicolegal practitioners, plant supervisors, industrial hygienists, plant physicians and technicians, and engineers concerned with the safety of personnel who handle U dusts. The report is broadly divided into procedures (Sections 1 and 2), presentation of results of short-term exposure studies (Section 3), results of respirator tests (Section 4), and a discussion of the significance of the results (Section 5).

The dusts studied include UF_6 , UF_4 , UCl_4 , UO_2 , UO_3 , UO_4 , U_3O_8 , U ores, $\text{Na}_2\text{U}_2\text{O}_7$, $(\text{NH}_4)_2\text{U}_2\text{O}_7$, UO_2F_2 , and $\text{UO}_2(\text{NO}_3)_2$. Because of the extensive nature of the work, complete data of all expts. are not included under the various expts. Hence, certain characteristic results of the toxicologic response by inhalation have been selected. (The information is also available in Voegtlin and Hodge, Pharmacology and Toxicology of Uranium Compounds. New York, McGraw-Hill Book Company, Inc., 1949. Chapter 10.)

- 2833 Eastman, E. D., Brewer, L., Bromley, L. A., Gilles, P. W., and Lofgren, N. L. Preparation and Properties of Sulfides and Oxide-Sulfides of Uranium. July 24, 1945. Declassified Aug. 17, 1946. 9p. (MDDC-193)

The methods for the prepn. of US , U_2S_3 , and US_2 are reported. US_2 and intermediates of U_2S_3 are prepd. by H_2S treatment of UO_2 or U_3O_8 in C system at 1200 to 1300° . In this method UOS is an intermediate and the C of the system enters the reaction in its conversion to pure sulfides. In order to obtain US_2 , the reaction temp. must be lowered below 1000°K . The U_2S_3 is obtained by decompn. (20 min at 1600° in vacuum) of US_2 . Any of the sulfides may be obtained by H_2S treatment of UH_3 at controlled temps. and concns. The lower sulfides may also be obtained by heating mixts. of UH_3 and US_2 . Intermediate cpds. are also mentioned. The colors, m.p., decompn. temps., and magnetic susceptibilities are given as follows. US_2 , black, $1850 \pm 200^\circ$, 1200° in vacuum, 3050×10^{-6} ; U_2S_3 , black, $1850 \pm 100^\circ$, 1800° in H_2 or vacuum, 2630×10^{-6} ; US , grayish, $>2000^\circ$, —, 4180×10^{-8} ; UOS, black, —, —, —. Data from Zachariasen are also given on crystal structure, d., etc.

- 2834 Ferretti, R. J., Price, G. R., and Schwartz, S. Uranium Excretion Studies. June 15, 1946. Declassified Dec. 12, 1946. 17p. (MDDC-541)

Since there are no clinical or biochem. tests known to be specific for U toxicity, the detn. of U in urine is the most important single index for the evaluation of U exposure in project personnel. This is illustrated by data of 86 individuals exposed to U in the Ames, Chicago, and Oak Ridge projects. Values of over $100 \gamma \text{ U/liter}$ are found only rarely in even the most heavily exposed individuals. Control unexposed students were found to excrete less than $1 \gamma \text{ U/liter}$. Because the fluorimetric method used is sensitive to $0.0001 \gamma \text{ U}$, analyses were done using only 0.1 cc urine. This sample is evapd. to dryness in a Pt dish, ashed over a flame, and fused with NaF without further purification. Fluorescence is then measured with a specially constructed fluorophotometer.

- 2835 Flagg, J. F. Chapter II. Analytical Methods. July 1, 1946. Declassified Sept. 10, 1946. 85p. (MDDC-321)

Colorimetric, fluorophotometric, polarographic, spectrographic, and semimicro volumetric methods of analysis for U are described. The fluorophotometer which was used is described as well as methods used to det. F and B halides. (This report is also in Voegtlin and Hodge, Pharmacology and Toxicology of Uranium Compounds. New York, McGraw-Hill Book Company, Inc., 1949. Chapter 2.)

- 2836 Fontana, B. J. Heats of Reaction of the Oxidation-Reduction Couples: $\text{H}_2\text{O}-\text{H}_2\text{O}_2$, $\text{Fe}^{++}-\text{Fe}^{+3}$, $\text{Ce}^{+3}-\text{Ce}^{+4}$, and $\text{U}^{+4}-(\text{UO}_2)^{++}$. Oct. 18, 1946. Declassified Dec. 12, 1946. 18p. (MDDC-542)

The heat of the $\text{U}^{+4}/(\text{UO}_2)^{++}$ couple has been detd., $\Delta H_{298} = 32.94 \pm 0.06 \text{ kcal/mole}$, through the reaction of $\text{U}^{+4} + \text{H}_2\text{O}_2$. This heat has been used to redet. values for the heat of the $\text{Fe}^{++}/\text{Fe}^{+3}$ and $\text{Ce}^{+3}/\text{Ce}^{+4}$ couples; $\Delta H_{298} = +9.48 \pm 0.08$ and $+37.83 \pm 0.05 \text{ kcal/mole}$, resp. Application of the $\text{U}^{+4}/(\text{UO}_2)^{++}$ heat to the calcn. of the entropy of U^{+4} , using the widely differing e.m.f. data for this couple, appears to indicate that the less neg. values, e.g., -0.328 v in 0.5M HCl , are more likely to be correct.

- 3837 Freymann, M., Guilmart, T., and Freymann, R. "The Complexity of the Electronic Spectra of Uranyl Salts." Compt. rend. 223, 545-7(1946).

The investigations were made to find a uranyl salt with a relatively simple spectrum. Absorption and fluorescence spectra of uranyl sulfate, nitrate, hydroxide, and acetate in the solid state, were measured by use of the powder method. Many of the bands which were badly defined at room temp. became very much sharper at -195° . However, since certain bands still remained broad at this temp., it would be desirable to use liq. H_2 or He. Except for certain intense bands, the sulfate, nitrate, hydroxide, and

acetate showed very different spectra. Water of crystn. also had an effect. A very strongly dehydrated sample of uranyl acetate showed no absorption bands. When commercial uranyl sulfate was recrystd., various samples showed very different spectra and these showed a marked change within a month of the prepn. Water of crystn. had little effect on the spectrum of uranyl acetate. A calcn. indicates the possibility of using spectroscopy in the visible for distinguishing the U isotopes if liq. H_2 and a spectrograph of greater resolving power are used.

- 2838 Freymann, M., Guilmart, T., and Freymann, R. "Classification of the Electronic Bands of Uranyl Acetate from Infrared and Raman Frequencies." *Compt. rend.* **223**, 573-5(1946).

A table of energy levels and a classification of the electronic bands of hydrated $UO_2(OAc)_2$ are presented. For the excited state, the levels are sepd. by 720 cm^{-1} . For the normal state, the levels correspond to the freqs. 210, 860, and 930 cm^{-1} , with their combinations and harmonics. An additional freq. about 30 cm^{-1} , which has not yet been observed directly, is proposed to account for the facts of the visible spectrum.

- 2839 Frisch, O. R. *Isotope Analysis of Uranium Samples by Means of Their Alpha-Ray Groups*. Declassified November 1946. 7p. (BR-49)

The method depends on the fact that all neg. ions, which, in pure N_2 give free electrons along the track of an α particle (whatever its direction or position in the chamber), can be drawn to the collecting electrode.

- 2840 Gambhir, I. R. and Singh, R. P. "Color in Relation to Chemical Constitution of the Metallic Derivatives of Isonitrosodiphenylthiobarbituric Acid." *Proc. Indian Acad. Sci. A.* **23**, 330-4 (1946).

The metallic salts of isonitrosodiphenylthiobarbituric acid have been prepd. in order to study their color in relation to mol. structure. The acid, m.p. = 227° , was prepd. by treating thiobarbituric acid with $NaNO_2$ in KOH soln. The NH_4 salt was prepd. by adding concd. NH_4OH to a satd. soln. of the acid in acetone, and recrystd. from H_2O (m.p. = 213°), the other salts were prepd. from this salt. The m.p. of the U salt is 219° , the absorption max. and S content are not reported. Structural formulas are given for many of the salts on the basis of their being internally complex cpds.

- 2841 Goldring, L. S. *A Spectrophotometric Study of the Hydrolysis of Uranyl Ion*. March 1, 1946. 16p. (MonC-106)

A spectrophotometric study of the behavior of $(UO_2)^{++}$ solns. of concns. from 0.004 to 0.16M and pH values between 2.00 and 4.30 has been made. The absorption spectrum of $(UO_2)^{++}$ is assumed to be given by studies at pH = 2. Beer's Law is obeyed at this pH. The fit of the data obtained to the dimerization equation proposed by Best, Taub, and Longworth, $2(UO_2)^{++} + H_2O = (UO_3 \cdot UO_2)^{++} + 2H^+$ has been investigated. It is found that the above reaction, with a mass action const. K, of 1.35×10^{-6} , does not adequately explain the results under conditions of advanced hydrolysis.

- 2842 Grummitt, W. E. and Wilkinson, G. "Fission Properties of U^{235} ." *Nature* **158**, 136(1946). When the fission yield is plotted against the mass no. for the thermal-neutron fission of U^{235} , there are two sym. groups with smooth curves passing through 0.005 for mass no. 84, 0.01 for 89, 0.05 for 96, 0.01 for 104, 0.00015 for 111, 0.0001 for 123, 0.01 for 130, 0.06 for 138, and 0.01 for 151. The total of fission yields for each group is 0.9. Most of the heavy group lies in the rare-earth region, and fission isotopes up to Eu might be expected. After about 100 days, the measured gross activity of U^{235} fission products is accounted for by activities of the sepd. isotopes. Half-lives and energies of several new isotopes are reported: Sn^{121} , 136 days, 1.2 mev(?); Sn^{121} , 17.5 days, 1.7 mev(?); Sn^{120} , 7.0 days, 1.8 mev; Sb^{125} , several yrs, 0.56 mev; Sb^{125} , 28 days, 1.86 mev(?); Cs^{136} , ~20 days. Fission yields of many β - and γ -active isotopes are reported with the energies and half-lives given for each.

- 2843 Guiter, H. "Study of the Potentiometric Titration Curve of Uranyl Nitrate with Sodium Hydroxide." Bull. soc. chim. France 403-4(1946).

When 5 ml of 1N $\text{UO}_2(\text{NO}_3)_2$ is titrated cold with 1N NaOH, an end point is reached corresponding to the formation of $5\text{UO}_2 \cdot 4\text{N}_2\text{O}_5$ at pH = 3 to 4. On heating, another end point is reached with a break at pH = 4 to 10 corresponding to the formation of $5\text{UO}_2 \cdot 3\text{N}_2\text{O}_5$. Further addn. of NaOH leads to the pptn. of $2\text{Na}_2\text{O} \cdot 7\text{UO}_3$. This suggests the possibility of carrying out a titration with methyl orange and another with phenolphthalein, or better, bromothymol blue. The titration in the cold is fairly fast and convenient, but the results are not very accurate. In test analyses, the values 4.1, 4.1, and 4.0 were obtained (theoretical 4.0) and 2.9, 2.9, and 2.9 (theoretical 3.0) for the hot titration.

- 2844 Haberlandt, H. and Hernegger, F. "Determination of the Uranium Content of Hyalite and Other Minerals by Means of Fluorescence Analysis." Anz. Akad. Wiss. Wien, Math.-naturw. Klasse No. 13, 116p.(1946).

The U content of hyalite was detd. by means of its degree of fluorescence in filtered ultraviolet radiation. The hyalites of pegmatites contained 4 to 6.4×10^{-7} g/g, while one from basalt contained 4.8×10^{-6} g/g. U detns. were also carried out with evansite, fischerite, and adamite. All of the samples contd. U. In most of the minerals there was established a relationship between the luminosity of fluorescence and the amt. of U. The location of the fluorescence bands due to the UO_2 complex was identical in the spectra of the different hyalites and autunite, while in evansites the bands were shifted toward the shorter wavelengths, and in adamite and an artificial U glass toward the longer wavelengths. It is concluded that the location of the bands in the fluorescence spectra of U minerals depends on the chem. compn. of the material (including the H_2O content). U-bearing minerals can thus be identified with the aid of fluorescence analysis combined with spectrochem. detns. The degree of sharpness of the bands in the fluorescence spectrum depends on whether the mineral is of cryst. or colloidal origin.

- 2845 Haven, F. and Hodge, H. C. Chapter VI. Toxicity Following the Parenteral Administration of Certain Soluble Uranium Compounds. July 1, 1946. Declassified Aug. 28, 1946. 57p. (MDDC-258)

Doses of 4 to 5 mg/kg of U nitrate produced in young Wistar rats mortalities of about 65% for males and 95% for females. Doses of 5 to 6 mg/kg of U nitrate in adult Wistar rats gave mortalities of about 50% in males and about 95% in females. Doses of 2.5 mg/kg of UO_2F_2 in male Wistar rats gave mortalities of 20%. In female rats the mortalities were 95%. A dose of 25.0 mg/kg of UCl_4 gave a mortality of 90% in adult male and female rats. There is an increase in toxicity with increasing age. Doses of 4 to 32 mg/kg of U nitrate gave an approx. LD_{50} of 6 to 8 mg U/kg in white mice. Doses of 4 to 150 mg/kg of U nitrate in male and female C_3H mice gave an approx. LD_{50} of 20 to 25 mg U/kg. The approx. lethal dose in mg U/kg of a $\text{UO}_2(\text{NO}_3)_2$ soln. administered intravenously in 4 species of animals is as follows: Rabbits, 0.1; guinea pigs, 0.3; rats, 1.0; and mice, 10 to 20. (This paper is also available in Voegtlin and Hodge, Pharmacology and Toxicology of Uranium Compounds. New York, McGraw-Hill Book Company, Inc., 1949. Chapter 6.)

- 2846 Haven, F. Chapter XII. Tolerance to Uranium Compounds. July 1, 1946. Declassified Aug. 26, 1946. 56p. (MDDC-257)

Species differences in mortality following the administration of U nitrate by three different routes clearly indicate the existence of a striking natural tolerance to this cpd. The rat possessed less natural tolerance than the mouse and the white mouse far less than the C_3H mouse. On the basis of mortality following a test dose, male rats have been shown to possess more natural tolerance and develop greater acquired tolerance to U nitrate than do female rats, which may be related to the fact recognized earlier that females retained a greater % of the dose in the kidney than males of the same age. Neuman's work (MDDC-264, 1946) on distribution and excretion of U in the rat has confirmed this finding and has added the fact that male rats of the same weight store more U in bones than female rats, thus sparing the kidney. The work on acquired tolerance shows that either the method of repeated doses or the method of increased doses may be used to produce tolerance in rats. The small dose used in the method of repeated doses should probably be large enough to cause considerable functional injury to the kidney in order to produce tolerance. The slight changes in body wt. following repeated doses too small to produce tolerance

and the greater changes following doses which produced tolerance would indicate that kidney damage is a prerequisite to tolerance. The markedly increased ratio of kidney wt. to body wt. and the concomitant decrease in dry residue, the absence of kidney phosphatase, the high urinary vol., and the low variable pH are all indicative of kidney damage in tolerant rats. The av. body wt. data for adult rats made tolerant by the repeated-dose method show that the initial body wt. is exceeded by about the time of the ninth injection. Concurrently the urinary excretion of citric acid during repeated dosage is at its height. The excretion of citric acid remained normal after the repeated administration of a dose of U nitrate (0.1 mg/kg) too small to cause tolerance to the test dose. By the method of increased dosage the 10-day interval was better than the 20-day interval for producing tolerance. At 10 days after a single injection the excretion of citric acid had begun to rise while at 20 days the excretion was falling. Each time an increased dose was given at 12-day intervals the excretion of citric acid was high. These facts are in agreement with the hypothesis that the enhanced urinary excretion of citric acid following administration of U is concerned with tolerance. As pointed out, no increase in urinary excretion of U by tolerant rats was found, which may be accounted for by the wide variation in excretion from animal to animal following a single dose. The kidneys of tolerant rats retain less U than those of nontolerant animals, a fact which may be explained by assuming that U, having filtered through the glomerulus as the bicarbonate complex, combines with citric acid present in the tubule and is excreted. In the absence of citric acid, U would combine with protein of the tubule and cause kidney damage. The available evidence indicates that the presence of citric acid in the kidney tubule in concns. above normal may account for acquired tolerance to the toxic action of U. (This information is also in Voegtlin and Hodge, Pharmacology and Toxicology of Uranium Compounds. New York, McGraw-Hill Book Company, Inc., 1949. Chapter 12.)

2847 Heal, H. G. Electrochemical Equilibria and Electrode Reactions in Non-Complex Aqueous Solutions of Uranium Salts. Oct. 20, 1944. Declassified July 1946. 57p. (NRC-1582)

The literature dealing with U electrochemistry is critically reviewed. A series of new expts. employing the polarographic technique is described, and hypotheses are advanced, upon which these and the older results can be explained. The existence of an unstable ion of U^{+5} , $(UO_2)^+$, is strongly suggested by the evidence. Assuming this, an attempt is made to provide a quant. theoretical explanation for the Becquerel effect, which is applied both to the older exptl. data and to some new figures. Proposals are made for future work.

2848 Heal, H. G. "Electrochemistry of Uranium." Nature 157, 225(1946).

The results obtained generally confirm those of Harris and Kolthoff. The first polarographic wave is due to the reaction $(UO_2)^{++} + e \rightleftharpoons (UO_2)^+$; the second to a 2-stage reduction $U^{+5} \rightarrow U^{+3}$. The second wave shows a kink at half its height, particularly in H_2SO_4 soln., in which the first part of the wave has an irregular shape, and the second approaches the log form of a reversible wave. The second wave is due to the reaction $(UO_2)^+ + e \rightleftharpoons (UO_2)$; this is followed by the chem. formation of U^{+4} or $(UO)^{++}$, and the third wave is due to $U^{+4} + e \rightleftharpoons U^{+3}$, or possibly to $(UO)^{++} + e \rightleftharpoons (UO)^+$. Harris and Kolthoff have suggested that the reactions at the Pt and Hg electrodes are different: this assumption is not necessary. The potential of a Pt electrode in uranyl/uranous mixts. is not the true reversible potential of a U^{+6}/U^{+4} equil. In a soln. 1M in $(UO_2)^{++}$ and U^{+4} and 1N in H^+ , the concn. of $(UO_2)^+$ would be approx. $10^{-6}M$, and would vary so that $E = E_0 + (RT/2F) \ln[(UO_2^{++})(H^+)^4/(U^{+4})]$; E_0 is not the true std. potential of the electrode reaction. No solid salts of U^{+5} are known. The concn. of $(UO_2)^+$ is increased above equil. by light. The potential-detg. ion is probably $(UO_2)^+$; the disproportionating ion is probably $UO(OH)^{++}$; their ratio is a function of temp. and pH, and they are interconvertible by hydrolysis or inverse hydrolysis.

2849 Hepler, O. E. and Simonds, J. P. "Experimental Nephropathies. IV. Glycosuria in Dogs Poisoned with Uranyl Nitrate, Mercury Bichloride and Potassium Dichromate." Arch. Path. 41, 42-9(1946).

Glycosuria was produced in dogs with uranyl nitrate, $HgCl_2$, $K_2Cr_2O_7$, and phlorhizin. A marked difference was observed in the power of the 3 inorg. chem. agents to produce glycosuria. Uranyl nitrate was the most potent. Some degree of correlation was found between the glycosuria and (a) the necrosis

of the tubular epithelium, (b) the albuminuria, and (c) the chem. agent and its dose. No definite or const. correlation was observed between the degree of glycosuria and the levels of sugar and urea in the blood or the amt. of phosphatase in the blood or in the cortex of the kidney. Results shed no light on the possible role of phosphatase in the absorption of glucose by the kidneys because no information is available concerning the effect of these inorg. chem. agents on phosphorylase. Certain fundamental differences are presented in the conditions and in the mechanism of the glycosuria induced by phlorhizin and that caused by inorg. poisons.

2850 Hoard, J. L. and Stroupe, J. D. The Structure of Crystalline Rubidium Uranyl Nitrate.

December 1, 1943. Declassified October 1946. 37p. (MDDC-426)

X-ray, optical, and goniometric data are consistent with the assignment of cryst. $\text{RbUO}_2(\text{NO}_3)_3$ to the hexagonal system (rhombohedral division). The fundamental lattice is rhombohedral; the primitive rhombohedron having $a = 8.30 \text{ \AA}$, $\alpha = 68^\circ 42'$ and containing two stoichiometric mols. The corresponding 6-mol. hexagonal unit has $a = 9.36$, $c = 18.88 \text{ \AA}$. Both Rb and U atoms must lie on the threefold axes. Application of lattice theory in rigorous form would require $(\text{UO}_2)^{++}$ as a whole to lie on a threefold axis and thus have a linear configuration. The x-ray intensity data show conclusively that both U and Rb lie on body-centered rhombohedral lattices; the data indicate, moreover, that the origins of the two lattices are sepd. by exactly $c/4$ along the unique axis. The x-ray symmetry is that of the point group D_{3d} , and no reflections $[hh\ 1]$, 1 odd (or $[\text{NO-L}]$, L odd) are observed. A sensitive test for pyroelectricity was neg. The only space group requiring all of these data is $D_{3d}^6 - R3c$; an at. arrangement based upon D_{3d}^6 is found to account satisfactorily for both x-ray and optical data. The at. positions within the hexagonal unit of structure are 6U in 6(a); 6Rb⁺ in 6(b); 12 O of $(\text{UO}_2)^{++}$ in 12(c); 18N in 18(e); 18O' of $(\text{NO}_2)^-$ in 18(e); 36 O'' of $(\text{NO}_3)^-$ in 36(f). This assignment is initially unique except for the distribution of Rb and U between the no-parameter positions (a) and (b). The structure has 6 variable parameters; these are reduced to 3 by using the well-established dimensions of $(\text{NO}_3)^-$. One parameter det. the positions of the centers of $(\text{NO}_3)^-$ on the twofold axes, a second fixes the orientation of the groups with respect to (0,0,1), and the third parameter det. the U-O bond distance in $(\text{UO}_2)^{++}$. This bond distance was estd. as 1.58 Å, on the basis of Bauer's work and known covalent radii. The large observed difference between the principal indexes of refraction, $W-E = 0.169$, requires that $(\text{NO}_3)^-$ be nearly or exactly in flat layers perpendicular to the threefold axis of the crystal. These data are accounted for semiquantitatively if, in addn., nearly or exactly linear $(\text{UO}_2)^{++}$ extends along the threefold axes. As reflections $[\text{HK}\cdot\text{L}]$, L odd, arise only from the scattering of $(\text{NO}_3)^-$ they can be used to complete the detn. of the variable parameters for these anions. The detailed at. arrangement in cryst. $\text{RbUO}_2(\text{NO}_3)_3$ is shown for which $(\text{NO}_3)^-$ lie exactly in plane layers spaced $c/6$ apart. Centers of the anions (N atoms) occupy the positions $(1/3,0)$; $(0,1/3)$; $(2/3,2/3)$; and $(2/3,0)$; $(0,2/3)$; $(1/3,1/3)$, resp., in alternate layers perpendicular to the unique crystal axis. U atoms and $(\text{NO}_3)^-$ lie in the planes $z = 1/12, 1/4, 5/12, 7/12, 3/4, 11/12$, Rb⁺ and uranyl O atoms in planes $z = 0, 1/6, 1/3, 1/2, 2/3, 5/6$. Each Rb⁺ is equidistant from 12 $(\text{NO}_3)^-$ and 2 uranyl O atoms all at 3.14 Å, each uranyl O is equidistant from 12 nitrate O atoms, also at 3.14 Å, each U is equidistant from 6 nitrate O atoms at 2.27 Å, and all O-O contacts between neighboring $(\text{NO}_3)^-$ are greater than 3.2 Å. If $(\text{UO}_2)^{++}$ is linear, as indicated by the most direct interpretation of the data, and the bond distance is close to the estd. value, 1.58 Å, there is probably no appreciable shift from the ideal positions shown. Even if the bond distance is materially changed and $(\text{UO}_2)^{++}$ is appreciably "kinked" changes in $(\text{NO}_3)^-$ parameters must be small. The uranyl O atoms are "caged" by nitrate O in a manner which shows that appreciable kinking of $(\text{UO}_2)^{++}$ is very improbable. The dimensional relations indicate that a bond angle, O-U-O, as small as 150° is quite unlikely. The resultant force exerted on a bent $(\text{UO}_2)^{++}$ by its environment is large and tends to straighten it out. All of the pertinent data indicate that in this crystal $(\text{UO}_2)^{++}$ is substantially linear. The structure indicates also that a charge of at least two protonic units is associated with the U atom of $(\text{UO}_2)^{++}$.

- 2851 Hoard, J. L. and Stroupe, J. D. The Structure of Crystalline Uranium Hexafluoride. Declassified Oct. 7, 1946. 44p. (MDDC-427)

Cryst. UF_6 in the form of cylindrical single crystals sealed within thin-walled capillary tubes were studied by x-ray diffraction and optical methods. Analysis of the data has led to a complete detn. of the structure of the crystal of 25°C . The orthorhombic unit of structure has $a = 9.900$, $b = 8.962$, $c = 5.207$ Å, space group $D_{2h}^{16} - \text{Pnma}$, and contains four mols of UF_6 . The calcd. d. is 5.06 g/cc at 25°C . To a good first approximation the structure is based upon closest packing of F atoms and contains nearly regular octahedral UF_6 mols. U atoms occupy the positions 4(c) in the mirror planes of D_{2h}^{16} with the parameters $x = 0.1259 \pm 0.0005$, $z = 0.081 \pm 0.001$. Modified Fourier analysis of the (hk0) and (h0l) data lead to the positions for F atoms that are tabulated. The configuration of the UF_6 mol. in the crystal is seemingly not quite regular, although the indicated variations may be within the accuracy of the detn. It seems rather more certain that the mol. configuration within the crystal is not compatible with that derived by Bauer for mols. of the vapor. The structure found for the crystal is discussed also in connection with other phys. data which have been reported for cryst. UF_6 .

- 2852 Hodge, H. C. Introduction [to Pharmacology and Toxicology of Uranium Compounds]. July 1, 1946. Declassified Sept. 13, 1946. 37p. (MDDC-322)

A comprehensive description of the organization and allocation of responsibilities and function is given of the Univ. of Rochester Project, in which research in the pharmacology and toxicology of uranium compounds was performed. The following subjects are treated: history; importance of inhalation of dust; toxicology program; personnel, collaborating divisions from the Manhattan Dept. of the Univ. of Rochester; the usefulness of animal experimentation in the control of U poisoning; (1) toxicity of cpds., (2) acute toxic effects, (3) chronic toxic effects, (4) factors in fluencing toxicity, (5) the mechanism of toxic effects, (6) early detection of poisoning, (7) restriction of survey studies on humans, (8) prophylaxis, (9) treatment of U poisoning, (10) medical supervision, (11) max. allowable concn; and security regulations. (This information is also in Voegtlin and Hodge, Pharmacology and Toxicology of Uranium Compounds. New York, McGraw-Hill Book Company, Inc., 1949. Introduction.)

- 2853 Hodge, H. C. Summary. July 1, 1946. Declassified Sept. 13, 1946. 75p. (MDDC-323)

This report is a summary of the work performed at the Univ. of Rochester on the pharmacology and toxicology of uranium compounds. (It summarizes Voegtlin and Hodge, Pharmacology and Toxicology of Uranium Compounds. New York, McGraw-Hill Book Company, Inc., 1949, and appears in the book as the Historical Foreword.) Detailed comprehensive summaries are given for the following subjects: Part I: 1. Chemistry of uranium compounds. 2. Analytical methods. 3. Statistical methods. 4. Pathological methods of uranium poisoning. 5. Characteristics of uranium poisoning. 6. Toxicity following the parenteral administration of certain soluble uranium compounds. 7. Studies of the toxicity of various uranium compounds. 8. The toxicology of compounds of uranium following application to the skin. 9. The toxicology of compounds of uranium following application to the eye. 10. Toxicity following inhalation. 11. Distribution and excretion of uranium. 12. Tolerance to uranium poisoning. 13. The action of uranium on enzymes and proteins. 14. Catalasuria as a sensitive test for uranium poisoning. 15. The mechanism of action of uranium compounds in the animal body. 16. Studies in human exposures to uranium compounds. Part II. Fluorides. Part III. Special materials: 1. Boron compounds. 2. Fluorocarbons. 3. Respiratory protective devices.

- 2854 Hull, D. E. The Counting Method of Isotopic Analysis of Uranium. Declassified Oct. 18, 1946. 62p. (MDDC-387)

Since the rates of α particle emission/g of various U isotopes are greatly different, this provides a basis for a method of isotopic analysis of U. It consists in counting, under definite geometrical and elect. conditions, the no. of α particles emitted/unit time, from weighed quantities of U. The size and geometry of the sample required for accurate detn. of the activity of U is detailed as well as the various corrections for thickness and counting losses. Since one of the most important factors in attaining high accuracy in the counting of α particles from U was the prepn. of the sample in a thin, uniform film,

methods of electroplating thin films of U oxide on Pt were investigated. The compn. of the electroplated film is not sufficiently const. to give the desired accuracy in measurements of specific activity when the film is weighed, 0.3% being about the limit of accuracy. To avoid this difficulty, a quant. plating method has been worked out which eliminates the need of weighing the films. The influence of various conditions on the rate of plating and the character of the deposit have been studied, and optimum conditions for plating on Pt are given. Exptl. detns. of the effects of self-absorption of α particles in the film and of finite resolving time of the counter on the specific activity have been made. The effects of various factors on the accuracy of the measurements with quant. electroplated films are discussed. The conclusion is drawn (and is corroborated by exptl. tests) that the probable error of the electroplating method is 0.05%. If 1,000,000 α particles are counted from such a film, the accuracy of the detn. should be better than 0.1%, probable error.

2855 Ioffe, A. V. "Electrical Resistance of the Contact between a Semiconductor and a Metal." Fiz. Zhur. 10, 49-60(1946).

The contact resistance and potential of the semiconductor and a metal were investigated with currents in both directions. For the semiconductors Cu_2O , UO_2 , CuO , V_2O_5 , TiO_2 , ZnO , NiO , CdO , CdS , and Se it was found that, close to metal, there arises a considerable addnl. resistance when an electron semiconductor borders on a metal possessing a higher contact potential or when a hole semiconductor borders on a metal having a lower contact potential. The contact potentials were found to be independent of the temp. and of the specific cond. The cond. was estd. and its dependence on the p.d., temp., and current direction was studied. Feeble rectification was observed.

2856 Jensen, K. J. and Mundy, R. J. Analytical Chemistry of the Manhattan Project, Chapter XVIII. Nitrogen. Declassified Dec. 17, 1946. 17p. (MDDC-572)

The chief need for the detn. of N was in connection with the quality of U metal. In one connection or another, occasion arose for the detn. in its various states of oxidation in cpds. and mixts. Semimicro and micro modifications of the Kjeldahl procedure were utilized extensively; the final measurement was made either titrimetrically or colorimetrically with Nessler's reagent. In many instances the free HNO_3 content of U and Th nitrate solns. was required. The micro-Kjeldahl method is most commonly used for the detn. of N in U samples. The method was also applied successfully to Th samples. The results obtained are consistent and there has been fair correlation with results from the vacuum fusion method. Information is detailed under the following topics: methods of soln.; methods of detn. of nitride N; volumetric micro-Kjeldahl method; vols. of permanent std. solns. necessary to match colors of NH_4Cl stds.; macro-Kjeldahl method for U metal; method of detn. of nitrate N; macro reduction method; indigo carmine; methods of detn. of HNO_3 and nitrate; peroxide pptn. method; ferrocyanide pptn. method; procedure for Et_2O soln.; procedure for aq. solns. A list of 34 references is included. (This paper is also available in Rodden, Analytical Chemistry of the Manhattan Project. New York, McGraw-Hill Book Company, Inc., 1950. Chapter 3.)

2857 Jensen, K. J. and Weaver, B. Chromium, Molybdenum, and Tungsten. Chapter XXXIII. Analytical Chemistry of the Manhattan Project. Declassified Nov. 7, 1946. 24p. (MDDC-492)

Chromium. The most widely used method for detg. macro amts. of Cr on the Manhattan Project has been the reduction of Cr^{+6} with std. FeSO_4 soln. With various modifications it has been used for numerous kinds of samples, including many contg. U. In the procedure used at several of the labs., chromic ion is oxidized to Cr^{+6} in acid by ammonium persulfate in the presence of Ag^+ . The Cr is estd. by adding an excess of std. FeSO_4 soln. and back-titrating with std. permanganate or ceric sulfate, using the ferrous phenanthroline complex, ferroin, as an indicator. This procedure is subject to few interferences. However, any substance which is reduced by the FeSO_4 soln. and not reoxidized rapidly by the ceric sulfate will interfere. Some interference of this type, for example, Mn, can be eliminated by addn. of a reducing agent such as sodium azide or dil. HCl which preferentially reduces the permanganate. After the excess persulfate has been destroyed, sodium azide or dil. HCl is added and the soln. is boiled a short time. V is a disturbing element, since it is oxidized to the vanadate state $(\text{VO}_3)^-$ by the persulfate and reduced by the FeSO_4 to $(\text{VO})^{++}$. $(\text{VO})^{++}$ is slowly reoxidized to $(\text{VO}_3)^-$ by the ceric sulfate, causing a constantly fading end point. Although the titration to a permanent end point is possible, large amts. of V should be sepd. from the Cr. This can be done by pptg. V cupferrate from a strongly acid soln. with pH between 1.2 and 1.6. In the procedures involving titration with permanganate, V does not interfere. The production of an intense color by chromate with sym-diphenylcarbazide was first observed in 1900 and has been the subject of many investigations since that time. This very sensitive and selective reagent has been very widely used for the detn. of small amts. of Cr in U materials and process solns. Much work has been done at various project labs. in adapting this reagent to their special needs.

Molybdenum. Macro amts. of Mo can be detd. by both gravimetric and volumetric methods. The gravimetric methods commonly used include pptn. of the Mo as lead molybdate or Mo sulfide, or as the Mo complex of α -benzoinoxime. The lead molybdate ppt. is ignited and weighed as such while Mo sulfide or the Mo complex with α -benzoinoxime is ignited to the oxide and weighed. The volumetric detn. of Mo, after its sepn. as volatile $\text{MoO}_3 \cdot 2\text{HCl}$ or insol. Th molybdate and subsequent reduction in a Jones reductor, has been employed by the Ames group. The simultaneous titration of U and Mo was found to be unreliable. Colorimetric methods, based on the colored cpds. Mo forms in the presence of $(\text{CNS})^-$ and of phenylhydrazine, have been used. Procedures using the thiocyanate complex have been most common.

Tungsten. Tungsten is pptd. quantitatively by α -benzoinoxime. In a British method, this fact is used in the micro detn. of W. Mo and W are pptd. together with α -benzoinoxime, ignited, and fused with a flux. The melt is dissolved in H_2O and made acid with H_2SO_4 . A reducing agent (thioglycolic acid) and KCNS are added. The resulting colored Mo complex is extrd. with BuOAc and W is detd. in the remaining aq. soln. W is usually pptd. as tungstic oxide and weighed as such. For W-U alloys the Ames lab. obtained sufficiently accurate results by simply dehydrating the soln. with HClO_4 and igniting and weighing the pptd. oxide. In some cases where interfering substances such as chromates, molybdates, and sulfates are absent, W can be pptd. as mercurous tungstate and ignited to tungstic oxide. The blue color of the W complex with toluene-3,4-dithiol has been applied to the detn. of traces of W in U materials by a British group. This method requires a preliminary sepn. with α -benzoinoxime followed by removal of the Mo. (This paper is also available in Rodden, Analytical Chemistry of the Manhattan Project. New York, McGraw-Hill Book Company, Inc., 1950. Chapter 18.)

2858 Jorgensen, T. A Method of Making Thin Uranium Oxide Films on Platinum Foils. Jan. 31, 1944. Declassified Oct. 28, 1946. 5p. (MDDC-467)

A thin film of U_3O_8 is made on Pt by putting a mixt. of alc. $\text{UO}_2(\text{NO}_3)_2$ and lacquer on a plate which is slowly rotated during drying, after which the film is heated.

- 2859 Kahn, M. The Preparation of Thin U_3O_8 Films. Apr. 22, 1943. Declassified Dec. 10, 1946. 13p. (MDDC-1605)

In the course of different investigations on the radioactive properties of U it was necessary to prep. a thin uniform film of U_3O_8 on a Pt disk, so that the α particles emitted could have their full range outside of the U layer. Two different methods of forming thin films of U_3O_8 by electrodeposition and ignition were investigated. The method involving F^- (electrolysis of a $UO_2(NO_3)_2$ soln. that contains a small amt. of NaF) is considered the better method. The films are very satisfactory for α counting and the UF_4 deposition is quant. The method is very easy to carry out and requires little time. The method involving $KOH-K_2CO_3$ mixts. shows very good possibilities. The deciding factor is the K_2CO_3 concn. which could be easily detd. by expt.

- 2860 Karunakaran, C. and Neelakantam, K. "Uranium Minerals from Nellore District." J. Sci. Ind. Research (India) 5, 36(1946).

The Ra content of U minerals from the Nellore district, India, compares favorably with that of ores from Colorado and Katanga, Belgian Congo. Study of a radioactive mineral recently collected indicates that it is probably samarskite.

- 2861 Kiess, C. C., Humphreys, C. J., and Laun, D. D. "Preliminary Description and Analysis of the First Spectrum of Uranium." J. Research Natl. Bur. Standards 37, 57-72(1946). (Research Paper No. 1729)

Observations of the arc and spark spectra of U afforded a sepn. of the lines of neutral atoms from those of ions. A list of more than 9000 lines with accurate wavelengths, wave numbers, and estd. intensities, for the region 2900 to 11,000 A, has been compiled. About 2000 of these lines have been classified as combinations between 18 low and metastable odd energy levels with about 280 high even levels. Well-resolved Zeeman patterns give g values for several low levels that identify them as components of 5L , 5K , 7M , and 7K terms arising in the electron configurations f^3ds^2 and f^3d^2s . The spectrum of U is interpreted as that of a rare-earth element analogous to Nd, U being the third member of a second group of rare earths beginning with Th. From the fact that U is easily ionized in electric arcs and magnetic fields, and also that the short-wave limit of the observed spectrum does not extend below 2900 A, it is concluded that the ionization potential of neutral U atoms is approx. 4 v.

- 2862 Kohn, M. "Detection of Uranium by Potassium Ferrocyanide." Chemist-Analyst 35, 52-3(1946). The formation of brown $(UO_2)_2[Fe(CN)_6]$ is prevented by the presence of acetates, oxalates, and tartrates as a result of the formation of uranyl complexes. The addn. of these anions will cause the brown color to disappear in testing for U on the spot plate.

- 2863 Kolthoff, I. M. and Harris, W. E. "The Polarography of Uranium. II. Polarography in Strongly Acid Solution." J. Am. Chem. Soc. 68, 1175-9(1946).

Previous measurements on the polarography of U^{+6} yielded two reduction waves, corresponding to the reductions U^{+6} to U^{+5} and to U^{+3} respectively. The first diffusion current increased with H^+ , and two alternative interpretations of this are given, involving a disproportionation of the $(UO_2)^+$, or formation of unreducible UO_2OH . Reasons for adopting the former hypothesis are given. It has been found that R increases with increasing [U] in 2M HCl, where R = ratio of the reduction of U to U^{+3} and U^{+5} resp. An increasing potential caused an increasing current at the Hg electrode; for a given concn. of U, the rate of U^{+5} decompn. increased with increasing pH, and with increasing temp. The retardation of the decompn. of U^{+5} , due to an excess of U^{+4} , has been evidenced polarographically. Change in drop time did not affect the U^{+5} decompn., and complex formation with various ions is found to increase the value of R.

- 2864 Landau, R., Birchnall, D. E., Joris, G. G., and Elgin, J. C. Absorption in a High Molecular Weight Non-Aqueous System. Uranium Hexafluoride in Heavy Oil. June 5, 1946. Declassified July 16, 1946. 42p. (MDDC-152).

In connection with the industrial design of a system for the absorption of UF_6 from inert gases (mol. wt. 352) by a special heavy oil (mol. wt. 750), an attempt was made to check the validity of established

techniques of calcn. (modified to some extent) by a limited exptl. program. Making use of the generally accepted theory and extrapolating the data available for the common absorption systems, the performance to be expected in the present system was first predicted. The exptl. study in a small-scale packed tower followed. Since the mol. wts. and associated properties for this nonaq. system differed very widely from published data for other systems (mostly aq.), and since the temp. of operation (200°F) was also beyond the range of most available data, it was felt that the results of this study would provide a severe critique of existing design methods and lend some confidence to their use in similar cases in the future. This paper presents a summary of the results obtained in graphical and tabulated form. In the countercurrent absorption of gases by liqs. or the reverse operation of stripping, it is generally assumed that the controlling mechanism (in the absence of chem. reactions) involves diffusion across two stagnant fluid films at the phase interfaces, these films being gas and liq. The quant. application of the 2-film theory of absorption has been described in the literature. If information is available to permit calcns. of the individual film resistance, then the over-all coeffs. may be calcd. for various conditions and the app. properly designed. If Henry's law does not hold, then the equation can only be used differentially at points in the app. Sufficiently good agreement between theory and expt. have been obtained to suggest that the design technique employed in this paper may be of considerable value in the absence of direct data, but that a substantial amt. of coordinated work is still required to establish engineering design of absorption and stripping equipment on a sound and accurate basis. There is also encouraging evidence that small-scale expts. can be extrapolated to plant-scale operation if the underlying correlations can be strengthened along the lines suggested. (This information is also available in Benedict and Williams, *Engineering Developments in the Gaseous Diffusion Process*. New York, McGraw-Hill Book Company, Inc., 1949. Chapter 7.)

- 2865 Lel'chuk, S. L., Vaskevich, D. N., Belen'kaya, A. P., and Dashkovskaya, F. A. "Kinetics of the Direct Esterification of Alcohol. I. Effects of Promoters on the Reaction Velocity." *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 191-200(1946).

Only elements of the 4th and 6th group of the periodic system promote the Cu catalysis of the esterification. Elements of the 8th group have little effect, as they promote decompn. of AcH into CO and CH_4 . For elements of the 3rd group, the yield of ester increases linearly with the at. no. For each catalyst including U, the yield at 275° for several reactions, and the primary yields are given.

- 2866 Lilly, R. C. A Non-Gravimetric Method for the Determination of Uranium on Platinum Discs. Declassified Nov. 1, 1946. 18p. (MDDC-430)

A volumetric method is described, for the detn. of U on Pt disks, which does not involve direct weighing of the deposited film. A statistical analysis of the results obtained indicates that the procedure is more consistent than that based on a gravimetric method and offers a relatively quick and convenient means for obtaining U assay results where an accuracy of approx. 99% is desired.

- 2867 Livingston, R. Minimum Hydrogen Peroxide Concentration Required for Precipitate Formation from 50 Per Cent Uranyl Salt Solutions. Declassified Nov. 22, 1946. 2p. (MDDC-493)

36 tests were carried out simultaneously in 3 ml corked pyrex test tubes at room temp. In each test 2 ml of the 50% (UO_2)⁺⁺ soln. was placed in the tube and the proper vol. of 70% HNO_3 or 96% H_2SO_4 was added to give the % by wt. of additional acid indicated in the table. Chem. analysis showed that the UO_2SO_4 soln. initially contained 0.26% free H_2SO_4 , while a less satisfactory analysis of the $\text{UO}_2(\text{NO}_3)_2$ indicated essentially no free acid. Six dilns. of "Superoxol" H_2O_2 soln. were standardized iodometrically for H_2O_2 . H_2O_2 was introduced into the test soln. by addn. of 0.1 ml of one of the dild. H_2O_2 solns. to give the concns. indicated in the table. In each case, a ppt. formed (sometimes only momentarily) on addn. of H_2O_2 , due to local satn. Results are given after the tubes had been shaken and allowed to stand for 3 hrs. After several days the only change noted was a decrease in the opalescence in some of the tubes accompanied by the formation of more ppt. The results indicate that the threshold concn. of H_2O_2 for ppt. formation is higher for nitrate than for sulfate, and is raised by the addn. of acid.

- 2868 Lizarralde, O. P. "Recovery of the Uranyl Cation of the Barber and Kolthoff Reagent for Determining Sodium." *Anales asoc. quim. argentina* **34**, 90-2(1946).

Conc. the filtrates by evapn., add 4 g/l of NH_4Cl , heat to 70 to 80°, ppt. $(\text{NH}_4)_2\text{U}_2\text{O}_7$ by an excess of NH_4OH , decant off the liq., wash the ppt. with considerable dil. NH_4OH , allow to settle, repeat the washing 6 or 7 times to remove org. matter, filter, dry in a porcelain capsule, decomp. in a muffle at 300 to 320°, cool, make up to a paste with 10% H_2O_2 , heat to 300 to 320°, repeat to obtain orange-red UO_3 contg. Zn uranate. Det. the Zn contamination by dissolving 1 g of the UO_3 in an excess of dil. H_2SO_4 , ppt. $(\text{NH}_4)_2\text{U}(\text{NH}_4)_2\text{U}_2\text{O}_7$ by NH_4OH , filter, and wash with dil. NH_4OH contg. a few drops of H_2SO_4 . Retain the filtrate, dissolve the $(\text{NH}_4)_2\text{U}_2\text{O}_7$ in dil. H_2SO_4 , and reppt. Det. Zn in the combined, evapd. filtrates by $\text{K}_4\text{Fe}(\text{CN})_6$ titration.

- 2869 McBrady, J. J. and Livingston, R. "The Formation of Quadrivalent Uranium during the Uranyl-Sensitized Photochemical Decomposition of Oxalic Acid." *J. Phys. Chem.* **50**, 176-90(1946).

The concns. of uranous salts in uranyl sulfate-oxalic acid solns. irradiated with actinic light were measured down to 10^{-7}M by an optical method. The quantum yield for the irreversible formation of U^{+4} , in the absence of air, was given by the relation

$$\phi = \frac{0.0136 (\text{H}^+)}{0.0455 + (\text{H}^+)} + \frac{0.63 (\text{U}^{+4})}{(\text{H}^+)}$$

With the UO_2SO_4 and $\text{H}_2\text{C}_2\text{O}_4$ at 0.0100M and 0.050M, resp. (Leighton and Forbes), this side reaction amts. to 1% of the total reaction. U^{+5} was not found. A mechanism has been proposed. The extinction coeffs. of uranyl and uranous salts were detd. over the entire visible range, with the strongest absorption band of uranous ion located at 650 m μ .

- 2870 McBrady, J. J. and Livingston, R. "A Preliminary Study of the Photochemical System Uranyl-Iodide." *J. Phys. Chem.* **50**, 339-45(1946).

A deaerated soln. contg. UO_2SO_4 and KI with no added acid was illuminated. I_2 and U^{+4} formed. A thermal back reaction caused the rate of formation of I_2 to decrease with time, and a steady-state concn. of a few micromoles of $\text{I}_2/1$ was reached in a few mins. This dark reaction resulted in the complete disappearance of I_2 after the illumination stopped; it was 1st order with a rate const. of 0.015 sec $^{-1}$. With air present the disappearance was incomplete, probably because of air oxidation of U^{+4} . The quantum yield for I_2 formation was approx. 0.002. Reaction mechanisms are discussed.

- 2871 Macmahon, P. S. and Srivastava, T. N. "Photoreaction between Iodine and Salts of Carboxylic Acids in Presence of Metal Ions as Catalysts." *J. Indian Chem. Soc.* **23**, 261-9(1946).

With the reagents carefully purified, no appreciable reaction was found to take place between I_2 (in the presence of KI) and the Na salts of certain carboxylic acids up to 40° (e.g., acetic, maleic, citric, and glyceric). However, on the addn. of traces of Mn^{++} , Cr^{+3} , Fe^{+3} , Co^{++} , $(\text{UO}_2)^{++}$, and Ce^{+3} reaction was immediately promoted in the presence of light. Carboxylic acids contg. no $[\text{OH}]$ groups did not react with I_2 in light in the presence of a catalyst, except in the case of Mn^{++} . Mn^{++} and Cr^{+3} were the most effective catalysts. The order of effectiveness of the metal catalysts was unaffected by changes of concn. of reactants, changes in temp., pH, or nature of the cation. In all cases, the end products were simple oxidation products or iodination cpds. and the end solns. contained the metal in a higher state of valency than originally used.

- 2872 MacNider, W. deB. "The Inability of Vitamin B Complex as Liver Extract to Protect the Kidney against the Toxic Action of Uranium Nitrate." *J. Pharmacol. Exptl. Therap.* **88**, 323-6(1946).

Animals intoxicated by 3 mg/kg of U nitrate afford evidence of a decrease in their oxidizing capacity as indicated by a glycosuria, the appearance of acetone and diacetic acid in the urine, and by a reduction in the reserve alk. of the blood. The intramuscular injection of 0.25 ml of vitamin B complex as liver extract (Lederle) had no influence in decreasing the toxic action of U nitrate when such injections were made every other day for 12 days prior to the use of the U and during the course of the intoxication.

- 2873 MacNider, W. deB. "Influence of an Alkaline Solution on Tissue Toxicity of Uranium Nitrate." Proc. Soc. Exptl. Biol. Med. **63**, 84-5(1946).

The investigation indicates that the use of an alk. soln. decreases the toxicity of U nitrate for certain tissues not by acting in any specific fashion in one or more intracellular systems but by maintaining such a normal reaction in terms of intracellular environment that various life processes within cells can function in a manner which approaches the normal.

- 2874 Mather, K. B. "Spectrographic Analysis of Uranium." J. Proc. Roy. Soc. N. S. Wales **80**, 187-95(1946).

This is a review of spectrographic methods. Data on equipment used, selection of U lines and interfering lines are given. From the position of U in periodic table it can be predicted that the strongest line of the U arc spectrum will appear somewhere between 4500 and 3500 Å.

- 2875 Maynard, E. A. and Hodge, H. C. Studies of the Toxicity of Various Uranium Compounds when Fed to Experimental Animals. July 1, 1946. Declassified Aug. 26, 1946. 119p. (MDDC-263)

In 30-day feeding expts. the only organ to show damage was the kidney. UO_2 , U_3O_8 , and UF_4 were non-toxic, while UO_3 , uranyl acetate, UO_4 , UCl_4 , UO_2F_2 , and $\text{UO}_2(\text{NO}_3)_2$ were toxic. Food intake in feeding expts. reached min. values in 5 to 12 days when 2% $\text{UO}_2(\text{NO}_3)_2$ was added to the diet. Expected mortalities occurred. Animals fed on a U-contg. diet showed growth inhibition when compared to animals on a normal diet. (This information is also available in Voegtlin and Hodge, Pharmacology and Toxicology of Uranium Compounds. New York, McGraw-Hill Book Company, Inc., 1949. Chapter 7.)

- 2876 Mott, N. F. "Supraconductivity of Rhenium and Uranium." Nature **158**, 861-2(1946).

A survey of superconductivity by Justi, who found that Re becomes superconductive at 0.90°K and U at 1.25°K, was presented at the Göttinger meeting of the German Physical Society.

- 2877 Myerson, A. L. and Eicher, J. H. The Viscosity of Gaseous Uranium Hexafluoride. Declassified Aug. 21, 1946. 37p. (MDDC-494)

A series of expts. was undertaken to investigate the reason for the large (10 to 20%) discrepancies between values of the viscosity of UF_6 gas reported by Fowler in the United States and by Llewellyn, Swaine, and Roberts in Great Britain. All investigators used the method of capillary flow to measure the ratio of the viscosities of UF_6 and air. It was found that with small-diameter metal capillaries, the apparent value of this ratio may vary with Reynolds number down to 10. The values finally detd. in the range 40 to 200°C agree well with those of Llewellyn, Swaine, and Roberts.

- 2878 Nag-Chowdhury, B. D. and Mousuf, A. K. "The Estimation of Uranium and Thorium from the β -Radioactivity of Minerals." Proc. Natl. Inst. Sci. India **12**, 341-9(1946).

U and Th in ores was detd. by a semiempirical method based on measurement of activity of the daughter elements with an ionization chamber used with a Dubridge and Brown circuit (as modified by Nag, Das, and Dasgupta) and a Leeds and Northrup type R galvanometer. With $R = 5 \times 10^{11}$ ohms, the current sensitivity was 2×10^{-15} amp/mm. For a mineral contg. p g U and q g Th/g sample, the ionization currents with Al absorbers of thickness t and t' are given by

$$I = pI_{\text{OU}} \times e^{-\mu t} + qI_{\text{OTh}} \times e^{-\mu' t}$$

and

$$I' = pI_{\text{OU}} \times e^{-\mu t'} + qI_{\text{OTh}} \times e^{-\mu' t'}$$

where I_{OU} and I_{OTh} are, resp., the ionization currents due to 1 g U and 1 g Th when no absorber is used. By comparison of the absorption curves of mineral samples with those of samples of known U and Th contents, the U and Th contents of the former can be calcd. Samples were prepd. by grinding and screening the minerals, placing a paste of the powder mixed with alc. on a circular area of a weighed Al plate, drying, and reweighing the plate. Several approximations are involved. Self-absorption is neglected, but its effect is minimized by the method of sample prepn. γ radiation is neglected, and its effect is minimized by using an air chamber (described in detail) designed to reduce absorption of γ and the effects due to a pair production and photoelectrons. The U and Th contents (in %) of samarskite, thorianite, and pitchblende were found to be resp., 4.03 ± 0.1 , 1.00 ± 0.1 ; 21.16 ± 1.1 , 60.24 ± 2.0 ; and 65.3 ± 1.2 , 7.23 ± 0.4 . The results for pitchblende are in good agreement with those of Nag-Chowdhury et al., i.e., 20.1 and

61.9. The method was found rapid and reliable for minerals in which the total radioactive content is above 1%.

2879 Neuman, W. F. Chapter XI. The Distribution and Excretion of Uranium. July 1, 1946. Declassified Aug. 26, 1946. 54p. (MDDC-264)

Within the limits of the data on hand, a provisional, general synthesis of the fate of U^{+6} in the animal body is made. A simplified diagram of the events which presumably take place is given. (a) U enters the blood stream via all routes of administration. (b) In the blood stream, U exists in two forms: a non-diffusible complex with the plasma proteins, and a diffusible complex with bicarbonate which are in reversible equil. with each other. (c) The bicarbonate complex enters the extracellular fluid bathing the soft tissues, but it either does not penetrate the cells, or, if it does, is not "fixed." It therefore reenters the circulation. (d) The bicarbonate complex is filtered by the kidney glomeruli. If the blood level of bicarbonate is increased there is a relatively greater proportion of the U present as the diffusible bicarbonate complex; therefore, the rate of filtration of U is increased. If the alk. reserve is high and a significant concn. of bicarbonate remains in the urine leaving the kidney, little U will combine with the protein surfaces of the tubules; most will be eliminated or reabsorbed. Conversely, if all of the bicarbonate is reabsorbed by the renal tubules, more of the filtered U will 'stick' to the tubules, thereby damaging cell surfaces; less will be excreted and less reabsorbed. (e) At the same time these events are taking place in the kidney, the bicarbonate complex filters into the fluid bathing the bone. The mechanism whereby U is deposited in bone is not clear. (f) In alkalosis, the distribution is shifted; less U is deposited in kidney, more is excreted in the urine. In acidosis, more U is deposited in kidney, less is excreted in the urine. (g) Young animals, because of the extensive circulation throughout the skeleton, deposit more of the dose in the bone system than do adults. From the toxicological standpoint, the pharmacology of U^{+4} is less important than the pharmacology of U^{+6} . Primarily, this difference in pharmacological importance is due to the difference in chem. properties of the two forms. Because of its protein affinity U^{+4} cannot pass a semipermeable membrane. It is believed, therefore, that little U^{+4} can enter the animal body except by direct injection. The distribution of U^{+4} was found to be quite similar to that of U^{+6} . The one marked difference noted was that U^{+4} accumulated in the livers of the injected animals. (Also in Voegtlin and Hodge, Pharmacology and Toxicology of Uranium Compounds. New York, McGraw-Hill Book Company, Inc., 1949. Chapter 11.)

2880 Ney, E. P. and Armistead, F. C. The Self-Diffusion Coefficient of Uranium Hexafluoride. Declassified Sept. 10, 1946. 18p. (MDDC-352)

A method is reported for measuring the self-diffusion coeff. of a vapor by observing with a mass spectrometer the rate at which material enriched in one isotope diffuses into normal material in an app. of known geometry. A value of D, the diffusion const., was obtained for UF_6 at 30°C. Knowledge of the viscosity together with the consts. reported here allow calcn. of the mol. force law. (This paper is also available in Phys. Rev. (2), 71, 14-19(1947).)

2881 Nichols, A. R. Jr., and Gropp, C. Absorption Spectra of Uranium Compounds in Aqueous Solution. Declassified Oct. 28, 1946. 19p. (MDDC-435)

The absorption spectra of aq. solns. of UCl_4 , UBr_4 , UI_4 , $U(SO_4)_2$, and uranous perchlorate have been recorded. All show main absorption bands centering at 650, 550, 495, and 430 m μ , although the sulfate shows minor differences from the others. The spectrum of ammonium uranous oxalate and that of an unknown fluoride-chloride complex were found to be similar to those of the other uranous solns., but displaced appreciably in wavelength. Spectra of UCl_3 , UO_2Cl_2 , and the uranyl carbonate complex are shown for comparison.

- 2882 Nichols, A. R. Jr. Autoxidation of Uranous Salts in Water Solution. Declassified 1946. 25p. (MDDC-436)

In the autoxidation of aq. UO_2Cl_2 , there is a decrease in pH and an O uptake which is in agreement with the equation: $2\text{U}^{+4} + 2\text{H}_2\text{O} + \text{O}_2 = 2(\text{UO}_2)^{++} + 4\text{H}^+$. The rate of autoxidation in solns. contg. 0.06 mole U^{+4} is appreciably increased by the addn. of as little as 0.00002 mole of Cu^{++} . At Cu^{++} concns. from 0.001M to 0.2M, the rate is proportional to the 0.82 power of the Cu^{++} concn. The autoxidation is first order with respect to O, while in the presence of Cu, the reaction is first order with respect to U. The rate is decreased by H^+ , Cl^- , and $(\text{SO}_4)^{--}$, while Co^{++} , Cr^{+3} , Fe^{+3} , and $(\text{UO}_2)^{++}$ have little or no effect.

- 2883 Nier, A. O., Stevens, C. M., Abbott, T. A., and Pickard, J. K. Recording Ionization Chamber for Traces of Radioactive Gases. Apr. 22, 1946. Declassified June 14, 1946. 12p. (MDDC-63)

A recording ionization chamber is described which has been used for the measurement of low concns. of UF_6 in mixts. of N_2 and O_2 . The chamber is constructed of noncorrosive material and designed to minimize the effect of radioactive contaminants which accumulate on the surfaces. Performance data are given. With UF_6 having normal isotopic concn., one ppm can be measured; for UF_6 enriched in U^{235} the sensitivity is increased correspondingly. (This paper is also published in Benedict and Williams, Engineering Developments in the Gaseous Diffusion Process. New York, McGraw-Hill Book Company, Inc., 1949. (p.14-21))

- 2884 Nye, R. D. and Demorest, D. J. Method of Extracting Uranium, Radium, and Vanadium from Their Ores. May 4, 1946. (U. S. Patent 2,442,429)

A method of treating ores contg. U, V, and Ra is described. The ores are reduced mechanically to a relatively fine state, and the reduced ores treated with a soln. of an alk. carbonate. Heat and agitation are used to ensure the complete dispersal of the Ra and U. The treated ores and solns. are washed with upward flowing currents of H_2O to sep. the soln., suspended fines, and floating slimes from a residue of coarse sand grains. The washed soln. and its fines and slimes are treated with an acid sulfate until the soln. is acid. A soln. of a metallic salt is then added to ppt. an insol. sulfate form of the metallic component of the salt and to take suspended fines and slimes out of soln., thereby leaving a clear supernatant soln. and a sludge ppt. The clear supernatant soln. is sepd. from the ppt. mechanically. The supernatant soln. is then treated with a caustic to ppt. concns. of U, Ra, and V cpds. and to produce an alk. soln. The basic soln. is reactivated for reuse in the washing of the treated ores. The sludge ppt. is combined with the residue of coarse sand grains for further concns. of the remaining V content by salt roasting.

- 2885 Orcutt, J. A. Pharmacology and Toxicology of Uranium Compounds. Chapter VIII. The Toxicology of Compounds of Uranium Following Application to the Skin. July 1, 1946. Declassified Aug. 26, 1946. 70p. (MDDC-266)

$\text{UO}_2(\text{NO}_3)_2$, UO_2F_2 , UCl_5 , UO_3 , $\text{Na}_2\text{U}_2\text{O}_7$, and $(\text{NH}_4)_2\text{U}_2\text{O}_7$ may be absorbed through the skins of exptl. animals to a sufficient extent to cause severe poisoning and death. U has been found in the blood stream of rats following the dermal exposure to $\text{UO}_2(\text{NO}_3)_2$. UCl_4 was also found to produce poisoning following application to the skin, but it is believed that oxidation to U^{+6} is necessary before significant absorption will take place. The insol. oxides (UO_2 , UO_4 , and U_3O_8) and UF_4 caused no signs of poisoning following application to the skin. Rabbits, rats, guinea pigs, and mice, in order of decreasing susceptibility, were poisoned by dermal exposure to $\text{UO}_2(\text{NO}_3)_2$. Species differences were significant, there being more than a hundredfold difference in the LD_{50} of rabbits and mice. Although the size of the dose required to produce poisoning varied among species, the general cause of poisoning was the same for all. In the case of rabbits, by the second day following acute exposure, the mean urinary protein was significantly pos. and a few deaths had occurred. On the third day, the mean nonprotein N of the blood became significantly elevated. On the fifth day, urinary protein had reached a max., blood nonprotein N was very high, the mean body wt. had dropped significantly, and mortality was highest. The mean nonprotein N reached a max. on the 9th day, when body wt. was also maximally depressed and the mortality was still relatively high, but the mean urinary protein had fallen to only slightly pos. values. Following the 10th day, mean values for all toxicological manifestations began to decrease rapidly and were essentially 'normal' by the 18th day following exposure, after which no deaths were observed. Although blood non-protein N detns. were not made for the other species, the pattern of urinary protein, body wt., and

mortality were essentially the same as for rabbits. The details of minor differences are indicated. Renal damage, characteristic of U poisoning, was observed microscopically in all of the animals that died and were examined. Survivors that had shown signs of severe poisoning, but had recovered, were found to have little histological evidence of renal damage, suggesting a remarkable ability for repair. Repeated dermal exposures resulted in the toleration of cumulative doses that would have been quite lethal if applied as single exposures. Signs of poisoning in the survivors gradually disappeared or lessened, after some time, even though the repeated exposures were cont., suggesting an acquired tolerance in survivors. $\text{UO}_2(\text{NO}_3)_2$, UCl_5 , and UCl_4 produced a mild to moderate, though transient, local irritation of the skin. A no. of detergents and "protective coatings" were studied in an attempt to prevent the percutaneous absorption of $\text{UO}_2(\text{NO}_3)_2$ but none proved to effect any significant protection. NaHCO_3 or $\text{Na}_2\text{CO}_3 + \text{H}_2\text{O}_2$ in aq. soln. was found to be most effective in removing toxic cpds. of U from the cotton clothes of workers. (This paper is also available in Voegtlin and Hodge, Pharmacology and Toxicology of Uranium Compounds. New York, McGraw-Hill Book Company, Inc., 1949. Chapter 8.)

- 2886 Orcutt, J. A. Pharmacology and Toxicology of Uranium Compounds. Chapter IX. The Toxicology of Compounds of Uranium Following Application to the Eye. July 1, 1946. Declassified Aug. 26, 1946. 8p. (MDDC-265)

The eyes of rabbits exposed to $\text{UO}_2(\text{NO}_3)_2$, UO_2F_2 , UO_3 , $\text{Na}_2\text{U}_2\text{O}_7$, $(\text{NH}_4)_2\text{U}_2\text{O}_7$, UCl_4 , UCl_5 , UF_4 , UO_2 , UO_4 , and U_3O_8 were studied. Moderate to severe local lesions and systemic poisoning were produced in most cases. (This paper is also available in Voegtlin and Hodge, Pharmacology and Toxicology of Uranium Compounds. New York, McGraw-Hill Book Company, Inc., 1949. Chapter 9.)

- 2887 Patterson, J. H., Vaslow, F., and Warf, J. C. The Determination of Trace Uranium in Thorium and in Monazite. Apr. 1, 1946. 7p. (CC-3254)

The method of Weissman and Duffield for detg. ppm. amts. of U in Th was used, with modifications. The original method consisted of two Et_2O extrns. followed by evapn. of the extr. with H_3PO_4 and observation of the intensity of the characteristic U fluorescence. The method was modified by the authors to include an oxalate pptn. which removed the Th quantitatively and extended the range of the method down to 0.1 ppm. An adaptation of the method was used for detg. U in monazite, whose dissolution was effected by pretreating with anhyd. HF at 600° , followed by pyrohydrolysis at 1000° , and finally dissolving in HNO_3 contg. traces of sodium fluosilicate.

- 2888 Peiser, H. S. and Alcock, T. C. X-Ray Powder Patterns of Some U Metal Compounds. March 19, 1945. Declassified Oct. 2, 1946. 7p. (BR-589)

X-ray patterns are given in tabular form for UC, UCl_4 , UF_3 , UF_4 , UO_3 , U_3O_8 , UO_2F_2 , and U nitride. A discussion of structure of UC and a proposed new value of the metallic radius of the U atom is included.

- 2889 Prescott, C. H. Jr., Reynolds, F. L., and Holmes, J. A. The Preparation of Uranium Metal by Thermal Dissociation of the Iodide. April 18, 1946. Declassified Nov. 1, 1946. 22p. (MDDC-437)

Conditions are given for the formation of U metal on a hot W filament from UI_4 . The UI_3 is heated in the presence of I_2 at 800°K forming UI_4 which is subsequently decompd. on the filament to U metal and I_2 or to UI_3 and I_2 at temps. slightly below the m.p. (1330°K) of U. Equil. conditions are assumed and a thermodynamic presentation is given involving conditions at the reaction vessel surfaces and at the hot filament surface. Exptl. and estd. values of the free energy change for the reaction $\text{UI}_3(\text{g}) = \text{U}(\text{l}) + 3\text{I}(\text{g})$ are given at three temps., their difference amounting to only 6.5 kcal. A bibliography of the literature and patent issues pertaining to the method is included.

- 2890 Priest, H. F. and Priest, G. L. Colorimetric Method for Determination of Uranyl Ion. June 30, 1943. Declassified June 28, 1946. 7p. (MDDC-175)

In carrying out analyses for U in corrosion products by existing methods such as ignition to the oxide, silver reductor, or titration with ceric sulfate, it became apparent that a rapid, fairly accurate method for detg. $(\text{UO}_2)^{++}$ would be of great value. The most logical color to use is that given by the ferrocyanide complex, but it proved to be unsatisfactory. Sodium salicylate also gives a color which has been used with some success, but its color appears to fade and is not very sensitive. A similar cpd., sodium cresotate, was found to give a stable orange-red color and is the reagent used. The method for prepg. this reagent is described. Procedure for an unknown sample. One-fifth of the amt. of soln. which is to be dild. in a 50-ml volumetric flask is placed in a test cell in the colorimeter and diluted to 5 ml. Re-agent is added dropwise from a microburet until the max. color is developed as evidenced by the colorimeter reading. Approx. five times this amt. of reagent is thus necessary for the soln. being prepd. in the volumetric flask. A precision of 2% or better can be obtained with this method.

- 2891 Priest, H. F. Preparation of Uranium Pentafluoride. May 24, 1943. Declassified June 25, 1946. 5p. (MDDC-177)

The reaction was carried out in a Cu reactor, which held 100 g of UF_4 in a removable tray. The reactor was fitted with valves and a bolted flange cover for easy removal of product. The tray was filled with UF_4 and placed in the reactor, and the cover was bolted in place, using an Al gasket. It was heated to 250°C in a stream of F_2 until there was a strong evolution of UF_6 . The valves were then shut, and the reactor allowed to cool. When at room temp. the reactor was evacuated using a cold trap until no more UF_6 could be removed. The valve was closed and the reactor placed in a dry box, which was then thoroughly flushed with dry N_2 . When the atm. in the box was dry, the reactor valve was opened to admit dry N_2 to the reactor, and the reactor cover was removed. The material was transferred to a glass tube with a tight cap and placed in a desiccator. On some preps. the pumping off of the excess UF_6 was done after transfer to glass. The UF_5 reacts very rapidly with moist air and can be handled only in a good dry box. It is light gray in color and appears to be isomorphous with UF_4 .

- 2892 Priest, H. F. The Vapor Pressure of Uranium Hexafluoride in Equilibrium with Uranium Pentafluoride. June 8, 1943. Declassified June 25, 1946. 7p. (MDDC-181)

The pressure was measured with a Syphon-bellows-type null-point gauge which had a 3-m optical lever so that 2 cm on the scale corresponded to 0.1 mm pressure. The UF_5 was put in a Pt thimble which was placed in the glass tube fitted with a std. taper joint. This joint was put together dry and sealed on the outside. A glass thermocouple well extended down into the thimble, and a calibrated Cu-constantan thermocouple, the cold junction of which was in an ice bath, was used for measuring the temp. The glass tube contg. the thimble was connected to the pressure device, and a side arm fitted with a Ni valve was used to connect the whole to vacuum system. The pressure was read on a monometer with an invar scale, using a mirror reading device to obviate reading errors. Each point was checked several times with the UF_6 being pumped out between runs. In each run a small side arm on the system was cooled in liq. air and sealed off. The material obtained was checked qualitatively, and in each case was definitely UF_6 . Freezing down in this fashion always dropped the pressure to 0.00 mm, indicating that there were no non-condensable gases. Two runs were made and averaged. The data are shown in the table below.

$^\circ\text{C}$	P(mm Hg) Run I	P(mm Hg) Run II	P(mm Hg) Av.
128.5	1.6	2.0	1.8
165.2	11.2	11.2	11.2
192.5	31.8	31.8	31.8
197.0	37.1	37.3	37.2
215.3	65.95	65.65	65.8

- 2893 Priest, H. F. Measurement of Density of Liquid UF_6 . Mar. 29, 1942. Declassified Aug. 16, 1946. 3p. (MDDC-176)

A tube was constructed, and after being cleaned, the stem was calibrated with H_2O and then with Hg at 27.5° using a thermostat and a precision cathetometer. The bottom of the tube was chosen as the reference point. The two methods of calibrating gave points all falling on the same line. The total vol. up to the place marked "seal-off point" was detd. using H_2O . The total wt. of the tube and ground joint was detd., and it was then fastened to a vacuum system by means of the joint using "Apiezon W" over the top of the joint as a seal. It was outgassed at 10^{-5} mm Hg for two days with frequent flaming and then 5.5919 g of resubld. UF_6 was subld. into the tube. It was sealed off at the seal-off point and weighed. The ground joint was removed and weighed after cleaning. This gives an accurate wt. of UF_6 by a difference method. The bulb was then completely immersed in a bath at 65.1°C measured with a National Bureau of Standards thermometer. The height of the column of liq. as measured with a cathetometer was 10.875 cm. This brought the meniscus just into the divergent portion of the stem. A correction was made for this by measuring the conical section thus introduced, 0.030 cm^3 . The vol. of the liq. was 1.491 cm^3 . The vol. of satd. vapor was 6.364 cm^3 which then corr. to std. conditions is 7.780 cm^3 . This corresponds to 0.1222 g of UF_6 leaving 5.4697 g as liq. The d. then is $3.667 \pm 0.05\text{ g/cm}^3$.

- 2894 Priest, H. F. The Measurement of the Surface Tension of UF_6 at Two Temperatures. Aug. 1, 1942. Declassified Dec. 20, 1946. 4p. (MDDC-573)

The purpose of the work described was to det. the degree of normality of the surface tension of liq. UF_6 . For that reason, in the interest of saving time, the measurement was made with no attempt at great precision. The capillary rise method was chosen as the simplest method for use with a closed system, the surface tension being calcd. according to the following equation: $s = \frac{1}{2}kdgr$; s = surface tension; h = height of capillary rise in cm; d = density of liq.; g = acceleration of gravity 980 cm/sec^2 ; r = radius of capillary in cm. App. and exptl. procedures are detailed and the results are tabulated. Comparison of the surface tension of UF_6 with that of such liqs. as CHCl_3 and C_6H_6 shows a value very similar to that for these liqs. Furthermore the temp. coeff. indicates that the surface tension-temp. curve falls in the same family as the similar curve for C_6H_6 and CHCl_3 . The surface tension of UF_6 is 17.66 dynes/cm at 65°C and 16.48 dynes/cm at 72.5°C ($\pm 3\%$). The surface tension is normal for an unassociated nonpolar liq. and has a temp. coefficient similar to that for such liqs.

- 2895 Priest, H. F. Thermal Conductivity of Liquid UF_6 . Oct. 11, 1944. Declassified June 25, 1946. 12p. (MDDC-179)

The value for the thermal cond. of liq. UF_6 at 72°C was found to be $3.83 \times 10^{-4}\text{ cal/}^\circ\text{C/sec/cm}$. This is an av. value over the temp. range from the cold plate to the hot plate. 72°C is the mid-point of the range for these runs. The temp. coeff. of the thermal cond. of a liq. is usually quite low and no attempt was made to measure it here.

- 2896 Randall, C. Citric Acid of Bone and Urine of Uranium Poisoned Rats. Master's Thesis, University of Rochester, 1946.

- 2897 "Research Pays Dividend. Pure Uranium by the Rentschler-Marden Process." Compressed Air. Mag. 51, 51(1946)Feb.

- 2898 Rodden, C. J. Analytical Chemistry of the Manhattan Project. Chapter XXI. Carbon, Hydrogen, and Oxygen. Declassified Dec. 20, 1946. 30p. (MDDC-581)

Following a résumé of methods, detailed procedures are given under the following headings: C and H, simultaneous detn. of C and H, app., blank corrections, procedure; detn. of C in U and U cpds., procedure; H_2O , detn. of H_2O in UO_3 , app., procedure; detn. of H_2O in UF_4 , Cu tube method, app., procedure; Na_2CO_3 method, procedure; detn. of H_2O in UO_2SO_4 , app., procedure; detn. of H_2O in Et_2O solns., procedure; O, detn. of combined O in metals, procedure. A list of 28 references is included. (This paper is also available in Rodden, Analytical Chemistry of the Manhattan Project. New York, McGraw-Hill Book Company, Inc., 1950. Chapter 6.)

- 2899 Rogers, L. B. "Relation between Size of the Bivalent Cation and Solubility of Triple Acetate Salt of Sodium." *Science* **103**, 420-1(1946).

In the cpd. $\text{NaM}(\text{UO}_2)_3(\text{OAc})_9 \cdot 6\text{H}_2\text{O}$, the soly. increases with the radius of the ions in the series where $\text{M} = \text{Mg}, \text{Ni}, \text{Co}, \text{Zn}, \text{Fe}, \text{Mn}, \text{Cu}, \text{Cd}$, and Hg . There is no relation between soly. and at. radius. From these solns. it is shown that the radius of Cu^{++} is about 0.81 Å. In the series $\text{M} = \text{Be}, \text{Ca}, \text{Sr}, \text{Ba}$, the cpd. is not known; the radii of these ions, except Ca^{++} , are outside the range of those of the first group. Thus, the ionic diameter of M^{++} suggests both the possibility of formation of the cpd. and its soly.

- 2900 Russell, H. Jr. The X-Ray Spectra of the Last-Row Elements. Sept. 22, 1944. Declassified Oct. 22, 1946. 24p. (MDDC-406)

X-ray energy-level diagrams as given in the literature are tabulated for Ra, Th, and U. A level scheme for Pa is derived from the published data. After a brief review of the use of x-ray data in studying outer electronic structure, it is pointed out that differences in the x-ray spectra should exist depending on whether the outer electrons are in $\bar{f}$ or $\bar{d}$ orbitals. The observed separation of the O_I and O_{II} levels in Th and U indicates that the $\bar{f}$ levels lie lower than the $\bar{d}$. This hypothesis also provides a reasonable explanation for the observed differences between the M_{IV} and M_V absorption edges and the M_{IV} and M_V levels calcd. from the emission spectra and the L_{III} edge.

- 2901 Scharff-Goldhaber, G. and Klaiber, G. S. "Spontaneous Emission of Neutrons from Uranium." *Phys. Rev.* (2), **70**, 229(1946).

Spontaneous emission of neutrons from U was observed with a H_2 -filled ionization chamber recording neutrons of energy > 100 kev. The partial decay const. for spontaneous fission for the "av." U atom $\approx 7 \times 10^{-24} \text{ sec}^{-1}$.

- 2902 Schuurmans, P. "Spectra of Neodymium and Uranium." *Physica* **11**, 419-25(1946).

In U_{II} , terms are given for the $5f^3 7s^2$, $5f^3 6d 7s$, and $5f^3 6d^2$ configurations. In contrast to Th, no configurations were found without f electrons.

- 2903 Schuurmans, P. "Configurations with f-Electrons." *Physica* **11**, 475-80(1946).

This paper is math. and theoretical. The energies of the terms with large L and S values are calcd. from configurations with f and d electrons. The results are useful in the analysis of the Th and U spectra.

- 2904 Schuurmans, P. "Methods of Analysis in the Spectra of the Rare Earths and in the Very Complex Spectra of Thorium and Uranium." *Physica* **12**, 589-94(1946).

The complexity of the spectra of the rare earths is due to the presence of f-type electrons in their electron configurations in which the coupling is intermediate between (ls) and (jj). This causes a departure from the Lande interval rule in multiple terms, but nevertheless leaves a regularity between the component levels that is helpful in predicting the location of new levels. In the case of U the Zeeman effect in some well-resolved lines which indicate that one of the low levels is $^3\text{M}_6^0$ which can appear only in configurations contg. f electrons.

- 2905 Schwartz, S. and Katz, E. J. An Introduction to the Non-Classified Literature Dealing with Biochemical Studies of Experimental Uranium Poisoning. Sept. 24, 1946. 19p. (CH-3712)

The nonclassified literature dealing with the biochem. effects of U poisoning is reviewed. Representative studies of various tests are noted with special reference to the literature of the past two decades. The large majority of these tests are based on alterations in kidney function. Chief emphasis has been given to tests of N retention, acidosis, albuminuria, and abnormalities in special renal clearance tests. While the latter appear to be sensitive and reliable indexes of kidney dysfunction, several authors have pointed out that the classical interpretation of these tests does not hold in U poisoning; inulin clearance, for example, may be markedly diminished even when histologically the glomeruli appear essentially normal. This is believed due to increased back diffusion of the inulin through the damaged tubules. Nearly all the studies reported are based on dog and rabbit expts.

- 2906 Scribner, B. F. and Mullin, H. R. The Carrier-Distillation Method for Spectrographic Analysis and Its Application to the Analysis of Uranium-Base Materials. Declassified Oct. 10, 1946. 35p. (MDDC-407)

The details of a method of fractional distn. in a d.-c. arc developed for the spectrographic detn. of 33 volatile impurity elements at concns. as low as fractions of ppm in U base materials are presented. The method was applied to control and inspection in production of high-purity U metal, oxides, and salts within the Manhattan Project. (This information is also available in J. Research Natl. Bur. Standards 37, 379-89(1946).)

- 2907 Scribner, B. F. and Mullin, H. R. "The Carrier-Distillation Method for Spectrographic Analysis and Its Application to the Analysis of Uranium-Base Materials." J. Research Natl. Bur. Standards 37, 379-89(1946).

This paper is similar to report MDDC-407(1946).

- 2908 Seaborg, G. T. The Transuranium Elements. April 29, 1946. Declassified June 24, 1946. 20p. (MDDC-227)

The first isolation of Np, Pu, Am, and Cm, their properties and the ultramicrochem. technique developed in connection with this work are described. The amts. of the elements available ranged from less than 1 γ to 1 mg. The elements 89 to 96 are added to the periodic table as an actinide series in which the 5f electron shell is being filled. At. nos., at. wts., activities, and half-lives are tabulated for the isotopes of Th, Pa, U, Np, Pu, Am, and Cm. (This paper is also available in Science 104, 379-86(1946) and Nature 159, 863-5(1947).)

- 2909 Seaborg, G. T. "The Transuranium Elements." Science 104, 379-86(1946).

This paper is similar to report MDDC-227(1946).

- 2910 Silverman, A. "Effect of Iron on Fluorescence in Glass." J. Am. Ceram. Soc. 29, 151-8(1946). The optimum concn. of U in Ca metaphosphate glass is about 0.54% $(\text{UO}_2)^{++}$ when fluorescence is excited by ultraviolet radiation. Fe not only absorbs a large portion of the radiation, thereby decreasing the fluorescence emission, but also reemits this absorbed radiation in the infrared, thus bringing about the infrared quenching of the fluorescence. Fe causes an electric disturbance around the fluorescing centers and is apparently capable of preventing the absorption of exciting radiation by these centers, further decreasing the intensity of fluorescence. A slight shift of the fluorescence spectrum toward shorter wavelengths is brought about by the presence of Fe and is evidence of a weakening of the binding forces within the glass.

- 2911 Singh, I. and Singh, S. I. "The Effect of Some Metals, Vitamins, Anaesthetics, and Other Substances on Unstriated Muscle." Proc. Indian Acad. Sci. B. 23, 301-11(1946).

In the present research, the action of the many materials, including U nitrate, on the excitability of unstriated muscle was investigated. Many of these metals are pptd. by alk. Ringer soln. (pH = 8, borate) or by the chlorides, but in the concn. used (1 in 10^7 to 10^4) they were found to be sufficiently sol. to exert definite actions. The action was that of the metal, as the corresponding anions in the concns. used had no significant effect. The muscle used was mostly that of the frog stomach and was stimulated by a.c., d.c., and K(0.02M to 0.04M KCl).

- 2912 Smales, A. A. A Rapid Colorimetric Method for the Determination of U in Solutions of $\text{UO}_2\text{F}_2 + \text{HF}$ by Means of Hydrogen Peroxide. Nov. 7, 1944. Declassified October 1946. 6p. (BR-526)

In order to run a large no. of analyses, a colorimetric method using H_2O_2 was devised. Other colorimetric methods and contradictory results on the H_2O_2 method are briefly mentioned. The role of $(\text{NH}_4)_2\text{CO}_3$, optimum wavelengths (436 and 404.7 $\text{m}\mu$), stability of color and effects of $(\text{NH}_4)_4$, F, Fe, Cu, Mn, Zn, Al, Mo, Ti, V, and Ce^{+4} are mentioned. Procedure; an aliquot of sample contg. less than 25 mg U is buffered with 2N ammonium citrate soln. and made just alk. with NH_4OH , and then 10 ml of sat. $(\text{NH}_4)_2\text{CO}_3$ soln. is added, and finally 10 ml std. H_2O_2 (% not given). Total is dild. to 50 ml and measurement made with 436 $\text{m}\mu$ (Hg) line. Blank directions and calcn. method are included.

- 2913 Smatko, J. S. Lanthanum, Neodymium, Praseodymium and Uranium Compounds Prepared by Auergesellschaft, Berlin. April 5, 1946. 6p. (FIAT Final Report 795; AEC File No. NP-43; OTS Catalog No. PB-48428)

This report describes methods for producing commercial La, Nd, and Pr cpds. from monazite sands, and U cpds. from pitchblende. Lab. methods for the production of very pure cpds. and a comparison of German and U. S. practices and reagents used in U purification are included.

- 2914 Smythe, C. P. and Hannay, N. B. The Dipole Moment and Molecular Structure of Uranium Hexafluoride. Oct. 1, 1944. Declassified Oct. 14, 1946. 7p. (MDDC-441)

The dielectric const. for UF_6 vapor was measured over a range of temp. and pressure. (From an av. polarization of 27.1 and d. (liq.) at 65° of 3.667, a dielectric const. value of 2.18 was calcd.) Although the possibility of a small moment, less than 0.5×10^{-18} , is not definitely excluded by the exptl. data, it is logical to conclude that the moment of the mol. is zero. The zero moment of the mol. shows that it is symmetrical in form, a conclusion shown to be consistent with the results of electron diffraction and x-ray analysis.

- 2915 Srivastava, T. N. "Reactions between Iodine and Sodium Salts of Carboxylic Acids in Presence of Metal Ions as Catalyst." Current Sci. (India) 15, 249-50(1946).

Reactions between I_2 and the Na salts of acetic, propionic, butyric, succinic, malic, benzoic, phthalic, glycolic, lactic, tartaric, citric, malic, and glyceric acids in light have a negligibly low velocity at 20 to 40° . The reaction is catalyzed by Mn^{++} , Cr^{+3} , Fe^{+3} , Co^{++} , $(\text{UO}_2)^{++}$, and Ce^{+3} .

- 2916 Staff Report. "Eighth Midwest Power Conference." Chem. Eng. News 24, 1382-3(1946).

A section of the report of the conference is a quotation from a paper, presented by R. R. Wisner, concerning the recovery of U from solns. resulting from the operations of the Y-12 electromagnetic U isotope sepn. plant. (See Wisner, Power Plant Eng. 50, 82-5(1946) May, for complete paper.)

- 2917 Szilard, L. Divergent Chain Reaction in Systems Composed of Uranium and Carbon. Declassified Nov. 21, 1946. 40p. (MDDC-446)

It is shown that a divergent chain reaction may be maintained in a system composed of U and C. Conditions particularly favorable for a chain reaction are obtained, if, instead of using a homogeneous mixt. of U and C, a large no. of rather small spheres of U metal are used, embedded in a mass of graphite. The small U spheres may form a close-packed hexagonal or cubic lattice embedded in a large sphere of graphite. The av. no. of fast neutrons emitted by U for 1 thermal neutron absorbed by U is calcd. from known exptl. data and is found to be about 2. In this system, conditions for a chain reaction become more and more favorable as the temp. increases, and it is shown that a chain reaction can be expected to be self-generating in such a system at about 900° even if the cross section of C were as high as 0.01, its present exptl. upper limit. As the intensity of the chain reaction increases with increasing temp. the system is thermally unstable. It can be controlled artificially. The time within which the control would have to respond is found to be longer than 1 sec. As much as 100 tons of graphite and 30 tons of U might perhaps be required in order to reach the point of divergence at which nuclear transmutation will go on with an intensity limited only by the necessity of avoiding overheating. But in so far as the capture cross section of C is likely to be below 0.01, the amt. of material required probably will be smaller.

- 2918 Tenny, G. H. The Radiography of Heavy Radioactive Metals. Oct. 28, 1946. Declassified Nov. 13, 1946. 29p. (MDDC-478)

The various expts. to det. best method of making radiographs of U are described. The production method at present in use employs a RaBr_2 cylinder (2514.4 mg Ra) as the source and the following film-and-screen combination in order: Pb filter 0.020 in., Patterson intensifying screen No. 353, Eastman Kodak Type A film, Patterson intensifying screen No. 353, Pb screen 0.020 in.; Eastman Kodak Type A film, Pb screen 0.020 in. and 1/4 in. Pb shield. This method proves to be satisfactory for the required purposes. In using penetrometers on the actual objects, a resolution of $2\frac{1}{2}\%$ up to a thickness of 4 in. was achieved. Since the only defects possible are mostly air bubbles, this method is able to detect them. The screen-and-film combination described makes it also possible to inspect pieces of various thicknesses at the same time. The method is far from being the ultimate one. There are two problems to be solved: (1) Due to the relatively large size of the source, the penumbra effect influences the resolutions. This could be avoided in using smaller sources. (2) The exposure time is a relatively long one which could be eliminated in using stronger sources.

- 2919 Tyler, P. M. Rare and Minor Metals. March 1946. 19p. (FIAT Final Report 750; OTS Catalog No. PB-28908)

The purpose of this report was to afford a comprehensive picture of the rare-metal industries in Germany. It reviews data in certain previous reports, but most of the data given were obtained as a result of a questionnaire submitted by the author to Dr. Hans Joachim Heine, of Metallgesellschaft, Frankfurt am Main. In general the rare-metals industries made little progress in wartime Germany, but there were some new developments. Production, uses, names of producers and users, and other data are given for Ba, Bi, B, Cs, Rb, Ca, Ce, Ga, Ge, Hf, In, La, Li, Mg, Te, Nb, Po, K, Re, Se, Na, Sr, Ta, Te, Th, Ti, U, and Zr. A list of reports covering production methods followed in Germany for certain of these metals is included.

- 2920 Weissman, S. I. and Duffield, R. B. Estimation of Small Quantities of Uranium in Thorium. July 26, 1943. Declassified Aug. 26, 1946. 4p. (MDDC-244)

Estn. of the intensity of the uranyl fluorescence furnishes a method for the detn. of quantities of U as low as 1γ U/ml of glassy H_3PO_4 . The test has been used to detect directly 3 parts of U in 10^6 parts Th.

- 2921 Weyl, W. A. "Colored Glasses. V. The Fluorescence and the Solarization of Glass." J. Soc. Glass Technol. 30, 90-172(1946).

The author classifies glasses into 4 groups, based on the fluorescence centers, namely, (1) fluorescent crystals imbedded in the glass such as ZnS ; (2) other crystals to which the glass furnishes a "fluorescence activator" like Mn; (3) atoms, or mols. energetically sepd. by the glass structure from each other like Ag atoms or CdS mols; (4) ions which are analogous to coloring ions and may be considered part of the glass structure itself. In the fourth class, glasses contg. rare earths, Mn, U, Cu, Th, Sn, Pb, and V are discussed. Fluorescence is of use in the study of the constitution of glasses, identification, detn. of vitrification temps. of glass batches, and illumination. Solarization is one particular form of photochem. reactions which are caused by the transformation of a part of the radiant energy absorbed by glass into chem. energy. Glass can be reverted from a state of solarization by storage in the dark, by exposure to long-wave radiation, and by heating to high temps. The most active elements (as ions) in solarization reactions are Fe, Ti, As, Sb, Mn, and Ce.

- 2922 Willis, J. H., Chapter V. Characteristics of Uranium Poisoning. July 1, 1946. Declassified Aug. 28, 1946. 80p. (MDDC-271)

Evidences of interference with the normal functions of both the liver and kidney in poisoning with uranyl salts have been found. In general the evidences of the liver dysfunction have not been particularly marked, while those of kidney dysfunction have been quite striking and in general have preceded in time the appearance of liver effect. It appears possible that the kidney is the only parenchymal organ affected directly by U, and that the effects on the other organs are consequent to the acidosis and azotemia, with attendant cachexia, induced by the kidney dysfunction. For this reason, tests of kidney integrity seem the most pertinent to U poisoning as diagnostic acids. Of the possible tests of renal integrity, the urinary excretions of catalase, protein, and phosphatase have the same significance; they indicate an active process of cellular breakdown within the kidney. Proteinuria may indicate also breakdown of some of the normal barriers between blood plasma and urine. In general, these tests show a sharp peak 2 to 5 days after the acute insult and usually return quickly to normal levels. Catalase appears dependably in the urine of the rabbit after single intravenous injections of 0.02 mg/kg of uranyl acetate. The tests of functional capacity of the kidney tubule (phenol red removal from the blood, the ratio of the urinary excretions of amino acid N and creatinine, chloride and diodrast clearances, chloride reabsorption, and diodrast secretion) attain their max. change 3 to 6 days after the acute insult by uranyl U. Even during cont. exposure to U the kidney function returns toward normal if the exposure is not sufficiently great to produce rapid fatality. After heavy exposures the chloride clearance and the amino acid N to creatinine ratio may remain elevated for appreciable periods of time after cessation of the exposure, indicating some prolonged interference with tubular activity. The ratio of the urinary concns. of amino acid N and creatinine has been found to be elevated consistently in rabbits by injection of 0.05 mg/kg of uranyl

acetate and sometimes by injection of 0.03 mg/kg. The other tests of renal function have not been studied in this way, but their dosage sensitivity would be expected to be about the same as that of the ratio. (This information is also in Voegtlin and Hodge, Pharmacology and Toxicology of Uranium Compounds. New York, McGraw-Hill Book Company, Inc., 1949. Chapter 5.)

2923 Wilson, H. M. and Smales, A. A. "Uranium in Urine." Nature 158, 590(1946).

Analysts (14) who had been in contact with Mg uranyl acetate soln. for 2 mos. had urine contg. 2 to 10 γ U/l. Eight who had not been in such recent contact with U salts varied from not detected to 4 γ /l. One of the solns. used by these analysts was made by satg. alc. with NaMg uranyl acetate. It is believed that this soln. is more likely to penetrate the skin. No deviation from normal health was found in the analysts examined.

2924 Wilson, R. R. Delayed Neutrons from Pu²³⁹. May 8, 1944. Declassified Dec. 31, 1946. 4p. (MDDC-559)

Neutron counts in a BF₃ chamber near a sample of Pu²³⁹ or U²³⁵, observed after turning off the source of primary neutrons, are attributed to delayed neutrons. It is found that the delayed neutrons from Pu²³⁹ are distributed in time just as those from U²³⁵, as though attributable to the same products, but are about 46% as numerous per fission. (This paper is also available in Phys. Rev. (2), 71, 560(1947).)

2925 Wisner, R. R. "Electromagnetic Processes of the Atomic Bomb Project." Power Plant Eng. 50, 82-5(1946) May.

A short section on U recovery is included.

2926 Yagoda, H. "The Localization of Uranium and Thorium Minerals in Polished Section. I. The α -Ray Emission Pattern." Am. Mineral. 31, 87-124(1946).

U and Th minerals occurring in polished sections are characterized by means of a selective α -ray emission pattern on light-desensitized emulsions. The characteristics of the emulsion are described, and details of the necessary technique are given. Developing at 32° is necessary to obtain reproducible autoradiographic ds. The emulsion shows lack of sensitivity to β - and γ -radiations, visible and ultra-violet light, and chem. agents producing pseudophotographic effects, and is only slightly sensitive to x rays and neutron radiations. The emulsions exhibit a marked fading of the latent image if development is delayed, and the latent image is destroyed by the presence of Hg vapor during the exposure. The procedure described produces a sharply defined, reproducible image of α -ray-producing particles in polished sections in direct contact with the emulsion. The resultant pattern can be enlarged up to 200 diameters and is serviceable in the identification of fine mineral grains and reveals the variation in the α -ray activity of minute structures. All known radioactive minerals and varieties are classified into 7 groups based on the relative photographic ds. produced by the mineral compared with a unit of minerals of known α -ray activity.

2927 Zebroski, E. and Newton, T. W. Fluorescence Analysis for Uranium. Declassified Oct. 28, 1946. 16p. (MDDC-443)

An adaptation of a colorimeter for the rapid estn. of small amts. of U (to $\pm 5\%$) by fluorescence of a NaF bead or fluoride-carbonate melt is described. Solns. contg. from 0.1 to 1000 γ /ml may be tested directly. The limit of visual detection on a 20-mg bead is about 0.0003 γ U. A periodic chart of interferences is presented. The strongest interferences center around the latter part of each transition series of elements. Several convenient purification methods are suggested and a simple test for interferences is given.

2928 Zimens, K. E. and Hedvall, J. A. "Radiometric Analysis of U Traces with Unknown U:Ra Ratio." Arkiv Kemi, Mineral. Geol. A. 22, No. 6, Paper 25, 13p. (1946).

The method now described avoids the usual assumption that Ra:U equil. has been attained and is therefore independent of the U:Ra ratio in the test material. The Th isotope UX₁ is pptd. from strongly acid soln. with Na₂H₂P₂O₆. Equil. with UX₂ is reached within a few mins, and the β radiation from this substance is measured, the counter being calibrated against known U sources. No other β radiator is pptd., and none is produced in this short time. The method is sensitive to 10⁻⁴ g and requires only that U:UX₁ equil. has been reached in the specimen, which is easily checked.

PUBLICATIONS LOCATED IN 1947

- 2929 Alekssevskii, N. E. and Migunov, L. "Investigation of Metals at Temperatures below 1°K." Fiz. Zhur. 11, 95(1947).

The app. (adiabatic demagnetization) is briefly described. The following metals were cooled to temps. between 0.06 and 0.15°K, and none were found to become superconducting: Si, Cr, Sb, W, Be, and Rh. Very pure U was found to become superconducting below 1.3°K.

- 2930 Allen, N. The Tensile Properties of Uranium at Elevated Temperatures in the α Range. March 4, 1946. Declassified July 1497. 2p. (BR-718A)

Cylindrical pieces prepd. from a transverse slice of a cast U billet were tested at 350 and 600°C in a creep-testing unit working at high vacuum. The elongation and yield point were measured and the ultimate tensile strength calcd. The broken test pieces showed a chisel fracture.

- 2931 Amdur, I. "Determination of the Molecular Law of Force from Self-Diffusion Coefficients." Phys. Rev. (2), 72, 642-3(1947).

Exptl. self-diffusion coeffs. of UF_6 (Ney and Armistead) and of CH_3 (Winn and Ney) were reported at room temp. The mol. force law is related to the ratio $\rho/D\eta$ (ρ is the d., D is the self-diffusion coeff., and η is the coeff. of viscosity). It is shown that force laws based on values of this ratio are likely to be incorrect.

- 2932 Amphlett, C. B. Stability of Solutions of UCl_4 in Alcohol, Acetone, and Water. May 31, 1944. Declassified Aug. 22, 1947. 4p. (BI-37)

UCl_4 can be recovered from solns. in alc., acetone, and H_2O by reduced pressure distn. In all cases the recovered products show a low % of U and dissolve more slowly and less vigorously in H_2O than does pure UCl_4 . The products from alc. and acetone appear to have an indefinite compn. and contain strongly adsorbed solvent and condensation products; in the case of acetone the tendency is to form syrups. The product from H_2O can be crystd. from the syrup obtained on concn. and appears to be a hydrate of UCl_4 . Alc. and acetone solns. can be refluxed unchanged, but aq. solns. undergo hydrolysis at 100°. The hydrolysis does not seem to be simple, the product forming a colloidal soln.; analysis shows a low % of U compared with any of the U oxides, and the product contains Cl^- .

- 2933 Amphlett, C. B. and Thomas, L. F. Determination of the Vapour Pressure of UF_6 between 0° and 15°C. Nov. 17, 1941. Declassified March 1947. 3p. (BR-8)

The method used in the detn. of the data (see table and graph in original) was the same as that adopted by earlier investigators. The relationship deduced is

$$\log p = -\frac{2660}{T} + 10.97$$

The heat of subln. was calcd. as well, and the result showed 12.16 kcal/g mole. The vapor pressure curve is reported to be a straight line.

- 2934 Amphlett, C. B. and Thomas, L. F. Determination of the Vapour Density of UF_6 at Room Temperature. Jan. 30, 1942. Declassified July 1947. 2p. (BR-187)

UF_6 was purified from HF and SiF_4 and then, using a "null" spiral Bourdon gauge and optical lever and a vol. about twice that used in earlier detns., the values 45.5, 151, and ~500 mm Hg were obtained at 12.5, 29.5, and 49.2° for vapor pressure. The apparent mol. wt. (and from this of course the vapor d. can be obtained) was also reported with values for vapor pressure at 14.3 to 17.6°. At this temp. the mean apparent mol. wt. is 354 ± 3 .

- 2935 Amphlett, C. B. and Thomas, L. F. Investigation of the Pressure-Density Relationship for the Hexafluoride of U at 49.2°C. Feb. 28, 1942. Declassified July 1947. 3p. (BR-174)

An outline of the procedure with a diagram of the app. is included. Data obtained on the apparent mol. wt. of UF_6 vs. p (pressure in mm Hg) and ρ (dynes/cm²) are graphed and the latter tabulated as well. Results show $\delta\rho/\delta p = 1.31 \times 10^{-8}$.

- 2936 Amphlett, C. B. and Haworth, W. N. The Vapour Pressure of UF_6 from 12° to 50°C. June 30, 1942. Declassified July 1947. 3p. (BR-186)

The values obtained, added to previous values, were used to construct a graph showing the relationship between $\log_{10} p(\text{mm})$ and $1/T^\circ\text{K}$.

- 2937 Amphlett, C. B. and Haworth, W. N. Pressure Density Relationship for UF_6 at 50°C. Revised Figure for $(\delta e/\delta p)$ 50°C. June 30, 1942. Declassified July 1947. 3p. (BR-182)

The revision results for more accurate detn. of the d. of UF_6 vapor at various pressures, as reported in BR-186(1947) are given.

- 2938 Anderson, O. E. and White, H. E. "Hyperfine Structure and the Nuclear Spin of U^{235} ," Phys. Rev. (2), 71, 911(1947).

By the use of U enriched in U^{235} , it was found from the arc spectrum that in the range 4000 to 8500 Å., only $\lambda 5915$ and $\lambda 6926$ show resolvable and measurable hyperfine structure. $\lambda 5027$ has an isotope shift of 0.426 cm^{-1} (0.108 Å). The flag pattern of $\lambda 5915$ is shown graphically. The nuclear spin, I , is probably $5/2$; possibly $7/2$.

- 2939 Anonsen, S. H., Bragdon, R. W., French, C. L., and Martin, G. L. A Comparison of the Gravimetric and Volumetric Determinations of Free UO_2 in Uranium Dioxide. June 1947. Declassified Nov. 6, 1947. 8p. (MDDC-1435)

The ignition assay of brown oxide for free UO_2 is subject to error due to the tendency of the powd. material to adsorb H_2O . This method is recommended for use only where speed is more important than accuracy. The volumetric method of assay is recommended for accurate detns.

- 2940 Archibald, R. C. and Trimble, R. A. —assigned to Shell Development Co. Recovery of Molybdenum, Tungsten, and Uranium. Nov. 28, 1947. (British Patent 595,197)

Oxidic W cpds. are treated with H_2S at 400 to 500° to convert them into sulfides, ground to about 120 mesh, suspended in H_2O , and oxidized by chlorates, perchlorates, chromates, dichromates, permanganates, HNO_3 , H_2O_2 , or tertiary butyl hydroperoxide. The concn. of oxidizing agents may vary greatly. In an example, sulfides are suspended in a small quantity of 5 to 20% HNO_3 held at 80 to 90°, and HNO_3 is added slowly with agitation. This method of oxidation leads to the formation of H_2WO_4 , which is 90% sol. in NH_4OH . The acid is dried at a temp. below 170° to prevent its decompn. The oxidation of the suspension is facilitated by blowing air during this stage of operation. The metallic contents of the W sulfide catalysts can be converted into NH_4OH -sol. H_2WO_4 by wet oxidation alone. Mo and U respond to the treatment in the same manner.

- 2941 Avgustinik, A. I. "Heats of Formation of Oxides and of Silicates." Zhur. Priklad. Khim. 20, 327-30(1947).

Heats of formation, ΔH , of oxides plotted against the at. no. of the element show the periodicity common to many other properties. Elements of the 3rd and 5th group show characteristic peaks with lows for the neighboring 4th-group element; in the 1st subgroups, the values of the ΔH increase toward the 7th group; in the 2nd subgroups they decrease. Halogens and the metals of the 1st subgroup occupy the lowest points; the "amplitude," i.e., the spread between the peak and the lowest point, increases toward the 7th group. From the periodic chart of the known ΔH values, one can est. the unknown ΔH of As_2O_5 , PdO , Ta_2O_5 , SnO_2 , Ga_2O_3 , UO_3 , and Pa_2O_2 to be 270, 10, 490, 500, 110, 270, and 220 kcal/mole resp.

- 2942 Bachelet, M. "Investigations on the Separation of Salts of Uranium in the Treatment of Betafite." *Bull. soc. chim. France* 628-32(1947).

Treatment at 115° for 6 hrs. of finely ground betafite, uranium columbotantalotitanate, with acids, dild. with 1 part H₂O, leaves insol. the following amts. of U; HNO₃ 20%; HCl 8%; H₂SO₄ 2%. Concd. H₂SO₄ heated to white fumes gives complete attack. Successful fusions are 1 part mineral with 2 parts alk. acid sulfate or pyrosulfate at 500° followed by soln. of the U in boiling H₂O, the Cb, Ta, and Ti being insol.; 1 part mineral with 2 parts NaOH at 700° followed by removal of excess NaOH with boiling H₂O and soln. of the U in HNO₃. To sep. U after NaOH fusion, filter, acidify the filtrate to pH = 2.8 pptg. Fe, Th, Ti; adjust to pH = 4.3 pptg. U, Cu, and some rare earths; dissolve the U ppt. in HNO₃, heat the soln. to crystn., and cool; dissolve the uranyl nitrate crystals in Et₂O. The alternate treatment (adjust the HNO₃ filtrate to pH = 1, add excess Na₂CO₃ to the filtrate forming Na₄UO₂(CO₃)₃ soln., and add NaOH to ppt. Na₂UO₄) requires less careful pH control but does not permit sepn. of Th and uses large amts. of Na₂CO₃ and NaOH.

- 2943 Bachelet, M. and Cheylan, E. "The Solubility of Uranyl Nitrate in Ethyl Ether." *J. chim. phys.* 44, 248-53(1947).

UO₂(NO₃)₂·6H₂O is readily sol. in Et₂O with the appearance of an aq. layer. UO₂(NO₃)₂·2H₂O dissolves without forming the aq. layer, whereas UO₂(NO₃)₂ is practically insol. Curves show the concns. of Et₂O solns. of the dihydrate as a function of the d., the vapor pressures of the solns. as a function of concn. at 0 and 10°, and the concns. of the satd. solns. as a function of temp. At -80°, the soly. is very low, but above -30° it increases rapidly and almost linearly with temp. From solns. satd. at 15 to 45° and cooled to 0 to 15°, UO₂(NO₃)₂·2H₂O·2Et₂O crystallizes, m. 45 ± 1.5°, vapor pressure 16 mm at 0°. From solns. satd. at -30 to 0° and cooled to -80 to -3°, UO₂(NO₃)₂·2H₂O·4Et₂O crystallizes, m. 2.2 ± 0.8°, vapor pressure 102 mm at 0°. Heating and cooling curves are given for both Et₂O complexes, and curves show their vapor-pressure variations with the quantity of Et₂O eliminated under vacuum.

- 2944 Bachelet, M., Cheylan, E., and LeBris, J. "Solubilities of the Principal Fixed Acids of Uranium Ores in Ether and Their Partition Coefficients between Water and Ether." *J. chem. phys.* 44, 302-05(1947).

Silicic, titanitic, vanadic, columbic, tantalic, molybdic, and tungstic acids are not sol. in Et₂O satd. with H₂O, and, hence, are not extrd. with uranyl nitrate during the extrn. of this material from its ores. However, boric and phosphoric acid show significant solys. and so pass partially with the uranyl nitrate.

- 2945 Balz, G. "Electrical Behavior and Allotropy of Uranium." *Metallforschung* 2, 144-6(1947). Elec. resistance on 99.5% pure U was detd. between 0 and 1000°; vacuum-heated material was used for the detn. Variable changes of a reversible character are shown at about 670 and 780° and indicate the existence of allotropic modifications. At room temp. (20°) the specific resistance of U is 0.372 × 10⁻⁶ ohm/m with a temp. coeff. of 1.92 × 10⁻³.

- 2946 Bane, R. W. and Grimes, W. R. *Analytical Chemistry of the Manhattan Project. Chapter XXXI. Iron, Cobalt, and Nickel.* Declassified Jan. 13, 1947. 43p. (MDDC-596)

Analytical sepn. methods are discussed. Headings include —Iron: methods of soln.; methods of sepn., pptn. (alk. peroxide), carbonate sepn., pyridine sepn., cupferron sepn.; solvent extrn., extrn. of FeCl₃, extrn. of Fe 8-hydroxyquinolate (oxinate), extrn. of Fe cupferrate; sepn. of Fe from U; procedure (cupferron extrn.); electrolysis; detn. of Fe, survey of various colorimetric methods for detn. of Fe; gravimetric methods; volumetric methods; iodometric methods; colorimetric methods; 1,10-phenanthroline; dimethylglyoxime; interferences in the detn. of Fe with dimethylglyoxime; disodium-1, 2-dihydroxybenzene-3, 5-disulfonate (tiron); interferences in the detn. of Fe with disodium-1, 2-dihydroxybenzene-3, 5-disulfonate (tiron); 8-hydroxyquinoline; salicylic acid. Cobalt: methods of soln.; methods of sepn.; methods of detn.; optimum range for detn. of traces of Co; colorimetric methods; sodium diethyldithiocarbamate; polarographic method. Nickel: methods of sepn.; methods of detn.; optimum range of methods for detg. traces of Ni; colorimetric methods; Br as oxidant, ammonium persulfate as oxidant;

polarographic method. A list of 73 references is appended. (Also in Rodden, Analytical Chemistry of the Manhattan Project. New York, McGraw-Hill Book Company, Inc., 1950. Chapter 16.)

- 2947 Becquerel, P. and Rousseau, J. "Action of Several Added Growth Substances, either Uranium Nitrate or Manganese Sulfate, on the Germination and Productivity of Pisum sativum." Compt. rend. 224, 773-5(1947).

A lowering of germination rate and a slight rise in production are noted from treatment with $\text{UO}_2(\text{NO}_3)_2$ in concns. of 10^{-3} and 10^{-4}M .

- 2948 Becquerel, P. and Rousseau, J. "Action of Growth Substances Added to either Uranium Nitrate or Manganese Sulfate on the Germination and Productivity of Wheat." Compt. rend. 225, 1106-09(1947).

The % germination of wheat grains in 8 days is 74% after soaking 24 hrs in U nitrate, and 87% after the same treatment with MnSO_4 (same concn.). After 24-hr soaking, U nitrate at 10^{-2}M produces an inhibition (34% germination). The effect of shorter exposure to these salts at concns. less than 10^{-4}M is thus essentially to retard germination. Longer exposure or higher concns. produces definite inhibition of germination up to 8 days. A mixt. of U nitrate and MnSO_4 at 10^{-4}M each has the same effect. The mixts. with phenylacetic acid of β -indoleacetic acid at 10^{-5}M leads to the same results. Harvest yields from wheat soaked 24 hrs in 10^{-3} or lower concns. of these cpds. is reduced only with U nitrate at 10^{-4} . All others of the above mixts. give as good or better harvest yields as the distd. H_2O controls (up to 30% increase for MnSO_4 plus phenylacetic acid).

- 2949 Berg, Y. N. and Vishnyakov, M. N. "Catalytic Decomposition of Diethylacetal." Zhur. Obschei Khim. 17, 1618-25(1947).

Without catalyst $\text{MeCH}(\text{OEt})_2$ is stable in glass vessels up to 350° ; catalytic decompn. is significant at 200° . Expts. were conducted between 200 and 350° , with catalyst columns of 13 to 16 cm, rate of flow 15 ml/hr. (1) With pure Cu catalysts (CuO reduced in H_2), max. decompn. is reached at 250° , main products in the condensate being MeCHO and EtOH ; in the gas, unsatd. hydrocarbons and H_2 . Addn. of U to the Cu catalyst acts in the same direction as addn. of Zr.

- 2950 Bernhardt, H. A., Flanders, V., Marshall, E. D., Simon, W., Staple, E., and Voss, F. Analysis of Small Amounts of Chromium in UF_6 . May 1, 1947. Declassified Dec. 10, 1947. 8p. (MDDC-1541)

A method of analysis has been developed in which the UF_6 is hydrolyzed and converted to the sulfate without loss of Cr. The Cr^{++} and Cr^{+3} are oxidized with ammonium persulfate to Cr^{+6} . The violet complex is formed by addn. of alc. diphenylcarbazide and extrg. with cyclohexanol. The light transmission of the cyclohexanol soln. is read on a Beckman spectrophotometer and the concn. of Cr detd. from a calibration curve. By this method, Cr was detd. with an accuracy of $\pm 10\%$, using std. soln. of Cr and Cr-free U salts.

- 2951 Betts, R. H. "Electrochemistry of Some Actinide Elements." In Proceedings of the Conference on Nuclear Chemistry. Ottawa, Chemical Institute of Canada, 1947. (p.68-76)

The results of polarographic studies on U and Pu are reviewed, and a schematic polarogram of Pu is given. The present electrochem. knowledge of Pu is confined to Pu^{+3} , Pu^{+4} , and Pu^{+6} . Evidence for the existence of Pu^{+5} rests on measurements of absorption spectra of mixts. of Pu^{+3} , Pu^{+4} , and Pu^{+6} , in which small amts. of Pu^{+5} are formed. The transitions between these states occur over a range from about +0.75 to -1.1 v on the H scale. No reliable est. has yet been obtained for the reduction potential between Pu metal and Pu^{+3} . The applications of electrochem. methods in preparative and analytical procedures and in the investigation of the kinetics of oxidation and reduction processes are discussed briefly.

- 2952 Betts, R. H. Studies on the Electro-Oxidation of Tetravalent Uranium. Apr. 15, 1947. 35p. (NRC-1606)

The conversion of U^{+4} to $(UO_2)^{++}$ at the anode has been studied. The current eff. of the oxidation is dependent on the U^{+4} concn., the c.d., and on the nature of the anode surface. At low c.d. the rate of the process varies in a systematic manner with U^{+4} concn., anode potential, and temp., but is independent of the U^{+6} concn. The results are interpreted on the basis of simple diffusion theory and overvoltage effects.

- 2953 Bigeleisen, J., Mayer, M. G., Stevenson, P. C., and Turkevich, J. Vibrational Spectrum and Thermodynamic Properties of Uranium Hexafluoride Gas. Declassified Aug. 12, 1947. 7p. (MDDC-1181)

The Raman spectra of liq. UF_6 and UF_6 dissolved in C_7F_{16} have been photographed. Three Raman lines are found for UF_6 at 200, 511, and 556 cm^{-1} . The infrared spectrum of the gas has been obtained in the region between 2 and $17\text{ }\mu$. A vibrational assignment of all the fundamental freqs. is made on the basis of the regular octahedral model. The calcd. infrared active overtones are in good agreement with expt. Using 2.0 Å as the U-F distance from electron diffraction measurements, the entropy, heat capacity, and $-(F - E_0^0/T)$ are calcd. from 100 to 1000°K for the gas. The calcd. entropy and gas heat capacity are in good agreement with expt. (This paper is also available in J. Chem. Phys. 16, 442-5(1948).)

- 2954 Bonner, F. T. Electrodeposition of Micro Amounts of Uranium on a Cathode of Small Area. Sept. 9, 1947. 10p. (MonC-380)

A method for electrodeposition of micro amts. of U (as oxide) on an area of 8 mm^2 has been developed and used with success. The electrolysis conditions are similar to those developed by Cohen and Hull, with the exception of the fact that a lowered pH appeared to improve the electrolysis in the present study. Attempts to adapt the method to deposition of Th and Pa on a small area were unsuccessful. An oxalic medium with low U concns. is used for deposition on a Pt cathode. The electrolytic cell is diagrammed.

- 2955 Bowen, E. J. "Fluorescence Quenching in Solutions." Analyst 72, 377-9(1947).

When a mol. absorbs a quantum of light, it receives considerable energy and "jumps" to an electronically excited state with one of its electrons assuming a new wave pattern. If undisturbed, this excited state ordinarily persists for about 10^{-8} sec and then reradiates all, or a large part, of the light energy. Usually the excited mols. lose the energy as heat. It is only when the excited state is quite stable that fluorescence is shown. Since fluorescence is proportional to the amt. of light absorbed, the phenomenon is useful for the analysis of cpds. contg. $(UO_2)^{++}$ or rare earths. Quenching is the term given to any effect reducing fluorescence eff. below unity and, from this point of view, all nonfluorescent-colored substances are 100% quenched. Quenching can be produced in fluorescent substances by intramol. or intermol. effects. These are discussed mathematically, to some extent.

- 2956 Bragdon, R. W. and Martin, G. L. Standardization of Ceric Sulfate Solutions with U_3O_8 . July 1946. Declassified July 23, 1947. 7p. (MDDC-1134)

A procedure is described for the standardization of ceric sulfate soln. with purified black uranium oxide, U_3O_8 (std. sample, 99.95% U_3O_8). When ceric sulfate is standardized with purified U_3O_8 the effect of weighing errors is decreased and a greater accuracy is generally obtained than in the standardization with arsenious oxide. In addn., the use of ammonium persulfate effects a saving of time over the normal practice of dissolving the U_3O_8 in HNO_3 .

- 2957 Breckpot, R. "The Spectral Analysis of Uranium Oxide." Congr. avance. méthod. anal. spectrograph. produits mét. (Paris) 8, 33(1947).

A systematic study has been made to det. the most favorable conditions for the preferential excitation of the impurity lines of U and other refractory elements. Part of the method of fractional subln. already used by Scribner has been used but with new entrainment agents. In_2O_3 and $AgCl$ gave the best results. A part of the selective excitation method in the presence of large amts. of alk. salts, notably K_2CO_3 , has been studied. Even when the spectrum of U is strongly depressed, Mo, Pb, Bi, and several other elements

are sharply brought out. The Mo, the principal impurity of U, is revealed in a particularly interesting fashion. These 2 methods have been extended to Th and La. They have not succeeded with Nb, Ta, and W.

- 2958 Brewer, L., Bromley, L. A., Gilles, P. W., and Lofgren, N. L. The Thermodynamic Properties of Equilibria at High Temperatures of Uranium Halides, Oxides, Nitrides and Carbides. Declassified Dec. 30, 1947. 72p. (MDDC-1242)

Table I contains melting, vapor pressure, and boiling data. Table II gives vaporization equations and consts. Table III gives the thermodynamic data for the aq. ions which were used in conjunction with the data for the solid substances. Table IV contains heats of formation and values of $(\Delta F - \Delta H_{298})/T$ from 298 to 1500°K. Table V contains the entropies at 298°K and $-(F - H_{298})/T$ for the cpds. Table VI gives the heat content and entropy increases above 298°K. 123 references are given for the data cited and a discussion of the chem. of each cpd. is included with the references. 12 figures are represented to show the species that exist when a halide is heated at const. pressures of 1, 10^{-3} , and 10^{-6} atm.

- 2959 Brewer, L., Bromley, L. A., Gilles, P. W., and Lofgren, N. L. The Thermodynamic Properties and Equilibria at High Temperatures of Uranium Halides, Oxides, Nitrides, and Carbides. Sept. 20, 1945. Declassified Dec. 30, 1947. 84p. (MDDC-1543)

This report is a revision, including new data on the heats of formation of aq. ions, of report MDDC-1242 (1947).

- 2960 Broda, E. "Adsorption Isotherm of a Photographic Emulsion for Uranyl and Lead Ions." Nature 160, 231-2(1947).

Further tests are reported, where concn. was varied widely and Pb ions were also investigated. $(\text{UO}_2)^{++}$ uptake is in excess of that possible by absorption alone, and the excess is attributed to adsorption; the isotherm has the form $(\text{wt. absorbed}) = \text{const.} \times (\text{conc.})^{0.8}$.

- 2961 Burhop, E. H. S., Massey, H. S. W., and Watt, C. The Ionization and Dissociation of Uranium Tetrachloride and Uranium Hexafluoride by Electron Impact. Declassified Dec. 22, 1947. 34p. (MDDC-1529)

Measurements have been made of the relative intensities of a no. of ion beams produced by electron impact for different electron energies, c.d., and pressures. Also the appearance potentials for the various ions have been measured. A sketch showing a sectional view of the arc chamber and analyzer and 8 graphs are included. (This paper is also published in Guthrie and Wakerling, The Characteristics of Electrical Discharges in Magnetic Fields. New York, McGraw-Hill Book Company, Inc., 1949. Chapter VII.)

- 2962 Burke, J. E. and Smith, C. S. "The Formation of Uranium Hydride." J. Am. Chem. Soc. 69, 2500-02(1947).

This paper is similar to report MDDC-280(1946).

- 2963 Calingaert, G., Soroos, H., Dykstra, F. J., Hnizda, V., and Capinjola, L. V. Attempted Preparation of a Volatile Uranium Carbonyl. May 29, 1946. Declassified Feb. 8, 1947. 17p. (MDDC-637)

Attempts were made to prep. a volatile carbonyl of U by a no. of methods. These included direct reaction of CO with U metal and UH_3 ; reaction of UH_3 with Ni carbonyl; reaction of CO with U halides in the presence of KCN, cystine, and reducing agents such as the Grignard reagent, zinc alkyls, butyllithium, Zn, and Na; and the reaction of CO with U pentaethylate and U borohydride. In no instance was there obtained any evidence of the formation of U carbonyl.

- 2964 Cantril, S. T. and Nickson, J. J. Uranium Poisoning. Review of Literature to 1942. Dec. 15, 1942. Declassified July 31, 1947. 6p. (MDDC-1199)

This review is divided into three headings: pathology, symptomology, and U poisoning in man. On the whole, very little was found in the literature on U poisoning in man and even less dealing with chronic poisoning with which the authors are most concerned. It is well established that the element is toxic, but the routes of absorption of U in various forms are not well established. It is known that the kidneys suffer damage when U is absorbed, and the signs of this toxicity can be seen in the urine. The central nervous system has also been seen to be damaged. It is likely that other organs also suffer but no definite information is available. Expts. are under way to study chem. toxicity in the mouse, but no results are given in this report. A bibliography is appended.

- 2965 Carobbi, G. "Suggestions for a Crystallochemical System of Ions." Atti mem. reale accad. sci. Modena (5), 7, 3-25(1947).

A general classification of ions is proposed in order to form groups whose elements are connected by isomorphism. The value of the ionic radius is the guide for the listing. One of the 9 groups obtained is Na^+ , Lu^{+3} Yb^{+3} Er^{+3} , Cd^{++} Ca^{++} , Tl^{+3} Ho^{+3} Y^{+3} , Ce^{+4} U^{+4} Th^{+4} , Ti^{+3} Dy^{+3} Tb^{+3} , Gd^{+3} Sm^{+3} Eu^{+3} . Ions not sepd. by commas in the same group are characterized by a greater isomorphic affinity. The author gives the 9 groups in a tabulated form in which empty places are also considered.

- 2966 Chackett, K. F. On the Determination of the γ Relationship, with Appendix, Notes on the Determination of γ . by E. G. Cox. Feb. 28, 1942. Declassified July 1947. 3p. (BR-175)

γ , the ratio C_p/C_v , is calcd., from $\gamma = \mu^2 (\delta\rho/\delta p)_T$ where μ = velocity of sound in the gas and ρ and p are d. and pressure, resp. For satd. UF_6 at 49° , $\gamma = 1.02$ and 1.03 when μ is measured in 60- and 25-cm tubes, resp. The error of detn. is discussed. The appended note discusses other methods of obtaining γ .

- 2967 Chackett, K. F. Correction to the Value of γ for UF_6 Vapour. Jan. 31, 1944. Declassified 1947. 2p. (BR-388)

A recalcn. of the value of γ for UF_6 vapor from an equation of state derived by Awbery is given. The new value is 1.066 for γ (or C_p/C_v). (See also report BR-175A(1947).)

- 2968 Church, J. S., Feuer, S., and Zweig, B. Bonding of Metals by Adhesives. May 6, 1946. Declassified Jan. 10, 1947. 5p. (AECD-2103)

This report is concerned with various methods of bonding U to Al using various commercially available adhesives. Selected results for several bonding agents are tabulated.

- 2969 Connick, R. E. Note on the Determination of Nitric Acid in Uranyl Nitrate Solutions. Sept. 8, 1945. Declassified July 31, 1947. 3p. (MDDC-1245)

A rapid method is described based on the pptn. of UO_4 by excess H_2O_2 , according to the reaction: $(\text{UO}_2)^{++} + \text{H}_2\text{O}_2 + x\text{H}_2\text{O} = \text{UO}_4 \cdot x\text{H}_2\text{O} + 2\text{H}^+$. The soln. is then titrated with std. base without removing the ppt., the H^+ formed by the UO_4 reaction being titrated along with any free cation in soln. It is necessary to know the U concn. in order to calc. the concn. of free acid. The method has not been tested thoroughly but present data indicate it is satisfactory under the conditions tried.

- 2970 Cook, L. J., McMillan, E. M., Peterson, J. M., and Sewell, D. C. "Total Cross Sections of Nuclei for 90-mev Neutrons." Phys. Rev. (2), 72, 1264-5(1947).

Total cross sections in barns (10^{-24} cm^2) were detd. for (elements) Li 0.314 ± 0.006 , Be 0.431 ± 0.008 , C 0.550 ± 0.011 , Mg 1.03 ± 0.02 , Al 1.12 ± 0.02 , Cu 2.22 ± 0.04 , Zn 2.21 ± 0.04 , Sn 3.28 ± 0.06 , Pb 4.53 ± 0.09 , U 5.03 ± 0.10 ; by the diff. between C and paraffin for H 0.083 ± 0.004 ; by the difference between D_2O and H_2O for D 0.117 ± 0.005 ; and from data on H_2O , $\text{N}:\text{C}(\text{NH}_2)\text{N}:\text{C}(\text{NH}_2)\text{N}:\text{C}(\text{NH}_2)$, and CCl_4 for O 0.765 ± 0.020 , N 0.656 ± 0.021 , and Cl 1.38 ± 0.03 .

- 2971 Cook, O. A. Experiments on the Electrodeposition of Uranium from Aqueous Solutions.

Aug. 27, 1945. Declassified Oct. 10, 1947. 4p. (MDDC-1368)

All of the expts. were made with a rotating Pt anode and a fixed Cu cathode. In every cell, bubbles of O_2 were evolved at the anode. The following topics are considered at length: analytical techniques for U; temp. effect; effect of pH; effect of uranyl concns. At 0.15 amp/dm² between 2 to 4 v, the optimum conditions for electrolysis of uranyl solns. are temps. above 80°C, and a pH between 5 and 7. However, pH values of 6 and 7 are more advantageous than pH=5, as the U oxide deposit adheres to the cathode better. At pH = 5 the U oxide flakes off very readily during the electrolysis. As an empirical rule for the successful deposition in (OAc)⁻ soln., it is apparently necessary to avoid ratios of U to (OAc) greater than 0.05.

- 2972 Crandall, H. W. The Formula and Structure of Uranyl Ion. June 1, 1947. Declassified Sept. 11, 1947. 27p. (MDDC-1294)

Although $(UO_2)^{++}$ has been shown to be a doubly pos. charged ion in dil. acid soln. by previous investigations, no evidence has been obtained to distinguish between the two possible ions $(UO_2)^{++}$ and $[U(OH)_4]^{++}$. The exchange of O between UO_2Cl_2 and H_2O has been measured in dil. HCl soln., using O^{18} as a tracer and analyzing with a mass spectrometer constructed by the author. It was found that in 0.1N to 0.65N HCl the formula of uranyl ion is $(UO_2)^{++}$. The uranyl-oxygen bonds are covalent in nature. Further, it was established that $(UO_2)^{++}$ was a covalently bonded unit in cryst. UO_2Cl_2 . The Raman spectra of UO_2Cl_2 and uranyl perchlorate was measured. The spectrum of uranyl perchlorate is closely similar to that of UO_2Cl_2 and those of other uranyl salts previously investigated. No pos. conclusion with regard to the configuration of $(UO_2)^{++}$ in soln. was reached. A discussion of the available data is included in the text.

- 2973 Crist, R. H. and Weinstock, B. The Vapor Pressure of Uranium Hexafluoride. April 12, 1943. Declassified Sept. 25, 1947. 8p. (MDDC-1295)

The vapor pressure of UF_6 was measured (273 to 358°K). The measurements were made by a null method in an all-metal app. with a brass Sylphon bellows. The data are represented by the equations: solid-vapor, $\log_{10}P$ (mm Hg) = $-3.77962 \log_{10}T - (3123.479/T) + 21.87103$; liq.-vapor, $\log_{10}P$ (mm Hg) = $-3.72662 \log_{10}T - (2065.679/T) + 18.60033$. The consts. in the equations were adjusted so that the equations would give the same heat of fusion and triple-point temp. as was detd. by Brickwedde et al. The vapor pressure at the triple point is 1133 ± 7 mm. The subln. point at which the vapor pressure is 1 atm. is 56.5°C. The heat of vaporization and the abs. entropy of the gas are calcd. at 273, 298, and 323°K for the solid, and at 348°K for the liq. Latent heats given are $\Delta H_{\text{subl.}} = 12.00$ kcal and $\Delta H_{\text{vap.}} = 6.89$ kcal. (This paper is also available in J. Chem. Phys. 16, 436-41(1948).)

- 2974 Cronheim, G. "o-Nitrosophenols. I. The Typical Properties of o-Nitrosophenol and Its Inner Complex Metal Salts." J. Org. Chem. 12, 1-6(1947).

Free o-ONC₆H₄OH forms very volatile crystals sol. in org. solvents; in the presence of H_2O , it shifts to the tautomeric brown o-quinone monooxime. The affinity of o-ONC₆H₄OH for some metal ions is so strong that they are formed by shaking a soln. in petroleum ether with an aq. soln. of MCl, M_2SO_4 , MNO_3 , or MOAc, adjusted to a pH = 6.2 to 6.4. In this way salts of the following metals are prepd.; Ag^+ , Au^3 , Cd^{++} , Co^{++} , Cu^{++} , Fe^{++} , Fe^{+3} , Hg^{++} , Mn^{++} , Ni^{++} , Pb^{++} , Pd^{++} , Sn^{++} , Ti^{+3} , U^{++} [?], Zn^{++} , and the cupferron salts of Al^{+3} , Ce^{+3} , Co^{++} , Cu^{++} , Hg^{++} , La^{++} , Mn^{++} , Ni^{++} , Pd^{++} , Pr^{+3} , Ti^{+3} , U^{++} [?], Va^{+3} , Y^{+3} , Zn^{++} , and Zr^{+4} . Sn^{++} and Cr^{+3} give no salts, while Al^{+3} , Pt^{++} , Pt^{+4} , Ce^{+3} , and La^{+3} are doubtful. The affinity of the various metallic ions differs greatly.

- 2975 Cubicciotti, D. D. and Sienko, M. J. The Emf of Cells with Uranium: Uranium Halide Couples in Fused Salt Electrolytes. Declassified Aug. 27, 1947. 10p. (MDDC-1201)

The e.m.f. of galvanic cells at high temps. was measured using U metal in equil. with its chloride as one-half of the cell, the other half of the cell being some reference electrode such as Ag-AgCl. Several designs of cells tried are described. A value of 2.83 v/equiv. at 1170°K and also at 990°K is considered as the most probable value for the potential of the U halide couple.

- 2976 Cunningham, B. B., Ghiorso, A., and Jaffey, A. H. Apparent Specific Activity of Uranium in a 2π Geometry Chamber. Declassified June 27, 1947. 10p. (MDDC-1202)

Using material from three different sources, values were consistently obtained for the specific activity of U which are 2 to 3% higher than the value reported by Kovarik and Adams. In calcg. specific activity values the counter geometry was assumed to be 50%. Calcn. of the absorption error, and a consideration of counter characteristics would indicate, however, that none of the values obtained should be lower than the true value by more than about 1%. Excellent agreement ($\pm 1\%$) was obtained in the case of uranyl nitrate from two different sources. U from metal gave a somewhat (1%) lower value at 30% greater sample thickness. When the thickness of sample from this source was reduced by 1/2, a good agreement ($\pm 0.2\%$) was obtained for all sources. The av. value for all sources and all samples counted was found to be 1548 ± 12 α particles/min/mg ($U_I + U_{II} + U^{235}$). This figure is to be compared with that of 1501 found by Kovarik and Adams, and that of 1517 found by R. Schiedt. Three explanations of the discrepancy between these values and those of Kovarik and Adams, suggest themselves. (1) The values found by Kovarik and Adams are in error. (2) The authors' sources were uniformly contaminated with an α emitter of high specific activity. (3) Greater than 50% of the U α particles emitted by these samples were counted in the app. used here. Further work is required to det. which, if any, of these explanations is correct. (This paper is also available in Seaborg, Katz, and Manning, The Transuranium Elements. New York, McGraw-Hill Book Company, Inc., 1949. Paper 16.6.)

- 2977 Currah, J. E. and Beamish, F. E. "Colorimetric Determination of Uranium with Thiocyanate." Anal. Chem. 19, 609-12(1947).

The test is based on the yellow color produced with $(UO_2)^{++}$ and $(CNS)^-$. $SnCl_2$ is added to reduce Fe^{+3} to Fe^{++} and prevent the formation of an interfering red color. From 0.05 to 0.80 mg of U can be detd. by measuring the transmittancy at 365 m μ with the aid of an empirical curve obtained with known quantities of U. As much as 1.25 mg Th, 2 mg Fe, and 50 mg Cu in 2.5 ml of soln. do not interfere. The soln. to be tested should be adjusted to pH = 1.0. To 10 ml of the soln. add 2 ml $SnCl_2$ reagent (50 g $SnCl_2 \cdot H_2O + 50$ ml concd. HCl and H_2O to make 500 ml) and 7 ml of 50% NH_4CNS soln.

- 2978 Dahl, A. I. and Van Dusen, M. S. "The Resistance-Temperature Relation and the Thermo-electric Properties of Uranium." J. Research Natl. Bur. Standards 39, 53-8(1947).
This paper is similar to report MDDC-457(1946).

- 2979 DeMent, J. "Uranium and Thorium Prospecting with the Geiger Counter." Mining Congr. J. 33, 30-2, 37(1947)August.

Portable equipment for the radiometric detn. of Th and U in minerals is described.

- 2980 DeMent, J. and Dake, H. C. Handbook of Uranium Minerals. Portland, Oregon, Mineralogist Publishing Co., 1947. 80p.

This book, contg. a catalog of U and Th minerals, also concerns itself with their prospecting and detecting, an analysis of the world's supply, and a general explanation of the importance of U.

- 2981 Deutsch, M. Mass Ratios and Energy Release in the Fission of U^{235} and Pu^{239} by Slow and by Fast Neutrons. Jan. 31, 1946. Declassified May 9, 1947. 31p. (MDDC-945)

The pairs of simultaneous fission fragments were observed in a double ionization chamber using electron collection. The most probable energy of the heavy fragment is for U^{235} :60 mev; Pu^{239} :65 mev. The most probable energy of the light fragments is in the same order, 94, and 93 mev. The overlap of the two groups is about equal in both cases and may well be entirely instrumental. The most probable total-kinetic-energy release is, for the two substances, resp., 153 mev, and 156 mev. The most probable mass after emission of the prompt neutrons for the heavy fragment in both cases seems to be about 140 mass units. The most probable mass of the light fragment for U^{235} is about 93; for Pu^{239} , 98. The highest fission yield for a single mass no. should be about 5.5% in both cases. The energy release for splitting a given ratio seems to be nearly the same for both substances. Numerous graphs are included.

- 2982 Dieke, G. H. and Duncan, A. B. F. Spectroscopic and Photochemical Properties of Uranium Compounds, with Particular Reference to Isotopic Separation. Declassified Feb. 14, 1947. 305p. (MDDC-688)

The report is divided into two parts, the first titled as above and the second titled "Preparation of Uranium Compounds." A general discussion and literature history is given with bibliography, indexes, and appendixes on absorption and fluorescence wavelengths, special preps., etc. Prepn. and investigations of absorption spectrum (a), fluorescent spectrum (f), temp. effect (t), and isotopic substitution effect (i) reported on $\text{UO}_2(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$ (f,i), $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ (a,f,i), $\text{CsUO}_2(\text{NO}_3)_3$ (a,f,t,i), $\text{RbUO}_2(\text{NO}_3)_3$ (a,f,i), $\text{KUO}_2(\text{NO}_3)_3$ (a,f), $\text{NH}_4\text{UO}_2(\text{NO}_3)_3$ (f), $\text{Rb}_2\text{UO}_2(\text{NO}_3)_4$ (a,f), $\text{K}_2\text{UO}_2(\text{NO}_3)_4$ (a,f,t), $[(\text{C}_2\text{H}_5)_4\text{N}]_2\text{UO}_2(\text{NO}_3)_4$ (f), UO_2Cl_2 (f), $\text{Cs}_2\text{UO}_2\text{Cl}_4$ (a,f,t,i), $\text{Rb}_2\text{UO}_2\text{Cl}_4 \cdot 2\text{H}_2\text{O}$ (f), $\text{K}_2\text{UO}_2\text{Cl}_4 \cdot 2\text{H}_2\text{O}$ (a,f), $(\text{NH}_4)_2\text{UO}_2\text{Cl}_4 \cdot 2\text{H}_2\text{O}$ (a,f), $[(\text{CH}_3)_4\text{N}]_2\text{UO}_2\text{Cl}_4$ (a,f), $[(\text{C}_2\text{H}_5)_4\text{N}]_2\text{UO}_2\text{Cl}_4$ (a,f), UO_2F_2 (f), $\text{Cs}_2\text{UO}_2\text{F}_4$ (f), $\text{K}_3\text{UO}_2\text{F}_5$ (a,f), $(\text{NH}_4)_3\text{UO}_2\text{F}_5$ (f), $\text{Cs}_2\text{UO}_2(\text{SO}_4)_2 \cdot 3\text{H}_2\text{O}$ (f), $\text{Rb}_2\text{UO}_2(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$ (f), $\text{K}_2\text{UO}_2(\text{SO}_4)_2$ (a,f), $(\text{NH}_4)_2\text{UO}_2(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$ (a,f,t), $\text{Ti}_2\text{UO}_2(\text{SO}_4)_2$ (a), $(\text{CH}_2)_6\text{N}_4\text{H}_2\text{SO}_4 \cdot \text{UO}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$ (f), $\text{CsUO}_2(\text{OAc})_3$ (f), $\text{RbUO}_2(\text{OAc})_3$ (a,f), $\text{KUO}_2(\text{OAc})_3$ (a,f), $\text{NaUO}_2(\text{OAc})_3$ (a,f), $\text{NH}_4\text{UO}_2(\text{OAc})_3$ (a,f), $\text{MgUO}_2(\text{OAc})_4$ (a,f), $\text{PbUO}_2(\text{OAc})_4 \cdot 2\text{H}_2\text{O}$ (f), $\text{UO}_2(\text{OAc})_2 \cdot 2\text{H}_2\text{O}$ (f), $\text{KBe}(\text{UO}_2)_3(\text{OAc})_9$ (f), $(\text{NH}_4)_2\text{UO}_2(\text{CO}_3)_2$ (f), $\text{K}_2\text{UO}_2(\text{CO}_3)_2$ (a,f), $(\text{CN}_3\text{H}_6)_2\text{UO}_2(\text{CO}_3)_2$ (a), $\text{K}_2\text{UO}_2\text{Br}_4 \cdot 2\text{H}_2\text{O}$ (f), $(\text{NH}_4)_2\text{UO}_2(\text{SeO}_4)_2$ (f), $\text{UO}_2(\text{COOH})_2 \cdot \text{H}_2\text{O}$ (f), $\text{UO}_2(\text{C}_2\text{Cl}_3\text{O}_2)_2$ (f), $\text{KUO}_2(\text{C}_2\text{Cl}_3\text{O}_2)_3$ (f), UF_6 (a,f), $\text{K}_4\text{U}(\text{C}_2\text{O}_4)_4 \cdot 5\text{H}_2\text{O}$ (a), $[(\text{CH}_3)_4\text{N}]_2\text{UCl}_6$ (a), $[(\text{C}_2\text{H}_5)_4\text{N}]_2\text{UCl}_6$ (a), Cs_2UCl_6 (a), $\text{Na}_4\text{UO}_6 \cdot 8\text{H}_2\text{O}$ (a), $(\text{NH}_3\text{OH})_2\text{UO}_4 \cdot 2\text{NH}_3$ (a), $(\text{NH}_3\text{OH})_2\text{UO}_4 \cdot \text{H}_2\text{O}$ (a), $\text{UO}_3 \cdot x\text{H}_2\text{O}$ (f), and uranyl acetylacetonate. Raman and infrared spectra for UF_6 are also reported. Zeeman and other effects are discussed for many of these salts. Bond strengths, lengths, and crystal structure for U and uranyl cpds. are also discussed. Expts. were carried out at approx 20, 77, and 298°K. Appendix 3 gives data on the d. of $\text{CsUO}_2(\text{NO}_3)_3$, m.p. of $\text{Cs}_2\text{UO}_2\text{Cl}_4$, hydration of UO_3 , and O exchange between $(\text{UO}_2)^{++}$ and $(\text{NO}_3)^-$ in $\text{CsUO}_2(\text{NO}_3)_3$. (This report is also published as Dieke and Duncan, Spectroscopic Properties of Uranium Compounds. New York, McGraw-Hill Book Company, Inc., 1949.)

2983 Dorrough, G. D. The Solubility of Uranoous Oxalate. Declassified July 8, 1947. 10p. (MDDC-1246) Methods based on α -activity measurements have been developed for the detn. of small amts. of U in soln., and these methods have been applied to the detn. of the soly. of $\text{U}(\text{C}_2\text{O}_4)_2$ under a variety of conditions. The two methods employed for the prepn. of samples were the electroplating method which is accurate and applicable to very low concns. of U and the filter paper method which is slightly less sensitive and less accurate but considerably more rapid and convenient. Complete procedures are presented. The exptl. values for the soly. in HCl do not fit any simple soly. product, due to hydrolysis of U^{+4} , and perhaps complexing with chloride. The soly. in H_2SO_4 is considerably greater presumably due to complexing of U^{+4} by sulfate. Soly. product calcns. indicate the hydrolysis of U^{+4} to $\text{U}(\text{OH})^{+3}$ is nearly complete.

2984 Dowdy, A. H. "Chemical Hazards of Uranium Handling." Chem. Eng. 54, 236+(1947).

2985 Duval, C. "The Thermogravimetry of Analytical Precipitates. VIII. Determination of Sodium." Anal. Chim. Acta 1, 97-102(1947).

$\text{NaMg}(\text{UO}_2)_3(\text{OAc})_9 \cdot 6\frac{1}{2}\text{H}_2\text{O}$ is best weighed as $2\text{MgU}_2\text{O}_7 \cdot \text{Na}_2\text{U}_2\text{O}_7$, after igniting at 360 to 745°. The corresponding Zn ppt. is also best weighed as $2\text{ZnU}_2\text{O}_7 \cdot \text{Na}_2\text{U}_2\text{O}_7$, after heating at 360 to 674°. Other analytical methods for Na are also considered.

2986 Eastman, E. D. and Webster, R. A. (written by B. J. Fontana) The Electrolysis of Uranium Halides. Declassified Oct. 9, 1947. 14p. (MDDC-1369)

The electrolysis of tetra- and trihalides of U in fused salt systems at temps. from 700 to 900°C has been investigated. Serious losses were found to be caused by reaction with atmospheric O_2 , refractories, and electrode materials. The tetrahalides are particularly active as oxidizing agents, even apart from the electrolytic process. The electrolytic behavior of U^{+3} salts indicates the existence at high temps. of an oxidation state of U lower than three.

- 2987 Eastman, E. D., Thurmond, C. D., and Webster, R. A. The Lower Oxidation States of Uranium in Its Molten Tribromide. Declassified May 20, 1947. 12p. (AECD-2311)

Exptl. data obtained during the detn. of conditions most favorable for the electrolytic reduction of U could be explained by assuming the presence of U in a lower oxidation state in molten UBr_3 . Expts. were designed to differentiate between this and other possible explanations such as the formation of a metallic "fog" of U in the melt, or direct dissolution of metal in the molten salt. The results allowed the construction of a portion of the liq.-solid phase equil. diagram of the system U- UBr_3 , which shows that U is sol. in molten UBr_3 and that if lower halides do exist in the liq. phase, they are unstable in the solid phase.

- 2988 Eastman, E. D., Strickland, A. E., and Brewer, L. Equilibrium Pressures in the System Uranium-Uranium Bromide. Declassified July 31, 1947. 6p. (MDDC-1196)

The vapor pressure of UBr_3 over a soln. of U in molten UBr_3 was found to be close to the vapor pressure of pure UBr_3 which indicates a pos. deviation from Raoult's law for UBr_3 in the U- UBr_3 soln.

- 2989 Eastman, E. D., Strickland, A. E., and Thurmond, C. D. Note on the Solubility of Uranium Tribromide in Fused Salts. Sept. 28, 1945. Declassified May 20, 1947. 5p. (AECD-2312)

The liq.-solid equil. of the systems $\text{SrI}_2\text{-UBr}_3$ and $\text{SrBr}_2\text{-UBr}_3$ have been investigated by the method of thermal analysis, and tentative temp.-compn. diagrams have been constructed.

- 2990 Ebert, H. and Schulze, A. "Electrical and Thermal Properties of Uranium." Metallforschung 2, 46-9(1947).

Two vacuum-melted samples of U, 99.9%, 99.5%, and a 3rd of lower but undetd. purity were investigated. Sample I contained more than 0.01% of Al, Be, Si, Mn, Fe, and Cu, and sample II somewhat less than 0.1% of the same impurities, except that Cu was present only as a trace. The specific elec. resistance expressed in 10^{-4} ohm cm and its temp. coeff., $A_{20} \times 10^3$ was found to be, resp., for I, 0.29 and 2.18; for II, 0.37 and 2.00; for III, 0.44 and 1.97. Thermoelec. potential against pure Cu and pure Pt was detd. Against Cu, with 2 samples of specimen II the values obtained for dE/dt were 4.3 and 5.0 $\mu\text{v}/^\circ$, and against Pt dE/dt was found to be 12 $\mu\text{v}/^\circ$. This places U in the same position as Mo in the thermoelec. series. The following values were obtained for d: for specimen II 18.32 g/cc, and for III 18.30 g/cc. Thermal expansion was detd., with specimen II, for temps. from 0 to 500°. The following values were obtained for $1/\alpha$ expressed in mm/m: at 100° 1.60, 200° 3.25, 300° 5.00, 400° 6.85, 500° 8.75. The methods used for these measurements are discussed in detail.

- 2991 Efendiev, F. M. "Combined Spectral and Chemical Analysis of Microelements." Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 11, 313-18(1947).

To det. small quantities of elements in soils, ores, etc., they must first be obtained in solns. of solvents which are easily evapd. in the discharge. The sensitivity of the results toward diff. light sources was studied for detg. Li, Na, K, Cs, Cu, Ag, Au, Mg, Ca, Sr, Ba, Zn, Cd, Hg, Ga, In, Tl, Ge, Sn, Pb, Bi, As, Sb, Mo, Co, Pt, and Ni. It was found that the best results were obtained with an arc of 10 to 12 kv, 20 to 30 ma without inductive or capacitive load. W, Ta, Th, U, Zr, and other refractory elements show poor sensitivity. A simple method of analysis has been worked out. A spectrogram of the soln. to be analyzed is first taken and then the test is repeated after addn. of a soln. contg. a known quantity of the metal to be analyzed.

- 2992 Eischens, R. P. and Selwood, P. W. "Structure Studies of Chromium-Aluminum Oxide and Related Catalyst Systems." J. Am. Chem. Soc. 69, 2698-2702(1947).

Magnetic susceptibility isotherms, x-ray diffraction, and surface-area studies are made of catalysts prepd. by impregnation, pptn., and copptn., and contg. Cr, Mo, W, and U, generally supported on $\gamma\text{-Al}_2\text{O}_3$, but in certain cases on $\alpha\text{-Al}_2\text{O}_3$, silica gel, TiO_2 , and ThO_2 . Among many interesting observations are effects of carrier area, failure of expts. with Mo because no appreciable paramagnetism is developed, and the general agreement in results by the 3 techniques.

- 2993 Evers, E. C. Certain Chemical and Physical Properties of the Uranium Chlorides. Declassified Feb. 27, 1947. 29p. (MDDC-690)

The properties and methods of prep. the various U chlorides and oxychlorides are described. U forms a series of polychlorides of definite compn., namely UCl_6 , UCl_5 , UCl_4 , and UCl_3 . On heating at atmospheric pressure, both UCl_6 and UCl_5 may be decompd. to UCl_4 , which is very stable. Anhyd. UCl_3 may be prepd. by heating UCl_4 with a reducing agent, H_2 being well suited for this purpose. Results of investigations relating to the mechanism of the liq. phase chlorination of UO_3 and of phase studies of the system $\text{UO}_3\text{-H}_2\text{O-HCl}$ are given. Results with HNO_3 and HClO_4 are also included for purposes of comparison.

- 2994 Faucherre, J. and Schaal, R. "Potentiometric Study of Soluble Basic Salts." Compt. rend. 225, 118-20(1947).

In this study the pH of the solns., detd. with a glass electrode, was found to vary linearly with the log of the diln. Applying Bye's formula, the authors found the equil. $2(\text{UO}_2)^{++} + 2(\text{OH})^- \rightleftharpoons [(\text{UO}_2)_2\text{O}]^{++} + \text{H}_2\text{O}$ to hold. This reaction and similar ones with other metals are almost instantaneous.

- 2995 Feather, N. "Radiations from Uranium (239) and Neptunium (239)." Nature 160, 749(1947). The intensity of the $\gamma_2 = 870$ kev indicated by Slatis in his level scheme does not correspond to the estd. 0.05 from the previous expts. From the observed second γ radiation the total disintegration energy of U^{239} is calcd. to 1.20 ± 0.05 mev so that the Slatis value of 2.06 mev cannot be attributed to this disintegration.

- 2996 Feather, N. and Krishnan, R. S. "The Radiations Emitted by $^{239}_{92}\text{U}$, and Its Formation in the Deuteron Bombardment of Uranium." Proc. Cambridge Phil. Soc. 43, 267-73(1947).

Small quantities of U were bombarded with 9 mev deuterons (10 min, at 2 to $5\mu\text{a}$). The radiations of U^{239} produced in this process were examined by the absorption method. The normal mode of disintegration involves β particles with an upper energy of 1.20 ± 0.02 mev, and a low-energy γ ray of 76 ± 3 kev. Evidence was found for electrons of less energy, and more penetrating γ rays of low intensity. Quantum radiations corresponding to L x rays were detected. The excitation function for the process $\text{U}^{238}(\text{d,p})\text{U}^{239}$ was studied.

- 2997 Ferguson, J. The Reduction of UF_4 by Hydrogen. May 14, 1942. Declassified August 1947. 6p. (BR-36)

The free energy of the reaction $\text{UF}_4 + 2\text{H}_2 \rightleftharpoons \text{U} + 4\text{HF}$ was calcd. as a function of temp. The heat of formation of U in this reaction is then calcd. (166 kcal) as was the value of entropy and other thermodynamic properties of the reaction along with its equil.

- 2998 Finkelburg, W. "Ionization Potentials and Electron Screening in the Periodic System." Z. Naturforsch. 2a, 16-20(1947).

The screening increment, Δs , is calcd. for all atoms and atomic ions for which either exptl. or spectroscopic values of the ionization potential E_i are known. These values were obtained by the relation $\Delta s = s_N - s_{N-1}$, where $s = Z - Z_{\text{eff}}$ and $Z_{\text{eff}} = n \sqrt{E_i}/R$. R = the Rydberg const. The Δs values show a regularity in the periodic system which permits the calcn. of unknown, and the correction of uncertain, ionization potentials. Thus the following new values of E_i were obtained: Nb, 6.9; Tc, 7.1; Pm, 6.3; Ho, 6.9; Tm, 6.9; Er, 6.9; Lu, 7.3; Hf, 7.3; Ta, 7.6; W, 7.6; Po, 8.3; At, 9.4; Fa, 4.0; Ac, 5.5; Th, 5.7; Pa, 5.7; U, 5.7. Corr. values of E_i were obtained as follows: Sb, 8.35; Bi, 7.25; Pd, 8.30.

- 2999 Fontana, B. J. Attempts to Reduce Uranium from Bromide Solutions in Ethyl Bromide and Related Solvents. Declassified July 8, 1947. 5p. (MDDC-1249)

Attempts have been made to reduce both UBr_4 and UBr_3 from ethyl bromide - benzene solns., ethyl bromide - hexaethyl benzene solns., ethyl bromide solns. and n-propyl bromide solns. In most cases the solys. were too low to give a sufficiently conducting soln., even with the addn. of other salts to the bath.

- 3000 Fontana, B. J. Heats of Reaction of the Aqueous Uranium Oxidation-Reduction Couples. Apr. 1, 1947. Declassified July 7, 1947. 8p. (MDDC-1603)

The heats of the $U^{+3} \rightarrow U^{+4}$ and $U^{+3} \rightarrow (UO_2)^{++}$ couples in 0.5M $HClO_4$ have been detd. through the reaction of U^{+3} with Fe^{+3} giving $H_{298} = +9.3 \pm 0.3$ and -23.7 ± 0.4 kcal/mole, resp. Reexamination of the aq. U ion oxidation-reduction potentials using the above heats (and that previously detd. for the $U^{+4} \rightarrow (UO_2)^{++}$ couples, $\Delta H_{298} = +32.94 \pm 0.06$ kcal/mole) leaves no doubt that the correct values are +0.63 v for $U^{+3} \rightarrow U^{+4}$ (1M HCl) and -0.33 v for $U^{+4} \rightarrow (UO_2)^{++}$ (0.5M HCl). Values of the ionic entropies thus calcd., based on $S(UO_2)^{++} = 17$ e.u., are $S_{U^{+3}} = -32$ e.u., and $S_{U^{+4}} = -79$ e.u. The heats of soln. of $UCl_3(s)$ and $UCl_4(s)$ in 0.5M $HClO_4$ have been measured, yielding $\Delta H_{298} = -28.9 \pm 0.4$ and -55.60 ± 0.06 kcal/mole, resp. Combination of the latter results with the heats of formation of $UCl_3(s)$ and $UCl_4(s)$ obtained from the literature allows ests. of the various oxidation-reduction heats to be made. The values thus obtained are consistent with those directly detd. to within about ± 1 kcal/mole, subject, however, to the calcn. of the new value $\Delta H_{298} = -113.1 \pm 0.7$ kcal/mole for the $U(s) \rightarrow (UO_2)^{++}$ couple.

- 3001 Fontana, B. J. The Heat of Solution of Uranium Tetrachloride in Aqueous Perchloric Acid Solutions. Aug. 19, 1947. Declassified Nov. 19, 1947. 2p. (MDDC-1452)

The heat of soln. of $UCl_4(s)$ has been measured and found to change appreciably with changing pH or ionic strength. The heat of hydrolysis of U^{+4} to form $(UOH)^{+3}$ is probably of the order of +11 kcal/mole.

- 3002 Fontana, B. J. Kinetics of the Decomposition of Tri-Valent Uranium Ion in Aqueous Solution. Aug. 19, 1947. Declassified Nov. 12, 1947. 7p. (MDDC-1453)

A brief preliminary study of the rate of oxidation of U^{+3} in aq. $HClO_4$ - $LiClO_4$ solns. (in the absence of O) was made. The reaction was followed spectrophotometrically. The reaction was found to be unimol. with respect to U^{+3} and independent of the pH (from 0.05M to 5.0M H^+). A 16-fold increase in rate is observed, however, on increasing the ionic strength from $\mu = 0.5$ to 5.0. Five references are included.

- 3003 Frenkel, A. W. The Effect of Uranyl-Chloride on the Respiration and Photosynthesis of Chlorella pyrenoidosa. Declassified Nov. 13, 1947. 5p. (AECD-2143)

UO_2Cl_2 at pH = 3.5 to 4.5 was found to inhibit exogenous respiration of glucose by Chlorella, approx. 20% at a U concn. of $10^{-4}M$ and 80% at $10^{-3}M$. Some stimulation was observed which may be due to uranyl sensitized decompn. of org. cpds. liberated by Chlorella cells.

- 3004 Freymann, M. "On the Classification of the Fluorescence Bands of Various Uranyl Salts." Compt. rend. 225, 529-31(1947).

In continuation of previous work a complete tabulation and classification are presented of the fluorescence bands of $UO_2(NO_3)_2 \cdot 6H_2O$, UO_2Cl_2 , and UO_2F_2 . Several of the bands are double or triple with the components sepd. by 30 cm^{-1} . To account for the 5 vibration freqs. of the chloride as revealed by the Raman spectrum it is suggested that it contains two forms of $(UO_2)^{++}$ corresponding to different perturbations by the neighboring H_2O mols. This view is supported by the fact that there are 2 fluorides ($\gamma_1 = 860$ and $\gamma_2 = 820$) which represent the complete sepn. of the 2 forms in the limiting case.

- 3005 Gibb, T. R. P. Jr. and Evans, H. T. Jr. "Semiquantitative Determination of Traces of Uranium. A Fluorophotometric Method for Field Use." Science 105, 72-3(1947).

The method of Hernegger and Karlik is the basis for 2 instruments described, one for preliminary studies and for calibration, the other for field use. A cast disk of more fusible mixed alk. fluorides is substituted for the NaF bead. With the portable instrument (4.8 lb with batteries) visual observations are made of the disk under observation and std. 2-g disk mounted on a comparator wheel. Quantities of the order of 0.1 to 200 γ /g flux are detd. Interfering elements are Sb, Bi, Cd, Ce, Co, Cr, Fe, Pb, Mn, and Zn.

- 3006 Gillies, D. M. Some Studies of the Reactions of Uranium Oxides with Hydrogen, Oxygen, and Water. June 1946. Declassified Feb. 7, 1947. 69p. (MDDC-647)

The purpose of this research was to obtain data that would be useful in predicting changes that might be expected to occur in the oxidation state and degree of hydration of powd. U oxides maintained for long periods of time at temps. between 30 and 300°C in the presence of excess H₂O, H₂, O₂, and possibly H₂O₂. The reaction of H₂ and O₂ with H₂O slurries of U₃O₈ were studied at 100 to 300°C. The rates of these reactions appear to fit an equation of the form $-d(1-x)/dt = kp^n(1-x)^\theta$, where x is the fraction of the U⁺⁶ or U⁺⁴ which has been reduced or oxidized, resp., at time t, and n is the order of the reaction with respect to the pressure, p, of the reacting gas. The exponent θ , the "order" of the reaction with respect to the solid oxide, is thought of as a measure of the decrease of the solid surface with time, the difficulty encountered by the gas mols. in penetrating the solid particles, or some equiv. phenomenon. The oxidation reaction appears to be first order with respect to O₂ (experimentally n = 1.14), and the value of θ , for the particular oxide prepn. used, was 3.7. The activation energy was computed to be 13,000 cal $\pm$ 10%. The value of θ for the reduction reaction, using the same oxide, was 15.0. Assuming the reaction to be first order with respect to H₂, the activation energy is 10,000 cal $\pm$ 15%. U₃O₈ suspended in H₂O is oxidized much more rapidly than it is reduced. Under 14 atms. of O₂ the oxidation reaction is 76% complete in t hrs. at 250°C; under 16.5 atms. of H₂ the reduction reaction is only 5 to 6% complete in 2 hrs at 250°C. This difference in rate is due largely to the difference in θ for the two reactions; that is, the rate of the reduction reaction decreases more rapidly with decrease in "available oxide surface" than does the rate of the oxidation reaction. UO₃·H₂O was reduced even more slowly than U₃O₈, possibly because the crystal size was much greater. The results indicate that in a U oxide-H₂O mixt. exposed to H₂ and O₂ at pressures of similar magnitude the U would drift toward U⁺⁶. The thermal decompn. of UO₄·2H₂O in the presence of H₂O, giving hydrated UO₃ and O₂, was studied as a function of temp. At 61°C the reaction is detectable but very slow; at 100°C the half-life is about 400 hrs; at 185°C the reaction is essentially complete in 1 hr. Assuming either a first- or second-order process, the activation energy is 30,000 cal $\pm$ 10%. The thermal stability of the hydrates of UO₃ in the presence of H₂O was investigated. The highest hydrate, UO₃·2H₂O, is stable up to at least 61°C. The transition to UO₃·H₂O occurs between 61 and 77°C. At 265°C the monohydrate seems to be stable, but at 300°C it slowly loses H₂O. At 350°C a cryst. hemihydrate, UO₃·H₂O, is formed. Previously unreported polymorphic forms of the hydrates exist. Different forms were obtained by the reaction of two different forms of the anhyd. oxide with H₂O. Two forms of the dihydrate were found; both were microcryst., but the x-ray patterns of the two were distinct. At least two forms of the monohydrate exist, a rhombic form and a triclinic form. The hemihydrate is a definite cryst. cpd. The crystal form is probably monoclinic. The cryst. monohydrate reacts with H₂O extremely slowly and can exist in liq. H₂O for long periods at temps. where the dihydrate is thought to be stable. Evidence is presented to support the conclusion that in the dihydrate one mole of H₂O is present as zeolitic water. Anhyd. UO₂ and U₃O₈ were not found to react with H₂O.

- 3007 Ginnings, D. C. and Corruccini, R. J. The Specific Heats of High Temperatures of Uranium, Uranium Trichloride, and Uranium Tetrachloride. Declassified Jan. 23, 1947. 17p. (MDDC-589)

The method consisted in heating the sample in a furnace to a known temp. and dropping it into an ice calorimeter which measured the heat evolved in cooling the sample to 0°C. The calorimeter was calibrated electrically. The sample was sealed in a Nichrome "V" capsule having a screw cap and Au gasket. The heat capacity of the empty capsule and the heat lost by the container during the drop were accounted for by "blank" expts. made with the empty capsule. The temp. of the sample was measured by a Pt, Pt-Rh thermocouple which had been calibrated at the National Bureau of Standards. The enthalpies,

referred to 0°C, of U in the range 0 to 900°C, of UCl_3 in the range 0 to 725°C, and of UCl_4 in the range 0 to 425°C are given. The two first-order transformations of U were observed and the heats of transition calcd. from the exptl. data. No evidence of first- or second-order transitions in the chlorides was found. Results are tabulated and discussed.

- 3008 Ginnings, D. C. and Corruccini, R. J. "Heat Capacities at High Temperatures of Uranium, Uranium Trichloride, and Uranium Tetrachloride." J. Research Natl. Bur. Standards **39**, 309-16(1947). (Research Paper No. 1831)

This paper is similar to report MDDC-589(1947).

- 3009 Gotte, H. and Radock, G. "Emanating Uranium Compounds." Z. Naturforsch. **2a**, 427(1947). $(\text{NH}_4)_2\text{U}_2\text{O}_4$ is a suitable substance for the sepn. of U-fission products by the Hahn and Strassmann method, but its emanating power depends on the method of prepn., and is very strongly influenced by atmospheric humidity. "Isobutylamine-" and "triethylamine ammonium uranates" (actual compn. doubtful) prepd. by simple pptn. methods have higher emanating powers.

- 3010 Goudsmit, S. A. Alsos. New York, Henry Schuman, 1947. 259p.
This is the story of the Alsos Mission, which undertook to investigate German efforts for the atomic bomb. The appendix is entitled "An Outline of the Uranium Problem."

- 3011 Grosse, A. V. A Method for Handling and Purifying UF_6 in Glass Vessels by Means of Alkali Fluoride Getters. September 1945. Declassified May 29, 1947. 2p. (MDDC-1038)

A new and efficient method for handling and purifying UF_6 in glass vessels became available when it was discovered that alk. fluorides, in particular KF and NaF, act as very eff. getters of impurities in UF_6 . Comparative tests showed that, whereas without KF or NaF glass is rapidly attacked, it stays clear for a yr or more in the presence of these fluoride getters.

- 3012 Grosse, A. V. Note on the Use of Silica-Free Glasses for Handling Anhydrous Hydrogen Fluoride and Uranium Hexafluoride. September 1945. Declassified June 13, 1947. 3p. (MDDC-1040)

Using silica-free Al phosphate glasses it was possible to conduct expts. which showed conclusively that UF_6 has a very small soly. in anhyd. HF. This could be checked by observing a crystal of UF_6 sink in an excess of boiling HF and dissolve to only a small extent.

- 3013 Grosse, A. V. Note on the Separation of Hydrogen Fluoride from Uranium Hexafluoride. Declassified June 13, 1947. 3p. (MDDC-1039)

Methods of sepg. HF from UF_6 are proposed. The first method proposes decantating or filtering the products of Ruff's reaction. However, a better sepn. can be effected by fractional distn. at low pressures.

- 3014 Grosse, A. V. UF_5 , A New Fluoride of Uranium. April 1944. Declassified June 13, 1947. 2p. (MDDC-1041)

The discovery of UF_5 is reviewed and a method of prepn. is presented. When UF_4 is heated with excess liq. UF_6 at 95 to 100° for periods of 20 to 100 hr, the new cpd. UF_5 is formed. It is a grayish-white solid, violently decompd. by H_2O into UF_4 , UO_2F_2 , and HF.

- 3015 Grummitt, W. E., Guéron, J., Wilkinson, G., and Yaffe, L. "The Fission Yields of Ba^{139} and Ba^{140} in Neutron Fission of U^{235} and U^{238} ." Can. J. Research B. **25**, 364-70(1947).

This paper is similar to report NRC-1578(1944).

- 3016 Guéron, J. and Yaffe, L. "Formation of Uranium Hydride." Nature **160**, 575(1947).

Ten g U in contact with 72 cc purified H_2 was completely transformed to UH_3 in 2 hr at 250°, in 24 hr at 100°, and in about 2 weeks at 20°.

3017 Guiter, H. "Hydrolysis of Uranyl Nitrate." Bull. soc. chim. France 64-7(1947).
The pH values of solns. of $\text{UO}_2(\text{NO}_3)_2$ from 1 to $4 \times 10^{-6}\text{N}$ were detd. colorimetrically. The plot of pH vs. $p[(\text{UO}_2)^{++}]$, assuming $\text{UO}_2(\text{NO}_3)_2$ to be completely ionized, shows four segments. The concn. range of $\text{UO}_2(\text{NO}_3)_2$, the postulated hydrolysis product, the hydrolysis const., and % hydrolysis for the segments are: (a) 1.0 to 0.062N , $[(\text{UO}_2\text{OH})_2]^{++}$, 1.13×10^{-5} , 3.6 to 9% ; (b) 0.062 to 0.008N , $\text{UO}_2\text{NO}_3\text{OH}$, 4.13×10^{-3} , 9% ; (c) 0.008 to $5 \times 10^{-4}\text{N}$, $(\text{UO}_2\text{OH})^+$, 3.15×10^{-5} , 9 to 35.6% ; (d) 5×10^{-4} to $3 \times 10^{-5}\text{N}$, $[\text{UO}_2(\text{NO}_3)_3(\text{OH})]^{-}$, 2.3×10^5 , 35.6 to 2.2% .

3018 Guiter, H. "Study of the Potentiometric Titration Curves of Uranyl Acetate with Sodium Hydroxide." Bull. soc. chim. France 275-6(1947).
A soln. which was 0.255N in $\text{UO}_2(\text{OAc})_2$ and 0.012N in HOAc was titrated with NaOH at room temp. and at the b.p. When stable equil. was established, the first inflection occurred at $\text{pH} = 6.8$ to 8.6 , corresponding to the formation of $\text{UO}_2(\text{OH})_2$, and the second inflection at $\text{pH} = 9.3$ to 9.9 , corresponding to the formation of $\text{Na}_2\text{O} \cdot 8\text{UO}_3$. For metastable equil. the first inflection at $\text{pH} = 6.6$ to 8.6 , represents the formation of a basic acetate, possibly $(\text{UO}_2)_{15}(\text{OH})_{29}\text{OAc}$, and the 2nd inflection corresponds to the formation of unstable $\text{Na}_2\text{O} \cdot 4\text{UO}_3$.

3019 Guiter, H. "Theory of the Hydrolysis of Salts of Weak Bases." Ann. chim. (12), 2, 72-82(1947).
The hydrolysis of salts of inorg. weak bases was studied by detg. the pH corresponding to different cation concns. It is postulated that a small increase in pH indicates the formation of cation complexes, since the amt. of H^+ present is insufficient to account for the pos. charge corresponding to the cations that have disappeared. The theory is tested by expt. work on the hydrolysis of the nitrates of Zn , Ag , Pb , UO_2 , and Hg .

3020 Hagemann, F., Katzin, L. I., Studier, M. H., Ghiorso, A., and Seaborg, G. T. The $4n + 1$ Radioactive Series. The Decay Products of U^{233} . Oct. 28, 1946. Declassified Dec. 10, 1947. 12p. (MDDC-1186)

The decay products of U^{233} , which constitute a substantial fraction of the entire missing $4n + 1$ radioactive series, are listed together with their radioactive properties in the following table:

Isotope	Radiation	Half-life	Energy of radiation (mev)
$^{229}\text{Th}_{90}$	α	7×10^3 yr	4.85
$^{225}\text{Ra}_{88}$	β^-	14.8 days	0.2
$^{225}\text{Ac}_{89}$	α	10.0 days	5.80
$^{221}\text{Fr}_{87}$	α	4.8 min	6.30
$^{217}\text{At}_{85}$	α	0.018 sec	7.00
$^{213}\text{Bi}_{83}$	$\beta^-(96\%)$	47 min	1.2 (β^-)
	$\alpha(4\%)$		6.0 (α)
$^{213}\text{Po}_{84}$	α	very short	8.30
$^{209}\text{Tl}_{81}$	(β^-)	?	?
$^{209}\text{Pb}_{82}$	β^-	3.3 hr	0.7
$^{209}\text{Bi}_{83}$	stable		

Neptunium ($4n + 1$) is suggested as a name for the series. (A condensation of this paper appears in Phys. Rev. (2), 72, 252(1947).)

3021 Hagemann, F., Katzin, L. I., Studier, M. H., Ghiorso, A., and Seaborg, G. T. "The $4n + 1$ Radioactive Series. The Decay Products of U^{233} ." Phys. Rev. (2), 72, 252(1947).
This is a condensation of report MDDC-1186(1947).

3022 Haldar, B. C. "Studies on Complex Carbonates of Uranium by Thermometric and Conductometric Methods." *J. Indian Chem. Soc.* **24**, 503-10(1947).

Both thermometric and conductometric methods indicate the existence in soln. of cpds. of the type $M_4UO_2(CO_3)_3$ and $M_2UO_2(CO_3)_2$, where M is Na or K.

3023 Hale, W. J. and Miller, H. —assigned to National Agrol Co., Inc. Butadiene. May 13, 1947. (U. S. Patent 2,420,477)

Butadiene is prepd. by the reaction of C_2H_4 with $CH_2:CHOEt$ or $MeCH(OEt)_2$ at 125 to 250° in the presence of a catalyst consisting of a metal core of Be, Mg, Zn, Cd, Al, or alloy thereof which is coated with a partially reduced oxide of a metal from family A of Groups V and VI of the periodic system.

3024 Hamaker, J. W. and Koch, C. W. Note on the Composition of Uranium Peroxides. Declassified Aug. 27, 1947. 3p. (MDDC-1211)

The complete report is reproduced below.

"Several samples of U peroxide were prepared and analyzed. An excess of superoxol was added to 0.22M uranyl nitrate solution and the mixture heated. The yellow powder, when filtered off, washed and air-dried, gave the analysis shown in Table 1 (samples 1 and 2). The calculated formula of U peroxide agrees very closely with that reported before, i.e., $UO_4 \cdot 2H_2O$.

Table 1 — Analysis of Uranium Peroxides

Sample	Method of washing	% U_3O_8	% H	% C	Kjel-dahl % N	Ce ⁺⁴ Titration % O per-oxide	Formula calculated
1	Water, alcohol, ether	82.45	1.25	--	--	--	$UO_{3.98} \cdot 2.11H_2O$
2	Water	82.41	1.29	--	--	--	$UO_{3.96} \cdot 2.18H_2O$
3	Water, alcohol, ether	69.80	1.95	3.00	3.43	--	$U(O^- + O^{--})_{4.17}(NH_4)_{0.99}$
4	Water	70.43	1.73	3.05	3.55	7.61	$U(O^-)_{1.94}(O^{--})_{2.02}(NH_4)_{1.01}(C_2O_4)_{0.51} \cdot 1.58H_2O$

At the same time an attempt was made to prepare the "crystalline" peroxide reported by A. Rosenheim and H. Daehr. Superoxol was added to a solution containing the calculated amounts of ammonium oxalate and uranyl nitrate to form uranyl ammonium oxalate and a minor fraction of the uranium was precipitated as a crystalline solid. These were the conditions reported by Rosenheim and Daehr, except that nitrate ions were present. As will be seen in Table 1 (samples 3 and 4), ammonium ion appears in the solid phase. The authors considered it very possible that the compound prepared by Rosenheim and Daehr also contained ammonium and oxalate ions. The solid was air-dried before analysis. Its formula corresponds closely to $(NH_4)_2U_2O_8C_2O_4 \cdot (3-4)H_2O$."

- 3025 Hamer, W. J. "Anodic Current Efficiency in the Counterflow Electrolysis of Uranyl Chloride Solutions." J. Research Natl. Bur. Standards 39, 141-7(1947). (Research Paper No. 1817)
The Cl-O ratio in the electrolysis of aq. solns. of UO_2Cl_2 was studied. By using the method of counter-flow electrolysis the concn. of the electrolyte is maintained const. throughout the expt. so that significant and reproducible results are obtained. For UO_2Cl_2 the current eff. (production of Cl_2) depends on the anode material and increases in the following order: magnetite, arc carbon, graphite, metallic carbides, and the Pt metals.
- 3026 Harris, W. E. and Kolthoff, I. M. "The Polarography of Uranium. III. Polarography in Very Weakly Acid, Neutral, or Basic Solutions." J. Am. Chem. Soc. 69, 446-51(1947).
This paper is confined to a discussion of the polarography of $(\text{UO}_2)^{++}$ in solns. contg. only slight traces of free acid, no free acid, or small quantities of alk. hydroxide and in carbonate solns. Data are given for the hydrolysis of UO_2Cl_2 solns. at 25° , for the diffusion currents of UO_2Cl_2 vs. 0.1M KCl, for amperometric titration of 10^{-3}M UO_2Cl_2 in 0.1M KCl with NaOH or HCl, and for the effect of $(\text{NH}_4)_2\text{CO}_3$ upon the half-wave potential of the first reduction of U^{+6} . From polarograms obtained in solns. of UO_2Cl_2 contg. 0.1M KCl either without or with small amts. of acid or alk. it is concluded that the first wave corresponds to the reduction of $(\text{UO}_2)^{++}$. The hydrolysis product $(\text{UO}_2\text{OH})^+$ from $(\text{UO}_2)^{++}$ is not reduced at the first wave, but is reduced at the second wave together with U^{+5} . The $(\text{UO}_2\text{OH})^+$ is reduced to U^{+3} and not to U^{+4} . It is assumed that under the specified conditions UO_2 and UO_2OH sep. as insol. films at the surface of the dropping Hg. The hydrolysis const. of the $(\text{UO}_2)^{++}$ at 25° is 8.1×10^{-5} . Amperometric titration of UO_2Cl_2 with NaOH yields complete pptn. long before the stoichiometric end point, $\text{UO}_2(\text{OH})_2$, is reached. At the proper concn. of $(\text{NH}_4)_2\text{CO}_3$, 2 well-defined waves of U^{+5} are found. Contrary to statements in the literature, each reduction wave corresponds to an electron transfer of one. Carbonate is not recommended as supporting electrolyte for the polarographic detn. of $(\text{UO}_2)^{++}$ because the diffusion current is not proportional to the concn.
- 3027 Harvey, B. G. "Chemistry of Plutonium." Proceedings of the Conference of Nuclear Chemistry. Ottawa, Chemical Institute of Canada, 1947. p.60-7.
The chemical properties of Pu are described and compared with those of U. A similar paper by the author appeared in J. Chem. Soc. 188, 1010-21(1947).
- 3028 Heaney, R. J. and Rodden, C. J. The Determination of U_3O_8 in Canadian Ores by Means of the "Ten Per Cent" Reductor. May 27, 1946. Declassified Apr. 29, 1947. 4p. (MDDC-901)
The eff. of the 10% reductor in overcoming the interference of Ni in the detn. of U_3O_8 volumetrically is verified with a group of synthetic mixts. The deleterious effect of Cu in ore samples is noted, and the various effects of the presence of Cu are investigated. The satisfactory detn. of U in Ni-bearing ores, provided that Cu and reducible elements other than U are removed, is shown.
- 3029 Helmholtz, L. and Friedlander, G. Physical Properties of Uranyl Sulfate Solutions. Dec. 15, 1943. Declassified Mar. 13, 1947. 12p. (MDDC-808)
Measurements are reported of the soly. of uranyl sulfate in H_2O at several temps., of the d. of the solns. as a function of concn., of the variation of d. of three different concns. from 0 to about 93°C , and of the pH as a function of concn. as well as of temp. The pH measurements were taken on uranyl sulfate samples prepd. in several different ways, and some conclusions are drawn as to the purity of these samples.
- 3030 Heron, A. M. "Recognition of Uranium and Thorium Minerals in the Field." Indian Minerals 1, 245-7(1947).
A brief description of U and Th minerals, with notes on their identification in the field is given.

- 3031 Hindman, J. C., Kraus, K. A., Howland, J. J. Jr., and Cunningham, B. B. Determination of the Plus Three Oxidation State of Plutonium and Notes on the Spectrophotometry of Plutonium and Uranium. Declassified Dec. 30, 1947. 21p. (MDDC-1547)

Expts. are described which led to the identification of Pu^{+3} . Through a series of qual. reduction expts. involving both Pu^{+4} and Pu^{+6} it was found that an oxidation state of Pu with oxidation no. less than 4 exists and that this oxidation state is characterized by purple-violet aq. solns. in HCl , H_2SO_4 , and HNO_3 . A method of spectrophotometric titration is described through which the oxidation state was identified as Pu^{+3} . The potential of the $\text{Pu}^{+3}/\text{Pu}^{+4}$ couple has been approximated through qual. expts. and has been more precisely evaluated during a spectrophotometric titration of Pu^{+4} with ferrous ammonium sulfate. A summary of some early spectrophotometric work involving Pu solns. in the various valence states and of some U solns. is also given. (This paper is also published in Seaborg, Katz, and Manning, The Transuranium Elements. New York, McGraw-Hill Book Company, Inc., 1949. Paper 3.2.)

- 3032 Hirschmann, F. A. F. "Qualitative Analysis of Aluminum and Its Alloys." Industria química (Buenos Aires) 9, 305-10(1947).

Dissolve 5 g of the sample in 125 ml of 6N HCl and a few drops of HNO_3 . Dil. with an equal vol. of H_2O , heat, and cool to sep. metals of group I. Subsequent operations are described under 39 headings for the detection of Ag, Pb, W, Cu, Bi, Cd, Sn, Sb, Mo, V, Zn, Mg, U, Fe, Mn, Ni, Ti, Sr, Ba, and Ca.

- 3033 Hirt, R. C. and Nachtrieb, N. H. Determination of Rare Earth Elements in Uranium Compounds. June 24, 1944. Declassified Jan. 31, 1947. 4p. (MDDC-903)

A brief description of the Et_2O extrn. method of sepg. U and rare earths is given. The pptn. of the materials as fluorides and purification as hydroxides is also discussed. The limits of sensitivity are detd. (This paper is also available in Anal. Chem. 20, 1077-8(1948).)

- 3034 Hoffman, J. I. Purification of Uranium Oxide. Declassified Mar. 18, 1947. 5p. (MDDC-777)

A procedure is given for the purification of U oxide by converting the oxide to the nitrate and partitioning the nitrate between a large amt. of Et_2O and a relatively small amt. of H_2O . In modified form, the procedure was found to be applicable to pitchblende and carnotite and concs.

- 3035 Hovorka, V., Sykora, V., and Vorisek, J. "The β -Oxime of Isatin and Its Use in Analytical Chemistry." Chim. anal. 29, 268-75(1947).

The β -oxime of isatin has, with respect to salt formation, 2 replaceable H atoms. Several methods of prepg. the oxime are described but a yield of about 80% can be obtained by boiling a mixt. of 15 g isatin, 8 g of $\text{NH}_2\text{OH}\cdot\text{HCl}$, and 200 ml of H_2O . The red isatin changes to the yellow oxime. Of the salts, Beilstein mentions only that with Ag, but cpds. with Hg, Cu, Pb, Fe, UO_2 , Ni, Co, Ce, Zr, and Th can be prepd. easily. HOAc solns. or solns. buffered with NaOAc can be used but in some cases it is necessary to make the soln. slightly ammoniacal. The uranyl cpd. is characteristic and by calcining the washed ppt., U_3O_8 is obtained. From 1 to 240 mg of U can be detd. The results are usually a few tenths of 1 mg too high. To 50 to 100 ml of boiling soln. add a slight excess of a 1% soln. of the oxime in 50% EtOH and buffer with 10% NaOAc soln. Allow to cool for 3 hrs, filter through ashless filter paper, wash with a soln. prepd. from 25 ml of reagent dild. with 500 ml of H_2O , calcine to U_3O_8 , and weigh. The detn. takes place easily in the presence of Mn, Zn, Cd, and Mg. When Ba, Sr, or Ca is present, it is best to add 10 to 15 drops of 0.5N HOAc . With Ni and Co present, it is advisable to ppt. at room temp. and to add a little NH_4CNS or Rochelle salt to prevent contamination. The results of 90 analyses were satisfactory.

- 3036 Howland, J. J. Jr. Absorption Spectra of Uranium(III) and Uranium(IV) in Molar Hydrochloric Acid. Declassified Sept. 5, 1947. 14p. (MDDC-1259)

The molar extinction coeffs. for the absorption of U^{+4} in 1M HCl have been detd. to 0.3 unit (1% of the abs. value at the band max.) over the range 4000 to 10,000 Å. The spectrum of U^{+3} in 1M HCl has been observed, and the molar extinction coeff. evaluated with a relative accuracy of 2% and an abs. accuracy of 10% at the max.

3037 Hutchinson, F. "The Self-Diffusion Coefficient of Argon." *Phys. Rev.* (2), 72, 1256(1947). The coeff. D for the diffusion of A^{41} into normal A(99.6% A^{40}) is $0.423 \pm 0.003 \text{ cm}^2/\text{sec}$, at 22° and 32 cm Hg. Kinetic theory gives the relation $pD = \epsilon\eta$, where p is gas d., η is viscosity, and ϵ is a no. that depends on the forces between 2 colliding mols. For A, $\epsilon = 1.31 \pm 0.01$. Values of ϵ for other gases are: H_2 , 20° , 1.37 ± 0.003 , -188° , 1.32 ± 0.06 , -252.8° , 1.28 ± 0.02 ; Ne, 20° , 1.27 ± 0.006 ; Kr, 20° , 1.30 ± 0.06 ; Xe, 20° , 1.24 ± 0.06 ; CH_4 , 20° , 1.33; UF_6 , 30° , 1.31.

3038 Investigations on Oxides of Uranium. Declassified April 1947. 1p. (BR-50)
This paper is composed of very brief notes on (1) analysis of residues from black U oxide remaining after treatment with HNO_3 , (2) suspensions of oxides in aq. soln, (3) prepn. of U_3O_8 .

3039 Jensen, K. J. and Rodden, C. J. Analytical Chemistry of the Manhattan Project. Chapter XIX. Silicon. Declassified Oct. 8, 1947. 16p. (MDDC-1373)

Detns. for Si in U ores and U metal are presented. Detailed procedures are given for the following: detn. of SiO_2 in U metal and oxide; detn. of SiO_2 in UF_4 ; the analysis of sol. salts of U; in the presence of phosphate, in the absence of phosphate (range 0.5 to 14 γ), in the absence of phosphate (range 0.02 to 2.5 γ). A bibliography of 21 references is included.

3040 Johns, I. B., Tevebaugh, A. D., Gladrow, E., Walsh, K., Chiotti, P., Ayers, B., Vaslow, F., and Fisher, R. W. The Reduction of Uranium Hexafluoride to Uranium Tetrafluoride. Aug. 18, 1945. Declassified Oct. 17, 1947. 16p. (MDDC-1412)

The reduction of UF_6 with H_2 , HBr , HCl , NH_3 , C_2H_4 , and SO_2 has been investigated. HBr at 80°C and HCl at 250°C give the best reductions. H_2 does not reduce UF_6 readily, and with NH_3 reduction, the product is a complex salt, probably NH_4UF_5 . Ethylene reductions give UF_4 mixed with C. The recommended method is the use of HCl at 250°C in a Ni app. An app. suitable for the reduction is described. Ten references are given.

3041 Johnson, O., Butler, T., and Newton, A. S. Preparation, Purification, and Properties of Anhydrous Uranium Chloride. Declassified Oct. 9, 1947. 43p. (MDDC-1374)

Methods of prepg. anhyd. UCl_3 , UCl_4 , UCl_5 , and UO_2Cl_2 are described which use U metal as the starting material. UCl_3 has been prepd. by the action of HCl on UH_3 or powd. U metal at 250°C . UCl_4 has been made by reaction of Cl_2 with UCl_3 and by direct reaction of Cl_2 (dild. by an inert gas) on UH_3 . UCl_5 has been prepd. only by disproportionation of chlorides having a Cl-to-U ratio of around 5.5. UO_2Cl_2 was found to be most satisfactorily made by the reaction of UCl_4 and O_2 at 300°C . The d. of these cpds. and of UCl_5 have been measured by the liq. displacement method and also detd. from x-ray-diffraction data. The d. in g/cm^3 obtained by liq. displacement method are 5.35, 4.88, 3.81, 1.56, and 5.38, all at 25°C for UCl_3 , UCl_4 , UCl_5 , UCl_6 , and UO_2Cl_2 , resp.; based on x-ray measurements, 5.51, 4.87, and 5.43 are obtained for UCl_3 , UCl_4 , and UO_2Cl_2 . Vapor pressure measurements have been made for UCl_4 and UCl_6 by the transpiration method. The vapor pressure of UCl_4 is 0.9 mm at 450°C and 100 mm at 675°C ; that of UCl_6 is 0.06 mm at 75.5°C and 1.75 mm at 138°C . UCl_4 m. 590°C and b. 802°C under 740-mm pressure. There is x-ray and thermal evidence for a crystal transformation in UCl_4 at 545°C . The reaction between Cl_2 and UCl_4 or UCl_3 has been shown to produce higher chlorides in which the Cl-to-U ratio varies with the reaction temp. Corrosion studies have been made on Ni and stainless steel and some refractory materials at 600°C . A bibliography of 39 references is included.

3042 Kasha, M. Absorption Spectra of Plutonium in Aqueous Solution. Fine Structure and Analytical Applications. Declassified Jan. 6, 1947. 14p. (MDDC-591)

Although the major part of the information is on plutonium and plutonyl ions, information on the fine structure of the uranyl spectrum is also included.

- 3043 Katz, E. J., Holt, L. G., and Schwartz, S. The Effect of Uranium Exposure on Urine Catalase Excretion. June 15, 1946. Declassified Oct. 8, 1947. 11p. (MDDC-1375)

No significant difference has been found in the urine catalase activity of control and U-exposed personnel. A prompt marked increase in urinary catalase activity lasting one to two weeks is found in rabbits injected with a kidney-damaging dose of U nitrate. Control rabbits have more catalase activity in the urine than do any human studied, with the exception of those with known kidney pathology. None of the human group studied have been exposed to an acute overwhelming dose of U comparable to the dose administered to the rabbits. A list of 5 references is included.

- 3044 Katzin, L. I. Half-Life of U^{233} . Sept. 29, 1947. Declassified Dec. 18, 1947. 1p. (MDDC-1549)
This article is an abstract and the entire text is reproduced below.

"The following information has been declassified for use in a lecture December 26, before the AAAS: The isotope U^{233} decays by emission of alpha particles with a half-life of 1.62×10^5 years."

- 3045 Kelley, K. K. and Moore, G. E. Entropy, Specific Heat, Etc., Data on U, UO_2 , and UO_3 . Dec. 24, 1942. Declassified Dec. 10, 1947. 2p. (MDDC-1499)

This report consists of tables giving heat contents of U, UO_2 , and UO_3 above 298.16°K (400 to 1500°K) as obtained from smooth curves and from exptl. results.

- 3046 Kennedy, J. W. and Segrè, E. Component Analysis of Small Uranium Samples. March 26, 1943. Declassified May 23, 1947. 26p. (MDDC-973)

A detailed account is given of project procedures used for the component analysis of small amts. of U. Details are given for the measurement of the mass, the α activity and the slow-neutron-produced fission of the sample. Calcns. and statistical errors are considered. Drawings of the following are included: ionization chamber; linear amplifier; power supply and scaling circuit; pulse generator; and lead shielding for Ra-Be source. The photographs are of an ionization chamber and linear amplifier and of a power supply and scaling circuit.

- 3047 King, E. L. The Rate of Exchange of U(IV) and U(VI). Declassified Mar. 24, 1947. 1p. (MDDC-813)

This document is an abstract and the entire text is reproduced below.

"The rate of exchange of uranium(IV) and uranium(VI) was measured in various perchloric acid and hydrochloric acid solutions at room temperature. It was found to be extremely slow. Since uranium(VI) is oxygenated while uranium(IV) is probably not, the process of exchange involves a breaking and re-forming of bonds. Such processes are generally slow."

- 3048 Knight, G. B. and Macklin, R. L. X-Ray Associated with U^{234} . Dec. 24, 1946. Declassified May 12, 1947. 4p. (MDDC-976)

The observation of L and M x rays from U^{234} unaccompanied by appreciable K-X radiation is reported. The suggestion is made that these arise from recoil atoms following α emission. (This paper is also available in Phys. Rev. (2), 72, 435(1947).)

- 3049 LaBelle, C. W. "The Variation of Toxicity with Particle Size of UO_2 Dust." Federation Proc. 6, 347-8(1947).

A finely ground sample of UO_2 has been sepd. into fractions of various particle sizes by a process of fractional sedimentation. Equal weights of the resulting fractions were suspended in physiologic saline and injected into the lungs of white rats by way of the trachea, at a dosage level of 100 mg/kg body wt. Growth, blood nonprotein N, and kidney phenolsulfonphthalein excretions were measured for each group injected. Those animals injected with particles 2 μ showed definite toxicological symptoms, which increased in intensity as the particle size was decreased. Animals injected with 0.2- μ particles showed a 25% loss in wt., 300% increase in blood nonprotein N, and 98% reduction in phenosulfonphthalein excretion for the smallest size of particles.

3050 Lautie, R. "Preparation of Metallic Powders." *Bull. soc. chim. France* 974-7(1947).
The prepn. of metals by reduction of their oxidized forms with K was studied. K was generated by the action of CaC_2 on KCl at 600 to 700° and 1 mm Hg. The K vapor then reacted with the metal cpd. and the free metal distd. and condensed as a powder. For the relatively volatile Zn and Cd this method offers no advantages over direct reduction with CaC_2 , but with less volatile metals this method gives a purer product. It is not suitable for the prepn. of the alk. or alk. earth metals or of Be or Mg from their oxides. Among the elements prepd. were Sb from Sb_2O_3 , Sb_2S_3 , and Sb_2OS_2 ; Bi from Bi_2O_3 ; Be from BeF_2 , BeCl_2 , and mixts. of these with KF or KCl; Mg from mixts. of KCl and MgCl_2 ; Zn and Ca (?) from oxides, sulfides, and silicates; Cu and Pb from oxides, sulfides, and chlorides; Cr, Mo, W, and U from sulfides, from mixts. of KCl and chlorides (Na_2UCl_6 or Na_2UF_6), and from alk. or alk. earth chromates, molybdates, tungstates, or uranates. Mixts. of cpds. were also reduced to give mixts. of metals or alloys. The yields were at least 90%. The purity of the product depended upon the purity of the cpd. but in general was at least 99.5%. It was always necessary to remove small amts. of metallic K and its cpds. from the powder by a wash with MeOH followed by one with H_2O ; redistn. was used in some cases. Zn, Cd, and Mg were also prepd. by reduction of cpds. with either Fe or ferrosilicon; Be can be prepd. from BeO by reduction with ferrosilicon. Ferro-Cr, Mo, W, or U can be prepd. by reduction of their oxysalts with ferrosilicon.

3051 Lewschin, V. L. and Shermet'ev, G. D. "The Period of Establishment of the Stationary Distribution in Excited Molecules of Uranyl Salts." *Zhur. Eksptl. Teoret. Fiz.* 11, No. 2(1947).
Observations on the fluorescence spectrum at various stages of the decay of the luminescence and in terms of the temp. and of the wavelength of the exciting light were made with the aid of a 17-cm disk phosphoroscope carrying 60 cells of 8 mm each at 72 mm from the center, revolving at 25, 50, and 100 rps and permitting reliable photographic detn. of decay of an av. duration 2×10^{-5} sec and detection of an inertia of up to 10^{-6} sec. While the usual (Kahlbaum) $\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$ (A) gives the well-known fluorescence spectrum consisting (at room temp.) of 8 double bands with stronger long-wave components, its recrystn. from H_2O after previous dehydration (several hr at 240°) gave a $\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$ (B) prepn. showing a fluorescence spectrum of simple bands only. The two forms are crystallographically and crystallo-optically different: (A) has $n = 1.599$, $n = 1.590$, $n_a = 1.583$, long crystals; (B), $n = 1.573$, $n = 1.569$, $n_a = 1.535$, shapeless grains, extinction oblique. The positions of the max. (nos. of bands in parentheses) and min. are: (A) main series max. (9) 457, (8) 478, (7) 495.2, (6) 517.6, (5) 542, (4) 569, (3) 598 μ , supplementary series max. (7') 490, (6') 512, (5') 535.4, (4') 561.1, (3') 588.7 μ , min. 482, 505.2, 530.5, 556.4, 584.3 μ ; (B) max. (7) 492, (6) 513.5, (5) 539, (4) 566, (3) 594 μ , min. 505, 532, 557, 584 μ . Progressive dehydration decreases the intensity of luminescence of both (A) and (B); the relative intensities without drying, after long drying at 18° and, after dehydration to $\text{UO}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$, to $\text{UO}_2\text{SO}_4 \cdot \text{H}_2\text{O}$, and to UO_2SO_4 (anhyd.), are: (A), 100, 91, 35, 1, 0; (B) 75, 43, 38, 9, 0. Dehydration of (A) causes no shift in the positions of the bands (accurate within 1 μ), in contradiction to contrary literature assertions; in (B), the positions of the min. are the same as in (A) but the max. are shifted by 3-4 μ to shorter waves; loss of 1 H_2O gives rise to a beginning doublet structure in the 7th band, loss of 2 H_2O makes that structure appear in all bands. Thus, 1 H_2O is indispensable for luminescence; the 2nd and 3rd mols of H_2O only increase the intensity in (A) but have no effect in (B), on the character of the spectrum; they do alter that character. The av. duration of luminescence, τ , was detd. on (A) by two photographic methods, from the distance of points of equal d. in two exposures of equal duration but with intensities in the ratio 4:1, and by comparison of the spreads in equal exposures but at different speeds of revolution, with the result $\tau = (2.7 \pm 0.2) 10^{-4}$ sec. Heating (A) from 18 to 100° results in a slight general weakening of the long-wave and medium-wave spectra (in excitation of Hg 435 μ), intensification of the short-wave side (excitation by Hg 366 μ), and appearance of a 9th band at 457 μ ; the reverse takes place on cooling from 18 to -185°; the 8th band disappears completely, the shorter-wave max. of each double band becoming weaker. The different effects of temp. on the different bands are basically detd. by changes of the distribution by levels in the upper state; in particular, the increase of the intensity of the 8th band at higher temps. indicates filling the 2nd upper level; the 9th band corresponds to transitions from the 3rd level. In addn. to these transitions from the 1st, 2nd, and 3rd upper level to the 1st lower level, higher temp. favors transitions ending in higher levels of the lower state;

hence, the increasing diffuseness of the bands. The length of the time lag between excitation and emission was estd. by 3 microphotogrammetric methods. From the position of the max. of emission relative to the edge of the exciting band, it must be 8×10^{-6} sec; from the position of the max. relative to the center of the exciting band, it is 3×10^{-6} sec; the same follows from the observed coincidence, i. e., absence of a shift along the time axis, of the curves of growth of the emission, at 25 and at 100 rps. Thus, the dark interval is at any rate less than 0.01 r. That the final equil. redistribution among the emitting levels is completed within 10^{-5} sec. from the excitation, follows from the perfect coincidence of the luminescence microphotograms in excitation with Hg 435 m μ and with Hg 366 to 311 m μ , both at the initial stage (10^{-5} sec) and averaged over the whole r; the deviations alleged by Nichols et al. are not real. Spectra taken at the initial stage of the emission (10^{-5} sec) and toward its end, i.e., when the intensity has decayed to 1/28, are strictly identical in all bands; hence, any changes of distribution which may occur in the course of the decay, must be compensated very fast as compared with the mean duration of the emission, or the transition probabilities from the various levels of the upper state to all levels of the lower state must be the same (within 2 to 3%). The redistribution of electrons after absorption, and the beginning of the emission, take no longer than 3×10^{-6} sec from the excitation; the final stationary distribution, involving at room temp., the 1st and 2nd vibrational levels, is completed within not over 1×10^{-5} sec and is maintained throughout the whole duration of the luminescence.

- 3052 Lo T.-Y. and Chen S.-M. "The Effects of Various Elements on Vitamin C Formation in Germinated Mung Beans." Science Record (China) 2, 81-3(1947).

The effects of cpds. of 23 elements on vitamin C formation in germinated mung beans were studied. The cpds. of U, Mg, Cd, Ni, and Zn caused an increase in vitamin C in mung bean sprouts.

- 3053 McClure, J. H. and Banks, C. V. Use of a Zinc Spiral in the Titrimetric Determination of Uranium. Declassified June 17, 1947. 2p. (MDDC-1044)

The titrimetric detn. of U by reducing UF_6 with a Zn spiral to U^{+4} and titrating with 0.1N tetrasulfatoceric acid is detailed. The advantage of eliminating soln. transfer as required in the Jones reductor is discussed.

- 3054 MacInnes, D. A. and Longworth, L. G. A Comparison of Analytical Methods for the Determination of Uranium. Nov. 24, 1942. Declassified Mar. 4, 1947. 5p. (MDDC 910)

The U content of a prepn. of hydrated UO_3 was detd. by three independent procedures: prolonged successive ignitions in air at 700, 820, and 930° to lower oxides of the approx. compn. U_3O_8 , further reduction of the same samples to UO_2 by dry H_2 at 900°, and titration with ceric sulfate of the $U(SO_4)_2$ obtained by passing a H_2SO_4 soln. of the UO_3 through a Jones reductor and aerating the somewhat over-reduced soln. The results of these three methods showed an extreme difference of 0.08%. A modified titration procedure was adapted to 5 mg of UO_3 , in which the overreduced sulfate soln. was aerated to U^{+4} and oxidized to $(UO_2)^{++}$ by excess $(MnO_4)^-$, the excess being detd. by differential potentiometric titration with $FeSO_4$. The results generally agreed closely but failed to give the true quantity of U. Extensive application of the differential titration method to overreduced solns. failed to locate the precise end point of the $U^{+3} - U^{+4}$ change. The difficulty is believed to reside with the excessively strong reducing power of U^{+3} . The reduction of uranyl solns. with Ag has been generally assumed to proceed quantitatively to U^{+4} . However, some overreduction appears to be possible.

- 3055 MacInnes, D. A. and Longworth, L. G. The Measurement and Interpretation of pH and Conductance Values of Aqueous Solutions of Uranyl Salts. Nov. 24, 1942. Declassified Mar. 5, 1947. 10p. (MDDC-911)

pH values of aq. solns. of UO_2Cl_2 , $UO_2(NO_3)_2$, $UO_2(OAc)_2$, and UO_2SO_4 , and pH and cond. measurements on solns. of UO_3 in aq. HCl are reported. Approx. values for the soly. of UO_3 in aq. HCl are also included. Although only slightly sol. in H_2O , UO_3 dissolves in aq. HCl to the extent of about 1:1 in base acid. Both electrometric and conductometric titrations of UO_3 with HCl yield, however, a sharp end point only at 2:1 acid to base, corresponding to $(UO_2)^{++}$. The additional soly. of UO_3 in aq. UO_2Cl_2 may be due to either of the following reactions: $(UO_2)^{++} + UO_3 + H_2O = 2[UO_2OH]^+$; $(UO_2)^{++} + UO_3 = [UO_3 \cdot UO_2]^{++}$. Cond. and transference measurements cannot distinguish between these two mechanisms. pH measurements appear to favor the second process.

- 3056 Macklin, R. L. and Knight, G. B. "X-Rays Associated with U^{234} ," Phys. Rev. (2), **72**, 435 (1947).

This paper is similar to report MDDC-976(1947).

- 3057 MacWood, G. E. The Rate of Sublimation of Solids. Declassified Jan. 9, 1947. 20p. (MDDC-605)

The development of a theory of the rate of subln. of solids is given and is compared with exptl. results on UCl_4 . The exptl. approach to this problem is made difficult by the large no. of possible variables involved. For this reason it was desirable to have a theoretical approach to the problem which takes account of first-order effects. Two different types of comparison are made with exptl. results. In the first the calcd. values of mass flux are compared with exptl. values for two temps. It is observed that the general behavior is reproduced by the theory by simply varying one parameter (emissivity factor to take care of the nonblackness of the surfaces involved). The second comparison with expt. involves an expt. suggested by the theoretical development, namely, measurement of the temp. gradient in the sublg. solid. It is shown that the max. temp. lowering of the surface is mainly in qual. agreement with the theoretically predicated values.

- 3058 MacWood, G. E. Thermodynamic Properties of Uranium Compounds. Declassified Feb. 4, 1947. 79p. (MDDC-657)

This paper presents all of the results that were obtained on heats of formation and equil. measurements of a no. of U cpds. These data were combined into a self-consistent system of thermodynamic relationships for these substances. The cpds. discussed are UCl_3 , UCl_4 , UCl_5 , $UCl_{5.85}$, UBr_3 , UBr_4 , UCl_3Br , UCl_2Br_2 , $UClBr_3$, uranous oxychloride (81.1% $UOCl_2$ + 18.9% UO_2), uranous oxybromide (95.5% $UOBr_2$ + 4.5% UO_2), uranium dichloromonobromide (87% UCl_2Br + 13% UCl_3), uranium monochlorodibromide (70% $UClBr_2$ + 30% UBr_3), UI_3 , UI_4 , UCl_3I , UBr_3I . The free-energy relationships that were derived are summarized. The general formation of the equation employed is $\Delta F^\circ = \Delta H_0 + a T \log T + b T^2 + IT$, in which ΔF° is the free energy, ΔH_0 , a, b, and I are consts., and T is the temp. ($^\circ K$).

- 3059 Manescu, I. "Influence of the Physicochemical State of Uranium on Its X-Ray Absorption Spectrum." Compt. rend. **225**, 537-9(1947).

The L-absorption spectra of U, its oxides UO_2 and UO_3 , the phosphate and sulfate U^{+4} , the nitrate and acetate of U^{+6} and uranyl sulfate were measured in the solid state and in aq. soln. All the samples had a superficial d. of approx. 20 mg/cm² of U. The spectra were observed in the first-order reflections from the (201) and (100) planes of mica. A partial tabulation of results for the L_{III} and L_{II} spectra shows that the discontinuity and spectral features are shifted toward shorter wavelengths in passing from metallic U to its cpds. of increasing valence. The min. and max. that follow the discontinuity show marked differences in wavelength, relative intensity, and width, according to the valence of the cpd.

- 3060 Marden, J. W., Lilliendahl, W. C., and Wroughton, D. M. "Recent Developments in Rare Metals." Steel **120**, No. 14, 93-4+(1947) Apr. 7.

This is an editorial report of a paper delivered before the Electrochemical Society. The prodn. of Th, Zr, and U metal is discussed. U of high purity (99.9+%) is obtained by electrolysis of KUF_5 .

- 3061 Mather, K. B. "Spectrographic Analysis of Uranium." J. Proc. Roy. Soc. N. S. Wales **80**, 187-95(1947).

Spectrograms used to establish the lines were from U acetate on graphite or U oxide on Cu; 124 lines in the region 2500 to 8000 A are listed. The cathode layer yielded greater sensitivity than the middle portion of the arc; 10^{-3} mg of U can be detected in the former and 5×10^{-3} mg in the arc column.

3062 Meyer, Joe, Muntz, J. A., Singer, T. P., and Barron, E. S. G. Tissue Metabolism of Rats Treated with Uranyl Nitrate. Nov. 18, 1946. Declassified Mar. 4, 1947. 15p. (MDDC-757). In rats, toxicity of injected uranyl nitrate can be easily detected by measuring the blood nonprotein N. As little as 0.1 mg/kg was enough to produce a definite rise 4 days after injection. Definite symptoms of intoxication were produced by 0.5 mg/kg, the blood value rising about 3.5 times above the normal. On injection of 0.5 mg/kg, the metabolism of kidney slices, as measured by the oxidation of pyruvate, succinate, and alanine, was progressively inhibited from the second day after injection. The synthesis of carbohydrate in the presence of pyruvate was also inhibited. Anaerobic glycolysis and choline oxidation were unaffected. The O_2 uptake of the liver was unaffected. There was a slight inhibition of pyruvate utilization. The synthesis of urea and the synthesis of glycogen were inhibited.

3063 Montignie, E. "Tellurides of Uranium, Thorium, and Cerium." Bull. soc. chim. France 748-9(1947).

Te 5 g, UO_3 3 g, and KCN 12 g were mixed and heated to redness in a porcelain crucible, and the gray mass was washed with H_2O to remove KCN and K telluride. The product analyzed 44.22% U and 53.90% Te; is insol. in common solvents; forms $UO_2(NO_3)_2$ with HNO_3 ; and forms red $TeSO_3$ with concd. H_2SO_4 . Ignition in air leaves a residue of UO_2 . Aq. K_2CO_3 gives no reaction, but fused K_2CO_3 forms K_2TeO_4 and K_2UO_4 .

3064 Mooney, R. C. L. X-Ray Structural Studies of the Tetrachlorides of Uranium and Thorium. Sept. 4, 1947. Declassified Dec. 30, 1947. 5p. (MDDC-1559)

The crystal structure of $ThCl_4$ and of UCl_4 has been detd. from x-ray powder diffraction photographs. The structures are isomorphous. The lattice is body-centered tetragonal; the space group symmetry D_{4h}^{19} —I4amd. The unit cell, with resp. dimensions and d. as follows, contains four mols.:

$$\begin{array}{llll} ThCl_4 & a_1 = 8.472 \pm 0.003 \text{ \AA} & a_3 = 7.468 \pm 0.003 \text{ \AA} & d.(\text{calc.}) = 4.60 \text{ g/cm}^3 \\ UCl_4 & a_1 = 8.296 \pm 0.009 \text{ \AA} & a_3 = 7.487 \pm 0.009 \text{ \AA} & d.(\text{calc.}) = 4.866 \text{ g/cm}^3 \end{array}$$

Positions have been found for the atoms such that the calcd. intensities are in good agreement with observations. (This information is also available in Acta Cryst. 2, 189-91(1949).)

3065 Moore, G. E. and Kelley, K. K. High-Temperature Heat Contents of Uranium, Uranium Oxide, and Uranium Trioxide. Declassified Feb. 21, 1947. 5p. (MDDC-758).

The high-temp. heat contents of U, UO_2 , and UO_3 were measured from 298.16° to 1300, 1500, and 900°K, resp., by methods previously described by Southard. The metal was found to exhibit two sharp transitions: at $935 \pm 3^\circ\text{K}$ and $1045 \pm 3^\circ\text{K}$, resp. Results near these temps. were accurately reproducible and there was no evidence of hysteresis. The heat and entropy of the 935° transition are 680 cal/g at. and 0.73 cal/°/g at., resp. Corresponding values for the 1045° transition are 1165 cal/g at. and 1.11 cal/°/g at. The equations representing the heat-content results, range of validity, and mean deviation are for U_α , $H_T - H_{298.16} = 3.15T + 4.22 \times 10^{-3}T^2 - 0.80 \times 10^5T^{-1} - 1046$, (298 - 935°K), 0.2%; for U_β , $H_T - H_{298.16} = 10.38T - 3525$, (935 - 1045°K), 0.1%; for U_γ , $H_T - H_{298.16} = 9.10T - 1026$, (1045 - 1300°K), 0.1%; for UO_2 , $H_T - H_{298.16} = 19.20T + 0.81 \times 10^{-3}T^2 + 3.957 \times 10^5T^{-1} - 7124$, (298 - 1500°K), 0.1%; for UO_3 , $H_T - H_{298.16} = 22.09T + 1.27 \times 10^{-3}T^2 + 2.973 \times 10^5T^{-1} - 7696$, (298 - 900°K), 0.1%. These yielded the following equations for heat contents: U_α , $C_p = 3.15 + 8.44 \times 10^{-3}T + 0.80 \times 10^5T^{-2}$; U_β , $C_p = 10.38$; U_γ , $C_p = 9.10$; UO_2 , $C_p = 19.20 + 1.62 \times 10^{-3}T - 3.957 \times 10^5T^{-2}$; UO_3 , $C_p = 22.09 + 2.54 \times 10^{-3}T - 2.973 \times 10^5T^{-2}$. A table of heat contents and entropy increments above 298.16° was compiled. (This information is also available in J. Am. Chem. Soc. 69, 2105-07(1947).)

3066 Moore, G. E. and Kelley, K. K. "High-Temperature Heat Contents of Uranium, Uranium Oxide, and Uranium Trioxide." J. Am. Chem. Soc. 69, 2105-07(1947).

This paper contains information similar to that found in report MDDC-758(1947).

- 3067 Morgan, K. Z. "Tolerance Concentrations of Radioactive Substances." J. Phys. Colloid Chem. 51, 984-1003(1947).

A review of some of elementary equations and procedures involved in detg. tolerance concns. or max. permissible concns. of radioactive substances when taken into the human system is given. This is a summary of a report to appear in the National Nuclear Energy Series.

- 3068 Muntz, J. A. and Barron, E. S. G. The Transport of Uranium to the Tissues. Some Properties of Uranium in Solutions and in Combinations with Proteins. Jan. 21, 1947. Declassified Mar. 4, 1947. 29p. (MDDC-760)

With the aid of a rapid method of ultrafiltration it has been found that $\text{UO}_2(\text{NO}_3)_2$ in aq. soln. diffuses readily. When the pH of the soln. was increased so that the U was present as a neg. ion, it could not be ultrafiltered. At pH values within physiological limits, U diffused freely in the presence of bicarbonate. At a concn. of bicarbonate of 0.03M, 75% of the U was found in the ultrafiltrate. In the presence of org. cpds. the ultrafiltration of U seemed to be detd. by the degree of association of the complex. Strongly associated complexes, such as maleate at pH = 6.5, diffused freely through the cellophane membrane. Addn. of serum albumin diminished the amt. of diffusible U presumably by chem. combination. When $\text{UO}_2(\text{NO}_3)_2$ was added to undialyzed rabbit serum, about 75% of the U was found in the ultrafiltrate; when it was added to dialyzed serum all the U was retained by the protein or remained as nondiffusible uranyl anion. Combination of $(\text{UO}_2)^{++}$ with serum protein takes place with the albumin fraction. This has been shown in vitro expts. with sepn. of the protein fractions by electrophoresis. For the analysis of U, a colorimetric method was used which allowed detns. from 10 to 80 γ of U. From these expts. it may be concluded that U is transported to the tissues as strongly associated complex cpds., mostly as bicarbonate and protein complexes. Rapid urinary excretion of $\text{UO}_2(\text{NO}_3)_2$ injected into animals must be due to glomerular filtration of the uranyl bicarbonate.

- 3069 Muntz, J. A., Singer, T. P., and Barron, E. S. G. Effect of Uranium on the Metabolism of Yeast and Bacteria. [1946]. Declassified Feb. 4, 1947. 26p. (MDDC-759)

The utilization of glucose (fermentation or oxidation) by living yeast cells was found to be extraordinarily sensitive to U under the proper conditions. The inhibitory effect was readily reversed by phosphate and bicarbonate, quite unlike the inhibitory effect of the metal on isolated enzymes. The enzymes responsible for carbohydrate metabolism in yeast, when obtained in cell-free juice, were also inhibited by U but this inhibition was not readily relieved by phosphate. This suggests that the toxic effect of the metal on these cells is brought about by a different mechanism than is the U inhibition on isolated enzymes which are sensitive to the metal. Different kinds of bacterial cells showed varying degrees of sensitivity to U. In all cases studied, phosphate relieved any inhibitory effect produced. The suggestion was made that U combines with certain accessory groups present on the cell surface and necessary for glucose utilization. Charts and graphs illustrate the results.

- 3070 Nessel, G. J., Casto, C. C., Orlemann, E. F., Grimes, W. R., and Larson, C. E. Potentiometric Titration of Uranium with Ferric Sulfate. Declassified May 29, 1947. 1p. (MDDC-1123)

This is a brief document and is reproduced below in its entirety.

"Measurement of the titre between the two end points indicated by changes in potential of a platinum-calomel electrode system during addition of ferric ion to a solution originally containing trivalent and quadrivalent uranium affords an accurate method for determination of uranium. Reduction is accomplished by passage of the uranium in acid solution at room temperature through a Jones reductor. The titration is best performed by addition of 0.1N ferric sulfate in 5% sulfuric acid solution to 0.3 to 0.5 g of reduced uranium in 225 ml of 5% sulfuric acid solution maintained at $92 \pm 2^\circ\text{C}$ under an inert atmosphere. A more reproducible first end point is obtained after addition of chromic ion to the solution of reduced uranium before titration. Nitrate, fluoride, and large amounts of phosphate interfere with this titration. Iron, chromium, nickel, cadmium, manganese, and aluminum do not interfere but molybdenum, tungsten, copper, and tin must be absent. The interference of vanadium is stoichiometric and may be corrected after separate determination of this element. Titanium introduces a third end point but no error results if all three are detected. Titrations which are accurate within $\pm 0.1\%$ may be made in twenty to thirty minutes."

- 3071 Ney, E. P. and Armistead, F. C. "The Self-Diffusion Coefficient of Uranium Hexafluoride," *Phys. Rev.* (2), 71, 14-19(1947).
This paper is similar to report MDDC-352(1946).

- 3072 Nichols, A. R. Jr. Electrolytic Reduction of Uranyl Ion. May 27, 1946. Declassified Jan. 24, 1947. 14p. (MDDC-658)

Due to the H overvoltage at the surface of a Hg cathode, U solns. in HCl may be reduced not only to U^{+4} , but until considerable U^{+3} is formed. Other metallic ions act as oxidation-reduction catalysts as well as being reduced themselves. This paper is a study of the various reactions taking place in soln. and at the surface of the cathode. Four different cells, referred to as the multiple cell, the unit cell, the batch cell, and the pilot cell were used in the course of this work. In each case a pool of Hg served as cathode. The anodes were of graphite. The course of electrolytic reduction of UO_2Cl_2 was studied in the presence of Fe, Cu, Cr, and Ni. Cu is first reduced to Cu^+ and then largely deposited in the Hg cathode. Cr and Cu are effective in reduction catalysis. H_2 is first evolved at a redox potential around +0.2 v as measured between a W probe and a Ag-AgCl half-cell. The reduction of U corresponds to a plateau in the redox potential curve in a range which is roughly +0.05 to +0.15 v. Suspended Cu appears at +0.07 v, corresponding to the disappearance of $(UO_2)^{++}$ and the appearance of U^{+3} . Practically no change in redox potential occurs after reaching a plateau at -0.55 v.

- 3073 Organic Derivatives of U. Declassified August 1947. 3p. (BR-10)

Complex cpds. with acetyl acetone of the form $UO_2(C_5H_7O_2)_2$ and $U(C_5H_7O_2)_5$ were prep'd. The former was obtained as orange, heat-unstable crystals by adding an equiv. amt. of the org. cpd. to a soln. of $UO_2(NO_3)_2$, and the latter as greenish-yellow crystals from a soln. of $UO_2(OAc)_2$ reduced with "Hydros" and buffered with NaOAc. The U^{+4} cpd. subld. at 150 to 160°, in vacuum, giving dark green crystals. Attempted preps. of carbonyls are reported by a no. of methods including direct CO treatment and Grignard reactions. No carbonyls were obtained. Brief notes on derivatives of U with o-cyanobenzamide, o-dicyanobenzene, phthalimide, and picolinic acid are included. None of these complexes were heat stable.

- 3074 Perfilov, N. A. "Half-Life Periods of the Spontaneous Fission of Uranium and of Thorium." *Zhur. Eksptl. Teoret. Fiz.* 17, 476-84(1947).

In order to resolve the conflict between the data of Maurer and Pose and of Pose and the original estn. of the discoverers of spontaneous fission of U (Petrzhak and Flerov), counts of the tracks produced by the fission fragments in a photographic emulsion were made by the method of oxidation of the emulsion prior to development (Perfilov), resulting in selective suppression of the development of grains excited by α particles only, without affecting the developability of tracks of fission products; the method is successful if the irradiation does not exceed 10^8 α particles (of 4-cm range)/ cm^2 ; hence, with U layers of the order of 1 mg/ cm^2 , at 1 to 2 mm from the photographic plate, exposures of over one month are permissible. Expts. were carried out with layers of $U_3O_8 = 0.924$ mg/ cm^2 and $ThO_2 = 1.23$ mg/ cm^2 , deposited from alc. suspensions of the powders on polished brass disks 61 mm in diam.; thermal neutrons were eliminated by Cd screens; the useful surface of the layers was 24×40 mm, their distance from the photographic plates 1.5 mm. Exposures were made under a pressure less than 1 mm Hg kept const. with the aid of a large vol. (61), at a depth of 50 m below ground (Moscow subway), for 1684 hrs; the shutter between the layer and the plate was opened only after the app. had been placed below ground; the constancy of the response of the emulsion to α particles was checked by exposure of control plates to α (Po) at the outset and at the end of the expt. Plates exposed to U and to Th were oxidized with a CrO_3 soln. 1/7500 g/cc for 15 min and developed; a control sample of each plate was developed without previous oxidation. The chainlike tracks produced by fission fragments were counted under the microscope and the length of each track was detd. by vertical micrometric displacement; only tracks with a depth path were considered authentic; from the length of the track, the range of the fragment in air was calcd. on the assumption that 6.9 to 7.0 μ in the emulsion was equiv. to 1 cm in air, as for α (Po). With U_3O_8 , 96 fission-product tracks were counted over 5.67 cm^2 with ThO_2 , 5 tracks over 4.95 cm^2 . The range dis-

tribution for U was plotted by steps of 0.25 cm air equiv.; the max. (33 tracks) corresponds to the range 0.75 to 1.0 cm in air; the lowest range (0.25 to 0.50 cm) is represented by 4 tracks, the highest (1.75 to 2.0 cm) by 1 track. A very similar relative distribution (with some increase of the no. of high-range fragments, possibly due only to fluctuations) was found with 217 tracks of products of fission induced by neutrons (slowed down in paraffin), on a plate preliminarily irradiated with α (Po) to the same α density as in the case of the spontaneous fission and developed in the same manner. Inasmuch as the oxidation with CrO_2 doubtlessly obliterates also the ends of the tracks produced by fission fragments, the actual ranges are certainly somewhat longer than those measured. The close similarity of the range-distribution curves of spontaneous and of neutron-induced fission demonstrates that the fragments are the same in these cases, and that which is observed in long exposure in the absence of neutrons, is actually fission. From the counts of the tracks, with a correction factor of 0.83 for U and of 0.79 for Th, to allow for the loss of fragments within the layers and for the 1.5-mm gap between the layer and the plate, the half-lives of spontaneous fission are found to be for U $(1.3 \pm 0.2) \times 10^{16}$ yrs and for Th 4×10^{17} yrs. The authenticity of the tracks was further checked by blank expts. (irradiation with α only) of the same length of exposure; only under the conditions of the exposure of the Th plate, was one single track (0.8 cm air) produced on 5 cm^2 which, by its depth course, might be taken to be a fission track; no such tracks were produced in α irradiation under the conditions of exposure of the U plate. Further blank expts. eliminated the possibility of contamination of the reagents. Contamination of the Th with U was equally excluded. The counts of fission tracks were found to be satisfactorily independent of the d. of preliminary irradiation with α (Po) (from 2.6×10^5 to $1.3 \times 10^6 \alpha/\text{mm}^2$). Variation of the concn. of the CrO_3 is without effect on the count between the limits 1/7000 to 1/20,000 g/cc; diln. to 1/40,000 doubles the count (nonobliterated α tracks); with 1/5000 and 1/2500, the count drops to 62 and 31%, resp. The possible error in the detn. of the half-life period is estd. to be, in the case of U, 10 to 12%, in the case of Th, up to 60%.

3075 Perfilov, N. A. "Half-Life Periods of the Spontaneous Fission of Uranium and of Thorium." Fiz. Zhur. 11, No. 3(1947).

This paper contains information similar to that reported in Zhur. Eksptl. Teoret. Fiz. 17, 476-84(1947).

3076 Pepkowitz, L. P. Microvolumetric Assay of Uranium. Dec. 3, 1945. Declassified Jan. 28, 1947. 9p. (MDDC-727)

A microvolumetric assay procedure for U is presented. U as UO_2SO_4 is reduced to U^{+4} by means of liq. Zn-Hg in a special titration cup. The U^{+4} is then titrated with std. ceric sulfate using a micro-wt. buret. The end point is detd. by using o-phenanthroline-ferrous complex as an indicator.

3077 Perlman, M. L. and Weissman, S. I. Preparation of Compacts of High-Density Uranium Hydride. Declassified Jan. 27, 1947. 5p. (MDDC-728)

Compacts of UH_3 having a d. of about 10 or more have been prepd. by allowing H_2 to react with U metal which is enclosed in a strong steel vessel. The results of several expts. are given and further work is outlined.

3078 Preparation of Metallic U by Electrolysis of the Fused Salts. Declassified May 1947. 2p. (BR-106)

This paper describes the prepn. of U metal by the electrolysis of KUF_5 , NaUF_5 , or UCl_4 in molten alk. chloride. The electrolysis is carried out at 700 to 800° with 5 to 6 v at 25 to 30 amps (45 min). A Mo cathode is used and the operation is carried out in CO_2 . The impurities encountered in this method are CaF_2 and U carbide. An attempt to prep. CaF_2 -free metal did not yield an adherent product. The fusion of the powd. product is also discussed.

- 3079 Prevot, A. R. and Taffanel, J. "Action of Certain Chemicals Agents on the Fermentations of Some Strictly Anaerobic Bacteria." Bull. assoc. diplômés microbiol. faculté pharm. Nancy No. 29, 4-24(1947).

The authors have shown that in a glucose medium of fixed compn., strictly anaerobic bacteria produced fermentation products in ratios sufficiently const. to permit the identification of the species. New work was done to det. if the ratios of fermentation products could be changed by adding dyes, vitamins, or metal salts to the medium. Clostridium perfringens, C. histolyticum, C. fallax, C. pseudofallox, Eubacterium nitritogens, Fusiformis biacutus, Fasocillus girans, and Ramibacterium ramosum, were grown in a basal "VF" medium with 1 or 2% glucose (vol., temp., and time of incubation not stated). Volatile acids formed were formic, acetic, propionic, butyric, and valeric. Most of the organisms produced 2 volatile acids, but some produced 1 or 3. Some nonvolatile acid was formed. Production of volatile acids was also det. (at the 5th, 10th, 20th, and 40th subculturings) in the presence of sol. salts of Ag, Ce, U, Zn, Ni, and Co. Ag and U generally shortened the time of fermentation, Zn and Co lengthened it. U (and sometimes Ag) generally inhibited fermentation, but the other metals usually increased the amts. of volatile acids formed, and in some cases changed the types of fermentations.

- 3080 Priest, H. F. and Priest, G. L. Report on Determination of Densities of Several Uranium Compounds. Aug. 10, 1942. Declassified Jan. 3, 1947. 2p. (MDDC-609)

Values for the apparent, or packing, d., as well as the abs. d. have been detd. for UO_3 , UO_2 , UF_4 from two sources, as well as a value for the packing d. of UF_6 . In order to det. the packing d., the material was ground to pass a 120-mesh screen and a known wt. placed in a conical graduated tube which was capped. This tube was then dropped a distance of 10 cm in a guiding tube onto a 1-in. rubber cushion. This packing was cont. until there was no change in vol. This vol. with the wt. gave then the packing or apparent d. In the case of UF_6 this procedure had to be appreciably modified. The abs. d. was detd. by placing a known wt. of the cpd. in a pycnometer and adding alc. of known d. to the correct vol. at 25°C. The wt. was again obtained and from this data the abs. d. were calcd. The d. of the alc. was checked frequently to prevent error. The abs. d. of solid UF_6 has not been detd. as yet, owing to the difficulty of finding a suitable liq. for use with UF_6 . This problem has been solved but it will be some time before the d. detn. will be completed. The following table shows the values obtained.

Material	Analysis	Abs. d. 25°C	Packing d. 27.5°C
UO_3	99.8	7.57	3.95
		7.51	
		av. 7.54	
UO_2	99.34	10.26	4.96
		10.29	
		av. 10.28	
UF_4 (wet method)	98.8	6.03	1.899
		5.99	
		av. 6.01	
UF_4 (dry method)	99.1	6.42	2.997
		6.44	
		av. 6.43	
UF_6	99.9		2.193

- 3081 Redman, C. and Saxon, D. An Investigation of the Delayed Neutron Decay Curves Resulting from Uranium and Plutonium Fission. Nov. 4, 1944. Declassified Mar. 18, 1947. 14p. (MDDC-1607)

Samples of Pu^{239} and U, enriched in U^{235} , were irradiated in a graphite pile. The decay of the delayed neutrons following fission was recorded on a magnetic wire recorder. Analyses were made of the decay data: 18 runs with Pu^{239} , and 37 with U. Within the limits of exptl. error the neutron half-lives for Pu^{239} and U^{235} are identical, namely, (55.0 ± 0.4) sec, (22.5 ± 0.3) sec, (4.45 ± 0.15) sec and (1.10 ± 0.06) sec. The change in the yield of the 55.0-sec period relative to that of the 22.45 sec period, in going from U^{235} to Pu^{239} , is of the proper sign but small in magnitude as compared to the change predicted from the fission yields for the known mass no. of delayed neutrons per fission gives the ratio of the no. from Pu^{239} to the no. from U^{235} as 0.5. (This paper is also available in Phys. Rev. (2), 72, 570-5(1947).)

- 3082 Redman, C. and Saxon, D. "An Investigation of the Delayed Neutron Decay Curves Resulting from Uranium and Plutonium Fission." Phys. Rev. (2), 72, 570-5(1947).

This paper is similar to report MDDC-1607(1947).

- 3083 Rindone, G. E., Marboe, E. C., and Weyl, W. A. "Oxidation and Reduction of Glasses by Means of Electrolysis." J. Am. Ceram. Soc. 30, 314-19(1947).

To study the effects of both anodic oxidation and cathodic reduction, a refractory crucible was used which had a refractory partition dividing it into 2 equal compartments and acting as a diaphragm. Electrolysis was carried out at 850° for 1 to 2 hrs. with 2 to 10 v, which caused a current of 20 to 30 ma to pass through the melt. Borate glasses (chiefly 23 mole % Na_2O , 77 mole % B_2O_3), also pure NaPO_3 glass, were used, and the amt. of metal oxide added was usually of the order of 0.1% by wt. Reduction of glasses contg. U produced dark green colors and destroyed fluorescence, owing to the transition of U^{+6} to U^{+4} .

- 3084 Roberts, A. M. Uranium Fluoride. Miscellaneous Notes. Note No. 2. The Stability of UF_4 in Boiling Water. Feb. 6, 1942. Declassified August 1947. 1p. (BR-12)

Expt. shows that UF_4 does not lose F on boiling in H_2O for 71.5 hrs.

- 3085 Roberts, A. M. Uranium Fluoride. Miscellaneous Notes. Note No. 8. The Adsorption of Atmosphere Moisture by Anhydrous Uranium Fluoride. Feb. 16, 1942. Declassified August 1947. 3p. (BR-18)

UF_4 was not found to be appreciably hygr. in air when tested at $18 \pm 4^\circ$ for as long as 564 hrs in lab. air.

- 3086 Rodden, C. J. Thorium Standard Samples. June 1947. Declassified Aug. 18, 1947. 19p. (MDDC-1220)

In connection with the work on the detn. of Th in ores and minerals, a sample of monazite sand was obtained from the Lindsay Light and Chemical Co., which was ground to pass 100 mesh. This sample was then analyzed by cooperating analysts. In addn. to being used on a std. monazite sand with known Th and U content, this sample was mixed with dunite which had been ground to pass 100 mesh in order to have a series of samples contg. 0.001; 0.01; 0.02; 0.05; 0.1; and 1% Th, resp. In this connection, it was desirable to obtain a reliable value on the Th and U content of the original sample of monazite. Through the cooperation of Michael Fleisher of the U. S. Geological Survey, Howard Kremers of the Lindsay Light and Chemical Co., and the United Kingdom Labs., the results given were obtained. The value 9.65% ThO_2 which was obtained on the std. monazite sand was used in the prepn. of the low-grade Th mixts.

- 3087 Rothenberger, C. D., Orlemann, E. F., Grimes, W. R., and Larson, C. E. Colorimetric Determination of Uranium with l-Ascorbic Acid. Declassified Sept. 15, 1947. 1p. (MDDC-1314)
The complete text of this document is reproduced below.

"A stable, yellow-brown color is produced by addition of l-ascorbic acid to weakly acid solutions of hexavalent uranium. In 50 ml of solution containing 0.5 to 15 mg of uranium buffered at pH = 4.0 with acetate ion the color intensity, measured with 10-mm cells on the Beckman spectrophotometer set at 410 millimicrons, is a linear function of uranium concentration. The method may be applied directly to suitable solutions containing 25 to 1500 mg uranium per liter. The reagent blank is reproducible and small but not negligible. Chloride, nitrate, and perchlorate ions are without effect on the color. Phosphate, sulfate, fluoride, and the anions of dibasic organic acids interfere. Compounds of chromium, vanadium, nickel, zinc, molybdenum, and aluminum interfere, while those of iron, cadmium, magnesium, calcium, tin, manganese, and thorium are without appreciable effect on the color. Addition of pyridine with the buffer solutions prevents interference of cupric ion. Diethyl ether extraction of uranium from aqueous acid solutions containing calcium nitrate provides a very rapid and effective purification of uranium for this colorimetric method. The combined purification and colorimetric method may be applied within sixty to seventy minutes to contaminated uranium solutions to yield results accurate to $\pm 2\%$."

- 3088 Rothstein, A. The Mechanism of Action of Uranium on Carbohydrate Metabolism of Yeast. Nov. 20, 1947. Declassified Dec. 18, 1947. 19p. (MDDC-1562)

Muntz, Singer, and Barron found that U in low concns. (of the order of 10^{-4} to 10^{-5} M) completely inhibited the oxidation of glucose as measured by O_2 consumption and glucose consumption under anaerobic conditions except in the presence of bicarbonate, but only partially inhibited the metabolism of EtOH and NaOAc. The inhibition of U could be relieved by addn. of phosphate, bicarbonate, citrate and adenosine-triphosphate. The action of U on the enzymes in yeast maceration juice was not similar to that on intact cells in that phosphate did not cause the reversal of inhibition. Other microorganisms such as Ps. aeruginosa, E. coli, and M. lysodeikticus also showed inhibition of glucose utilization but at higher U concns. In the case of the latter organism, a max. of only 22% inhibition is attained even at relatively high U concns. They suggested that U combined with certain accessory groups present on the cell surface is necessary for glucose utilization. The exptl. findings of these authors were confirmed during the initial stages of this investigation, and, because these results were very promising, more extensive quant. studies were undertaken to det. if possible the exact site of action of U in the scheme of carbohydrate metabolism and to establish whether the U acted at the surface of the cell or whether it penetrated into the cell and acted within the cytoplasm. There appears to be surface action of U, but with very high concns. of $UO_2(NO_3)_2$ (up to 10^{-2} M), some U does penetrate into the cell. The U in the cell is probably tied up as bicarbonate and phosphate complex. U seems to act on one or some of the early stages of glucose metabolism. It also has other measurable effects on the yeast cell. There seems to be a marked change in permeability as indicated by a more rapid leakage of base from the cells. There is leakage of traces of phosphates, which does not occur in absence of U. Other changes undoubtedly occur. Schemes of glucose metabolism, schemes of carbohydrate metabolism, and seventeen graphs are included.

- 3089 Rothstein, A., Dittman, D., Berke, H., and Minor, J. T. "The Excretion and Retention of Non-protein Nitrogen (NPN) in Animals Poisoned with Uranium." Federation Proc. 6, 367(1947).
Within a day or two after exposure of animals to toxic levels of U dusts, there is a decreased rate of excretion of nonprotein N followed after a similar interval by an increase in the nonprotein N of the blood. Urea and creatinine N follow the same course of events, but creatine and amino acid N do not. There is a rise in creatine N in the urine which only appears when there is a rise in blood nonprotein N. However, the rate of the urinary amino acid N excretion is increased in cases of mild U poisoning where there is no increase in blood nonprotein N. The increased excretion of amino acid N is one of the most sensitive early tests of poisoning (especially in rabbits), whereas the increase in blood nonprotein N occurs much later and is a sign of more severe injury. A more satisfactory test than the excretion rate of amino acid N is the ratio of urinary amino acid N to creatinine N. This ratio remains const. in control animals, but increases in 1 to 5 days after U exposure, depending on the dose, and remains high if exposure is continued over a 5-wk period. The ratio is roughly proportional to the intensity of the exposure. The increased amino acid N excretion in U poisoning is renal in origin and is not accompanied by an increase in blood.

- 3090 Rundle, R. E. The Structure of Uranium Hydride and Deuteride. Declassified Feb. 10, 1947. 8p. (MDDC-865)

U forms a metallic hydride, UH_3 , a cpd. of definite compn. This hydride is unique in that it does not fall in the class of volatile hydrides, saltlike hydrides, or interstitial-soln. hydrides. It is almost lacking in metal-metal bonds, and has an arrangement unrelated to that of the metal itself. Debye-Scherrer powder diagrams of the cpd. were made and the d. of the hydride was measured by He displacement. The results of these studies show the hydride to be cubic, $a = 6.631 \text{ \AA}$ with eight U atoms/unit cell at position (a) $0\ 0\ 0$, $1/2\ 1/2\ 1/2$, and (c) $1/4\ 1/2\ 0$, $0\ 1/4\ 1/2$, $1/2\ 0\ 1/4$, $1/2\ 0\ 1/4$, $3/4\ 1/2\ 0$, $3/4\ 1/2\ 0$, $0\ 3/4\ 1/2$, $1/2\ 0\ 3/4$ of the space group $\text{O}_h^3 \text{O}^2$, or T_d^4 . The x-ray d. is 10.92 g/cc . The spacing in UD_3 is $6.620 \text{ \AA}$, definitely smaller than for the hydride. It is proposed that the H atoms form U-H-U bridges between metal atoms of type (a) and (c) in the structure, where the bridge contains one electron pair for the two bonds. This structure accounts for the phys. properties, unique metal arrangement, and formula of the hydride, and is consistent with the author's theory of electron-deficient structures. (This paper is also available in J. Am. Chem. Soc. **69**, 1719-23(1947).)

- 3091 Rundle, R. E. "The Structure of Uranium Hydride and Deuteride." J. Am. Chem. Soc. **69**, 1719-23(1947).

This paper is similar to report MDDC-865(1947).

- 3092 Rundle, R. E., Baenziger, N. C., and Wilson, A. S. X-Ray Study of the Uranium-Oxygen System. Declassified July 3, 1947. 14p. (MDDC-1273)

The U-O system has been studied as a function of compn. by x-ray diffraction. Several new oxides and transition phases have been revealed, and the structures of most of the oxides have been detd. fully or in part. The phases of the U-O system are: (1) Between U and UO , two phases, the metal phase and the cubic monoxide with NaCl structure. (2) Between UO and UO_2 the monoxide and dioxide, with little solid soly. (3) Between UO_2 and $\text{UO}_{2.2}$ or $\text{UO}_{2.3}$, one phase with the CaF_2 structure. The UO_2 spacing decreases as the O content of the phase is increased. The phase with excess O corresponds to UO_2 from which some U has been removed at random from the structure. (4) Between $\text{UO}_{2.3}$ and U_2O_5 , two phases. One phase is $\text{UO}_{2.2}$ with disordered fluorite structure, the other phase is U_2O_5 , an orthorhombic phase closely related to U_3O_8 in structure. (5) Between U_2O_5 and U_3O_8 , one phase. The structure changes continuously with compn. (6) Above U_3O_8 , only individual oxides have been examined, but the structure of UO_3 is very similar to that of U_3O_8 , and there is preliminary evidence that single phases of intermediate character can be produced. The structure of UO , UO_2 , U_2O_5 , and U_3O_8 are described. This paper summarizes material reported on U oxides presented in earlier reports.

- 3093 Rundle, R. E., Baenziger, N. C., Wilson, A. S., and McDonald, R. A. The Structure of the Carbides, Nitrides, and Oxides of Uranium. Declassified Mar. 5, 1947. 9p. (MDDC-1608)

In this paper studies on the systems U-C, U-N, and U-O are summarized rather briefly, giving pertinent structural information and necessary details concerning the methods used in carrying out the work. U-C. UC is face-centered cubic, $a = 4.951 \text{ \AA}$, and has the NaCl -type structure. UC_2 is body-centered tetragonal, $a = 3.517 \text{ \AA}$, $c = 5.987 \text{ \AA}$, and has the CaC_2 structure. C is sol. in UC_2 at high temp., UC_2 decomp. into UC and C at intermediate temps. U_2C_3 probably exists at temps. above 2000° . It does not exist at room temp. U-N. UN is face-centered cubic, $a = 4.880 \text{ \AA}$, and has the NaCl -type structure. U_2N_3 is body-centered cubic, $a = 10.678 \text{ \AA}$, and has the Mn_2O_3 structure. The sesquinitride structure gradually changes toward the ideal dinitride structure in a one-phase region extending to the compn. $\text{UN}_{1.75}$. High pressure is needed to form UN_2 which is face-centered cubic, $a = 5.31 \text{ \AA}$, and has the CaF_2 structure. U-O. UO is face-centered cubic, $a = 4.92 \text{ \AA}$, and has the NaCl -type structure. It is very difficult to prep. free from C or N. UO_2 has the CaF_2 structure, $a = 5.4381 \text{ \AA}$. O is sol. in the CaF_2 structure to approx. the compn. $\text{UO}_{2.25}$ at which point the lattice const. is $a = 5.4297 \text{ \AA}$. U_2O_5 is orthorhombic, $a = 6.72 \text{ \AA}$, $b = 31.8 \text{ \AA}$, $c = 8.27 \text{ \AA}$. The structure is related to those of U_3O_8 and UO_3 . A one-phase region exists from U_2O_5 to UO_3 in which the various structures continuously transform from one to another. (This report is also available in J. Am. Chem. Soc. **70**, 99-104(1948).)

- 3094 Ryan, D. E. and Beamish, F. E. The Determination of Thorium in the Presence of Uranium by Means of Ferron. May 9, 1946. Declassified 1947. 9p. (NRC-1633)

In a previous report the quant. detn. of Th by means of ferron was described. This report deals with ferron as a reagent for Th alone and in the presence of U. Th may be detd. quantitatively in the presence of twice its amt. of U by a single pptn. The sepn. of Th from large quantities of U has been accomplished by a double pptn. It has been found that $(\text{SO}_4)^{--}$ interferes in the pptn. of the Th ferron complex and that reagent solvents, other than H_2O , tend to have a dissolving action on the ppt.

- 3095 Ryan, D. E., McDonnell, W. J., and Beamish, F. E. "Determination of Thorium and Its Separation from Uranium by Ferron." Anal. Chem. 19, 416-17(1947).

Ferron (7-iodo-3-hydroxyquinoline-5-sulfonic acid) ppts. Th in the presence of W, La, Ce, Ti, Ni, and Co without interference; Ag, Hg, and Cu must be absent. A 0.2% aq. soln. is a satisfactory reagent. The pH of the soln. analyzed should lie between 2 and 3.5. Probably 1 Th combines with 2 ferron in the ppt. Ignition of the ppt. to 900° yields ThO_2 . Some 23 expts. with about 10 mg of Th in the soln. gave satisfactory recovery even when 100 mg of U was present.

- 3096 Samson, S. and Sillén, L. G. "The Crystal Structure of Barium Uranate; the Nonexistence of the UO_4 Group." Arkiv Kemi Mineral. Geol. A. 25, No. 21, 16p. (1947).

Tabular golden-yellow single crystals of BaUO_4 were prepd. by fusion of $(\text{NH}_4)_2\text{U}_2\text{O}_7$ in 8-fold excess of BaCl_2 . X-ray-diffraction diagrams registered (included Weissenberg photographs of the zero, first, and second layers) about (001) and (010). Heavy atoms were located by Fourier methods, and O atoms were placed by space and symmetry considerations. Cell dimensions are $a = 5.751$, $b = 8.135$, $c = 8.236$ Å, all ± 0.005 Å, with 4 mols/unit cell. The space group is D_{2h}^{11} — Pbcm. 4 Ba are in 4(d), $x = 9.474$, $y = 0.200$; 4 U are in 4(a); 8 O' are in 8(e), $x = 0.29$, $y = -0.06$, $z = 0.09$; 4 O^2 in 4(c), $x = 0.11$, and 4 O^3 in 4(d), $x = -0.13$, $y = -0.04$. The structure consists of infinite layers parallel to (100) of octahedrally coordinated U atoms, linked in the layer by 4 shared corners. Each U atom thus is associated with 2 unshared O atoms. Ba ions bind the sep. layers. The slight soly. of uranates is attributed to this silicate-like sort of coordination. Taken from Chemical Abstracts.

- 3097 Sauerwein, K. "Neutron Capture of Uranium in Various Energy Regions." Z. Naturforsch. 2a, 73-9(1947) Feb.

A study of the capture process, using the self-absorption and β -absorption methods, pointed to the existence of a broad absorption band (several hundred ev wide) for neutron energies of a few hundred ev, in addn. to an isolated resonance at 7.5 ev. The band is ascribed to numerous closely spaced resonances.

- 3098 Schaal, R. and Faucherre, J. "Variations of pH as a Function of the Dilution. Application to the Study of Soluble Basic Salts." Bull. soc. chim. France 927-32(1947).

Measures of the pH as a function of the diln. make possible some precise observations on the ionic state of certain sol. basic salts, e.g., the basic nitrates of Be, UO_2 , Pb, Th, and Cr, and the basic perchlorates of Pb and Th, all of which are condensed. The theoretical results of Bye were used for detg. their degree of condensation, which may be 2 or 4. The condensation of the sol. basic salts is a general phenomenon that it is impossible to neglect, and it may also be necessary to take account of this phenomenon of condensation in the formation of slightly sol. basic salts. This ionic condensation may be detected and measured by other physicochem. methods, and P. Souchay in an unpublished work has confirmed these results cryoscopically. The ionic condensation is rapid in every case except for the basic nitrate of Cr, the speed of aging of which increases with the concn. of the dissolved basic ion, the concn. of the indifferent base electrolyte, and the temp.

- 3099 Schlesinger, H. I. and Brown, H. C. Uranium Borohydride, $U(BH_4)_4$, and Its Alkyl Derivations. Sept. 1, 1946. Declassified Apr. 24, 1947. 44p. (MDDC-1341)

Analysis, and measurements of the vapor d. of a new cpd. show it to be uranium (tetra) borohydride, $U(BH_4)_4$. On the basis of data described in the exptl. part, the equation for the reaction may be written: $UF_4 + 2Al(BH_4)_3 \rightarrow U(BH_4)_4 + 2Al(BH_4)F_2$. Treatment of the cpd. with trimethylboron leads to the formation of two additional new cpds. to which the formulae, $U(BH_4)_3(BH_3CH_3)$, and $U(BH_3CH_3)_4$, have been assigned. Discussion of related cpds., properties, and reactions is presented at length.

- 3100 Schuurmans, P., van den Bosch, J. C., and Dijkwei, N. "The Spectrum and Zeeman Effect of Uranium. Preliminary Analysis." Physica 13, 117-40(1947).

New wavelength measurements and Zeeman effect data are reported which make possible the classification of several strong lines. In U_{II} two groups of terms could be established, between which no combinations have been found until now. Group A contains even terms, arising from the electron configuration f^4s (with $I_{7/12}$ lying lowest) and from f^4d . Group B contains odd terms, arising from f^3s^2 (with $I_{9/12}$ lying lowest), from f^3ds and from f^3d^2 . In U_I only one group of terms was found. This group contains odd terms, arising from f^3ds^2 (with $I_{6/8}$ lying lowest) and from f^3d^2s .

- 3101 Scott, K. G., Axelrod, D., Crowley, J., Lanz, H. C. Jr., and Hamilton, J. G. Studies on the Inhalation of Fissionable Materials and Fission Products and Their Subsequent Fate in Rats and Man. Dec. 31, 1945. Declassified Aug. 28, 1947. 166p. (MDDC-1276)

The purpose of these expts. was to ascertain the possible hazard resulting from inhalation of fissionable materials and fission products. Aerosols of Pu, U plus fission products, and Pa and short-lived fission products obtained from the cyclotron and the Clinton Pile were administered to rats. A Zr^{89} aerosol was administered to one human subject and to rats. Aerosols of the above elements were almost totally retained by the head and lungs immediately after exposure. After 4 days the lungs contained the largest % of these elements. The elements deposited in the head were quickly eliminated via the gastrointestinal tract. The same avenue of elimination was used by the lungs, but at a slower rate. The small % absorbed into the body was primarily deposited in the skeleton after conditions of equil. had been established. Radioautographic studies indicate that the site of deposition in the lungs of these materials is in the bronchial passage and the alveolar structures. They are rapidly removed from the bronchial tree, presumably by ciliary action and are very slowly released from the alveoli. No accumulation of any of the radioelements was observed in either blood vessels or lymph nodes. Charts, diagrams, and photographs are included, and a bibliography is appended.

- 3102 Seaborg, G. T. "The Transuranium Elements." Nature 159, 863-5(1947).
This paper is similar to report MDDC-227(1946).

- 3103 Seaborg, G. T., Gofman, J. W., and Stoughton, R. W. Nuclear Properties of U^{233} . A New Fissionable Isotope of Uranium. Apr. 15, 1942. Declassified Jan. 28, 1947. 1p. (MDDC-787)

The whole text of this document is reproduced below.

"The bombardment of thorium with slow neutrons produces Th^{233} (by the reaction $Th^{232}(n,\gamma)Th^{233}$), which emits beta-particles and has a half-life of 23.5 min. The daughter of Th^{233} is the 27.4-day beta-emitting Pa^{233} which in turn decays to U^{233} . We have measured the radioactive and the fission properties of U^{233} . Our measurements on a sample of U^{233} weighing 3.8 micrograms show that this isotope undergoes fission with neutrons. The same result was obtained in a check experiment with another sample of U^{233} weighing 0.8 microgram."

(This is also published in Phys. Rev. (2), 71, 378(1947) and in Seaborg, Katz, and Manning, The Transuranium Elements. New York, McGraw-Hill Book Company, Inc., 1949. Paper 19.13.)

- 3104 Seaborg, G. T., Gofman, J. W., and Stoughton, R. W. "Nuclear Properties of U^{233} . A New Fissionable Isotope of Uranium." Phys. Rev. (2), 71, 378(1947).

This paper is similar to report MDDC-787(1947).

- 3105 Shoenberg, D. "Uranium Not a Superconductor." Nature 159, 303(1947).

It is shown that U is not a superconductor above 1.08°K. The superconductor reported by Mott and by Shoenberg was probably due to U carbide.

- 3106 Sill, C. W. and Peterson, H. E. "Fluorescence Test for Uranium in Aqueous Solutions." Anal. Chem. 19, 646-51(1947).

The yellow-green fluorescence of $(UO_2)^{++}$ will serve to detect 0.01 mg of U in 200 ml Sn^{++} , $(SnO)^{++}$, Ce^{++} , and possibly one or two rare-earth ions interfere. The test consists in dissolving the ore, oxidizing the Sn, pptg. the rare earths with Na_2CO_3 , and observing the fluorescence, with the 2537 Å line of Hg as ultra-violet source. $(PO_4)^{-3}$ and F^- strengthen the fluorescence. Ions which strongly absorb the ultraviolet radiation and those which weakly interfere are listed.

- 3107 Simon, F. E. Remarks on Some Physical Properties of Uranium Metal. Aug. 16, 1943. Declassified September 1947. 13p. (BDDA-112; BR-280A)

Data are included on d., structure, m.p., heat content, thermal expansion, entropy, compressibility, Young's Modulus, velocity of sound, vapor pressure, electrical cond., thermal cond., magnetic susceptibility, and control of metal purity.

- 3108 Slätis, H. "β- and γ-Radiation from U^{239} and Np^{239} ." Nature 160, 579-80(1947).

The γ radiation was measured by absorption in Pb. For U^{239} two components were found with energies of 920 and 80 kev, for Np^{239} three components with energies of 500, 200, and 51 kev. The β spectrum was taken with the magnetic lens spectrograph. U^{239} has two internal-conversion lines of 50.7 and 67.8 kev which correspond to the L and M lines of a nuclear γ radiation. The energy of this γ radiation is calcd. to L = 73.0 kev and M = 73.5 kev. From the Fermi analysis of the β spectrum a double upper limit for the energy is found with 2.06 and 1.12 mev, where the difference of 0.94 mev corresponds to absorption measurements for the higher value, and the lower one to the internal-conversion line. The nuclear level scheme for the disintegration of U^{239} shows 2.06 mev for the total disintegration energy and 1.12 mev and $\gamma_1 = 73$ kev with succession of $\gamma_2 = 870$ kev.

- 3109 Smethurst, P. C. "Photoreduction Processes in Colloids." Process Engraver's Monthly 54, 142-5(1947).

Some org. salts of Fe such as ferric NH_4 citrate added to gum soln. and coated as a layer will give a light-sensitive system in the sense that the originally unhardened colloid is hardened by exposure. The exposure required is of the order of 10 times that required for the reversed ferric-gum system. Exposure to light in this case reduces the ferric salt to ferrous, but the pH conditions are now such that $Fe(OH)_2$ is formed, which is oxidized to $Fe(OH)_3$ and hardens the layer locally. Analogous cases of colloid sensitization by U salts are given.

- 3110 Snell, A. H., Nedzel, V. A., Ibser, H. W., Wilkinson, R. G., Sampson, M. B., and Levinger, J. S. Studies of the Delayed Neutrons. I. The Decay Curve and the Intensity of the Delayed Neutrons. Declassified May 9, 1947. 8p. (MDDC-939)

The delayed neutrons resulting from slow neutron fission of U have been found to decay as a combination of exponentials with half-lives of 0.4, 1.8, 414, 23, and 56 sec and respective initial relative intensities when activated to satn. of 0.4, 0.5, 1.1, 1.0, and 0.14. Under equil. conditions the delayed neutrons are $1.0 \pm 0.2\%$ as abundant as the instantaneous fission neutrons. (This paper is also available in Phys. Rev. (2), 72, 541-4(1947).)

- 3111 Snell, A. H., Nedzel, V. A., Ibser, H. W., Wilkinson, R. G., Sampson, M. B., and Levinger, J. S. "Studies of the Delayed Neutrons. I. The Decay Curve and the Intensity of the Delayed Neutrons." Phys. Rev. (2), 72, 541-4(1947).

This paper is similar to report MDDC-939(1947).

- 3112 Spedding, F. H., Newton, A. S., Nottorf, R., Powell, J. E., and Calkins, V. The Preparation and Some Properties of UBr₃, UBr₄, UOBr₂, and UO₂Br₂. Declassified Nov. 5, 1947. 42p. (MDDC-1481)

An investigation of the prepn. and some of the phys. properties of UBr₃, UBr₄, UOBr₂, and UO₂Br₂ has been carried out. UBr₃ has been prepd. by the action of HBr on UH₃ and by the reduction of UBr₄ with H₂. The $d_{40}^{26^\circ} = 5.98$. The soly. of UBr₃ in various org. and inorg. solvents has been studied. UBr₄ has been prepd. by several methods, the most useful of which were (1) the action of Br₂ on UBr₃ followed by distn. using Br₂ in N₂ as a carrier gas, and (2) the direct synthesis from U metal turnings in a quartz app. using Br₂ carried in He gas to form the UBr₄ and dist. it in one operation. The $d_{40}^{26^\circ}$ of UBr₄ = 5.33, m.p. = $519 \pm 2^\circ\text{C}$, and the b.p. (740 mm) = 761°C . The soly. in various org. and inorg. solvents was studied. The vapor pressure of UBr₄ was measured and can be expressed by the following equations:

$$\text{For sublimation: } \log P_{\text{mm}} = \frac{-10,900}{T} + 14.56$$

$$\text{For vaporization: } \log P_{\text{mm}} = \frac{-7,060}{T} + 9.71$$

$$\Delta H(\text{sublimation}) = 50,000 \text{ cal/mole}$$

$$\Delta H(\text{vaporization}) = 32,000 \text{ cal/mole}$$

$$\Delta H(\text{fusion}) = 18,000 \text{ cal/mole}$$

A study of the UBr₄ - UBr₃ system showed a eutectic at 75 mole % UBr₄ with some evidence of solid soly. at UBr₄ concns. above the eutectic. UOBr₂ was found in the residue from the distn. of UBr₄. It has also been prepd. by the action of Br₂ on U₃O₂S₄ at 600°V. It is relatively nonhygr. and dissolves in H₂O to give a clear green soln. UO₂Br₂ has been prepd. in an impure state by the controlled oxidation of UBr₄. Both these cpds. are of importance as impurities in UBr₄. 36 references are included.

- 3113 Spedding, F. H., Newton, A. S., Warf, J. C., Johnson, O., Nottorf, R. W., Johns, I. B., and Daane, A. H. Uranium Hydride. I. Preparation, Composition, and Physical Properties. Declassified Dec. 16, 1947. 29p. (MDDC-1585)

The methods of prepn. and formation of UH₃ and UD₃ are given. The formula of the cpd. is discussed and its phys.-chem. properties are investigated. These included its thermal decompn., phys. state, d., electrical cond., dissocn. pressure-compn. isotherms, pressure-temp. relationships, heat of formation, kinetics of formation, and H-D sepn. studies. Finally, the classification of UH₃ with respect to other hydrides is briefly discussed. The evidence concerning UH₃ presented in the paper, and the x-ray-diffraction data, indicate that this substance falls into a newly recognized class. This cpd. is characterized by a continuous, valence-type of bonding, with each H atom bridging between two metal atoms. The theory also postulates one electron pair for the two bonds (a resonating system of electron-deficient "half-bonds"). The continuous structure accounts for the metallic properties, such as electrical cond. and the proper spacing of the U atoms in the lattice. (This information is also available in condensed form in Nucleonics 4, 4-15(1949) Jan.)

- 3114 Spedding, F. H., Warf, J. C., Newton, A. S., Johnson, O., Johns, I. B., Ayers, J. A., Butler, T. A., Fisher, R. W., and Nottorf, R. The Chemical Properties of Uranium Hydride. Declassified Aug. 28, 1947. 31p. (MDDC-1222)

UH₃ is a pyrophoric powder. In many of its reactions it acts as a powerful reducing agent. It dissolves readily in oxidizing acids but very slowly, if at all, in nonoxidizing acids. It is converted to the uranyl salt by treatment with strong oxidizing agents and also by several weak oxidizing agents. The latter include Ag, Hg⁺⁺, and Sb salts in HCl. The reaction between UH₃ and halogen or hydrogen halide gases at about 250°C offers a convenient method of prepg. anhyd. U halides from U metal. There is also a smooth reaction of UH₃ with H₂S, steam, CO₂, phosphine, C₂H₄, CH₄, and phosgene to form binary cpds. of U. There is no reaction at room temp. with org. liq. other than chlorinated solvents. UH₃ is completely wetted by Hg, but the process is reversed when the "amalgam" is brought in contact with air, H₂O, or H₂S at room temp. A bibliography of 55 references is appended.

- 3115 Staple, E., Marshall, E., and Simon, W. The Determination of Small Amounts of Nitrate in U₃O₈ and Other Uranium Oxides. July 23, 1496. Declassified Dec. 9, 1947. 14p. (MDDC-1564)

This report describes a method which permits the detn. of (NO₃)⁻ in the 0 to 100 ppm range with a reasonable precision (10% of the (NO₃)⁻ content). A first attempt was based on the reduction of the (NO₃)⁻ to NH₃ with Devarda's alloy. This method was found to be erratic with such small quantities of (NO₃)⁻ in the presence of U. A method based on the isolation of the (NO₃)⁻ from the oxide by distn. followed by a colorimetric detn. of (NO₃)⁻ in the distillate as the [Fe(NO)]⁺⁺ complex was developed. This method has been found to have the required range and precision mentioned above. This method is obviously not applicable when volatile interfering substances are present.

- 3116 Sterett, C. C. and Calkins, V. P. The Ionic Absorption Spectra of the Uranium Halides in a Polar, Non-Aqueous Solvent. Apr. 7, 1947. Declassified Nov. 10, 1497. 13p. (MDDC-1473)

The absorption spectra of various U halides have been measured in MeOAc, the following halides of U being used: UCl₃, UBr₃, UCl₄, UBr₄, UBrCl₃, UCl₅, UCl₆, UOCl₂, and UO₂Cl₂. All these halides but UOCl₂ were found to be sol. in MeOAc. Only two distinct spectra were exhibited by these halides. UO₂Cl₂ gave an absorption spectra characteristic of (UO₂)⁺⁺ whereas all the other sol. halides gave an absorption spectra characteristic of U⁺⁴. Mechanisms for these reactions have been proposed.

- 3117 Sterett, C. C. and Calkins, V. P. Spectrophotometric Evidence for the Existence of Uranium Pentachloride as a Double Compound of Hexa- and Tetrachloride. Declassified May 22, 1947. 1p. (MDDC-1094)

This report is brief and is reproduced below in its entirety.

"The molecular absorption spectra of solutions of UCl₅, UCl₆, and UCl₄ in carbon tetrachloride and thionyl chloride were measured with a Beckman spectrophotometer equipped with a quartz prism and an incandescent lamp permitting measurements in the wavelength range from 300 mμ. The results obtained indicate that the pentachloride exists as a double halide compound of the hexa- and tetrachloride and not as a simple chloride compound corresponding to its usually assigned formula of UCl₅. Although the tetrachloride gave a decreasing absorption continuum in both the carbon tetrachloride and thionyl chloride solution, the absorption spectra curves for the hexa- and pentachloride showed identical maxima at 650 and 850 mμ in both solvents, thus indicating that the higher two chlorides of uranium undergo the same molecular electronic transitions. By noting the height of the maxima obtained with pure hexachloride solutions and by the use of Beer's law, it was found that the height of the maxima procured with the pentachloride solutions corresponded to that height which should have been attained if the pentachloride used were composed of equimolar amounts of the hexa- and tetrachloride of uranium. These quantitative data corroborated the qualitative data concerning the frequencies at which these maxima occurred."

- 3118 Stokinger, H. E., Roberts, E., Spiegl, C. J., Rothstein, A., Rothermel, J. J., and Sprague, G., Jr. "Toxicity of Uranium Dusts." Federation Proc. 6, 374(1947).

This is an abstract only.

- 3119 Sutton, J. Ionic Species in Uranyl Solutions. Mar. 21, 1947. 6p. (NRC-1612)

From measurements of the absorption spectra and pH of solns. of uranyl perchlorate, two species, $[\text{UO}_3\text{UO}_2]^{++}$ and $[(\text{UO}_3)_2\text{UO}_2]^{++}$, were shown to exist in solns. above pH = 2.0. The equil. consts. for the formation of these ions were detd. Exptl. data are included.

- 3120 Tannenbaum, A. Distribution of U^{233} in Tissues of Mice Following Injection of U^{233} (+6) Nitrate. October 1945. Declassified Sept. 11, 1947. 9p. (MDDC-1280)

The purpose of this investigation was to study the distribution and excretion of U^{233} and to compare the results with those previously obtained with normal U salts. Six adult C₃H male mice, weighing about 30 g were used as exptl. animals. The soln. contained 300 γ U^{233} /ml. Some of the animals received an intramuscular injection in the right hind leg and others were injected subcutaneously in the interscapular area. The U^{233} was injected at three levels: 1.5, 15, and 45 γ . Clinically the animals showed no ill effects except for a slight decrease in body weight. There was no ulceration of obvious tissue damage at the site of the injection and no limitation of motion of the leg injected. The major portion of the injected material is rapidly excreted; only about 10% of the injected U^{233} was recovered, regardless of the amt. injected, site of injection, or whether the mice were sacrificed at 2 weeks or at 4 weeks. It is probable that at first most of the U^{233} excreted represents elimination from the injection site without intermediate fixation in the tissue, rather than U^{233} which has been fixed in the tissue and then excreted. By the 4th week, however, on the basis of the amt. found in the bladder urine and the gastrointestinal tract, it appears that the excretion is of the order of 1% daily (or less) of the total U^{233} in the body, including that remaining at the injection site. The bone is the principal site of accumulation and the kidney next in importance. The liver contained only about 1% of the total U^{233} in the body; all other organs contained very small amts. The blood values were unquestionably lower than those for other tissues studied. The spleen showed a higher concn. of U^{233} than did the liver; it is so small an organ, however, that it accounted for relatively little of the U^{233} in the total body. With the exception of the kidneys the amt. of U^{233} found in any organ was roughly proportional to the amt. injected. The mice receiving the 45 γ dosage showed a greater proportion in the kidneys than did the other animals; this might be expected if the dose produced "chemical" damage to the kidneys. The proportion of U^{233} found in the kidneys of these 2 mice begins to approach the proportion of U found in the kidneys of animals injected with or fed toxic amts. of U nitrate. The distribution of U^{233} is similar to that of U^{238} . U^{233} , therefore, may be used as a tracer for studies on U distribution and excretion. Both accumulate principally in the bone and kidneys, and it may be expected that chem. or radiation damage caused by ordinary U and the isotopes thereof would be mainly in these organs.

- 3121 Tannenbaum, A. and Silverstone, H. The Toxicology of U-Compounds. Progress Report on the Injection and Ingestion to October 31, 1944. Declassified Jan. 13, 1947. 37p. (MDDC-615)

The criteria of toxicity were appearance of mice, wt. changes, gross and micro. pathological changes, and mortality. The U content of the organs and tissues were detd. On subcutaneous injection, U cpds. are very toxic. Depending on the particular strain of mouse utilized in the expt., a single subcutaneous injection of 0.5 to 2 mg of U as the nitrate, produced mortality in some members of a group; 4 mg was lethal to all mice. Strain is a modifying factor in toxicity, while age and sex play less important roles. Injections of the above-mentioned amts. of U produced an acute intoxication: the most const. and striking pathological change was an acute necrotizing nephrosis. The deaths occurred during the acute intoxication (first 2 wks); otherwise, the mice recovered more or less completely. The main sites of U accumulation are the kidneys and bone. Disappearance from these organs is a slow process. U is excreted in the urine and feces. In the ingestion expts. the U cpd. was incorporated into the diet. Daily doses of 10 mg of U as the nitrate produced relatively low toxicity and no mortality, while doses of 80 mg of U daily were toxic and lethal. It is clear that the relatively low toxicity of U cpds. on ingestion (compared

with injection) is due to the low rate of absorption of these cpds. from the gastrointestinal tract. The nature and duration of the intoxication, the gross and micro. pathological changes and the distribution of U in the tissues were all similar to that found in the injection studies. U accumulates slowly in the kidneys and bone, and disappears slowly after the removal of U from the diet. Studies on comparative toxicity reveal that the following cpds. may be grouped with regard to their toxicity on ingestion: UO_2 , U_3O_8 , UF_4 —nontoxic; UO_3 —toxic in high doses; UCl_4 —nontoxic in moderate doses, toxic in high doses; $\text{UO}_2(\text{NO}_3)_2$, UO_4 , $\text{Na}_2\text{U}_2\text{O}_7$ —toxic in moderate doses; UO_2F_2 —toxic even in relatively low doses. In considering the toxicology of U cpds. it is necessary to distinguish clearly between exposure to U, absorption of U, the presence of U in the tissues, and U toxicity. The lack of relationship of the amt. of U in the tissues and the state of intoxication at any one time is discussed. It is suggested that the acute intoxication be considered apart from the subsequent course. The significance of the anions of the ingested cpd. is discussed; e.g., it is probable that UO_2F_2 is more a problem of F toxicity than U toxicity. The course of chronic U poisoning is still to be recognized and described.

- 3122 Tannenbaum, A. and Silverstone, H. Accumulation of Uranium in the Tissues of Mice Ingesting Uranyl Nitrate. Sept. 13, 1946. Declassified Feb. 5, 1947. 9p. (MDDC-665)

The previous observation that U gradually accumulates in the kidney and bones of mice that are daily fed a const. amt. of U cpd. was confirmed. The present expt. was not cont. long enough to indicate, one way or the other, whether the U in the tissue finally reaches a plateau level (where absorption and excretion are approx. equal). The results of an earlier expt. suggest this possibility.

- 3123 Tannenbaum, A. and Silverstone, H. Failure to Affect Toxicity of Ingested Uranium Chloride by Dietary Acid (HCl) or Base (NaHCO_3). Sept. 13, 1946. Declassified Feb. 26, 1947. 13p. (MDDC-697)

This study was designed to investigate the toxicity of the HCl released by hydrolysis of UCl_4 , and at the same time acquire information on the modifying effects of moderate amts. of acid (HCl) or base (NaHCO_3) on the toxicity of ingested UCl_4 . Six groups of mice were fed a basic lab. ration with the following addns.:

- M40: nothing added
- M43: 0.6 to 1.2% HCl
- M41: 0.8% UCl_4
- M44: 0.8% UCl_4 + 0.46% HCl
- M42: 3.2% UCl_4
- M45: 3.2% UCl_4 + 1.06% NaHCO_3

With due consideration to the amts. of HCl liberated from UCl_4 , and the amts. of added HCl or NaHCO_3 , the data on growth of the mice, morphologic changes in the kidneys, and amts. of U found in the kidneys and bone indicate that (1) HCl in itself did not account for any considerable part of the toxicity of UCl_4 ; (2) the addn. of 0.46% HCl to the diet contg. 0.8% UCl_4 did not augment the relatively slight toxicity of this dosage; and (3) NaHCO_3 , which would presumably neutralize some of the acid, did not decrease the significant toxic action of the 3.2% dosage. In this expt. the most important factor in toxicity was the dosage of UCl_4 fed.

- 3124 Tannenbaum, A. and Silverstone, H. Relationship of Uranium Excretion to the Total Amount of Uranium in the Mouse. Sept. 13, 1946. Declassified Feb. 26, 1947. 9p. (MDDC-698)

The rate of excretion of U accumulated in the tissues of mice was detd. in two ways. (1) The amts. of U in kidneys and bones of mice were detd. at various times between 45 and 287 days following subcutaneous injection of $\text{UO}_2(\text{NO}_3)_2$. The total U in kidneys plus bone was found to decrease at the rate of 0.5% daily. (2) In another expt. the U excreted daily in urine plus feces was detd. just preceding the sacrifice of the animals for analysis of tissues. The ratio of the U excreted daily to the U present in the body averaged 0.9%. These excretory rates refer to the U that has been absorbed and fixed in the tissues; specifically excluded is the U excreted from sites of entry such as lungs, gastrointestinal tract, or an injection site. The results indicate that the total U in the body may be estd. from the daily excretion of U (the former is approx. 100 to 200 times the latter), and that, of the U which has accumulated in the tissues, one-half is eliminated in about 70 to 140 days.

- 3125 Tannenbaum, A. and Silverstone, H. Studies on Acquired Tolerance to Uranium. Nov. 29, 1946. Declassified Mar. 11, 1947. 17p. (MDDC-825)

Generally the injection of U salts causes the animal to be more tolerant to subsequent injections. However, expts. with mice given $\text{UO}_2(\text{NO}_3)_2$ either by injection or feeding did not result in significant acquired tolerance as tested by means of subsequent injections. There is conclusive evidence, however, that mice previously fed the nitrate do acquire tolerance or resistance to further feeding of the material. This was shown in expts. in which a daily toxic dose was fed and others in which the daily dose was gradually increased to lethal levels. In certain instances, at least, the tolerance was of limited degree and duration. It is concluded that tolerance to U can be developed, but that the factors involved are incompletely understood.

- 3126 Tellechea, M. "Uranium." Rev. museo hist. nat. Mendoza 1, 38-50(1947).

This is a general account of U, with brief descriptions of some U minerals and notes on the U deposit at Mendoza, Argentina.

- 3127 Temkin, M. and Kiperman, S. "Kinetics of Synthesis and Decomposition of Ammonia on Various Catalysts." Zhur. Fiz. Khim. 21, 927-52(1947).

The equation for the rate, v , of reaction, $v = k_1 P_1 (P_2^3/P_3^2)^a - k_2 (P_3^2/P_2^3)^{1-a}$, in which P_1 , P_2 , and P_3 are the partial pressures of N_2 , H_2 , and NH_3 , resp., and k_1 , k_2 , and a are consts., is integrated by assuming the total pressure to be const. The energy of activation is expressed as a function of a . Variations of the adsorbed amt. of N_2 may cause the decompn. of NH_3 to be a zero-order reaction at very low NH_3 concns. Consideration of earlier expts. shows that the equation is valid for various catalysts (Fe, Mo, W, U, Ce, Mn, Os, Ru, Cu, and Pt), that a usually is 0.5, and that the activation energy is almost independent of the nature of the catalyst. This proves that the reaction mechanism is identical on various catalysts. The rate of synthesis should depend on the degree of uniformity of the catalyst surface. 57 references are given.

- 3128 Tenney, G. H. "Radiography of Radioactive Heavy Metals." Ind. Radiography Non-Destructive Testing 5, No. 4, 33-6(1947).

This paper contains a discussion of methods used in the radiography of U metal in general and of radiographic inspection of U^{238} in particular. Satisfactory procedure involves the use of Ra sources. Brief data on cassettes, films, intensifying screens, and darkroom techniques are given.

- 3129 Tevebaugh, A. D., Tevebaugh, R. D., Cline, W. E., and Warf, J. C. The Conversion of UF_4 to U_3O_8 . Declassified Dec. 23, 1947. 6p. (MDDC-1526)

Methods of conversion of UF_4 to U_3O_8 by fusion with $(\text{NH}_4)_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ and other salts are described. A pyrohydrolytic method is described whereby a mixt. of steam and air at 800°C is used to convert UF_4 to U_3O_8 .

- 3130 Tishkoff, G. H. Dimerization and Absorption at the Dropping Mercury Electrode. Aug. 15, 1947. Declassified Sept. 15, 1947. 5p. (MDDC-1390)

This paper presents a mechanism based upon dimerization and adsorption which also includes rate complications as an inherent step in the reduction mechanism. The postulates are successfully applied to the irreversible reduction of uranyl carbonate.

- 3131 Toussaint, W. J., Dunn, J. T., and Jackson, D. R. "Production of Butadiene from Alcohol." Ind. Eng. Chem. 39, 102-05(1947).

This is a description of lab. expts. on production using silica-gel-supported Ta oxide catalyst approx. 2.5% is given. Various other oxides were also found to be effective. These were Zr, Co, Th, U, and Ti.

- 3132 Tsien S. -T., Ho Z. -W., Chastel, R., and Vigneron, L. "On the New Fission Processes of Uranium Nuclei". Phys. Rev. (2), 71, 382-3(1947).

Photographs are given showing evidence for ternary and quaternary fission, the probability of their occurrence relative to binary fission being 0.003 ± 0.001 and 0.0003 ± 0.0002 , respectively.

- 3133 Tsien, S. -T., Ho Z. -W., Vigneron, L., and Chastel, R. "Ternary and Quaternary Fission of Uranium Nuclei." Nature 159, 773-4(1947).

Earlier reports are summarized and slightly corr. A case of tripartition with fragment masses ~ 127 , 77, and 32 is reported.

- 3134 Tsien S. -T., Ho Z. -W., Chastel, R., and Vigneron, L. "New Modes of Fission of Uranium. Ternary and Quaternary Division." J. phys. radium (8), 8, 165-78(1947).

A full review of the subject is given, and a no. of further details are added. The mass of the long-range light particle in ternary fission of U^{236} is given at 9 ± 2 , the freq. of ternary fission as 0.003 ± 0.001 per binary fission. Fast neutron studies (fission of U^{239}) showed that in $\sim 1.2\%$ of all fissions a light particle of short range was emitted; in 10^4 fissions no long-range particles were found. Quaternary fission of U^{236} occurs 0.0002 ± 0.00015 per binary. The directionality of emission of the light particle in ternary fission is discussed.

- 3135 Tsien, S. -T., Ho, Z. -W., Chastel, R., and Vigneron, L. "New Modes of Fission of Uranium Ternary and Quaternary Division." J. phys. radium (8), 8, 200-12(1947).

This is a continuation of the paper of the same title in J. phys. radium (8), 8, 165-78(1947). This section contains the collected results of other authors.

- 3136 Vaes, J. F. "Six New Uranium Minerals from Shinkolobwe." Ann. soc. geol. Belg. Bull. 70B, 212-25(1947).

Six new U minerals from Shinkolobwe, Katanga, Belgian Congo, are described: billietite, a hydrous Ba uranate which occurs as small tabular crystals; vandendriesscheite, a hydrous Pb uranate, which occurs in the form of pseudo-hexagonal crystals; masuyite, a hydrous Pb uranate, which is found in small geodes in pitchblende; richetite, a hydrous (?) Pb uranate, which occurs as small tabular masses embedded in uranophane needles; studtite, a hydrous U carbonate, which occurs as long thin fibers; and diderichite, a hydrous U carbonate, which occurs as fibrous crusts.

- 3137 van der Maas, G. J. and Yntema, J. L. "An Attempt to Determine the Range of U^{235} [α -Rays] from the Radiation of a Normal Uranium Sample." Physica 13, 453-8(1947).

With the aid of a linear amplifier the α radiation of U^{235} was detected in the radiation of a sample of U oxide. Four sets of number-deflection statistics of the oscillograph deflections were detd., each of which shows a clear surplus due to the α radiation of U^{235} . From the position of the surplus it can be concluded that the range of U^{235} is between that of U^{234} and U^{238} , but nearer to that of the latter.

- 3138 Van Wazer, J. and Halpern, I. An Anomaly in the Study of Dielectric Constant. Declassified Oct. 14, 1947. 1p. (MDDC-1358)

The entire text of the report is reproduced below.

"During a study of the dielectric constant of solid uranium tetrachloride of doubtful purity, it was found that some samples showed frequency dispersion, while others did not, with the high-frequency limiting dielectric constant of those samples exhibiting variation equal to the dielectric constant of the other samples. Since from x-ray measurements this salt does not appear to contain dipoles and there was no good indication of the existence of two solid phases under these conditions, a study was made of the thermal variation of the dielectric constant. Contrary to expectations, the dielectric constant increased with rising temperature. Attempts were made to explain these phenomena as the effect of (1) impurities in the solid, (2) absorbed HCl or other polar gases, and (3) assuming that the uranium tetrachloride molecule is polar, an equilibrium between two solid structures in one of which there is no dipole rotation.

The first two explanations do not agree in magnitude with chemical analysis, and the third is not in accord with x-ray structure studies. It was therefore concluded that the observed dispersion ($\epsilon = 8.0$ at 200 c, $\epsilon = 4.5$ at 100 kc for experiments on a sample at 110°C) and the temperatures variation ($\epsilon = 7.2$ at 164°C, 4.5 at 110°C, and 4.0 at 25°C at 100 kc) cannot readily be explained by existing theories of the behavior of solid dielectrics."

- 3139 Van Wazer, J. and John, G. A Kinetic Study of the Oxidation of Uranium Tetrachloride.
Declassified Sept. 24, 1947. 3p. (MDDC-1322)

A described method for kinetic studies of solid-gas reactions in which the solid undergoes a color change has been used for detg. the activation energy for oxidation of UCl_4 . The oxidation process consists of two independent steps. There is also a side reaction in which the UCl_4 reacts with the Cl_2 evolved to form volatile UCl_5 . (This paper is also available in J. Am. Chem. Soc. 70, 1207-09(1948).)

- 3140 Villar, G. E. "The New Pleiad of the Actinides." Bol. soc. quím. Peru 13, 73-93(1947).

From the viewpoint of pure chem. the pleiad of the actinides is a necessary consequence. The actual collocation of the elements of at. no. higher than 89 in the periodic table of Mendeleev does not agree with the facts. The at. wt. of the preceding homologs is greater than the av. of the homologs above and below, in contradiction to the general rule. The chem. reactions, the valences, and the crystallography are more nearly similar to the rare earths than to the homologs in the periodic table. The sexivalence is admitted for U, but for the oxygenated cpds. the predominant valence is considered to be 4 and the structure for these cpds. is explained by 0 bridges. In consequence, the homologs of the rare earths La, Ce, Pr, Nd, Pm, Sm, Eu, Gd are Ac, Th, Pa, U, Np, Pu, Am, Cm. The last four elements show chem. properties so similar to U that they are included on this basis.

- 3141 Wacker, P. F. and Cheney, R. K. Specific Heat, Enthalpy, and Entropy of Uranyl Fluoride. Declassified July 9, 1947. 5p. (MDDC-1069)

The heat capacity of UO_2F_2 was measured from 13 to 418°K using a vacuum-type colorimeter equipped with thermostated radiation shields. From the data so obtained, the enthalpy was calcd. to be 63.96, 77.62, and 108.15 int. j/g at 298.16, and 338.16, and 423.16°K, resp., while the entropy was calcd. to be 0.4400, 0.4830, and 0.5635 int.j/°-g at the same temps. No evidence of a transition was found. The values of the specific heat, enthalpy, entropy, and free energy are tabulated at 5° intervals of temp. (This report is also available in J. Research Natl. Bur. Standards 39, 317-20(1947).)

- 3142 Wacker, P. F. and Cheney, R. K. "Specific Heat, Enthalpy, and Entropy of Uranyl Fluoride."
J. Research Natl. Bur. Standards 39, 317-20(1947).

This paper is similar to report MDDC-1096(1947).

- 3143 Wahl, A. C. and Seaborg, G. T. Nuclear Properties of 93^{237} . Apr. 13, 1942. Declassified Dec. 17, 1947. 2p. (AECD-1830)

The bombardment of U with fast neutrons produces the β -emitting 6.8-day U^{237} , formed in the reaction, $\text{U}^{238}(\text{n},2\text{n})\text{U}^{237}$, Np^{237} , the daughter of U^{237} , was investigated, the primary purpose of the investigation being to measure the fission properties of this isotope. (This paper is also in Seaborg, Katz, and Manning, The Transuranium Elements. New York, McGraw-Hill Book Company, Inc., 1949. Paper 1.5.)

- 3144 Wahlin, H. B. Emissivity and Temperature Scale for Vacuum Heated Uranium. Sept. 12, 1944. Declassified Apr. 7, 1947. 2p. (MDDC-830)

In this investigation the true and apparent temps. were detd. for U which had been heated in a vacuum of 10^{-6} mm or lower for a period of 300 hrs or more. In the procedure, flat strips of the metal were used and rolled into hollow cylinders about 3 mm in diameter and 12 cm long. A hole $1/2$ mm in diameter was drilled in the side of the cylinders. These were then mounted in a tube connected to a pumping system and evacuated. During the heat treatment, continuous pumping was carried on. At the start, the emissivity, calcd. from the temps. of the metal surface and the temp. of the hole (which gives the true temp.), was higher than the final value. Continuous heating at temps. between 1250 and 1300°K will clean the surface and lower the emissivity. This cleaning, may be speeded up by turning the heating current off and allowing the cylinder to cool through the recalcence points. The true and apparent temps. calcd. from the emissivity data are tabulated. The temp. scale used is applicable to clean U surface only.

- 3145 Ware, E. Organic Reagents for Uranium Analysis. August 1945. Declassified Nov. 7, 1947. 21p. (MDDC-1432)

A careful literature survey has been made to ascertain what org. reagents combine with U ions, and under what conditions. From the many reagents reported to give reactions with U, those showing greatest promise of having value for the detection and/or detn. of that element have been selected for more detailed investigation. The results of studies on many of these reagents are contained in this report. Of the reagents studied, none combines exclusively with U. For the colorimetric detection and detn. of U, chromotropic acid and aluminon seem particularly useful. Of the reagents that ppt. U quantitatively, for subsequent detn. either by weighing or ignition of the complex, 8-hydroxyquinoline seems unexcelled, although it is far from being an ideal reagent.

- 3146 Warf, J. C. Some Reactions of Uranium Metal. Declassified Oct. 9, 1947. 15p. (MDDC-1391)

A summary of certain reactions of U metal is presented. U is a strong reducing agent and reacts with a wide variety of substances. Descriptions are given of its reactions with many materials, including air, O_2 , H_2 , HCl , Cl_2 , N_2 , H_2O , HF , HNO_3 , H_2SO_4 , H_3PO_4 , Ag and Cu salts, Br_2 , C, SiO_2 , UF_4 , UO_2 , perchloric acid, org. acids, metals, and alk. peroxide solns. 35 references are given.

- 3147 Warf, J. C., Newton, A. S., Butler, T. A., and Spedding, F. H. Uranium Hydride. III. Dispersions in Mercury. Declassified Dec. 17, 1947. 6p. (MDDC-1586)

The formation of dispersed systems of UH_3 and Hg is described. The systems are termed amalgams, although the evidence disclosed that the preps. are not true solns. or amalgams, but suspensions. The consistency of the amalgams as a function of concn., the behavior of radio-xenon in UH_3 upon amalgamation, the exchange of H with the D of UD_3 amalgams and vice versa, the chem. properties of the hydride amalgams, and the formation of related systems are discussed. (This information is also available in Nucleonics 4, 43-7(1949) March.)

- 3148 Weiss, G. and Blum, P. "Determination of Uranium by the Method of Auger." Bull. soc. chim. France 735-7(1947).

The $(UO_2)^{++}$ soln. either in 0.5N H_2SO_4 or 0.4N HCl is passed through a Jones reductor and reoxidized by bubbling air through it in the usual manner. The U^{+4} is titrated potentiometrically to $(UO_2)^{++}$ with 0.1N $Fe_2(SO_4)_3$ in an atm. of CO_2 with Pt and Hg_2Cl_2 electrodes at a temp. not exceeding 70°. In the presence of Fe (the ratio Fe/U may = 100); 2 to 3 g $(NH_4)_2SO_4$ must be added before reduction. NH_4SCN must be present. It does not affect the potential of the system, but acts as a catalyst. Tables of results and 6 references are given.

3149 Wexler, S. Uranium Poisoning. July 9, 1942. Declassified June 16, 1947. 3p. (MDDC-1054)
Poisoning from U may come about either through inhalation of U oxide dust (U_3O_8 , UO_2 , or UO_3) or through contact with the sol. salts. The pathological manifestation of U poisoning is nephritis, an inflammation of the kidney. The intensity of the anatomical and functional lesion is the result of the accumulation of the metal in the organ as a result of attempts at excretion. Protection of the body against U involves protection of the hands and care to avoid inhalation or ingestion. In the synthesis of uranyl nitrate, rubber gloves are recommended. Protection against ingestion depends solely upon the worker; care must be exercised to prevent the taking of any U by mouth during such operations as pipetting, etc.

3150 White, J. R. and Cameron, A. E. The Critical Ionization Potentials of Uranium Hexafluoride and Hydrogen Fluoride. Declassified Apr. 21, 1947. 1p. (MDDC-874)

The critical electron energies found necessary for the formation of ions in UF_6 and HF vapor are: UF_5 , 15.5 v; UF_4 , 20.1 v; UF^{+3} , 23.5 v; UF^{++} , 29.9 v; UF^{+1} , 37.9 v; U^+ , 50.3 v; HF^+ , 5.4 v. (This paper is also available in Phys. Rev. (2), 71, 907(1947).)

3151 White, J. R. and Cameron, A. E. "Critical Ionization Potentials of Uranium Hexafluoride and Hydrogen Fluoride." Phys. Rev. (2), 71, 907(1947).

This paper is similar to report MDDC-874(1947).

3152 Wilson, R. R. "Delayed Neutrons from Pu^{239} ." Phys. Rev. (2), 71, 560(1947).

This paper is similar to report MDDC-559(1946).

3153 Wylie, A. W. "Coprecipitation of Urinous Sulfate with Rare-Earth Double Sulfates." Nature 160, 830(1947).

$U(SO_4)_2$ in acid soln. is partly or wholly pptd. with Ce and Ce-group elements, the amt. depending mainly on the concn. of U and rare-earth ions. If the U concn. is high enough, a pale-green ppt. is obtained. Almost quant. pptn. can be obtained at a rare-earth-oxide concn. of not less than 24 g/l provided that at least 98% of the rare earths are pptd. and that the ratio of UO_2 to rare earths in soln. is 0.1 or less. For example, by adding Na_2SO_4 to a soln. of Ce_2O_3 32, UO_2 3.4, H_2SO_4 106 g/l, and filtering after 30 min at 20° , 99% of the Ce_2O_3 and 97% of the UO_2 pptd. at the mol. ratio of $Na_2SO_4 : Ce_2O_3 = 6.5$. With a mol. ratio of 1.1, 72% of the Ce_2O_3 and 34% of the UO_2 pptd. No significance amt. of UO_2SO_4 is copptd. under similar conditions.

3154 Wytzes, S. A. and van der Maas, G. J. "A New Determination of the Mean Ranges of the α -Particles from U_I and U_{II} ." Physica 13, 49-61(1947).

A method of measurement is described, using a wide-aperture ionization chamber, which has the advantage that it can be used for weak sources with a large surface, and still have a high resolving power. The method was applied to U_I and U_{II} and it was found possible to sep. these ranges completely. The mean ranges were measured relative to that of Po (38.44 mm) and were found to be (at $15^\circ C$, 760 mm Hg): U_I , 27.02 mm; and U_{II} , 32.58 mm.

3155 Yaffe, L. and Mackintosh, C. E. "Fission Yields of Masses 131, 132, 134, and 136 Formed in Neutron Fission of Uranium." Can. J. Research B. 25, 371-5(1947).

This paper is similar to report NRC-1572(1945).

3156 Zachariasen, W. H. Fluorides of Uranium and Thorium with the Lanthanum Fluoride Type of Structure. June 1946. Declassified July 18, 1947. 4p. (MDDC-1153)

This apper gives the results of crystal structure studies of a series of fluorides of U and Th, all of which have the LaF_3 -type of structure. The list includes UF_3 , $ThOF_2$, $BaUF_6$, $PbUF_6$, $SrUF_6$, $BaThF_6$, $PbThF_6$, $SrThF_6$, and $CaThF_6$.

- 3157 Zachariasen, W. H. The Crystal Chemistry of Fluorides of Thorium, Uranium, Neptunium, and Plutonium. June 11, 1947. Declassified July 14, 1947. 9p. (MDDC-1151)

This paper consists of a set of notes for oral presentation. Information on the studies of more than 50 fluorides of Th, U, Np, and Pu is contained. Table 1 gives a list of the fluorides which were examined. As shown in Table 2, some of these cpds. have crystal structures of previously known types. A no. of new structure types are shown. Because of the small scattering power of F, complete structure detns. could be carried out only for some of the cpds. However, the positions of the heavy-metal atoms have been found for all of the cpds. listed in Table 1. Table 3 shows the lattice dimensions of fluorides having previously known structure types. The lattice dimensions of the tetrafluorides illustrate the striking decrease in the size of the ion with increasing at. no. due to the filling of the 5f shell. The corresponding contraction in the trivalent state is demonstrated by the lattice dimensions of the tri-fluorides. Of considerable interest are the double fluorides of Th and U with Ba, Pb, Sr, or Ca. In the structure there is complete intermixt. of tetravalent and divalent cations so that these double fluorides become in effect pseudotrifluorides. Similarly, pseudodifluorides with the CaF_2 type of structure were encountered in PuOF and in the α forms of K_2ThF_6 , K_2UF_6 , and Na_2UF_6 . Table 4 gives complete crystal structure data for UO_2F_2 and for the two forms of UF_5 . UO_2F_2 is of layer structure type. The UO_2 groups have their axes normal to the layers while the F atoms are slightly below and above the U planes. All the various prepns. of UO_2F_2 which the writer has examined show stacking disorder of the layers. This stacking disorder varies considerably in degree from one sample to the next, depending upon the heat treatment of the samples. In the α - UF_5 structure there are strings of UF_6 -octahedra parallel to the fourfold symmetry axis with only van der Waals' forces holding the strings together. In the β - UF_5 form, on the other hand, each U is linked to 7 F atoms so that a 3-dimensional network of UF_7 -polyhedra is obtained. As a consequence the β form has more than 10% higher d. than the α form. Table 5 gives the crystal structure data for U_2F_9 , NaTh_2F_9 , and Na_2UF_7 . The first two cpds. are cubic and isomorphous in spite of the lack of correspondence in their formulas. The heavy-metal atoms are structurally equiv. In U_2F_9 there is resonance between the 4, and the 5, or 6 states. The Na atoms in NaTh_2F_9 are located in positions corresponding to holes in the U_2F_9 structure. The analogous U cpd., NaU_2F_9 , does not exist. The tetragonal Na_3UF_7 structure is closely related to that of CaF_2 . The unit cell corresponds to two CaF_2 cells placed on top of each other. There is segregation between Na and U atoms and furthermore one in every 8 F atoms is removed at random to balance the valences. As for the other cpds., only partial structure detns. are presented. Table 6 gives a list of the lattice dimensions for the various cpds. Most of these cpds. are phases observed in the systems KF-UF_4 , KF-ThF_4 , and NaF-UF_4 , which the writer has studied in detail. Because of the many phases which occur in these systems it was difficult to prep. single-phase samples, and the identification of the various phases accordingly could not be carried out by the orthodox methods of analytical chem. The chem. identity was therefore detd. in the following unusual way. First the dimensions of the unit cell were deduced. Next with the aid of the observed diffraction intensities the no. and positions of the U atoms in the unit cell were detd. Table 8 and 9 illustrate how this information, together with a knowledge of the space requirements of K and F atoms, permits the detn. of the chem. formula. The various unusual cpds. referred to in the tables were prepd. by different investigators as listed in Table 10.

- 3158 Zachariasen, W. H. Crystal Structure Studies of the Systems KF-UF_4 , KF-ThF_4 , and KF-LaF_3 . Feb. 9, 1946. Declassified Sept. 5, 1947. 23p. (MDDC-1283)

Detailed studies of the systems KF-UF_4 , KF-ThF_4 , and KF-LaF_3 show the existence of these phases: In the KF-UF_4 system: KU_6F_{25} , KU_3K_{13} , KU_2F_9 , KUF_5 , α - K_2UF_6 , β - K_2UF_6 , α - K_3UF_7 , β - K_3UF_7 . In the KF-ThF_4 system: $\text{KTh}_6\text{F}_{25}$, KTh_2F_9 , KThF_5 , α - K_2ThF_6 , β - K_2ThF_6 , K_5ThF_9 . In the KF-LaF_3 system: α - KLaF_4 , β - KLaF_4 . Lattice dimensions and further information about the crystal structure of the various phases are given. About 130 different chem. prepns. were made. The results given represent conclusions drawn from the interpretation of the x-ray-diffraction patterns of the numerous prepns. Thermal analysis data were taken. Most of the 200 x-ray-diffraction patterns which were taken as part of the present investigation were powder photographs.

- 3159 Zachariasen, W. H. Crystal Structure Studies of the Systems NaF-UF₄, NaF-ThF₄, and NaF-LaF₃. August 1946. Declassified July 18, 1947. 10p. (MDDC-1154)

In the NaF-UF₄ system the following intermediate phases have been found: NaUF₅, α -Na₂UF₆, β -Na₂UF₆, γ -Na₂UF₆, and Na₃UF₇. NaLaF₄ is the only intermediate phase observed in the system NaF-LaF₃. In the course of an incomplete study of the system NaF-ThF₄ the phases NaTh₂F₉, β -Na₂ThF₆, γ -Na₂ThF₆, and Na₄ThF₈ have been observed. Crystal structure data are given for all of the phases.

- 3160 Zachariasen, W. H. X-Ray Diffraction Studies of Miscellaneous Uranium Compounds. June 1946. Declassified July 18, 1947. 4p. (MDDC-1152)

Lattice dimensions are given for the following cpds.: K₃UO₂F₅, UCl₆, UO₃·H₂O, UO₄·2H₂O, K₂UO₄, BaUO₄, UF₄, ThF₄, CeF₄, and UF₄·2.5H₂O. The positions of the heavy-metal atoms have been found for most of the cpds. This paper gives a summary of results of incomplete crystal structure detns. for miscellaneous U cpds. as well.

- 3161 Zachariasen, W. H. Crystal Radii of the Heavy Elements. Nov. 17, 1947. Declassified Dec. 29, 1947. 4p. (MDDC-1572)

Crystal radii for the trivalent and tetravalent ions of the heavy elements from Ac to Am as deduced from crystal structure data are listed and briefly discussed. (This paper is also available in Phys. Rev. (2), 73, 1104-05(1948).)

- 3162 Zachariasen, W. H. The UCl₃-Type of Crystal Structure. Nov. 14, 1947. Declassified Dec. 30, 1947. 3p. (MDDC-1573)

The UCl₃ type of structure was observed in the course of war research within the Manhattan Project. The crystal structure of the prototypic cpd. UCl₃ was first described in reports issued within the Manhattan Project in January and March 1944. Since that time 17 additional cpds. have been found to crystallize with the UCl₃ type of structure. UCl₃ is hexagonal with two mols. per unit cell. The lattice periods are

$$a_1 = 7.428 \pm 0.003 \text{ \AA} \text{ and } a_3 = 4.312 \pm 0.003 \text{ \AA}$$

corresponding to a calcd. d. = 5.51. The d. = 5.44 is reported in the literature. The space group is C6₃/m(C_{6h}²) and the atomic positions are

$$2 \text{ U in } \pm(1/3 \ 2/3 \ 1/4), 6 \text{ Cl in } \pm(x \ y \ 1/4) (\bar{y}, x-y, 1/4) (y-x, \bar{x}, 1/4)$$

The parameter values are found to be $x = 0.375 \pm 0.014$, and $y = 0.292 \pm 0.014$. Each U atom is bonded to 9 Cl atoms, 3 at a distance of U-Cl = 2.95 Å and 6 at U-Cl = 2.96 Å. The closest distance of approach of 2 Cl atoms is Cl-Cl = 3.45 Å. Lattice dimensions are given for the following cpds. in addn. to UCl₃: AcCl₃, NpCl₃, PuCl₃, AmCl₃, LaCl₃, CeCl₃, PrCl₃, NdCl₃, AcBr₃, UBr₃, NpBr₃, LaBr₃, CeBr₃, PrBr₃, La(OH)₃, Pr(OH)₃, Nd(OH)₃. (This paper is also available in J. Chem. Phys. 16, 254(1948).)

PUBLICATIONS LOCATED IN 1948

- 3163 Agron, P., Grenall, A., Kunin, R., and Weller, S. The Intermediate Uranium Fluoride Compounds (α -UF₅, β -UF₅, U₃F₉, and U₄F₁₇). Declassified Jan. 16, 1948. 8p. (MDDC-1588)
The occurrence of two allotropic forms of UF₅ has been established by means of x-ray diffraction and chem. analysis. A brief survey of the conditions of prepn. of α -UF₅ and β -UF₅ is given. The black U fluoride originally designated as "black UF₄" has been identified as U₂F₉ by means of chem. analysis and x-ray measurements. A brief discussion of the prepn. and the properties of this cpd. is presented. According to the nomenclature of the International Union of Chemistry, this cpd. should be called di-uranium ennefluoride. A new U fluoride cpd., of compn. U₄F₁₇, has been established by means of chem. and x-ray analysis. A discussion of the prepn. is presented. The x-ray-diffraction pattern of U₄F₁₇ is compared with that of green monoclinic UF₄.
- 3164 Agron, P. A. The Thermodynamics of Intermediate Uranium Fluorides from Measurements of the Disproportionation Pressures. Declassified Jan. 16, 1948. 14p. (AECD-1878)
The equil. disproportionation pressures of UF₆ over the following U-F cpds. have been measured in the ranges indicated: α -UF₅(100 to 200°C); β -UF₅(100 to 152°C); and U₄F₁₇(270 to 350°C). In addn., the transition temp. and pressure of α - and β -UF₅ have been established at 125°C and 1.76 mm UF₆, resp. From these measurements and previous thermodynamic data of UF₄ and UF₆, the heats of formation, entropies, and free energies of these intermediate cpds. are calcd.
- 3165 Agron, P. A. and Taylor, A. H. The Thermal Conductivity of Uranium Hexafluoride. Jan. 30, 1948. Declassified Feb. 18, 1948. 42p. (MDDC-1747)
Measurements of the thermal cond. of UF₆ (gas) have been made by the hot-wire method and the value detd. as $K = 1.45 (1 + 0.0048 t^{\circ}\text{C}) \times 10^{-5}$ (cgs). This value is in good agreement with that calcd. by means of the Eucken equation, using the viscosity data and the heat capacity of the gas. Comparisons are also made with certain available exptl. values. The av. of all exptl. and calcd. values available is taken as the most probable value. Accordingly, the value of K, the thermal conductivity of UF₆ (g), becomes $K = 1.46 (1 + 0.0042 t^{\circ}\text{C}) \times 10^{-5}$ (cgs).
- 3166 Allen, R. P. and Neuman, W. F. The Treatment with 2,3-Dimercaptopropanol (BAL) of Acute Systemic Uranium Intoxication in Rats. May 26, 1947. Declassified Aug. 11, 1948. 18p. (AECD-2204)
Albino rats were systemically poisoned with 3.0 mg/kg of HgCl₂, and successfully treated with BAL as late as 30 min after the administration. BAL was assayed against the toxic effects of UO₂(NO₃)₂·6H₂O, UO₂F₂, and UCl₄ parenterally administered to albino rats with neg. results. The neg. results were taken as confirmatory evidence for the view that U exerts its toxic effects primarily by some other means than a combination with -SH groups. (Similar information is published in J. Pharmacol. Exptl. Therap. 96, 95-8(1949).)
- 3167 Amphlett, C. B. and Thomas, L. F. Determination of Vapor Pressure of UF₆ between 20 and 30°C. Aug. 26, 1941. Declassified May 1948. 2p. (BR-92)
A sensitive Bourdon gauge was used on purified UF₆ and values obtained over the range 21 to 30.4°C. The temp. rise was limited to 4°/hr. Pressure values (mm Hg) from 83 to 158 are reported.
- 3168 Amphlett, C. B. and Thomas, L. F. Determination of the Vapour Density of UF₆ at 30°C and at 50°C. Jan. 31, 1942. Declassified June 1948. 3p. (BR-171)
When methods similar to those outlined in BR-92 and BR-93(1948) were used, values for UF₆ of apparent mol. wt. (337) and vapor d. (167-2 to 167-3) and (337) and (167) were obtained for temps. of 29.43 and 49.2°, resp. The results are tabulated and graphed along with information on the vapor pressure of UF₆ at the same temps.

- 3169 Amphlett, C. B. and Thomas, L. F. Report on the Reconversion of Hexafluoride to Metal. Part I. Conversion of U Hexafluoride to U_3O_8 . Oct. 10, 1941. Declassified June 1948. 2p. (BR-110)

Purified UF_6 (HF removed with KF crystals) was distd. into capsules and this broken in NaOH to ppt. $Na_2U_2O_7 \cdot xH_2O$. This was dissolved in HNO_3 and then $(NH_4)_2U_2O_7$ was pptd., filtered, dried, weighed, and calcined to U_3O_8 at 600° . A 99% yield is reported.

- 3170 Andrieux, J. L. "Making Metallic Powders by Electrolysis of Fused Salts." Rev. met. 45, 49-59(1948).

General considerations of electrolysis of molten baths are reviewed. Specific examples are given of making powd. Be, Al, Ti, Zr, Th, Ta, Nb, Cr, Mo, W, U, Mn, Cu, Fe, Co, Ni, and Pt group metals. Borides are prepd. by electrolysis of corresponding borates with addn. of fluorides at about 1000° . CaB_6 is made by electrolyzing $2CaB_2O_4 + CaF_2$ in a small C crucible, 20 amp at 6 to 7 v being used; borides of other alk. earth metals are made in the same way. For making Ce borides it is more advantageous to use alk. earth borates with a small amt. of CeO_2 , one-tenth of the latter being sufficient. The method was successfully applied to making TiB_2 , LaB_6 , NdB_6 , GdB_6 , YB_6 , ErB_6 , ThB_5 , VB_2 , Cr_3B_2 , UB_4 , MnB , Zr_3B_4 , TaB_2 , NbB_2 , MoB , and WB .

- 3171 Andrieux, J. L. "Making Metallic Powders by Electrolysis of Fused Salts." J. four élec. 57, No. 3, 54(1948).

This paper is a condensation of that published in Rev. mét. 45, 49-59(1948).

- 3172 Anonsen, S. H. and French, C. L. The Use of Aluminium Chloride in the Determination of the Total Uranium Content of Uranium Tetrafluoride. July 1946. Declassified July 23, 1948. 3p. (AECD-2169)

It was desirable to find a method for dissolving UF_4 easily without the use of H_3BO_4 since many other samples are analyzed for trace amts. of B in the same lab. and therefore the possibility of contamination is always present. The following analytical procedure (condensed form) with $AlCl_3$ substituted for H_3BO_4 was studied and the validity tested satisfactorily; about 0.5 g UF_4 is dissolved in 1 g $AlCl_3 \cdot 6H_2O$ and 50 ml 4N HCl; 3 ml of 1:1 H_2SO_4 is added and the soln. evapd. to 10 ml and dild. to 75 ml with H_2O . The resulting soln. is drawn through a Jones reductor. 30 ml H_2SO_4 and 3 ml H_3PO_4 are added and the soln. titrated to a green end point with 0.08N $Ce(SO_4)_2$ in the presence of o-phenanthroline ferrous complex indicator.

- 3173 Ashenburg, N. J. Uranium Dioxide Studies. Jan. 30, 1948. Declassified May 17, 1948. 54p. (AECD-2008)

The chronic toxicity from exposure of animals to UO_2 has been detd. at 2 atmospheric concns., 1 and 10 mg U/m^3 . At the 1-mg level, 20 dogs and 174 rats were exposed; at the 10-mg level similar nos. of dogs and rats were exposed and in addn. 25 rabbits and 30 guinea pigs. Exposure occurred for 6 hr daily except on weekends for a total of approx. 1600 exposure hr during the year, following a 30-day animal-conditioning period for the collection of control data on the criteria under study. Examn. of the animals at the termination of the 1-yr exposure showed that the level of 1 mg/ m^3 of UO_2 dust did not effect changes in any of the criteria studied and was thus considered a "safe" level of exposure for animals. The 1-mg level produced extremely mild renal pathological changes in 40% of the dogs and 10% of the rabbits, the only 2 species showing these effects. Likewise, no biochem. changes were observed throughout exposure, but some increases in urinary protein of certain dogs and rabbits were seen. Thus, the purpose of these studies was fulfilled, namely, the detn. of "safe" and "borderline" levels of exposure for a period of 1 yr to U dust. As is to be expected from the insoly. of UO_2 , large amts. of U (av. 1000 γ/g) were retained in the lungs at the end of 1 yr at the 10-mg level, but little accumulation of U occurred in the bone and kidney. Accumulation of even greater amts. of U was detected in the pulmonary lymph nodes in dogs and rats. No hematological changes of importance were noted.

- 3174 Ashenburg, N. J. Uranium Tetrachloride. Two One-Year Inhalation Studies of Animals at 0.2 and 0.05 mg U/m³. Jan. 30, 1948. Declassified Mar. 8, 1948. 60p. (AECD-1780)

In conformity with other studies of chronic inhalation toxicity from U dust, animals were exposed daily for 1 yr to UCl₄ distributed in an atm. equiv. to concns. of 0.05 mg and 0.2 mg U/m³, for the purpose of detg. "borderline" or safe levels of exposure for the duration of 1 yr. At the 0.05-mg level, 21 dogs, and 150 rats were exposed; at the 0.2-mg level, the same no. of these 2 species were exposed, and in addn., 20 rabbits and 30 guinea pigs. The customary period of 1 mo. prior to exposure was employed for acclimatizing the animals to chamber conditions and for the collection of control toxicologic data. UCl₄ differed from certain other U dusts employed in this series in that exposure was complicated by the formation of hydrolytic products, UOCl₂, UO₂Cl₂, and HCl. At the end of 1 yr, some renal injury, attributable to U exposure, was seen in all species at both levels, but at the 0.05-mg level this was confined to 10% of the dogs and 6% of the rats and was from slight to moderate in degree. At the 0.2 mg level, 50% of all dogs and 9% of the rats showed mild renal injury; rabbits showed 20% (2 of 10) and guinea pigs 10% (1 of 10). Injury was, for the most part, chronic in nature as seen in repeated serial histologic examn. and as confirmed in a few instances by changes in certain biochem criteria. There was evidence from bromosulfonaphthalein dye retention studies of possible liver injury in dogs at the higher level, although no histologic evidence for this was seen. There were changes of possible significance in the hemoglobin and reticulocyte count of rats, but not in dogs. No appreciable accumulation of U occurred at either level in the tissues of any species.

- 3175 Bakken, R., Gleditsch, E., and Pappas, A. C. "The Uraninites." Bull soc. chim. France 515-17(1948).

This is a study of the U⁺⁴/U⁺⁶ ratio in uraninites. On the assumption that the U₃O₈ of the uraninites is composed of UO₂·2UO₃ this ratio would be 0.47. But in this investigation a ratio ranging from 0.3 to 4 was obtained. Expts. were carried out by using a cryst. uraninite, a cleveite from Norway. The crystal selected as the sample for the analysis was analyzed in strata, i.e., proceeding toward the material constituting the center of the crystal. Gangue and silica in the crystal itself were negligible. The Pb and Fe content diminished slightly, but constantly, from the center toward the exterior and increased in the products of alteration. Th, as ThO₂, did not vary much in the different layers, but increased in the outer layer. The quantity of U decreased slightly proceeding from the center. The ratio UO₂/UO₃ diminished proceeding from the center. It was concluded that RaG is not found as the dioxide in the ore. The amt. of gas liberated on heating the ore was detd. One series of analyses showed that the gas consisted of CO₂, N₂, O₂, Rn, and He. It was shown that UO₃ decomposes slightly, when the ore was heated, to give UO₂ and O₂.

- 3176 Ballenger, H. F. Polarographic Method for the Quantitative Determination of Uranium in Atmospheric Dust. Aug. 26, 1944. Declassified June 18, 1948. 11p. (AECD-2065)

The sample of dust is collected and deposited from a known vol. of air using a high-voltage electrostatic (Cottrell) precipitator in conjunction with an electric vacuum pump. The app. is set up in the locality to be sampled. Care must be taken that the equipment will not interfere with the normal work in the area. The depositing tube is removed and lined with Whatman No. 42 filter paper. At the end of the test, the filter paper is carefully transferred to an Erlenmeyer flask and taken to the laboratory for the chem. treatment and polarographic analysis. Detailed directions for chem. treatment and polarographic analysis are given. A modified Heyrovsky Polarograph Model XI is used.

- 3177 Barron, E. S. G. Chapter VII. On the Mechanism of Action of Uranium and the Transport of Uranium to the Tissues. November 1946. Declassified Apr. 9, 1948. 9p. (AECD-1993-G)

U combines reversibly with serum albumin and forms strongly associated complexes with bicarbonate and with a no. of org. acids. U is transported to the tissues mostly as albumin-U and uranyl bicarbonate. Excreted into the kidneys by glomerular ultrafiltration of uranyl bicarbonate it diffuses into the tissues through the capillary walls. U inhibits reversibly a no. of enzyme systems. Complete reactivation was achieved with citrate and α-hydroxyaspartate. These cpds. might be of use in the treatment of U poisoning. Some metabolic reactions in isolated cells were inhibited by amts. of U too small to pro-

duce enzyme inhibition; inhibition in these cells seems to be due to distribution of the metal on the surface of the cell. A no. of metabolic reactions were inhibited in the kidney and the liver of U-treated rats.

- 3178 Barron, E. S. G. and Gasvoda, B. The Mechanism of Uranyl Nitrate Inhibition of Cell Metabolism. Declassified May 12, 1948. 30p. (AECD-2009-H)

Cryst. plasma albumin combined with U at both sides of its isoelectric point. At the alk. side the combination was dissocd. on addn. of citrate but not of phosphate. At the acid side it combined more strongly and it was not dissocd. on addn. of phosphate or citrate. U inhibition of glucose metabolism by yeast was also dissocd. at pH = 7.3, while it was not at pH = 3.8. The inhibition produced by U was instantaneous and was roughly proportional to the ratio, total N/U. Glucose oxidation by bacteria was little affected or not at all. Lactate oxidation by gonococci, succinate oxidation by *E. coli*, and the respiration of sea urchin sperm were reversibly inhibited by $\text{UO}_2(\text{NO}_3)_2$. Inhibitions were released on addn. of phosphate and citrate. These expts. are presented as evidence that U inhibition of cellular metabolism is due to combination of the metal with the protein of the cell membrane, which renders the membrane impermeable to metabolites.

- 3179 Barron, E. S. G., Muntz, J. A., and Gasvoda, B. "Regulatory Mechanisms of Cellular Respiration. Part I. The Role of Cell Membranes. Uranium Inhibition of Cellular Respiration." J. Gen. Physiol. 32, 163-78(1948).

This paper is based on report AECD-2009H(1948).

- 3180 Benedict, M. and Williams, C. Volume 16. Introduction. Declassified Sept. 1, 1948. 4p. (AECD-2229)

This paper refers briefly to the subjects covered in the volume: special plant instruments, vacuum engineering, development of heat transfer equipment, and absorption of UF_6 , and fluorine. It appears as the introduction to Benedict and Williams, Engineering Developments in the Gaseous Diffusion Process. New York, McGraw-Hill Book Company, Inc., 1949.

- 3181 Berke, H. The Ratio of Urinary Amino Acid Nitrogen to Creatinine as a Sensitive Test for Uranium Poisoning in the Rabbit. Feb. 21, 1948. Declassified May 24, 1948. 142p. (AECD-2276)

It has been shown that the ratio of amino acid N to creatinine in spot samples of urine is a sensitive test for U poisoning in the rabbit. This ratio was far more const. in untreated animals than the amino acid N concn., because it eliminated fluctuations due to varying rates of urinary flow. It was even more const. than the rate of excretion of amino acids and required only a spot sample of urine, whereas, the detn. of the rate of excretion required a 24-hr sample. Because U poisoning results in a rise in amino acid excretion, but little change in that of creatinine, the ratio can be used as a measure of the effect of U on amino acid excretion. The min. dose of U which elicited a significant response in the ratio in a group of 8 rabbits was 0.02 mg U/kg. This dose was less than that needed for responses in urinary protein, blood nonprotein N, or renal function as measured by the phenolsulfonophthalein test. Plasma levels of amino acid N did not change after U poisoning, indicating the renal origin of the U-induced amino aciduria. The ratio was applied as a test to rabbits repeatedly injected with graded levels of U (0.04, 0.10, and 0.20 mg/kg). In general, the ratio rose to a max. a few days after each poisoning, then slowly declined. In all cases the ratio remained well above control values. Three distinct trends, however, in these max. were observed. In one, the highest value of the ratio for any injection period occurred after the first or second injection, and the max. progressively declined with each subsequent poisoning. In another, the max. in ratio reached about the same value after each poisoning. In the third, only observed at the highest dosage level, (0.20 mg U/kg.), the max. in ratio showed progressive increases in height after each U poisoning. The advantages inherent in using the ratio as a test of U poisoning are as follows: (1) it is analytically simple and fast, (2) it is very sensi-

tive, (3) it is applicable to spot samples of urine, (4) it differentiates variations in amino acid N caused by changes in the rate of urinary flow from increases due to the renal damage following U exposure, (5) it will detect the renal damage caused by repeated U injections at a level of 0.04 mg/kg, and higher, for at least a few months after exposure to U is terminated. The disadvantages of the test are concerned mainly with its lack of specificity. Nevertheless, the use of the ratio as a diagnostic test for U poisoning is valid when known interferences are absent and exposure to U has been experienced. (This paper is also in Science 108, 529-31(1948).)

3182 Berke, H. "The Ratio of Urinary Amino Acid Nitrogen to Creatinine as a Sensitive Test for Uranium Poisoning in the Rabbit." Science 108, 529-31(1948).

This paper is similar to report AECD-2276(1948).

3183 Berke, H. and Rothstein, A. The Ratio of Amino Acid Nitrogen to Creatinine in the Urine as a Sensitive Test for Uranium Poisoning. May 25, 1948. Declassified July 19, 1948. 44p. (AECD-2150)

Expts. were performed to det. whether amino aciduria could be used as a test of subtle U poisoning. The concn. of amino acid N in spot samples of urine of normal rabbits and humans varied considerably although the rate of excretion of amino acid N was relatively const. Most of the variation resulted from variations in the rate of flow of urine and this could be largely eliminated by using the ratio of amino acid N to creatinine. The ratio was as const. as the rate of excretion of amino acid N, but required only a spot sample of urine rather than a 24-hr sample. The ratio proved to be a very useful test for U poisoning in rabbits. The min. dose of U, given as uranyl nitrate, which would elicit a significant response, was 0.002 mg/kg body weight. A proteinuria did not appear until 0.04 to 0.1 mg U/kg were given. The data for creatinine and amino acid N concns. and the ratio of the two indicated that the most sensitive response of the kidney (at 0.01 mg U/kg) was a decrease in the rate of urine flow with consequent increases in the concn. of both and no change in the ratio. At higher levels of U dosage, this picture was followed by an increase in the concn. of amino acid N and the ratio with creatinine with no further change in the concn. of creatinine. With repeated intravenous injections of $\text{UO}_2(\text{NO}_3)_2$ in rabbits at 3- to 5-wk intervals, certain patterns of response of the amino acid N/creatinine ratio were observed. The first response was always a marked peak followed by a return to lower but still abnormal values. In general, the magnitude of the response was proportional to the dose of $\text{UO}_2(\text{NO}_3)_2$ given. After subsequent injections, the size of the peak usually diminished or even disappeared but the general level of the ratio remained abnormally high. With large doses of U, however, the ratio tended to become progressively higher with no disappearance of the peaks. The ratio did not return to normal for several months after the last injection even though the kidneys at this time showed no histopathology. The urinary protein tended to show a peak response after each injection followed by a return to normal. During exposure to inhalation of UO_2F_2 dust, the urinary amino acid N concn. became elevated after 3 to 5 days, and remained high throughout the rest of the 35-day exposure period. In contrast, the urinary protein, catalase, and blood-nonprotein-N responses were more transient with high levels following the initial insult to the kidney. A return to more normal values followed after about 5 wks, when regeneration of damaged tubules in the kidney were almost completed. The amino acid N response is independent of the protein and catalase response, and for this reason the 3 tests together are more sensitive than any one alone. Some additional evidence is presented bearing on the development of tolerance by the kidney.

3184 Bernstein, S., Talbott, F. L., Leslie, J. K., and Stanford, C. P. Yield of Photoneutrons from U^{235} Fission Products in Be. Feb. 20, 1948. Declassified Mar. 25, 1948. 15p. (AECD-1833)

A yield of photoneutrons from a sample of 25 fission products at the center of a 9-inch diameter Be sphere has been studied. Samples of U^{235} were exposed in the pile for periods of 30 sec, 14 min, 6 hr, and 74 hr. The photoneutrons were observed from 0.3 sec to about 4 wks after the end of the exposure. Curves showing the photoneutron yield relative to the delayed neutron yield as a function of time are

given for these exposure and observation times. A possible explanation of the relative yields of Be and D_2O with time in terms of the variations of the photodisintegration cross sections with energy and the av. variation of fission product γ -ray energy with time is proposed.

- 3185 Betts, R. H. "Studies on the Electro-Oxidation of Tetravalent Uranium." Can. J. Research B. 26, 441-55(1948).

The conversion of U^{+4} to $(UO_2)^{++}$ at a Pt anode has been studied over a wide range of c.d. and anode potentials. At high c.d., the rate of the oxidation is dependent on the U^{+4} concn. and is independent of the particular c.d. used. At low c.d., the rate of the process increases exponentially with increases in the anode potential and temp., but is independent of the U concn. It is concluded that at high c.d., the rate of oxidation is limited by the rate of diffusion of U^{+4} to the anode, while at low c.d., the rate of the reaction is limited by the slowness in electron transfer between the metallic ion and the anode. A formal correlation is made between the irreversible characteristics of this system and those displayed during the electrodeposition of H_2 and O_2 from aq. soln.

- 3186 Bigeleisen, J., Mayer, M. G., Stevenson, P. C., and Turkevich, J. "Vibrational Spectrum and Thermodynamic Properties of Uranium Hexafluoride Gas." J. Chem. Phys. 16, 442-5(1948).

This paper is similar to report MDDC-1181(1947).

- 3187 Bigeleisen, J. and Mayer, M. G. Fluorescence Spectra of Uranyl Compounds. January 1948. Declassified Feb. 12, 1948. 1p. (MDDC-1721)

This is an abstract and is reproduced below in its entirety.

The pioneer work of Nichols and Howe on the fluorescence of the uranyl salts has been extended by the spectroscopic group at the SAM Laboratories and Johns Hopkins University of the Manhattan Project. Measurements have been made with single crystals and powders between $20^\circ C$ and $300^\circ K$ with spectrographs of low and high resolution. The fluorescence of one salt differs from another. While the spectrum is due to an electronic transition in the uranyl ion, the vibrations of the uranyl ion and the lattice are excited. The anion in the lattice primarily determines the intricate structure of the fluorescence. An analysis of the strong lines in the fluorescence, based on the vibrations of uranyl ion are given. The analysis is supported by studies with enriched O^{18} and U^{235} .

(This paper was presented orally at the American Chemical Society Symposium held April 1948.)

- 3188 Bishop, C. and Roberts, E. Some Aspects of Carbohydrate Metabolism in Normal Animals and in Animals Poisoned with Uranyl Nitrate, Hydrogen Fluoride, and Alloxan. February 1948. Declassified Apr. 6, 1948. 59p. (AECD-1920)

Exposure to U cpds. produces alterations in carbohydrate metabolism of dogs and rats. A group of rats was exposed to an atm. contg. 19 mg of $UO_2(NO_3)_2/m^3$. In both nonfasted and fasted rats, normal glucose levels and normal liver and muscle glycogen % was found. Only when fasted rats were given a dose of glucose intraperitoneally, were the variations from the normal conditions discovered. Although normal liver glycogen formation occurred, muscle glycogen formation was considerably reduced, and in consequence the body glucose level was very high. In another series of rats with the same exposure, fasted animals were found to excrete more urinary glucose than did normal rats. Peculiarly enough, these rats, after an injection of glucose, excreted approx. the same amt. as they did without glucose injections; whereas, normal unexposed rats exhibited increased glycosuria following an injection of glucose. When dogs were exposed to an atm. contg. 1.2 mg of $UO_2(NO_3)_2/m^3$, the glucose tolerance curves obtained after exposure were not highly abnormal, but did show a slow return to normal fasting glucose levels. These dogs excreted glucose in urine and protein in the urine during the second week of exposure. When $NaHCO_3$ was administered in the recovery phase a more normal glucose tolerance curve was obtained. This may be ascribed either to a tolerance or to the effect of the bicarbonate. Dogs inhaling an atm. contg. 20 mg of $UO_2(NO_3)_2/m^3$ exhibited marked proteinuria, but only a slight and inconstant glycosuria. The blood nonprotein N and urea N were uniformly elevated; these values decreased to normal in surviving dogs. The blood CO_2 fell with min. in the 4th and 8th days, and

thereafter rose again so that death did not occur in the periods of most marked acidosis. As to the carbohydrate metabolism, the fasting blood glucose was normal; however, as with rats, the tolerance curves were high, but the administration of bicarbonate did not influence this excessive and prolonged rise. The blood lactate and pyruvate which rises in the normal dog to a max. 15 to 30 min after a dose of glucose showed no increase in U-poisoned dogs, or occasionally showed a small and late rise. In the recovery phase, the surviving dogs returned to a normal glucose tolerance curve, together with normal lactate and pyruvate curves. The effect of U poisoning on carbohydrate metabolism may be described as a decreased eff. of utilization apparently related to the glycolytic formation of triosis. Injected glucose yields higher than normal body glucose values, normal liver glycogen values, erratic muscle glycogen values, and lower than normal blood triose values.

- 3189 Boullé, A. and Dominé-Bergès, M. "A New Preparation of Uranium Oxide UO_3 and a Study of Its Decomposition." *Compt. rend.* 227, 1365-7(1948).

Very pure hydrated U oxide was obtained electrolytically from a 10% soln. of $\text{UO}_2(\text{NO}_3)_2$, by the method described by Jolibois (*Compt. rend.* 215, 319(1942)). It loses H_2O , in air, at 380 to 390°. At higher temps. UO_3 is transformed into U_3O_8 . This reaction was studied with the aid of a thermobalance which showed a 2-step loss of weight: 0.61% at 520° and 1.27% at 610°. The existence of an intermediary state, stable between these temps., was confirmed by a simultaneously carried out thermal analysis which showed changes in structure at the same temp. points; (UO_3 is amorph., the two other stages are cryst.). X-ray spectra, taken with $\text{CuK}\alpha$ radiation, furnished further confirmation. The intermediate stage is best interpreted as a solid soln. corresponding to an approx. compn. $\text{UO}_{2.90}$.

- 3190 Boutaric, A. Maraux, C. "Study of the Fluorescence of Uranium Solutions with Meunier's Electro-Fluorometer." *Bull. soc. chim. France* 952-6(1948).

A description of the app. is given. It is used for fluorescence measurement of U solns. If the fluorescence of a std. is F_0 and the fluorescence of the unknown substance is F , then the intensity of fluorescence is $\log_{10} F/F_0$. The fluorescence depends on the concn. At 0.30 g/l a max. is obtained. The influence of the pH is studied with 0.05% U solns. with buffers using the Sorenson, Clark, Lubs method. The fluorescence increases with the pH (starting with 5.28) until approx. pH = 8 and then decreases fairly rapidly. The influence of the addn. of KI (0.5 to 3%, novocaine, and several other org. and inorg. inhibitors to U solns. is investigated.

- 3191 Brady, E. L. and Rubinson, W. Absorption Study of the Radiation Characteristics of $6.8d \text{U}^{237}$. Declassified Jan. 19, 1948. 8p. (AECD-1775C)

An Al absorption curve of the radiations of U^{237} over the range 0.2 to 1700 mg Al/cm² has been resolved into four components: a γ (or x-ray) background and 3 β components of Feather ranges 660, 60, and 22 mg Al/cm², corresponding to energies of 1.5, 0.25, and 0.12 mev. The half-life of U^{237} has been found to be 6.8 ± 0.1 days. A Pb absorption curve has been resolved into 3 components of half-thicknesses 4.8, 0.78, and 0.26 g Pb/cm², corresponding to γ energies of 0.53, 0.23, and 0.14 mev. The significance of all the β and γ components has not been elucidated. A decay mechanism is not even tentatively proposed at this time.

- 3192 Brady, L. J., Susano, C. D., and Larson, C. E. Chemical and Physical Properties of Uranium Peroxide. May 21, 1948. Declassified Nov. 1, 1948. 12p. (AECD-2366)

This is the complete document of which report AECD-1741(1948) was an abstract. See that report for an abstract of this paper.

- 3193 Breslow, D. S. and Hamaker, J. W. Szilard-Chalmers Process for Uranium. Apr. 13, 1942. Declassified Dec. 8, 1948. 5p. (AECD-2409)

The development of a Szilard-Chalmers procedure for the concn. of U^{239} and U^{237} is reported. A procedure with org. U cpds. in which the activated U is expelled from an org. U cpd. during the interaction of the neutron with the U atom is described. The org. cpd. used is the salicylaldehyde-o-phenylenediamine uranyl complex. It is prepd. in two steps: salicylaldehyde is condensed with o-phenylenediamine

in hot EtOH and the resulting complex is then condensed with $\text{UO}_2(\text{OAc})_2$ in the same solvent. The resulting cpd. is then recrystd. from pyridine. Because of the inconvenience of using pyridine a modification in the method was made which would eliminate the use of this substance.

- 3194 Brewer, L. The Reaction of Uranium Oxides with Sulfur Monochlorides. July 31, 1948. Declassified Sept. 21, 1948. 6p. (AECD-2307)

Thermodynamic calcs. are made on the reaction of U oxide with S_2Cl_2 . This indicates that the reaction at 400 to 500°K will produce UOCl_2 if there is an excess of oxide and UCl_4 if there is an excess of S_2Cl_2 .

- 3195 Brewer, L. The Thermodynamics of the Actinides. December 1947. Declassified Feb. 16, 1948. 1p. (MDDC-1722)

This is an abstract and is reproduced below in its entirety.

The available thermodynamic data for the various oxidation states of thorium, uranium, neptunium, and plutonium have been recently compiled by Brewer, Lofgren, and Gilles in declassified Atomic Energy Commission Papers. The data have been converted to a form which allows direct comparison of the stabilities of the various oxidation states of the actinides. The heats of formation of the higher oxidation states from the trivalent state vary regularly through the actinide series. The heats of formation from the metal show alternations which indicate that the properties of the metals do not vary uniformly. The thermodynamic data are also used to predict which oxidation states of the various halides of Th, U, Np, and Pu should be stable and preparable. (See report AECD-1899(1948) for complete version of this paper.)

- 3196 Brewer, L. The Thermodynamics of the Actinides. Feb. 10, 1948. Declassified Apr. 15, 1948. 10p. (AECD-1899)

This is the complete document for which report AECD-1722(1948) is the abstract. See entry for that report for an abstract. (This paper was presented orally before the American Chemical Society in April 1948.)

- 3197 Brewer, L., Bromley, L. A., Gilles, P. W., and Lofgren, N. L. "The Thermodynamic Properties and Equilibria at High Temperatures of Uranium Halides, Oxides, Nitrides, and Carbides." Phys. Rev. (2), **74**, 650-5(1948).

This paper is a summary of data found in reports MDDC-1242(1947) and MDDC-1543(1947).

- 3198 Brewer, L., Bromley, L., Gilles, P., and Lofgren, N. The Preparation and Properties of Refractory Sulfides. Declassified Aug. 25, 1948. 47p. (AECD-2242)

The methods of prepn. of the sulfides of Ce, Th, U, and Ba are discussed. Where necessary, the app. is described. Procedures for the handling and grinding of the sulfides and hydrides which are used for their prepn. are given. A dry box which has been found convenient for these operations is described in detail. The phys., mech., chem., and thermodynamic properties are given for various sulfide refractories which have been developed at the Berkeley, California, chem. labs. The substances discussed are BaS, CeS, Ce_3S_4 , Ce_2S_3 , ThS, Th_2S_3 , Th_4S_7 , ThS_2US , U_2S_3 , US_2 , and solid solns. of the "two plus" sulfides. 33 references are included.

- 3199 Brewer, L., Bromley, L., Gilles, P., and Lofgren, N. The Preparation and Tests of Refractory Sulfide Crucibles. Declassified Sept. 7, 1948. 33p. (AECD-2253)

Crucibles have been prepd. from all of the sulfides of Ba, Ce, and Th, and also from some of the mixed sulfides of Ce with Th, and U with Th. The type of molds used as well as the methods of pressing of the sulfide powders are described in detail. Sintering procedures and techniques are listed for each of the various refractories. Over 800 refractory sulfide crucibles have been produced by the procedures described. These crucibles have ranged from extremely small containers with 0.0026 cc capacity to 50 cc crucibles. Tests of these crucibles indicate that they are satisfactory refractories for a large no. of metals and halides. Tests of the individual sulfide refractories as containers for various melts are summarized. The individual differences as well as similarities of the sulfide refractories are pointed out.

- 3200 Bricker, C. E. and Furman, N. H. A Modified Method for the Determination of Chromium in Uranium or Its Compounds. June 19, 1943. Declassified Jan. 9, 1948. 5p. (MDDC-1616)
Since a soln. of UO_2SO_4 has 100% transmission beyond 520 $\text{m}\mu$ and the min. of the diphenylcarbazide Cr complex is at 540 $\text{m}\mu$, it was possible to det. Cr by this method in the presence of the $(\text{UO}_2)^{++}$ without making any sepns. or extrs. The transmission curves of UO_2SO_4 , of diphenylcarbazide in 0.1% H_2SO_4 , and of the diphenylcarbazide-chromium complex in the same soln. are shown. Although the max. amt. of Cr that can be detd. in 25 ml was not detd. it appears that the calibration curve may be linear only to 40 γ Cr/25 ml. Thus, if a sample contains more than 50 ppm of Cr, only 5 ml aliquots should be taken for analysis. This method for Cr is fairly rapid and gives very reproducible results. The Cr diphenylcarbazide color in the presence of the metal, etc., is not too stable but is quite satisfactory for colorimetric measurement. There is no detectable amt. of fading in 15 min. It is best, however, to add the reagent and measure the transmittance as soon as possible. Although a thorough investigation of the rate of fading has not been made, it was found that after 3 or 4 hr, the soln. had about 20% more transmittance.
- 3201 Brickwedde, F. G., Hoge, H. J., and Scott, R. B. "The Low-Temperature Heat Capacities, Enthalpies and Entropies of UF_4 and UF_6 ." J. Chem. Phys. **16**, 429-36(1948).
This paper is similar to report MDDC-368(1946).
- 3202 Bridgman, P. W. "Compression of 39 Substances to 100,000 kg /sq. cm." Proc. Am. Acad. Arts Sci. **76**, 55-70(1948).
With one exception, the curves are all concave downward, and the vol. would thus vanish at infinite pressure. Readings are given at 25,000 kg/cm² (the fiducial vol.), 30,000; and up to 100,000 kg/cm². The vol. at 1 kg/cm² is given as 1.000. The fig. following the material is the value at the highest pressure. Li, 0.672; Na, 0.606; K, 0.500; Rb, 0.473; Cs, 0.368; Be, 0.945; C(graphite), 0.885; Mg, 0.847; Al, 0.915; Si, 0.940; P (black), 0.799; P (violet), 0.660; Ti, 0.937; Mn, 0.915; Ge, 0.917; As, 0.884; Zr, 0.910; La, 0.798; Ce, 0.708; Pr, 0.811; Nd, 0.822; Th, 0.886; U, 0.941; ZnS, 0.924; ZnSe, 0.887; ZnTe, 0.868; HgS, 0.879; HgSe, 0.7771; HgTe, 0.765; PbS, 0.876; PbSe, 0.841; PbTe, 0.820; quartz (crystal), 0.868; quartz (glass) 0.798; glass "A" (potash lead silicate of very high Pb content), 0.828; Pyrex glass, 0.809; "C" (soda Zn borosilicate), 0.834; borax glass, 0.753.
- 3203 Bridgman, P. W. "Rough Compressions of 177 Substances to 40,000 kg/sq. cm." Proc. Am. Acad. Arts Sci. **76**, 71-87(1948).
This is a continuation of the article in Proc. Am. Acad. Arts Sci. **76**, 55-70(1948). One of the materials investigated was U.
- 3204 Bunce, W. E., Furman, N. H., and Mundy, R. J. The Solubility of Sodium Uranyl Carbonate in Water and in Solutions of Various Salts. May 1947. Declassified Jan. 12, 1948. 13p. (MDDC-1617)
Na uranyl tricarbonate was prepd. by a slight modification of a process that was described in 1842 by Ebelman. It was found that the tricarbonate was less sol. in H_2O or in solns. of Na_2CO_3 or NaHCO_3 as the temp. was increased. The soly. of the tricarbonate at any temp. decreased with increasing concns. of Na_2CO_3 or NaHCO_3 . Na_2SO_4 or K_2SO_4 decreased the soly. of the tricarbonate in H_2O and in solns. of Na_2CO_3 or NaHCO_3 . $(\text{NH}_4)_2\text{SO}_4$ caused an increase in the soly. of the tricarbonate over that found in H_2O . Solys. were measured at 30, 60, and 90°C for the solns. that were stable at the three temps. Equil. was attained very slowly either from supersatd. or unsatd. soln., with an excess of solid present.
- 3205 Burkhart, L. E., Stukenbroeker, G., and Adams, S. Isotope Shifts in Uranium Spectra. Nov. 11, 1947. Declassified May 27, 1948. 10p. (AECD-2001)
A study is made of the isotopic shift caused by U^{238} and U^{235} in the emission spectrum of U. The shift is sufficient to allow quant. detn. of the concn. of the components of a mixt. of the U isotopes by routine spectrographic analysis. Data show comparative values obtained by mass spectrometer and spectrograph. (This paper is also available in Phys. Rev. (2), **75**, 83-5(1949).)

- 3206 Carmichael, H. and Tunnicliffe, P. R. "Measurement of α -Active Dust in the Atmosphere." J. Ind. Hyg. Toxicol. 30, 211-27(1948).

A filter and a precipitator are used for concg. radioactive dust from the atm. The calibration of the apps. and their advantages are described. The permissible concn. of Pu is 70 disintegrations/m³/min. Since Rn normally present in the atm. will give 100 to 5000 disintegrations/m³/min., it is necessary for at least 6 hrs to elapse after collecting the sample before U or Pu can be detd. It is necessary to use both types of app. so that the eff. of each can be detd. at frequent intervals.

- 3207 Chackett, K. F. Report on the Measurement of γ for Argon, Methyl Bromide, and UF₆. Jan. 31, 1942. Declassified June 1948. 2p. (BR-172)

A preliminary value of 1.1 for γ (i.e. C_p/C_v) is reported for UF₆. Values of 1.68 and 1.20 are reported for A and MeBr, resp.

- 3208 Chackett, K. F. Redetermination of the Velocity of Sound in UF₆ Vapour. Declassified June 1948. 2p. (BR-185)

The sample of UF₆ previously used was purified of SiF₄ by a careful fractional sepn. at -36°C leaving the condensed UF₆ in the tube and then detg. the velocity of sound at 49.20 and 420 mm Hg. Using a new figure for the velocity of sound, γ (or C_p/C_v) is found to be 1.063 with a probable error of $\pm 0.5\%$. The new value of u (velocity of sound) for UF₆ at these conditions is 8990 cm/sec.

- 3209 Chao, T.-P. and Chen, S.-C. "Rarer Elements in Qualitative Analysis. II: Uranium." J. Chem. Education 25, 686-7(1948).

In order to include U in the elementary course of qual. analysis, the authors have devised a method by which the regular system of analysis may be used for identification of the element. U falls in the Al division of group III and a procedure for sepn. and identification is given.

- 3210 Chargaff, E. and Green, C. "Inhibition of the Thromboplastic Effect." J. Biol. Chem. 173, 263-70(1948).

Expts. were carried out so as to distinguish between antithromboplastic and antithrombic effects. (a) Solns. of thromboplastic protein and inhibitor were mixed, kept 0.5 hr at room temp., then added to a soln. contg. prothrombin and Ca⁺⁺. After 20 min 0.2 ml of a 1.4% fibrinogen soln. was added to 0.03 ml of the mixt. and clotting time detd. (b) The first two solns. were mixed, kept 20 min at room temp., inhibitor soln. was added, then fibrinogen. Cpds. were tested for inhibitory action over the range 0.025 to 0.00005M. NaAsO₃, NaCN, NaF, NaN₃, NaIO₃, NaS₂O₈, and HONH₂ exhibited no antithromboplastic effect. Of the cations tested U⁺⁶ was one of many to exhibit the antithromboplastic effect.

- 3211 Ciusa, R. and Oreste, D. "Some Metallic Diazoates." Gazz. chim. ital. 78, 57-60(1948).

In the present work Na p- and o-nitrobenzeneisodiazoate were used to prep., by double decompn., some hitherto unknown salts of other metals. The salts are intensely colored and sol. in various org. solvents. They are sol. in aq. mineral acids, and the solns., added to alk. 2-naphthol, ppt. intensely colored cpds. Addn. of the calcd. wt. of an aq. soln. of each metal salt to aq. nitrobenzeneisodiazoate ppts. immediately the corresponding isodiazoate, with evolution of N₂. In this way the uranyl and other p-nitrobenzene-isodiazoates were prepd. Likewise o-nitrobenzeneisodiazoates were prepd. and this uranyl salt is brown-red. The salts do not fuse and when heated they deflagrate. They are very sol. in acetone and pyridine.

- 3212 Cohen, K. "Fundamentals of Isotope Separation." Nucleonics 2, No. 6, 2-9(1948).

This is a description of how a single theory of cascades provides abs. stds. for raising the separative eff. of all presently known methods for sepn. of U, C, or other isotopes. This paper was delivered before the American Chemical Society.

- 3213 Comparat, P., Ecochard, F., Lafoucrière, J., and Thibaud, J. Uranium 235 et Plutonium 239. Paris, Gauthier-Villars, 1948. 109p. (Publications de l'institute de physique atomique de l'université de Lyon)

This book contains a discussion of modern knowledge of the constitution of matter, the transformation of matter into energy, the methods followed by the United States in the production of the atomic bomb, and the methods by which useful power could be obtained from sources of atomic energy.

- 3214 Cook, O. The Electrodeposition of Plutonium. Declassified Jan. 14, 1948. 12p. (MDDC-1657) The optimum conditions for the deposition of U oxides (i.e., probably mixed UO_2 and U_3O_8) are temps. above 80°C and a pH between 6 and 7. As an empirical rule for the successful deposition in (OAc) soln., it is apparently necessary to avoid ratios of U to OAc salts greater than 0.05. The conditions for the electrodeposition of Np are probably very similar to those of U. Np can be quantitatively codeposited with U oxides. The conditions for the electrodeposition of Pu are too similar to those of U to effect a quant. sepn. An indication was found that lower temps. favor the deposition of Pu. Pu, like U, cannot be deposited in a Hg cathode.

- 3215 Courtois, J. and Anagnostopoulos, C. "Action of Some Mineral Acids Forming Complexes with Phosphates." Compt. rend. 226, 523-5(1948).

At pH = 8.4 the alk. phosphatases of the liver and kidney of dogs are inhibited less than 20% by molybdic, phosphomolybdic, tungstic, and phosphotungstic acids. Metavanadic acid and $\text{UO}_2(\text{OAc})_2$ exert a weaker inhibition. At pH = 5.2 acid phosphatases of type II undergo a more marked inhibition. With phosphotungstic and metavanadic acids and $\text{UO}_2(\text{OAc})_2$, the inhibition of acid phosphatase is 2 to 3 times as strong as for the alk. phosphatase.

- 3216 Crandall, H. W. The Formula and Structure of Uranyl Ion. Dissertation, Univ. of California, 1948.

- 3217 Cranshaw, T. E. and Harvey, J. A. "Measurement of the Energies of α -Particles." Can. J. Research A26, 243-54(1948).

The energies of the α particles from weak preps. of several new radioactive substances were measured in a grid ionization chamber filled with A. The accurately known energies of α particles from several well-known sources were used for calibration. The voltage pulses produced by electron collection from the tracks were amplified in a linear amplifier of high stability and converted into flat-topped pulses. An accurately known voltage was subtracted, and the small residual pulses were further amplified. The freq. distribution of pulse sizes was recorded on an electronic pulse analyzer. The final values of the energies are as follows: U^{233} , 4.823 ± 0.003 ; Ac^{225} , 5.801 ± 0.010 ; Pa^{221} , 6.298 ± 0.010 ; At^{217} , 7.023 ± 0.010 ; Po^{213} , 8.336 ± 0.005 ; and Pu^{239} , 5.159 ± 0.005 . The ionization-energy curve in A was found to be linear within exptl. error for α particles of energies 5 to 9 mev. Extrapolation of this line detcs. an intercept of 85 kev at zero ionization. 15 references are included.

- 3218 Crossland, R. S., Haven, F. L., and Edwards, V. M. Studies of the Unsaturation of Phospholipid Fatty Acids of the Liver, Kidney, and Blood of Uranium-Poisoned Rats. January 1946. Declassified Dec. 29, 1948. 24p. (AECD-2428)

The effect of U nitrate on the unsaturation of the phospholipid fatty acids of the liver, kidney, and blood of rats has been studied. It was found that with an acute dose (5 mg/kg injected intraperitoneally) the I no. of the liver was increased about 14%. The I no. of the kidney was decreased about 25%. A limited no. of detns. on the blood fatty acids showed an increase of 20%. When repeated small doses (0.33 mg/kg) or U nitrate were given followed by an acute dose, the I nos. of both the liver and kidney of these tolerant animals were normal. Apparently the repeated small doses prevent the changes in unsaturation which are caused by single acute doses. Two series of rats that had survived an acute dose of U nitrate showed normal av. and low av. I nos., resp., for liver. These values showed the greatest variation of

any series for liver, with a large % of the figures falling below normal. The I nos. for the kidney were, likewise, normal and low normal, resp., for the 2 series. When rats were given a subacute dose of U nitrate (2.5 mg/kg) the I no. of the liver was elevated about 11%. The value for kidney, however, was a low normal. If any injury to the kidney had occurred, as was indicated by the ratio of kidney to body weight, such injury had been repaired, whereas the corresponding injury to liver apparently persisted.

3219 Dale, P. P. Oral Conditions among Ten Enlisted Men Chronically Exposed to UF₆ for Six Months. Declassified Sept. 5, 1948. 9p. (AECD-2329)

Through phys., medical, and dental examns. of 10 volunteers chronically exposed to UF₆ for about 6 months disclosed normal findings. No untoward results were observed in 6 subjects requiring minor oral surgery. Fluorimetric analyses were obtained from 3 extd. vital teeth and a sample of alveolar bone from two of the men. The crowns, the gingival two-thirds of the roots, and the apical third (root tips) were analyzed. The data indicated substantial U storage in the dental root tips and alveolar bone which was deposited by the systemic or hematogenous route. The low values in the crown suggest little or no U retention by direct contact.

3220 D'Amato, F. and Gustafsson, A. "Experimental Control of the Mutation Process." Hereditas 34, 181-92(1948).

With the exception of KCN in high concn. and of colchicine in low concn., all chemicals used in the pre-treatment of barley seeds before exposure to x rays increased the mutation rate as compared with controls. KCN in high concn. decreased the mutation rate. Barley seeds of nearly uniform size (those remaining on the 2.8-mm sieve) were used since small seeds react differently from large ones. Seeds were irradiated with 7500 r. H₂O content before radiation was approx. 11%. Chemicals used for pre-treatment include colchicine solns. (0.1%, 0.05%, 0.01%, and 0.005%), KCN (0.01M, 0.001M, and 0.0001M), H₂O₂ (1% and 0.5%), butter-yellow (satd. soln.), Fe₂(SO₄)₃ (0.1M), H₂O₂ and buffer solns. of pH = 3 and pH = 10. The highest mutation rates were induced by the dil. solns. of KCN (0.001M and 0.0001M), the satd. soln. of butter-yellow and the concd. soln. of H₂O₂. UO₂(NO₃)₂ 0.001M produced only 6.0% of normally fertile plants and 0.0001M only 7.1% compared to 96.7% in the control.

3221 Davenport, W. H. Jr. and Thomason, P. F. Ammonium Thioglycolate as a Colorimetric Analytical Reagent for Uranium (VI) in the presence of Various Anions. Aug. 1, 1948. Declassified Dec. 1, 1948. 12p. (AECD-2398)

U⁺⁶ forms a yellow-orange sol. complex with ammonium thioglycolate in a basic soln. The color intensity remains const. over a wide pH range and is independent of the exact reagent concn. The complex is fairly stable and unaffected by many of the common anions. A no. of cations interfere either by reacting with the reagent or by pptg. in NH₃ solns. Some of these interferences may be eliminated by the use of excess reagent or complexing agents. The method is best suited to the detn. of U in the concn. range 0.100 to 1.600 mg in 25 ml. Solns. contg. U in this range obey Beer's Law. (This paper is also available in Anal. Chem. 21, 1093-5(1949).)

3222 de Hoffmann, F., Feld, B. T., Frisch, O. R., and Stein, P. R. Delayed Neutrons from U²³⁵ after Short Irradiation. Apr. 6, 1945. Declassified May 17, 1948. 29p. (AECD-1971)

The decay curve of the delayed neutrons from U²³⁵ after an approx. 10-millisecond irradiation is measured for times from 0.2 sec to 10 min. This curve is resolved into 5 periods and their relative intensities are detd. When the data are converted to the conventional case of infinite irradiation we may represent the decay curve on a relative basis by the following formula where it is in secs.

$$N(t) = 0.076e^{-t/0.52} + 0.279e^{-t/2.5} + 0.279e^{-t/7.9} + 0.294e^{-t/32.4} + 0.54e^{-t/79.9}$$

Indications of a 6-millisecond delayed-neutron period are found. These 6-millisecond neutrons seem to amt. to only 2% of the delayed neutrons when irradiated to saturation. (This paper is also in Phys. Rev. (2), 74, 1330-7(1948).)

- 3223 de Hoffmann, F., Feld, B. T., Frisch, O. R., and Stein, P. R. "Delayed Neutrons from U^{235} after Short Irradiation." *Phys. Rev.* (2), **74**, 1330-7(1948).

This paper is similar to report AECD-1971(1948).

- 3224 DiPace, J. A. and Furman, N. H. The Determination of Water in Uranyl Nitrate and in Ethereal Solutions of Uranyl Nitrate. Declassified Jan. 12, 1948. 9p. (MDDC-1618)

The primary purpose of this study was to find a method for the detn. of H_2O in the solvent layers that had been shaken to equil. with aq. solns. of $UO_2(NO_3)_2$ or other nitrates. The chief problem is the removal of the last mols. of H_2O that are mostly firmly bound in the mol. of hydrated uranyl nitrate. The Karl Fischer reagent for H_2O has been found useful for the detn. of the water of hydration of uranyl nitrate by dissolving the salt in dry MeOH, adding a measured amt. of the Fischer reagent, and back-titrating the excess of the Fischer reagent with a std. soln. of H_2O in MeOH. H_2O in Et_2O solns. of $UO_2(NO_3)_2$ is detd. with the Fischer reagent by the same type of procedure that is used above.

- 3225 Duval, C. "Gravimetric Analysis of Uranium. A Study of the Precipitate Using Chevenard's Thermobalance." *Compt. rend.* **227**, 679-81(1948).

The author undertook a critical study of all procedures for U analysis (valences 4-6) to see if the best conditions for calcination of the ppts. could be stated, and to see if certain methods would be suitable for automatic analysis. 16 reagents, the formulas of the corresponding ppts. and the allowable temps. for calcination or drying are listed. The methods using HF, cupferron, and $H_2C_2O_4$ can only be applied to U^{+4} and permit the estn. of U^{+6} . Precision is the same in all three methods, but the $H_2C_2O_4$ is the most practical one. Weighing of the oxalate is done in the 100 to 180° range. Of the three methods using oxime, β -isatoxime, quinaldinic acid, oxime is the most precise, practical, and economical. In this case, the ppt. loses one mol. of oxime from 157 to 252°, leaving the new $UO_2(C_9H_6ON)_2$, stable from 252 to 346°. Thus, it is possible to filter, dry, and weigh the ppt. in 1 hr, and to apply the method for the automatic detn. of U. By using NH_3 in the presence of NH_4NO_3 , U_3O_8 is obtained between 745 and 946° and dissocn. starts at 946°. Pptn. of pyrouranate (by employing ethylene diamine) does not offer any advantages over pyridine. There is an appreciable difference between tannin, hexamethylene tetramine, and ammonium benzoate. Mercury oxide is not suitable at all. Using a slow current of air, charged with NH_3 , following Trombe's method (*Compt. rend.* **215**, 539(1942)), gives satisfactory results, so far as the formation and immediate washing of the ppt. starting from pH = 3.8 is concerned. Weighing in the form of the peroxide is good, infrared absorption showing that $UO_4 \cdot 2H_2O$ should be written as $UO_3 \cdot H_2O \cdot H_2O$. Measuring in the form of sulfate, phosphate, and vanadate causes difficulties and is not so precise as other methods.

- 3226 Duval, T. and Duval, C. "Critical Study of the Reactions of Cations. Part IV. Uranium." *Anal. Chim. Acta* **2**, 313-15(1948).

The best drop method for U analysis during the period 1937-1947 was reported in the *Deuxième rapport* (Ed. by P. Wenger and R. Duckert), Bale, Wepf et Cie, 1945. (English edition, New York, Elsevier Publishing Co., 1948.) This was the micro. examn. of crystals formed by anthranilic acid in a satd. soln. The lower limit is 0.01 γ , and the analysis may be performed in the presence of Cu and Fe. For the Fourth Report, only the microchem. reaction given by an alk. thiocyanate and sparteine, even in the presence of large excess of Fe, will be retained. This method is described.

- 3227 Eastman, E. D., Fontana, B. J., and Webster, R. A. Observations on the Preparation of the Tribromide and Triiodide of Uranium. Declassified Feb. 18, 1948. 9p. (MDDC-1751)

UBr_3 has been prepd. both by the reduction of UBr_4 with H_2 at 600 to 700°C, and by direct union of U and Br_2 at about 570°C. An attempt to prep. the triiodide by the latter method was unsuccessful.

- 3228 Eastman, E. D. and Fontana, B. J. Electrolysis of Non-Aqueous Solutions of Uranium Bromides and Reaction of Alkali Metals with Uranium Bromides in Liquid Ammonia. June 1945. Declassified Jan. 6, 1948. 15p. (MDDC-1579)

Attempts to electrodeposit metallic U from solns. of UBr_4 in some org. solvents and in H_2O were unsuccessful. Only in formamide, acetamide, and EtOH soln. was any metallic U produced. A brief survey of the stability of U salts in formamide, acetamide, and EtOH is given. A study of the behavior of UBr_3 and UBr_4 solns. in liq. NH_3 and the action of reducing metals on these solns. is made.

- 3229 Eastman, E. D. and Thurmond, C. D. Rate of Reduction of Water by UBr_3 and UCl_3 . September 1945. Declassified Sept. 15, 1948. 7p. (AECD-2313)

The amt. of H_2 evolved in the reaction of UBr_3 and UCl_3 with H_2O corresponds closely to that required for the oxidation of the U to U^{+4} . The rate of reaction of the trihalides with H_2O varies with the method of their prepn. Reaction is less rapid at 0°C than at room temp. for both salts. At 0°C UCl_3 can be kept, even in satd. aq. soln. in contact with solid salt, with little oxidation, for considerable lengths of time. Added HCl increases the rate of oxidation of UCl_3 .

- 3230 Eichner, C., Ertaud, A., Ortel, Y., Stohr, J., and Vautre, L. Préparation de l'oxyde d'uranium UO_2 de densité élevée (8 à 9). Commissariat à l'Énergie Atomique. October 1948. (CEA-35)

UO_2 was prepd. from UO_4 by thermal reduction of H_2 (heated to 350° and the exothermic reaction raised the temp. to 900 or 1000°). High d. was obtained by hydraulic compression in a 3-piece tubular mold.

- 3231 Elliott, N. "The Magnetic Susceptibility of Uranium Tetrafluoride, UF_4 ." Phys. Rev. (2), **74**, 498-9(1948).

The magnetic susceptibility of UF_4 was measured, 74.5 to 294.5°K : χ^{-1} vs. temp. is linear. The magnetic moment of U^{+4} is 2.83 Bohr magnetons. The U^{+4} ion is in a $^3\text{F}_2$ state with two 6d electrons whose orbital contribution to the magnetic moment has been quenched by the cryst. yield. The magnetic behavior of the halides of U^{+4} is in contrast to that of the oxalate, sulfate, and acetylacetonate, whose magnetic moments agree with the existence of a $^3\text{H}_4$ state.

- 3232 Esch, U. and Schneider, A. "Concerning the Uranium Carbide, UC_2 ." Z. anorg. Chem. **257**, 254-66(1948).

This is a study of the U- UC_2 system by x-ray and d. measurements. U is found to carburize at 1800° to $\text{UC}_{1.56}$. X rays show UC_2 to have broad homogeneity range; the axis ratio c/a declines with declining C. U carbide forms subtractive solid solns. Analytical and production methods are included. Graphs, tables, and 30 references are presented.

- 3233 Faucherre, J. "On the Condensation of Basic Ions in the Hydrolysis of Aluminum and Uranyl Nitrates." Compt. rend. **227**, 1367-9(1948).

In a previous work (Geloso and Faucherre Compt. rend. **227**, 200(1948)) it was shown that, by diln. at const. ionic strength, the pH of hydrolysis of a pure salt varies according to the relation $d\text{pH}/d\log V = n/(q+1)$, where V is diln., q the no. of H^+ ions involved, and n the condensation degree of basic ions. When applied to the hydrolysis of $\text{UO}_2(\text{NO}_3)_2$ the above formula is replaced by $d\text{pH}/d\log(c - [\text{H}^+]) = -n/(q+1)$, where c is the original salt concn., and $[\text{H}^+]$ the ion activity of H^+ . This theory indicates a condensation in pairs of the basic ion ($2(\text{UO}_2)^{++} + 2\text{H}_2\text{O} \rightleftharpoons (\text{UO}_2^+\text{OH})_2 + 2\text{H}^+$) for c lying between $2 \cdot 10^{-1}$ and $1 \cdot 10^{-4}$. This result agrees with the exptl. data on neutralization of $\text{UO}_2(\text{NO}_3)_2$ (Faucherre and Schall Bull. soc. chim. France, 927(1947)).

- 3234 Foster, M. D., Stevens, R. E., Grimaldi, F. S., Schlecht, W. G., and Fleischer, M. Methods for the Complete Decomposition of Rock and Ore Samples to be Analyzed for Very Small Amounts of Uranium and Thorium. Declassified Mar. 8, 1948. 7p. (AECD-1782)

This paper presents the methods used in the Chemical Laboratory of the Geological Survey for the decompn. of samples to be analyzed for very small amts. of U and Th. It is desirable to have a general method applicable to most types of rocks and ores without modification, although it is evident that some samples will require special treatment. Complete decompn. of the sample is essential, as U and Th may be present in some of the most refractory minerals such as zircon, microlite, and monazite. The samples are decompd. by means of volatile acids whenever possible, HNO_3 and HF being used for the initial treatment. The HF is removed by repeated evapns. with HNO_3 , which is then removed by evapn. with HCl. HF can be removed more readily by fuming with H_2SO_4 or HClO_4 , but both reagents are undesirable. Many samples, such as phosphate rock and limestone, have high Ca contents and the greater part of the Ca ppts. out as sulfate. HClO_4 is avoided because the presence of perchlorates sometimes leads to the formation of rather stable emulsions during extrn. with org. solvents (such as EtOAc) in the analytical procedures. In the special procedure for refractory minerals, decompn. is effected by fusion with Na_2O_2 .

- 3235 Frederickson, A. F. "Some Mechanisms for the Fixation of Uranium in Certain Sediments." Science 108, 184-5(1948).

It is suggested that $(\text{UO}_2)^{++}$ ions are formed from U oxides and are then adsorbed by various minerals and thus concd. in various sedimentary rock strata.

- 3236 Freed, S. and Leitz, F. J. Jr. The Absorption Spectra of Transuranic Salts in Crystals. March 1948. Declassified Apr. 15, 1948. 6p. (AECD-1890)

Absorption spectra, mainly in the visible and near ultraviolet regions, were taken of these anhyd. salts at room temp. and at that of liq. N_2 : UCl_4 , NpCl_4 , PuCl_3 , AmCl_3 , and AmBr_3 . The spectra of these salts have the features characteristic of rare-earth spectra, sharp lines clustered in groups. It follows that the heavy elements have their least stable electrons within the inner 5f shell when their ions are inactivated, as well as in their basic electronic states. The spectra of the salts of Am are among the sharpest known for crystals, even at room temp. In this respect they are matched, so far as we know, only by the salts of Eu^{+3} . The spectra confirm the resemblance drawn between these ions on other grounds and make it very likely that Am^{+3} has 6 electrons in the 5f shell with $7F_0$ for its basic electronic state. (This paper is also in J. Chem. Phys. 17, 540-1(1949).)

- 3237 Frey, M. "The Observation and the Origin of a Separation of 30 cm^{-1} ." Compt. rend. 226, 332-4(1948).

The sepn. of several of the fluorescence and some of the absorption bands of uranyl salts by 30 cm^{-1} is explained as a characteristic freq. of the crystal lattice along with 930, 210, and 860 cm^{-1} .

- 3238 Freymann, M. "Classification of the Electronic Bands of Uranyl Salts on the Basis of Infrared and Raman Frequencies of the UO_2^{++} ." J. phys. radium (8), 9, 158-60(1948).

The fluorescence and absorption bands of $\text{UO}_2(\text{OAc})_2 \cdot 2\text{H}_2\text{O}$ in the visible region are diffuse at ordinary temps. but become very sharp at liq.-air temp. Of these, 47 fluorescence bands and 40 absorption bands were classified as harmonics and combinations of the 3 fundamental freqs. 210, 860, and 930 cm^{-1} observed in the infrared and Raman spectra.

- 3239 Freymann, M. and Chantrel, H. "On the Fluorescence Spectra of Certain Organic Uranyl Nitrate Compounds." Compt. rend. 227, 1029-31(1948).

Fluorescence spectra are given of uranyl nitrate and of its cpds. with acetone, Et_2O , and dioxane; the observations were made at the temp. of liq. air. The data confirm the classification of the fluorescence spectra of uranyl salts which has been previously suggested by the authors (Compt. rend. 223, 543, 573 (1946); 225, 529(1947); 226, 332(1948)).

- 3240 Freymann, M. and Freymann, R. "Fluorescence Spectra of Uranyl Salts at the Temperature of Liquid Hydrogen; Existence of a Difference of about 12 cm^{-1} ." Compt. rend. **227**, 1096-8 (1948).

Continuing their study of the fluorescence and absorption spectra of uranyl salts at low temps. (Compt. rend. **226**, 1029(1948)), the authors give the results of observations made at the temp. of liq. H_2 (-253°C). The cpds. studied were uranyl nitrate and uranyl acetate. A frequently occurring difference of about 12 cm^{-1} was added to those observed previously.

- 3241 Fried, S. and Davidson, N. R. The Ignition of U_3O_8 in Oxygen at High Pressures and the Crystallization of UO_3 . June 25, 1945. Declassified Jan. 29, 1948. 14p. (MDDC-1659)

When samples of U_3O_8 or amorph. UO_3 are heated in O_2 under a pressure of 30 to 150 atms. at temps. of 500 to 750°C , they are converted to cryst. UO_3 . Three cryst. varieties of UO_3 are formed. The least stable of these is hexagonal UO_3 , the crystal structure of which is very closely related to that of U_3O_8 . The most stable phase is isomorphous with the UO_3 prepd. by the Mallinckrodt Chemical Co. by calcining $\text{UO}_2(\text{NO}_3)_2$. The different varieties of UO_3 show markedly different stabilities with regard to decompn. into lower oxides in the presence of O_2 under 1 atm. pressure at 600 to 800°C . The most stable UO_3 phase remains unchanged at 700°C but decompn. to U_3O_8 at 800°C . The less stable, amorph. UO_3 decompn. at 620°C to $\text{UO}_{2.959}$ which is tan in color. At 625 to 630°C , the compn. is reduced to $\text{UO}_{2.82}$ and at 650°C , the decompn. to U_3O_8 is essentially complete. These observations appear to explain the vastly discrepant reports in the literature as to the temp. at which UO_3 decompn. to U_3O_8 . Samples of UO_3 prepd. elsewhere by the vapor phase oxidation of U_3O_8 with HNO_3 gave x-ray patterns different from those of any of the 3 phases prepd. by ignition of U_3O_8 in O_2 under high pressure. One of these samples when treated at 600°C with O_2 at atmospheric pressure "disproportionated" into a mixt. of U_3O_8 and "Mallinckrodt" UO_3 .

- 3242 Furman, N. H. "Analytical Work in the Manhattan District Project." Chem. Eng. News **26**, 2490-2(1948).

The chief concern of the work was the detection and detn. of U in the presence of other elements. Many new ideas were made practical. With the spectroscope, it was found that the addn. of 2% Ga_2O_3 causes other less volatile cpds. or elements to dist. in the arc and aids in the detn. of 33 elements by their spectral lines. Many new colorimetric tests for U were developed. In estg. the impurities present in purified U cpds. it was found advantageous to deposit small quantities of various metals by electrolysis in a cathode of Hg. After distg. off the Hg, the metals could be detd. with the polarograph. Many other new ideas were adopted in gravimetric, volumetric, and gasometric work.

- 3243 Furman, N. H. and Haight, G. P., Jr. The Volumetric Assay of Uranium Tetrafluoride. May 1947. Declassified July 21, 1948. 12p. (AECD-2155)

It is shown that UF_4 may be dissolved in a mixt. of $\text{H}_3\text{BO}_4 + \text{H}_2\text{SO}_4$ without attacking the residue that is ordinarily reported as oxalate insol. in nearly pure preps. of UF_4 . The sol. U^{+4} may be titrated with ceric sulfate after which an excess of that reagent is added and after warming to dissolve the UO_2 , etc., the excess of ceric sulfate is detd. The data are then used to calc. the % UF_4 , UO_2 , and UO_2F_2 (by difference).

- 3244 Furman, N. H. and Heberling, J. B. The Interference of Nickel in the Reduction of Uranium Solutions in the Jones Reductor. Rev. May 1947. Declassified Jan. 12, 1948. 9p. (MDDC-1622)

Ni interferes seriously with the reduction of $(\text{UO}_2)^{++}$ solns. in the Jones reductor. The Ni that is deposited causes vigorous H_2 evolution so that eventually the reductor will not reduce $(\text{UO}_2)^{++}$ quantitatively. Co, Mn, Zn, Ca, Mg, Al, and Na ions have no apparent action upon the reduction or the subsequent aeration to convert U^{+3} to U^{+4} . Ni ion, if added after reduction of a U soln. has no harmful effect upon the aeration and the titration with a std. ceric sulfate soln.

- 3245 Furman, N. H. and Norton, D. R. Uranyl Cupferrates. The Extraction of Traces of Uranium Cupferrate by Ether from Concentrated Uranyl Solutions. The Preparation of $\text{UO}_2(\text{O}(\text{NO})\text{NC}_6\text{H}_5)_2 \cdot \text{NH}_4\text{O}(\text{NO})\text{NC}_6\text{H}_5$. Rev. April 1947. Declassified Jan. 12, 1948. 11p. (MDDC-1623)

It is shown that minor amts. of U are extrd. by Et_2O and cupferron from concd. solns. of UO_2SO_4 , contg. free H_2SO_4 . The Et_2O upon evapn. yields the form of uranyl cupferrate that is obtained by pptn. CHCl_3 extrs. a negligible amt. of U under similar conditions. Uranyl cupferrate that is pptd. by a slight excess of cupferron from a neutral aq. soln. has a compn. that may be represented by the formula $\text{UO}_2(\text{O}(\text{NO})\text{NC}_6\text{H}_5)_2 \cdot \text{NH}_4\text{O}(\text{NO})\text{NC}_6\text{H}_5$. The ppt. is practically insol. in Et_2O , H_2O , or 10% H_2SO_4 . It dissolves slightly in MeOH, acetone, and EtOH as well as in neutral or acidic concd. solns. of UO_2SO_4 . The uranyl cupferrate is decompd. upon heating to approx. 200°C .

- 3246 Furman, N. H. and Mason, W. B. The Use of Cupferron in Inorganic Analysis with Special Reference to the Determination of Uranium. I. Introduction: The Properties of Various Cupferrates. Declassified Jan. 9, 1948. 17p. (MDDC-1619)

The work of numerous investigators who have studied the properties and the analytical applications of cupferron (ammonium phenyl nitrosohydroxylamine) following its introduction by Baudisch is summarized in this paper. The facts upon which the use of cupferron as an analytical reagent depends have been reviewed. The great usefulness of the reagent in the analytical sepn. of various other elements from U has been pointed out.

- 3247 Furman, N. H. and Mason, W. B. The Use of Cupferron in Inorganic Analysis with Special Reference to the Determination of Uranium. II. The Factors that Control the Extraction of Various Elements from Aqueous Solutions by Cupferron Plus an Organic Solvent. Rev. May 1947. Declassified Jan. 9, 1948. 10p. (MDDC-1620)

A theoretical formulation of the factors that enter into the extrn. of cupferrates of the metals to org. solvents is given. The conclusion is reached that under the conditions which prevail in many extrns. a large vol. of org. phase may not be advantageous since the distribution of hydrogen cupferrate is of the order of 200 between acidic aq. solns. and CHCl_3 . New exptl. data on the distribution of Cu, U^{+4} , and Mo are presented.

- 3248 Furman, N. H., Mason, W. B., and Pekola, J. S. The Use of Cupferron in Inorganic Analysis with Special Reference to the Determination of Uranium. III. The Isolation of Uranium as the Quadrivalent Cupferrate. Rev. May 1947. Declassified Jan. 9, 1948. 17p. (MDDC-1621)

The pptn. of U^{+4} cupferrate has been critically tested and found to be adequate, provided losses during washing are avoided by adding hydroxylamine hydrochloride and by using a higher concn. of cupferron in the wash soln. than has been the custom. A procedure for the semimicro isolation of U by extrns. with an Et_2O soln. of hydrogen cupferrate with repeated reduction by liq. Zn-Hg has been developed.

- 3249 Gapon, T. B. and Gapon, E. N. "Precipitation Chromatography." Doklady Akad. Nauk S.S.S.R. 60, 401-04(1948).

In contradistinction to adsorption chromatography, the method of pptn. chromatography uses columns made up of a carrier (Al_2O_3 , $\text{Al}(\text{OH})_3$, SiO_2 , gel, etc.) mixed with a pptg. reagent. The column can be used either dry or wet. The following are examples of sepns. effected by this method: (1) Dry column of SiO_2 gel with Na_2SiO_3 as precipitant, prepd. by mech. mixing ($\text{Na}_2\text{SiO}_3:\text{SiO}_2 = 1:9$). After a 12-hr filtration of mixed solns. of nitrates (mostly 0.5N), and washing (without pressure), 2 colored zones (upper/lower) were visible; | and ||, resp., mean sharp boundary and short colorless intermediate zone. Cu^{++} , Co^{++} , blue | pink; Cu^{++} + Ni^{++} , blue | green; Cu^{++} + Ag^+ , blue | gray; Fe^{+3} + Cu^{++} , brown | blue; $(\text{UO}_2)^{++}$ + Cu^{++} , yellow || blue; $(\text{UO}_2)^{++}$ + Ni^{++} , yellow || blue.

- 3250 Gemant, A. "Measurement of Diffusion Coefficients in Liquids by Radioactive Tracers." *Science* 107, 622(1948).

For the purpose of an investigation of hydrocarbon oils the writer has developed a method of measuring by means of radioactive tracers the diffusion coeff. in liqs. The activity is followed by a Geiger-Müller counter during the diffusion process. This is made possible by using a suitable thin, highly porous structure, contg. the solvent, into which the solute diffuses from the soln. which is located below the porous structure. The counter tube is placed on top of the latter. If the equations involved in the diffusion and radioactive absorption process and the effect on counts of the distance of a sample from the counter are known, the observed rate of increase of cpm can be evaluated in terms of the diffusion const. A diffusion test takes about 2 hr to complete. Results on aq. and org. solns. of $\text{UO}_2(\text{NO}_3)_2$ have been obtained to date. A paper on this subject is in the course of prepn.

- 3251 Grant, W. E., Darch, W. J., Bowden, S. T., and Jones, W. J. "The Surface Tension and Viscosity of Solutions of Uranyl Salts." *J. Phys. Colloid Chem.* 52, 1227-36(1948).

The surface tension and viscosity of solns. of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, $\text{UO}_2(\text{OAc})_2 \cdot 2\text{H}_2\text{O}$ and $\text{UO}_2(\text{OAc})_2$ in H_2O and MeOH have been measured at a series of temps. from 0°C to the neighborhood of the b.p. of the solvent. The surface tension of H_2O is raised by $\text{UO}_2(\text{NO}_3)_2$ but is lowered by $\text{UO}_2(\text{OAc})_2$. The surface tension of MeOH is raised by $\text{UO}_2(\text{OAc})_2 \cdot 2\text{H}_2\text{O}$, $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, and slightly by anhyd. $\text{UO}_2(\text{OAc})_2$. The Buglinginsky equation applies to aq. solns. of $\text{UO}_2(\text{NO}_3)_2$ and MeOH solns. of $\text{UO}_2(\text{OAc})_2 \cdot 2\text{H}_2\text{O}$, but the Freundlich relation is in better accord with the results for MeOH solns. of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$. The viscosity of H_2O is increased by $\text{UO}_2(\text{NO}_3)_2$, but is little influenced by $\text{UO}_2(\text{OAc})_2$. $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ and $\text{UO}_2(\text{OAc})_2 \cdot 2\text{H}_2\text{O}$ increase the viscosity of MeOH, but the anhyd. acetate has only a slight effect. Equations of the Jones-Talley type are found to be applicable over the range of concns. studied, but here the consts. are purely empirical. Calcns. by means of the Falkenhagen-Dole-Vernon expressions are not possible even for the aq. solns. owing to the complexity of the ionization and the incidence of hydrolytic reactions. 31 references are included.

- 3252 Gregory, N. W. Preparation and Properties of the Uranium Halides. Declassified Feb. 18, 1948. 76p. (MDDC-1755)

The most extensive studies of the U halides have been confined principally to UCl_4 and UF_6 . Considerable additional information has been obtained regarding the bromides, iodides, oxyhalides, and the mixed halides. This paper contains a summary of the information acquired regarding the methods of prepn. and the phys. and chem. properties of these cpds. Nearly all the mixed halides, which involve chlorine, bromine, and iodine, in the trivalent and tetravalent states of U, have been prepd. Many had not been prepd. prior to the work discussed herein and the nomenclature applied to these cpds. is based on that commonly accepted for similar cpds. of other elements. Information given in this work pertains only to exptl. results from the Radiation Lab., Univ. of California, although reference is made to results reported by other investigators. Work which has been concerned with the U chlorides, with the exception of UCl_3 , is discussed in another paper. Very little has been done here with regard to the U fluorides.

- 3253 Grimaldi, F. S. Elimination of Interference by Nickel in the Determination of Uranium by Means of Zinc Amalgam Reductors. Declassified Mar. 9, 1948. 7p. (AECD-1815)

The observation that Zn-Hg reductors are poisoned by solns. contg. Ni is confirmed; expts. are described showing the effect in HCl soln. The effect is caused by deposition of metallic Ni on the amalgam surface, promoting vigorous evolution of H_2 . This interference is easily overcome by using a solid amalgam richer in Hg (10% by wt), thus lowering the activity of the Zn enough to prevent deposition of metallic Ni. Either HCl or H_2SO_4 solns. may be used. The valence changes during reduction of the elements commonly detd. by means of the Jones reductor are the same for the "10%" reductor and the std. reductor.

- 3254 Grønvald, F. "Crystal Structure of Uranium Oxide (U_3O_8).'' *Nature* 162, 70(1948).
Single U_3O_8 crystals could not be prepd.; however, one prepn. gave X-ray photographs in which reflections with indices (001) only were sharp and well defined. From this a hypothetical crystal structure was formulated. The cell is orthorhombic with dimensions $a = 6.703 \text{ kX}$; $b = 3.969 \text{ kX}$; $c = 4.136 \text{ kX}$. The d. of U_3O_8 is 8.34 g/cc . The elementary cell contains 2 U atoms. The U_3O_8 structure is probably related to the ReO_3 structure, but with deformed $(\text{UO}_6)^{-4}$ octahedrons with anion vacancies.
- 3255 Grønvald, F. and Haraldsen, H. "Oxidation of Uranium Dioxide (UO_2).'' *Nature* 162, 69-70 (1948).
 UO_2 was heated in O_2 from 100 to 265° , and the products were examined by the X-ray powder method. At 150° UO_2 takes up O_2 to $\text{UO}_{2.34}$. Change to lower symmetry is indicated ($a = 5.40 \text{ kX}$). Change from UO_2 to $\text{UO}_{2.34}$ is accompanied by an increase in d. from 10.80 g/cc . In the range 200 to 250° , O_2 exceeds $\text{UO}_{2.34}$ and a new phase, δ , is formed. The phase is tetragonal with consts. $a = 5.37 \text{ kX}$, $c = 5.54 \text{ kX}$, and $c/a = 1.03$. Calcd. ds. given are $\text{UO}_{2.34}$, 11.46 ; $\text{U}_{0.88}\text{O}_{2.12}$, 10.04 ; $\text{U}_{0.82}\text{O}_2$, 9.44 . U atoms form a face-centered lattice $(0,0,0; 0; 1/2, 1/2, 0, 1/2; 1/2, 0, 1/2, 1/2)$. Observed and calcd. intensities are in good accord. A phase near the compn. U_2O_5 was found, stable below 260 to 270° , as a tetragonal deformed UO_2 with compn. not to exceed $\text{U}_{0.88}\text{O}_{2.12}$. U_3O_8 has homogeneity between $\text{UO}_{2.67}$ and $\text{UO}_{2.56}$.
- 3256 Grosse, A. V. Exchange of Uranium between UF_4 and UF_6 . Declassified Jan. 14, 1948. 7p. (MDDC-1644)
Exchange of U in UF_4 and UF_6 takes place with measurable velocity at 100°C . The rate of exchange can be increased by a factor of 10 by using HgCl_2 as a catalyst. The UF_6 combined with UF_4 , to form UF_5 or $(\text{UF}_4 \cdot \text{UF}_6)$, exchanges much faster than free UF_6 . A process for enriching UF_6 with U^{235} , after it has been depleted in this isotope, by means of an exchange with UF_4 -contg. U^{235} in natural concn., is discussed. Data are given on the rate of exchange of $\text{U}(\text{SO}_4)_2$ and UO_2SO_4 and between solid UF_4 and UO_2SO_4 in aq. solns.
- 3257 Grummitt, W. E. and Wilkinson, G. "Fission Products of U^{233} ." *Nature* 161, 520(1948).
A table is given of the yields and identification of 31 active isotopes resulting from U^{233} and U^{235} fission (mass numbers 89 to 147). The yield of Ba^{140} from U^{235} fission in natural U was taken as a reference. The yield curve shows a double hump as with U^{235} , but the groups are one unit lower on the mass scale. The max. are approx. the same in all cases, $\sim 6 \times 10^{-2}$.
- 3258 Gruschow, J. and Mann, W. Uranium Tolerance and Citrate Excretion. Apr. 15, 1948. Declassified Aug. 10, 1948. 18p. (AECD-2212)
Previously, an acquired tolerance to the toxic action of U cpds. was developed in two mammalian species, rats and rabbits. In rats made tolerant by repeated injections of U, an increased excretion of urinary citrate was demonstrated. In these expts. a tolerance to U has been produced in dogs. Further, these tolerant dogs evidenced an increased excretion of urinary citrate. The significance of these results is discussed.
- 3259 Haenny, C. and Rochet, O. "Measurement of Uranium Concentration with Impregnated Ilford D₁ Plates and the Fission Cross Section." *Helv. Phys. Acta* 21, 186-8(1948).
Plates were impregnated with a soln. contg. $\text{UO}_2(\text{NO}_3)_2$ (0.1 to 0.0001 g U/ml) in HOAc , 5% by vol. Another plate (emission C2), sensitive to α particles, was placed on the impregnated plate, developed after 24 hrs, and the tracks on the latter counted to det. the U concn. The results are given by $T = A c^f$, where $A = 26.0 \pm 0.7$, $f = 0.81 \pm 0.01$, T is the observed no. of tracks, and c is the molar concn. of U. Similar results were obtained for Th with $f = 0.77$. An equation is given to use for detn. of the abs. concn. of U in g/cc of emulsion, corrections being made for the min. observed track length and the emulsion contraction during fixing. The impregnated plates are not very sensitive to α particles but show fission tracks clearly. When soaked in solns. contg. 0.01 to 0.2 g U/ml and exposed to slow neutrons from a 500-mc Ra-Be source, the no. of fission tracks is proportional to the amt. of U present.

The concn. optimum is 0.3 g U/cc emulsion corresponding to a soln. concn. of 0.142 g U/ml. The fission cross section is 4.9 barns, with an uncertainty of 30%. Neutron fluxes were measured with B-impregnated plates.

- 3260 Hagemann, F., Katzin, L. I., Studier, M. H., Seaborg, G. T., and Ghiorso, A. The 4N + 1 Radioactive Series: the Decay Products of U²³³. Oct. 28, 1946. Declassified Sept. 22, 1948. 39p. (AECD-2300)

The path of the decay chain between the isotopes U²³³ and Bi²⁰⁹ is traced and the properties found for the isotopes which are members of the chain are given. The findings may be summarized as follows:

(This information is also available in Phys. Rev. (2), 79, 435-43(1950).)

- 3261 Haissinsky, M. and Cottin, M. "A Szilard-Chalmers Effect in Natural α -Disintegrations." J. chim. phys. 45, 270-2(1948).

The Szilard-Chalmers effect resulting from the reaction $\text{U}^{238} \rightarrow \text{Th}^{234}$ was investigated. The authors developed a chem. method adapted from a technique of Starke (Naturwissenschaften 30, 577(1942)) to sep. Th^{234} which was formed by α emission. The exptl. accuracy is insufficient to indicate the influence of the degree of diln. of the chem. solns. used on the eff. of sepn., but it is shown that there is a marked decrease in eff. when solid cpds. are used, which is consistent with a hypothesis of Franck and Rabinowitsch (Trans. Faraday Soc. 30, 120(1934)).

- 3262 Haldar, B. C. and Choudhury, G. B. "Basic Nitrates of Uranium." Science Culture 13, 427-8 (1948).

The system $\text{UO}_2(\text{NO}_3)_2\text{-NaOH}$ was studied by a thermometric method. Thermometric titration of the solns. of the 2 cpds. at room temp. indicated the existence of the basic nitrate $4\text{UO}_2(\text{NO}_3)_2\cdot\text{UO}_2(\text{OH})_2$ in the concn. range of 0.02912 to 1.1648M $\text{UO}_2(\text{NO}_3)_2$. The temp.-concn. curves also indicate the presence of the uranates $\text{Na}_4\text{U}_7\text{O}_{23}$ and Na_2UO_4 . A break corresponding to the formation of $\text{UO}_2(\text{OH})_2$ and Na_2UO_4 appears at the point 1: 2 of $\text{UO}_2(\text{NO}_3)_2\text{:NaOH}$.

- 3263 Hamilton, J. G. The Metabolic Properties of the Fission Products and Actinide Elements. March 1948. Declassified May 28, 1948. 49p. (AECD-2012)

These radioactive materials were administered by mouth and by injection. The fission products studied included the carrier-free radioactive isotopes of Sr, Y, Zr, Ru, Nb, Te, I, Xe, Ba, La, Ce, Pr, Cs, and Pm. In addn., the 8 members of the actinide series, Ac, Th, Pa, U, Np, Pu, Am, and Cm were subjected to metabolic expts. The results of these studies indicated that most of the fission products and all of the heaviest elements are absorbed to a very small degree by way of the digestive tract, deposited primarily in the skeleton following parenteral administration, and eliminated very slowly from that organ. The uptake by the skeleton of the actinide group is very similar to that observed with the members of the fission-product series studied which are deposited in this structure. With the exception of U, elimination from bone occurred very slowly. In the case of the actinide elements, an accumulation in the region of the nonmineralized portion of the bone has been observed with Ac, Th, Pu, Am, and Cm. The curious property of the fission products and the majority of the actinide elements to be laid down in this portion of the skeleton and to be retained there for prolonged intervals, renders them of considerable concern from the point of view of the possible medical hazards to be encountered should these materials be accidentally introduced into the body.

- 3264 Hamilton, J. G. "The Metabolic Properties of the Fission Products of the Actinide Elements." *Revs. Modern Phys.* 20, 718-28(1948).

This article is similar to report AECD-2012(1948).

- 3265 Harris, W. W. and Wolters, R. A. Optical Properties of UF₄. Nov. 5, 1947. Declassified Jan. 19, 1948. 8p. (MDDC-1662)

The principal indexes of refraction, crystal system, and habit of UF₄ crystals as obtained by optical methods are reported. Samples of UF₄ from different sources were examined. UF₄ is monoclinic, occurring as flat 6-sided tablets, as triangular needles twinned parallel to the long direction of the crystal, and as dendrites. Refractive indexes are; $\alpha = 1.552$, $\beta = 1.584$, and $\gamma = 1.598$. The optic angle is 67° and the sign is neg.

- 3266 Harrison, G. R. and Kent, R. III. Spectrographic Determination of Trace Materials in Uranium Salts and in Magnesium, Dolomite, and Lime. Declassified Jan. 12, 1948. 32p. (MDDC-1581)

The main purpose of the study summarized in this report was to make quant. analyses in many thousands of samples of U metal, U oxides of various types, Mg, lime, and dolomite, for any or all of 40 metallic constituents, including the rare earths. Special-diffraction-grating spectrographs of high dispersion were adapted to analytical use, and when used in conjunction with an improved carrier distn. method involving addn. of AgCl or GaO to the sample being analyzed, these made possible precise detns. of amts. which with some elements could be as low as 5 parts in 10⁸. Most of the developmental work involved prepn. of std. samples of suitable form, and the methods of making these, and of burning samples so that the stds. would be comparable with them, are detailed in the report. Tables are given of the wavelengths of the spectrum lines used, and of the sensitivities attained with each element in the various types of samples in which it was detd.

- 3267 Haven, F. L. and Randall, C. "The Urinary Excretion of Citrate in Uranium Poisoned Rats." *J. Biol. Chem.* 175, 737-44(1948).

Following the administration to rats of single intraperitoneal doses of 2.5 mg of U nitrate/kg, the urinary excretion of citrate rose in 3 days to 3 to 4 times the normal level; a return to normal was followed by a secondary rise of equal magnitude. When a rat received increased doses of U nitrate at 12-day intervals, the urinary excretion of citrate was high each time a larger dose was given. At the time of administration of 5 mg of U nitrate to a rat that had previously received 11 injections of 0.33 mg/kg, (a dose which causes tolerance) the excretion of citrate was twice the normal; when the repeated dose consisted of 0.11 mg/kg (a dose too small to cause tolerance), the urinary excretion of citrate was normal at the time the dose of 5 mg/kg was given. High concns. of citrate within the kidney tubule appear to result in formation of a sol. complex with U and thus protect against the toxic action. 23 references are included.

- 3268 Haworth, W. N. Determination of the Vapour Density of U Hexafluoride at 30°C. Sept. 5, 1941. Declassified May 1948. 2p. (BR-93)

This is a redetn. of the vapor pressure (expressed in terms of d.) as reported in Br-92(1947). At temps. varying between 29.2 and 29.9°, values of 173.9 to 166 were obtained for the vapor d. The difference in av. apparent mol. wt. and the theoretical value is discussed and assigned to possible impurities such as SiF₄. A method for obtaining more accurate results is discussed.

- 3269 Hellestam, S. "Polarographic Determination of Uranium." *Svensk Kem. Tid.* 60, 253-67(1948). Strubl [Collection Czech. Chem. Commun. 10, 466(1938)] has given a method for a polarographic detn. of U in the presence of Fe. The author shows that this method cannot be extended to cases when, besides Fe, other metals are present (Al, Mg, Ti, V, W, Mo). Instead, another method is suggested for the elimination of these elements through electrolysis with a Hg cathode, after a partial sepn. by means of a soln. of cupferron in CHCl₃; this method is rapid, and it has the advantage of permitting the use of H₂SO₄ solns. In another procedure U is isolated as a perchlorate; the detn. is then made by the polaro-

graphic or some other phys. method. From the measurements made, the following values of diffusion coeffs. of uranyl ion were calcd: in 2M hydroxylamine-hydrochloride, $0.45 \times 10^{-5} \text{cm}^2/\text{sec}$; in satd. K_2SO_4 soln., $0.78 \times 10^{-5} \text{cm}^2/\text{sec}$; in 0.04 to 0.14M perchlorate soln., $0.73 \times 10^{-5} \text{cm}^2/\text{sec}$.

3270 Herbain, M. "Photometric Determination of Sodium by Differential Determination of Uranium Precipitated as Streng's Triple Salt." Bull. soc. chim. biol. **30**, 231-4(1948).

In one flask place 2 cc distd. water and in another 2 cc of the unknown soln., contg. not over 3 mg of Na. Add 8 cc of Kahane's U reagent to each, stopper, let stand overnight for the ppt. to settle, then det. U in an aliquot of each filtrate by the method of Tissier and Benard, and calc. the Na from the difference.

3271 Hirt, R. C. and Nachtrieb, N. H. "Spectrographic Determination of Rare Earth Elements in Uranium Compounds." Anal. Chem. **20**, 1077-8(1948).

This paper is similar to report MDDC-903(1947).

3272 Hodge, W., Eastwood, L. W., Lorig, C. H., and Cross, H. C. Development of Cast Aluminum Alloys for Elevated Temperature Service. Battelle Memorial Institute. 1948. 32p. (NACA-TN-1444)

The exptl. work was divided into 3 parts to det. (1) the effects of heat treatment and exposure to elevated temps. on the tensile properties of the various alloys subsequently cooled to room temp.; (2) the effect of various alloy addns. on the room-temp. and elevated-temp. properties of Al-6% Mg alloys; and (3) the improvement in high-temp. creep properties of some of the optimum compns. An alloy prepd. from Al 99.5% and contg. Mg 6, Mn 1, Cu 1.5, V 0.1, Zr 0.25, Ti 0.08, and Be 0.005% was a superior compn. for sand-casting and elevated-temp. service. Extensive tables were presented showing the effect of addns. to Al-6% Mg alloys of Sb, Be, B, Cd, Ca, Ce, Cr, Co, Cu, Fe, Li, Mg, Mn, Mo, Ni, Si, Ag, Ti, W, U, V, Zn, and Zr on the room-temp. tensile properties, the tensile properties at 600°F, and the creep properties at 600°F.

3273 Hoekstra, H. R. and Katz, J. J. Heavy Metal Borohydrides. March 1948. Declassified Apr. 15, 1948. 8p. (AECD-1894)

The prepn. of U borohydride and observation of its properties aroused considerable interest in other heavy metal borohydrides. Using essentially the same methods employed in the prepn. of U borohydride, the borohydrides of Th, Np, and Pt have been prepd. Since Al borohydride was used as one of the reactants in each instance, the reactions were of necessity carried out in vacuum, using approx. the std. vacuum line setup developed by Stock and his coworkers in Germany and by Schlesinger in Chicago. Th borohydride, a cryst. white solid with m.p. 204°C, was prepd. by treating anhyd. Th fluoride with Al borohydride. It is less volatile than the U borohydride, but it is the most volatile Th cpd. known. The structure of $\text{Th}(\text{BH}_4)_4$ is very similar to that of the U cpd. Both are orthorhombic. Th borohydride can be exposed to air, and in small amts., even be dropped into H_2O without exploding. Np borohydride was prepd. from NpF_4 , and the formula of the substance obtained was calcd. to be $\text{Np}(\text{BH}_4)_4$. X-ray analysis of the product obtained in the prepn. of the Pu borohydride from PuF_4 failed to reveal whether the cpd. was a Pu^{+3} or Pu^{+4} borohydride. The Hf cpd. was prepd. from the fluoride, while the Zr and Ti cpds. were prepd. from the respective chlorides. Hf and Zr borohydride are low melting (28 to 30°C) cryst. solids having vapor pressures of about 15 mm at room temp. (The paper was presented orally at the April 1948 symposium of the American Chemical Society, and is also available in J. Am. Chem. Soc. **71**, 2488-92(1949).)

3274 Hoffman, J. I. "Purification of Uranium Oxide." J. Wash. Acad. Sci. **38**, 233-6(1948).

U_3O_8 is obtained by heating purified uranyl nitrate at 1000°. Uranyl nitrate is obtained by evapg. a HNO_3 soln. of about 50 g of impure oxide to dryness on a steam bath, extrg. the residue with 100 ml of Et_2O contg. 5 ml H_2O , and removing the uranyl nitrate from the Et_2O phase by successive treatments with 20-ml portions of H_2O . The method is applied to mixts. contg. U_3O_8 and cpds. of other elements especially those of the rare-earth group (cf. Wells), to pitchblende, and to carnotite. Spectrochem. tests of purified U_3O_8 for 64 elements showed only traces of Ag, Al, Ca, Cu, Fe, Mg, Mo, Na, and Si.

- 3275 Hoge, H. J. and Wechsler, M. T. Determination of the Density of UF_6 from the Sinking Temperatures of Glass Floats. Declassified Sept. 21, 1948. 11p. (AECD-2301)

By observing the temp. at which glass bodies were just equal in d. to the liq., the d. of UF_6 was measured from the triple point ($64.052^\circ C$) to $162.59^\circ C$. The d. of the liq. at the triple point was found to be 3.630 g/cm^{-3} . Results of an earlier investigation are also reported. They confirm the later data, and lead to a value of 4.87 g/cm^{-3} for the d. of the solid at $62.5^\circ C$.

- 3276 Holmes, A. "Monazite from Bodmin Moor, Cornwall. A Study in Geochronology. I. Monazite as a Geological Timekeeper." Proc. Roy. Soc. Edinburgh 63, 115-24(1948).

Detrital monazite from the granite of Bodmin moor, Cornwall, England, has been analyzed for Pb, U, and Th for geologic age detn. An apparent age of 290 million years is considered due to both the presence of original Pb and partial loss of U. The abs. age is 215×10^6 yrs, or late Carboniferous. Data on monazite from Mt. Isa, Queensland, and Las Vegas, New Mexico, are included.

- 3277 Holmes, A. "The Oldest Known Minerals and Rocks." Trans. Edinburgh Geol. Soc. 14, 176-94 (1948).

This paper discusses the Pb method of detg. the age of rocks contg. U and Th, with particular reference to studies made on uraninites from Karelia (U.S.S.R.), Arendal (Norway), and the Canadian Shield (Ontario).

- 3278 Howland, J. J. Jr. and Calvin, M. Paramagnetism and Electronic Structure of Aqueous Ions of Elements 92 to 95. Mar. 1, 1948. Declassified Apr. 15, 1948. 10p. (AECD-1895)

In this paper it is shown that the configuration of the electrons in incomplete shells for the aq. actinide ions from Np^{+6} to Am^{+3} must be $(5f)^{1-6}$. Assumption of configurations of the types $(6d)^{1-6}$ or $6d(5f)^{1-5}$ would generally fail to explain the observed magnetic susceptibilities of solns. of these ions. If the electrons in unfilled orbitals are influenced only slightly by neighboring atoms ($5f$'s are shielded by a $(6s)^2 (6p)^6$ shell) then the macroscopic paramagnetism of solns. can be quantitatively deduced from the electronic structure of the central atom in the ion. In some examples the converse, deduction of the structure from the susceptibility, should be possible. The magnetic susceptibilities of solns. of U^{+4} , Np^{+4} , Np^{+5} , Np^{+6} , Pu^{+3} , Pu^{+4} , Pu^{+6} , and Am^{+3} were measured on 0.1 ml samples in a suspended, divided glass capillary. The capillary moved horizontally 0.01 to 0.2 cm when the field of 17,000 gauss was applied. This paper was presented at the April 1948 meeting of the American Chemical Society.

- 3279 Howland, J. W. Chapter XVI. Studies on Human Exposures to Uranium Compounds. July 1, 1946. Declassified Apr. 30, 1948. 44p. (MDDC-260)

This paper is divided into five major parts: (1) A review of the literature is presented in which the clinical use of U as a drug in the treatment of disease in the yrs 1874 to 1930 is described. (2) An historical description is included of the selection of $150 \mu\text{gU/m}^3$ as a temporary max. allowable concn. (3) Some of the factors known to be important in exposures to dusts are presented and their influence indicated. (4) Reports are made in considerable detail of two accidents in which workers were exposed to flood concns. of UF_6 . Case reports are included, both of fatal and of nonfatal cases. (5) A careful outline is presented of the program of medical observations conducted by the medical branch on workers in labs. and plants in which chronic exposures to U cpds. were possible. The description included pre-employment examns. periodic health checkups with lab. procedures. A special program of industrial hygiene was set up at 4 selected sites. (a) a large lab., (b) a small U processing plant, (c) a large ore and U processing plant, and (d) a large U processing plant. In addn., two programs of special examns. were carried out; one on 10 men working in a UF_6 plant, and the other on 31 men with possible exposures to UO_3 , UO_4 , and UCl_4 .

- 3280 Hutchinson, C. A. Jr. and Elliott, N. S. The Magnetic Susceptibilities of Some Uranium and Neptunium Compounds. January 1948. Declassified Feb. 16, 1948. 1p. (MDDC-1702).

This document is an abstract of a paper presented before the American Chemical Society in April 1948. It is reproduced below in its entirety.

The magnetic susceptibilities of some uranium and neptunium compounds have been studied over a wide temperature range. The magnetic moments calculated from these data give information as to the ground state electronic configurations of the ions involved. 5f orbitals are shown to be prominent in the ground states and certain similarities with the rare earths are established.

- 3281 Hutchinson, C. A. Jr and Elliott, N. Magnetic Susceptibilities of Some Uranium and Neptunium Compounds. March 1948. Declassified Apr. 14, 1948. 11p. (AECD-1896)

This is the full document of which MDDC-1702(1948) is an abstract. See reference to that report for an abstract.

- 3282 Hutchinson, C. A. Jr. and Elliott, N. "The Magnetic Susceptibilities of Some Uranium (IV) Compounds." J. Chem. Phys. 16, 920-6(1948).

The magnetic susceptibilities of $U(SO_4)_2 \cdot 3.26H_2O$, $U(C_2O_4)_2 \cdot 5H_2O$, and $U(C_5H_7O_2)_4$ (acetylacetonate) were detd. at 75 to 330°K. The Weiss-Curie law is obeyed at temps. above 195°K. The data indicate the presence of two 5f electrons in the ground state. The susceptibility of $Th(C_5H_7O_2)_4$ at room temp. was also detd. Spectrographic analyses of the U cpds. used are reported.

- 3283 Jungerman, J. and Wright, S. C. Fission Excitation Functions. June 10, 1947. Declassified Jan. 23, 1948. 6p. (MDDC-1679)

The abs. cross sections for fission for bombardments of α particles and deuterons on Th and U were measured for the energies available at the 60-in. Berkeley cyclotron using the recoil method. Comparison with the theory of Bethe and Konopinski for the total cross sections shows that there is more competition present with the fission process for the bombardments on Th than on U. (This information is also available in Phys. Rev. (2), 74, 150-2(1948).)

- 3284 Jungerman, J. and Wright, S. C. "Fission Excitation Functions." Phys. Rev. (2), 74, 150-2 (1948).

This paper is similar to report MDDC-1679(1948).

- 3285 Katzin, L. I. Organic Solvents of Uranyl Nitrate. Declassified Aug. 17, 1948. 4p. (AECD-2213) Studies were made with several org. liqs. in which $UO_2(NO_3)_2$ is highly sol. for the purpose of identifying the solvates. $UO_2(NO_3)_2 \cdot 3H_2O$ was used as the starting salt. Concd. solns. of the salt were made and the solvates crystd. out of soln. Formulas for the crystals were then detd. However, it was thought probable that for each solvent a whole range of pure and mixed solvates may be formed. The org. solvents used were Et_2O , diethyl "cellosolve", diethyl "carbitol", dibutyl "carbitol", acetone, methyl propyl ketone, hexone, diisopropyl ketone, $EtOAc$, ethyl propionate, and isobutyl alcohol.

- 3286 Kennedy, J. W., Perlman, M. L., Segrè, E., and Wahl, A. C. Formation of the 50-year Element 94 from Deuteron Bombardment of U^{238} . June 1942. Declassified July 23, 1948. 6p. (AECD-2156)

It is shown by bombardment with deuterons of a sample of U^{238} depleted in U^{235} and U^{234} , that the 50-yr Pu activity and 2.0-day Np activity are formed in the same yield as with the natural mixt. of U isotopes; these activities are thus shown to arise from the U^{238} nucleus, and from considerations of the energy of the cpd. nucleus ($U^{238} + d$), it is probably produced by (d,2n) reaction as follows:

(This paper is also in Seaborg, Katz, and Manning, The Transuranium Elements. New York, McGraw-Hill Book Company, 1949. (Paper 1.9).)

- 3287 Kern, D. M. H. and Orlemann, E. F. The Potential of the U(V), U(VI) Couple and the Kinetics of U(V) Disproportionation in Perchlorate Media. Dec. 26, 1947. Declassified Feb. 4, 1948. 25p. (MDDC-1703)

Millimolar solns. of U^{+5} were prepd. by electrolysis of $(UO_2)^{++}$ in sodium perchlorate-perchloric acid solns. and studied by means of the dropping Hg electrode. The U^{+5}/U^{+6} couple has been shown to be reversible. The diffusion coeff. of $(UO)^+$ is $0.86 \times 10^{-5} \text{ cm}^2/\text{sec}$ in 0.4M $NaClO_4$; that of $(UO_2)^{++}$ is $0.68 \times 10^{-5} \text{ cm}^2/\text{sec}$ in 0.09M $NaClO_4$ -0.01M $HClO_4$ at 25°C. In 0.01 to 0.5M perchloric acid the U^{+5} species is $(UO_2)^+$ as shown by the fact that the potential of the couple $(UO_2)^+ \rightleftharpoons (UO_2)^{++} + e$ is const. at $-0.066 \pm 0.002 \text{ v}$ at 25°C over this range of acidity in sodium perchlorate-perchloric acid solns. of ionic strength = 0.5. In sodium perchlorate-perchloric acid mixts. of ionic strength 0.4 the disproportionation of $(UO_2)^+$ at 25°C obeys the following law from $a_H^+ = 0.01$ to 0.4 and from $(UO_2)^+ = 10^{-5}$ to 10^{-3} M .

$$-\frac{d[UO_2]}{dt} = k_2 \cdot a_H^+ \cdot [UO_2^+]^2 \text{ where } k_2 = 130 \pm 4(\text{moles/l})^{-1} \text{ sec}^{-1}.$$

The most probable mechanism for the disproportionation is

(This information is also available in J. Am. Chem. Soc. 71, 2102-06(1949).)

- 3288 Kilner, S. B. Determination of Small Amounts of Uranium by the Polarographic Method. Nov. 30, 1942. Declassified June 17, 1948. 2p. (AECU-2059)

Strubl has published a method for detg. U in $Fe(OH)_3$ ppt. polarographically, which is claimed to be sensitive to 0.1% U. It has been found possible to det. approx. 50 γ U/cc, and by using enough $Fe(OH)_3$ to give a final soln. nearly satd. with $FeCl_2$, it should be possible to detect as little as 1 part in 10,000 of U in $Fe(OH)_3$ and est. it to within 20% or so. The presence of 10 γ U/cc can be noticed if the run is carefully made, which means that 0.001% U can be detected in the $Fe(OH)_3$ ppt.

- 3289 Kinsey, B. B., Hanna, R. C., and Van Patter, D. "Gamma Rays Produced in the Fission of U^{235} ." Can. J. Research A, 26, 79-98(1948).

Measurements made on the coincidence counting rate between the fissions produced in an ionization chamber and the discharges of a Geiger counter are described. By detg. the abs. eff. of the counter, the total energy emitted in the form of γ radiation was estd. to be about $4.6 \pm 1.0 \text{ mev}$. Measurements were made on the range of the electrons projected from an Al radiator placed between the ionization chamber and 2 thin-walled counters. From this expt., the av. energy of the radiation appears to be about 2.5 mev. The result is confirmed by absorption measurements in Pb. The absorption curve indicates a fairly homogeneous radiation and gives some evidence for the existence of a softer component with an energy of about 500 kev.

- 3290 Knight, G. B., Goldin, A. S., Macklin, P. A., and Macklin, R. L. U-234 Specific Alpha Activity. Dec. 8, 1948. 15p. (AECU-43)

The half-life, specific activity, decay const. and fraction in natural U of U^{234} have been redtd. by a radioactive growth method. A pure sample of U^{234} was prepd. by decay of isolated $UX_1(Th^{234})$ and its α activity was measured and compared with the specific activity of pure U^{238} . The values obtained are estd. to be accurate to 1.3%, but differ by more than this % from other values based on mass spectrometer data. (This paper is also available in Phys. Rev. (2), 76, 336-9(1949).)

3291 Koster, W. "The Effect of Temperature on the Modulus of Elasticity of Pure Metals." Z. Metallkunde 39, 1-9(1948).
Moduli of elasticity and temp. coeffs. from -180 to 1000° or to m.p., are given for Be, Mg, Ca, Ba, Al, La, Ti, Zr, Th, Ta, Mo, W, U, Mn, Fe, Co, Ni, Rh, Ir, Pd, Cu, Ag, Au, Zn, Cd, In, Tl, Si, Sn, Pb, Sb, and Bi.

3292 Kraus, K. A. and Nelson, F. The Hydrolytic Behavior of Uranium and the Transuranic Elements. January 1948. Declassified Feb. 12, 1948. 1p. (MDDC-1705)

This document is an abstract of a paper presented before the American Chemical Society in April 1948. It is reproduced below in its entirety.

The hydrolytic behavior of uranium, neptunium, and plutonium is discussed on a comparative basis. The differences in behavior within the series for corresponding oxidation states are stressed, and the differences and similarities with other comparable ions are discussed.

(See reports AECD-1864 and AECD-1888(1948) for full text.)

3293 Kraus, K. A. and Nelson, F. The Hydrolytic Behavior of Uranium and the Transuranic Elements. Part I. The +5 and +6 Oxidation States. Declassified Mar. 8, 1948. 12p. (AECD-1864)

This paper was presented at the April 1948 meeting of the American Chemical Society. An abstract of the paper appears as report MDDC-1705(1948).

3294 Kraus, K. A. and Nelson, F. The Hydrolytic Behavior of Uranium and the Transuranic Elements. II. The +3 and +4 Oxidation States. Declassified Apr. 15, 1948. 22p. (AECD-1888)

MDDC-1705(1948) is an abstract of this paper.

3295 Kraus, K. A. and Nelson, F. Chemistry of Aqueous Uranium (V) Solutions. II. Reaction of UCl_5 with Water. Thermodynamic Stability of UO_2 . Potential of U(IV)/(V) , U(IV)/(VI) , and U(V)/(VI) Couples. Nov. 10, 1948. Declassified Dec. 3, 1948. 27p. (AECD-2394)

Aq. solns. of UCl_5 were examined polarographically and simultaneously their pH was measured with a glass electrode assembly. It was found that near $\text{pH} = 2$, U^{+4} and U^{+6} are the primary soln. products and that these oxidation states can react with each other to yield appreciable concns. of U^{+5} (or UO_2^+) in equil. with U^{+4} and U^{+6} . From potential measurements of such equil. mixts., the formal potentials of the $\text{U}^{+4}/\text{U}^{+5}$ and $\text{U}^{+5}/\text{U}^{+6}$ couples near $\text{pH} = 2$ were calcd. From combination of these data with the various hydrolytic data the formal potentials of these couples in 1M HClO_4 were estd. The pH measurements were in agreement with the assumption that the ionic species of U^{+4} , U^{+5} , and U^{+6} near $\text{pH} = 2$ in 0.1M Cl^- are primarily $(\text{UOH})^{+3}$, $(\text{UO}_2)^{++}$, and $(\text{UO}_2)^+$. (This paper is also available in J. Am. Chem. Soc. 71, 2517-22(1949).)

3296 Krause, H. "Determination of a Number of Metal Ions by Phosphate Titration." Z. anal. Chem. 128, 98-106(1948).

In previous papers the author has shown that Zn, Mn, and Cd can be titrated with $(\text{NH}_4)_2\text{HPO}_4$ soln., by stopping when no further pptn. of ZnNH_4PO_4 , MnNH_4PO_4 , or CdNH_4PO_4 is noticeable. Similarly, U can be pptd. by $(\text{NH}_4)_2\text{HPO}_4$ as $\text{UO}_2\text{NH}_4\text{PO}_4$ in a hot, buffered HOAc soln. and the ppt. washed with hot 2% NH_4OAc soln.; the excess $(\text{PO}_4)^{-3}$ can be titrated with Zn^{++} as usual. Satisfactory results are shown for all these titrations.

3297 Kritchevsky, E. S. and Hindman, J. C. The Potentials of the Uranium Three-Four and Five-Six Couples in Perchloric and Hydrochloric Acids. May 1948. Declassified July 1, 1948. 38p. (AECD-2086)

The $\text{U}^{+3}/\text{U}^{+4}$ couple is shown to be reversible at the dropping Hg electrode. From the pH independence of the couple it is concluded that the ionic species are U^{+3} and U^{+4} in acid solns. The reaction $\text{U}^{+3} = \text{U}^{+4} + \text{e}^-$ has a formal oxidation potential of $+0.631 \pm 0.005$ v in 1M HClO_4 and $\pm 0.640 \pm 0.005$ v in 1M HCl at 25°C . The difference in potential between the chloride and perchlorate solns. is attributed to

the formation of a chloride complex of U^{+4} . The potential of the reaction $(UO_2)^+ = (UO_2)^{++} + e^-$ is -0.063 ± 0.004 v in 1M $HClO_4$ at $25^\circ C$. Cl appears to complex $(UO_2)^{++}$ and U^{+4} to approx. the same extent. The reduction of $(UO_2)^+$ at the dropping Hg electrode is pH dependent in the absence of the max. suppressors, thymol and gelatin. (This information is also available in J. Am. Chem. Soc. **71**, 2096-102(1949).)

3299 Kröger, F. A. "The Incorporation of Uranium in Calcium Fluoride." Physica **14**, 488(1948). The incorporation of U in CaF_2 is discussed for 2 cases: (1) in the presence of O in the form of CaO , and (2) in the absence of O_2 . In the absence of O the fluorescence obtained is weaker (Toorks, U. S. Patent 2,323,284(1943)). Since in CaF_2 a Ca site is surrounded by 8 F sites, the fluorescence center in this system will be the U ion, surrounded by 4 O and 4 F ions.

3300 Kröger, F. A., Hoogenstraten, W., Bottema, M., and Botden, T. P. J. "The Influence of Temperature Quenching on the Decay of Fluorescence." Physica **14**, 81-6(1948).

Temp. quenching causes a marked increase of the rate of decay of fluorescence. It is shown that both the eff. of fluorescence and the decay are detd. by the probabilities of the fluorescence transition and of a radiationless transition. By combining data from measurements of the eff. and the decay, it is possible to obtain the two transition probabilities separately, and both as a function of the temp. The results with $(NH_4)_3UO_2F_5$ and $Mg_2TiO_5 \cdot Mn^{+4}$ are used to verify whether the radiationless process follows the theories of Mott and Seitz or that of Moglich and Rompe; they are found to favor the former. A few examples are presented.

3301 Kröger, F. A., Stevels, J. M., and Botden, T. P. J. "Fluorescence of Sexivalent Uranium in Glass." Philips Research Repts. **3**, 46-8(1948).

U^{+6} groups in basic glasses act as network formers, whereas uranyl groups in acidic glasses act as network modifiers. The emission and absorption bands show a direct relation.

3302 Kroll, W. J. "Rare-Metal Metallurgy." Metal Ind. (London) **73**, 263-5(1948).

The author discusses various methods for producing metals from their ores. He briefly discusses the reduction of the oxides of Th, V, and U with Ca in a pressure vessel.

3302 LaBelle, C., Booth, C., and Barrett, R. The Retention of Uranium Dioxide in Rabbits. Apr. 19, 1948. Declassified June 3, 1948. 32p. (AECD-2028)

An app., fitted with a system of electronic controls, has been constructed in which a rabbit breathes dusty air in a facepiece. The valves are operated in such a way that the exhaled air is drawn off through a filter-paper sampler at a regulated rate to maintain the air pressure within the facepiece essentially equal to that of the atm. A duplicate line continuously samples the same vol. as the atm. is being inhaled, permitting calcn. of the quantity of dust retained by the rabbit. When the retention, in $\gamma/\text{min}/\text{kg}$ body weight is plotted against dust concn. in γ/l on a log-log plot, a straight line is obtained with a slope of $3/2$ over the concn. range from 10 to $250 \text{ mg}/\text{m}^3$. No significant differences could be shown between the retention of dust particles 1μ and $1/2\mu$ in diameter. The quantity of dust retained was directly proportional to the vol. of air breathed, and was independent of the rate of breathing. Individual animals show a two- to threefold variation from the mean probably as a result of anatomical variation in the respiratory tract.

3304 Landau, R., Birchenall, C. E., Joris, G. G., and Elgin, J. C. "Absorption in a High Molecular Weight Nonaqueous System." Chem. Eng. Progress **44**, 315-26(1948).

This paper is based on report MDDC-152(1946) and deals with data obtained on the absorption of UF_6 in a high mol. wt. oil.

- 3305 Larson, C. E. Chemical and Physical Properties of Uranium Peroxide. January 1948. Declassified Feb. 18, 1948. 1p. (MDDC-1741)

This article is an abstract and is reproduced here in its entirety.

The precipitation of uranium peroxide from acidic uranyl solutions is one of the most specific and useful reactions of uranium. Because the solubility of uranium peroxide is intermediate between such insoluble compounds as ferric hydroxide, and comparatively soluble compounds such as magnesium sulfate, careful attention must be paid to the conditions of precipitation if a reasonable degree of quantitiveness is to be obtained. For this reason an intensive study of the equilibria and kinetics of the precipitation reaction has been made. In pure solutions the equilibrium constant for the reaction $\text{OU}_2^{++} + x\text{H}_2\text{O}_2 \rightleftharpoons \text{UO}_4 \cdot x\text{H}_2\text{O} + 2\text{H}^+$ was found to be 6.7×10^2 . The effect of cations and anions on precipitation was systematically investigated. The most effective inhibitors were sulfate and fluoride ion among the anions and alkali and alkaline earths among the cations. The specific effect of ferric ion in catalytically decomposing peroxides was investigated and methods found for minimizing its effect. Conditions of precipitation were found to have a profound effect on subsequent surface characteristics of the dried product. The physical and chemical properties of the solid uranium peroxide are summarized.

(This paper was presented orally before the American Chemical Society Symposium held in April 1948.)

- 3306 Lauterbach, K., Laskin, S., and Leach, L. Determination of the Surface Area of Uranium Compounds of Different Particle Sizes by Low-Temperature van der Waals Adsorption of Ethane. Declassified Aug. 3, 1948. 22p. (AECD-2244)

In order to extend the scope of information on the physicochem. properties of U dusts, surface area measurements have been made on several representative U cpds. The exptl. method most suitable to the purpose was found to be the low-temp. gas adsorption one. Using a modified form of the app. developed by Wooten and Brown, C_2H_6 (at -183°C) was chosen as the adsorbate in order to evaluate the very small surface areas encountered. Adsorption isotherms obtained with C_2H_6 were found to be similar to the typical sigmoid isotherms described in the literature when N_2 and other gases were used. A method was developed enabling the calcn. of the theoretical surface of the material from optically measured median-particle diameters, weighted in terms both of mass and surface. The ratio of the exptl. and the calcd. specific surfaces for each sample was then taken as a measure of the relative porosity of the material. The C_2H_6 adsorption method was found to be accurate for surface values as low as 10 cm^2 , using the blank sample tube as area for detn. The gas adsorption method was also cross-checked against the method of calcg. specific surface for particle-size measurements using micro. glass beads. The two methods yielded specific surface values, which differed by an av. value of only 8.7%. The U cpds. investigated were UO_2 , UO_3 , UO_4 , UF_4 , and the nitrate. With the exception of UO_4 , all of these cpds. exhibited fairly low specific surfaces of the order of from 0.4 to $0.7 \text{ m}^2/\text{g}$. Corresponding specific surfaces detd. from direct micro. measurements showed a similar range of values. By C_2H_6 adsorption the specific surface of the UO_4 , however, was found to be $5.74 \text{ m}^2/\text{g}$, whereas the calcd. value was only $0.49 \text{ m}^2/\text{g}$. A porosity value of 11.7 was thus obtained indicating a significant surface irregularity. Specific surface detns. were also carried out on two solid samples, which were obtained by drying aq. suspensions of fine and coarse UO_2 dust. The fine material showed a tenfold larger area of $4.23 \text{ m}^2/\text{g}$ as compared with $0.47 \text{ m}^2/\text{g}$ for the coarse suspension. The corresponding calcd. specific surfaces, however, showed only a fivefold larger area for the fine suspension. This difference and the relatively high porosity values of 14.1 for the fine suspension and 6.8 for the coarse suspension indicate a change in the phys. structure of the material or a leaching of the surface associated with the process of prepg. this suspension. These results are similar to the findings on increased surface areas associated with the washing of sized glass beads reported in the literature. (This information is also available in J. Franklin Inst. 250, 13-24(1950).)

- 3307 Leslie, E. H. Note on Improvements in Spectrochemical Techniques. Dec. 28, 1948. 11p. (AECU-48)

A method of mounting small, odd-shaped steel samples for spectrochem. analysis using silver solder is presented. Statistical data on analyses performed on samples mounted in this manner as compared with identical but unmounted samples show that comparable results are obtained. The "Handy Punch," a device used to produce the vent hole in the sample charge in the carrier distn. method of spectrochem. analysis for trace impurities in U base materials, is described.

- 3308 Levvy, G. A., Kerr, L. M. H., and Campbell, J. G. " β -Glucuronidase and Cell Proliferation." Biochem. J. 42, 462-8(1948).

The increase in β -glucuronidase activity of liver and kidney of mice treated with menthol is corroborated, and the effect is attributed to the toxic action and organ injury which results in cell proliferation. Menthol had no effect on the spleen. Substances having a similar injurious effect in liver or kidney are CHCl_3 , CCl_4 , $\text{Hg}(\text{NO}_3)_2$, yellow phosphorus, phenylarsenoxide, $\text{UO}_2(\text{OAc})_2$, menthol glucuronide, and sulfathiazole. It is interesting to note that CHCl_3 affected kidney glucuronidase only of male mice. High glucuronidase activities were found in livers from adult mice after subtotal hepatectomy, and in liver, spleen, and kidneys from infant mice.

- 3309 Litz, L. M. Uranium Carbides - Their Preparation, Structure, and Hydrolysis. Dissertation, Ohio State University, 1948.

It was found that finely divided U metal would react with CH_4 at temps. as low as 625°C to produce a carbide which was identified as UC. Previously only UC_2 had been reported in the literature. By reacting U metal with graphite at 2100°C , well-defined metallic crystals of UC were produced. By increasing the temp. to approx. 2400°C , crystals of UC_2 were obtained. The x-ray diffraction pattern obtained by the Debye-Sherrer photographic method indicated that the crystal structure of UC is face-centered cubic with $a_0 = 4.955 \text{ \AA}$. The Debye-Sherrer films showed that UC has the NaCl structure, and UC_2 has the CaC_2 structure. Intensity measurements with an x-ray spectrometer confirmed these results. The U carbides give widely different hydrolysis products with varying temps. Below 100°C the gaseous products are chiefly hydrocarbons. Above 100°C the concn. of hydrocarbons decreases and the amt. of H_2 increases until, at temps. above 300°C , the gaseous product is almost pure H_2 . When C_2H_2 was added to the system during hydrolysis, the nascent H was effective in hydrogenating C_2H_2 , a reaction which did not take place in the presence of H_2 . The rate of reaction of the U carbides with halogens was found to vary in the order $\text{BrCl} > \text{Br}_2 > \text{I}_2$. In no case was there any org. halide produced.

- 3310 Litz, L. M., Garrett, A. B., and Croxton, F. C. "Preparation and Structure of the Carbides of Uranium." J. Am. Chem. Soc. 70, 1718-22(1948).

UC_2 and the previously unreported monocarbide, UC, have been prepd. by several methods. The crystal lattice consts. have been detd. for the two structures, and x-ray diffraction evidence is presented which indicates that UC has the NaCl type of structure, and UC_2 has the CaC_2 type of structure. The lattice consts. observed are: UC, $a_0 = 4.995 \text{ \AA}$; UC_2 , $a_0 = 3.54 \text{ \AA}$; $\text{C}_0 = 5.99 \text{ \AA}$.

- 3311 Livingston, R. The Synthesis of U_2F_9 . Declassified July 28, 1948. 1p. (AECU-2177)
This is not an abstract; the text of the document is reproduced below in its entirety.

"In the study of radiation effects on UF_6 it became desirable to synthesize UF_5 , as well as other compounds, for x-ray diffraction studies. The UF_5 synthesis was attempted by the reaction of dry-process (monoclinic) UF_4 with UF_6 . Several runs were made, and in each case a black product was formed. Samples were submitted to W. H. Zachariasen for diffraction studies, and he found that the material was cubic and could not contain as many as five fluorine atoms per uranium atom. Moreover, the material on standing a few weeks formed a green product which was shown by Zachariasen to be identical with the starting UF_4 . A typical synthesis of the black fluoride was carried out by placing 15.5 g dry-process UF_4 in a monel-metal cell, evacuating and baking at 100°C for 20 hr and then condensing

16.5 g UF_6 in the cell. The mixture was heated to 125°C for $2\frac{1}{2}$ hr, followed by the removal of excess UF_6 by pumping for several hours at $100\text{--}110^\circ\text{C}$. A supply of this substance was sent to the S.A.M. Laboratory at Columbia University. This group continued the study. Weller, Grenall, and Kunin showed the correct formula to be U_2F_9 . W. H. Zachariasen has recently reported on the crystal structure work on the black U_2F_9 described above (*J. Chem. Phys.* 16, 425(1948))."

3312 Lloyd, S. J. and Cleere, M. C. "A New Organic Uranium Compound." *Science* 108, 565(1948). By mixing 100 cc of an alc. soln. of anhyd. $\text{UO}_2(\text{OAc})_2$ and 80 cc of alc. hexamethylenetetramine under proper conditions a new cpd. is formed which shows needlelike crystals, decomps. at 185°C , is sol. in glacial HOAc and insol. in alc. The analysis gives U, 46.3% and N, 9.7%.

3313 McCoy, J. R. and Tuthill, S. M. The Determination of Zinc in the Presence of Uranium. June 1947. Declassified July 21, 1948. 11p. (AECD-2180)

A procedure for detg. Zn in UF_4 and in pitchblende by means of dithizone (diphenylthiocarbazone) is presented. With this procedure it is possible to det. as little as $1\ \gamma$ Zn, which makes a more sensitive test than the present spectrographic methods. The procedure includes a method for the elimination of Ni and Pb which are normally present in pitchblende and which would interfere with the detn. of Zn.

3314 McNally, J. R. Jr. A Preliminary Investigation of the Spectra of Uranium Isotopes. Declassified Sept. 9, 1948. 1p. (AECD-2302)

This document is an abstract. See report AECD-2349(1948) for complete text.

3315 McNally, J. R. Jr. A Preliminary Investigation of the Spectra of Uranium Isotopes. Sept. 9, 1948. Declassified Oct. 15, 1948. 15p. (AECD-2349)

A number of wavelength differences in the spectra of U isotopes has been previously reported. These differences have been correlated to the spectroscopic energy systems of U_I and U_{II} and are found to be of two types: (1) a simple isotopic displacement arising from configuration-nucleus interaction, and (2) a simple isotopic displacement arising from perturbations between close-lying levels. Wave number shifts as large as one wave number are not uncommon between 235 and 238 lines, the shifts usually being toward the violet for the lighter isotope. The magnitude of shift in U_I is generally of the order of 0.3 cm^{-1} , but ranges from -0.7 cm^{-1} to 1.5 cm^{-1} in U_{II} . Configurations involving the s^2 electron group show the largest isotope shifts indicating an additive type of interaction for the s electrons and the nucleus. (This paper is also in *J. Optical Soc. Am.* 39, 271-7(1949).)

3316 MacNider, W. deB. "Inability of 2,3-Dithiopropanol (BAL) to Protect the Liver against Toxic Action of Uranium Nitrate." *Proc. Soc. Exptl. Biol. Med.* 68, 160-1(1948).

The author has shown that doses of BAL (10%, benzyl benzoate 20%, in peanut oil) equiv. to 15 mg/kg, when administered subcutaneously to dogs for 8 days, were ineffective against the hepatotoxic action of 4 mg/kg of U nitrate; instead, it tended to increase the toxic effects. The livers showed diffuse necrosis with advanced fatty degeneration.

3317 MacNider, W. deB., Trott, J. R. Jr. and Bruce, M. D. "Concerning the Inability of 2,3 Dithiopropanol (BAL) to Prevent or to Modify the Acute Renal Injury Induced by Uranium Nitrate." *J. Pharmacol. Exptl. Therap.* 94, 262-73(1948).

U nitrate when given subcutaneously to dogs in the amt. of 4 mg/kg induced a const. type of acute renal injury which was largely confined to the proximal convoluted segment of the renal nephron. However, no histologically demonstrable cell changes were found in the kidneys of dogs given 15 mg/kg of 2,3-dithiopropanol (BAL). But the use of BAL either as a prophylactic agent before U nitrate intoxication was experimentally produced or after, as an alleviating agent, increased the severity of renal injury. Furthermore, renal toxic action of U was greatest when BAL was used both before and after. It was concluded from this that BAL so influenced the epithelial tissue of the kidney as a sensitizing agent for U that the nephrotoxic action of this substance became more severe at its point of selective action and even spread to other segments of the renal nephron. 17 references are included.

- 3318 Majumdar, A. N. "A New Method for the Colorimetric Estimation of Traces of Uranium." *Science Culture* 13, 468-9(1948).

The author has devised a method which is accurate to within $\pm 3\%$. It was found that in the absence of interfering ions and sol. carbonates, $(\text{UO}_2)^{++}$ gives a blue-colored lake with alc. quinalizarine at a pH approx. = 7.2. The region of max. absorption was detd. from the plot of the % transmittancy with filters of varying wavelengths in a photoelectric colorimeter. The max. absorption was found in the region of 575 m μ . At this pH (7.2) the blank has a light-violet color; the region of max. absorption for the blank was found to be at 515 m μ . From the transmittancy curves of the two (blank and U lake) it was found that the filter 620 m μ was the most suitable; at this region the absorption of the blank was quite negligible while that of U lake was very near the max. The % transmittancies of a series of std. U solns. of varying strengths with quinalizarine were detd. in a photoelectric colorimeter using a 620-m μ filter. The plot of the log transmittancy against concn. was found to be a straight line when the concn. was within the range of 3 to 10 ppm U (3 to 10 γ U/cc). Thus Beer's law holds true within this region and this method can be used for the colorimetric estn. of U.

- 3319 Masi, J. The Heats of Vaporization of Uranium Hexafluoride. Declassified Sept. 16, 1948. 20p. (AECD-2288)

Vaporizations of UF_6 were carried out in a heavy wall, nickel-plated calorimeter. Measurements of the heat of vaporization of the solid were made at 7 temps., and of the liq. at 4 temps., covering the range from 4 to 90°C. The app. was tested before beginning the measurements by obtaining the heats of vaporization of H_2O at 3 temps. The scattering of the data on UF_6 is about 1%. Vapor pressure equations and an equation of state for the satd. vapor have been obtained by correlating the results with the vapor pressure data, heat of fusion, and triple point given in the literature. From these equations and the National Bureau of Standards' values for the thermodynamic properties of the solid and liq., the entropies of the ideal gas are calcd. and compared with those given in the literature from spectroscopic data and mol. structure. (This paper is also in *J. Chem. Phys.* 17, 655-8(1949).)

- 3320 Meister, G. Production of Rarer Metals. Declassified Feb. 11, 1948. 16p. (MDDC-1673)

The rarer or less-familiar elements considered are Th, Zr, and U. All these metals were prepd. more or less pure in the early part of the nineteenth century. Since that time purer raw materials were produced, improvements were made in these earlier methods, and new methods were developed so that metals have been prepd. in a purer state. The H_2 reduction method, although used successfully commercially in reducing W and Mo oxides, fails completely in the case of Th, Zr, and U. When the oxides are reduced with C the resulting metal generally has a high C content and is brittle. Reduction of oxides with Mg generally produces a low grade metal powder, but when Ca is used, especially in the presence of CaCl_2 , a fairly good metal is obtained. Alumino-thermic reductions of the oxides generally are violent and produce some beads of metal but usually the product is not satisfactory and often forms alloys with Al which are not easily decompd. The thermal dissocn. of cpds., as the iodide, has been commercially used in the production of Zr and produces a very high purity metal. The iodide is decompd. by a hot filament, usually W, and the pure metal deposited thereon. Deposition by fused salt electrolysis has been developed and it produces a good grade of powder especially in the case of Th, U, and Ta.

- 3321 Meister, G. "Production of Thorium, Zirconium, and Uranium." *Metal Progress* 53, 515-20 (1948).

Methods for the production of pure Th, Zr, and U are described. This paper is based on report MDDC-1673(1948).

- 3322 Melander, L. and Slätis, H. "Preparation and Radiation of U^{237} ." *Phys. Rev.* (2) 74, 709-11(1948). U^{237} was prepd. by irradiating U with fast neutrons from Li bombarded with deuterons: $\text{U}^{238}_{(n,2n)}\text{U}^{237}$. The sepn. and purification of U^{237} are described. Eleven β -ray lines are tabulated with their momentum, energy, ionization, work energy of the corresponding γ quanta, and origin. The upper limit is $H_p = 1784$. The half-life is 6.63 ± 0.05 days.

3323 Monk, A. T. and Allison, S. K. Computed Values of X-Ray Lines and Limits for the Trans-Uranic Elements. Sept. 6, 1944. Declassified Aug. 31, 1948. 10p. (AECD-2263)

For the elements Bi, Ra, Ac, Pa, U, Np, Pu, Am, and Cm the following tables are given: (1) wave number/R values for energy levels K, L_I, L_{II}, L_{III}, M_I, M_{II}, M_{III}, M_{IV}, and M_V; (2) wavelengths of crit. absorption limits in x units (10⁻¹¹ cm) for energy levels listed above; (3) crit. excitation voltages in kv for K, L_I, L_{II}, L_{III}, M_I, and M_V; (4) levels which must be excited to produce various emission lines; (5) wavelengths in x-units and intensities of emission lines in the K series; (6) wavelengths in x units and intensities of some emission lines in the L series; (7) first-order glancing angles from calcite and rock salts for crit. absorption wavelengths; (8) first-order glancing angles from calcite for certain L-series lines; and (10) first-order glancing angles from rock salt for certain L-series lines. The methods of computing these various values are discussed.

3324 Morette, M. A. "A Method for Separation of Uranium from Phosphoric Acid. Application to the Recovery of Uranium." Ann. pharm. franc. 6, 529-34(1948).

A method is shown for the sepn. of U from (PO₄)⁻³, which can be used in analysis and as a means for recovering U from the waste product from biochem. labs. where the detn. of phosphates is made by titration with uranyl salts. The originality of the procedure lies in the use of Ca(OH)₂ for the disintegration of uranyl phosphate. The method consists of the following operations: uranyl phosphate is mixed, in H₂O, with slaked lime; the product of the reaction is an insol. mixt. of red Ca uranate and Ca phosphate. Through the addn. of (NH₄)₂CO₃ a sol. uranocarbonate complex is formed, for which, after filtration and neutralization with HNO₃, (NH₄)₂UO₄ is pptd. by adding NH₃; this is transformed into a soln. of UO₂(NO₃)₂.

3325 Morgan, K. Z. "Protection against Radiation Hazards and Maximum Allowable Exposure Values." J. Ind. Hyg. Toxicol. 30, 286-93(1948).

The max. permissible exposure to radiation is discussed. The daily tolerance value has been set at 0.1 r/day for x or γ radiation; 0.1 rep/day (rep = roentgen equiv. phys.) for x, γ, or β rays, 0.01 rep/day for α rays, 0.02 rep/day for fast neutrons; and 0.1 roentgen equiv. man for all these types of radiation. Concns. which will give a tolerance exposure to certain organs are:

Radioisotope	γ/cc air	γ/cc water
Ra	2 × 10 ⁻¹⁰ lungs	4 × 10 ⁻⁷ bone
U	2 × 10 ⁻⁴ lungs	60 bone
I ¹³¹	7 × 10 ⁻¹⁴ thyroid	4 × 10 ⁻¹⁰ thyroid
Na ²⁴	9 × 10 ⁻¹⁴ blood	6 × 10 ⁻¹⁰ blood
P ³²	6 × 10 ⁻¹³ bone	4 × 10 ⁻⁹ bone

The protective devices and the instruments used in the USAEC for measuring the intensity of radiation near these limiting intensities are described.

3326 Mueller, M. E. The Vapor Pressure of Uranium Halides. Declassified May 28, 1948. 105p. (AECD-2029)

It is the purpose of this paper to present a crit. review of vapor-pressure measurements made on U halides which were investigated by the chem. staff of the Univ. of Calif. Radiation Lab. in the time interval from Feb. 1943 to July 1946. Measurements made by other groups are included. With the exception of UF₄, no work was done on U fluorides, but this is the only important group omitted from the list of cpds. considered. The fluorides have been investigated by the Columbia Univ. group. Vapor pressure measurements are presented and evaluated for UF₄, UCl₃, UCl₄, UCl₆, UBr₃, UBr₄, UCl₃Br, UCl₂Br₂, UClBr₃, UBr₃I, and UI₄. Equil. decompn. pressure measurements are presented for UOCl₂, UOBr₂, UI₄, UCl₃I, and UBr₃I. Summaries are given of the vapor pressure equations, m.p.'s, triple point pressures, heats of subln. and vaporization, and of vapor pressures and decompn. pressures. The effusion method is critically examined and found to be applicable to a much higher pressure for U halides than it has been the practice to use the method. Measurements obtained for the flow of UCl₄ gas

through tubes are used to establish the vapor pressure equation for the substance with greater certainty and to yield values for the mol. diameter, mean free path, and viscosity of the gas.

- 3327 Myer, M. G. and Bigeleisen, J. Absorption Spectra of Some Uranyl Salts. January 1948. Declassified Feb. 12, 1948. 1p. (MDDC-1727)

This paper is an abstract and is presented here in its entirety.

"The absorption measurements on single crystals of the uranyl salts by the spectroscopic group at the SAM Labs. and Johns Hopkins Univ. of the Manhattan Project will be discussed. The absorption spectra are much more complicated than the corresponding fluorescence spectra. Whereas all of the fluorescence lines originate from transitions from the lowest level in the excited state (except where anti-Stokes lines are involved) to various levels in the ground state, in absorption there are transitions from the ground state to each of the four discrete electronic states which lie between 20,000 and 28,000 cm^{-1} above the ground state. Superimposed on the electronic transition are vibrations of the uranyl ion and the lattice. The structure of the absorption spectra will be discussed with the aid of results obtained by using enriched isotopes."

(This paper was presented orally at the American Chemical Society Symposium held in April 1948.)

- 3328 Neidrach, L. W., Mitchell, A. M., and Rodden, C. J. Analytical Chemistry of the Manhattan Project. Chapter XXVI. Beryllium, Magnesium, Calcium, Strontium, Barium, and Radium. Declassified July 23, 1948. 41p. (AECD-2159)

Be and its salts are analyzed for Be content. The detn. of Mg and Ca was chiefly for traces in U and its cpds. The detn. of Ba and Sr was of minor importance. Samples of U and Ra concs. and ores were analyzed for Ra content. Spectrographic analysis is a very useful method for the detn. of traces of Be, Mg, Sr, Ca, and Ba because of the sensitivity of the spectral lines. 44 references are given. (This paper is also available in Rodden Analytical Chemistry of the Manhattan Project. New York, McGraw-Hill, 1950. Chapter 11.)

- 3329 Neuman, W. F. and Havill, R. Jr. Poloragrophic Studies of the Uranyl-Citrate Complex. Feb. 19, 1948. Declassified Mar. 18, 1948. 20p. (AECD-1801)

Citrate forms a sol., complex ion, combining with U in a mole ratio of one. The complex probably exists in soln. as a dimer with very little tendency to dissociate. It is stable over a wide range of pH. From the negativity of the half-wave potential, it appears unlikely that uranyl citrate would be reduced in vivo.

- 3330 Neuman, W. F., Fleming, R. W., Carlson, A. B., and Glover, N. "Fluorophotometric Determination of Uranium in Biological Material." J. Biol. Chem. 173, 41-52(1948).

Hoffmann detd. U content by measuring visually the fluorescence of NaF fusions of U-contg. materials. Inorg. impurities quench the fluorescence. Isolation of U from solns. of tissue ash by adsorption on protein and the use of a special fluorophotometer improve the method. Tissue ash is dissolved in 2N HCl, an aliquot contg. 50 to 100 mg ash placed in a graduated centrifuge tube and neutralized, and 100 mg serum albumin added. After diln. to 30 ml the tube is heated at 80° for 45 min. The coagulum is sepd. and washed at pH = 4.5 by centrifugation. The ppt. is made up to 10 ml with concd. HNO_3 ; 0.1 ml aliquots are dried in Pt cups and fused with about 80 mg NaF. In the case of liver, blood, and spleen an electrolysis of the soln. of tissue ash was found necessary before pptn. with protein. U can be detd. in concns. as low as 0.005 γ/g of soft tissue.

- 3331 Neuman, W. F., Fleming, R. W., Dounce, A. L., Carlson, A. B., O'Leary, J., and Mulryan, B. "The Distribution and Excretion of Injected Uranium." J. Biol. Chem. 173, 737-48(1948).

Male and female rats were kept on a synthetic diet for several months and then injected intravenously (by tail vein) with a soln. of 0.1% $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ at a dose level of 2.5 mg U/kg. After the animals were sacrificed, the distribution of U was measured in different tissues. Roughly $\frac{1}{3}$ of the U was excreted rapidly via the urine; $\frac{1}{3}$ was found in the skeleton from which it was mobilized slowly. The kidney initially fixed as much as $\frac{1}{2}$ of the dose but the concn. fell rapidly to a very low value in 40 days. All other soft tissues, including blood, contained negligible amts. Alk. administration reduced the amt. deposited in kidney, increasing proportionately the quantity found in urine. NH_4Cl feeding exerted an effect opposed to that of alk. administration.

- 3332 Neuman, W. F., Neuman, M. W., Main, E. R., and Mulryan, B. J. The Deposition of Uranium in Bone. I. Animal Studies. February 1948. Declassified Apr. 15, 1948. 11p. (AECD-1915)

The deposition of injected U in bone was found to be directly related to growth activity. Young rats, irrespective of sex, showed a greater concn. of U in bone than did older animals. (This information is also available in J. Biol. Chem. 175, 705-9(1948).)

- 3333 Neuman, W. F. and Neuman, M. W. The Deposition of Uranium in Bone. II. Radioautographic Studies February 1948. Declassified Apr. 5, 1948. 9p. (AECD-1916)

Radioautographs of bone contg. U^{233} showed this element to be deposited only in the mineral portions and to be particularly concd. on surfaces adjacent to the circulation and calcification. Once fixed, little redistribution of U occurred. As the normal growth and calcification processes cont., new bone accumulated over the lines of deposition and the resorption of bone to some extent was inhibited, probably because of the insolubility of U-impregnated bone salt. (This report is also available in J. Biol. Chem. 175, 711-14(1948).)

- 3334 Neuman, W. F., Neuman, M. W., Main, E. R., and Mulryan, B. J. The Deposition of Uranium in Bone. III. The Effect of Diet. February 1948. Declassified Apr. 6, 1948. 10p. (AECD-1917)

The effect of several exptl. diets on the rate of mobilization of skeletal U in rats was tested. Alk. and acidic diets were without effect; a rachitogenic diet increased the rate of mobilization. Nearly $\frac{1}{2}$ of the U originally deposited disappeared in the 7-wk dietary period. If the femurs and humeri are assumed to be representative of the skeleton as a whole, the half-life of skeletal U in the rat must be of the order of 50 to 60 days. This would correspond, on a log basis, to an excretion rate of slightly over 2%/day. (This paper is also available in J. Biol. Chem. 175, 715-19(1948).)

- 3335 Neuman, W. F., Neuman, M. W., Main, E. R., and Mulryan, B. J. The Deposition of Uranium in Bone. IV. In Vitro Adsorption Studies. Mar. 10, 1948. Declassified Aug. 11, 1948. 15p. (AECD-2215)

Bone ash and fresh bone were equilibrated with U in $(\text{HCO}_3)^-$ buffer under a variety of conditions, especially those considered to simulate conditions existing in the animal during U poisoning. Observations of the transfer of U from the soln. to the bone phase and the simultaneous soln. of Ca and P suggested that the mechanism of fixation at concns. of U occurring in vivo involves an ionic exchange between U in soln. and some group (probably Ca) on the surface of the bone crystals. This was substantiated by a study of the soly. of U in the solns. employed. The ionic exchange occurring in vitro quantitatively accounts for the deposition of U in the animal skeleton. (This paper is also available in J. Biol. Chem. 179, 325-33(1949).)

- 3336 Neuman, W. F., Neuman, M. W., Main, E. R., and Mulryan, B. J. The Deposition of Uranium in Bone. 5. Ion Exchange Studies. Declassified Apr. 28, 1948. 11p. (AECD-2018)

Previous studies have indicated that the fixation of U by bone is, for the most part, a surface phenomenon involving ionic exchange. This is a report of a series of investigations of the ion-exchange mechanism. First, a comparison was made of the ability of several bone preps. to adsorb U in vitro with their ability to exchange $(\text{PO}_4)^{-3}$ and Ca^{++} . Second, a study was made of the effect on phosphate and Ca

exchangeability of a preliminary satn. of glycol ashed bone in U. A correlation was demonstrated between the magnitude of the fraction of exchangeable Ca and phosphate of bone preps. and their ability to fix U. The presence of adsorbed U inhibited the exchange of bone Ca and phosphate. These results confirm the view that U fixation by bone involves an ionic exchange. (This paper is also available in J. Biol. Chem. 179, 335-40(1949).)

- 3337 Neuman, W. F., Neuman, M. W., Main, E. R., and Mulryan, B. J. The Deposition of Uranium in Bone. 6. Ion Competition Studies. Declassified May 5, 1948. 13p. (AECD-2019)

Previous studies have indicated that the deposition of U in bone is a surface-limited reaction involving an exchange of the $(\text{UO}_2)^{++}$ of the soln. for some ion in the surface of the mineral phase of bone, probably Ca. As a further test of the exchange hypothesis, a series of ion-competition expts. was conducted, in which the effects of varying concns. of H^+ , $(\text{HCO}_3)^-$, $(\text{PO}_4)^{-3}$, and Ca^{++} were observed. Evidence was obtained which confirmed the exchange hypothesis and established Ca as the surface ion in bone which U displaces. All available data have been summarized and the mechanism of the deposition of U in bone is discussed in detail. (This paper is also available in J. Biol. Chem. 179, 341-8(1949).)

- 3338 Neuman, W. F., Neuman, M. W., and Mulryan, B. J. "The Deposition of Uranium in Bone. Part I. Animal Studies." J. Biol. Chem. 175, 705-09(1948).

This paper contains information similar to that in report AECD-1915(1948).

- 3339 Neuman, M. W. and Neuman, W. F. "The Deposition of Uranium in Bone. Part II. Radioautographic Studies." J. Biol. Chem. 175, 711-14(1948).

This paper is similar to report AECD-1916(1948).

- 3340 Neuman, W. F., Neuman, M. W., Main, E. R., and Mulryan, B. J. "The Deposition of Uranium in Bone. Part III. The Effect of Diet." J. Biol. Chem. 175, 715-19(1948).

This paper is similar to report AECD-1917(1948).

- 3341 Newton, A. S. The Formation of U^{232} by Helium Ions on Thorium. Apr. 14, 1948. Declassified June 25, 1948. 6p. (AECD-2081)

The production of U^{232} by the sum of $(\alpha, 4n)$ and $(\alpha, p3n)$ reactions on Th has been studied. The cross section at an av. energy of 37.5 mev was 0.013 barns and the threshold for the reaction was about 30 mev. (This document is also available in Phys. Rev. (2), 75, 209-11(1949).)

- 3342 Newton, A. S. — assigned to U. S. Atomic Energy Commission. Method of Preparing Uranium Hydride. Aug. 10, 1948. (U. S. Patent 2,446,780)

U hydride is prepd. continuously by vaporizing H_2O , reducing the H_2O vapor with V, Fe, or Zn at 600 to 800° to form H_2 in a reaction zone in a closed system maintained below atm. pressure and allowing the H_2 to react with dense metallic U free from U oxide at 150 to 400°, while controlling the pressure within the system by controlling the temp. of the H_2O undergoing vaporization. The U may be in metallic form or alloyed with Sn, Cu, Bi, Al, Ag, or Au. The U can be prepd. by reduction of UF_4 with Mg or Ca to form MgF_2 or CaF_2 and metallic U at a temp. sufficiently high to melt the U and cause it to sep. from the fluoride into a molten metallic U pool. An example, a drawing, and a description of the app. are given.

- 3343 Newton, A. S. — assigned to U. S. Atomic Energy Commission. Method of Preparing Uranium Deuteride. Oct. 26, 1948. (U. S. Patent 2,452,139)

A method is given for the prepn. of UD_3 from U and D, in a reversible reaction requiring suitable conditions of temp. and pressure. Metallic U is obtained from a mixt. of powd. UF_4 and Mg heated in a crucible, in which molten U seps. under a layer of slags. The metal must be free from parting planes of oxide. The app. for the prepn. of UD_3 is a closed system composed of two parts: in part one, vapors of heavy water react with U turnings at $\sim 700^\circ C$ to form D; in part two, D reacts with U turnings at $\sim 250^\circ C$ to form UD_3 . The pressure should not exceed the decompn. pressure of UD_3 , which is ~ 27 mm Hg at the above temp. The UD_3 forms a black powder falling off the metal and exposing fresh metallic surfaces all through the reaction; the end is indicated by the rising pressure. The patent claims include several variants in the details of the procedure and in the nature and form of the reagents. The final UD_3 is a convenient means of storing and handling D, the latter being released by heating above the decompn. temp. at the existing pressure.

- 3344 Newton, A. S. The Use of Uranium and Uranium Compounds in Purifying Gases. Declassified July 20, 1948. 10p. (AECD-2135)

It has been found that with a simple setup U and certain U salts are very useful for obtaining several commonly used gases in a high degree of purity. This method was first used with A but has since been extended to include H_2 , N_2 , HCl , HBr , and Cl_2 . The method is based on the reactivity of U metal (it being quite active and forming no protective skin of oxide), the formation of a U hydride which can be decompd. to yield H_2 and the metal at a reasonably low temp., and the fact that the U oxide is more stable than the nitride of any of the halogen salts except perhaps the fluoride.

- 3345 Newton, A. S., Warf, J. C., Spedding, F. H., Johnson, O., Johns, I. B., Nottorf, R. W., Ayers, J. A., Fisher, R. W., and Kant, A. Uranium Hydride. II. Radiochemical and Chemical Properties. Declassified Jan. 7, 1948. 9p. (MDDC-1649)

The radiochem. properties of UH_3 involving leaching of the fission products and the behavior of radio-Xe were investigated. A general survey of the chem. properties of UH_3 was made. This included its reactions with air, H_2O , acids, oxidizing agents, heavy-metal salt solns., halogen-bearing gases, NH_3 , phosphine, and other gases, the effects of solvents, and attempted reductions of org. cpds. A few of the reactions afforded excellent preparative methods for certain anhyd. U cpds., otherwise somewhat difficult to prep. Some of the applications of UH_3 and the hydride reaction are listed briefly.

- 3346 Nickson, J. J., Ferretti, R., and Cantril, S. T. The Distribution of Uranium in Tissues of Dogs Administered Uranium Metal or Oxide (U_3O_8) by Oral or Pulmonary Routes. May 1, 1948. Declassified Oct. 22, 1948. 8p. (AECD-2356)

A study of the distribution of U was made in the tissues of 5 dogs given talc, U oxide, or U metal either orally or by pulmonary insufflation over a period of several months. The animals were sacrificed about 3 yr after the last dose was given. High concns. of U were found in the adrenals of all dogs used in this study. All values reported are corr. for fluorescence quenching. Oxide vs. metal by pulmonary insufflation. The dog given U oxide retained approx. 4 times the amt. of U in the lung and kidney cortex as did the dog that received metal. The av. concn. of U in the brain, liver, and spleen is slightly more in the dog that received metal as compared with the oxide-treated animal. Oxide vs. metal by feeding. The concn. of U in the kidney cortex of the dog that received the metal was 6 times that of the dog that received the oxide, and the concn. of U in the brain tended to be somewhat higher in the oxide-treated dog than in the dog receiving the metal. The concn. of U in the bone shaft and rib was much greater in the dog administered the metal as compared with the dog which received the oxide.

- 3347 Nogami, H. H. and Hurley, P. M. "Absorption Factor in Counting Alpha Rays from Thick Mineral Sources." Trans. Am. Geophys. Union 29, 335-40(1948).

By counting α -emission from a thick layer of a powd. sample and applying the appropriate absorption factor, a measurement of the combined U and Th content in most minerals and rocks can be made.

- 3348 Norström, A. and Sillén, L. G. "On the Partition of Uranyl Nitrate between Diethyl Ether and Aqueous Nitric Acid." *Svensk Kem. Tid.* 60, 227-34(1948).

Péligot observed in 1842 that $\text{UO}_2(\text{NO}_3)_2$ is appreciably sol. in Et_2O and used this property for sepg. U from other constituents of pitchblende. This method has since been used repeatedly for analytical and preparative purposes. The present investigation deals with distribution ratios. Aq. solns. contg. a small amt. of $\text{UO}_2(\text{NO}_3)_2$ and varying amts. of HNO_3 and NH_4NO_3 were brought to equil. with Et_2O at 20°C . The distribution ratios of U and acid between the Et_2O and the aq. layer are shown as functions of the acidity of the aq. phase. Two cases were studied: (1) no NH_4NO_3 added, and (2) satn. with NH_4NO_3 . The advantage of adding NH_4NO_3 was observed, and conclusions are drawn for practical work.

- 3349 Nye, R. D. and Demorest, D. J. Extracting Uranium, Radium, and Vanadium from Their Ores. June 1, 1948. (U. S. Patent 2,422,429)

Carnotite and similar ores are ground to about 40 mesh, treated with a heated alk.-carbonate soln. and washed mechanically so as to sep. the Ra- and U-bearing fines and sludge from the sand residue. This wash liq. and sludge is then treated with H_2SO_4 to pH = 5 when a salt such as BaCl_2 is added to ppt. a conc. of V values. The ppt. is filtered and the supernatant soln. and filtrate, contg. the U and Ra values, are made alk. with caustic soda. The resultant ppt. is suitable for extn. of Ra, U_3O_8 , and V_2O_5 by std. processes. V values contained in the sand and previously formed sludge residues are suitable for extn. by the salt-roasting process.

- 3350 O'Connor, P. R. The Chemical Identification of Isotopes Formed in the Bombardment of Uranium with High Energy Particles. Aug. 14, 1947. Declassified Feb. 4, 1948. 41p. (MDDC-1706)

Chapter I is a survey of the isotopes for the elements higher than Bi formed when U is bombarded with 200-mev deuterons. The yield of the various isotopes is given in a table, with the yield of Ba^{140} taken as 1.0×10^7 . In most cases these isotopes seem to be formed by the ejection of many neutrons from the cpd. nucleus, followed by a series of rapid orbital electron capture processes until a relatively stable nucleus is reached. There is no evidence for the formation of shielded isotopes (except U^{237}) in this region but in many cases the half-lives of the isotopes are too long for detection. Chapter II is a study of a no. of elements in the slow neutron fission region in order to obtain a rough yield curve with variation in mass of the isotopes. The relative yields are given in a table. Ests. of error in yield detn. are given in the figure, due either to chem. losses or contamination from other isotopes. In view of the high yields at the wings of the fission yield curve, it was apparent that isotopes below and above the fission region would probably be formed. The following elements were purified to investigate this: Cr, Fe, Ni, and Cu, below, and W, Os, and Au above the fission region. It was found in all these cases that a small amt. of activity was present after purification which could be assigned to known isotopes of these elements. In several cases it was possible to take crude absorption curves to aid in identification, but in most cases there was too small an amt. of activity, which usually consisted of several components, thus making absorption analysis difficult. The only isotopes which can be tentatively identified are β emitters, all on the heavy-mass side of stability. This suggests that the fission region has been extended considerably by bombardment with high-energy particles. Spectrographic analysis of the U metal showed Fe was present as an impurity to the extent of 50 to 100 ppm. However, it is known from previous work that many reactions would occur on Fe that would confuse the U picture quite badly. However, the fact that no positron-emitting isotopes were observed (as expected from reactions on Fe) seems to be fairly good evidence that the isotopes identified are formed from U. Chapter III gives some preliminary results dealing with the yield of various isotopes formed in high-energy deuteron bombardments of U, as a function of deuteron energy. The excitation functions for the formation of the following isotopes are considered: AcX, ThX, At^{211} , and Ba^{140} .

- 3351 Pauling, L. and Ewing, F. J. "The Structure of Uranium Hydride." J. Am. Chem. Soc. 70, 1660-1(1948).

The conclusions of Rundle about the structure of UH_3 are substantiated by considerations of interatomic distances. UH_3 contains a new low valent form of U similar to those of Cr and Mn. In UH_3 each U atom forms 12 bonds with bond no. $\frac{1}{2}$ with the surrounding H atoms, corresponding to a valence of 6 for U'. Each U'' forms 4 such bonds with 4 H atoms and also forms 2 bonds with adjacent U'' atoms at 3.316 Å. The calcd. bond no. for these bonds is 0.16; this gives 2.3 for the valence of U''. The brittleness of UH_3 suggests that it has a filled-Brillouin-polyhedron structure, contg. 49.8 (calcd.) electrons/unit.

- 3352 Pearlman, N. and Sacher, G. A. Changes in Mean Blood Levels of Metallurgical Laboratory Employees during the First Year of Employment, as Related to Working Conditions. June 1946. Declassified June 3, 1948. 7p. (AECD-2030)

Mean levels of several blood elements were investigated for a control group and for groups exposed to radiation and U toxicity hazards in the Metallurgical Lab. at Univ. of Chicago six months and one year after employment. No significant decrease in mean level was found for any blood element. Lymphocytes of the groups exposed to radiation hazards and those of the metal-working groups increased significantly after employment. The increase of lymphocyte count in the exposed groups in excess of a slight increase in the control group is on the borderline of significance ($p = 0.05$). Thus, it is possible that working in the presence of radiation or metal hazards somewhat brings about slight lymphocytosis. Individual daily monitoring indicates that the av. measured exposure is less than 0.1 r/day for all individuals in these groups.

- 3353 Peierls, R. Considerations Regarding Chain Reactions. Sept. 1940. Declassified Feb. 1948. 19p. (B-5; MS-1,2,3, and 4)

This paper consists of 4 sep. reports titled as shown below:

MS-1. On the Possibility of a Slow-Neutron Chain Reaction; MS-2. Speed of Reaction in a Chain Reaction with Slow Neutrons; MS-3. Radioactive Effects of U Chain Reaction; MS-4. Effect of Fast Neutron in Ordinary U.

- 3354 Perlman, I., O'Connor, P. R., and Morgan, L. O. The Bombardment of U^{233} with 44 Mev Helium Ions and the Formation of Pu^{234} . Declassified Sept. 10, 1948. 8p. (AECD-2289)

Pu^{234} has been identified as a product of the bombardment of U^{233} with 44-mev α . Its mass assignment was made by the identification of members of the U^{230} series following its decay. Pu^{234} has a half-life of 8 to 9 hr, and decays by orbital electron capture and α -particle emission in the ratio 100/1. The α particles from Pu^{234} have a range of 4.9 ± 0.1 cm in air at 15°C and 760 mm Hg (6.2 mev). Pu^{236} and Np^{234} were also observed as products of the 44-mev α bombardment of U^{233} . The reactions forming the observed isotopes and the cross sections for these reactions are:

$\text{U}^{233}(\alpha, n)\text{Pu}^{236}$	$0.0005 \times 10^{-24} \text{ cm}^2$
$\text{U}^{233}(\alpha, 3n)\text{Pu}^{234}$	$0.001 \times 10^{-24} \text{ cm}^2$
$\text{U}^{233}(\alpha, p2n)\text{Np}^{234}$	$0.0002 \times 10^{-24} \text{ cm}^2$

- 3355 Pickle, C. B. An Improved Fluorophotometer. Oct. 1, 1946. Declassified Dec. 22, 1948. 14p. (AECD-2433)

This is a description giving operating characteristics of an electronic instrument for measuring the intensity of fluorescence from a mixt. of U and NaF when excited by ultraviolet light. Circuit diagrams and performance curves are included.

- 3356 Pimentel, G. C. and Stevenson, F. R. The Solubility of Uranyl Oxalate and the Existence of Undissociated Uranyl Oxalate in Solution. Sept. 8, 1945. Declassified Sept. 15, 1948. 9p. (AECD-2323)

The soly. of the solid $\text{UO}_2\text{C}_2\text{O}_4 \cdot x\text{H}_2\text{O}$ was measured at various acid and $\text{UO}_2(\text{NO}_3)_2$ concns. The results prove the existence of the complex, $\text{UO}_2\text{C}_2\text{O}_4$, in solns. contg. excess $(\text{UO}_2)^{++}$.

3357 Pincher, C. Into the Atomic Age. London, Hutchinson and Co., 1948. 158p. Fission (particularly of U^{235}) and chain reactions are discussed.

3358 Poole, J. H. J. and Bremner, J. W. "The Emission of α -particles from the Different Faces of a Radioactive Crystal." Phys. Rev. (2), 74, 836(1948).

Mather and Kurie and Merton found no significant difference in the α -ray emission from the various faces of $ThSO_4$ and U nitrate, resp. Mühlestein (Arch. sci. phys. nat. 2, 240(1920)), using U nitrate, found differences as large as 15%. The null effects with U nitrate were confirmed. If the result had been pos., it would have implied that (a) the radioactive nucleus was not spherically symmetrical but had definite axes of symmetry, and (b) the orientation of the nucleus was controlled by the cryst. forces. Nuclei possessing nuclear spin and magnetic moment would fulfill condition (a). Elements of even at. no. and mass have zero spin and zero magnetic moment: U^{238} and Th^{232} fell into this class, so the null effect for them would be expected. U^{235} , U^{233} , and Pu^{239} possess spins greater than zero; this expt. should be tried on cpds. of these isotopes.

3359 Poole, J. H. J. and Bremner, J. W. "Investigation of the Radioactivity of Rocks by the Photographic Method." Nature 161, 884-5(1948).

The photographic method, suggested by I. Joliot-Curie is used to est. the total U and Th content of rocks. The method employed is to place an Ilford Nuclear Research plate at a distance of about 0.1 mm from a flat surface of a specimen cut with a diamond saw, and to expose the plate for 1 to 3 wk, depending on the probable activity of the specimen. More recently, the plate has been placed in contact with the cut surface, as this makes easier the identification of α -ray tracks, which all originate from one nucleus. Enough data have not yet been obtained to det. whether this method will prove possible. A photomicrograph of a very active spot obtained from a Finnish granite is shown.

3360 Prescott, C. H. Jr. The Higher Chlorides of Uranium. December 1947. Declassified Feb. 12, 1948. 3p. (MDDC-1710)

Besides the valence state of 3 which U exhibits in common with other elements of the actinide and lanthanide series, the more common valence states of U are 4 and 6. With chlorine, besides UCl_3 , three other chlorides, UCl_4 , UCl_5 , and UCl_6 , are formed. UCl_4 is the most stable, while UCl_6 evolves Cl_2 starting slowly about $100^\circ C$. UCl_5 disproportionates in vacuum into UCl_4 and UCl_6 with volatilization of UCl_6 above $150^\circ C$. UCl_6 , hitherto unknown, was discovered in attempts to purify UCl_5 by vacuum subn. All the chlorides are stable in dry air but hydrolyze upon access of moisture, UCl_6 being highly reactive. U oxides may be chlorinated with a variety of reagents, some in the vapor phase as described. Liq. phase chlorination of UO_3 , U_3O_8 , or a mixt. of UO_3 and UO_2 in 2:1 ratio yields UCl_5 .

3361 Price, G. R., Ferretti, R. J., and Schwartz, S. The Microfluorometric Determination of Uranium. June 16, 1945. Declassified Sept. 14, 1948. 52p. (AECD-2282)

A rapid and extremely sensitive procedure is described for the microdetn. of U without recourse to preliminary purification. It is based on the measurement of fluorescent light emitted by U in fused NaF irradiated with ultraviolet light. A photoelectric photometer which has been devised for this purpose, is sensitive to the fluorescence from 1×10^{-11} g U or less. Other factors, however, still prevent accurate detn. of amts. less than about 5×10^{-10} g. Exptl. data are presented which show that the method is applicable to both biol. and inorg. material in the presence of even large amts. of quenching impurity. In addn., a theoretical formulation of the quenching process is presented. This agrees with the exptl. data in demonstrating that quenching, under the conditions of the method, is a function of the ratio of quencher to NaF only: it is independent of the ratios of either U to NaF or of U to quencher. The procedure has been applied to the study of urine U excretion in project personnel. The results show very satisfactory correlation with U exposure histories.

- 3362 Radioactive Mineral Deposits. Notes for the Guidance of Prospectors in Australia. Australian Bureau of Mining Research, 1948. 25p. (Geology and Geophysics Pamphlet No. 3)

The properties of U- and Th-bearing minerals are discussed, and typical occurrences described.

- 3363 Reiber, H. H. and Young, H. A. Vapor Phase Chlorination of Uranium Oxides. December 1947. Declassified Feb. 16, 1948. 7p. (MDDC-1729)

U oxides or oxychlorides may be chlorinated with a variety of reagents such as CCl_4 , S_2Cl_2 , SOCl_2 , and even MoCl_5 . Between 400 and 500°C, CCl_4 vapor (often with a sweep gas such as CO_2) will chlorinate UO_2 , UO_3 , U_3O_8 , UO_2Cl_2 , and $\text{U}(\text{C}_2\text{O}_4)_2$. With UO_2 the reaction is $\text{UO}_2 + \text{CCl}_4 \rightarrow \text{UCl}_4 + \text{CO}_2$, the UCl_4 remaining as residue. Small amts. of COCl_2 , UCl_5 , and Cl_2 are formed. Higher oxides give more UCl_5 . The CCl_4 cracks slightly to $\text{C}_2\text{Cl}_6 + \text{Cl}_2$. Vapor phase chlorination with $\text{CCl}_4 + \text{Cl}_2$ or direct chlorination of UCl_4 yields UCl_5 as a subl., or mixed chlorides with as much chlorine as $\text{UCl}_{5.5}$. Vacuum subln. of this product is also discussed.

- 3364 Rekers, P. E. Homotransplantation of the Mammalian Adult Kidney. Dec. 18, 1946. Declassified Feb. 12, 1948. 7p. (MDDC-1764)

During the course of study on the toxicity of U and its cpds. it was found that the incidence and degree of renal damage encountered in industrial and lab. personnel was a great deal less than expected and accordingly less attention need be directed to therapeutic measures. However, because of anticipated renal damage, techniques were developed for transplantation of a normal kidney. A technique is described for the homotransplantation of a kidney in the dog. The transplantation of a kidney to the neck region employing the cannula technique for blood vessel anastomosis was found to be more desirable. Renal function of the homotransplanted kidney lasted from 1 to 5 days. Drawings showing techniques are included.

- 3365 Report on the Electrolysis of Fused U Chlorides for Metal Production. Declassified May 1948. 3p. (BR-77)

The prepn. of UCl_4 by the direct Cl_2 treatment of $\text{U}_3\text{O}_8 + \text{C}$ is reported together with data on the electrolysis of a mixt. of this with 1:1 $\text{NaCl} : \text{CaCl}_2$ as electrolyte. Electrolysis was carried out at 35 amps. The metal was isolated by 5% HOAc leaching of the cathodes in a CO_2 atm. The purity, color, and yields are discussed as is the loss of U by volatilization of UCl_5 from the crude UCl_4 .

- 3366 Rodgers, J. and Neuman, W. F. Titration Studies of Complex Ions of Uranium and Organic Anions. September 1947. Declassified Aug. 11, 1948. 14p. (AECD-2216)

Because of its importance in U toxicology, a program was undertaken to study the behavior and characteristics of the U-citrate complex. Titration data of complexes of citrate and of other homologous anions with $(\text{UO}_2)^{++}$ are reported. A consideration of the data obtained has led to the tentative assignment of a structural formula for the uranyl-citrate complex.

- 3367 Rona, E. Exchange Reactions of Uranium Ions in Solution. January 1948. Declassified Feb. 16, 1948. 1p. (MDDC-1730)

This document is an abstract of a paper presented at the American Chemical Society meeting in April 1948 and is presented here in its entirety.

"Exchange between U(IV) and U(VI) ions in aqueous solution was studied with U^{233} as tracer. The systems investigated were $\text{UCl}_4\text{-UO}_2\text{Cl}_2$, $\text{UOCl}_2\text{-UO}_2\text{Cl}_2$, and U(IV) carbonate—U(VI) carbonate. The rate of the $\text{UCl}_4\text{-UO}_2\text{Cl}_2$ exchange was measured as a variety of temperatures and concentrations. The reaction is of the second order with a heat of activation of 41.7 kcal/mole. The influence of pH was also studied. Exchange in the $\text{UOCl}_2\text{-UO}_2\text{Cl}_2$ system is significantly faster and is also of second order. The U(IV) carbonate - U(VI) carbonate system has been studied in a preliminary way and is also of second order.

Present results indicate that exchange between a non-oxygenated uranium and an oxygenated uranium is slower than between two oxygenated uranium atoms in different oxidation states.

Preliminary results on neptunium will be presented."

(See report AECD-1909(1948) for complete document.)

- 3368 Rona, E. Exchange Reactions of Uranium Ions in Solution. March 1948. Declassified Apr. 20, 1948. 8p. (AECD-1909)

This is the full document of which MDDC-1730(1948) is an abstract. See reference to that report for an abstract.

- 3369 Rosen, L. and Phillips, A. On the Tripartition of U^{235} Nuclei by Thermal Neutrons. Declassified Mar. 29, 1948. 1p. (AECD-1828)

This document is an abstract and the entire text is presented here.

"By making use of a triple ionization chamber, a triple coincidence circuit and a gated 10 channel amplitude discriminator, it was been found possible to set an extremely low limit on the frequency of triple fissions in the case that none of the fragments have either very low energies or very low masses. Pulses from all three ionization chambers were amplified and fed to the triple coincidence circuit within its resolving time ($1 \mu s$) the 10 channel amplitude discriminator was triggered and the pulse from counter II recorded. If this pulse was greater than 105 mev, it was assumed to be due to two fragments from two different fission events and thus was discarded. This made it possible to eliminate about 80% of the accidental coincidences. The results of this experiment are as follows: Frequency of tripartition when each fragment has an energy greater than 25 mev and a mass greater than 20 mass units (charge greater than 10 electronic charges) is less than one per 2×10^5 binary fissions. Frequency of tripartition in the case of symmetric fission is less than one per 10^6 binary fissions."

- 3370 Rothstein, A. Uranium Tetrafluoride. Two One-Year Inhalation Toxicity Studies of Animals at 3.0 and 0.5 mg/m³, Respectively. Feb. 17, 1948. Declassified Mar. 25, 1948. 41p. (AECD-1919)

One yr of exposure to inhalation of 3 mg of U/m^3 as UF_4 dust resulted in definite but mild signs of toxicity in some animals of each of 4 species, the dog, the rabbit, the guinea pig, and the rat, but a similar 1-yr exposure to 0.5 mg of U/m^3 as UF_4 resulted in no observable signs of toxicity in dogs and barely detectable signs in only 4 of 105 rats. The toxic effects were related to mild renal changes similar to those found in previous 30-day studies. No deaths, alterations in growth rate, hematological counts, blood nonprotein N, urinary protein, or dental fluorosis attributable to exposure to U were observed. There was, however, an elevation of the urinary ratio of amino acid to creatinine in rabbits and there was storage of U in bones, lung, kidney, and pulmonary lymph nodes.

- 3371 Rothstein, A. and Larrabee, C. The Cell Surface of Yeast as the Site of Inhibition of Glucose Metabolism by Uranium. Feb. 18, 1948. Declassified May 6, 1948. 19p. (AECD-1981)

Yeast cells suspended in a dil. soln. of $UO_2(NO_3)_2$ rapidly take up U. A rapid phase of U-uptake, complete in less than 2 min, is followed by a very slow uptake continuing for at least 3 hr. At the end of the rapid phase, the concn. of U in the cells is at least 50 times that in the medium, suggesting that a highly undissocd. complex of U is formed. The relationship between U uptake and the U concn. of the medium resembles a titration curve. With low U concns., nearly all of the U is taken up, but as the U concns. of the medium is raised, the uptake reaches a max. value, which is independent of further increases. Such behavior is inconsistent with the concept of U diffusion into the cell. Other data inconsistent with the concept of penetration of U into the cell include (1) the max. concn. of U-complexing groups, as calcd. from U uptake, is less than 1% of the calcd. U-complexing capacity of the aq. phase of the cytoplasm, and (2) inhibition of glucose metabolism by U can be reversed by adding to the medium 2% of the inorg. phosphate already present in the cytoplasm. It is suggested that the rapid phase of U uptake is associated with the formation of a complex with groups on the cell surface. Possibly the

slow cont. phase of uptake is associated with penetration into the cell. (This paper is also available in J. Cellular Comp. Physiol. 32, 247-59(1948).)

- 3372 Rothstein, A., Frenkel, A., and Larrabee, C. Certain Characteristics of the Complex of Uranium with Cell Surface Groups of Yeast. The Relationship of These Groups to Glucose Metabolism. Declassified Apr. 28, 1948. 21p. (AECD-1968)

$\text{UO}_2(\text{NO}_3)_2$ in low concns. inhibits the anaerobic consumption of glucose to a max. of about 90%. About 10% of glucose consumption is not poisoned by U. The relationship between inhibition, the initial U concn., and the yeast concn. involves a family of S-shaped curves, one for each yeast concn. As the yeast concn. is raised, a higher initial U concn. is required to attain a given inhibition. From the relationship between inhibition, initial U concn., and yeast concn., certain predictions can be made on the basis of simple assumptions:

1. If it is assumed that U forms a dissociable complex with certain "groups" necessary for the metabolism of glucose, thereby reducing the available concn. of those groups, then on the basis of the mass law, it can be predicted that at a fixed inhibition, the initial U concn. should be proportional to the yeast concn. with an intercept equal to the equil. concn. of free $(\text{UO}_2)^{++}$ in the medium. Such is the case.
2. If it is further assumed that the % inhibition is equal to the % of the total cell "groups" complexed with U, then a prediction can be made concerning the relationship of U uptake by the cells to the inhibition. The predicted values were found to check reasonably well with the experimentally detd. U uptake. It is implied in the preceding assumption that U complexes with some substrate for an enzyme and that the rate of glucose consumption is proportional to the concn. of enzyme not complexed by U.

The reaction between U and the yeast cell "groups" (Y), involved in glucose metabolism is of the form $\text{U} + \text{Y} \rightleftharpoons \text{UY}$ and the dissocn. const. is about 2.5×10^{-7} . There are about 4×10^7 active "groups" per cell. In addn. to the U complex associated with inhibition, there are two other complexes formed which are not involved in glucose metabolism; one involves 0.5×10^7 groups per cell, and a lower dissocn. const., and the other 2 to 2.5×10^7 groups per cell, and a higher dissocn. const. than that for the complex associated with inhibition. (This paper is also available in J. Cellular Comp. Physiol. 32, 261-74 (1948).)

- 3373 Rothstein, A. and Larrabee, C. "The Relationship of the Cell Surface to Metabolism. II. The Cell Surface of Yeast as the Site of Inhibition of Glucose Metabolism by Uranium." J. Cellular Comp. Physiol. 32, 247-59(1948).

This paper is similar to report AECD-1981(1948).

- 3374 Rothstein, A., Frenkel, A., and Larrabee, C. "The Relationship of Cell Surface to Metabolism. III. Certain Characteristics of the Uranium Complex with Cell Surface Groups of Yeast." J. Cellular Comp. Physiol. 32, 261-74(1948).

This paper is similar to report AECD-1968(1948).

- 3375 Rundle, R. E., Baenzinger, N. C., Wilson, A. S., and McDonald, R. A. "The Structure of the Carbides, Nitrides, and Oxides of Uranium." J. Am. Chem. Soc. 70, 99-105(1948).

This paper is similar to report MDDC-1608(1947).

- 3376 Rundle, R. E., Baenzinger, N. C., Newton, A. S., Daane, A. H., Butler, T. A., Johns, I. B., Tucker, W., and Figard, P. The System Uranium-Nitrogen. Declassified Jan. 23, 1948. 22p. (AECD-2247)

The U-N system has been subjected to chem. and x-ray study. The results of these studies are summarized. The U nitrides are UN, U_2N_3 , and UN_2 . Nitrides of compns. between U_2N_3 and UN_2 exist as single phases of intermediate structure. Reaction of oxide-free U metal or UH_3 with N_2 or NH_3 at elevated temps. and ordinary pressures produces a nitride of the approx. compn. $\text{UN}_{1.75}$. This nitride can be reduced with H_2 to U_2N_3 . The higher nitride, UN_2 , can be obtained only at high pressures (about 1800

psi). UN can be obtained from any higher nitride by thermal decompn. above 1300°C. UN₂ has the CaF₂ structure, while U₂N₃ has the closely related Mn₂O₃ structure, and phases of intermediate compn. have intermediate structures. The vol. decreases with increased N content within the compn. range U₂N₃ to UN₂. UN has the NaCl structure. Solid solys. in the two phase area from metal to UN and from UN to U₂N₃, have been studied at room temp. by x-ray diffraction. Solid solys. appear to be very slight in both regions. 15 references are given.

- 3377 Rundle, R. E., Wilson, A. S., Baenzinger, N. C., and Tevebaugh, A. D. X-Ray Analysis of the Uranium-Carbon System. Declassified Sept. 30, 1948. 10p. (AECD-2325)

The only U carbides found at ordinary temps. are UC and UC₂. There is good reason to believe that the sesquicarbide U₂C₃ is formed above 2000°C but cannot be quenched to room temp. UC is face-centered cubic, $a = 4.951$ A, with the NaCl structure. UO and UN are isomorphous with UC and O and N can replace C in UC. UC₂ is body centered tetragonal with the LaC₂ structure, as has been reported in the literature. The lattice parameters are: $a = 3.52$ A and $c = 5.99$ A. The solys. of both U and C in UC must be small since the UC spacing is not a function of compn. There is evidence for soly. of C in UC₂, but the soly. is not pronounced.

- 3378 Rundle, R. E., Wilson, A. S., and McDonald, R. A. The X-Ray Investigation of the Uranium Hydrogen System: the Structure of UH₃. July 7, 1945. Declassified Sept. 15, 1948. 14p. (AECD-2309)

The U-H system has been examined by x-ray diffraction. This study has revealed one cubic hydride, UH₃. Since the structure of the hydride is unrelated to the structures of any of the forms of the metal and the hydride has a definite compn. it is not an interstitial solid soln. but a true cpd. The soly. of H₂ and U in UH₃ are so slight that they do not affect the hydride spacing by more than 0.001 A. The hydrides UH₃ and UD₃ have the following x-ray lattice dimensions and d.:

	A	d.
UH ₃	6.6310 ± 0.008 A	10.92
UD ₃	6.620 ± 0.002 A	11.11

The structure of UH₃ has been detd. The positions of the metal atoms in the simple cubic unit are $2U'$ in $(0\ 0\ 0)(\frac{1}{2}\ \frac{1}{2}\ \frac{1}{2})$, and $6U''$ in $(\frac{1}{4}\ \frac{1}{2}\ 0)(\frac{3}{4}\ \frac{1}{2}\ 0)$. 17 references are included.

- 3379 Rundle, R. E. and Wilson, A. S. The Structures of Some Metal Compounds of Uranium. Declassified Nov. 10, 1948. 12p. (AECD-2388)

The cpds. UAl₂, UAl₃, UAl₅, UHg₂, UHg₄, and USn₃ have been studied. These cpds. all have std. type structures except UHg₄ and UAl₅, which are quite complex. UHg₄ appears to be a distortion of a body-centered cubic arrangement. The structure of UAl₅ remains unknown. (This paper is also in Acta Cryst. 2, 148-50(1949).)

- 3380 Sacconi, L. "Inorganic Chromatographic Adsorption." Gazz. chim. ital. 78, 583-91(1948). The chromatographic behavior of the following ions was studied, Ti^{+4} , U^{+4} , Ti^{+3} , and Ce^{+3} , and their sepn. from the major part of the other ions performed. The expts. reported prove that the "basic" adsorption of many of the cations is not due to the alkyl. of the alumina but rather due to a specific action of the alumina itself.

- 3381 Salts of U. Declassified May 1948. 2p. (BR-65)

Very brief descriptions of methods of prepn. for UCl₄, UCl₅, UCl₆, KUF₅, NaUF₅, UF₆, and UF₄ are given. In several incomplete references to more complete data on the method are given.

- 3382 Samoilov, B. N. "Absorption and Luminescence Spectra of Uranyl Salts at Temperatures of Liquid Helium." *Zhur. Eksptl. Teoret. Fiz.* 18, 1030-40(1948).

Absorption and luminescence spectra of the following uranyl salts were investigated at 4.2°K: potassium uranyl sulfate, uranyl sulfate, uranyl chloride, uranyl acetate, and sodium uranyl acetate. The results are given in detailed tables and photographs of spectra. At the temp. of liq. air a preliminary study was made of the polarization properties of uranyl acetate and sodium uranyl acetate. Although belonging to the isometric crystallographic system, the latter salt showed some remarkable polarization phenomena, viz, the circular polarization observed on certain lines of the luminescence spectrum, and the circular dichroism of two lines of the absorption spectrum.

- 3383 Samson, S. and Sillén, L. G. "The Crystal Structure of Barium Uranate: the Absence of UO_4 Groups." *Arkiv Kemi, Mineral. Geol.* A25, Paper No. 21, 16p. (1948)

U differs from the related Cr, Mo, and W in that all uranates are insol., while alk. chromates, molybdates, and tungstates are, as a rule, readily sol. The authors assumed that this striking difference was related to the increasing radii of the 6-valent ions, from Cr to U: whereas CrO_4 groups are probably well developed in the chromates, and the corresponding tetraeders are known to show certain deformations in molybdates and tungstates, the radius of the U^{+6} ion must be too large to allow of a stable tetraeder grouping of the O ions. This assumption was tested experimentally on BaUO_4 , (it was proposed to use BaU_2O_7 in the near future). A complete lattice detn. was made, which confirmed the predicted absence of UO_4 groups. This structure should account for the nonsol. of the uranates. (Taken from *Nuclear Science Abstracts*)

- 3384 Sannie, C. "Cytotoxicological Methods." *Ann. méd. légale criminol. police sci. méd. sociale toxicol.* 28, 91-5(1948).

This paper is a discussion of results obtained on the toxicity of 32 ions ($(\text{NH}_4)^+$, K^+ , Rb^+ , Cs^+ , Li^+ , Ag^+ , Th^+ , Th^{+4} , Cu^{++} , Hg^{++} , Pb^{++} , Mg^{++} , Ca^{++} , Sr^{++} , Ba^{++} , Be^{++} , Zn^{++} , Cd^{++} , Mn^{++} , Ni^{++} , Co^{++} , $(\text{UO}_2)^{++}$, Cr^{+3} , Fe^{+3} , Al^{+3} , Y^{+3} , La^{+3} , Ce^{+3} , Pr^{+3} , Dy^{+3} , Au^{+3} , Pt^{+4}) to fibroblasts and other tissues in tissue culture.

- 3385 Scheminzy, F. "Photography of the Fluorescence Spectrum of Faint or Millimeter-Sized Light Sources." *Spectrochim. Acta* 3, 191-205(1948).

The author describes the construction of a miniature spectrograph which he had previously developed for use with a Contax camera and hand spectroscope for the photography of fluorescence spectra. This instrument produces good photographic spectra with superimposed wavelength scale with relatively short exposure times even in the case of samples smaller than 1 mm. The manipulation of this instrument is discussed and the exposure devices are described. Suggestions are given for the choice of an objective, the most suitable emulsions, development procedure, and color photographs. In the discussion of the bands characterizing the fluorescence spectrum of U compds., the author points out that there is a band at about 663 $\text{m}\mu$ which has previously been overlooked on account of insufficient red sensitivity. Accordingly, the spectrum of U-NaF beads possesses seven bands.

- 3386 Schubert, J. and Cohn, E. C. Diffusion Coefficients of Carrier-Free Fission Products in Uranyl Nitrate and Acid Solutions. May 1944. Declassified Nov. 8, 1948. 5p. (AECD-2377)

In the expts. reported here, the diffusion coeffs. of radiotracers from U fission were measured under conditions where the compn. of the bulk electrolytes in both the upper and lower cells of McBain-Northrop sintered-glass diaphragm cells were identical except for the presence of about 10^{-14}M of radiotracer in the upper cell. The techniques, calcs. and calibration procedures employed were essentially those described by McBain and Liu in *J. Am. Chem. Soc.* 53, 59(1931). A table is presented which gives the diffusion coeffs. of the carrier-free fission products Ba^{140} , Sr^{89} , La^{140} , Zr^{95} , Nb^{95} , Ru^{103} , Te^{132} in $\text{UO}_2(\text{NO}_3)_2$, in HNO_3 , and H_2SO_4 solns. at 25 °C. 9 references are given.

- 3387 Schumar, J. F. Uranium, Thorium, and Beryllium Melting and Fabrication. Mar. 23, 1948. Declassified Apr. 1, 1948. 9p. (AECD-1851)

The difficulties encountered in casting these metals are listed, and the precautions taken against them discussed. Some of the mech. properties of U, Th, and Be are given, and the methods of fabrication of each of the metals are outlined in some detail. Because of their extreme reactivity with O₂ both Be and U are cast in a vacuum or under protection of inert gases. Be has been successfully cast in dry and purified A or He atms. On the other hand, U, which reacts with even small amts. of O₂ (that are difficult to remove from inert gases), is cast in a vacuum. Seven photographs are included.

- 3388 Schwab, G. M. ed. in chief. Handbuch der Katalyse. VII. Band. Katalyse in der Organischen Chemie. R. Criegee, ed. Vienna, Springer-Verlag, 1943. (Ann Arbor, Mich, J. W. Edwards, 1948.)

The uses of U and U cpds. in org. synthesis are discussed in Part 1 pages 104, 361, 362, 429, 453, 461, 476, 553, 558, 561, 563, 575, 585, 613, and 614 and in Part 2 pages 53, 60, 117, 154, 165, 169, 178, 394, 494, 510, 547, 548, and 564.

- 3389 Schwartz, S. Biochemical Studies Relating to the Effects of Radiation and Metals. Jan. 11, 1947. Declassified Aug. 4, 1948. 77p. (AECD-2198)

Various biochemical effects of radiation have been studied in 10 patients given total body x-ray in total doses of 75 to 310 r (skin), in 5 patients given 20 to 36 mc P³², and in 5 project personnel accidentally exposed to excessive doses of ext. radiations. Similar studies have also been made of several hundred project personnel exposed in most instances to relatively small amts. of U, Pb, and other metals, and to chem. and radioactive sources. These studies included the investigation of liver function, of white blood cell chem., and of various urinary constituents such as coproporphyrin, urobilinogen, "corticosteroid-like" substances, catalase, and U. Definitely excessive exposures resulted in various abnormalities in the above tests. With the exception of urinary U analysis, none of them were specific in indicating overexposure to either radiation, metals, or chems. When interpreted in the light of the exposure and medical history, however, they may aid in the clinical interpretation of relatively marked overexposure. In addn., they may afford further insight into the nature of radiation effects. The literature on the biochem. effects of radiation is reviewed briefly, and certain suggestions are offered regarding future investigations in this field. 119 references are included.

- 3390 Schwartz, S. Chapter VI. Biochemical Effects of Uranium Poisoning. November 1946. Declassified Apr. 9, 1948. 11p. (AECD-1993-F)

The present survey is limited to a brief summary of reported studies and to a consideration of investigations made in the lab. at the Univ. of Chicago. Two periods may be considered in analyzing the biochem. effects of a single toxic or lethal dose of U. The early period is detectable within a few hr after administration of U and generally lasts 1 to 4 days. It is characterized by albuminuria, and commonly by increased per diem excretion of H₂O and a no. of other metabolites such as glucose, Cl, and P. Signs of N retention appear by the second day. Concns. of blood nonprotein N, urea N, and creatinine increase progressively. Impairment of liver function, as reflected by diminished excretion of phenyltetrachlorophthalein has been reported within 3 days after administration of 2 mg of U nitrate/kg body weight to dogs. The later period is characterized especially by increasing oliguria, and eventually by anuria on about the fifth to seventh day if the outcome is fatal. Excretion of nearly all metabolites decreases. If the animal survives 12 days it will usually recover. By this time glycosuria is nearly always absent, and albuminuria is sporadic. Urine specific gravity may remain low for several weeks. In animals injected repeatedly with U, it is claimed that liver damage becomes of paramount importance, and death may be due to disease of this organ rather than to that of the kidney. Death in such animals may be associated with severe hypoglycemia. Hg, cantharidin, K₂Cr₂O₇, and other nephrotoxins, also produce blood and urinary alterations similar to those of U poisoning. Chief emphasis in investigations by the authors was placed on the exploration of new procedures which might be of value in the early diagnosis of overexposure to U in humans. For this reason, considerable study was made of personnel at Iowa State College. Investigations by E. S. G. Barron and his coworkers at the Univ. of Chicago confirmed the great sensitivity

of the nonprotein-N detn. as an early indication of U poisoning in animals. Special consideration was given the study of U excretion in the urine of project personnel, since it alone might be expected to yield specific information on the degree of exposure to this metal. Good correlation was found between the urinary U concn. and the history of exposure to U. Studies by the authors confirmed earlier studies by the Univ. of Rochester group on the elevation of urinary catalase following the administration of U to rabbits. In these animals, catalase excretion increased within the first 24 hr, reached a peak after several days, and returned to normal in 1 to 2 weeks. In rabbits injected with 2 to 5 mg U nitrate/kg body weight there is a prompt reduction in the urinary excretion of coproporphyrin. Rabbits given 0.5 to about 2 mg U/kg body weight show a gradual increase in urinary coproporphyrin excretion, generally to 2 to 3 times above control values. Several members of the Metallurgical Lab. at the Univ. of Chicago who worked with UO_2F_2 consistently excreted increased amts. of urinary coproporphyrin. A marked fall in the excretion of urinary inorg. S was found in rabbits injected with 1.5 to 4 mg U nitrate/kg body weight. Essentially no significant abnormalities were found in the routine urinalyses of project personnel exposed to U. In rabbits injected with 3 to 5 mg U nitrate/kg body weight, the authors were especially impressed by the marked fall in urine specific gravity.

- 3391 Seaborg, G. T. and Perlman, M. L. "Search for Elements 94 and 93 in Nature. Presence of 94²³⁹ in Pitchblende." J. Am. Chem. Soc. 70, 1571-3(1948).

This report describes a careful search for Np and Pu in a sample of pitchblende conc. obtained from the Great Bear Lakes region of Canada. A chem. method for sepg. and concg. these elements from U and Th was applied to a sample of the pitchblende. A final fraction of Np and Pu pptd. with rare-earth carrier was counted for fissions with slow and with fast neutrons, and an upper limit of 1 part in 10^8 to 10^9 was set for the amt. of these elements in the sample. Based on the no. of α -particle counts in the sample, 1 part in 10^{14} is estd. as the amt. of 30,000-year Pu^{239} in the original pitchblende conc.

- 3392 Secoy, C. H. The System Uranyl Sulfate-Water. I. Temperature-Concentration Relationships Below 300°C. Jan. 28, 1948. Declassified Feb. 16, 1948. 9p. (MDDC-1767)

The temp.-concn. diagram for the system $\text{UO}_2\text{SO}_4\text{-H}_2\text{O}$ is presented and the results discussed. The stable hydrates are the trihydrate and monohydrate. A dihydrate, metastable with respect to the trihydrate, was formed under certain conditions. The ice-trihydrate eutectic was found at -38.5°C and at a compn. of 3.82 molal. The soly. of the trihydrate increases with temp. to the transition to the monohydrate at 181°C and a concn. of 8.66 molal. The monohydrate shows retrograde soly. Activity coeffs. for UO_2SO_4 , calcd. from the f.p. data without benefit of heat capacities, agree well with those of other bivalent metal sulfates at concns. below 1 molal but rise more rapidly than those for the other sulfates above this concn. Investigation at higher temps. with a 1 molal soln. shows that at about 325°C a second liq. phase appears. The aq. phase undergoes crit. transformation at or very near the crit. temp. of pure H_2O , indicating that the soly. of salt in H_2O has reached a very low value at or below that temp. (This information is also available in J. Am. Chem. Soc. 70, 3450-2(1948).)

- 3393 Secoy, C. H. The System Uranyl Sulfate-Water. II. Temperature-Concentration Relationships above 250°C. July 7, 1948. Declassified Sept. 1, 1948. 12p. (AECD-2265)

App. for the study of the soly. of salts in H_2O to temps. above the crit. point of H_2O is briefly described. The soly. of $\text{UO}_2\text{SO}_4\text{-H}_2\text{O}$, the stable solid phase in this region, has been followed from 181 to 375°C . Its soly. decreases with rising temp. to about 240° and increases above this temp. Solns. with a concn. below 82.7% UO_2SO_4 display a two-liq.-phase region below the crit. temp. of H_2O . This phenomena has heretofore not been reported for solns. of electrolytes. Both arms of the curve bounding the two-liq.-phase region are followed to the crit. temp. of H_2O . The soly. of salt in H_2O has very nearly reached zero at 350° and, since the aq. phase always undergoes the crit. change at 374.4° (the crit. temp. of pure H_2O), it must have reached zero at or below this temp. The lower crit. soln. temp. of the two-liq.-phase region is 294° and the crit. concn. is 30% UO_2SO_4 . (This information is also available in J. Am. Chem. Soc. 73, 3343-5(1950).)

- 3394 Secoy, C. H. "The System Uranyl Sulfate-Water. I. Temperature-Concentration Relationships below 300°." J. Am. Chem. Soc. **70**, 3450-2(1948).

This paper contains information similar to that in report MDDC-1767(1948).

- 3395 Seybolt, A. U. Preparation and Properties of Some Gold Alloys. Sept. 30, 1943. Declassified Dec. 21, 1948. 10p. (AECD-2434)

Samples of Au and 5 Au alloys were prepd. and tested for hardness, yield strength in compression, and d. The alloys contained approx. 5% and 10% Ni, and 10% each of Mn, Fe, and U. Ni was by far the most potent addn. for hardening and strengthening; a yield strength (0.2% offset) of about 69,000 psi was found for the alloy with 10% compared with 5800 psi for pure Au. All alloys were less dense than Au, 10% Ni having a d. of 17.06, 10% U, 18.6. The Au-Mn and the Au-Fe alloys showed some age hardening effects.

- 3396 Short, H. G. and Dutton, W. L. "Determination of Rare Earth Elements and Yttrium in Uranium Compounds." Anal. Chem. **20**, 1073-6(1948).

Using a Hilger Automatic Littrow model spectrograph furnished with quartz and glass trains, the authors have developed a method for the detn. of rare-earth elements together with Y in U and its cpds. The extrn. of rare-earth complexes was attempted with org. solvents (cupferron at various pH values, sodium diethyldithiocarbamate, and benzoin oxime, sebacic and other org. acids, α -naphthol, and α -nitroso, β -naphthol) but no satisfactory method could be found. Direct pptn. as oxalate, hydroxide using NH_3 , and fluoride also proved unsatisfactory. It is seen that the bulk of the U must be sepd. first. This was done by extrn. of an Et_2O soln. of nitrates with small amts. of H_2O , whereby the rare earths pass into the aq. layer. The rare earths are then pptd. as fluorides and subsequently purified as hydroxides. The spectrographic method may then be used. High sensitivity is obtained. The lines used for identification and estn. of the elements are given, as are data on the recoveries and detn.

- 3397 Singer, T. P., Muntz, J. A., Meyer, Joe, Gasvoda, B., and Barron, E. S. G. Inhibition of Enzymes by Uranium. Feb. Declassified May 11, 1948. 45p. (AECD-2021)

The effect of $\text{UO}_2(\text{NO}_3)_2$ on the activity of 28 enzyme systems, many of them in pure cryst. state, has been studied. Some of the enzymes (succinoxidase, hexosemonophosphate oxidase, lysozyme) were completely inhibited; others (pyruvate dismutation, pancreatic esterase, cytochrome oxidase, monoamine oxidase, carboxypeptidase, cathepsine, urease) were partially inhibited; and still others (hexokinase, choline oxidase, pyruvate oxidase) were slightly inhibited. 15 other enzymes were not affected. The combination of U with the protein moiety of enzymes is reversible. Enzyme reactivation of different degrees occurred on addn. of citrate, α -hydroxyaspartate, oxaloacetate, malate, tartrate, malonate, and oxalate. Reactivation is the consequence of successful competition for U that is thereby removed from its combination with protein. The most powerful competitors for U seem to be substances that form cyclic complex cpds. where union between the metal and the org. acid is through both ionic and covalent bonds.

- 3398 Smales, A. A. "Monazite from Bodmin Moor. A Study in Geochronology. II. Analysis of Bodmin Moor. Monazite for Lead-Thorium and Uranium." Proc. Roy. Soc. Edinburgh, **63**, 125-9(1948).

This paper describes the method of microanalysis and the polarographic detns. made for Pb, Th, and U in detrital monazite from Bodmin moor, Cornwall, southwest England, in connection with detns. of apparent age.

- 3399 Smith, F. A. and Dziuba, S. P. Preliminary Observations on the Uranium Content of Photographic Materials. Dec. 22, 1948. 7p. (AECU-106)

Fluorophotometric analysis of U content of 11 photographic materials, manufactured on a commercial basis, showed quantities of U ranging from less than 0.2 μg U/g to 1.19 μg U/g of sample.

- 3400 Smith, G. G., Orlemann, E. F., Smales, A. A., Rothenberger, C. D., and Grimes, W. R. Colorimetric Determination of Uranium with l-Ascorbic Acid. Nov. 7, 1947. Declassified June 4, 1948. 28p. (AECD-2101)

U^{+6} in weakly acid soln. buffered with $(OAc)^{-}$ produces with a large excess of l-ascorbic acid a yellow-brown color whose intensity is a linear function of U concn. up to at least 15 mg U/50 ml. The color intensity is independent of pH in the range 4.5 to 4.8 but adjustment of the pH to 4.0 ± 0.1 is recommended to minimize the danger of slow pptn. of hydrous ferric oxide. Addn. of pyridine along with $(OAc)^{-}$ buffer minimizes the interference of Cu^{++} . The color intensity is a function of concn. of $(OAc)^{-}$ and of l-ascorbic acid so the amts. of these reagents used must be closely controlled. Cl^{-} , $(NO_3)^{-}$, and $(ClO_4)^{-}$ are without appreciable effect on the color produced. The anions such as phosphate, fluoride, sulfate, citrate, tartrate, and oxalate, which are capable of producing stable complexes with U in weakly acid soln., interfere with the detn. of U by lowering the intensity of the color produced. Moderate amts. (at least 25 mg) of Fe, Cd, Mn, Na, Ca, Sn, Mg, and Th are without effect on the method. Cr and V interfere as do significant amounts of Ni, Zn, Mo, and Al.

- 3401 Smith, S. B. Polarographic Determination of Uranium in Dust Samples. Aug. 30, 1943. Declassified Oct. 15, 1948. 17p. (AECD-2381)

Samples of dust collected from the atm. with an electrostatic precipitator were analyzed for U by means of a dropping Hg electrode app. 2 to 3 γ U can be detected in a cell soln. vol. of 1 ml. Fe, Ni, and Cr present in shop dusts did not interfere. Cu might interfere if present in excess but may be removed by a sulfide pptn. Directions for the prepn. of cell solns. and the operation of the polarograph are given. The polarographic method described may be used for the detn. of U in samples other than atm. dusts.

- 3402 Spedding, F. H., Daane, A., Johns, I. B., Johnson, O., Newton, A. S., Nottorf, R. W., and Warf, J. C. Preparation and Physical Properties of Uranium Hydride. Declassified Apr. 5, 1948. 44p. (AECD-1852)

The prepn. of UH_3 is described and its compn. shown. It has a d. of 10.95 g/cm³ and has a simple cubic crystal structure with 8 U atoms per unit cell. Data for the equil. H_2 pressure are given for temps. between 250 and 430°C with -31,000 cal/mole as the heat of formation. The pressure-compn. isotherm as well as other data indicates that UH_3 is a true cpd. with no appreciable soly. for U or H_2 . Similar data are reported for UD_3 . H_2 - D_2 sepn. studies show that the decompn. of UH_3 - UD_3 mixts. gives low sepn. factors.

- 3403 Spiegl, C. J. The Toxicity of Uranium Hexafluoride Fume in Animals Exposed for One Year to 0.05 and 0.2 mg U/m³, Respectively. Feb. 5, 1948. Declassified Apr. 7, 1948. 65p. (AECD-1918)

Groups of animals were exposed to fumes of UF_6 in air in order to evaluate chronic toxicity and to est. a "max. tolerated concn." One month was used for acclimatizing the animals and for establishing control biochem. values. For the next successive 12 months, 21 dogs, 185 rats, and 16 rabbits were exposed to 0.2 mg U/m³, and 17 dogs, 179 rats, and 30 guinea pigs, to 0.05 mg U/m³. Rabbits and guinea pigs were studied during only the last 9 months.

- 3404 Sprague, G. J. Jr. Control Exposure Chamber Studies. Jan. 9, 1948. Declassified Feb. 16, 1948. 55p. (MDDC-1731)

Data have been collected and evaluated on 12 dogs, 194 rats, 31 rabbits, and 30 guinea pigs serving as controls for 12 U-dust-exposure studies performed at extremely low concns. of U for a period of 1 yr. The results of more than 31,000 sep. observations have been summarized and have included chamber control data of nuisance dust concn., temp., humidity, mortality, weight response, histologic findings, biochem. changes, dental changes, hematology, and analysis of animal tissues. Most arresting was the incidental observation that a conditioning period of approx. 4 months is indicated before animals come into equil. with the conditions imposed by daily exposure as judged from a study of weight records and biochem. changes. Evidence from these studies indicates the dog was the species most consistently normal in biochem. response and from a histologic standpoint of any species studied. The dog was, therefore, considered to be best suited for use in U-dust-inhalation studies.

- 3405 Stacey, [M.] and Wilkinson, [D. H.?] The Production of UCl_4 from U_3O_8 . Feb. 28, 1942. Declassified June 1948. 1p. (BR-176)
The conversion of UCl_5 to UCl_4 by heating (400°) in CO_2 for 1 hr is described. The direct chlorination of U_3O_8 with C and S_2Cl_2 is noted and a yield of 87% is reported upon conversion without S cpds. present at about 500° .
- 3406 Stakman, E. C., Daly, J. M., Gattani, M. L., and Wahl, I. "Variation Induced by Uranium Nitrate in Corn Smut and the Cultivated Mushroom." Science **108**, 554-5(1948).
This is a discussion of the variations obtained with liq. and agar growth media at $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ concns. of 0.5 to 1.0 g/l.
- 3407 Steadman, L. T. A Spectrochemical Method for the Determination of Uranium. Aug. 10, 1948. Declassified Sept. 1, 1948. 19p. (AECD-1267)
A spectrochem. method for the analytical measurement of U is described. It is applicable to various source materials including animal tissues and fluids, ores, soil, and vegetation. A d.c. C-arc method is employed with a medium quartz spectrograph. The U may be isolated and concd. by an Et_2O extrn. procedure. The range of measurement is 0.05 to 10 γ U on the arc. The std. error is about $\pm 15\%$.
- 3408 Steadman, L. T. "A Spectrochemical Method for the Determination of Uranium." Anal. Chem. **20**, 1127(1948).
This is an abstract of a paper presented at the 33rd meeting of the Optical Society of America, Oct. 21 to 23, 1948 in Detroit. See report AECD-2267(1948) for complete paper.
- 3409 Steinberg, E. P., Seiler, J. A., Goldstein, A., and Dudley, A. Fission Yields in Uranium 233. Nov. 1, 1947. Declassified Jan. 6, 1948. 11p. (MDDC-1632)
A survey of the radiochem. methods for the detn. of fission yields is presented. The yield-mass spectrum resulting from the slow neutron fission of U^{233} is reported and the data are compared with similar spectra for U^{235} and Pu^{239} . The accurate detn. of fission yields by the radiochem. method involves a rather comprehensive study of the radiochem. of the fission products, of their decay schemes, radiations, genetics, and of the accurate measurement of fission rates and α - and β -disintegration rates. From the definition of fission yield, it follows that the abs. yield of a nuclide is given by
- $$\text{yield (\%)} = \frac{\text{no. atoms formed directly and/or by decay} \times 100}{\text{no. of fissions}}$$
- The no. of atoms formed is detd. by radiochem. analysis for the nuclide. The no. of fissions occurring in the sample of fissionable material during the neutron irradiation is detd. by direct count in a pulse ionization chamber.
- 3410 Sverdlov, Z. M. and Sevchenko, A. N. "Prolonged Photoluminescence of Uranyl Compounds at the Temperature -185°C ." Doklady Akad. Nauk S.S.S.R. **61**, 821-3(1948).
Crystals of various uranyl salts were illuminated by ultraviolet rays at -185°C . It was found that short waves ($\lambda \cong 250.0 \text{ m}\mu$) produced a luminescence effect of 5 to 8 sec. duration, while long waves ($\lambda \cong 366.0 \text{ m}\mu$) produced no measurable effect. Uranyl salts are thus capable of a prolonged photoluminescence (at low temp.), not observed by previous experimentors who had found a cathode luminescence only (Nichols and Howes, (1919)). The present authors obtained the spectrum of the prolonged photoluminescence of potassium-uranyl sulfate. Although showing the bands of the luminescence spectrum of uranyl salts (Wawilow and Lewschin, Z. Physik **48**, 397(1928)), the spectrum lacks the characteristic discrete structure of the bands at -185°C ; it also lacks the lines 511.5, 534.2, and 558.9 $\text{m}\mu$ which correspond to purely mol. transitions in the crystal.

- 3411 Tannenbaum, A., Silverstone, H., Schwartz, S., and Barron, E. S. G. An Introduction to the Toxicology of Uranium. November 1946. Declassified Apr. 9, 1948. 74p. (AECD-1993)

This is a review of the work on the pharmacology and toxicology of U. The separate chapters are treated as reports AECD-1993A through AECD-1993H.

- 3412 Tannenbaum, A. and Silverstone, H. Chapter I. Introduction and General Considerations. November 1946. Declassified Apr. 9, 1948. 4p. (AECD-1993A)

A general discussion is given of the nature of U poisoning and of objectives such as probable symptoms, signs, and pathology that would occur if human beings were poisoned by U.

- 3413 Tannenbaum, A. and Silverstone, H. Chapter II. Nature of Uranium Poisoning as Observed in Mice. November 1946. Declassified Apr. 9, 1948. 7p. (AECD-1993B)

Subcutaneous injections of $\text{UO}_2(\text{NO}_3)_2$ are rapidly absorbed, and afford an excellent means of studying the clinical picture of acute U poisoning. With smaller lethal doses, signs all develop more slowly, but in the same sequence. The mice injected with nonlethal doses showed only transient toxic symptoms and to a much smaller degree.

- 3414 Tannenbaum, A. and Silverstone, H. Chapter III. Factors Affecting Uranium Poisoning. November 1946. Declassified Apr. 9, 1948. 8p. (AECD-1993C)

When mice were fed U cpds., the following comparative toxicities were found:

UO_2 , U_3O_8 , UF_4 — relatively nontoxic, even in high doses.
 UO_3 , UCl_4 — toxic in high dosages.
 $\text{UO}_2(\text{NO}_3)_2$, UO_4 , $\text{Na}_2\text{U}_2\text{O}_7$ — toxic in moderate dosages.
 UO_2F_2 — toxic, even at relatively low dosages.

The soly. of the U cpd. and its rate of absorption from the gastrointestinal tract are probably the most important factors in detg. its relative toxicity. With most of the U cpds. that are toxic, this property stems from its U content. However, the significance of the anion should not be neglected since the investigations suggest that for UO_2F_2 (and probably for UF_6) the toxic effects are more a problem of F than U poisoning. The avenues of entrance are important in that they result in different degrees of absorption into the blood, and because of the probability of local effects at the site of entry. U cpds., fed daily in dosages 5 to 10 times the amts. lethal on single injection, result in comparatively little intoxication because of the limited absorption through the gastrointestinal tract. From comparative weight changes and detns. of U content of the kidneys, it is believed that absorption through the skin of mice was roughly 4 times that which occurs on ingesting comparable amts. of $\text{UO}_2(\text{NO}_3)_2$ over a similar period. It is believed that the inhalation of UO_2 dust does not produce toxic effects. It is guessed that inhalation effects are somewhere between those obtained on ingestion and those following subcutaneous injection. There is no question that the species of animal plays an important role in the degree of toxicity produced by a given amt. of U cpd.; e.g., on subcutaneous injection of $\text{UO}_2(\text{NO}_3)_2$, the single dose that will generally cause death in a high proportion of the exptl. adult animals is of the order of 1 to 2 mg for the mouse, 2 to 4 mg for the rabbit, and 50 to 100 mg for the dog. It is obvious that the dose for various species, on the basis of a unit of body weight, varies considerably. Dependence upon strain of mouse was noted in the toxicity of $\text{UO}_2(\text{NO}_3)_2$ fed in the daily ration. There does not appear to be any consistent dependence of mortality of mice on the age of the animal when the comparison is drawn on the basis of a uniform dose. Male mice appear to be more resistant than the females, but the difference is relatively small and not invariable. Expts. with mice, given $\text{UO}_2(\text{NO}_3)_2$ either by injection or feeding, did not result in significant acquired tolerance as tested by subsequent injections. On the other hand, there is conclusive evidence that mice previously fed $\text{UO}_2(\text{NO}_3)_2$ do acquire tolerance or resistance to further feeding of the chemical.

3415 Tannenbaum, A. and Silverstone, H. Chapter IV. Distribution in Tissues and Excretion of Uranium. November 1946. Declassified Apr. 9, 1948. 11p. (AECD-1993D)

Two fundamental procedures have been employed with practical success in the quant. analysis of U in tissues and excreta. One of these methods, depending on the fluorescence of U cpds. fused with NaF, is an exceedingly sensitive means of detecting U. The second approach depends on the ionizing activity of the α particles emitted during radioactive disintegration of U. In both procedures, the ash of the tissue of excreta interferes by quenching or self-absorption necessitating the use of empirical correction factors. A third analytic technique is that of radioautography. While quantitation is not as practical by this procedure, it does serve well in demonstrating localizations within tissues and in illustrating differences between tissues. U has been detected by the fluorometric procedure in the tissues of animals that had no known exposure to U. The reported levels are very low and have only academic significance in the problem of U toxicology. When mice, rats, rabbits, or dogs are injected with $\text{UO}_2(\text{NO}_3)_2$ the greatest concns. of U in the body are found in the bones and kidneys. Concns. of U found in selected tissues of a mouse 1 month after injection and of a dog about 2 months after injection, are tabulated. In both species bone and kidney are the principal sites of concn. of U following injection. Liver and spleen contain a considerably lower concn. of U than the kidney, yet these are higher than other soft tissues. In the rat also, the kidney and bone contain higher concns. than do liver and spleen; this difference is great enough to be seen in radioautograph films. In all studies on mice and dogs the concn. of U/g of fresh composite bone was considerably greater than the concn. in kidney when the injected dosage was nontoxic. However, injection of toxic dosages in mice resulted in kidney concns. equal to or greater than bone concns. The actual amts. of U in a tissue depend not only on the concn., but also on tissue mass. As a consequence liver, skin, muscle, and gastrointestinal tract may account for considerable proportions of the U in the body despite the fact that they contain low concns. That the distributions of U in kidney and in bone are not homogeneous has been shown both by direct analysis of dissected tissue and by radioautographs. Radioautographs of the kidneys of mice and rats demonstrated much higher concns. in the cortex—principally toward the cortico-medullary junction. Radioautographs and analyses of bone indicate that the U concns. mainly in cancellous (spongy) bone and in the endosteum. The concns. in the compact bone or in epiphyseal cartilage are relatively low. When U cpds. are fed in the daily diet, U tends to accumulate gradually in the tissues. The rates of accumulation appear to be dependent on the soly. in the gastrointestinal tract (and by inference, absorption) of the cpd. fed. The rate of accumulation is also dependent on the concn. or amt. of the cpd. in the diet. In studying the excretion of U it is necessary to distinguish between the U coming directly from the exposure site and the U demobilized from the tissues proper. Detn. of the U present in urine and feces during or immediately after exposure serves to indicate the degree of and danger from exposure. In several studies with mice and dogs, the excretion of U has been detd. following the injection of $\text{UO}_2(\text{NO}_3)_2$. When relatively small, nontoxic doses of $\text{UO}_2(\text{NO}_3)_2$ were injected, subcutaneously or intramuscularly, as much as 50 to 90% of the injected U was excreted, almost entirely in the urine, within 24 hr. Within one week less than 15% of the injected U remained in the body. When larger and toxic doses were injected, however, mice excreted less than 10% of the injected dose during the first 24 hr and one month after injection as much as 40% was still found in the body. A daily excretion of U of between 0.5 and 1.0% of the U in the tissues implies that through demobilization and excretion the U of the tissues will be reduced one-half in 70 to 140 days. It is stated that it may be assumed that 75% or more of the U in the tissues is situated in bone and kidneys.

3416 Tannenbaum, A. Chapter V. Gross and Microscopic Pathology of Uranium Poisoning. November 1946. Declassified Apr. 9, 1948. 16p. (AECD-1993E)

During the course of many of the investigations, animals were sacrificed to study the anatomic and histologic changes. The morphologic changes produced by acute U poisoning have been studied by many investigators; in the present discussion an attempt is made to describe both acute and chronic changes in the mouse and to correlate them with the clinical course (weight, appearance, mortality). There is little question that U may produce somewhat different morphological changes in different species. In most species, however, the tubular necrosis is the outstanding anatomic change of the acute episode. 24 hr after mice were injected subcutaneously with moderately toxic or lethal dosages of uranyl nitrate (1 to 2 mg), a gross examn. showed all the organs to be relatively normal except the kidneys; they were

enlarged, pink-grey, and of smooth surface. Microscopically the kidneys revealed cloudy swelling of the convoluted tubules. Similar degenerative changes were present in the liver and myocardium. The lungs, spleen, pancreas, and gastrointestinal tract were essentially normal. It appears that a single injection of $\text{UO}_2(\text{NO}_3)_2$ results principally in a necrotizing nephrosis. If the animal survives, the nephrosis is repaired in a few wks.; the kidneys subsequently are relatively normal, except for the presence of the focal areas of calcification that were formed within the tubules in which necrosis of the epithelial cells occurred. When U cpds. were fed in the daily diet, both the clinical course and accompanying morphologic changes depended on the size of the daily dosages and on whether the U cpd. was fed in a highly toxic dosage directly or after having been gradually increased from lower dosages. It was detd. that 20 mg U as nitrate, when fed daily to mice, produced an acute toxic response in some strains and not in others. The kidneys were principally involved. A few mice died, but those that did not succumb, recovered relatively completely in 3 to 4 wks. In an expt. in which the daily dose of $\text{UO}_2(\text{NO}_3)_2$ was successively increased from 5 mg U (4 wks.) to 20 mg (7 wks.) to 40 mg (24 wks.), no significant changes were observed in the kidneys of sacrificed mice until 10 days after the 40 mg dosage was instituted. Results obtained indicate that cortical fibrosis (following the atrophy of the convoluted tubules that had been affected) occurs when large doses are fed; it may take somewhat longer to produce these chronic effects when the dosages are increased more gradually. Daily ingestion of a ration contg. 80 mg of U (as nitrate) resulted in a severe acute reaction in all species of mice studied. Once U is absorbed into the body tissues it produces its principal morphologic effect in the kidneys; a degeneration of the tubular epithelium. If the amt. absorbed is toxic there is a resultant acute cloudy swelling of the lining cells of the convoluted tubules; with larger dosages, acute necrosis of these cells occurs. The glomeruli (in most species) remain virtually intact; this does not rule out the possibility of functional changes. By about 3 weeks following the single subcutaneous injection of a nonlethal dose the kidneys return to a relatively normal state. Following the acute renal response to daily feeding of moderate dosages, the kidneys also return to normal even though ingestion of $\text{UO}_2(\text{NO}_3)_2$ continues.

- 3417 Tannenbaum, A. and Silverstone, H. Chapter VIII. Summary of Experimental Studies Relationship to Uranium Poisoning in Man. November 1946. Declassified Apr. 9, 1948. 9p. (AECD-1993H)

Utilizing knowledge obtained through animal expts., an attempt is made to interpret the significance of the data with respect to the problem of U poisoning in man. From the data now available U appears to be less of a toxicological hazard than Hg or Pb.

- 3418 Tannenbaum, A., Silverstone, H., and Koziol, J. Tracer Studies on the Distribution and Excretion of Uranium in Mice, Rats, and Dogs. Oct. 31, 1946. Declassified July 14, 1948. 72p. (AECD-2167)

The excretion of U and the distribution of U in tissues following injection of $\text{UO}_2(\text{NO}_3)_2$ was studied in mice, rats, and dogs. Highly radioactive isotopes of U were used either as tracers or alone; radioautographs as well as analytical data were obtained. The conclusions of the studies are as follows: 1. A high proportion of the U is excreted in the urine within 24 hr after the injection. Much smaller proportions are excreted during this period when the dosages are toxic than when they are nontoxic. 2. Initially, fecal excretion of U is relatively low, but as the urinary excretion rapidly decreases, the fecal U may assume significant proportions. 3. Less than 10% of the injected U remains in the body by 1 mo. following injection of nontoxic dosages of the nitrate. When the injected dose is toxic as much as 40% may be retained. 4. The kidneys and bones are the principal sites of accumulation (retention) of the injected U. A greater proportion is retained in the kidneys with toxic doses than with nontoxic doses. Other tissues contain much smaller concns. of U. 5. Radioautographs indicate that in bone, U accumulates almost entirely in the cancellous portion (trabeculae) and endosteum. 6. Similar radioautographic studies on kidney reveal that the cortex is the essential site of accumulation with some tendency for concn. at the corticomedullary junction. 7. When the U at the site of injection has been depleted (or removed entirely) the daily rate of excretion of U from the body is of the order of 0.5 to 1.0% of that present in the body.

- 3419 Thomas, L. F. [Investigation of the Pressure-Density Relationship for UF₆.] Mar. 31, 1942. Declassified June 1948. 1p. (BR-178)
Values of d. (0.00362 and 0.003130 g/cc) are given at 219.5 and 194.4 mm Hg. Changes in the app. used in the detn. are reported as well.
- 3420 Thomas, L. F. Investigation of the Pressure-Density Relationship for U Hexafluoride. May 1, 1942. Declassified June 1948. 1p. (BR-183)
The preliminary results at 49.2° show p(mm Hg) = 552.2, d. = 160, and apparent mol. wt. = 321 for UF₆.
- 3421 Thompson, H. E. and Steadman, L. T. Insufflation Studies in Rabbits with Dusts of Uranium Compounds. June 11, 1948. Declassified July 21, 1948. 125p. (AECD-2127)
In a large series of rabbits, both the responses exhibited by the animals and the fate of the dose have been observed following the intratracheal insufflation of a sol. (uranyl nitrate) and an insol. (U₃O₈) cpd. Large (100 mg) and small (5 and 10 mg) doses have been given. For comparison, in a third series of tests, a large dose of UO₂(NO₃)₂ was injected intramuscularly.
- 3422 Thompson, R. C. The Isolation of Protactinium from Uranium Ore Residues and Some Observations on Its Chemical Behavior. January 1948. Declassified Feb. 20, 1948. 1p. (MDDC-1770)
This is an abstract, the complete text is given below.
"Studies on the chemistry of protactinium were carried on in three broad categories: (1) tracer scale studies of coprecipitation, absorption, and solvent extraction, (2) development and application of procedures for the extraction of milligram amounts of protactinium from natural sources and (3) some milligram scale adsorption, solvent extraction and solubility studies. Coprecipitation studies point to the likelihood that absorption phenomena are chiefly involved. Protactinium is adsorbed from acid solution, probably in colloidal form, on Amberlite IR-1, a cation exchange resin. Amberlite IR-4, an anion exchange resin has been successfully employed to adsorb protactinium from hydrofluoric acid solution, probably as the (PaF₇)⁻ ion. Protactinium nitrates and chlorides can be extracted from aqueous solutions into suitable organic solvents. Using adsorption and solvent extraction methods for final purification, and coprecipitation with manganese dioxide for concentration, 20 mg of pure protactinium were isolated from uranium ore residues. Preliminary solubility studies of protactinium oxide in hydrochloric, nitric, sulfuric, and perchloric acid suggest strongly that such solubility as is observed must be attributed to the formation of complex ions."
(For complete report see AECD-1897(1948).)
- 3423 Thompson, R. Studies on the Chemistry of Protactinium. February 1948. Declassified Apr. 15, 1948. 4p. (AECD-1897)
This is the complete paper for report MDDC-1770(1948). See the entry for that report for an abstract. (This paper was presented orally before the American Chemical Society in April 1948.)
- 3424 Tishkoff, G. H. Polarographic Analysis of U. Oct. 20, 1944. Declassified May 27, 1948. 5p. (AECD-2005)
A method is described for the polarographic analysis of U⁺⁴ salts and UO₂ for the amt. of U⁺⁶ present as an impurity. Theory, app., procedure, calcs., results, discussions, and scope of method are included.
- 3425 Tishkoff, G. H. and Dounce, A. L. Pharmacology. Section III, Part E-6. Physico-Chemical Studies of U Compounds in Solution. Report of Progress for December, 1944 (University of Rochester). Declassified May 26, 1948. 18p. (AECD-1999)
Oxidation-reduction studies including polarography. The behavior of the U⁺⁶/U⁺⁴ system at the Pt electrode has been carefully studied. In connection with this work the effect of concn. on the absorption spectrum of the U⁺⁶/U⁺⁴ system has been investigated, and the effect of concn. of (UO₂)⁺⁺ on the polarographic half-wave potential of the first cathodic wave has been studied. Some work on the catalytic action of (UO₂)⁺⁺ on the lactate-methylene-blue system is reported, in which it demonstrated that it slowly

catalyzes the reduction of methylene blue by lactic acid. In addn. the action of citrate in slowing both reduction of U^{+6} by leuco-methylene blue and oxidation of U^{+4} by methylene blue has been demonstrated, and an explanation given. An expt. was performed on the reduction of $(UO_2)^{++}$ in the presence of plasma by $Na_2S_2O_4$. U complex formation. The inhibition by buffer ions at various pH values of the formation of certain colored complexes of $(UO_2)^{++}$ has been studied (particularly ferrocyanide). The pH dependence of this inhibition has been explained in terms of the equil. between U cation and U anion complexes. The investigation of the effect of pH and buffer ions on the electrical transport of $(UO_2)^{++}$. An extension of the cation-anion-complex theory has been made which may prove useful in explaining reactions of U cpds. with biol. materials.

3426 Tishkoff, G. H. and Fanta, P. E. Pharmacology Section III. Part E-6(a,b). Progress Report for February 1945. Declassified May 26, 1948. 6p. (AECD-2000)

Investigations have largely clarified the Pt electrode and polarographic behavior of U. These results are based upon rigorous math. relationships. It was concluded that at a U concn. = 0.0001M, $(UO_2)^{++}$, U^{+5} , and U^{+4} are combined with 3, 1, and 2 $(OAc)^-$, resp., above 0.05M acetate; and 2, 0, and 2 $(OAc)^-$, resp., below 0.05M acetate. The effect of bicarbonate on the electrical transport of $(UO_2)^{++}$ in the presence of protein has been investigated.

3427 Tobias, C. A., Weymouth, P. P., Wasserman, L. R., and Stapleton, G. E. "Some Biological Effects Due to Nuclear Fission." Science 107, 115-18(1948).

Theoretical considerations indicate that relatively localized high-energy radiation can be obtained by thermal neutron bombardment of U^{235} fixed inside the body. Fixation in the reticulo-endothelial system was accomplished by intravenous injection of colloidal UO_2 since 58% and 25% of the injected dose was recovered from the liver and spleen, resp. Accordingly, a group of mice which had received U^{235} enriched colloidal UO_2 and had been exposed to thermal neutrons from a pile all died within 3 weeks; their livers and spleens showed degenerative changes in addn. to the usual depression of lymphoid and hematopoietic tissues. The changes on the whole corresponded to those seen after massive dose of whole-body x rays. None of the control groups of animals died; they showed only transient effects. The lethality, therefore, came from the combined neutron- U^{235} coincidence. So far as the liver is concerned, the energy from fission recoils appears to be some 27 times more effective lethally than that from β energy of P^{32} -labeled phosphate.

3428 Turnbull, A. H. Data Sheets. Oct. 19, 1942. Declassified May 1948. 27p. (BR-64)

Tables and/or graphs are included showing the phys. properties of UF_6 and SF_6 ; the vapor pressure of solid and liq. UF_6 ; the heat of subln. of UF_6 ; the heat of evapn. of UF_6 ; the specific heat of UF_6 (as solid, liq., and gas); the specific heat of solid UF_6 minus that of liq. UF_6 vs. temp.; the d. of liq. UF_6 ; vapor pressure of SF_6 ; sp. ht. at const. pressure for SF_6 ; vapor pressure of HF ; and the velocity of sound in SF_6 .

3429 Uranyl Nitrate. Declassified June 1948. 6p. (BR-70)

The more important phys. and chem. properties of uranyl nitrate selected from Gmelin's Handbuch der anorganische Chemie. (8th ed.) 1936 are collected. Values for various properties for all known hydrates are given as well as data on photolytic properties and complexes.

3430 Van Wazer, J. and John, G. "A Kinetic Study of the Oxidation of Uranium Tetrachloride." J. Am. Chem. Soc. 70, 1207-09(1948).

This paper is similar to report MDDC-1322(1947).

- 3431 Vier, D. T., Schultz, M. L., and Bigeleisen, J. Fluorescence of Uranium Trioxide Hydrates. Dec. 21, 1944. Declassified Feb. 16, 1948. 8p. (MDDC-1733)

The hydrates of UO_3 fluoresce when exposed to ultraviolet light at room temp. and below, an observation that has not been reported previously. This paper contains the results of an investigation of this fluorescence at 20°K , 66°K , and in some cases, at room temp. The fluorescence spectrum of these hydrates consists of 3 or 4 bands at approx. equal intervals of 810 wave nos. The spectrum begins at about 5000 Å and extends to about 6000 Å. The anhyd. oxides do not fluoresce.

- 3432 Vier, D. T., Schultz, M. L., and Bigeleisen, J. "The Fluorescence of Uranium Trioxide Hydrates." J. Optical Soc. Am. 38, 811-14(1948).

This paper is similar to report MDDC-1733(1948).

- 3433 Vilar, G. E. "Tetravalence of Uranium in Uranyl Compounds and Other Uranium Compounds." Anales asoc. quím. argentina 36, 5-18(1948).

U is quadrivalent in oxides, uranates, and uranyl cpds., in all of which the

radical appears. If the formula U_2O_4 is accepted in place of UO_2 , the same radical occurs. It is possible that UO_3 may actually be U_2O_6 , so that here the same radical appears.

- 3434 Warf, J. C. The Preparation and Properties of Uranium Trifluoride. Declassified Oct. 29, 1948. 15p. (AECD-2413)

The means of prepg. UF_3 are discussed. The most practical method found is the reduction of UF_4 with U although reduction with H_2 or (H) may also be feasible. In the first case a U- UF_4 mixt. is treated with H_2 at 250°C when the U is broken down into powder, UH_3 . This permits intimate mixing with the UF_4 . The mixt. is heated, decomp. the UH_3 . Raising the temp. to 1000 to 1100°C completes the reaction. The UF_3 thus formed is a black, cokelike solid. A literature survey and discussion of other means of prepn. are given. X-ray diffraction patterns were taken and the structure of UF_3 is established. The cpd. is hexagonal, $a_1 = 4.13 \text{ Å}$, $a_3 = 7.33 \text{ Å}$. Heating to 1600°C was found to disproportionate the substance into UF_4 and U, the first of which subld. while the latter reacted with the crucible. The chem. properties of UF_3 were investigated and tabulated. The cpd. may be reduced to U metal by Ca, using a bomb technique, yielding smooth compact metal. 21 references are given.

- 3435 Warf, J. C. and Baenzinger, N. The Preparation and Properties of Some Mixed Uranium Halides. Declassified Sept. 15, 1948. 17p. (AECD-2314)

Cpds. of U^{+4} contg. two halogens have been prepd. Six combinations of the four halogens are possible, and at least one cpd. of each group was made. The two general methods of prepn. used were: (a) reaction of U trihalide with a halogen of greater atomic wt. and (b) interactions of two tetrahalides. X-ray diffraction patterns were made in most cases and cooling curves of melts were made for the bromochlorides. UBrCl_3 was found to be tetragonal, isomorphous with UCl_4 , but further replacement of Cl by Br (as in UBr_2Cl_2) caused increasing distortion. All of the cpds. contg. I were thermally unstable. A summary of the analytical methods is given.

- 3436 Watters, J. I., Fred, M., Shell, S., Corvin, I., and Byerly, W. Chemical Research—Analytical. Report for Month Ending April 15, 1945. May 12, 1945. Declassified May 18, 1948. 22p. (AECD-1988)

Data are presented on the gases evolved during the detarring of the graphite crucible assembly used in the vacuum fusion method for the detn. of O_2 in U. Below 2100°C the rate of gas evolution increases abruptly with an increase in temp. but above this point shows no such increase. The compn. of the gas was detd. as a function of temp. and the CO and hydrocarbon content found to increase as the temp. was raised. Attempts to increase the accuracy of the Cu spark method are described. Reproducibility for

U detns. is about 3%. Densitometry over a large intensity range is more difficult than for other methods because of the rapid decrease in intensity during the exposure. Several polarograph cells are described which have been used successfully with as little as 100 to 200 μ l of soln. An inert anode using agar + KCl or K_2SO_4 is shown, and two cells, for 100 to 200 and 300 to 500 μ l, using the anode are described. A small cell using a Hg pool anode is also shown. Exptl. data obtained in the polarography of $(UO_2)^{++}$ solns. in H_2SO_4 and HCl are presented and discussed. It is indicated that in the 3-step reduction to U^{+3} in dil. H_2SO_4 the first step corresponds to more than a 1-electron change. The U^{+5} intermediate either disproportionates or is reduced to produce a second wave depending on the acid concn. The sum of the first two waves is, however, a 2-electron change. The effect of acid concn. and max. suppressor on the wave shape is shown, and the precautions to be observed in interpreting slope analysis pointed out. The height of the first wave in 1N H_2SO_4 was found to be linear with concn. to within an av. of 1.8% and can be used for analytical purposes.

3437 Weinstock, B. and Crist, R. H. "The Vapor Pressure of Uranium Hexafluoride." J. Chem. Phys. 16, 436-41(1948).

This paper is similar to report MDDC-1295(1947).

3438 Westrum, E. F. Jr. Thermochemical Measurements on the Transuranium Elements. January 1948. Declassified Mar. 1, 1948. 1p. (MDDC-1773)

This paper is an abstract and is reproduced below in its entirety.

"The heats of reaction of plutonium metal, trichloride, tribromide, and oxychloride with aqueous hydrochloric acid and the heat of precipitation of the trifluoride have been accurately measured using 10 to 100 mg samples in a small vacuum-walled calorimeter. The dependence of the heat of solution of the trichloride on the concentration of hydrochloric acid has also been determined over a considerable range. From these data the heats of formation of the compounds and the aqueous plutonium(III) ion have been calculated and correlated with other measurements on uranium and the transuranium elements. The calibration and performance of a microcalorimeter designed to permit the precise determination of heats of solution and reaction of quantities of about 1 mg of the rarer transuranium elements and their compounds is described. This has been used in determining the heat of formation of neptunium trichloride and is being used for americium. A slight modification of the instrument (substitution of a silver adsorber for the reaction vessel) made possible the calorimeter measurement of the rate of energy production by alpha-disintegration of curium (242) and the estimation of the half-life period in good agreement with that obtained by radiophysical methods."

(See report AECD-1903(1948) for complete document.)

3439 Westrum, E. F. Jr. Thermochemical Measurements on the Transuranium Elements. March 1948. Declassified Apr. 15, 1948. 16p. (AECD-1903)

This is the full document of which MDDC-1773(1948) is an abstract. See reference to that report for an abstract. (This report was presented orally before the American Chemical Society in April 1948.)

3440 Wilhelm, H. A. and Daane, A. H. — assigned to U. S. Atomic Energy Commission. Uranium Monocarbide and Method of Preparation. Aug. 31, 1948. (U. S. Patent 2,448,479)

U carbides of low C content (less than 10%) have structural strength and resistance to wear superior to metallic U or U oxide. A process is shown for the prepn. of these carbides (which may be represented by the formulas UC, UC_2 , and U_2C_3) from the oxides UO_2 or U_3O_8 and C, mixed in stoichiometric proportions and heated in a crucible below the m.p. of the carbide expected. In one of the examples cited a mixt. of finely powd. UO_2 and graphite is first pressed under 26 tons/in.² to the form of a bar $\frac{1}{2} \times \frac{1}{2} \times 2$ in., which is stood on end in a graphite crucible and heated at 2300°C for 20 min; the product, which has the compn. $U_1C_{1.27}$, is essentially UC contg. some C dissolved or dispersed: ($UO_2 + 3C \rightarrow UC + 2CO$). Several variants of the method, which concern the mode of mixing, heating, etc., are covered by this patent.

- 3441 Wills, J. H. and Main, E. "Renal Function in Normal Rabbits and Dogs and the Effect of Uranyl Salts." Am. J. Physiol. 154, 220-8(1948).

This paper presents a study of the effects of U on the handling of Cl, inulin, and diodrast by the dog and rabbit kidney, the organ predominantly affected by the administration of U. In the kidney of the normal dog and rabbit the clearance of Cl and its reabsorption by the tubule are functions of the urine rate; the value of the Cl clearance increases with urine rate and the fractional reabsorption of Cl decreases slightly. However, the ability of the kidney to clear diodrast from the blood by secretion is not a function of urine rate. Under the conditions of the expts. the inulin clearance appears to be a function of urine rate in the dog but not in the rabbit. The effect of uranyl salts on the function of the proximal convolution leads to decreased reabsorption of Cl, decreased secretion of diodrast, and probably to increased permeability of the tubular membrane to H₂O and dissolved substances. 18 references and 4 tables are included.

- 3442 Wilson, A. S. and Rundle, R. E. X-Ray Studies of Alpha, Beta, and Gamma Uranium. Declassified June 9, 1948. 8p. (AECD-2046)

The three forms of U metal, first discovered by heat capacity studies, have been examined by x-ray diffraction. α U, stable to 640°C, is orthorhombic with a unique structure. Though the structure of β U remains unknown, the observed x-ray powder diagram indicates that the structure is of low symmetry. γ U, stable from 760°C to the m.p., is body-centered cubic of structure type A2.

- 3443 Wilson, H. B. The Relation of Particle Size of Uranium Dioxide Dust to Toxicity Following Inhalation by Animals. February 1948. Declassified Mar. 12, 1948. 29p. (AECD-1963)

The relation of particle size to toxicity of UO₂ dust following inhalation by animals has been detd. in 2 parallel studies. In both studies, 16 rabbits and 24 rats were exposed to UO₂ dust at approx. 80 mg/m³. In the first expt., the mass-median (M_g) particle size was 0.45 μ . In the second expt. at the same dust concn., the UO₂ had a mass-median particle size above 1 μ . The size fractions were prepd. by sedimentation methods. The dusty atms. were produced by means of an aspirator feed that developed an aerosol from an H₂O suspension of UO₂. Collection of Cascade Impactor samples each day permitted a close check on particle-size variation. The filter-paper dust sampler was used to det. concn. Particles from the "fine" suspension were found to have a total surface area ten times that of the particles in the "coarse" suspension, the difference resulting largely from the difference in particle size. In the rabbit, (a) proteinuria, (b) elevation of urinary amino acid N-creatinine ratio and (c) elevation of blood nonprotein N occurred in both expts. but was significantly greater at 0.45 μ particle size. Renal pathology in the rabbit was about the same in both studies. In the rat, however, slight but definite renal damage was observed in nearly all animals exposed to UO₂ of 0.45 μ size, whereas practically none was observed in rats exposed to the larger sizes. Appreciable lung damage occurred in rats from the 0.45 μ particles; none from the particles of M_g greater than 1 μ . Retention of UO₂ in the lung in both species was 2- to 5-fold greater at the smaller particle size than at the larger. Accumulation of UO₂ in the kidney and femur was only 0.1% that in the lung. Differences related to particle size were less clear-cut here. (This information is also available in J. Ind. Hyg. Toxicol. 30, 319-31(1948).)

- 3444 Wilson, H. B., Sylvester, G. E., Laskin, S., LaBelle, C. W., and Stokinger, H. E. "The Relation of Particle Size of Uranium Dioxide Dust to Toxicity Following Inhalation by Animals." J. Ind. Hyg. Toxicol. 30, 319-31(1948).

This paper is similar to report AECD-1963(1948).

- 3445 Winston, W. B. "Uranium." Calif. J. Mines Geol. 44, No. 1, 73-92(1948).

This is a description of U metal and minerals. U in an asphaltic material is treated including its identification, occurrence, production, prospecting, mining, cong., and marketing. The U-ore-purchasing schedule in the U. S. is discussed as are the uses, technology, and history of the material. A bibliography is included.

3446 Yaeger, R. G. Uranyl Nitrate. Four One-Year Inhalation Toxicity Studies of Animals at 0.04, 0.25, "0.4," and 2.0 mg U/m³. May 17, 1948. Declassified July 21, 1948. 112p. (AECD-2129)

Exposures at concns. below 0.5 mg UO₂(NO₃)₂/m³ for 1 yr were found to be essentially noninjurious and to constitute "safe" exposure for dogs and rats. The level of 0.5 mg, however, was moderately injurious to the majority of dogs and rabbits exposed, mildly so to rats, and completely nontoxic to guinea pigs. 4 mg UO₂(NO₃)₂ dust was almost uniformly injurious to dogs, rabbits, and rats, though less so to the rabbit species, and completely nontoxic to guinea pigs.

3447 Young, H. S. Preparation of Uranium Trichloride by Reduction of the Tetrachloride with Metals. February 1947. Declassified Oct. 22, 1948. 2p. (AECD-2360)

The document is reproduced below in its entirety.

"Introduction. When metallic copper was exposed to vapors of uranium tetrachloride, it was found that uranium trichloride and copper chloride were formed. The formation of uranium trichloride from copper and the tetrachloride suggested that it might be convenient to prepare pure uranium trichloride in a similar fashion, using a metal that would leave no contaminants in the product.

"Discussion. Various metals were exposed to pure uranium tetrachloride vapors in a vacuum sublimation apparatus. In each case the over-all reaction was found to be $x\text{UCl}_4 + \text{M} \rightarrow x\text{UCl}_3 + \text{MCl}_x$. A difficulty was presented by the fact that with many metals the uranium trichloride formed a hard coat of dark red crystals on the metal surface, preventing further reaction, and was contaminated by the chloride of the metal. It was thought that a metal which sublimed readily and which had a volatile chloride should be satisfactory. Zinc metal satisfies these conditions and large yields of pure uranium trichlorides were obtained by its use.

"Experimental. The apparatus was essentially an all-glass vacuum sublimation still with a controlled temperature gradient maintained in the condenser, so that vapors were fractionally condensed. The metals were placed at a position adjacent to the charge of uranium tetrachloride. The tetrachloride vapors passed over the hot metal at 450-480°C. The excess tetrachloride vapors as well as the volatile reaction products were fractionally condensed for identification, and the yield of uranium trichloride and weight loss of metal were determined.

"Sixty-two grams of zinc metal and 97 g of uranium tetrachloride were charged in a typical experiment. After 18 hr all the zinc and 13 g of the uranium tetrachloride had sublimed from the charge section. The quantity of uranium trichloride produced, 10.2 g, represents 86% conversion of the tetrachloride vapors. This uranium trichloride analyzed 69.3 U, 30.8 Cl, 0.18 Zn. Theoretical analysis is 69.1 U, 30.9 Cl.

"Summary. Good quality uranium trichloride can be prepared by reduction of uranium tetrachloride vapors by metallic zinc. Zinc and its chloride sublime readily, continually exposing new surface for reaction, and zinc chloride is so volatile that it does not appreciably contaminate the uranium trichloride produced.

"Reference. Young, H. S., Wagner, E. L., and Miller, A. J. Report C-2.350.5, Nov. 23, 1945."

3448 Yu P.-N. "A Modified Method in the Analysis of Uranium Ore with High Content of Columbium and Tantalum." J. Chinese Chem. Soc. 15, 170-8(1948).

Scott's method was investigated. Considerable time was saved by fusing the ore with K₂S₂O₇ and extg. with hot water. After removal of some interfering elements, U is pptd. by NH₃, ignited, and weighed as U₃O₈.

3449 Zachariasen, W. H. "Crystal Radii of the Heavy Elements." Phys. Rev. (2), 73, 1104-05(1948). This paper is similar to report MDDC-1572(1947).

3450 Zachariasen, W. H. "The UCl₃-Type of Crystal Structure." J. Chem. Phys. 16, 254(1948). This paper is similar to report MDDC-1573(1947).

- 3451 Zachariasen, W. H. The Crystal Structure of Alpha-Phase Compounds A_2XF_6 and AXF_4 . Jan. 26, 1948. Declassified July 19, 1948. 6p. (AECD-2162)

It is shown that the cpds. K_2ThF_6 , K_2UF_6 , $KLaF_4$, $KCeF_4$, Na_2ThF_6 , and Na_2UF_6 have cubic modifications with CaF_2 structure. The unit cube thus contains $\frac{1}{3}$ mol. A_2XF_6 or 2 mols. AXF_4 with the A and X atoms distributed at random over the metal sites of the CaF_2 structure.

- 3452 Zachariasen, W. H. The Crystal Structure of Beta-Phase Compounds A_2XF_6 and AXF_4 . Jan. 21, 1948. Declassified July 20, 1948. 17p. (AECD-2163)

It is shown that the following double fluorides K_2ThF_6 , K_2UF_6 , $KAlF_4$, $KCeF_4$, Na_2UF_6 , Na_2ThF_6 , $NaLaF_4$, $NaCeF_4$, and $NaPuF_4$ under proper conditions crystallize with hexagonal symmetry and with closely related structures contg. 6 F atoms per unit cell. The cpds. K_2ThF_6 , K_2UF_6 , $KLaF_4$, and $KCeF_4$ have been prep'd. with the B_1 structure which is based upon the space group $C62m$. The atomic positions for $B_1-K_2UF_6$ are: 1 U in (0 0 0), 2 K in $\pm (\frac{1}{3} \frac{1}{3} \frac{1}{2})$, 3 F in $(x_1 \ 0 \ \frac{1}{2})(0, x_1 \ \frac{1}{2})(x_1 \ x_1 \ \frac{1}{2})$ with $x_1 = 0.220$, 3 F in $(x_2 \ 0 \ 0)(0 \ x_2 \ 0)(x_2 \ x_2 \ 0)$ with $x_2 = 0.640$. The crystals of K_2ThF_6 and K_2UF_6 have been prep'd. with the B_1' structure which is the disordered form of the B_1 structure. In the disordered form the K and heavy metal atoms are distributed at random over the sites (0 0 0) and $\pm (\frac{1}{3} \frac{1}{3} \frac{1}{2})$. The Na cpds. and K_2UF_6 when quenched from the melt have the B_2 type of structure which is based upon the space group $\bar{C}32$. The atomic positions for $B_2-Na_2UF_6$ are: 1 U in (0 0 0), 2 Na in $\pm (\frac{1}{3} \frac{1}{3} u)$ with $u = 0.385$, 3 F in $(x_1 \ 0 \ \frac{1}{2})(0 \ x_1 \ \frac{1}{2})(\bar{x}_1 \ \bar{x}_1 \ \frac{1}{2})$ with $x_1 = 0.250$, 3 F in $(x_2 \ 0 \ 0)(0 \ x_2 \ 0)(\bar{x}_2 \ \bar{x}_2 \ 0)$ with $x_2 = 0.600$. In the AXF_4 cpds. the sites (0 0 0) are occupied by the heavy atoms, while the alk. atoms and the remaining heavy atoms are distributed at random over the sites $\pm (\frac{1}{3} \frac{1}{3} u)$. The relationship between the B_1 and the B_2 structures is discussed. In the B_1 structure an atom at $(\frac{1}{3} \frac{1}{3} \frac{1}{2})$ is bonded to 9 F atoms. The corresponding atom is shifted to $(\frac{1}{3} \frac{1}{3} 0.385)$ in the B_2 structure and the coordination no. is, as a consequence, reduced from 9 to 6.

- 3453 Zachariasen, W. H. The Crystal Structure of $CaUO_4$ and $SrUO_4$. April 1945. Declassified July 19, 1948. 12p. (AECD-2139)

The isomorphous cpds. $CaUO_4$ and $SrUO_4$ were prep'd. by adding U_3O_8 to molten $CaCl_2$ or $SrCl_2$. The deduction of the chem. formulas from the x-ray diffraction data is described. (This paper is also in Acta Cryst. 1, 281-5(1948).)

- 3454 Zachariasen, W. H. "The Crystal Structure of $CaUO_4$ and $SrUO_4$." Acta Cryst. 1, 281-5(1948). This paper is similar to report AECD-2139(1948).

- 3455 Zachariasen, W. H. The Crystal Structure of $\gamma-Na_2UF_6$. Jan. 19, 1948. Declassified June 29, 1948. 4p. (AECD-2089)

$\gamma-Na_2UF_6$ is orthorhombic. The unit cell contains two mols. and has dimensions $a_1 = 5.54 \pm 0.01$ A; $a_2 = 4.01 \pm 0.01$ A; $a_3 = 11.67 \pm 0.02$ A. The calcd. d. = 5.07. The space group is $(\bar{1}mmm)$ and the at. positions are: (0 0 0), $(\frac{1}{2} \frac{1}{2} \frac{1}{2})$, 2 U in (0 0 0), 4 Na in $\pm(0 \ 0 \ u)$ with $u = \frac{1}{4}$, 4 F in $\pm(v \ \frac{1}{2} \ 0)$ with $v = \frac{1}{4}$, 8 F in $\pm(x \ 0 \ z)(\bar{x} \ 0 \ z)$ with $x = \frac{1}{4}$ and $z = \frac{1}{6}$. Each U and each Na is bonded to 8 F with $Na-F = U-F = 2.41$ A.

- 3456 Zachariasen, W. H. The Crystal Structure of Na_3UF_7 . Jan. 15, 1948. Declassified Mar. 3, 1948. 6p. (AECD-1798)

The compound Na_3UF_7 is tetragonal with two mols. per unit cell. The lattice dimensions are: $a_1 = 5.448$ A, $a_3 = 10.896$ A. The space group is $14/mmm$ and the at. positions are (0 0 0) $(\frac{1}{2} \ \frac{1}{2} \ \frac{1}{2}) + 2 \bar{U}$ in (0 0 0), 2 Na in (0 0 $\frac{1}{2}$), 4 Na in $(\frac{1}{2} \ 0 \ \frac{1}{4})(0 \ \frac{1}{2} \ \frac{1}{4})$, 14 F in $\pm(u \ u \ v)(\bar{u} \ \bar{u} \ v)(u \ \bar{u} \ v)(\bar{u} \ u \ v)$, with $u = \frac{1}{4}$ and $v = \frac{1}{6}$. Each metal atom is bonded to 7 F atoms at the corners of a cube with $Na-F = U-F = 2.36$ A. The wide homogeneity range of the phase is explained in terms of the crystal structure.

- 3457 Zachariasen, W. H. Crystal Structure Studies of Sulfides and Oxy-Sulfides of Uranium, Thorium, and Cerium. Sept. 1, 1946. Declassified July 19, 1948. 24p. (AECD-2141)

Results of x-ray diffraction investigations of the U-S system, Th-S system, Ce-S system, and the corresponding oxysulfides are reported. (The portion of this report containing information on U is also available in Acta Cryst. 2, 291-6(1949).)

- 3458 Zachariasen, W. H. The Crystal Structure of Uranium Hexa-Chloride. Jan. 27, 1948. Declassified July 19, 1948. 6p. (AECD-2184)

UCl₆ is hexagonal with 3 mols. per unit cell and lattice dimensions $a_1 = 10.95 \pm 0.02$ A and $a_3 = 6.03 \pm 0.01$ A. By means of x-ray diffraction data obtained from a microprep. of UCl₆, the complete structure was detd. and found to be of mol.-type contg. octahedral UCl₆ mols. with U-Cl = 2.59 A. The closest distance between Cl atoms belonging to different mols. is Cl-Cl = 3.65 A. (This paper is also available in Acta Cryst. 1, 285-7(1948).)

- 3459 Zachariasen, W. H. "The Crystal Structure of Uranium Hexachloride." Acta Cryst. 1, 285-7 (1948).

This paper is similar to report AECD-2184(1948).

- 3460 Zachariasen, W. H. The Crystal Structure of α -UF₅ and of β -UF₅. June 1946. Declassified Jan. 21, 1948. 3p. (MDDC-1674)

α UF₅ is tetragonal body-centered with $a_1 = 6.512 \pm 0.001$ A, $a_3 = 4.463 \pm 0.001$ A. The unit cell contains 2 mols. and the calcd. d. = 5.81. Each U atom is bonded to 6 F atoms. These UF₆ octahedra are linked by shared corners into endless chains along the a_3 axis. β UF₅ is also tetragonal body-centered. The unit cell contg. 8 mols. has dimensions $a_1 = 11.450 \pm 0.0002$ A, $a_3 = 5.198 \pm 0.001$ A. The calcd. d. = 6.45. The space group is I4₂d. A structure is proposed in which each U atom is bonded to 7 F atoms. Four corners in each UF₇ polyhedron are shared with adjacent polyhedra. (This paper is also available in Acta Cryst. 2, 296-8(1949).)

- 3461 Zachariasen, W. H. The Crystal Structures of U₂F₉ and NaTh₂F₉. June 1946. Declassified Jan. 20, 1948. 4p. (MDDC-1675)

The cpds. U₂F₉ and NaTh₂F₉ are cubic body-centered with 4 mols. per unit cell. The lattice consts. and calcd. d. are

	a.	d.
U ₂ F ₉	8.4545 ± 0.0005 A	7.06
NaTh ₂ F ₉	8.705 ± 0.001	6.58

The space group is I4₃m(T_d^3). The 8 heavy-metal atoms per unit cell are at positions (x x x); ($\bar{x} \bar{x} \bar{x}$) with $x = 0.187 \pm 0.004$. Reasonable positions for the F and Na atoms are given. There are 9 F atoms about each heavy atom and 6 F atoms about each Na atom. The mean interatomic distances are U - F = 2.31 A, Th - F = 2.40 A, and Na - F = 2.34 A. (This paper is also available in J. Chem. Phys. 16, 425(1948).)

- 3462 Zachariasen, W. H. "The Crystal Structures of U₂F₉ and NaTh₂F₉." J. Chem. Phys. 16, 425 (1948).

This paper is similar to report MDDC-1675(1948).

- 3463 Zachariasen, W. H. The Crystal Structure of Uranyl Fluoride, UO_2F_2 . Sept. 1, 1946. Declassified July 19, 1948. 13p. (AECD-2140)

The ideal structure of UO_2F_2 is rhombohedral. The rhombohedral unit cell contains 1 mol. and has dimensions $a = 5.764 \pm 0.001 \text{ \AA}$, $\alpha = 42^\circ 43' \pm 3'$. The calcd. $d = 6.365$. The space group is $R\bar{3}m$ and the atomic positions are: 1 U in (0,0,0), 2 O in $\pm(u,u,u)$ with $u = 0.122$, 2 F in $\pm(v,v,v)$ with $v = 0.370$. Each U is bonded to 2 O'' with $\text{U}-\text{O} = 1.91 \text{ \AA}$ and to 6 F with $\text{U}-\text{F} = 2.48 \text{ \AA}$. The ideal structure is a typical example of a layer structure. The layers are normal to the threefold axis and 5.230 $\text{\AA}$ apart. The axis of $(\text{UO}_2)^{++}$ is normal to the plane of the layers. The actual structure of UO_2F_2 shows stacking disorder, the degree of disorder depending upon the thermal history of the sample. The detailed nature of the disorder is deduced. (This paper is also available in Acta Cryst. 1,277-81(1948).)

- 3464 Zachariasen, W. H. "The Crystal Structure of Uranyl Fluoride, UO_2F_2 ." Acta Cryst. 1, 277-81(1948).

This paper is similar to report AECD-2140(1948).

- 3465 Zachariasen, W. H. The Crystal Structure of Trichlorides, Tribromides, and Trihydroxides of Uranium and of Rare Earth Elements. Declassified June 29, 1948. 14p. (AECD-2091)

The cpds. UCl_3 , UBr_3 , LaCl_3 , LaBr_3 , $\text{La}(\text{OH})_3$, CeCl_3 , CeBr_3 , PrCl_3 , PrBr_3 , $\text{Pr}(\text{OH})_3$, NdCl_3 , and $\text{Nd}(\text{OH})_3$ are shown to be isomorphous. They have hexagonal structures with two mols. per unit cell. The complete structures are detd. and described.

- 3466 Zachariasen, W. H. "Double Fluorides of Potassium or Sodium with Uranium, Thorium, or Lanthanum." J. Am. Chem. Soc. 70, 2147-51(1948).

Many double fluorides were found in the systems $\text{KF}-\text{UF}_4$, $\text{KF}-\text{ThF}_4$, $\text{KF}-\text{LaF}_3$, $\text{NaF}-\text{UF}_4$, $\text{NaF}-\text{ThF}_4$, and $\text{NaF}-\text{LaF}_3$ by the x-ray diffraction method. The observed diffraction intensities can, with good approximation, be attributed to the heavy atoms since the scattering powers of K, Na, and F are small compared to those of U, Th, and La. Since a small no. of degrees of freedom is involved, the no. and positions of the heavy atoms within the unit cell can be detd. from the intensity measurements. The vol. of the unit cell, V , and the no. of heavy atoms within it, N_x , are thus accurately known exptl. quantities. The vol. of the unit cell for fluorides of the heavy elements under consideration can be attributed to the F atoms, with the heavy-metal atoms fitting the interstices between the anions. The vol. requirement of a F atom may be set at $V_F = 18 \text{ \AA}^3$; exptl. values are: for UF_3 18.1, UF_4 19.4, U_2F_9 16.9, α - UF_5 19.0, β - UF_5 17.0, UF_6 19.3, LaF_3 18.2. The mean values for the vol. requirement of a K or a Na atom obtained from a no. of known crystal structures are $V_K = 21 \text{ \AA}^3$ and $V_{\text{Na}} = 7 \text{ \AA}^3$. $V = N_A V_A + N_F V_F$, where N_A and N_F are, resp., the no. of alk. atoms and of F atoms per unit cell, and V_A is the vol. requirement of an alk. atom. In addn. to the terminal cpds. the following phases were observed: In the $\text{KF}-\text{UF}_4$ system: KU_6F_{25} , KU_3F_{13} , KU_2F_9 , KUF_5 , α - K_2UF_6 , β - K_2UF_6 , β_1 - K_2UF_6 , β_2 - K_2UF_6 , α - K_3UF_7 , and α - K_3UF_7 ; in the $\text{NaF}-\text{UF}_4$ system: NaUF_5 , α - Na_2UF_6 , β - Na_2UF_6 , γ - Na_2UF_6 , and Na_3UF_7 . Crystal structure data are given also for KNp_2F_9 , KPu_2F_9 , NaPuF_5 , KPuF_5 , RbPuF_5 , and NaPuF_4 . (This paper summarizes data contained in several MDDC reports.)

- 3467 Zachariasen, W. H. The Crystal Structure of Uranium Silicides and of CeSi_2 , NpSi_2 , and PuSi_2 . Jan. 6, 1948. Declassified June 28, 1948. 11p. (AECD-2092)

It is shown that CeSi_2 , USi_2 , NpSi_2 , and PuSi_2 have the ThSi_2 type of structure. A second form of USi_2 is found with the AlB_2 type of structure. USi is shown to be isomorphous with FeB . The cpd. U_3Si_2 is found to be tetragonal and to have a structure contg. Si_2 groups. The cpd. U_3Si is also tetragonal with a structure which can be regarded as a distorted cubic face-centered lattice. In the various U silicides the coordination no. for U is 9, 10, or 12. The interatomic distance U-Si ranges from 2.85 $\text{\AA}$ to 3.17 $\text{\AA}$. A Si atom is bonded to three other Si atoms in the two forms of USi_2 . In one of the USi_2 structures the Si atoms form a three-dimensional network, while the Si atoms form "graphite layers" in the other USi_2 structure. Infinite zigzag chains of Si atoms occur in the USi structure, while the U_3Si_2 structure

contains the Si atoms as Si_2 groups. There are no covalent bonds between Si atoms in U_3Si . The observed Si-Si bond distances in the U silicides range from 2.22 Å to 2.35 Å. (This paper is also in Acta Cryst. 2, 94-9(1949).)

3468 Zebroski, E. L. and Tolbert, B. M. Assay Procedures for Uranium Using Ether Extraction, Electrolysis, and Cupferron Precipitation. Declassified Mar. 16, 1948. 24p. (AECD-1884)

A general assay method for U in the presence of Cu, Cr, Fe, Co, Ni, Ti, V, Mg, Ca, Al, Bi, and P is presented. The procedure consists of Et_2O extrn., electrolysis, and a double cupferron pptn. Purity of the product (av.) is 99.0% and over-all recovery is about 99.8%. An efficient Et_2O extractor which permits quant. 0.42 mg or 0.38% and the apparent recovery 100.0%. An efficient Et_2O extractor which permits quant. recovery of U from suitable $(\text{NO}_3)^-$ solns. in about 20 min is described. A new method for carrying out a double-cupferron pptn. using $\text{Na}_2\text{S}_2\text{O}_4$ as a reducing agent is discussed. Five alternative methods of U assay are described for samples with varying amts. and types of impurities: (1) An Et_2O extrn., electrolysis and NH_3 pptn. process for Cu samples is presented; (2) An Et_2O extrn.-double-cupferron pptn. is outlined for samples contg. Cu, Ni, or Cr; (3) A formic acid destruction of nitrates, electrolysis-single-cupferron procedure for stainless-steel impurities is presented; (4) A double-cupferron pptn. for alk. metals and alk. earth impurities is described; (5) A double- Et_2O extrn. for samples not contg. phosphate is described. A no. of gravimetric methods for U analysis which permit recovery of the pure oxide, U_3O_8 , have been investigated. Procedures for sepn. from massive amts. of Cu, residues from ignited graphite, or 18-8 stainless steel, and combinations of these were developed and tested. The more important ions considered were Cu, Cr, Fe, Co, Ni, Ti, V, Mg, Ca, Al, Bi, and P. For routine use, there are serious objections to many previous methods. Pptn. of U as $(\text{NH}_4)_2\text{U}_2\text{O}_7$ is subject to losses due to the formation of the sol. carbonate, peptization, and inclusion of silica from the NH_3 . These difficulties are especially serious when NH_3 pptn. is used for the removal of Cu or when converting from nitrate to sulfate solns. by repeated pptns. In the pptn. of uranous oxalate, errors are introduced due to incomplete reduction of the sample to U^{+4} and difficulties in complete pptn. and crystn., especially for small samples. Pptn. of U as UO_4 is very slow and inconvenient. Destruction of nitrates by formic acid, HOAc , or urea to permit electrolysis of massive amts. of Cu, Fe, etc., was developed to a workable procedure but suffered from a variable induction period in the nitrate destruction and often required an excessively long electrolysis. Pptn. of U with 8-hydroxyquinoline is not selective and has many of the objections of NH_3 pptn.

PUBLICATIONS LOCATED IN 1949

- 3469 Ahrlund, S. "On the Complex Chemistry of the Uranyl Ion. I. The Hydrolysis of the Six-Valent Uranium in Aqueous Solutions." *Acta Chem. Scand.* **3**, 374-400(1949).

It has been shown by extinction measurements that $(\text{UO}_2)^{++}$ is the only existing complex of U^{+6} in aq. soln. from $\text{pH} \approx 0.1$ (the lowest investigated) up to $\text{pH} \approx 2$. Over that pH further hydrolysis complexes are gradually formed. Thus, $(\text{UO}_2)^{++}$ may be regarded as a complex-forming central group, and the formulas for its complex formation have been developed in a manner analogous to that for other metal ions. The further hydrolysis of $(\text{UO}_2)^{++}$ has been studied by pH measurements when $\text{UO}_2(\text{ClO}_4)_2$ solns. were titrated with NaOH. The total U concn. ranged from 2 to 60 mc. The ionic strength of the solns. was kept const. and equal to 1 with the aid of NaClO_4 . The detns. were done, first with a quinhydrone electrode and then with a glass electrode. Both electrodes gave essentially the same image of the hydrolysis complex formation, which may be described as follows: (1) The hydrolysis becomes appreciable at $\text{pH} \approx 3$. Pptn. does not occur until, on the av., $1.3 (\text{OH})^-$ has been used per $(\text{UO}_2)^{++}$; pH is then 4.5 to 5. (2) The complex formation curves found at different C_m (total concn. of central atom) prove that a polynuclear complex formation plays a very important role in the hydrolysis, even at the smallest C_m . This fact places $(\text{UO}_2)^{++}$ in an analogous position to other metallic ions, containing O, in the same group of the periodic system: chromate, molybdate, tungstate. The first mononuclear dissozn. const. χ_1' and the first dinuclear χ_1'' , have been detd. At 20°C they were found to be: $\chi_1' = (2.0 \pm 0.4) \times 10^{-5} \text{ C}$; $\chi_1'' = (4 \pm 1) \times 10^{-3} \text{ C}$. 24 references are given.

- 3470 Ahrlund, S. "On the Complex Chemistry of the Uranyl Ion. II. The Complexity of Uranyl Monochloroacetate. A Comparative Potentiometric and Extinctionmetric Investigation." *Acta Chem. Scand.* **3**, 783-808(1949).

This is a continuation of previous work by the author (*Acta Chem. Scand.* **3**, 374(1949)). The complexity of uranyl monochloroacetate has been investigated according to two methods: potentiometrically (by pH measurements with the quinhydrone electrode) and extinctionmetrically (at the Hg line of 3130 Å). Both methods indicate that the complex formation is entirely mononuclear; there is no sign of polynuclear complexes. The complexity constns. of the 3 mononuclear complexes existing in the range of concn. used are calcd. according to both methods. The results agree quantitatively. The conclusion is that potentiometric and extinctionmetric methods of measurements of complexity give consistent results if properly used. The constns. obtained may, therefore, with great certainty be considered as the true constns. according to the law of mass action.

- 3471 Ahrlund, S. "On the Complex Chemistry of the Uranyl Ion. III. The Complexity of Uranyl Thiocyanate. An Extinctionmetric Investigation." *Acta Chem. Scand.* **3**, 1067-76(1949).

The complexity of the uranyl thiocyanate system in aq. soln. is extinctionmetrically investigated. The measurements are performed at 20°C and at the ionic strength $I = 1$, which is brought about by NaClO_4 and 100-milliequiv. HClO_4 . The latter presses the hydrolysis of $(\text{UO}_2)^{++}$ back to a value which may be neglected. According to both the criteria applied, no polynuclear complexes seem to exist in this system. The first three complexes of the mononuclear series are proved. Their constns. are at the existing conditions $\beta_2 = 5.7$, $\beta_2 = 5.5$, and $\beta_3 = 15$.

- 3472 Ahrlund, S. "Determination of Small Amounts of Uranium. IV. Spectrophotometric Determination of Uranium with Cyanoferrate(II)." *Svensk Kem. Tid.* **61**, 197-203(1949).

A report is given of the development of a spectrophotometric method, using a Pulfrich photometer, for the detn. of U in extremely dil. solns. of $\text{UO}_2(\text{NO}_3)_2$ (concns. $<100 \text{ mg U/l}$), which also contain HNO_3 and traces of other heavy metals, especially Fe. After detn. of the spectral range most convenient for the detn. of U (4600-4800 Å, where the U extinction is great and Fe extinction has a min.) known amts. of Fe^{+3} were added to U solns. of different concns. Results show that 10% of Fe^{+3} by weight may be present without danger. The applicability of the method depends on whether the method of sepn. of U used is sufficiently effective so that this limit is not exceeded.

- 3473 Alberman, K. B. and Anderson, J. S. "The Oxides of Uranium." J. Chem. Soc. Suppl. No. 2, 303-11(1949).

Phase equil. in the U-O system between the compn. limits UO_2 and $\text{UO}_{2.3}$ have been investigated in detail with regard both to the structure of the phases formed and to the kinetics of their formation from UO_2 and O_2 . UO_2 , which possesses a fluorite structure, will take up O_2 at temps. below 230° to a compn. $\text{UO}_{2.2}$ without change of structure or appreciable change of cell dimension. Oxides in this compn. range disproportionate, when annealed at high temp., into 2 well-defined cubic phases, viz., UO_2 and a phase of compn. close to $\text{UO}_{2.2}$ (" β - UO_2 phase"). Oxides in the compn. range $\text{UO}_{2.2}$ to $\text{UO}_{2.3}$ prepd. below 230° have tetragonal structure with axial ratio c/a changing progressively with compn.; these oxides disproportionate on heating into the β -cubic phase and a U_3O_8 -like phase. Kinetic studies of the oxidation process suggest that oxidation proceeds by way of a diffusion-controlled re-action in a solid phase of variable compn. These studies suggest a general similarity between the oxides of U and those of Mo and W.

- 3474 Allen, R. The Effects of Uranium Dioxide Powder Applied Subcutaneously Through an Incision in the Skin of Rabbits. May 23, 1949. Declassified Oct. 4, 1949. 7p. (AECD-2709)

Insol. UO_2 was applied in incisions made under the skin of 4 rabbits to det. its effect on wound healing and the extent, if any, of its systemic absorption. The animals, as compared with 3 controls (incision only), were observed for a month for local and systemic changes and finally, an analysis of the skin area was made to det. the amt. of U remaining at the site of application. The normal course of wound healing was not altered by the administration of as much as 40 mg of UO_2 powder to a 3-cm incision, nor was U absorbed to any significant degree from its site of application.

- 3475 Allison, J. A. C. and Mann, F. G. "The Constitution of Complex Metallic Salts. Part XIV. The Action of Trialkyl-phosphines and -arsines on the Tetrahalides of Tin and Uranium." J. Chem. Soc. 2915-21(1949).

Trialkyl-phosphines and -arsines combine with stannic chloride and bromide to give covalent cpds. of type $[(\text{R}_3\text{P})_2\text{SnCl}_4]$ and $[(\text{R}_3\text{P})_2\text{SnBr}_4]$; the corresponding tetraiodo-analogues could not be isolated as stable cpds. The structure of "bridged" derivatives of compn. $[(\text{R}_3\text{P})_2\text{SnCl}_4, \text{HgCl}_2]$ and $[(\text{R}_3\text{P})_2\text{PdCl}_2, \text{SnCl}_4]$ which have been isolated is discussed. Trialkyl-phosphines combine with UCl_4 and UBr_4 to give similar covalent derivs. $[(\text{R}_3\text{P})_2\text{UCl}_4]$ and $[(\text{R}_3\text{P})_2\text{UBr}_4]$, but no indication of the formation of analogous trialkylarsine derivs. was obtained. The salt, tris-2: 2'-dipyridyluranium hexathiocyanate, $[\text{dpy}_3\text{U}](\text{SCN})_6$, is described as hygr. compact yellow crystals or as hexagonal plates which slowly become opaque on exposure to air, apparently with the formation of the monohydrate.

- 3476 Alter, H. W., Newton, T. W., and Larson, E. E. Uranium and Hydrogen Functions of Uranium Glass Electrodes. Feb. 4, 1946. Rev. July 19, 1948. Declassified Feb. 2, 1949. 17p. (AECD-2467)

Exptl. procedures and results for studies with a special hard glass of low electrical resistance contg. UO_3 and with canary glass, which failed to show any U electrode functions, are discussed.

- 3477 Ames, D. P., Sedlet, J., Anderson, H. H., and Kohman, T. P. Rapid Radiometric Assay for Radium, and Application to Uranium Ore Process Solutions. Declassified Sept. 1, 1949. 27p. (AECD-2696)

A rapid method of assay for Ra in soln. based on the pptn. of Ra with Ba as carrier and counting of its α particles, is described. In sulfate-free solns. $(\text{Ba}, \text{Ra})\text{Cl}_2$ is pptd. with concn. HCl and Et_2O . In sulfate-contg. solns. $(\text{Pb}, \text{Ra})\text{SO}_4$ is first pptd. followed by a $(\text{Ba}, \text{Ra})\text{Cl}_2$ pptn. The chloride is converted to the sulfate on a pyrex disk for counting α particles in a parallel-plate ionization chamber. The method is general for all α -emitting substances accompanying it in nature. Applications to U-ore process solns. are described. The method is found suitable for certain control problems in which knowledge of approx. Ra concns. is required in 30 to 60 min. In this application the sensitivity is limited by interfering activities to 10^{-10} g Ra/ml. (This paper is also available in Seaborg, Katz, and Manning, The Transuranium Elements. New York, McGraw-Hill Book Company, Inc., 1949. Paper 22.70.)

3478 Anderson, J. S. "Chemistry of the Heavy Elements." *Nature* **163**, 983-4(1949).

A symposium organized by the Chemistry Division of the Atomic Research Establishment, Harwell, on behalf of the Chemical Society, was held at Rhodes House, Oxford, during Mar. 28-30. One main topic of discussion was the chem. of the heavy elements. The first session of the symposium was devoted to the elements other than U. The second session was devoted to the complex chem. of $(\text{UO}_2)^{++}$ solns. Some of the topics discussed are as follows: review of the chem. of the transuranic elements; the position of the cis- and transuranic elements in the periodic system; contributions to the chem. of Th and Pa; tracer chemistry of Pa solns.; measurements on ionization equil. in $\text{UO}_2(\text{NO}_3)_2$ and UO_2SO_4 ; complex cpds. of UCl_4 with tertiary alkyl phosphines; a paper on the lower oxides of U which revealed a complex system comparable with that of the oxides of Mo and W; high-temp. phase equil. in the U-C and Th-C systems were reviewed; the formation of H_2O_2 from H_2O by the action of Po α rays; improved techniques for the detn. of Rn and Ra in natural waters; and a new and highly selective method for the detection and detn. of small amts. of U, based on the use of paper chromatography.

3479 Andrieux, J. L. and Blum, P. "On the Electrolytic Preparation and Properties of Uranium Borides." *Compt. rend.* **229**, 210-12(1949).

Since earlier expts. by one of the authors had shown that a uranium boride, UB_4 , could be formed by the electrolysis of a bath of molten borate and alk. earth fluorides in soln. with a quantity of U_3O_8 (Andrieux, *Ann. chim.* (10), **10**, 423(1929)), an attempt was made to prep. new borides of U by varying the concns. of borate and U_3O_8 in the bath and by substituting MgFe_2 for the alk. earth fluorides. In the first attempts the concn. of U_3O_8 was too great in respect to the borate, and only UB_4 was formed. When the concn. of U_3O_8 was reduced to as much as 1/40 to 2 mols. of the borate, there resulted a mixt. of UB_4 with a new boride UB_{12} . The 2 borides can be sepd. by the use of concd. HCl or H_2SO_4 , since UB_4 is easily attacked by these while the UB_{12} is very resistant to the acids.

3480 Arden, T. V. "The Formation of Complex Ions in Uranyl Sulfate Solution." *J. Chem. Soc. Suppl. No. 2*, 299(1949).

Studies on the reactions of UO_2SO_4 with CaOH and other alks. give additional information on the nature of the complex ions present in UO_2SO_4 solns. Results obtained from potentiometric and conductometric titrations resemble those obtained by Sutton.

3481 Arden, T. V., Burstall, F. H., and Linstead, R. P. "A New Method for the Detection and Determination of Uranium." *J. Chem. Soc. Suppl. No. 2*, 311-13(1949).

A chromatographic method employing org. solvents in conjunction with strips or sheets of absorbent paper is described for the sepn. of U from other metals in soln. U as $\text{UO}_2(\text{NO}_3)_2$ is dissolved and moves with the solvent front as diffusion of the solvent in the absorbent paper proceeds. Most other metals remain stationary or move only slowly in comparison with U. Detection is accomplished with potassium ferrocyanide while quant. detn. is achieved by removal of the portion of paper contg. the U, followed by measurement with the polarograph, colorimeter, or fluorimeter.

3482 Arrol, W. J., Chackett, K. F., and Epstein, S. "The Extraction and Purification of Xenon and Krypton Isotopes from Neutron Irradiated Uranium." *Can. J. Research B.* **27**, 757-63(1949).

Both long-lived and stable isotopes of Kr and Xe are formed as the result of the slow-neutron fission of U^{235} . Methods are described for the extrn. of these gases from massive neutron-irradiated U metal, for sepg. them from contaminating gases and from each other and on measuring them in a McLeod gauge (the amts. of U being of the order of 50 g and the rare gases of the order of 10^{-3} cc at std. temp. and pressure). An accurate value of the ratio of fission Xe to fission Kr is given. Further expts. are described on Geiger-Müller counter measurements of the long-lived Kr isotope.

- 3483 Baenziger, N. C. and Rundle, R. E. The MBe₁₃ Compounds. Oct. 26, 1948. Declassified Mar. 2, 1949. 5p. (AECD-2506)

A series of intermetallic cpds. of the compn. MBe₁₃ has been found, where M is U, Th, Ce, and Zr. Powder diagrams of the phases appear to be simple cubic, $a \cong 5$ Å, but rotation and Weissenberg diagrams of ZrBe₁₃ reveal that the true unit is face-centered cubic, $a \cong 10$ Å, and with 8ZrBe₁₃ per unit. Upon close inspection the (5,3,1) reflection, requiring the larger unit, can be seen on powder diagrams of all four cpds. The lattice consts. reported are from back reflections obtained with a symmetrical, self-focusing powder camera. 5 references are included. (This information is also available in Acta Cryst. 2, 258(1949).)

- 3484 Baenziger, N. C. and Rundle, R. E. "The MBe₁₃ Compounds." Acta Cryst. 2, 258(1949). This paper is similar to report AECD-2506(1949).

- 3485 Baenziger, N. C., Rundle, R. E., Snow, A. I., and Wilson, A. S. Compounds of Uranium with the Transition Metals of the First Long Period. Declassified May 25, 1949. 27p. (AECD-2598)

The transition elements Mn, Fe, Co, and Ni form several metal cpds. with U, ranging in compn. from U₆M to UM₅. In general, the cpds. formed by these 4 metals with U are very similar. In the alloy systems of U with Mn, Fe, Co, and Ni, the following occur: U₆Mn, U₆Fe, U₆Co, and U₆Ni, all tetragonal and isostructural, and of a new structural type; UCo, a body-centered cubic cpd., Z-8, with a unique structure; UNi, structure undetd.; UMn₂, UFe₂, and UCo₂, with the C-15 structure; UNi₂ with the C-14 structure; UNi₅ with the PdBe₅ structure, closely related to the C-15 structure. In addn., UCu₅ has a similar structure. Lattice consts. and full structure detns. are reported for all cpds. except UNi. For the latter, only powder data have been available and the structure is complex.

- 3486 Baldinger, E. and Huber, P. "Determination of the α -Energy of U²³⁵ and of the Half-Life Period of U²³⁴," Helv. Phys. Acta 22, 365-8(1949).

The relative energies of α particles emitted by U²³⁵, U²³⁸, and U²³⁴ were detd. with the aid of an ionization chamber and two different forms of a pulse spectrograph, one comprising 19 canals with sep. counters, the other with cathode-ray tubes and photographic recording. Both instruments gave concordant results. It was found $(E_{235} - E_{238})/(E_{234} - E_{238}) = 0.365 \pm 0.015$, and $E_{235} = 4.393 \pm 0.01$ mev; half-life of U²³⁴ = $(2.33 \pm 0.1) \cdot 10^5$ yrs, half-life of U²³⁵ = $(8 \pm 1.5) \cdot 10^8$ yrs.

- 3487 Banks, C. V. New Titrimetric Methods for Thorium. Declassified Nov. 2, 1949. 67p. (AECD-2735)

A brief account of the history of Th has been presented. The present analytical methods for detg. Th have been discussed and found to be largely gravimetric. Because of a definite need for a rapid, accurate method for detg. Th, a study of the titrimetric detn. was made. This study has resulted in the development of a new oxidimetric method in which Th is pptd. as the normal molybdate, and the Mo equiv. to the Th is reduced and titrated. This method was found to work very well in the presence of Ca and U but not so in the presence of the rare earths. Mo can be conveniently sepd. from certain ions as Th molybdate, and this method has been successfully applied to the analysis of U-Mo alloys. A new potentiometric method for detg. Th has been devised in which the Th is titrated with ammonium paramolybdate and the end point detected by means of a Mo-calomel electrode system. 56 references are given.

- 3488 Bartlett, T. W. The General Electric X-Ray Photometer and Its Application to the Determination of Uranium. II. Determination of Uranium in Solutions. Oct. 28, 1949. Declassified Dec. 29, 1949. 20p. (AEC-2766)

The precision of the General Electric x-ray photometer as detd. by replicate readings on a std.-thickness Al block and on std. U solns. contg. up to 10.0 g U/l was represented by a 95% symmetric confidence interval of 0.65 scale divisions. From equations of calibration curves, this confidence interval was estd. to correspond to ± 0.05 g U/l. Abs. errors in excess of 0.1 g U/l occurred because of failure of the calibration points to fall exactly on a straight line. The range of U concns. which may be used in the x-ray photometer was found to be 0.07 to 90 g U/l when the 30-ml L-shaped absorption cells are employed at a primary of 100 v. The extent of interference by the elements investigated increased as the at. no. increased with the exception of Ag and I₂. Examples of the apparent U content in g/l of 1% solns. of several elements were as follows: Na, 0.3; Fe, 2.7; Mo, 6.1; Ag, 5.0; Pb, 8.8. As a result of these interferences, satisfactory accuracy for most purposes could be achieved only by a chem. sepn. of U from interference prior to measurement on the x-ray photometer.

- 3489 Bass, H., DiGiovanni, H., and LeVine, H. D. Extrapolation Chamber Determination of Beta Ray Surface Dose Rate for Uranium and Some Uranium Compounds. Declassified Dec. 6, 1949. 34p. (AEC-2753)

The purpose of the work reported herein was to measure the β -ray surface dose rate of U and some of its cpds. Interest was centered on the dose rate through the stratum corneum of the portion of the fingers involved in handling activities. Since this layer has a min. thickness of about 7 mg/cm², α -particle radiation is inconsequential at this depth. An extrapolation chamber was used in conjunction with a vibrating-reed electrometer. The β -ray surface dose rate from U through a filter of 7 ± 0.4 mg/cm² was found to be 239 mrep/hr. Corresponding detns. were made by photographic and fixed ionization-chamber methods. The results indicate the possibility of applying these two methods to field use.

- 3490 Bassett, L. G., Wiberley, S. E., and Savolainen, J. Solvent Extraction of Inorganic Ions. Aug. 1, 1949. 15p. (AECU-402)

Infrared absorption data on HCl, UO₂(NO₃)₂, and FeCl₃ in aq. media using AgCl windows are reported. The shift of the H-Cl fundamental in Et₂O has been detd. as 495 ± 10 cm⁻¹ using the NaCl prism. More precise detn. of this value will be made as soon as the LiF prism is available. Initial data on the refractive index of solns. of FeCl₃ in HCl are reported. Further investigation of other phys. properties of these solns. are necessary before any correlation can be made with the infrared absorption data.

- 3491 Bassett, L. G., Wiberley, S. E., Savolainen, J., Clark, H. M., and Ross, S. Solvent Extraction of Inorganic Ions; Third Quarterly Progress Report. Nov. 1, 1949. 32p. (RIPB-3)

Work has cont. in the attempt to correlate the structure of org. solvents with their ability to extr. inorg. ions. A study of the infrared absorption spectra of Me₂O in CCl₄ satd. with HCl shows further evidence of the bonding of the proton of the HCl to the C-O group. This verifies previously reported data obtained with diethyl and isopropyl ethers. A study of the spectra of several inorg. salts, Fe(NO₃)₃, Th(NO₃)₄, UO₂(NO₃)₂, in various ethers indicates a similar behavior of the inorg. cations. It appears that one of the factors involved in the soly. of inorg. ions in oxygenated org. solvents may be attributed to the ability of the O of the solvent to combine in some manner with the inorg. ion concerned. Refractive indexes of solns. of varying (Fe⁺³/Cl⁻) are being obtained by a new method less subject to minor variations in exptl. technique. This method is based on the additivity of the refractive index. Two solns., one of HCl and the other of FeCl₃, of such concns. that both have the same refractive index R₀, can be mixed to make a series of samples with varying (Fe⁺³/Cl⁻). A change in refractive index from R₀ is indicative of complex formation.

- 3492 Bassett, L. G., Wiberley, S. E., and Shepardson, J. U. Final Technical Report. Dec. 12, 1949. 9p. (NYOO-98)

In the chem. analyses of a std. sample of high-grade U ore, deviations were obtained by 4 different labs.: National Bureau of Standards; Lucius Pitkin, Inc.; Ledoux and Co.; and Mallinckrodt Chemical Works. Results are presented for a comparison of the established analytical methods for U_3O_8 used by the above labs. A gravimetric procedure involving an extrn. method for U was also used on the same ore sample. A preliminary investigation of a new rapid titrimetric procedure involving Hg cathode electrolysis as a means of eliminating interfering elements is reported.

- 3493 Belov, N. V. "New Structural Types with Densest Packing of Constituent Atoms." Doklady Akad. Nauk S.S.S.R. 65, 677-9(1949).

The recently published detns. of the cryst. structure of heavy-element cpds., in particular those contg. U and the transuranium elements (Zachariasen, Acta Cryst. 1, 265(1948); Aurivillius, Arkiv Kemi Mineral. Geol. 26B, No. 2, (1948)), fit very well into the systematics proposed by the author in his book Structure of Ionic Crystals and Metallic Phases, Moscow-Leningrad, 1947, (in Russian). The cases discussed here are those of α - UF_5 , α - UO_3 , UO_2F_2 , $CaUO_4$, UCl_6 , and $CsPuCl_6$. The leading idea of the systematics is the densest possible packing of large ions, principally anions.

- 3494 Benedict, M. and Williams, C., eds. Engineering Developments in the Gaseous Diffusion Process. New York, McGraw-Hill Book Company, Inc., 1949. 129p. (National Nuclear Energy Series, Division II, Volume 16)

The appropriate individual chapters of this book have, for the most part, been listed separately under the appropriate report number. The table of contents follows: Chap. 1, "Recording Mass Spectrometer for Process Analysis" by A. O. Nier, T. A. Abbott, and J. K. Pickard, MDDC-53(1946); Chap. 2, "Recording Ionization Chamber for Traces of Radioactive Gases" by A. O. Nier, C. M. Stevens, T. A. Abbott, and J. K. Pickard, MDDC-63(1946); Chap. 3, "Magnetic Gear for Torque Transfer to a Closed System" by T. A. Abbott and J. K. Pickard, MDDC-69(1946); Chap. 4, "Mass Spectrometers for Leak Detection" by A. O. Nier, C. M. Stevens, A. Hustrulid, T. A. Abbott, F. S. Stein, and J. E. Binns, MDDC-5(1946); Chap. 5, "New Developments in Vacuum Engineering" by R. B. Jacobs and H. F. Zuhr, MDDC-52(1946); Chap. 6, "Theory of Heat and Mass Transfer in Batch Condensation of Solids" by W. I. Thompson, MDDC-66(1946); Chap. 7, "Absorption in a High-molecular-weight Nonaqueous System—Uranium Hexafluoride in Heavy Oil" by R. Landau, C. E. Birchenall, G. G. Joris, and J. C. Elgin, MDDC-152(1946); Chap. 8, "Continuous Fluorine-disposal Plant" by R. Landau, MDDC-153(1946); Chap. 9, "The Reaction of Fluorine Oxide with Sodium Hydroxide" by E. Simons, T. P. Wilson, and S. C. Schuman, MDDC-186(1946).

- 3495 Bensey, F. N. and Eckert, A. C. Quantitative Analysis of UO_2 - U_3O_8 Mixtures by X-Ray Diffraction. Mar. 8, 1949. Declassified May 5, 1949. 9p. (AECD-2581)

A method of quant. analysis using x-ray diffraction has been applied to the detn. of UO_2 in UO_2 - U_3O_8 mixts. contg. 1 to 30% UO_2 by wt. Two techniques have been employed in the analysis. In one the pattern is recorded photographically, and in the other the diffracted x rays are measured by a Geiger-counter spectrometer. The photographic method is good to a lower concn. limit of 2%, and the Geiger-counter spectrometer has a lower limit of 1%.

- 3496 Bernhardt, H. A., Bishop, H. W., Capps, R. H., and Weisblatt, H. B. Solubility of Oxygen, Nitrogen, and Fluorine in Uranium Hexafluoride. Sept. 10, 1949. Declassified Nov. 17, 1949. 15p. (AECD-2734)

The sols. of gaseous F_2 , O_2 , and N_2 in both solid and liq. UF_6 have been detd. over a range of temp. At the 95% confidence limit the av. mole % of F dissolved in solid UF_6 in the temp. range between $50^\circ C$ and the m.p. is 0.058 ± 0.025 while the av. mole % of F dissolved in liq. UF_6 is 0.124 ± 0.020 in the temp. range between 70 and $85^\circ C$. The mole % of N and O dissolved in solid UF_6 over the same temp. range as above are 0.055 ± 0.025 and 0.068 ± 0.050 , resp., while the corresponding % in the liq. are 0.093 ± 0.103 and 0.165 ± 0.031 . These sols. correspond to calcd. activity coeffs. for F_2 , N_2 , and O_2 in the liq. phase of 0.24 ± 0.08 , 0.47 ± 0.88 , and 0.25 ± 0.07 , resp. Measurement of the equil. pressure of F_2 - UF_6 systems at 20 to $85^\circ C$ revealed no evidence of cpd. formation.

- 3497 Bertaut, F. and Blum, P. "The Structure of the Borides of Uranium." Compt. rend. **229**, 666-7(1949).

From a study of the Debye-Sherrer diagram of the microcryst. powder of UB_{12} it appears that the lattice has a face-centered cubic structure described in detail in the article. The study of UB_4 has not yet been completed. Some details are given but the positions of the B atoms is not yet known.

- 3498 Betts, R. H. and Michels, R. K. "Ionic Association in Aqueous Solutions of Uranyl Sulphate and Uranyl Nitrate." J. Chem. Soc. Suppl. No. 2, 286-94(1949).

Spectrophotometric methods have been used to study ionic association in aq. solns. of $UO_2(NO_3)_2$ and UO_2SO_4 . The stoichiometric association consts. for the equil. $(UO_2)^{++} + (HSO_4) \rightleftharpoons UO_2SO_4 + H^+$ and $(UO_2)^{++} + (NO_3)^- \rightleftharpoons (UO_2NO_3)^+$ were found to be 5.0 ± 0.34 and 0.21 ± 0.01 , resp. These values were obtained for solns. 2M in H^+ . Results for concns. of $(NO_3)^-$ greater than 3M could not be interpreted with assurance. In this region, either small amts. of $UO_2(NO_3)_2$ are formed, or more probably, the value of the association const. changes slightly with the ionic environment.

- 3499 Bishop, E. and Crawford, A. B. "The Separation of Beryllium, Aluminum, Uranium, and Vanadium by Cupferron in Systematic Qualitative Analysis." Analyst **74**, 364-5(1949).

A method of using cupferron to sep. Be, Al, U, and V from a residue contg. $Al(OH)_3$, $Be(OH)_2$, $(UO_2)_3(VO_4)_2$, $AlVO_4$, and U is described. This process has been tested on the macro, semimicro, and micro scales by proportional alteration of quantities and found satisfactory in all combinations of ions.

- 3500 Biswas, S. and Patro, A. P. "Fission Cross-Section of Uranium-235 for Thermal Neutrons." Indian J. Phys. **23**, 97-106(1949).

The cross section of fission of U^{235} for thermal neutrons has been detd. The Cu cathode of a proportional counter was coated with electrolytically deposited U which was converted to U_3O_8 by heating. The exact amt. of U was detd. by accurate weighing. The fission counter and a Ra-Be neutron source were placed inside a large paraffin block. Operating the counter in the proportional region, large fission pulses were detected against a background of natural α -ray pulses, using the usual amplifier, discriminator, scaling, and recording circuits. In order to sep. the effects of thermal neutrons, the observations were taken with and without a $1/2$ -mm Cd shield around the counter and the difference gave the rate of thermal neutron fissions, which were attributed to U^{235} . To measure the neutron flux, a BF_3 counter of identical dimensions was placed in the same position in the paraffin block as the fission counter and the no. of thermal neutrons were counted with the Cd-difference method. The cross section of fission of U^{235} for thermal neutrons was detd. as $(526 \pm 10) \times 10^{-24} \text{ cm}^2$.

- 3501 Bloche, E., Lévêgue, P., and Provisor, H. "Polarographic Determination of Uranium in an Acid Medium in the Presence of Iron, Copper, and Phosphates." Bull. soc. chim. France 831-2(1949).
- 3502 Boullé, A. and Dominé-Berges, M. "On the Reversibility of the Reaction $3\text{UO}_3 \rightleftharpoons \text{U}_3\text{O}_8 + \text{O}_2$." Compt. rend. 228, 72-4(1949).

In the authors' previous work (Compt. rend. 227, 1365(1948)) the formation of a solid soln. $\text{UO}_{2.90}$, stable at 520 to 610°C, was recognized as an intermediate stage in the decompn. of UO_3 . In the present paper the conditions of the reverse reaction are described, viz., of the reoxidation of U_3O_8 and of the solid soln. The x-ray spectra of U_3O_8 revealed the existence of two cryst. states, I and II, the state I being obtained from the state II by heating at $\leq 575^\circ\text{C}$. Whereas a total reoxidation of II can be made through heating in air or in O_2 at 300 to 500°, I does not reoxidize. The reoxidation of the solid soln. $\text{UO}_{2.90}$ could not be observed in the exptl. conditions used for the other oxides.

- 3503 Brady, E. L., Jaffey, A. H., Turkevich, A., and Finston, H. Production of 6.8d U^{237} at the St. Louis Cyclotron. 1946. Declassified May 13, 1949. 3p. (AECD-2587)

The yield of 6.8d U^{237} in U irradiated with neutrons at the St. Louis cyclotron has been detd. in two sets of expts., and compared with pile production at Clinton. The results are tabulated below.

Target	U^{237} yield (% of fissions)	Fission rate (fission/min/gU/ μa)
Be target	17	3.8×10^7
Be target	1.2	
Li target	17	2.4×10^6

- 3504 Brewer, L., Edwards, R. K., and Templeton, D. H. The Crystal Structure of UBi. Aug. 31, 1949. Declassified Nov. 2, 1949. 15p. (AECD-2730)

Samples of U-Bi alloys have been prepd. and investigated by means of x-ray diffraction. One of the 4 phases identified is attributed to the cpd. UBi. Its diffraction pattern corresponds to a simple cubic lattice with $a = 3.182 \text{ \AA}$; however, since this cube is large enough for only 1 atom, the pattern is interpreted as being due to a NaCl structure with $a = 6.364 \text{ \AA}$. (Report AECU-653(1949) is a revision of this information.)

- 3505 Brewer, L., Edwards, R. K., and Templeton, D. H. The Crystal Structure of UBi. Nov. 15, 1949. 16p. (AECU-653)

This report is a revision of AECD-2730(1949).

- 3506 Bricker, C. E., Furman, N. H., and McDuffie, B. A Method for the Determination of Traces of Metals. Mercury Cathode Electrolysis, Followed by Distillation of the Mercury and Polarographic or Colorimetric Examination of the Distillation Residue. Related Procedures. I. Outline of the Method. October 1947. Declassified May 25, 1949. 16p. (AECD-2600)

This work originated with the purpose of detg. minor amts. of Cd in U and related materials. The use of a small (2 ml) Hg cathode as a collector for traces of electrolyzable metals has been tested for a variety of materials that can be brought into dil. H_2SO_4 solns. The metals that are deposited are sepd. from Hg by distn. of the latter, after which sensitive methods such as polarography and spectrophotometry may be applied to the analysis of the residue.

- 3507 Bricker, C. E., Furman, N. H., and McDuffie, B. A Method for the Determination of Traces of Metals. II. Studies of the Electrolysis of Metals into Mercury Cathodes. October 1947. Declassified May 24, 1949. 12p. (AECD-2601)

Some details of the electrolysis of small quantities of various metals into a Hg cathode from concd. uranyl solns. have been presented. The U^{+4} - U^{+3} mixt. that is formed may prevent the deposition of Cr and Mo in a Hg cathode, provided the soln. is rather concd. in U. Fe is frequently found to divide between Hg cathode and soln. The presence of traces of metals that affect the overvoltage of H at the Hg cathode appears to be a contributing factor. The use of redox potential buffers other than the U^{+4} - U^{+3} system as a device for controlling group sepns. in electrolysis with Hg cathodes has been suggested.

- 3508 Brunton, D. C. and Hanna, G. C. "Fission Fragment Energies in U^{235} and U^{233} ." Phys. Rev. (2), 75, 990-1(1949).

Expts. were undertaken to det. the energy distribution of the fission fragments of U^{233} . A double "back-to-back" ionization chamber was used with a thin source mounted on the common cathode. Electron collection was employed with Frisch grids shielding the collecting electrodes (Cranshaw and Harvey (1948)). The fission source was a collodion film of $\sim 14 \mu\text{g}/\text{cm}^2$ containing 3 to 5 $\mu\text{g}/\text{cm}^2$ of U dissolved in it, and the neutron source was the thermal column of the Chalk River pile. The results obtained have been tabulated and compared in tabular form with previous data of a similar nature for Pu^{239} and U^{235} . Contour diagrams of the fission modes in U^{233} and a curve of the variation in the total kinetic energy with the mass ratio for U^{235} and U^{233} are also given.

- 3509 Burkhart, L. E., Stukenbroeker, G., and Adams, S. "Isotope Shifts in Uranium Spectra." Phys. Rev. (2), 75, 83-5(1949).

This paper contains information similar to that in report AECD-2001(1948).

- 3510 Burstall, F. H. and Ryan, W. Chemical Methods for the Estimation of Uranium in Mineral Products. Technical Report CRL-AE-1 to ACAE(M) Chemical Panel and DAE Analytical Panel. Declassified August 1949. 7p. (BR-743)

Method I. Procedures for getting the ore into soln. and extrns. with cupferron and CHCl_3 are described. A method for volumetric estn. is indicated based on an H_3PO_4 soln. titrated with $\text{Ce}_2(\text{SO}_4)_3$. Method II. The procedures are similar to the previous method but are based on extrn. with Et_2O . A method for volumetric estn. with low-grade ore, a method for colorimetric estn., methods for fusion, and directions for the prepn. of reagents are included.

- 3511 Carter, J. M.—assigned to U. S. Atomic Energy Commission. Process of Producing Uranium Tetrabromide. May 10, 1949. (U. S. Patent 2,469,916)

This invention pertains to the prepn. of UBr_4 by a liq. phase reaction of a U oxide (usually UO_2) with SBr; the reactive SBr is formed in situ by agitating and refluxing a mixt. of the U oxide, Br_2 , and S at an elevated temp. (usually about 170°C), which may vary considerably (140 to 190°C). The object of this invention is to provide an easier, more eff., and more economical way of producing UBr_4 and to obviate the difficulties which arise when uranous-uranic oxide is used as the starting material. The app. for the reaction consists of a reaction vessel equipped with stirring means, heating means, a reflux condenser, charging ports, and a trap. After the mixt. is refluxed for some time, some of the contaminants (SBr and excess Br_2) are distd. out of the reaction mass; the excess S is then extrd. from the mass with a solvent and the UBr_4 is isolated.

- 3512 Casto, C. C. Analytical Chemistry of the Manhattan Project. Chapter VI. Electrolytic Separation Methods. Declassified June 2, 1949. 48p. (AECD-2617)

Considerable development work has been done on Hg cathode electrolysis in acid soln.; a summary of this work is presented. The use of the Hg cathode for the purification of U solns. is discussed. Electrolysis from H_2SO_4 media and the deposition rate as a function of various factors are considered. Further discussion covers the use of the Hg cathode in the detn. of impurities in U cpds.; techniques and equipment for minimizing anodic oxidation; electrolytic deposition of U on solid metal cathodes; the deposition of U using a buffer soln. of NaOAc or NH_4OAc with HOAc, $(\text{NH}_4)_2\text{C}_2\text{O}_4$, and NaF solns.; the effect of various factors upon the compn. of the electrodeposit; the deposition of U from NaF medium; deposition of U on Ni and Cu; and the electrodeposition of Th on a solid metal cathode. 45 references are given.

- 3513 Charbonnier, G., Scherrer, P., and Wäffler, H. "Cross Section for Fission of U^{238} by Means of the Lithium Gamma Radiation ($h\nu = 17.5$ Mev)." Helv. Phys. Acta **22**, 385-6(1949).

The cross section for photofission of the U^{238} nucleus was detd. by the photographic method. Kodak NTA type plates were satd. in a soln. of high U concn. The emulsions thus treated contained 2.8×10^{18} U nuclei/cm² of surface area. They were then bombarded for several hrs with Li γ rays. Using a value of the abs. intensity of the Li γ radiation given elsewhere (Waeffler and Hirzel, Helv. Phys. Acta **21**, 200(1948)) the cross section was found to be $4.6 \pm 1.5 \times 10^{-26}$ cm². This is in good agreement with the results of Baldwin and Klaiber (Phys. Rev. (2), **71**, 3(1947)), who used the bremsstrahlung of a 100 mev betatron, but is three times as great as the value found by Arakatsu (Proc. Phys.-Math. Soc. Japan **23**, 440(1941)) who also used Li γ rays.

- 3514 Cheylan, M. "The Instability to Heat of the Uranyl Nitrate-Diethyl Ether System." Bull. soc. chim. France 641-5(1949).

The instability of $\text{UO}_2(\text{NO}_3)_2$ in the presence of Et_2O (the "explosive uranyl nitrate") has been explained by the formation of nitrous products, the catalytic action and the radioactivity of the U ion, or by the oxidizing action of the nitrate. It is shown that the Et_2O solutions of $\text{UO}_2(\text{NO}_3)_2$ are oxidizable without deflagration up to 85 to 90°; that the catalytic action and the radioactive effect of the U ion appear to be negligible; that the isolatable cpds. of the $\text{UO}_2(\text{NO}_3)_2$ - Et_2O system do not contain NO_2 in the mol.; and that the cpds. are stable to detonation and also are stable to heat of up to 85 to 90°, the temp. which provokes the deflagration of the mass with the formation of orange UO_2 and of different products of oxidation of Et_2O , notably acetaldehyde and ethyl peroxide. It is also shown that this decompn. is due to the sole oxidizing action of a sol. nitrate which is present in the Et_2O in strong concns. and that this decompn. can be demonstrated also with Th nitrate, which excludes all specific action of the U ion.

- 3515 Claffy, E. W. "The Polarographic Method for Determining Trace Elements in Rocks and Minerals." Am. J. Sci. **247**, 187-99(1949).

Polarographic analysis is based on the measurement of current developed in a soln. contained in an electrolytic cell with a dropping Hg electrode. The magnitude of the current is proportional to the concn. of the element, and its measurement establishes quant. detn. Identification of the element is made from the "half-wave potential," each electro-reducible or electro-oxidizable substance having a characteristic value. The method is particularly suitable for quant. analysis of amt. in the range of 10^{-2}M to 10^{-6}M (about 0.X to 0.000X%), for many metals and nonmetals occurring in rocks and minerals. Usually, not more than 3 or 4 elements are detd. simultaneously with the polarograph. In many cases, detns. can be made in the presence of other elements, which by ordinary chem. methods are impossible or impractical. Detn. of many major constituents can also be made, although with less accuracy, thus permitting a quick, simple, and approx. analytical method suitable for broad surveys. Included in the 40 elements (approx.) to which this method is applicable, are the following: Ra, Ti, Zr, V, Cb, U, and Ge.

- 3516 Clark, F. "The Recovery of Uranium from Sodium Estimation Residues." Analyst **74**, 411-12(1949).

A method developed by the Chemical Inspection Department of the Ministry of Supply for the recovery of U from residues and liquors left after Na detns. with Zn uranyl acetate is set forth in detail. The principle of the method is the pptn. of hydrated UO_4 which is converted into UO_3 by ignition. UO_3 dissolved readily in HOAC, forming uranyl acetate, the salt required for prep. the pptg. agent for Na. Liq. and solid residues are collected and treated separately. It is stated that UO_3 recovered by this method will be completely free from Zn if the washing is carried out efficiently.

- 3517 Clark, F. L., Spencer-Palmer, H. J., and Woodward, R. N[M]. Alpha Ray Analysis of U Isotopes. Part II. Results. Oct. 10, 1944. Declassified March 1949. 36p. (BR-522)

An α -counting app. (see report BR-431) is used to det. the relative α activities of U^{234} , U^{235} , and U^{238} in normal U and in samples enriched in U^{234} and U^{235} . The best values obtained are

$$\alpha \text{ activity of } \frac{\text{U}^{234}}{\text{U}^{238}} = 1.005 \pm 0.005 \text{ and } \alpha \text{ activity of } \frac{\text{U}^{235}}{1/2(\text{U}^{234} + \text{U}^{238})} \times 100 = 3.63 \pm 0.03\%$$

(Errors shown include only counting errors.)

The peak activity (relative) of U^{235} to U^{238} lies between 3.4 and 3.8%. This is in serious disagreement with Miers' value of about 4.6%. This discrepancy is discussed and the possibility of an α particle from U^{235} being about the same as one from U^{238} is proposed, and the possibility rejected, a similar possibility for confusion with the α from U^{234} is said to be more plausible. Because the exact value was not detd., no definite conclusion was reached as to the α activity of U^{235} . Activities of other elements are also considered.

- 3518 Cook, W. D., Hazel, F., and McNabb, W. M. "Volumetric Determination of Small Amounts of Uranium (Chromous Chloride as Reducing Agent)." Anal. Chim. Acta **3**, 656-9(1949).

A volumetric method is proposed for the rapid detn. of small amts. of U. The U^{+6} is reduced to U^{+4} with chromous chloride, the excess of which is destroyed by air oxidation. Phenosafranine, a low-potential redox indicator, is used to follow the reduction and air oxidation. $\text{Fe}_2(\text{SO}_4)_3$ is added to the soln. and the resulting Fe^{++} titrated with $(\text{Cr}_2\text{O}_7)^{-}$ soln.

- 3519 Crompton, C. E., Tichenor, R. L., and Young, H. A. Determination of Traces of Uranium Using the Polarograph. The Catalytic Reduction of Nitrate Ions in the Presence of Uranyl Ions. April 10, 1945. Declassified Sept. 20, 1949. 16p. (AECD-2704)

The catalysis by U of the reduction of $(\text{NO}_3)^{-}$ at the dropping Hg electrode has been found to provide a method of analysis for small amts. of U (0.008 to 1.1 ppm) only when nearly all other ions are absent. The optimum supporting electrolyte is 0.05M $(\text{NO}_3)^{-}$, 0.03M H^{+} , 0.005M Cl^{-} , 1.035M Na^{+} , and 0.0001 to 0.0002% methyl red. Anions interfere, roughly, in proportion to their ability to form complexes with $(\text{UO}_2)^{++}$. Among the cations which are not reduced before H^{+} is discharged at the Hg cathode, the polyvalent ions cause the largest decrease in the catalytic current.

- 3520 Dahl, A. I. and Cleaves, H. E. The Freezing Point of Uranium. Declassified Mar. 22, 1949. 13p. (AECD-2541)

The freezing temp. of U of about 99.99% purity was measured with an optical pyrometer and found to be $1133 \pm 2^\circ\text{C}$. Both the initial purity and the initial freezing temp. were lower than the foregoing values. However, holding the metal at temps. just above the m.p. for several hrs resulted in a decrease in the content of several impurities and an increase in the freezing temp. to a final const. value. The freezing temp. was not greatly affected by the crucible material, similar values being obtained in Be, Th, and graphite crucibles. (This paper is also available in J. Research Natl. Bur. Standards **43**, 513-17(1949).)

- 3521 Dahl, A. I. and Cleaves, H. E. "The Freezing Point of Uranium." J. Research Natl. Bur. Standards **43**, 513-17(1949).

This paper is similar to report AECD-2541(1949).

- 3522 Dahlman, B. and Rynninger, R. "Determination of Small Amounts of Uranium. V. Spectrochemical Determination in Solutions." Svensk Kem. Tid. **61**, 204-13(1949).

The present investigation has shown that quantities between 0.05 and 5 mg of U can be detd. spectrochemically in pure solns. of $\text{UO}_2(\text{NO}_3)_2$, using Fe as internal std. element. The spectrograph used was a 3-prism glass spectrograph of Zeiss construction with a F: 84 cm camera. The $\text{UO}_2(\text{NO}_3)_2$ solns. are obtained by Et_2O extrn. from very complex solns. contg. large quantities of other elements. The precision of the method was calcd. statistically and the std. deviation was found to be $\pm 7\%$ of the U concn. By a slight modification of the method, U quantities between 0.005 and 0.5 mg can be detd. with the same accuracy.

- 3523 Davenport, W. H. and Thomason, P. F. "Determination of Uranium(VI) in Presence of Anions. Ammonium Thioglycolate as a Colorimetric Analytical Reagent." Anal. Chem. **21**, 1093-5(1949).

This paper is similar to report AECD-2398(1948).

- 3524 Davey, C. N. and Florida, C. D. The Ultraviolet Fluorimeter by Hilger and Watts Limited. May 1949. 7p. (AERE-EL/R-337)

The design and testing of a fluorometer constructed by Hilger and Watts, Ltd., in which all the components are arranged on a horizontal axis, are described. This instrument consists of a source of ultraviolet light, a lens and filter system, a sample holder, another lens and filter system, and a device for measuring fluorescent light. The instrument is applicable to the method of U analysis of Neuman et al. (J. Biol. Chem. 1948) which consists, briefly, of fusing the sample with a fusion mixt. contg. a percentage of NaF. This fused sample fluoresces upon illumination with ultraviolet light, and the intensity of fluorescence is a measure of the quantity of U present. Suggestions for improvement of the instrument are included.

- 3525 Davidson, C. F. A Prospector's Handbook to Radioactive Mineral Deposits. London, Geological Survey of Great Britain, 1949. 28p.

The common radioactive minerals, principal types of radioactive mineral deposits, and radioactivity testing methods as an aid to prospectors in their exploration for U and Th ores are described.

- 3526 de Groot, V. S. R. "Separation by Diffusion Mainly of Uranium Isotopes." Voord. Koninkl. Inst. Ing. No. 3, 1-05(1949).

When a gaseous mixt. diffuses through a porous wall, the lighter molecules will travel faster than the heavier ones, because of the greater thermal velocities. This phenomenon is applied to sep. U^{235} from U^{238} . As the sepn. of a single diffusion process is very small, the operation must be repeated in countercurrent in thousands of units linked together into a cascade. Some peculiarities in the construction of the cascade, necessary to obtain a reasonable production, are mentioned.

- 3527 De Juren, J. and Knable, N. Nuclear Cross Sections for 95-Mev Neutrons. June 10, 1949. Declassified Sept. 15, 1949. 27p. (AECD-2705)

The total cross sections of 12 different elements (H, D, Be, C, N, O, Al, Cl, Cu, Sn, Pb, and U) were measured using the neutron beam from the 184-in. cyclotron operating with deuterons. Bi fission ionization chambers were employed as both monitor and detector in conventional "good geometry" attenuation measurements in the neutron flux emerging from the 3-in. diameter collimating port in the 10-ft thick concrete shielding. The mean energy of detection of the neutrons in this expt. is estd. to be

95 mev. Measurements were also made with a monitor and detector placed inside the concrete shielding where an intense neutron flux over a large area was available. Attenuators of 4 different elements were placed in front of the detector in a "poor geometry" arrangement so that attenuation was due essentially to inelastic collisions which degrade the neutron energy below the fission threshold. A second detector was placed outside the concrete shielding in the collimated neutron beam in line with the neutron source, absorber, and first detector. Attenuation in it was caused by both inelastic and elastic scattering. By this arrangement the ratio of inelastic to total cross section could be detd. directly in one expt. The nuclear radii as calcd. from the observed cross section using the theory of the transparent nucleus varied as $1.38 \times 10^{-13} A^{1/3}$ cm. In this energy range the ratios of the inelastic to total cross sections were all less than one-half. Also available in Phys. Rev. (2), 77, 606-14(1950).

- 3528 Dieke, G. H. and Duncan, A. B. F. Spectroscopic Properties of Uranium Compounds. New York, McGraw-Hill Book Company, Inc., 1949. 250p. (National Nuclear Energy Series. Division II, Volume 2)

This book is similar to report MDDC-688(1947).

- 3529 Dinse, A. G. The Effects of Uranium on Plants. Declassified Dec. 22, 1949. 29p. (AECD-2787)

In this literature review and bibliography all references are included to the effects of U on plants, found in Chemical Abstracts through March 10, 1949; Experiment Station Record through its last year of publication, 1946; Biological Abstracts through 1948; and Bibliography of the Minor Elements through 1948. Low concns. of the U salts are beneficial to plant and bacterial growth, but concns. above a certain low level are growth-retarding and even toxic. Seed germination is stimulated in the higher plants, and nitrogen fixation is increased in bacteria, by a low U concn. U is a natural constituent of most soils, usually in amts. far greater than the needs of the plant. Plants may take U from the soil or nutrient soln.; it occurs in greater amts. in roots than in stems and leaves. The effects of U are mainly attributed to its chem. properties, rather than to its radioactivity. 75 references are given.

- 3530 Dinse, A. G., Barnett, T. B., Hodge, H. C., and Maynard, E. A. Oral Toxicity of Uranium Compounds. I. Repeated Intraperitoneal Injections of Uranyl Nitrate. Declassified Dec. 22, 1949. 29p. (AECD-2770)

Groups of male and female rats were injected daily for 1 mo. with the same vols. (10 cc/kg) of various concns. of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ in aq. soln. In the first expt., weanling female rats were treated as follows: (1) control group, no treatment, (2) control group, injected with distd. water daily, (3) dose of 0.08 mg/kg daily, (4) dose of 0.40 mg/kg daily, (5) dose of 2.0 mg/kg daily. In the second expt., weanling male rats were treated as follows: (1) single dose of 1.0 mg/kg, (2) dose of 0.17 mg/kg daily, (3) dose of 0.68 mg/kg daily, (4) dose of 1.0 mg/kg daily. None of the control rats and none of the rats receiving up to and including 0.40 mg/kg daily died. Of the remaining three groups, the mortalities were as follows: 0.67 mg/kg daily, 20%; 1.0 mg/kg daily, 60%; 2.0 mg/kg daily, 90%. During the 1-mo. period of treatment, growth rates of the control rats, those receiving the single dose, and those receiving daily doses of 0.08 and 0.17 mg/kg, resp., were all closely similar; specifically, the av. body weights at the end of the mo. were within 10 g of each other. Considerable growth depressions followed the daily injection of 0.40 to 2.0 mg/kg. At the time of autopsy, organ weights were recorded. In general, the rats had sacrificed body weight in order to maintain the vital organs. An exception was the liver which showed a loss in weight. When the daily doses are computed as cumulative doses the total amts. administered are found to be small; e.g., a daily dose of 0.08 mg/kg gave a total dose of only 0.3 mg during the mo., and the highest dose, 2.0 mg/kg, amounted to only 4.0 mg in the mo. The anatomical diagnosis showed the following progressive increase in renal injury with dosage: 0.08 mg/kg, very slight changes; 0.17 mg/kg, slight changes; 0.40 mg/kg, mild to moderate injury; 0.67 mg/kg, moderate to moderately severe injury; 1.0 mg/kg, moderately severe injury. There were too few survivors to

assess the relative damage following the administration of 2.0 mg/kg. These data provide the basis for indicating the relationship between % uranyl nitrate mixed into the diets of rats and ingested for 1 mo. and the daily doses given intraperitoneally. Using mortality as a criterion, 1% $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ in the diet is roughly equiv. to 0.2 to 0.3 mg/kg intraperitoneally. Using weight depression as a criterion, 1% in the diet is roughly equiv. to 0.33 to 0.39 mg/kg intraperitoneally. Using the pathological changes as a criterion, 0.5% in the diet is compared with 0.17 mg/kg and 2.0% in the diet is compared with 0.67 mg/kg; therefore, 1% in the diet is intermediate between 0.17 and 0.67 mg/kg intraperitoneally.

3531 Domange, L. and Wohlhuter, M. "Sensitivity of Uranium Fluoride, UF_4 , towards Water Vapor." Compt. rend. 228, 1591-2(1949).

Using a method described in Ann. chim. (11), 7, 226(1937), the action of water vapor on UF_4 was studied, the reaction involved being $\text{UF}_4 + 2\text{H}_2\text{O} \rightarrow 4\text{HF} + \text{UO}_2$. Water vapor was passed over UF_4 with different speeds; the resulting vapor phases were analyzed, and the compns. were extrapolated for zero velocity. The temp. range investigated was 200 to 500°C. It was found that heating with water vapor decomp. UF_4 rather easily, the sensitivity of U toward this reaction approaching that of Zn. From the values of the equil. consts. for various temps., the reaction heat was found to be equal to about -30 kcal. Using the known values of the formation heat of UO_2 , HF and H_2O , it is found that the formation heat of UF_4 is about 440 kcal; the value 443 ± 3 kcal is given in MDDC-1543(1947).

3532 Downs, W. L., Maynard, E. A., and Hodge, H. C. Oral Toxicity of Uranium Compounds. Section 3. Effect of a Single Dose of Uranyl Nitrate. Declassified Dec. 22, 1949. 21p. (AECD-2772)

50 male and 50 female rats were given access to a diet contg. 2% $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ for a single 24-hr period and thereafter maintained for 10 mo. on the stock ration. Equal groups of control rats were observed during the same period. The rats were kept in pairs, 1 male and 1 female in each cage. The male rats were removed from the cage near the end of the gestation period. The litters were removed at birth and the rats remated. There was no interference in growth associated with the single dose of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$. A single 24-hr feeding did not reduce the no. of females bearing litters. The exptl. female rats had a small reduction in the no. of litters but a larger reduction in the total no. of young. It seems to be reasonable to conclude that, under the circumstances of this ex-
expt., U administration adversely affected the reproductive functions in the absence of a severe derangement of nutrition.

3533 Duval, C. "Thermogravimetric Analysis of Precipitates. XXIV. Determination of Uranium." Anal. Chim. Acta. 3, 335-44(1949).

A study has been made of the gravimetric methods for the detn. of U^{+4} and U^{+6} ; two new forms of weighing are suggested, as oxalate and anhyd. oxinate. The following table summarizes the temp. limits, detd. by means of the Chevenard thermobalance, for various ppts.:

Pptg. reagent	Form weighed	Temp. limits (degrees)
Ammonium hydroxide	UO_3	480 to 610
Ammonium hydroxide	U_3O_8	745 to 946
Ammonia (gas)	U_3O_8	675 to 946
Pyridine	U_3O_8	745 to 946
Ammonium benzoate	U_3O_8	691 to 946

Pptg. reagent	Form weighed	Temp. limits (degrees)
Hexamethylenetetramine	U ₃ O ₈	745 to 946
Tannin	U ₃ O ₈	570 to 878
Hydrogen peroxide	U ₃ O ₈	811 to 946
Hydrofluoric acid	U ₃ O ₈	811 to 946
Ammonium sulfate	U ₃ O ₈	850 to 946
Disodium phosphate	U ₂ P ₂ O ₁₁	673 to 946
Oxalic acid	U(C ₂ O ₄) ₂	100 to 180
Oxalic acid	U ₃ O ₈	700 to 946
Cupferron	U ₃ O ₈	800 to 946
β -Isatoxine	U ₃ O ₈	408 to 946
8-Hydroxyquinoline	HUO ₂ (C ₉ H ₆ ON) ₃	<157
8-Hydroxyquinoline	UO ₂ (C ₉ H ₆ ON) ₂	252 to 346
Quinaldinic acid	U ₃ O ₈	610 to 946

- 3534 Elliott, N. "The Magnetic Susceptibilities of Some Tetravalent Uranium Fluorides." Phys. Rev. (2), 76, 431-2(1949).

The magnetic susceptibilities of UF₄, KUF₅, K₂UF₆, and Na₃UF₇ have been measured by the Gouy method over a temp. range of approx. 74 to 300°K. The UF₄ was prepd. from UO₂ by treatment with anhyd. HF, and the complex salts were prepd. by the fusion of UF₄ with stoichiometric quantities of the alk. or alk. earth fluorides. This was done in a Pt crucible in an HF atm., as described by Zachariasen, J. Am. Chem. Soc. 70, 2147(1948). With the exception of K₂UF₆, these substances obeyed the Curie-Weiss law $\chi = C/(T + \theta)$ over the whole temp. range for the investigation. K₂UF₆ followed the Curie-Weiss law down to 198°K, but deviated below this temp. At 76°K its susceptibility is 8.6% smaller than that given by the Curie-Weiss equation. These data are given in tabular form along with the experimentally calcd. values for the magnetic moments of the free ions. The values obtained for the latter are in good agreement with the theoretical value calcd. by Van Vleck in Theory of Electric and Magnetic Susceptibilities. N. Y., Oxford University Press. (See also report AECD-1896(1948).)

- 3535 Engelkemeir, D. W. and Turkevich, A. Further Studies of the Radiation Characteristics of U²³⁷. 1946. Declassified May 18, 1949. 33p. (AECD-2558)

Studies of the nuclear radiations of U²³⁷ by absorption in Al, Cu, and Pb, together with coincidence measurements give proof of the presence of many conversion electrons accompanying the decay of this nuclear species. There appear to be 50, 200, and ~400 kev γ 's besides Np x rays (~14 and ~95 kev) and particles of at least three types. No simple decay scheme seems consistent with the data on the relative intensities.

- 3536 Erlenmeyer, H., Oppliger, W., Stier, K., and Blumer, M. "Determination of the Uranium Content in Rocks. Geochemical Studies. Part I." Helv. Chim. Acta 33, 25-36(1949).

A colorimetric detn. of U is based on the fluorescence in ultraviolet light exhibited by U-contg. beads of fused NaF. The method was systematically studied with the view of its applications to rock analysis, and the results showed that quant. detns. of 10⁻⁶ g U ($\pm 5\%$) are possible. A U-contg. soln., evapd. to a small vol. (2 to 5 cm³), is mixed with 1 g NaF into a mass that is then calcined and ground into a powder, from which, with the aid of a Pt loop, fused beads are prepd. The main problem was, first, the detn. of the degree of weakening of the fluorescence, which is caused by many of the elements present in a rock sample, and, second, the finding of a simple general method for the removal of the disturbing elements. The sample is either directly dissolved in hot concd. HCl (basic rocks), or it is previously calcined with Na₂CO₃, then dissolved in HCl (acid rocks). The soln. is then treated,

successively, (1) with NH_3 , whereby U is carried over in the $\text{Fe}(\text{OH})_3$ ppt., (2) with dild. HCl for dissolving, and (3) with $(\text{NH}_4)_2\text{CO}_3$ in order to sep. U (which remains in the soln.) from Fe. The soln., now free from disturbing admixts., serves for the prepn. of NaF beads, as shown above. Results of U detns. in many rocks (chiefly from the Alps) such as bituminous rocks, Fe ores, bauxites, and pegmatites, and in river water are given.

3537 Facchini, U. and Orsoni, L. "A Method for the Determination of Uranium Content in Minerals by Using the Fission of U^{235} ." Nuovo cimento (9), 6, 241-54(1949).

Layers of powd. U cpds. are irradiated with thermal neutrons, and the pulses counted that are produced in an ionization chamber as a result of U fission reactions. The no. of pulses is proportional to the U content in the sample irradiated, to the sample's d., and to the range of U^{235} fission products in the sample. The U content is detd. by comparison of the no. of pulses with that of a sample of a known compn. The app. used is described and its theory outlined.

3538 Fairhall, L. T. Industrial Toxicology. Baltimore, Williams and Wilkins Co., 1949. Pages 183-6 contain a brief discussion of the characteristics of U, its industrial uses, and its toxicology. The information included is documented by 16 references which, when appropriate, are included in this bibliography.

3539 Feather, N. "Classical Radioactivity, 1940-1949." Nucleonics 5, 22-41(1949) July. The author discusses the exptl. work, published since Jan. 1, 1940, on the radioactivity of U^{238} , U^{235} , and Th^{232} and their natural decay problems. 190 references are included.

3540 Ferretti, R. J. and Schwartz, S. Uranium Distribution Studies. June 15, 1946. Declassified June 15, 1949. 12p. (MDDC -540)

A description of a microfluorimetric method for the detn. of small quantities of U in animal tissue is given. In detecting U in rabbits examined in this study, quantities as small as 0.0001γ were detected. The bone quenching effect is discussed and a correction factor is calcd. The bones and kidneys were found to be the major site of U deposition in the rabbit.

3541 Fields, P. The Preparation and Decontamination of 93Np^{239} in Trace Concentrations. Declassified Mar. 2, 1949. 9p. (AECD-2486)

Np^{239} , an isotope emitting β particles with a 2.3-day half-life, is formed by $\text{U}^{238}(\text{n},\gamma)\text{U}^{239} \xrightarrow[23\text{m}]{\beta} \text{Np}^{239}$.

Early work, which was performed using the cyclotron as a neutron generator, laid the foundation for the larger scale prepn. of Np^{239} using piles as the neutron source. Methods are described for the prepn. of pure Np^{239} activity from neutron-irradiated U cpds. The methods described fall essentially into two classes: (1) copptn. methods, and (2) solvent extrn. methods. (This paper is also available in Seaborg, Katz, and Manning, The Transuranium Elements. New York, McGraw-Hill Book Company, Inc., 1949. Paper 15.10.)

3542 Foley, T. T. and Anderson, R. C. "Spectrophotometric Studies of Complex Formation with Sulfosalicylic Acid. II. With Uranyl Ion." J. Am. Chem. Soc. 71, 909-12(1949).

As part of a series of studies on complex formation with sulfosalicylic acid, it has been of interest to compare the reactions of U—as a member of another transition series of elements—with that of Fe. Weil and Rozenblum (Bull. tran. inst. pharm. (Poland) I, 1(1902)) reported as a solid cpd. of U and sulfosalicylate, $(\text{C}_6\text{H}_3(\text{OH})(\text{SO}_3)(\text{COO}))_2\text{U}$, but no observations in soln. were made. Müller, Fernandes, Mai, Weinland, and Hager (Z. anorg. allgem. Chem. 160, 193(1927)) have reported complex formation between uranyl ion and salicylic acid or various salts. In this particular investigation, reactions of sulfosalicylic acid in solns. contg. U as $(\text{UO}_2)^{++}$ have been studied. Spectrophotometric data for solns.

with concns. in the region of 0.005M and over a pH range of 2 to 10 indicate only one complex formed with $(\text{UO}_2)^{++}$ and sulfosalicylic acid. This involves 1 : 1 -mole ratio of $(\text{UO}_2)^{++}$ and sulfosalicylic acid. The effects of changing pH, of temp., and of $(\text{OAc})^-$ have been studied. The dissocn. const. and free energy of formation of the complex have been calcd.

3543 Forsling, W. "Compounds of Thorium and Quadrivalent Uranium with Benzoylacetone and Dibenzoylmethane." Acta Chem. Scand. 3, 1133-6(1949).

Prepns. of Th benzoylacetate, Th dibenzoylmethane, U^{+4} benzoylacetone, and U^{+4} dibenzoylmethane have been described. The method to prep. U^{+4} acetylacetate given by Biltz and Clinch is mentioned.

3544 Foster, M. D. and Stevens, R. E. The U. S. G. S. Carbonate-Phosphate-Peroxide Method for the Determination of Very Small Amounts of Uranium in Naturally Occurring Materials. Declassified June 24, 1949. 14p. (AECD-2630)

A procedure is described for the detn. of very small amts. of U (as low as 0.10 mg) in naturally occurring materials. U is sepd. from the bulk of the constituents by repeated pptn. of them with Na_2CO_3 and is then copptd. with Al as phosphate in (OAc) . The phosphate ppt. is dissolved in $\text{NaOH} \cdot \text{Na}_2\text{O}_2$ soln., and U is detd. colorimetrically. A discussion of the important features of the method, exptl. work done in connection with the development of the method, and comparative results by this and other methods are given.

3545 Freed, S. and Leitz, F. J. Jr. "The Absorption Spectra of Transuranic Salts in Crystals." J. Chem. Phys. 17, 540-1(1949).

This paper is similar to report AECD-1890(1948).

3546 Fried, S. M. and Davidson, N. R. —assigned to U. S. Atomic Energy Commission. Method of Preparing Uranium Trioxide. Aug. 2, 1949. (U. S. Patent 2,477,924)

A process for the prepn. of UO_3 in cryst. form from amorph. U_3O_8 is described. This is accomplished by heating the oxide between 450 and 750°C under O_2 , pressures varying from 20 to 150 atms. The time required for the conversion varies from 12 to 112 hr, depending upon the pressures and temps. to which the system is subjected. This time can be reduced to 1 1/2 to 2 hr by using O_2 pressures between 60 and 150 atm. at a temp. from 700 to 750°C. A description of the app. for the prepn. of UO_3 is given.

3547 Furman, N. H. and Watters, J. I. Analytical Chemistry of the Manhattan Project. Chapter VIII. Electrometric Methods, Apparatus, and Technique. Declassified June 2, 1949. 75p. (AECD-2623)

The general principles and techniques of potentiometric methods are briefly surveyed, and a description of potentiometric app. is given. The potentiometric titration of U is discussed in detail. General polarographic methods and app. are also surveyed; detailed polarographic methods for the analysis of U are given. Conductometric methods are briefly discussed.

3548 George, D'A. Mineralogy of Uranium and Thorium Bearing Minerals. Rev. January 1949. 198p. (RMO-563)

This report is in two parts. Section I is devoted to a summary of the distribution, chem., tests, mode of occurrence, and classification of the minerals and is based in part upon lab. investigations and in part upon literature studies and field reports prepd. by the writer's colleagues during the course of work for the Manhattan Engineering District. Section II is devoted to descriptions of the individual minerals. In prepg. it, the literature was freely consulted and abstracted. The information from the literature has been largely taken from such std. references as J. D. and E. S. Dana, System of Mineralogy, 6th Ed., 1892 and 7th Ed., Vol. I, revised by Palache, Berman, and Frondel; A. N. Winchell, Elements of Optical Mineralogy, Part II. 1933; E. S. Larsen, The Microscopic Determination of

Non-Opaque Minerals, U. S. Geological Survey, Bulls., 679 and 848 as revised in conjunction with Harry Berman. The bulletins of the Mineralogical Society of America were also consulted, as were other sources of information. Wherever possible, however, the writer has presented the results of his lab. researches as well as the U_3O_8 and ThO_2 contents of selected minerals analyzed during the investigations. In addn., an attempt has been made to point out means of rapidly differentiating between minerals of similar chem. compn. and to eliminate or define the many variety names which have been applied to minerals showing insignificant variations in compn. The description of minerals is under three general headings, viz., Hypogene Uranium Minerals, Hypogene Thorium Minerals, and Supergene Uranium Minerals. All of the known U minerals are described in detail, but this treatment is accorded to only a few of the Th minerals.

- 3549 Gibson, M. The Determination of Manganese in Uranium Manganese Alloys. February 1949. 17p. (AERE-C/R-350)

Two methods have been developed for the detn. of Mn in U-Mn alloys. In each case, exptl. work leading up to the establishment of the method is given. In one method, Mn is detd. volumetrically after soln. of the alloy in HNO_3 and oxidation with sodium bismuthate to permanganate. The permanganate is titrated with std. ferrous ammonium sulfate. This method is suitable for the detn. of Mn contents varying from 1% to >90% with an error not exceeding $\pm 0.25\%$. In the other method, Mn is detd. colorimetrically as permanganate. The alloy is dissolved in HNO_3 , H_3PO_4 is added, and the oxidation carried out with potassium periodate. The method is rapid and suitable for Mn contents from 0.2 to 10% with an error not exceeding $\pm 2\%$. The final detailed procedure for each method is given.

- 3550 Gilman, H. and Jones, R. G. Report on Studies Concerned with Organic Compounds of Uranium. Declassified Sept. 30, 1949. 36p. (AECD-2713)

This report on volatile U cpds. covers work done from February 1942, to March 1943. Prepn. of a wide variety of U cpds. and tests for volatility are reported. Although many of the cpds. were entirely non-volatile, they are described here as a contribution to the general chem. of U. The report is divided into four sections. The first section deals with U^{+4} cpds., the second with U^{+5} cpds., the third with U^{+6} cpds., and the fourth with the $(UO_2)^{++}$ cpds.

- 3551 Glover, N. The Isolation of Micro-Quantities of Uranium by Precipitation with Protein Prior to the Fluorometric Determination of Uranium. A Detailed Study of the Factors Involved. Release approved Dec. 22, 1949. 57p. (AECU-667)

This report presents a detailed study of the conditions required for the quant. sepn. of U by means of protein from substances which interfere with its fluorometric detn. This sepn. was prerequisite to the fluorometric detn. of U and has been used in studies on the distribution and excretion of U in animals. The general procedure was as follows: the acid soln. of ashed tissue and U was neutralized with alk. to pH = 4.2 to 5.0, made 0.05M with $(OAc)^-$ buffer, pH = 5.0, 120 mg of albumin was then added, and the soln. vol. adjusted to 35 ml with distd. water. After the soln. was heated, the coagulated protein-U mass was centrifuged, washed once with 0.05M $(OAc)^-$, dissolved in concd. HNO_3 , and analyzed fluoro-photometrically. Quantities of U as large as 2 to 5 mg and as small as 10 μg or less may be isolated quantitatively from 35 ml of pure soln. under such conditions. Within this concn. range, the pH is not crit. in the vicinity of the isoelectric point of the albumin (pH = 4.4 to 5.5). Increase in the protein concn., the pH, or decrease in the buffer concn. will raise this upper limit of U concn. that may be quantitatively isolated. The inverse relationship between buffer concn. and % of U isolated has been established and its importance demonstrated. All the readily available buffers react with U and thus compete with the protein. Acetate buffer, being the weakest complexer, was chosen for the procedure. No difference was observed between NaOAc and NH_4OAc . Citrate has 10 or more times the complexing affinity for U as $(OAc)^-$ at pH = 4.6 or higher. Because more than 90% of the bound U can be removed with $(HCO_3)^-$, it is concluded that the protein-U combination is dissociable even though the protein is

coagulated. Quant. isolation of U from soln. was obtained with crystd. egg albumin, bovine serum albumin, Fraction V from bovine plasma, and commercial preps. of egg albumin powders. Quant. isolation of U was achieved from solns. of ashed kidney and bone at ratios of 1 : 100 and 1 : 1000 of U : tissue-ash. The bone studies using Ca^{45} showed that at pH = 5.0 the isolated U was practically free of Ca salts. The quenching effects of ashed kidney and bone upon the fluorescence of U-NaF fusions were detd. and found to be about 20% in the presence of 50 μg of tissue ash. 20 references are included.

3552 Glueckauf, E., McKay, H. A. C., and Mathieson, A. R. "The Activity Coefficient of Uranyl Nitrate in the Presence of Sodium Nitrate." J. Chem. Soc. Suppl. No. 2, 299-302(1949). The activity coeff., γ_1 , of $\text{UO}_2(\text{NO}_3)_2$ in the presence of NaNO_3 has been measured by a solvent-extrn. method, using a technique of circulating an org.- $\text{UO}_2(\text{NO}_3)_2$ soln. through a series of aq. solns. At const. ionic strength it has been found that $\log \gamma_1$ varies linearly with the NaNO_3 molality. Thermodynamic arguments show, however, that $\log \gamma_2$, the activity coeff. of the NaNO_3 , cannot be a simple linear function of the $\text{UO}_2(\text{NO}_3)_2$ molarity.

3553 Gofman, J. W. and Seaborg, G. T. Production and Properties of U^{232} and Pa^{232} . Oct. 20, 1942. Declassified Mar. 3, 1949. 6p. (AECD-2492)
The bombardment of Th with deuterons in the 60-in. cyclotron produced, in addn. to the 27.4-day Pa^{233} , the isotope Pa^{232} , which emits β particles and γ rays with a half-life of 1.6 days. The 1.6-day Pa^{232} decays to U^{232} , which emits α particles and has a half-life of about 30 yrs. The isotope U^{232} , which is formed in rather good yield, about one mc/ $10^3 \mu\text{a}$ hrs of deuterons, is expected to be useful as a tracer isotope for U. (This paper is also available in Seaborg, Katz, and Manning, The Trans-uranium Elements. New York, McGraw-Hill Book Company, Inc., 1949. Paper 19.4.)

3554 Goldbeck, C. G. and Rodden, C. J. Colorimetric Peroxide Determination of Uranium and Its Application to Low Grade Ores. Declassified Mar. 9, 1949. 26p. (AECD-2510)
A colorimetric method using NaOH and Na_2O_2 for the analysis of U in the presence of V has been developed. Interference by V is overcome by heating the soln. contg. the reagents to the b.p. and then allowing to cool. The method has been applied to Colorado carnotite-bearing sandstone and other low-grade U-bearing ores after sepg. the U by an Et_2O extrn.

3555 Goldschmidt, B. "The Purification of Uranium." Atomes 4, 52-3(1949).
Briefly the method used for obtaining U cpds. pure enough for use in the French pile consisted in the extrn. of $\text{UO}_2(\text{NO}_3)_2$ with Et_2O pptg. the $\text{UO}_2(\text{NO}_3)_2$ as UO_4 with H_2O_2 , converting the UO_4 to UO_3 with heat, and reducing the UO_3 to UO_2 in a stream of H_2 . By this procedure strong neutron absorbers such as B, Cd, Li, and certain of the rare earths were eliminated.

3556 Gordon, P. and Kaufmann, A. R. The Alloy Systems Uranium-Aluminum and Uranium-Iron. Declassified Aug. 26, 1949. 42p. (AECD-2683)
The melting of alloys is described, and scaled drawings of an induction melting furnace used are presented. Heat treatment of specimens and thermal measurements with a scaled diagram of the app. used are described. U-Al and U-Fe equil. diagrams, photographs of microstructures, x-ray-diffraction studies, and some phys. properties of the alloys are given. (This paper is also available in J. Metals 188, 154-61 (1950).)

- 3557 Grande, F., deOya, J. C., and Díaz, J. "Effect of Uranium Poisoning in Partly Pancreatectomized Dog." Bull. Inst. Med. Res. Univ. Madrid 2, 53-5(1949).

In dogs with approx. 70% of the pancreas removed, damage to the kidneys by U nitrate (3 mg/kg intramuscularly) did not provoke the onset of diabetes. The blood-sugar level remained normal indefinitely.

- 3558 Grimaldi, F. S. The U. S. G. S. Cupferron-Extraction Method for the Determination of Very Small Amounts of Uranium in Naturally Occurring Materials. Declassified June 24, 1949. 17p. (AECD-2631)

Detailed procedures are given for the detn. of very small amts. of U (down to 0.002%) in naturally occurring materials of widely varying types. U is concd. by cupferron pptn. from reduced soln., then purified by cupferron pptn. and extrn. after oxidation to U^{+6} . Final detn. is obtained colorimetrically in alk. peroxide soln. Detailed procedures are presented, with exptl. data in support of the principal steps of the procedures.

- 3559 Gueron, J. "Analytical Chemistry and Standards for Nuclear Purity." Atomes 4, 53-6(1939) The analytical procedures for the production and purification of U, heavy water, and graphite were among the tasks assigned to the General Chemistry Section of the French Atomic Energy Commission. The activities of some of the groups in this service — spectrographic, mass spectrographic, colorimetric analyses, and electrochem. — are briefly discussed.

- 3560 Gustafson, J. K. Uranium Resources. Address at Metallurgic Colloquim, Department of Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass. Mar. 9, 1949. (Speech-91)

- 3561 Guthrie, A. and Wakerling, R. K., eds. Characteristics of Electrical Discharges in Magnetic Fields. New York, McGraw-Hill Book Company, Inc., 1949. 376p. (National Nuclear Energy Series, Division I, Volume 5)

The appropriate individual chapters of this book have, for the most part, been listed separately under the appropriate report number. The table of contents follows: Chap. 1, "Qualitative Description of the Arc Plasma in a Magnetic Field" by D. Bohm, MDDC-597(1947); Chap. 2, "The Use of Probes for Plasma Exploration in Strong Magnetic Fields" by D. Bohm, E. H. S. Burhop, and H. S. W. Massey, AECD-2230(1948); Chap. 3, "Minimum Ionic Kinetic Energy for a Stable Sheath" by D. Bohm, MDDC-537(1946); Chap. 4, "Theoretical Considerations Regarding Minimum Pressure for Stable Arc Operations" by D. Bohm, MDDC-681(1947); Chap. 5, "Experimental Investigation of Threshold Pressure for Stable Operation of Arcs" by E. H. S. Burhop, H. S. W. Massey, and G. Page, MDDC-636(1947); Chap. 6, "Measurements of the Absolute Values of the Cross Sections for Ionization of Uranium Tetrachloride and Uranium Hexafluoride by Electrons" by W. E. Berkey, E. H. S. Burhop, J. D. Craggs, J. Keene, and H. S. W. Massey, MDDC-564(1946); Chap. 7, "The Ionization and Dissociation of Uranium Tetrachloride and Uranium Hexafluoride by Electron Impact" by E. H. S. Burhop, H. S. W. Massey, and C. Watt, MDDC-1529(1947); Chap. 8, "The Rate of Ion Production by an Electron Beam" by T. L. Hill and L. H. Aller, MDDC-425(1946); Chap. 9, "A Study of the Arc Plasma" by D. Bohm, E. H. S. Burhop, H. S. W. Massey, and R. W. Williams, AECD-2094(1948); Chap. 10, "Discharge Cathodes" by W. E. Parkins, MDDC-660(1947); and Chap. 11, "Theory and Operation of a Philips Ionization Gauge Type Discharge" by J. Backus, MDDC-1327(1947).

- 3562 Haenny, C., Lerch, P., and Rochat, O. "Determination of the Relation between the Effective Cross Sections of Boron and of Uranium by the Photographic Method." Helv. Phys. Acta **22**, 609-11(1949).

Ilford C₂ + B, 100 μ , and Ilford D1, 50- μ plates loaded with U were irradiated, with and without a Cd screen, by a Ra-Be source of 50 mc. The soln. used to load the plates with U is described in detail. Special provisions were made to eliminate α tracks which might be confused with fission tracks, and to erase the haze produced by γ rays. The no. of tracks on the various plates is tabulated, and, assuming a cross section for B of 707 barns at 2200 m/sec, the U cross section turns out to be 580 ± 120 barns. In conclusion the author discusses the effects of underdevelopment of the plates. This appears to be an effective method of discriminating in favor of highly ionizing particles.

- 3563 Haenny, C., Lerch, P., and Rochat, O. "Fission Cross Section of U and the Discrimination between Various Tracks in Photographic Emulsions." Verhandl. schweiz. naturforsch. Ges. **97**(1949).

This is a summary of a work described by Rochat in Mem. soc. vaud. sci. nat. **9**, 195(1949).

- 3564 Harley, J. H. and Jetter, E. Determination of Uranium in Air Dust Samples by Alpha-Counting Methods. Dec. 7, 1949. 8p. (NYOO-94)

This report describes the handling of air-dust samples counted in the Analytical Lab., Health and Safety Division of the New York Operations Office. An outline is given of the counting procedure and calcs. involved in obtaining results of the desired accuracy. The present established tolerance for U in air has been set at 70 disintegrations/min/m³. This corresponds to approx. 50 $\mu\text{g}/\text{m}^3$ for U²³⁸ or natural U only. U-dust samples are generally taken on the 1 $\frac{1}{2}$ -in. Whatman No. 41 papers. Either parallel plate or scintillation counters are used for counting the samples.

- 3565 Harris, W. W., Baer, E. M., and Marshall, E. D. Semi-Micro Gravimetric Determination of Uranium. June 29, 1949. 11p. (AECU-408)

A modified procedure is described for the detn. of U in U cpds. using an NH₄OH pptn. followed by conversion of the NH₄OH ppt. to U₃O₈ for weighing. With U₃O₈ samples weighing from 20 to 50 mg a precision of 0.28% U at the 95% confidence level is attained. Interferences include carbonate, org. complexing agents, and cations and anions pptd. by NH₄OH.

- 3566 Harris, W. W. and Scott, R. H. Optical Properties of Three Uranium Phosphates. Sept. 30, 1949. Declassified Nov. 22, 1949. 13p. (AECU-2746)

By use of a polarizing microscope, data on the crystal system, crystal habit, and principal refractive indexes have been detd. for UO₂HPO₄·4H₂O, UO₂NH₄PO₄·3H₂O, and (UO₂)₃(PO₄)₂·4H₂O. A qual. method for identifying and differentiating these cpds. in ppts. by means of the refractive indexes is described. 15 references are given.

- 3567 Haslam, J. and Beeley, J. Note on the Determination of Chromium in Uranium Chromium Alloys. June 13, 1944. Declassified August 1949. 3p. (BR-441A)

A method is given for the detn. of up to 3% Cr in U-Cr alloys. The method is based on the isolation of the mixed Cr-U oxides, followed by perchloric acid oxidation of the Cr and volumetric detn. of the dichromate produced.

- 3568 Heal, H. G. "Some Observations on the Electro-Chemistry of Uranium." Trans. Faraday Soc. **45**, 1-11(1949).

Data on the polarography of U salt solns., in the valences of 3, 4, and 6 are given. These measurements are compared with the older published work on the oxidation-reduction potentials of the U ions, and the 2 sets of figs. related by means of the hypothesis of an unstable (UO₂)⁺ ion, which is also held responsible for the shift of potential of a U⁺⁶/U⁺⁴ electrode under illumination. New figs. are given for several oxidation-reduction potentials.

- 3569 Heal, H. G. and Thomas, J. G. N. "Unstable Ions of Quinquevalent Uranium." Trans. Faraday Soc. 45, 11-20(1949).

The formation and disproportionation of an unstable $(\text{UO}_2)^+$ ion in H_2SO_4 solns. of U^{+4} and U^{+6} have been studied. The technique was to measure the potential of a Pt reference electrode in the soln., which is detd. by the $\text{U}^{+6}/\text{U}^{+5}$ activity ratio. U^{+5} is formed by reactions of U^{+4} with U^{+6} , which is accelerated by light, and by electrolytic reduction of U^{+6} , attaining a max. concn. of approx. 10^{-5}M under the conditions of the expts. Its disproportionation is of the second order in U^{+5} , and approx. of the first order in H^+ . The activation energy of the disproportionation is about 9500 cal. A no. of values for the rate const. are given.

- 3570 Helger, B. and Rynn timer, R. "Determination of Small Amounts of Uranium. III. Further Investigations on the Ether Extraction Method and Development of a Generally Applicable Procedure." Svensk Kem. Tid. 61, 189-96(1949).

In order to find a generally applicable method, based on Et_2O extrn. for the detn. of small amts. of U, different kinds of decompn. were studied. For decompn. rock samples, treatment with HCl and HNO_3 and decompn. of the insol. residue with HNO_3 and HF is as a rule satisfactory. Metallurgical slags and similar products must be sintered with Na_2O_2 and Na_2CO_3 . Sulfates and phosphates were found to interfere with the Et_2O extrn. and must be removed. Precautions must be taken to prevent losses caused by reduction of $(\text{UO}_2)^{++}$ to U^{+4} . The methods for final detn. by pptn. with oxine and colorimetric detn. with cyanoferrate have been studied and modified.

- 3571 Henderson, J. F. Pitchblende Occurrences between Beaverlodge and Hottah Lakes, Northwest Territories. Geological Survey of Canada, 1949. (Paper 49-16)

- 3572 Hodge, H. C. Summary [of the Pharmacology and Toxicology of Uranium Compounds]. Declassified Dec. 22, 1949. 163p. (AECD-2789)

This report summarizes the chapters on chem., biochem. methods, oral toxicity, inhalation toxicity, insufflation studies, metabolic studies, bone deposition, enzyme studies, max. allowable concn., and effects of U on plants for the proposed portion of the NNES vol. Pharmacology and Toxicology of Uranium Compounds, Part 4 (to be published).

- 3573 Hodge, H. C., Stokinger, H. E., Neuman, W. F., Bale, W. F., and Brandt, A. E. Suggested Maximum Allowable Concentration of Insoluble Uranium Compounds in Air. Apr. 6, 1949. Declassified Dec. 22, 1949. 115p. (AECD-2784)

At the end of a year's exposure to atms. contg. UO_2 at concns. averaging about 10 and 1 mg as U/m^3 , resp., the U content of lung tissue and of pulmonary lymph nodes was as follows:

U content			
Air content (mg U/m^3)	Dog lung ($\mu\text{g/g}$)	Dog P.L.N. ($\mu\text{g/g}$)	Rat lung ($\mu\text{g/g}$)
10	950	2500	300-600
1	116	198	50-100

By a process of interpolation, it is predicted that if conditions comparable to those in the expts. were maintained, except that the dust concns. were lowered to 500 or 50 $\mu\text{g U/m}^3$, the U content of lung tissue and of pulmonary lymph nodes would be as follows:

Assumed air content ($\mu\text{g U/m}^3$)	Predicted av. U content in lung or pulmonary lymph nodes ($\mu\text{g/g}$)
500	50 to 120
50	6 to 12

The U tolerance for tissue (considering U as an internal α emitter) is calcd. to be of the order of 25 $\mu\text{g U/g}$ fresh tissue. Based on the predicted U deposition in lung tissue and in pulmonary lymph nodes and on the calcd. U tolerance for α radiation, the max. allowable concn. is tentatively proposed as 100 $\mu\text{g/m}^3$. This concn. has a probable safety factor of 2- to 5-fold. From the few available analyses of dogs and rats exposed for 1 yr to 10 mg/m^3 as UO_2 and for an additional yr to 2 mg/m^3 as U nitrate, the biol. half-life of UO_2 dust particles in the lung is calcd. to be of the order of 2 to 4 mo. Only short-term (30-day) exposures to UO_2 dusts of controlled particle size are available. These show a marked correlation between decreasing particle size in the range of 2 to 0.5 μ and increasing lung retention of U. Large particles (2 μ) inhaled at 80 mg/m^3 gave rise to an av. lung content of about 150 $\mu\text{g U/g}$, whereas small particles (0.5 μ) at the same concn. produced an av. lung content of over 1200 $\mu\text{g U/g}$. Similar studies to those on UO_2 were made on animals exposed to UF_4 at 3 and 0.5 mg/m^3 , resp. No such high U values in lung and in pulmonary lymph nodes were found for UF_4 , although this tissue showed unquestionably larger U contents than followed an exposure to U nitrate at 2 mg/m^3 . The insol. UO_2 and, to a much lesser degree, UF_4 tend to accumulate in the lung when animals breathe such dusty atms. A small amt. of U gets into the body fluids and is deposited in the skeleton or is excreted via the kidneys and the urine. The bone and kidney U contents are entirely comparable in magnitude following dust exposures to 10 or 1 mg U/m^3 as UO_2 , to 3 or 0.5 mg U/m^3 as UF_4 , or to 2 mg U/m^3 as U nitrate. Studies of the chem. toxicity of UO_2 , UF_4 , high-grade ore, and U_3O_8 have been summarized and tabulated. Eight 30-day studies are reported for various air concns. of UO_2 , 5 such studies on UF_4 , 3 on high-grade ore, 1 on U_3O_8 , and 5 on control groups. Two yr-long expts. have been conducted on UO_2 dusts and 2 on UF_4 dusts; a single chronic control group has been examined in exactly comparable ways. From the standpoint of chem. toxicity, the suggested max. allowable concn. range of 200 to 250 $\mu\text{g/m}^3$ in each case allows a reasonable margin of safety.

3574 Hodge, H. C., Stokinger, H. E., and Neuman, W. F. Suggested Maximum Allowable Concentration of Soluble Uranium Compounds in Air. June 30, 1949. Declassified Dec. 22, 1949. 107p. (AECD-2785)

At the end of a year's exposure to sol. U cpds. suspended as a dust in the atm., the tissues of dogs, rats, rabbits, and guinea pigs contained on the av. the amts. of U shown.

Approx. air concn. ($\mu\text{g/m}^3$)	Lung ($\mu\text{g/g}$)	Kidney ($\mu\text{g/g}$)	Bone ash ($\mu\text{g/g}$)
2000	1.3	2.3	5.9
250 to 150	0.6	0.8	1.8
50 to 40	0.4	0.4	0.4

On the av., the lung contains the least, the kidney intermediate amts., and the bone the highest amts. of U. With increasing air concn., there is a tendency for an increase in the tissue content of U. From analyses of the U content made during the yr, it is evident that with increasing exposure time there is an increase in bone deposition of U. This is not a large increase at any concn., but it is clearly distinguishable in the tests at the higher dust levels. Even at an air concn. of 2000 $\mu\text{g/m}^3$, the predicted max. bone U content is only 17 $\mu\text{g U/g}$. If the figure of 25 $\mu\text{g U/g}$ of tissue is accepted as the U tolerance for tissue (considering U as an int. α emitter), it is evident that the amt. deposited in bone following the inhalation of atms. contg. the max. allowable concn. will never constitute a radiological hazard. Based on the rate of deposition of U in the rat femur when rats are exposed to an atm. contg. 2000 $\mu\text{g U/m}^3$ as $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ dust, the predicted biol. half-life of U in rat bone is of the order of

10 mo. The known typical U injury to the kidney is an extremely sensitive and reliable indicator of toxic effect; the amt. of a sol. U cpd. in the air which fails to produce any kidney injury is taken as a physiologically safe concn. The air concn. of $50 \mu\text{g U/m}^3$ of sol. U dusts is recommended as a tentative max. allowable concn. Studies of the chem. toxicity of UF_6 , UO_2F_2 , $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, and UCl_4 have been summarized and tabulated. Three 30-day studies are available on UF_6 , 4 on UO_2F_2 , 4 on $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, and 5 on UCl_4 . Two 1-yr studies are available on UF_6 , 4 on $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, and 2 on UCl_4 . One 2-yr study is summarized in which the exposures during the first yr were to several sol. and insol. U dusts, and the exposure during the second yr was to $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ dust. From the standpoint of the toxic effects observed in all these studies, the max. allowable concn. recommended, viz., $50 \mu\text{g U/m}^3$, appears to be a reasonable tentative figure.

3575 Hoekstra, H. R. and Katz, J. J. "The Preparation and Properties of Group IV-B Metal Borohydrides." *J. Am. Chem. Soc.* **71**, 2488-92(1949).

This paper is similar to report AECD-1894(1948).

3576 Hoekstra, H. R. and Katz, J. J. Alkaline Earth Polyuranates. June 1949. Declassified July 12, 1949. 6p. (AECD-2647)

The prepn. of alk. earth polyuranates is critically discussed. It appears that thermal decompn. of the double alk. earth uranyl acetates provides the simplest approach to the synthesis of these cpds.

MgU_2O_7 undergoes reversible decompn. at elevated temps. Equil. studies of this decompn. are described, and the phase relationships of this system are discussed. Preliminary observations on the dissocn. of the Ca, Sr, and Ba cpds. are also discussed. The work described is part of a general investigation of metal uranates and polyuranates. The material given here, however, includes only the diuranates of Mg, Ca, Sr, and Ba.

3577 Holmes, A. "Report to Committee on the Measurement of Geologic Time." In National Research Council Division of Geography and Geology. Committee on the Measurement of Geological Time. Report for 1947-48. 1949. (Exhibit A, p.16-21)

Pb/U/Th analyses of uraninite from Morogoro, Tanganyika, and of uraninite and monazite from post Delhi pegmatites of the Aravalli belt in India are reported.

3578 Hovorka, V. and Holzbecher, Z. "Determination of Uranium in the Presence of Cerium(III), Thallium(I), Silver, Lead, Copper, Mercury(II), and Potassium Ferricyanide by Means of Isatin β Oxime." *Collection Czechoslov. Chem. Commun.* **14**, 40-58(1949).

The usual method of detecting U with isatin β oxime is applicable in the presence of Ce^{+3} or Tl^{+} . $\text{Na}_2\text{S}_2\text{O}_3$ is used to prevent pptn. of Ag, Pb, or Cu if present. To prevent pptn. of Hg^{++} if present, excess Cl^- is used to form HgCl_4^- . The sepn. of Fe^{++} from U cannot be carried out by complexing the Fe as cyanide and oxidizing to $\text{Fe}(\text{CN})_6^{3-}$, since a blue cpd. is absorbed by the prepn. of uranyl isatoxime.

3579 Howland, J. J. and Calvin, M. Paramagnetic Susceptibilities and Electronic Structures of Aqueous Cations of Elements 92 to 95. Dec. 8, 1948. Declassified Dec. 19, 1949. 21p. (AECD-2440)

Magnetic susceptibilities per g-at. wt. of elements 92 to 95 in most of their oxidation states were measured at 20°C on 0.1 ml of soln. which was 0.005M to 0.09M in heavy element. The values obtained (all paramagnetic) in e.m.u. $\times 10^6$ were: U^{+4} , 3690; Np^{+6} , 2060; Np^{+5} , 4120; Np^{+4} , 4000; Pu^{+4} , 1610; Pu^{+3} , 370; and Am^{+3} , 720. The results could be interpreted only on the basis of electronic configurations $5f^n$, even though susceptibilities were generally lower than the theoretical values and lower than exptl. values for corresponding lanthanide $4f^n$ cations. The lower values should be expected as a result of the Stark effect produced by electric fields of anions and of H_2O dipoles. Failure of the Russell-Saunders approximation to the coupling between electrons may account for some of the error in the theoretical calcs. Wider multiplet splitting in the actinides accounts for the fact that the susceptibilities of Pu^{+3} and Am^{+3} are manifold lower than those of Sm^{+3} and Eu^{+3} , resp. (This information is also available in *J. Chem. Phys.* **18**, 239-43(1950).)

- 3580 Hseung, Y. and Yeh, C. C. "Note on the Fluorescence Test of Bentonite." Am. Mineral. **34**, 896-7(1949).

In differentiating between swelling and nonswelling bentonites contg. Na^+ , both materials are first moistened with zinc uranyl acetate, and then they are subjected to ultraviolet light. The swelling bentonites fluoresce under the light, whereas the nonswelling bentonites fluoresce only slightly, or not at all. The fluorescence reaction is due to the ppt. of the triple salt sodium uranyl zinc acetate, $\text{Na}(\text{UO}_2)_3 \text{Zn}(\text{CH}_3\text{COO})_9 \cdot 6\text{H}_2\text{O}$. When the Na content is less than 0.2%, there is no fluorescence. Feigl (Rec. trav. chim. **58**, 473(1939)) reported 2.5 γ as the limit of identification of Na by the fluorescence test.

- 3581 Hyde, E. K. Determination of the Half-Life of U^{233} . Sept. 5, 1946. Declassified Jan. 21, 1949. 7p. (AECD-2457)

The half-life of the α -emitting isotope, U^{233} , has been redetd. to be $1.62 \pm 0.01 \times 10^5$ yrs. The U used in the detn. was produced by a several-mo. irradiation of Th with the neutrons of the U-graphite chain-reacting pile at the Clinton Engineer Works. The nuclear transformations involved may be represented as

(This information is also available in Seaborg, Katz, and Manning, The Transuranium Elements. New York, McGraw-Hill Book Company, Inc., 1949. Paper 19.15.)

- 3582 Hyde, E. K., Studier, M. H., and Ghiorso, A. Products of the Deuteron and Helium Ion Bombardments of U^{233} . Dec. 3, 1946. Declassified Apr. 18, 1949. 28p. (AECD-2572)

Information concerning the lighter isotopes of Np and Pu has been obtained by studying the products of the bombardment of U^{233} with deuterons and He ions from the 60-in. cyclotron. Np^{234} is shown to be an orbital-electron capturing isotope of 4.40 ± 0.05 days half-life with an associated γ ray of 1.9-mev energy. Evidence is presented that the isotope Pu^{234} decays by the emission of α particles of approx. 6.0-mev energy with an apparent half-life of 8 ± 4 hrs. Pa^{230} is shown to be produced by a $(\text{d},\alpha\text{n})$ reaction, which is a type of nuclear transformation hitherto unknown. By correlation of information from these bombardments, with information obtained by others (James et al. "Products of the Helium-Ion and Deuteron Bombardment of U^{235} and U^{238} ." In Seaborg, Katz, and Manning, The Transuranium Elements. New York, McGraw-Hill Book Company, Inc., 1949. Paper 22.8) from bombardments of U^{233} , Np^{235} is identified with an 8.3-mo. orbital-electron capturing isotope and Pu^{237} is identified with a 40-day orbital electron capture decay. From the failure to find any evidence for Pu isotopes of mass 231, 232, 233, and 235, and for Np isotopes of mass 231, 232, and 233, some conclusions regarding their half-lives are reached. (This information is also available in Seaborg, Katz, and Manning, The Transuranium Elements. New York, McGraw-Hill Book Company, Inc., 1949. Paper 22.15.)

- 3583 Inghram, M. G., Hayden, R. J., and Hess, D. C. Jr. U^{235} Fission Yields in the Rare Earth Region. May 1949. Declassified Dec. 19, 1949. 11p. (AECD-2759)

The U^{235} fission yield curve for U fuel rods, from mass number 143 to 160, has been measured by use of mass spectrometric techniques. 8% yields are assumed in this region, and on the basis of measurements of the Nd, Sm, Eu, and Gd fission isotopes, 9 other yields are obtained. The resulting yield curve is smooth. Based on the same assumptions which give the smooth yield curve the following cross sections and half-lives are obtained. Cross sections: Sm^{149} , 47,000 barns; Sm^{151} , 7200 barns; Gd^{155} , 41,000 barns; Gd^{157} , 59,500 barns. Half-lives: 61^{147} , 2.26 yr; Sm^{151} , 122 yr. (This paper is also available in Phys. Rev. (2), **79**, 271-4(1950).)

- 3584 Jacquet, P. A. and Caillat, R. "On the Electrolytic Polishing of Uranium in the Light of Physicochemical and Metallographical Studies." Compt. rend. 228, 1224-6(1949).

The fact that electrolytic polishing produces a well-defined state of the metal surface has been applied to micrographic exams. and to the study of the formation of UH_3 . The following reaction takes place following electrolytic polishing of uranium: $\text{U} + (3/2)\text{H}_2 \rightarrow \text{UH}_3$ (about 220°) which was found useful. It assured easy and effective cleaning of the specimen, removing the oxide layer from the metal.

- 3585 James, R. A., Florin, A. E., Hopkins, H. H., Jr., and Ghiorso, A. Products of Helium-Ion and Deuteron Bombardment of U^{235} and U^{238} . March 1948. Declassified Mar. 3, 1949. 28p. (AECD-2495)

In addn. to Pu^{238} , Pu^{239} , Np^{237} , Np^{238} , and Np^{239} , several more isotopes of these elements have been produced. Np^{236} is a β -particle emitter with a half-life of 22 hrs. Its daughter, Pu^{236} , emits α particles with a range of 4.3 cm (energy 5.7 mev) and decays with a half-life of 2.7 yr. Np^{235} decays by orbital electron capture with a half-life of 400 ± 20 days. A Pu isotope which decays by orbital electron capture with a half-life of 40 days has been assigned the mass 237. A Np isotope (Np^{234} or Np^{233}) has been found which decays by orbital electron capture with a half-life of about 4.5 days; its characteristic x rays are accompanied by a γ ray with an energy of 1.8 mev. U^{237} , Pu^{240} , and Pu^{241} are also produced in these bombardments. (This paper is also available in Seaborg, Katz, and Manning, The Transuranium Elements. New York, McGraw-Hill Book Company, Inc., 1949. Paper 22.8.)

- 3586 Jones, W. M. The Reduction of Water Vapor by Uranium Metal. Declassified Oct. 14, 1949. 8p. (AECD-2724)

A procedure is described in which small H_2O samples of the order of a few tenths of a g can be converted quantitatively to H_2 by reduction with U metal. The reaction is carried to completion in a quartz reaction tube at high temps., and the H_2 formed is pumped through a heated Pa valve by an automatic Toepler pump for measurement. Exptl. results establishing the completeness of conversion to within 0.01% are included.

- 3587 Jungerman, J. Fission Excitation Functions for Charged Particles. Sept. 21, 1949. Declassified Nov. 22, 1949. 24p. (AECD-2744)

The detection of fission produced by means of bombardment with charged particles has been accomplished using a method which consisted in counting the pulses of ionization produced by the fission fragments in an ionization chamber. The detection of a fission pulse in the presence of the ionization produced by the beam itself is made possible by using a cancellation principle (G. C. Baldwin and G. S. Klaiber, Phys. Rev. (2), 71, 3(1947)). This principle has been used to measure fission excitation functions on the 60-in. Crocker cyclotron and the 184-in. synchrocyclotron. 60-in. cyclotron. The excitation functions for U^{238} , Th^{232} and U^{235} bombarded with α particles and deuterons, resp., have been plotted as mev's vs. cross section in barns. The value of w, the av. no. of ev necessary to form an ion pair, was detd. and the results tabulated. These values were used to find the multiplication factor, M, introduced by the ionization chamber when the computation of the fission cross sections was made. In order to have an independent check on the abs. value of the cross section the cross section of the reaction $\text{Bi}^{209}(\alpha, 2n)\text{At}^{211}$ was measured with the same equipment. Comparison of the results obtained with a previous expt. (J. Jungerman and S. C. Wright, Phys. Rev. (2), 74, 150(1948)) was made. A comparison of fission cross sections and calcd. total reaction cross sections for α particles of a Th target indicated that competition is greatest in the case of the Th and least for U^{235} . 184-in. synchrocyclotron. Excitation functions were observed and plotted for α particle and deuteron bombardment of U^{238} , Th^{232} , U^{235} , Bi^{209} , and Au^{197} . Results are similarly evaluated and discussed.

- 3588 Jungerman, J. and Wright, S. C. Kinetic Energy Release in Fission of U^{238} , U^{235} , Th^{232} , and Bi^{209} by High Energy Neutrons. Feb. 24, 1949. Declassified May 19, 1949. 25p. (AECD-2594)
The ionization produced by single fission fragments are observed in an ionization chamber using electron collection. If fission is induced by 90-mev neutrons, the distribution of kinetic energy of the fission fragments vs. the no. of fragments is found to have a single peak in contrast to the fission induced by 45-mev neutrons in which two peaks appear. The dip between the two peaks is about 20% of the height of the peaks. The mean kinetic energy is found to be 80 ± 2 mev for U^{238} , 83 ± 1.5 mev for U^{235} , 82 ± 2 mev for Th^{232} , and 71 ± 2 mev for Bi^{209} in the case of fission produced by 90-mev neutrons. The mean kinetic energy is 79 ± 3 mev for U^{238} and 84 ± 3 mev for Th^{232} if 45-mev neutrons are used. The most probable kinetic energy of the fragment is 83 mev for U^{238} , 80 mev for U^{235} , 83 mev for Th^{232} , and 75 mev for Bi^{209} in the case of fission produced by 90-mev neutrons. The bearing of these observations on the mechanism of fission is discussed. (This paper is also in Phys. Rev. (2), 76, 1112-16(1949).)
- 3589 Jungerman, J. and Wright, S. C. "Kinetic Energy Release in Fission of U^{238} , U^{235} , Th^{232} , and Bi^{209} by High Energy Neutrons." Phys. Rev. (2), 76, 1112-16(1949).
This paper is similar to report AECD-2594(1949).
- 3590 Kahaen, E. and Simenauer, A. "Trial Determination of Uranium in the State of the Complex Acetate." Bull. soc. chim. France 531-3(1949).
A study has been made of the pptn. of U as Na, U acetate, or as a triple Mg, Na, U, acetate, by means of a reagent rich in Na and Mg.
- 3591 Kalmon, B. The Beta-Gamma Surface Dosage Rate from Natural Uranium. Aug. 22, 1949. Declassified Nov. 28, 1949. 6p. (AECD-2748)
An exptl. detn. has been made of the β - γ dosage rate at the surface of a natural U disk. The measurements were made with a Ryerson electrometer and an extrapolation ionization chamber. The av. value so obtained is 246.5 mrep/hr($\pm 5\%$).
- 3592 Kasha, M. "Vibrational Fine Structure in the Absorption Spectra of Uranyl and Plutonyl Ions in Aqueous Solution." J. Chem. Phys. 17, 349(1949).
A section of the absorption spectra obtained for $(UO_2)^{++}$ and $(PuO_2)^{++}$ in aq. soln. is shown. Analogous absorption bands centering about 4100 Å have been found in both cases corresponding to forbidden electronic transitions and further distinguished by discrete, though diffuse, regular vibration structures. See also MDDC-591(1947).
- 3593 Katz, J. J. and Gruen, D. M. "Higher Oxides of the Actinide Elements. The Preparation of Np_3O_8 ." J. Am. Chem. Soc. 71, 2106-12(1949).
An effort was made to prep. higher Np oxides (with an O-Np ratio greater than 2) in order to compare their properties with analogous cpds. of other actinide elements: in this case U oxides were used. NO oxidation of U_3O_8 above 250° resulted in a brick-red anhyd. UO_3 with a crystal structure distinct from other known phases of UO_3 . NO oxidation of UO_2 resulted in products varying in compn. from $UO_{2.2}$ to $UO_{2.9}$, depending on the temp. Treatment of $Np^{4,5,6}$ hydroxide ppts. (dried at 70°) with NO at 300 to 450° yielded Np_3O_8 , isomorphous with U_3O_8 . Direct analysis of the product led to the formula $NpO_{2.64} \pm 0.03$. Thermal decompn. curves of UO_3 and Np_3O_8 were compared. The former showed a region of stability corresponding to the formula $UO_{2.91}$. The curve for Np_3O_8 showed no plateau but indicated a marked similarity in the thermal stabilities of UO_3 and Np_3O_8 . Attempts at the prepn. of NpO_3 and higher oxides of Pu, Am, and Pa were unsuccessful.

- 3594 Katzin, L. and Sullivan, J. C. The System Uranyl Nitrate-Water-Organic Solvent. December 1948. Declassified Mar. 18, 1949. 47p. (AECD-2537)

The ternary systems $\text{UO}_2(\text{NO}_3)_2\text{-H}_2\text{O-}$ org. solvent have been studied with the following org. solvents: Et_2O , ethylene glycol diethyl ether (diethyl cellosolve), hexyl ether, acetone, methyl isobutyl ketone, isobutyl alcohol, and tertiary butyl alcohol. For each system, tables are given listing the % H_2O and $\text{UO}_2(\text{NO}_3)_2$ in the aq. and org. phases and the compn. of the uranyl nitrate solvates of the solid phase; phase diagrams have also been constructed for the several ternary systems. The form of the uranyl nitrate which is in soln., the electron donor behavior of the solvents, the nature of the various solid phases, and general considerations concerning the soly. of inorg. salts in org. solvents are discussed.

- 3595 Katzin, L. I. and Hellman, N. N. Theoretical Consideration of the Ether Extraction of Uranyl Nitrate from Aqueous Solutions Containing Various Metal Nitrate Salting Agents. Nov. 20, 1947. Declassified Dec. 19, 1949. 22p. (AECD-2758)

On the hypotheses of (a) strong electrolyte behavior of $\text{UO}_2(\text{NO}_3)_2$, (b) reaction of Et_2O with hydrated $\text{UO}_2(\text{NO}_3)_2$ with loss of three H_2O , and (c) extrn. of the resulting hydrate-ether etherate into the org. phase, an equation has been derived for the distribution of $\text{UO}_2(\text{NO}_3)_2$ between H_2O and Et_2O . A test of the relationship has been made with data available for the extrn. of trace concns. of $\text{UO}_2(\text{NO}_3)_2$ from strong salt solns. Within the limits of accuracy of the data used, the relationship shows distinct promise.

- 3596 Kern, D. M. H. and Orlemann, E. F. "The Potential of the Uranium(V), Uranium(VI) Couple, and the Kinetics of Uranium(V) Disproportionation in Perchlorate Media." J. Am. Chem. Soc. 71, 2102-06(1949).

This paper is similar to report MDDC-1703(1948).

- 3597 Kienberger, C. A. Determination of Uranium 234 by Alpha Counting. Mar. 14, 1949. 13p. (AECU-209)

An α -counting method for the detn. of the wt. % of U^{234} in U cpds. is described. This method consists in measuring the U^{235} enrichment, detg. the α activity, calcg. that portion of the α activity which is due to the U^{234} , and dividing this activity by the specific activity of U^{234} . At the 95% probability level, this method gives an estd. precision of $\pm 1.7\%$. The accuracy of the method is estd. to be $\pm 1\%$.

- 3598 Kienberger, C. A. The U^{234} Content of Natural Uranium and the Specific Alpha Activities of the Isotopes. Apr. 4, 1949. 10p. (AECU-310)

The U^{234} content of natural U was detd. by a combination of α counting and mass-spectrometer techniques, to be 0.005481 ± 0.000012 weight %, the precision being expressed on the basis of 95% probability. This corresponds to a half-life of $(2.522 \pm 0.008) \times 10^5$ yrs. Considering possibilities of bias, these figures are believed to lie within 1% of the true values. In conjunction with this detn., the half-lives of the other natural U isotopes were also measured.

- 3599 Koch, H. W., McElhinney, J., and Gasteiger, E. L. Experimental Photofission Thresholds in $^{92}\text{U}^{235}$, $^{92}\text{U}^{238}$, $^{92}\text{U}^{233}$, $^{94}\text{Pu}^{239}$, and $^{90}\text{Th}^{232}$. Jan. 30, 1947. Declassified Aug. 29, 1949. 39p. (AECD-2699)

An investigation of the photofission thresholds in U^{235} , U^{238} , Pu^{239} , and Th^{232} with a 20-mev betatron is reported. A method of a self-cancellation is described which permits the detection of fissions and the detn. of threshold energies in the 2 highly α -active samples of U^{233} and Pu^{239} . An investigation of the photoneutron threshold in N and the energy calcn. from mass data provided a check of the abs. energy scale obtained from voltage measurements on the betatron. From this investigation the photofission threshold values for U^{238} , U^{235} , Pu^{239} , and U^{233} show a max. difference or spread of 0.23 mev, whereas the theory predicts a spread of 1.7 mev. Also, the order of the exptl. thresholds are not the same as the predicted order. Emphasis was placed on detg. this order as accurately as was possible. For this reason all the isotopes were referred to the U^{238} threshold and were investigated in succession with U^{238} . The thresholds of U^{235} , U^{238} , and Th^{232} were detd. most accurately. According to theory, the

the U^{238} threshold should be larger than the U^{235} threshold by approx. 0.6 mev. The expt. showed definitely that the order is reversed with the U^{235} threshold, the larger one by 0.23 (± 0.10) mev. The orders of the exptl. thresholds for Pu^{239} and U^{233} are also not in agreement with theory. (This paper is also available in Phys. Rev. (2), 77, 329-36(1950).)

- 3600 Kohman, T. P., Turkevich, A., Jaffey, A. H., Coryell, C. D., Engelkemeir, P[D]. W., Elliott, N., Novey, T. B., Brown, H. S., and Davidson, N. R. Yields of Plutonium from Cyclotron Neutrons in Various Uranium Containing Media. July 10, 1945. Declassified Mar. 9, 1949. 37p. (AECD-2513)

Measurements have been made of the production of Pu^{239} and of fission activity from cyclotron neutrons at various positions along the axis of columns of uranyl nitrate, UO_2 , and U metal in the combinations, UO_2 + uranyl nitrate, U metal + uranyl nitrate, U metal + UO_2 , and U metal + UO_2 + uranyl nitrate. The activity of U^{239} induced in U metal foils and chemically sepd. was used as a measure of Pu production, and the activity collected by recoil in cellophane as a measure of fission. Results are presented in tables and graphs and are discussed. The combinations give greater yields of Pu than uranyl nitrate alone. The use of U metal + uranyl nitrate is recommended for prolonged bombardments; a 5-in. layer of U metal around the cyclotron target does not reduce the yield of Pu^{239} in the uranyl nitrate below that which results when uranyl nitrate is used alone, and in addn. the U metal acquires in itself a comparable amt. of Pu^{239} . (This paper is also available in Seaborg, Katz, and Manning, The Transuranium Elements. New York, McGraw-Hill Book Company, Inc., 1949. Paper 2.3.)

- 3601 Kohn, M. "Some Reactions of Uranyl Ferrocyanide." Anal. Chim. Acta 3, 34-5(1949). Uranyl ferrocyanide is sol. in H_3PO_4 , HF, KF, NH_4F , Na_2CO_3 , $NaHCO_3$, K_2CO_3 , and $KHCO_3$. These reactions can be used in spot tests.

- 3602 Kopelman, B. and Gregg, C. C. "Some Wetting Properties of Metal Powders." Trans. Am. Soc. Metals 41, 293-302(1949).

The wetting characteristics of Al, Mg, Cu, Ni, Ti, Mo, Ta, Pt, C, W, W oxides, UO_2 , $MnCO_3$, ZnO, PbO, and TiO_2 powders were investigated qualitatively by examn. of suspensions of the powders in kerosene- H_2O and CCl_4 - H_2O mixts., with and without wetting agents. Metal powders are poorly wetted by H_2O and org. liqs. and are difficult to disperse in liq. media; the higher-melting metals are more difficult to disperse than the lower-melting metals. Dispersion of the lower-melting metals can be improved by the use of org. solvents contg. 1% oleic acid. The addn. of surface-active agents (Dupanol ME) improves the wetting behavior of the higher-melting metals in H_2O . A small amt. of H_2O_2 was without effect. The higher oxides of multivalent metals and the oxides of univalent metals are hydrophilic; the lower oxides of multivalent metals and the metals themselves are not water-dispersible. (This is a paper presented before the 13th Annual Convention of the American Society for Testing Materials in Philadelphia, Oct. 23 to 29, 1948.)

- 3603 Kraus, K. A., Johnson, G. L., and Nelson, F. Chemistry of Aqueous Uranium(V) Solutions. I. Preparation and Properties. Analogy between U(V), Np(V), and Pu(V). Dec. 15, 1948. Declassified Jan. 18, 1949. 33p. (AECD-2460)

Aq. solns. of U^{+5} of considerable stability have been prepd. and studied. Addnl. evidence for the formula $UO_2(H_2O)^+$ for U^{+5} is presented. Through consideration of potential and hydrolytic data on U and the transuranic elements predictions regarding the thermodynamic stability of the pentavalent states of these elements can be made and it is shown that they have an optimum stability between pH = 2 to 5. (This information is also available in J. Am. Chem. Soc. 71, 2510-17(1949).)

- 3604 Kraus, K. A., Nelson, F., and Johnson, G. L. "Chemistry of Aqueous Uranium(V) Solutions. I. Preparation and Properties. Analogy between Uranium(V), Neptunium(V), and Plutonium (V)." J. Am. Chem. Soc. 71, 2510-17(1949).

This paper is similar to report AECD-2480(1949).

- 3605 Kraus, K. A. and Nelson, F. "Chemistry of Aqueous Uranium(V) Solutions. II. Reaction of Uranium Pentachloride with Water. Thermodynamic Stability of $(\text{UO}_2)^+$. Potential of U(IV)/(V), U(IV)/(VI), and U(V)/(VI) Couples." J. Am. Chem. Soc. 71, 2517-22(1949). This paper is similar to report AECD-2394(1948).

- 3606 Kraus, K. A. and Nelson, F. Hydrolytic Behavior of Metal Ions. I. The Acid Constants of Uranium(IV) and Plutonium(IV). Nov. 7, 1949. Declassified Nov. 23, 1949. 31p. (AECD-2742)

Through pH measurements of UCl_4 solns., U^{+4} was established to be the species of U^{+4} in acidic solns. The acid const. of U^{+4} was detd. as a function of ionic strength for chloride and perchlorate solns. through a spectrophotometric method. The molarity const. could be fitted approx. to a Debye-Huckel limiting law and the activity const. $K_a = 0.21 \pm 0.02$ was estd. for the equil. $\text{U}^{+4} + 2\text{H}_2\text{O} \rightleftharpoons \text{UOH}^{+3} + \text{H}_3\text{O}^+$. The stability const. for the reaction $\text{U}^{+4} + \text{Cl}^- \rightleftharpoons \text{UCl}^{+3}$ was estd. to be $K_c = \sim 0.63$ ($\mu = 0.5$) and $K_c^1 = 7.0$ ($\mu = 0$). The acid const. of Pu^{+4} ($K_m = 0.025$, $\mu = 0.5$) was found to be almost identical with, though slightly smaller than that of U^{+4} ($K_m = 0.032$, $\mu = 0.5$). The spectral data, the quant. hydrolytic data, and the observation that the chloride complexes of U^{+4} and Pu^{+4} weak are confirmatory evidence of the hypothesis that these elements are members of a "rare-earth-like" series.

- 3607 Kritchevsky, E. S. and Hindman, J. C. "The Potentials of the Uranium Three-Four and Five-Six Couples in Perchloric Acid." J. Am. Chem. Soc. 71, 2996-3102(1949).

This paper is similar to report AECD-2086(1948).

- 3608 Kuroda, K. "On the Equilibrium of the Radioactive Elements in the Hydrosphere. V. A Simple Method for Distinguishing Uranium and Thorium in Radioactive Minerals." Bull. Chem. Soc. Japan 22, 149-50(1949).

The use of an "I.M. fontactoscope" is proposed for distinguishing the U from Th by measuring the Rn isotope formed.

- 3609 Lang, A. H. Notes on Prospecting for Uranium in Canada. Geological Survey of Canada, 1949. 22p. (Paper 49-44)

- 3610 Langwill, K. E. — assigned to U. S. Atomic Energy Commission. Producing Thin Film of Metal Oxide. Nov. 1, 1949. (U. S. Patent 2,486,955)

A method is described for forming a thin, smooth, adherent U oxide coating of uniform thickness on a polished Pt disk. An amyl acetate soln. of UO_2Cl_2 is prepd. contg. about 2 mg chloride/ml of amyl acetate and about 8% by vol. of an org. solvent soln. for a binder. The soln. is sprayed onto the Pt disk and then heated to 600°C . This converts the UO_2Cl_2 into U_3O_8 . The spraying and heating operation is repeated until the coating has been built up to approx. $1/2 \text{ mg } \text{U}_3\text{O}_8/\text{cm}^2$.

- 3611 Laquer, H. L. Elastic Constants and Sound Velocities. III. The Elastic Constants of Uranium. Declassified May 26, 1949. 29p. (AECD-2606)

Whereas static methods consist in a direct detn. of the relation between stress and strain or possibly the cross-contractional ratio σ , all dynamic methods are based on the measurement of sound velocities. In this work, sound velocities were obtained by detg. the natural resonance freqs. of cylindrical specimens of known length. The elastic const. of a no. of well-defined specimens of polycryst. U metal have thus been detd. by a dynamic method. Young's modulus was found to be $20.5 \times 10^{11} \text{ dynes/cm}^2$ with a probable accuracy of 1%. This is 10 to 20% higher than values previously available in the project literature. The shear modulus was $8.34 \times 10^{11} \text{ dynes/cm}^2$ with a probable accuracy of 0.5%. No other satisfactory values for the shear modulus have so far been available. The accuracy of these measurements is limited only by anisotropy and relatively large size of the individual crystallites in the available specimens. 17 references are included.

3612 Lawson, J. L. "88-Mev Gamma-Ray Cross Sections." *Phys. Rev.* (2), **75**, 433-44(1949). Total cross sections for 88-mev γ rays have been measured in 6 elements by absorption methods to a statistical accuracy of about 1.5%. The results expressed in cm^2/gram are 0.0107, 0.0252, 0.0471, 0.0665, 0.0909, and 0.0973 for the elements Be, Al, Cu, Sn, Pb, and U, resp. Values appear generally lower than predictions of existing theory by a factor proportional to Z^2 . Ratios of pair formation cross sections in different elements have been obtained in a few cases; these data can be used together with the total cross section to obtain nonpair cross sections (presumably Compton scattering). The cross section so obtained at 88 mev agrees within the exptl. accuracy of about 15% with the Klein-Nishina prediction for Compton scattering.

3613 Lederer, M. "Inorganic Paper Chromatography." *Nature* **163**, 598-9(1949). Techniques for the sepn. of various metals are referred to. A list of Rf (rate of flow) values covering U, Cu, Cd, and other ions is included. Investigations with BuOH and other solvents are described.

3614 Lindh, K., Rynninger, R., and Skaraeus, E. "Determination of Small Amounts of Uranium. II. Preliminary Experiments on the Ether Extraction Method." *Svensk Kem. Tid.* **61**, 180-8(1949). By extrn. with Et_2O , even small amts. of $\text{UO}_2(\text{NO}_3)_2$ can be sepd. quantitatively from solns. contg. large amts. of other elements, especially Fe, even up to a weight ratio U:Fe of 1: 25,000. The eff. of the extrn. is influenced by the concn. of $(\text{NO}_3)^-$ and free HNO_3 . The min. time required for extrn. has been detd. using a special type of app. Two colorimetric methods for detg. U have been studied with special regard to their application to an Et_2O extr. The colorimetric detn. of U with H_2O_2 in Na_2CO_3 soln. has proved applicable, whereas the salicylate reaction of U in NH_3 soln. is interfered with by Fe even in amts. of 0.02 mg/l, which may easily remain in the extr., from solns. originally high in Fe.

3615 Ljunggren, G., Rynninger, R., and Sillén, L. G. "Determination of Small Amounts of Uranium. I. A Critical Discussion of Methods Previously Used and a General Survey of the Present Investigation." *Svensk Kem. Tid.* **61**, 170-80(1949).

The object of this first paper in the series is to outline an investigation into the problem of rapidly, easily, and routinely detg. U in concns. as small as 0.001%, to within 0.001%, and in the presence of large quantities of interfering elements. The literature on various analytical methods for U is reviewed briefly, and the choice of a suitable method is discussed. The proposed exptl. work is then outlined.

3616 Lukesh, J. S. Note on the Structure of Uranium. 1949(?) 3p. (AECU-398)
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"The structure of the low temperature or alpha phase of uranium has been studied by Wilson (1933) and by Jacob and Warren (1937) In both investigations, the powder technique was used. Wilson reports a monoclinic cell with the following constants: $a = 2.829 \text{ \AA}$, $b = 4.887$, $c = 3.308$, $\beta = 63^\circ 26'$ ($116^\circ 34'$). Jacob and Warren observed additional lines and deduced an orthorhombic cell with $a = 2.852 \text{ \AA}$, $b = 5.865$, $c = 4.945$. The space group is $D_{2h}^{17} - \text{Cmcm}$. Atoms are in the 4c position and satisfactory intensity agreement was found with the y parameter equal to 0.105 ± 0.005 .

"Because of the uncertainties inherent in the interpretation of powder photographs of low symmetry, it was felt advisable to confirm the structure using single crystals. Rotation and Weissenberg photographs are consistent with the cell and space group of Jacob and Warren. Intensities are in substantial agreement with those calculated from the suggested structure. No refinement of the parameter is possible because of the high absorption. As a typical example, calculation gives $002 \gg 006 > 004$, whereas it is observed that $006 \gg 002 > 004$. The apparent reversal is due to the fact that, for Cu radiation, 006 is a high theta reflection and is relatively unaffected by absorption.

"It is of interest to note that the cell deduced by Wilson can be considered as contained in that of Jacob and Warren. The axial relations can be expressed as follows: $a_{\text{mono}} = a_{\text{ortho}}$, $b_{\text{mono}} = c_{\text{ortho}}$, $c_{\text{mono}} = a_{\text{ortho}} + b_{\text{ortho}}/2$ —the monoclinic angle, β , is that between the a axis and the $a + b$ direction. References: Wilson, T. A. Physics 4, 148(1933); Jacob, W. C. and Warren, B. E. J. Am. Chem. Soc. 58, 2588(1937)."

- 3617 Lusk, L. M., Braun, H. A., and Laug, E. P. "The Effect of BAL on Experimental Lead, Tungsten, Vanadium, Uranium, Copper and Copper-Arsenic Poisoning." J. Ind. Hyg. Toxicol. 31, 301-05(1949).

Young rabbits 8 to 10 weeks old were given single doses of a 1% soln. of $\text{Pb}(\text{OAc})_2$ (20 to 40 mg/kg) into the marginal ear vein; immediately after the lead administration, the treated animals were given an intravenous dose of a 3% aq. soln. of BAL (30 mg/kg), and 6 hr later, the same dose subcutaneously. Thereafter, BAL was given twice daily on the second, fourth, sixth, eighth, and tenth days in doses of 15 mg/kg; doses cont. thereafter at longer intervals. In the W and other expts., adult rabbits were used, and they received single doses of 5 to 10% solns. of the metals followed by single doses of 30 mg/kg of BAL intramuscularly shortly thereafter (about 20 min). The results of the Pb expts. indicate that the effect of BAL depends on the route of administration of the Pb salt; a therapeutic effect for BAL was found only in those cases where the Pb had been administered via the intravenous route. Even at high dose levels BAL did not protect the animals against toxic amts. of ammonium metavanadate or U nitrate administered subcutaneously; however, increased tolerance was observed in those rabbits which had received sodium tungstate, cupric sulfate, and cupric arsenite. 11 references are given.

- 3618 McConnell, G. The Preparation of 25 kg of Acid-Free Anhydrous Uranyl Sulphate. June 18, 1943. Declassified Aug. 11, 1949. 5p. (BDDA-186; BR-229A)

The prepn. of anhyd. UO_2SO_4 free from excess H_2SO_4 and HNO_3 is described. An aq. soln. of UO_2SO_4 contg. about 30% excess H_2SO_4 and traces of HNO_3 was obtained by dissolving U_3O_8 in a mixt. of these two acids, and the excess acids removed by repeated pptn. of the acetone complex $\text{UO}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}(\text{CH}_3)_2\text{CO}$ (formed when acetone is added in equal vol. to the aq. soln. of specific gravity 1.65 to 2.00) with subsequent stripping of the acetone by boiling with H_2O . It was found that a min. of three pptns. was required for removal of the free acid. The purified liquors were then concd. to a sp. gr. greater than 2.24 in silica balloons and allowed to cryst. overnight. In this way the trihydrate, $\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$, was obtained, which was filtered, dried at 95°C , powd., and dehydrated in vacuum (25 mm Hg) at 190 to 200°C . The final dehydration was carried out in silica dishes and the preliminary drying at 95°C was found necessary in order to avoid breakages of the silica ware, due to incipient fusion of the mass followed by re-solidification accompanied by expansion.

- 3619 McElhinney, J. and Ogle, W. Relative Photofission Cross Sections of Several Fissionable Materials. Feb. 18, 1949. Declassified Sept. 13, 1949. 38p. (AECD-2706)

The photofission excitation curve of U^{238} up to 21 mev has been measured. An attempt has been made to det. the photofission cross-section shape as a function of bremsstrahlung energy making appropriate assumptions as to the x-ray spectrum of the betatron. It was not possible to obtain a unique soln. for the cross-section shape; but two possible solns. are given, both of which have a resonance peak at about 15 mev. The photofission yield of several fissionable materials relative to U^{238} has been measured in the region of the resonance. The relative yields per atom for the substances under investigation are U^{235} , 1.49; Pu^{239} , 2.51; U^{233} , 2.49; Th^{232} , 0.257; Th^{230} , 0.847; and U^{238} , 1.00. Appendix I presents a theoretical consideration of the bremsstrahlung spectrum impinging on U^{238} in the fission chamber. Appendix II considers the response to different energy quanta of the R thimbles used to monitor the betatron x-ray beam.

- 3620 McKenna, F. E., Quill, L. L., Schubert, J., and Warf, J. C. Analytical Chemistry of the Manhattan Project. Chapter XIII. Other Methods. Declassified Aug. 17, 1949. 87p. (AECD-2676)

Chromatographic adsorption methods of quant. sepn. The following topics are discussed: principles governing ion exchange adsorption under both equil. and nonequil. conditions; exptl. procedures and techniques including types of adsorbents, description of app., prepn. of adsorption columns, and detailed analytical procedures for sepn. and concn. of cations. 24 references are given. Gas analysis. Descriptions of conventional and unusual app. and analyses are given. 38 references are given. Mass spectroscopy. Brief mention is made of the use of the mass spectrometer for isotopic analyses of H_2O , U, and stable isotopes, and for the qual. and quant. analyses of gas mixts., fluorocarbons, Pu and U. 9 references are shown. Pyrohydrolysis. In this method the hydrolyzable substance is heated while exposed to a current of superheated steam. The steam carries out the volatile acid component which is condensed and titrated with std. base; the remaining oxide is dried and weighed. Procedures for the analysis of light-metal halides and for the tri- and tetrachlorides and bromides of U and Pu are given. X-ray analysis. Three types of analyses using x rays are discussed: (1) diffraction of x rays by crystals and interpretation of the resulting crystal structure diagram, (2) the production of characteristic x radiation of the sample and analysis of the resultant spectrum, (3) the absorption of x rays, particularly for the detn. of U. 22 references are included.

- 3621 Macklin, R. L. U-235 Gamma Radiation. Declassified Apr. 18, 1949. 4p. (AECD-2564)
Evidence for the existence of a γ ray accompanying the α decay of U^{235} is presented. The energy of the γ ray, as detd. by several independent absorption measurements is 162 kev. (This paper is also in Phys. Rev. (2), 76, 595-7(1949).)

- 3622 Macklin, R. L. " U^{235} Gamma Radiation." Phys. Rev. (2), 76, 595-7(1949).
This paper is similar to report AECD-2564(1949).

- 3623 McNally, J. R. Jr. "A Preliminary Investigation of the Spectra of Uranium Isotopes." J. Optical Soc. Am. 39, 271-7(1949).
This paper is similar to report AECD-2349(1948).

- 3624 McNally, J. R. Jr. and Harrison, G. R. Further Classification of the Spectrum of Singly-Ionized Uranium. Feb. 11, 1949. 19p. (AECU-153)
The present status of the classification of the spectrum of singly ionized U is discussed. Analysis of this spectrum was begun at MIT in 1941, but publication was withheld during the war for security reasons. During this period a preliminary analysis of the complex ion spectrum was published by Schuurmans (Over de analyse van enig complexe spectra (Th en U). Dissertation, Univ. of Amsterdam, 1946) and also by Schuurmans, Van de Bosch, and Dijkwel (Physica 13, 117(1947)). The early Zeeman effect studies at the MIT Spectroscopy Lab. have been supplemented by isotope-shift investigations in the Y-12 labs. of Carbide and Carbon Chemicals Corp. The application of IBM equipment to the classification of the spectrum has also materially aided the analysis of the complex energy structure of U_{II} .

- 3625 Maddock, A. G. "Chemical Effects of Nuclear Recoil." Research 2, 556-63(1949).
Up to the present time little work has been done on the chem. effects of nuclear recoil. Earlier work is outlined in the article, and expressions are given for the recoil energies in several possible types of nuclear reactions. The effect of α decay on U cpds. is discussed. (n,p) reactions initiated by slow neutrons were studied, and the effects of recoil on resulting S cpds. are described in detail. Some work was also done on reactions which involve two consecutive recoils. A simple theory is given for the Szilard-Chalmers effect in the alkyl halides and in the oxyanions, and the author concludes with several remarks about electron recoil processes. It is noted that exptl. results in this field do not agree with the proposed theories, and a new line of approach is suggested. Further investigation of the chem. effects of decay might lead to evidence of the existence of the neutrino.

- 3626 Marasimhasastri, M. and Rao, G. G. "Vanadimetry. Part V. Volumetric Estimation of Uranium with Sodium Vanadate." Current Sci. (India) **18**, 402-03(1949).

An over-all concn. of 0.01N $\text{H}_2\text{C}_2\text{O}_4$ has been found effective in overcoming the difficulty of the slowness of the end point in the titration of U^{+4} with sodium vanadate when diphenyl benzidine is used as indicator.

- 3627 Marble, J. P. "Present Status of Absolute Age Measurements in Brazil." In, National Research Council Division of Geography and Geology. Committee on the Measurement of Geological Time. Report for 1948-49. 1949. (Exhibit C, p.68-74)

Published data and supplementary analytical work on radioactive material are reported from Brazil. In particular, uraninite from Boqueira and Xique-Zique Rio Grando do Norte, and monazite from Santa Cruz are discussed. A table of approx. ages of radioactive minerals from several Brazilian localities is included.

- 3628 Masi, J. F. "The Heats of Vaporization of Uranium Hexafluoride." J. Chem. Phys. **17**, 655-8(1949).

This paper is similar to report AECD-2288(1948).

- 3629 Mathieson, A. R. "Stability of Complexes of Uranyl Nitrate with Ketones and Ethers." J. Chem. Soc. Suppl. No. 2, 294-8(1949).

New complexes of $\text{UO}_2(\text{NO}_3)_2$ with ketones have been prep'd. by dissolving $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ in the ketones, and subsequent crystn. Those formed by acetone and methyl ethyl ketone were shown by analysis to have the formula $\text{UO}_2(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O} \cdot \text{X}$ (X = ketone). The vapor-pressure curves of evapg. solns. of the complexes in their own ketone as solvent, det'd. at different temps., enabled the estn. of the energies of rupture of the ketone-uranyl nitrate bonds. The formation by Et_2O of a complex $\text{UO}_2(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O} \cdot (\text{C}_2\text{H}_5)_2\text{O}$ was confirmed, and related cpds. appear to be formed by $\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ with some ketones. The absorption spectra of org. solns. of the complexes were compared with that of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ in H_2O . The bearing of these results on the soly. of $\text{UO}_2(\text{NO}_3)_2$ in the solvents under consideration is discussed.

- 3630 Maynard, E. A. Oral Toxicity of Uranium Compounds. Section 2. Age Versus Toxicity. Declassified Dec. 22, 1949. 24p. (AECD-2771)

Groups of male and female rats were placed on diets contg. 2% of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ for periods of 30 days. The rats varied in age from 17 days to 6 months. In most of the cases groups of 50 males and 50 females were studied. In a few instances, groups as small as 20 or less were used. The groups of 50 were made up of two groups of 25 each, so that it is possible to compare essentially duplicate expts. The mortality in both male and female rats has an extraordinary dependence on the initial age. The 17-day-old rats were found to be highly susceptible; all of these rats died. Between 17 and 30 days of age there is a ppt. and linear decrease of mortality to values less than 20%. Thereafter, the susceptibility increases with age somewhat more rapidly for the male rats than for the female rats to a value of about 75% at age 6 months. The growth responses are grouped into three categories: (a) very young rats fail to grow; (b) weanling rats, 21 to 30 days, exhibited a transient decrease in growth rate followed by growth curves parallel to those of the control groups; (c) young adult rats precipitously lost weight for about 2 weeks and thereafter regained weight with nearly the same rapidity. The differences in susceptibility to U poisoning as a function of age may depend on such factors as differences in skeletal development, differences in body weights, or differences in food intake. Groups of male and female rats were given intraperitoneal injections of an aq. soln. of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ (50 mg/cc). The doses were chosen to give a high mortality in adult rats; male rats received 128 mg/kg, female rats 200 mg/kg. The 24- and 48-hr mortalities were recorded. The rats selected varied in age from 21 days to 6 months. For the most part, groups of 50 males and 50 females were studied. The youngest rats were more susceptible than those 1 to 3 months of age. The older rats were more susceptible than the weanlings. Although the variation in age in the 24-hr mortality is qualitatively similar to the variation of mortality with age in the feeding expt. described previously, the mechanisms involved are probably different. The reason for the resistance of the 1-month-old rat is not known.

- 3631 Maynard, E. A., Barnett, T. B., Downs, W. L., Neuman, W. F., and Hodge, H. C. Oral Toxicity of Uranium Compounds. One-Year Feeding Test. Serial Study of Uranyl Nitrate. Section 4. Declassified Dec. 22, 1949. 55p. (AECD-2773)

Groups of male and female rats have been maintained on diets contg. 0 (a control group), 0.1, 0.5, and 2.0% $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, resp., for various periods up to 1 yr. In a large-scale, serial sacrifice study, rats were examined at daily intervals for the first 5 days, at weekly intervals for the first mo., at intervals of 2 wks for the first 6 mos., and at the 30th, 38th, and 52nd wks. The growth was notably depressed in rats maintained on a diet contg. 2% $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$. The addn. of 0.1% produced negligible, if any, effect on growth. The growth of rats on the 0.5% diets consistently averaged slightly below those for the control rats. Mortality data are available on 125 male and female rats, resp., at each of the dietary levels during the first wk. Data are available on 100 of each sex during the first 14 wks, on 75 of each sex during the first 36 wks, and 50 of each sex during the balance of the yr. An abnormally high mortality was observed in the rats on the 2% diet; in contrast, the rats on the 0.5 and 0.1% diets exhibited the same order of mortality as did the control rats. The U content of the kidneys increased with increasing % of U nitrate in the diet. The U content of the femurs of the rats on the 0.5% diet ultimately reached values of approx. 20 $\mu\text{g U/g}$; on the 2% diet the values became as great as 200 $\mu\text{g U/g}$. Based on a no. of assumptions, it has been calcd. that the rat absorbs about 0.1% of the U from the diet. From hematological observations it was concluded that long-cont. administration of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ at a dietary level of 2% was accompanied by a low-grade anemia and a tendency toward a low-grade leukocytosis. Extensive histological examns. failed to reveal any renal abnormalities in rats maintained on the diet contg. 0.1% of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$. In rats fed the 0.5% diet, mild tubular necrosis occurred during the first wk, followed by epithelial regeneration, so that only slight traces of injury were present at the end of the expt. The kidneys of rats maintained on the 2% diets showed moderately severe tubular necrosis initially, followed by regeneration. In these rats, however, pathological changes developed progressively, different from the initial injury and characterized by tubular atrophy, increase in stroma, and narrowing of the cortex. The only other abnormalities appearing regularly were found in the testes of the male rats on the 2% diet. The origin of these changes is obscure.

- 3632 Maynard, E. A., Downs, W. L., and Hodge, H. C. Oral Toxicity of Uranium Compounds. Section 5. Two-Year Feeding Tests. Declassified Dec. 22, 1949. 21p. (AECD-2774)

Groups of 50 male and 50 female rats were fed diets contg. 0, 0.5, 2.0, and 20% UO_2 for a period of 2 yrs. There was no evidence of a depression of body wt. in any of the groups. The mortality for each group compared favorably with the mortalities observed in control rats. There was no indication of a shortening of life span. Results of hematological observations were uniformly neg. U analyses for sugar and for protein were essentially neg. Pathological examns. showed none of the changes characteristic of U poisoning. The usual scattering of incidental pathological changes was noted. The U content of the kidneys did not increase as the % UO_2 increased in the diets. The U content of the femurs increased slightly with increase in UO_2 content of the diets.

- 3633 Maynard, E. A. and Hodge, H. C. Oral Toxicity of Uranium Compounds. Section 6. One-Year Feeding Experiments on Dogs. Declassified Dec. 22, 1949. 38p. (AECD-2778)

A total of 30 dogs were fed various daily doses of 5 U cpds., i.e., UO_2 , UF_4 , $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, UCl_4 , and UO_2F_2 at levels that were tolerated for a period of 1 yr. 16 control dogs were also studied. The daily doses ranged from 0.0002 g/kg body wt. of the sol. UO_2F_2 to 10 g/kg body wt. of the insol. UO_2 . At the end of the 1-yr feeding period the only dogs in which an adverse effect on growth was noted were those which received U nitrate at a daily dose of 0.2 g/kg body wt. A questionable effect was noted when UF_4 was fed daily at a level of 5 g/kg. When blood-nonprotein-N and urea-N values were used as criteria of toxicity it was apparent that in most of the dogs studied, marked acute U poisoning was not produced. Some scattered abnormal urinary protein and sugar values were found. This was particularly noticeable in the dogs fed UCl_4 at a daily level of 0.05 g/kg body wt. Most of the recorded values did not deviate greatly from normal values. Histological studies disclosed that renal cortical tubular changes are the principal pathological effects of feeding U cpds. to dogs. No marked abnormalities occurred in the hematological picture when observations were made on red-cell counts, white-cell counts,

hemoglobin, and differential white-cell counts at various intervals during the 1-yr feeding period. A limited no. of U analyses were made of tissues from dogs fed $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ and UCl_4 . The highest liver value reported was $2 \mu\text{g/g}$ for a dog fed 0.05 g/kg . Kidney values mostly ranged below $1 \mu\text{g/g}$. Bone values ranged from 1 to $5 \mu\text{g/g}$. When blood F detns. were made on the dogs which received daily doses of UF_4 for a period of 1 yr it was evident that the dependence of the blood F level on dietary intake of F is essentially a linear function. Analyses of bone and tooth samples from these same dogs also demonstrated that the dependence of bone and tooth content of F on the amt. of F ingested is nearly linear.

- 3634 Maynard, E. A., Randall, C., Hodge, H. C., and Scott, J. K. "Effects of Feeding Uranium Nitrate Hexahydrate in the Diets of Breeding White Rats." *J. Pharmacol. Exptl. Therap.* **95**, 421-8(1949).

Two groups of 50 pairs of rats each were maintained for 7 months on a control diet and on a diet contg. 2% of $\text{NO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, resp. The growth rate of both male and female rats receiving the 2% diet was notably depressed. An increased growth rate, insufficient to compensate entirely for the previous loss, occurred when the exptl. rats were placed on the control diet 7 months after the start of the expt. U feeding sharply reduced the no. of female rats having litters. In addn., the exptl. rats had fewer young per litter. When the exptl. rats were replaced on the stock diet the females having litters were more productive than the control rats. Females which failed to have litters on the exptl. diet did not have litters later on the stock diet. Rats fed 2% $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ exhibited a slightly greater mortality during the 12-month period, 17 to 10% for the controls. $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ feeding produced an irregularity of the oestrus cycle since only 19 of 44 exptl. female rats had regular oestrus cycles and regular mating. U, except in traces, does not cross the placental barrier since very little was found in the newly born of the exptl. females upon assay. 11 references are given.

- 3635 Maynard, E. A., Downs, W. L., and Hodge, H. C. 5.2. Uranium Tetrafluoride (UF_4). Declassified Dec. 22, 1949. 12p. (AECD-2775)

Groups of 50 male and female rats were fed diets contg. 0, 0.5, 2.0, and 20% of UF_4 for a period of 2 yrs. Only the groups fed a 20% UF_4 diet exhibited a growth depression, but even in these rats the effect was not large. There was no indication that UF_4 , even up to 20% of the diets, decreased the life span. In the hematological observations there was little or no indication of any change ascribable to the UF_4 . Urine analyses for sugar and protein were uniformly neg. Only in the kidneys were any changes found on histological examn. that could be attributed to the administration of U; and in this organ mild tubular degeneration with typical and atypical regeneration were described only in the rats fed 20% diets. The usual nonspecific pathological changes were also found. The U content of the kidneys and femurs increased somewhat with increasing % UF_4 in the diet.

- 3636 Maynard, E. A., Downs, W. L., and Hodge, H. C. 5.3. Uranyl Fluoride (UO_2F_2). Declassified Dec. 22, 1949. 35p. (AECD-2776)

Groups of male rats, for the most part 25 each, were fed diets contg. 0, 0.01, 0.05, 0.10, 0.15, 0.25, and 0.50% UO_2F_2 for 2 yrs. Groups of female rats, 15 to 25 per group, were fed diets contg. 0, 0.01, 0.05, 0.25, and 0.50% UO_2F_2 for a period of 2 yrs. In the male rats and in the female rats the 0.05% diet did not depress body wt. In the male rats 0.1% UO_2F_2 was the lowest dietary % producing wt. depression. Diets contg. 0.15% consistently depressed the body wts. of male rats, and diets contg. 0.25% produced depressed body wts. in both male and female rats. The addn. of 0.25% UO_2F_2 shortened the life span of the male rat but not that of the female. The addn. of 0.05% was without effect on the life span. Hematological observations showed a trend for red-blood-cell counts and hemoglobin values to be depressed in male rats with increasing UO_2F_2 . A tendency toward higher white-blood-cell counts in the rats on the higher doses of UO_2F_2 was also found. Urine analyses for sugar and protein were surprisingly free from evidence of a pos. response to the administration of such amts. of U. U content of the kidneys and of the femurs increased with increasing UO_2F_2 in the diets. The F content of bones and teeth increased in the same manner. Based on the amts. of U and F found in the bone, it is probable that about 5000 times as much F is absorbed as U. As a result of histological examns.,

the addn. of 0.10% or less UO_2F_2 was described as producing no evidence of injury. Adding 0.15% produced min. and inconsistent renal tubular changes; this level may be considered as the lowest, producing just detectable change. Testicular atrophy was also described. There is no evidence that the freq. of spontaneous disease was affected by adding UO_2F_2 to the diets.

3637 Maynard, E. A., Downs, W. L., and Hodge, H. C. 5.4. Uranyl Nitrate Hexahydrate ($\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$). Declassified Dec. 22, 1949. 30p. (AECD-2777)

Groups of 15 to 25 male and female rats were fed diets contg. 0, 0.01, 0.05, 0.1, 0.5, 1.0, and 2.0% $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ for a period of 2 yrs. For the male rats, diets contg. up to 0.05% $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ produced no detectable depression in wt.; female rats tolerated a diet contg. 0.10% without effect on growth. The lowest % in the diet associated with detectable growth depression was 0.1 for the male rats, and 0.5 for the female rats. Even 2% $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ did not lessen the life span over a 2-yr period. The hematological observations were essentially neg. for the male rats; but revealed a tendency for an anemia and a low-grade increase in white-blood-cell counts for the female rats fed the 1.0 and 2.0% diets. Urine analyses for sugar and protein gave no evidence of a chronic or continuing U effect. On the contrary, there was an apparent trend toward a lessened pos. response with increasing amts. of $\text{UO}_2(\text{NO}_3)_2$ in the second yr. U contents of the kidneys and femurs of the rats increased with increasing U in the diet. On the basis of detailed histopathological examns., the kidney has been found to be the only organ exhibiting significant changes. There was a clear-cut dependence of the degree of injury on the dosage. No histological change identified as U poisoning was found in the kidneys of rats fed the 0.01, 0.05, and 0.1% diets. The kidneys of the rats fed the 0.5% diets exhibited subtle, borderline changes; this % may be identified as a zone of min. response. In the rats fed the 1 and 2% diets the changes were typical and consistent. A no. of male rats showed degenerative changes in the testes. The common pathological findings were seen; there was no evidence of a relation between the freq. of spontaneous disease and the feeding of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ in the diet. Evidence of tolerance to acute U poisoning was found in rats that had been ingested diets contg. U nitrate for 2 yrs.

3638 Meinke, W. W., comp. Chemical Procedures Used in Bombardment Work at Berkeley. Addendum No. 1. 1949. Declassified Dec. 2, 1949. 18p. (AECD-2750)

This is an addendum to AECD-2738(1949). Additional procedures for chem. sepsns. from targets bombarded with high-energy particles are given in detail. The elements considered include Bi, Ra, Ac, Th, Pa, and U.

3639 Meinke, W. W., Ghiorso, A., and Seaborg, G. T. "Three Additional Collateral Alpha-Decay Chains." *Phys. Rev.* (2), 75, 314-15(1949).

This is a continuation of investigations of the type which led to the observation of artificial radioactive chains collateral to the natural Th and Ac families (*Phys. Rev.* (2), 74 695(1948)) have led to the identification of an additional collateral chain and partial identification of two others. The isotopes U^{229} , U^{228} , and Pa^{226} have been observed to decay to Bi^{209} , Pb^{208} , and Pb^{206} , resp., by a series of α emissions for the most part. The measured half-lives and the nature and energies of the radiations are shown in tabular form along with the latest data for the previously reported Pa^{227} and Pa^{228} collateral chains.

3640 Melander, L. and Slätis, H. "On the Preparation and Radiation of U^{237} ." *Arkiv Mat. Astron. Fysik A* 36, No. 15, 9p.(1949).

Results, which have been reported elsewhere (*Phys. Rev.* (2) 74, 709-11(1948)), are discussed in greater detail.

3641 Mercader, A. L. and Benavente, E. P. "Spectroscopic Determination of Uranium in Minerals." *Anales asoc. quím. argentina* 37, 235-45(1949).

An attempt was made to use the spectrographic analysis for the quant. detn. of U in ores whose U content does not exceed 1%. The authors followed the procedure described by Strock (*Spectrum Analysis with the Carbon Arc Cathode Layer*. London, Hilger Ltd., 1936), the correction for background being

made according to Scott (*J. Soc. Chem. Ind. (London)* **25**, 63(1944)). Mo. was used as a std. The ore examined, from Mendoza Province, Argentina, was found to contain 0.77% U; this is a mean of 8 analyses, the mean deviation being about 8%.

- 3642 Miller, A. J. and Armstrong, G. M. —assigned to U. S. Atomic Energy Commission. Pre-
cipitation of Ammonium Diuranate. Apr. 5, 1949. (U. S. Patent 2,466,118)

This paper describes a process for the pptn. of $(\text{NH}_4)_2\text{U}_2\text{O}_7$ from aq. solns. contg. $(\text{UO}_2)^{++}$ and F^- consisting in adding sufficient NH_4OH to the soln. to ppt. a major portion of the U as $(\text{NH}_4)_2\text{U}_2\text{O}_7$, digesting the resulting slurry at an elevated temp. of 55 to 75°C, for about 5 to 20 min, cooling to about ambient temp. and then adding additional NH_4OH to prevent complexing of $(\text{UO}_2)^{++}$ by F^- and obtain complete pptn. of the U.

- 3643 Miller, P. D., Pray, H. A., and Munger, H. P. The Preparation of Uranyl Carbonate and
Measurement of Its Solubility. Aug. 1, 1949. Declassified Nov. 22, 1949. 15p. (AECD-2740)

A method for the prepn. of normal uranyl carbonate has been developed. Heretofore, this cpd. has been known only as a rare, naturally occurring material. The first preps. were made by adding a quantity of $\text{Na}_2\text{U}_2\text{O}_7$ as a paste to a CO_2 soln. previously heated to 60°C. When it appeared evident that the reaction at normal pressures was not producing the desired product, the operation was conducted in an autoclave. Investigations were made using $\text{Na}_2\text{U}_2\text{O}_7$, $(\text{NH}_4)_2\text{U}_2\text{O}_7$, UO_3 , and $\text{UO}_2(\text{OH})_2$, as starting materials. The best starting material proved to be UO_3 , since it furnished a product higher in U and CO_2 than did the other materials tested. The state of subdivision of the UO_3 and the continuity of suspension appear to be important. Uranyl carbonate is a cream-colored cryst. salt having a d. about 5.7. Its x-ray-diffraction pattern consisted of sharply defined lines characteristic of cryst. materials. The soly. of uranyl carbonate in H_2O at 30°C is 0.028 g/1000 g, and at 60°C is 0.083 g/1000 g. These values are considerably lower than are those for the tricarbonates. Uranyl carbonate reacts with Na_2CO_3 in soln. with the formation of complex cpds. which have not been identified, but which appear to include species both lower and higher in carbonate. Equil. values are necessary to define these reactions.

- 3644 Mooney, R. C. L. "The Crystal Structure of ThCl_4 and UCl_4 ." Acta Cryst. **2**, 189-91(1949). This paper is similar to report MDDC-1559(1947).

- 3645 Morgan, H. W. The Infrared Spectra of the Acetylacetonates of Uranium, Thorium, Iron, and
Magnesium. May 6, 1949. Declassified July 28, 1949. 16p. (AECD-2659)

The work described was undertaken to det. the vibration freqs. associated with the U—O bonds in the uranous acetylacetonate complex. The spectra of the U, Th, Fe, and Mg acetylacetonate complexes, and of acetylacetone, are traced and compared. By comparison of these 5 spectra, the bands in the complexes due to the acetylacetonate group are recorded. Assuming that the uranous and Th complexes have the same type of structure, comparison of these two spectra with each other and with the spectra of the Fe and Mg complexes allows selection of the U—O freqs.

- 3646 Morris, G. O. Uranyl Fluoride. Miscellaneous Notes. Note No. 31. The Preparation of
Anhydrous UF_4 from Small Samples of U_3O_8 . Oct. 7, 1943. Declassified Nov. 8, 1949. 2p.
(BDDA-191; BR-306A)

One-g samples of U_3O_8 can be converted to anhyd. UF_4 by the "dryway" process. This process consists in dissolving the U_3O_8 in HNO_3 , decomp. the UO_2NO_3 to UO_3 in a furnace, passing a current of H_2 at 650°C over the UO_3 to produce UO_2 , cooling the reactor to 450°C, and passing a current of HF gas in excess for 2.0 hrs. Two special samples of U_3O_8 have been successfully converted to UF_4 . The U recoveries were 96.45 and 98.1%, resp.

- 3647 Morris, G. O. Uranyl Fluoride Miscellaneous Notes. Note No. 38. The Dryway Preparation of Anhydrous UO_2F_2 . June 14, 1944. Declassified Nov. 8, 1949. 4p. (BDDA-217; BR-442A)
What is believed to be a new method of prepg. anhyd. UO_2F_2 consists in reacting UO_3 with HF gas at 400°C . The product contains 96.11% UO_2F_2 and 3.29% insols., the latter being essentially Cu scale deriving from the reactor. The anhyd. product is a very pale yellow hygr. solid. Suggestions for further research, to develop the process, are included.
- 3648 Morris, G. O. Uranyl Fluoride. Miscellaneous Notes. Note No. 39. The Complex between $\text{U}(\text{SO}_4)_2$ and HF. Evidence of Its Existence and Instability. June 23, 1944. Declassified Nov. 8, 1949. 7p. (BDDA-221; BR-454A)
This paper presents evidence to show the existence of a H_2O -sol. complex between $\text{U}(\text{SO}_4)_2$ and HF; having a mole ratio 1: 2 of $\text{U}(\text{SO}_4)_2$ and HF. Alk. metals substituted for H in the HF indicate that the complex is an acid and that the probable formula is $\text{H}_2[\text{U}(\text{SO}_4)_2]$. An outline of a decompn. mechanism is given.
- 3649 Neuman, W. F. Urinary Uranium as a Measure of Exposure Hazards. June 29, 1949. Declassified Dec. 22, 1949. 28p. (AECD-2786)
The purpose of this report is to furnish an interim guide to industrial hygienists and plant management and to serve as a preliminary basis for the actual setting up of working stds. by an authorized committee. The "recommended values" are based almost entirely on animal experimentation and can in no sense be regarded as final. The general mteabolism of $(\text{UO}_2)^{++}$ is reviewed briefly. Factors influencing the urinary excretion of U are discussed in detail. Based on known facts, the max. concn. of urinary U which may be considered safe is calcd. Collection of urine specimens, storage and shipment of samples, and methods of analyses are also discussed. Finally, a suggested program of future research is presented which would aid in obtaining a more accurate evaluation of urinary U values. 42 references are given. (This paper is also available in Ind. Med. Surg. 19, 185-91(1950).)
- 3650 Neuman, W. F., Neuman, M. W., Main, E. R., and Mulryan, B. J. "Deposition of Uranium in Bone. IV. In Vitro Adsorption Studies." J. Biol. Chem. 179, 325-33(1949).
This paper is similar to report AECD-2215(1948).
- 3651 Neuman, W. F., Neuman, M. W., Main, E. R., and Mulryan, B. J. "The Deposition of Uranium in Bone. V. Ion Exchange Studies." J. Biol. Chem. 179, 335-40(1949).
This paper is similar to report AECD-2018(1948).
- 3652 Neuman, W. F., Neuman, M. W., Main, E. R., and Mulryan, B. J. "The Deposition of Uranium in Bone. VI. Ion Competition Studies." J. Biol. Chem. 179, 341-8(1949).
This paper is similar to report AECD-2019(1948).
- 3653 Neuman, W. F. and Allen, R. P. "The Failure of 2,3-Dithiopropanol (BAL) to Affect Acute, Systemic Uranium Poisoning." J. Pharmacol. Exptl. Therap. 96, 95-8(1949).
This paper contains information similar to that found in report AECD-2204(1948).
- 3654 Neuman, W. F., Allen, R., and Mulryan, B. J. Preliminary Observations of Uranium Metal on Wound Healing with Reference to Gas Formation. Jan. 13, 1949. Declassified Feb. 21, 1949. 5p. (AECD-2476)
Small-scale tests were conducted to det. whether U caused gas formation when exposed to tissue fluid. In vitro expts. and in vivo expts. using rabbits were carried out. It is clear that U metal did not result in gas formation when exposed to tissue fluids. The apparent absorption of gas in the in vitro expt. probably resulted from the soln. (as a bicarbonate complex) of some partially oxidized U. Clinically, if gas formation is observed in wounds contg. U metal, it appears justifiable to assume that bacterial contamination is responsible.

- 3655 Neuman, W. F., Neuman, M. W., and Mulryan, B. J. The Failure of Non-Isotopic Uranium to Inhibit Resorptive Processes in Rat Femur. Mar. 21, 1949. Declassified May 2, 1949. 9p. (AECD-2580)

In an earlier study (Neuman and Neuman, J. Biol. Chem. **175**, 711(1948)) it was shown that a radioactive U nitrate prepn. intraperitoneally administered to rats resulted in an inhibition of the resorptive processes of the skeleton. A repetition of the expt. employing nonisotopic U gave no interference with the resorptive process of bone. It was concluded that the inhibition of these resorptive processes reported earlier was caused by radiation and not by any specific chem. property of U itself. (This paper is also available in J. Biol. Chem. **182**, 151-2(1950).)

- 3656 Neuman, W. F., Havill, J., and Feldman, I. Further Polarographic Studies of the Uranyl Citrate Complex. July 27, 1949. Declassified Oct. 18, 1949. 13p. (AECD-2728)

A recent publication elsewhere demonstrated that $(\text{UO}_2\text{OH})^+$ gives a polarographic wave above $\text{pH} = 4.2$, which would interfere markedly with polarographic studies of the U citrate complex. Therefore, the polarography of U in citrate medium has been reinvestigated. Except below $\text{pH} = 4.2$ or with an excess of citrate, the formation of $(\text{UO}_2\text{OH})^+$ was found to interfere polarographically. Further data have been obtained and the dissocn. const.,

$$K_c = \frac{[\text{UO}_2^{++}][\text{H}_2 \text{ citrate}^-]}{[\text{H}^+]^{3/2}[\text{dimerized complex}^-]^{1/2}}$$

was redetd. at a slightly lower $\text{pH} = 2.94$ to 3.57 and found to be 0.18 ± 0.08 .

- 3657 [Neuman, W. F.], Tishkoff, G. H., and Sunier, A. Chapter IV. Behavior of Uranium at the Dropping Mercury Electrode in the Presence of Complexing Anions. II. Bicarbonate and Carbonate Media. Declassified Dec. 22, 1949. 42p. (AECD-2769)

It has been observed in a previous investigation on the ultrafiltration of U from blood sera, that the concn. of U in the filtrate is a direct function of the CO_2 content of the sera. Further exptl. evidence has shown that U exists in blood predominantly as the bicarbonate complex. This report concerns the investigation of this complex, particularly its chem. behavior under physiological conditions. The investigation was carried out by polarographic means with a dropping Hg electrode. Theoretical considerations of the reaction mechanisms are presented. Diffusion studies of ionic and mol. species present in buffered solns. of $\text{UO}_2(\text{OAc})_2$ are presented in order to help det. the penetration of $(\text{UO}_2)^{++}$ through membranes of the human body.

- 3658 New Brunswick Laboratory. Assayer's Guide. Declassified July 6, 1949. 82p. (AECD-2640)
Methods for the detn. of the following are outlined: U_3O_8 in pitchblende, U_3O_8 in low-grade ore and sands, U_3O_8 in ores high in As and heavy metals, U in ores high in As and heavy metals (modified procedure), U_3O_8 in carnotites and low-grade pitchblendes (colorimetric), U_3O_8 in shales (colorimetric), U_3O_8 in phosphates (colorimetric), U in low-grade ores and sands (fluorimetric), ThO_2 in ores (hexamine method), Th oxide in ores (iodate method), and ThO_2 in monazite sand.

- 3659 Newton, A. S. "The Formation of U^{232} by Helium Ions on Thorium." Phys. Rev. (2), **75**, 209-11(1949).

This paper is similar to report AECD-2081(1948).

- 3660 Newton, A. S.—assigned to U. S. Atomic Energy Commission. Nitrogen Purification Process. Nov. 8, 1949. (U. S. Patent 2,487,360)

A simplified method for the purification of N_2 by the removal of O_2 is described. The N_2 gas is purified from O_2 and certain other gaseous impurities by passing it over $UN_{1.5}$ to $UN_{1.75}$ while maintaining the nitride at an elevated temp. usually not less than $200^\circ C$ and preferably about 500 to $600^\circ C$; the process may be used singly or in conjunction with other purification processes. The U nitride suitable for use may be prepd. by passing NH_3 or N_2 over U turnings at about $800^\circ C$; other reactive nitrides may also be used.

- 3661 Newton, A. S., Warf, J. C., Spedding, F. H., Johnson, O., Johns, I. B., Nottorf, R. W., Ayers, J. A., Fisher, R. W., and Kant, A. "Uranium Hydride. II. Radiochemical and Chemical Properties." Nucleonics 4, 17-24(1949)Feb..

This paper contains information similar to that in report MDDC-1649(1948).

- 3662 O'Brien, I. C. and Feldman, C., translators. Gmelin's Handbook of Inorganic Chemistry. Uranium and Isotopes. System Number 55. Feb. 10, 1949. (TID-82)

This is a translation of a portion of the 8th German Edition, Berlin, Verlag Chemie, 1936.

- 3663 Osborne, D. W., Thompson, R. C., and Van Winkle, Q. Products of the Deuteron and Helium Ion Bombardments of Pa^{231} . December 1948. Declassified Mar. 16, 1949. 8p. (AECD-2539)

Pa^{231} was bombarded with He ions (max. 42 mev) and deuterons (max. 21 mev) in the Berkeley 60-inch cyclotron. The U and Pa fractions were isolated chemically from the deuteron-irradiated material, and the Np, U, and Pa fractions from the He ion-irradiated material. Aliquots of the fractions were evapd. on Pt foils and studied by means of the differential pulse analyzer, α decay, decay of the Geiger-Müller activities through various absorbers, and absorption curves. The following activities were reported as resulting from the deuteron bombardment: Pa^{232} , Pa^{230} , Pa^{229} , U^{230} , U^{231} , U^{232} ; activities from the He ion bombardment were Pa^{230} , U^{229} , U^{230} , U^{231} , U^{232} , Np^{234} and a 1.5 day Np. Nuclear property data such as half-lives and characteristic radiations are given for these activities, as well as cross-section data for the reactions producing them. (This paper is also available in Seaborg, Katz, and Manning, The Transuranium Elements. New York, McGraw-Hill Book Company, Inc., 1949. Paper 19.11.)

- 3664 Pannell, J. H. Accuracy of Radioassays Obtained with Improved Automatic Sample Changer. July 22, 1949. 11p. (MITG-A82)

Tests were run for the purpose of detg. the accuracy of β -ray measurements made on an automatic sample changer. The results obtained on low-grade U and Th ores are described in this report which includes some details of the sample changer itself. The automatic sample changer proved to be sufficiently accurate for the radioassay of ores contg. as little as 0.024% U_3O_8 or 0.05% ThO_2 . Sources of error in the original design have been eliminated by mech. and electronic improvements.

- 3665 Petretic, G. J. and Rodden, C. J. Photometric Determinations of Copper, Manganese, Molybdenum, Nickel, Titanium, and Vanadium in Uranium Bearing Materials. Declassified Mar. 9, 1949. 70p. (AECD-2515)

The direct detn. of trace elements in the presence of the U is desirable since it eliminates the need of a sepn. of the U from the trace element. An application of the monocolour dithizone detn. of Cu was made resulting in a rapid control procedure for the detn. of Cu in high-grade U materials. The application of the permanganate colorimetric procedure to the rapid detn. of Mn in U metal is possible to a few ppm. The thiocyanate-stannous chloride method for the detn. of Mo has been applied to the analysis of U metal and intermediate products. The dimethylglyoxime method for the colorimetric detn. of Ni has been applied to the analysis of U samples; investigation of various oxidants was made and, of these, persulfate was found to be satisfactory. Ti was found to be completely sepd. from U by cupferron. The extent of the interference due to Mo and V was investigated, and it was shown that Ti in U metal can easily be detd. in their presence. An application of the peroxide colorimetric detn. of Ti was made, making possible a rapid detn. of the Ti content of U metal. The colorimetric detn. of V using H_2O_2 was successfully applied to the analysis of U cpds. and U-bearing materials. 17 references are given.

- 3666 Picciotto, E. E. "The Study of the Radioactivity of Rocks by the Photographic Method." Bull. soc. belge geol. paléontol. hydrol. 58, 75-89(1949).

The use of photographic plates, and especially of the new Ilford and Kodak plates, in nuclear physics is briefly described. In particular, the application of these methods to the study of the radioactivity of rocks is discussed. In a series of studies made by the authors, the photographic plates were placed in close contact with a thin, highly polished sheet of the rock sample and then developed under specified conditions. This method was used to det. the concn. of U and Th in 2 radioactive rock samples, and the results are given. The samples were then reduced to powder form and the concns. were again detd. Work on dissolved samples has not yet been completed. In conclusion, the relative merits of these different techniques are indicated.

- 3667 Pike, S. T. Uranium and the American Mines. Remarks at the Annual Meeting of the Colorado Mining Association, Denver, Colo. Feb. 1, 1949. (Speech-69)

- 3668 Pocyna, A. Recovery of Uranium. Oct. 25, 1949. (U. S. Patent 2,485,841)

A process is described which allows recovery or extrn. of V and U cpds. from ore, particularly carnotite, usually as oxides. The ore is first finely ground, and then oxidized with CaOCl_2 ; the mixt. is treated with HCl or H_2SO_4 to liberate the oxidizing agent, heated to dryness and until HCl is expelled, and cooled. NH_4Cl is then added to preserve the formed thioglycolate. Fe, V, and U are pptd. from soln. by adding Na_2CO_3 . Such subsequent steps as ignition of org. impurities, addn. of NaNO_3 , fusion, lixivating, pptn. of the Al cpds., filtering, acidifying, boiling, alkalizing, and sepg. render the desired products.

- 3669 Price, G. R., Ferretti, R. J., and Schwartz, S. "Fluorophotometric Determination of Uranium." Anal. Chem. 21, 1585-7(1949).

This is the abstract of a paper presented at the meeting of Optical Society of America Oct. 27 to 29, 1949, Buffalo, N. Y.

- 3670 Prigent, J. "Study of Oxide of Uranium 'Thermistors'." J. phys. radium (8), 10, 58-64(1949).

Some attempts to prep. U oxide thermistors are described. (Such thermistors are used to detect infrared and ultrahertzian radiations.) The methods of prepn. of UO_2 are described and the data obtained on various properties of the pastes of U oxide, i.e., resistance and the influence of applied force, temp., and pressure, are given in the form of several curves. The practical application of the samples obtained has not been very satisfactory and thus other oxides usually are used.

- 3671 Pringsheim, P. Fluorescence and Phosphorescence. New York, Interscience Publishers, Inc. 1949. 794p.

Following an introduction in which the general theory and exptl. technique used in the study of fluorescence and phosphorescence are discussed, the material is divided into two sections, i.e., (1) fluorescence of gases and vapors, and (2) fluorescence and phosphorescence of condensed systems. Included is a 36-page discussion of the luminescence of the rare-earth metals and uranyl salts. The natural minerals and crystals which are discolored by irradiation are also discussed.

- 3672 Prospectors' Guide for Uranium and Thorium Minerals in Canada. Ottawa, Dept. of Mines and Resources, 1949. 41p.

- 3673 Quill, L. L. and Rodden, C. J. Analytical Chemistry of the Manhattan Project. Chapter XXXVII. Scandium, Yttrium, and Rare Earths. Declassified June 2, 1949. (AECD-2618)

Various methods for sepg. the above elements from U and Th are given; pptn., extrn., and volatilization procedures are given in detail. Gravimetric and spectrophotometric methods for detg. the individual rare earths and Sc and Y are discussed.

- 3674 Rabbits, F. T. "Determination of Uranium in Ores. Modified Mercury Cathode-Cupferron Method." Can. Mining J. 70, 84-6(1949) Oct.

A picture of a modified Hg cathode cell along with a wiring diagram is presented. The construction of the cell and its operation are completely described. By electrolysis with the Hg cathode in dil. acid solns., the elements having high decompn. potentials (approx. 30 elements) are removed quantitatively because they are not deposited in the Hg. Therefore, simplified procedures for detg. the remaining elements may be employed utilizing less time and increasing the accuracy of the analysis. Several chem. formulas and references are included.

- 3675 Rabbits, F. T., Guest, R. J., Jordan, J. E., Kornelsen, E. K., Proulx, E., Lachance, G. R., and Rice, W. B. The Determination of U_3O_8 in Ores and Solutions. Cellulose Column Method. Ottawa, Dept. Mines and Technical Surveys, Sept. 2, 1949. 17p. (AEC File No. NP-1529; Memorandum Series No. 105)

An analytical procedure is described which gives a considerable saving in time and reagents compared with previous methods and yields results of improved accuracy and precision. In addn. it is applicable to any concn. of U in ores and solns. The sample is brought into soln. by a suitable method. If As is absent, it is preferable to obtain a HNO_3 soln. free of chlorides and sulfates. An Et_2O extrn. of the $UO_2(NO_3)_2$ is then performed in a cellulose column as described in report CRL/AE-19. The Et_2O in the extr. is distd. off and the U remaining can be detd.: (1) colorimetrically by NaOH and H_2O_2 ; (2) volumetrically by use of a Jones reductor and dichromate; (3) gravimetrically as the oxine ppt.; (4) fluorimetrically. With many ores it is necessary to eliminate As before the column extrn. as otherwise the recovery of U is not quant. HBr with HCl and hydrazine hydrochloride are considered more suitable for eliminating As than H_2S since the sepn. can be accomplished by heating in the original beaker without a filtration. However a min. amt. of HBr should be used to avoid losses through spattering on evapn. Sulfates are removed largely by pptn. with carbonate-free NH_4OH and resoln. in HNO_3 . If phosphates are present they can be complexed by Fe. If insufficient Fe is present in the sample, more is added as $Fe(NO_3)_3$ soln.

- 3676 Rabinowitch, E. I. and Katz, J. J. The Chemistry of Uranium. (1), Chapters 1 through 10. Declassified June 7, 1949. 315p. (AECD-2624)

The report is divided into chapters on nuclear properties of U; properties of the U atom; U in nature; extrn. of U from ores and prepn. of U metal; phys. properties of U metal; chem. properties of U metal; intermetallic cpds. and alloy systems of U; the U-H system; U borides, carbides, and silicides; and U cpds. with elements of group V.

- 3677 Rabinowitch, E. I. and Katz, J. J. The Chemistry of Uranium, Chapters 11 through 16. Declassified Aug. 12, 1949. 570p. (AECD-2667)

This report is a continuation of AECD-2624. It consists of a discussion of the following: (Chapter 11) Uranium oxides, sulfides, selenides, and tellurides: (phase relationships in the U-O system; phys. properties of anhyd. U oxides; phase relationships and phys. properties in the U-O- H_2O system; oxidation and reduction of U oxides and hydroxides; conversion of other U cpds. to oxides and hydroxides; conversion of U oxides and hydroxides to other U cpds.; U-S system; U selenides and tellurides). (Chapter 12) The nonvolatile fluorides of uranium: (UF_3 ; UF_4 ; UF_5 ; and the intermediate fluorides, U_2F_9 and U_4F_{17}). (Chapter 13) Uranium hexafluoride: (prepn. of UF_6 ; phys. properties of UF_6 ; chem. properties of UF_6). (Chapter 14) Uranium-chlorine compounds: (UCl_3 ; UCl_4 ; UCl_5 ; UCl_6). (Chapter 15) Bromides, iodides, and pseudohalides of uranium: (UBr_3 ; UBr_4 ; UI_3 ; UI_4 ; mixed halides of U^{+3} and U^{+4} ; uranium borohydrides; uranium carbonyl). (Chapter 16) Oxyhalides of uranium: (UO_2F_2 ; UO_2Cl_2 ; UO_2Br_2 ; UO_2I_2). Extensive references are included for each chapter.

- 3678 Rochat, O. "Use of Photographic Plates for the Detection of Fission Reactions of Uranium." Mem. soc. vaud. sci. nat. 9, 195-240(1949).

Various aspects of the photoemulsion method for the study of the U fission reaction were examined, such as the photographic development techniques, the ways of distinguishing between fission products and α particles of the U radioactivity, and the procedures for the detn. of the fission cross section. A feeble neutron source of 50 mc and rather heavily charged plates (0.9 mg/cm^2) were used. The value of the U^{235} fission cross section found was 580 ± 120 barns. Track photographs are included. The prepn. of U-loaded plates and the detn. of the amt. of U in plates is also discussed.

- 3679 Rodden, C. J. "Determination of Naturally Occurring Radioactive Elements." Anal. Chem. 21, 327-35(1949).

Numerous chem. and radiochem. methods for the detn. of U and Th are reviewed. These include both direct and indirect methods utilizing the radiations (α , β , and γ) and gravimetric, spectrophotometric, and fluorometric methods. It is noted that the chem. detn. of U in ores is the more accurate method. Th in minerals is most accurately detd. by chem. means but may be estd. radiochemically. 82 references are given.

- 3680 Rosen, L. and Taschek, R. Search for Three-Way Fission of U^{238} by 14-Mev Neutrons. Sept. 25, 1947. Declassified Jan. 18, 1949. 4p. (AECD-2452)

The photographic technique has been employed to investigate the possibilities of the disintegration of a U^{238} nucleus into three particles of comparable masses when exposed to 14-mev neutrons. 24,000 tracks were analyzed with the conclusion that, if the above event takes place, its cross section is less than 0.00025 that of binary fission.

- 3681 Rosen, L. and Hudson, A. M. Symmetrical Tripartition of U^{235} by Thermal Neutrons. Aug. 29, 1949. Declassified Oct. 17, 1949. 30p. (AECD-2725)

By making use of an ionization chamber divided into three sections and a triple coincidence circuit in conjunction with either a gated 10-channel amplitude discriminator or a double-coincidence circuit, it has been found possible to det. the freq. of symmetrical triple fission in U^{235} relative to the freq. of binary fissions. The results of the expts. are that triple fissions occur to the extent of $6.7 \pm 3.0/10^6$ binary fissions in the case where the fragments come off with comparable masses. 20 references are given. (This paper is also available in Phys. Rev. (2), 78, 533-8(1950).)

- 3682 Roth, H. P. "Microstructure of Uranium." Metal Progress 56, 662-3(1949).

Six micrographs are shown along with a few brief remarks. The notation on the various U micrographs are as follows: as rolled at 500°C (19% reduction); extruded (2:1 reduction ratio), annealed at 300°C ; extruded (8:1 reduction ratio), annealed at 300°C ; extruded (2:1 reduction ratio), annealed at 700°C ; cold-rolled 2%, annealed 500°C ; rolled 10% at 500°C , annealed at 600°C .

- 3683 Rothstein, A. The Metabolic Effects of Uranium on the Yeast Cell. Jan. 11, 1949. Declassified Feb. 9, 1949. 18p. (AECD-2477)

In the present paper, the qual. effects of U on yeast cells are described in some detail. On the basis of these effects, it is possible to make some general statements regarding the mechanism of action of U. U inhibits the utilization of glucose under both anaerobic and aerobic conditions: no CO_2 is produced, no O_2 is consumed, no hexose is consumed. If U is added after the glucose, there is a delay before inhibition takes effect. If U is added prior to the glucose, no such lag occurs. U inhibits not only the metabolism of glucose, but of fructose and galactose as well. In the case of galactose, cells which are adapted to this substrate are inhibited to a greater extent than are unadapted cells. The metabolism of stored glycogen is relatively unaffected by U as measured by either O_2 consumption or glycogen degradation. The same is true for the aerobic metabolism of alc. or acetate, and for glycogen synthesis from alc. U increases the rate of liberation of base by cells suspended in substrate-free medium. U apparently acts on one of the earliest steps in hexose metabolism, a step which occurs at the surface of the cell. Either the permeability of the cell to hexose is decreased, or an enzyme inhibition is involved. 21 references are given.

- 3684 Rothstein, A. and Meier, R. Relationship of the Cell Surface to Metabolism. VI. Hydrolysis of Sucrose and Raffinose. Oct. 28, 1949. Declassified Dec. 5, 1949. 10p. (AECD-2751)

U has been found not to inhibit the rapid hydrolysis by yeast of sucrose to glucose plus fructose, and of raffinose to fructose plus melibiose. It does prevent utilization of the products of hydrolysis and any direct utilization of the sucrose and raffinose. The hydrolytic enzymes are bound to the cell structure and do not appear in the supernate. The quant. recovery of the products of hydrolysis in the supernate of U-inhibited yeast indicates that the sucrose and raffinose-splitting enzymes are located on the surface of the cell. 10 references are included.

- 3685 Rothstein, A., Meier, R. C., Hurwitz, L., Berke, H. L., and Larrabee, C. The Mechanism of Action of Uranium on Cells. July 5, 1949. Declassified Dec. 22, 1949. 51p. (AECD-2783)

U in low concns. inhibits the anaerobic or aerobic metabolism of glucose and fructose by yeast and the fermentation of galactose by "adapted" cells. Concns. of U which inhibit sugar metabolism, however, have little or no effect on the aerobic metabolism of lactate, acetate, pyruvate, or alc., but much higher concns. of U partially inhibit metabolism of acetate or lactate. U has little effect on endogenous metabolism of reserve stores on the degradation or synthesis of glycogen, or on fermentation of glycogen induced by dinitrophenol. The kinetics of metabolism in the presence and absence of U can be fitted by the Michaelis-Menton equation, or simple modifications. A difference in kinetics of anaerobic and aerobic metabolism is paralleled by a difference in inhibition curves. More U-binding, cell-surface loci are involved in aerobic than in anaerobic metabolism. Elevation of the temp. reverses the U inhibition. This effect is due not to dissocn. of the U-cell-surface complex, but is associated with a higher energy of activation for the U-inhibited reaction as compared to the normal rate-limiting process. The same U-binding loci are involved in the metabolism of glucose and fructose, but different loci are involved in galactose metabolism in "adapted" cells. The dissocn. const. for the U-cell-surface complex is best matched by the const. for the U-polyphosphate complex. A hypothesis for the mechanism of action of U is presented. Sugars do not penetrate the cell by a simple diffusion process, but are actively transported. The transport mechanism involves the phosphorylation of glucose by hexokinase and adenosine triphosphate on the surface of the cell. The resynthesis of adenosine triphosphate must also occur on the surface of the cell. U inhibits sugar transport by complexing with polyphosphate group of adenosine triphosphate, thereby preventing transphosphorylation. This mechanism is consistent not only with the data on yeasts, but with the known facts concerning the action of U on the kidney tubule. 59 references are given.

- 3686 Rundle, R. E. and Wilson, A. S. "The Structures of Some Metal Compounds of Uranium." Acta Cryst. 2, 148-50(1949).

This paper is similar to report AECD-2388(1948).

- 3687 Sacconi, L. "Study of Magnetic Properties of Some Complex Compounds of U IV, Having the Coordination Number Eight." Atti accad. nazl. Lincei classe sci. fis. mat. nat. (8), 6, 639-45 (1949).

In the course of a study of complex cpds. of U^{+4} with the coordination no. 8, the author obtained several U-org. cpds. by the reaction of HCl solns. of the U^{+4} ion with various diketones and nitroso cpds. Measurements of the magnetic susceptibility of these substances were made. The usually accepted configuration $6s^2 6p^6 6d^2$ for U^{+4} was found to disagree with the magnetic properties observed. Only the presence of two 5f electrons in U^{+4} can account for the typical covalent bonds revealed by the magnetic measurements. The true configuration is, accordingly, $5f^2 6s^2 6p^6$.

- 3688 Scharff-Goldhaber, G., der Mateosian, E., McKeown, M., and Sunyar, A. W. Low Energy Photons from Radioactive Nuclei. Dec. 5, 1949. 1p. (AECU-767)

The document is in abstract form; it is reproduced below in its entirety.

"Low-energy photons have been observed for a number of radioactive nuclei with the help of an argon-filled proportional counter. The following results have been obtained:

	Sm ¹⁵¹	Gd(153)	Pa ²³¹	U ²³⁴
Energy of γ rays in kev	21	26	27	
x rays observed	L	K,L	L _I L _{II} L _{III}	L _I L _{II} L _{III}

The 24-kev electrons reported by Teillac for Pa²³¹ and interpreted as L electrons of a 44-kev transition are reinterpreted as M electrons of the 27-kev transition. Although no unconverted γ rays could be detected from U²³⁴, it is shown that it is more plausible to ascribe the L radiation to a highly converted nuclear transition following at least one-quarter of the α transitions rather than to excitation of the electronic shell by the α rays as suggested by Macklin and Knight."

- 3689 Schramm, C. H., Gordon, P., and Kaufmann, A. R. The Alloy Systems Uranium-Tungsten, Uranium-Tantalum, and Tungsten-Tantalum. Declassified Aug. 26, 1949. 39p. (AECU-2686)

The U-W and U-Ta alloy systems have been found to contain in each case only 5 phases (neglecting the gas phase), the high temp. liq. soln. of the 2 metals involved, and the solid phases α , β , and γ -U plus either W or Ta. No intermediate phases were detected in either system. The temps. of the α , β , and γ -U transformations have been located at 670 and 770°C, resp., in the U-W system, and 680 and 760°C, resp., in the U-Ta system. The solidus transformations have been described as of the peritectic types in both systems, occurring at 1135°C in the U-W system, and at 1175° in the U-Ta system. The order of magnitude of the terminal solid solns. for both systems has been shown to be small. The liq. solys. of W in U up to 2400°C and of Ta in U up to 2000°C have been reported. Two phases of the U-Ta-C ternary system have been discovered; one approx. UTa₁₀C₄, having a low crystal symmetry and an extremely high m.p., and the other being a face-centered cubic phase with $a_0 = 4.41$ Å. The Ta-W system has been indicated to be a continuous series of solid solns. The relationship between lattice parameter and compn. for the Ta-W solid solns. has been detd. (This paper is also available in J. Metals 188, 195-204(1950).)

- 3690 Scott, K. G., Axelrod, D., Crowley, J., and Hamilton, J. G. "Deposition and Fate of Plutonium, Uranium and Their Fission Products Inhaled as Aerosols." Arch. Path. 48, 31-54(1949).

The purpose of the expts. described was to ascertain the possible hazards resulting from the inhalation of fissionable materials and fission products. With the exception of one study on a human subject, young rats were used for all of the expts., and after anesthetization, were given Pu, U, and mixts. of fission products contg. Sr, Y, Zr, Nb, Ru, Ba, La, Ce, Cs, Pr, Nd, and Pm in the form of smokes and sprays. The rats were given: Pu oxide as smoke; Pu nitrate as a spray; fission products, contg. Pu and U, as aerosols; carrier-free fission-products aerosols; aerosols of carrier-free Zr or Zr oxide; and aerosols of Pa as Pa oxide. The prepn. of the aerosols is given in detail. The Zr aerosol was administered to both a human subject and the rats. It was shown that the aerosols were almost totally retained by the head and lungs immediately after exposure; after 4 days the lungs contained the largest % of these elements. The elements deposited in the head and the bronchial tree were quickly eliminated through the gastrointestinal tract, while the nonciliated portions of the lungs removed the substances at a slower rate. The main plumonary site of deposition of the substances was in the bronchial passages and alveoli; a small amt. was absorbed and appeared in the skeletal structure, but none was found in the blood vessels or in the lymph nodes.

- 3691 Scott, T. R. "A Source of Error in the Colorimetric Estimation of Uranium." Nature **163**, 768-9(1949).

It has been found that the error occurring when the H_2O_2 method (Sandell, E. B., Colorimetric Determination of Traces of Metals. New York, Interscience Publishers, Inc., 1944) for the estn. of U content is applied using a modern type of spectrophotometer (the colors being measured at $360\text{ m}\mu$) can be traced to the presence of $NaHCO_3$. The results, which were previously found to be low by as much as 30%, can be best corr. by avoiding the formation of $(HCO_3)^-$. This can be done by neutralizing the acid solns. contg. U with NaOH; the neutral solns. are then treated with Na_2CO_3 and the color developed as usual with H_2O_2 .

- 3692 Scott, T. R. "The Use of Ether Extraction in the Determination of Uranium." Analyst **74**, 486-91(1949).

The variables affecting the Et_2O extrn. of $UO_2(NO_3)_2$ from aq. solns. have been examined and an analytical procedure capable of wide application has been described. Extrns. are carried out in solns. contg. 3N HNO_3 and 1M $Fe(NO_3)_3$, the latter being a more eff. salting-out agent than the majority of inorg. nitrates. Under these conditions 99% recovery of U can be achieved by 3 extrns. using equal vols. of Et_2O and aq. soln., and considerable amts. of other anions can be tolerated in soln. without substantial modification of the procedure.

- 3693 Senftle, F. E. and Boyce, C. R. The Preparation of Standard Samples for Field Analyses. Ottawa, Dept. of Mines and Resources, June 7, 1949. 3p. (AEC File No. NP-1602; Radiation Laboratory Topical Report No. 25)

The std. samples of U ores supplied for calibration purposes in field analysis methods are described. Each set contains 2 std. with 0.5 and 7.0% U_3O_8 , resp. These have been found adequate to standardize Geiger counters for use in field assays.

- 3694 Senftle, F. E. and McMahon, C. "Determination of Uranium in Ores by Field Analysis." Can. Mining Met. Bull. **42**, 618-21(1949).

Two methods are presented for detg. the U content of ores in the field. They are, the field-est. method and the field assay method. A portable Geiger counter with a rate meter is generally used for this type of work. In the est. method, the deflections for each of the several sides of the specimen are recorded. The net readings are averaged and the sample is weighed. The approx. % U_3O_8 equiv. (C_x) is obtained by comparison with the std.

- 3695 Sevchenko, A. N. "Luminescence of Uranyl-Containing Glasses and Crystals." Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. **13**, 188-202(1949).

Exptl. proofs are described of the polarized character of the luminescence of $(UO_2)^{++}$ contg. glasses and crystals. The effect is studied in its relation to temp., extinction time, nature of the salt, its concn., etc. 22 diagrams and spectrum photographs and 23 references (mostly Russian) are included.

- 3696 Sevchenko, A. N. and Stepanov, B. I. "Infrared Spectra of Uranyl Salts." Zhur. Eksptl. Teoret. Fiz. **19**, 1113-20(1949).

An investigation of absorption spectra of $4(UO_2)^{++}$ salts, in the region between 5 and $14\text{ }\mu$, showed the presence of a no. of higher harmonics and combination freqs. These could be interpreted by taking as fundamental freqs. 830, 200, and 920 cm^{-1} . It follows from a comparison of the band intensities with data furnished by the selection rules, that in uranyl sulfate and K uranyl sulfate the $(UO_2)^{++}$ ion has a bent shape, while in uranyl acetate and uranyl nitrate it is almost rectilinear. The influence of the water of crystn. on the relative intensities of various bands was noted. The bands' freqs. do not vary with the quantity of water of crystn.

- 3697 Shaw, E. H. Jr., Ordal, E. N., and Wingfield, F. J. "Preliminary Report on the Toxic Effect of Uranium to *Paramecium caudatum*." *Proc. S. Dakota Acad. Sci.* **28**, 121-7(1949).

Cultures of *Paramecium caudatum* were treated with various concns. of $\text{UO}_2(\text{OAc})_2$ at pH = 7, death time being plotted against molarity. The similarity of the resulting curve to that of a bimolecular chem. reaction, going to partial completion, is pointed out. Cytological changes are described.

- 3698 Simon, W., Asbury, I., and Flanders, V. E. A Precise Volumetric Method for the Determination of Uranium in Uranium Oxides. Aug. 27, 1948. Declassified July 20, 1949. 21p. (AECD-2652) 2652)

A volumetric procedure using ceric ammonium sulfate as the titrant has been developed for the analysis of U in relatively pure samples of U oxide with a precision of 0.05% of the U present. This procedure differs from the std. volumetric procedures only in the quality of the equipment and in the method of dissolving the samples. Techniques for sampling and weighing, soln. of the oxide in hot concd. H_2SO_4 , reduction of sample in a Jones reductor, aeration procedures, titration of sample, reagent blank titration miscellaneous sources of errors, standardization of ceric ammonium sulfate, indicator prepn., and details of the exptl. procedure are discussed.

- 3699 Skimkin, D. B. "Uranium Deposits in the USSR." *Science* **109**, 58-60(1949).

This is a summary of research and exploration of the U deposits in the USSR, with special reference to occurrences in Central Asia and the deposits associated with pegmatites in the region between Baikal Lake and the Aldan gold fields.

- 3700 Skinner, H. A. The Preparation of Small Quantities (Approximately 1 g) of Pure UF_6 . May 8, 1944. Declassified July 22, 1949. 5p. (BDDA-212; BR-423A)

A method is described for the prepn. of small quantities, of the order of 1 g, of UF_6 by direct fluorination of UF_4 . The conversion of $\text{UF}_4 \rightarrow \text{UF}_6$ by F_2 treatment is quite straightforward in principle. In practice, on the small-scale required by these expts., there are a no. of difficulties. The chief of these are (1) ensuring max. purity of all starting materials and (2) ensuring complete dryness of starting materials and reaction vessels. It was early established that the most promising manner in which to achieve (2) was by prolonged drying under high vacuum. The app. consisted of the F_2 cell, F_2 purifying line, fluorination reactor, and UF_6 receivers, and the vacuum line. The method gives a yield corresponding to an eff. of conversion of 80 to 95%.

- 3701 Smales, A. A. Separation and Determination of Small Amounts of U and Fe by Means of 8-Hydroxyquinoline. Apr. 4, 1944. Declassified July 1949. 7p. (BR-412)

The method calls for the sepn. and detn. of U and Fe using CHCl_3 extrn. of the metal-oxine complexes at differing pH values when NH_4OAc is used as the buffer. The method may be used for the detn. of as little as 0.05 mg U. Notes on the removal of interfering ions are also given.

- 3702 Smales, A. A. and Furby, E. "Absorptiometric Determination of Uranium." *Nature* **164**, 579(1949).

The effect of $(\text{HCO}_3)^-$ in the H_2O_2 method for the absorptiometric detn. of U is considered. This is one of two general effects which have not been stressed in the literature, i.e., that the light absorption of optical d. for a given concn. of U with excess peroxide present is dependent (a) upon the final pH and (b) upon the particular alk. used (or if a mixt., upon the relative amts.). An accompanying graph shows that at 365 $\text{m}\mu$ the sensitivity of the method is some 25% greater at the higher pH values than at the pH ~11 reached by Sandell's conditions (Colorimetric Determination of Traces of Metals, New York, Interscience Publishers, Inc., 1944) as used by Scott (*Nature* **163**, 768(1949)). This sensitivity was achieved with a commercial filter absorptiometer using a Hg lamp source. It was possible to overcome the effect noted by Scott, for reasonable amts. of NaHCO_3 or Na_2CO_3 , or both, by addn. of NaOH to a pH = 12.9.

- 3703 Smales, A. A. and Furby, E. Spectrophotometric Determination of Uranium Using Hydrogen Peroxide and Alkali. Atomic Energy Research Establishment. April 1949. 16p. (AERE-C/R-344)

The spectrophotometric detn. of U using H_2O_2 in alk. soln. is discussed with emphasis on the effect of pH and the relative sensitivities obtainable with a Hilger Spekker Absorptiometer and a Beckman Spectrophotometer. It is shown that pH variations have a marked effect, and that for best results it is desirable to work at $pH \geq 12$, while, as might be expected, the relative sensitivities of the two instruments are almost identical under similar conditions. The use of the Absorptiometer as a monochromatic instrument, particularly at 365 $m\mu$, is discussed, and it is shown that amts. of U as small as 50 to 1000 μg may readily be detd. using this instrument and a 4-cm cell.

- 3704 Snyder, W. S. and Powell, J. L. Absorption of γ -rays. Nov. 7, 1949. Declassified Nov. 25, 1949. 18p. (AECD-2739)

Tables of absorption coeffs. as functions of γ -ray energy and at. nos. have been compiled for Al, Fe, Cu, Ag, Sn, Ta, Pb, and U; they are representative of the best exptl. data available at the present time. It was found that, except for limited ranges of the variables involved, the theoretical formulas that have been developed for calcg. absorption coeffs. cannot in general be relied on to give absorption coeffs. within an accuracy of 5%. The various approximations which enter into the theoretical calns. of cross sections for photoelectric and Compton absorption and for pair production are discussed in detail. 16 references are included.

- 3705 Soye, C. "Study of a Complex of Uranium and Choline." Compt. rend. 228, 1228-30(1949). The potentiometric curve obtained by neutralizing an aq. soln. of $UO_2(NO_3)_2$ (0.0055M) with a 0.55M soln. of choline is described. The first point of inflection, i, occurred at $pH = 4.40$, and corresponded to 1:1, uranyl nitrate to choline; at $pH = 5.25$ the soln. began to ppt. and the pptn. seemed complete at 1 U for 2 cholines. The substance for analysis was prepd. by evapn. of either the filtrate of an equimol. mixt. of $UO_2(NO_3)_2$ and choline in alc. or aq. solns., or aq. solns. of mixts. of choline and $UO_2(NO_3)_2$ in proportions such that the $pH \leq 4$. The crystals formed were bright yellow, nonhygr., sol. in H_2O , slightly sol. in alc., and insol. in Et_2O and C_6H_6 ; they consisted of raylike needles more closely grouped and finer than those of uranyl nitrate. The mol. wt. detd. by cryoscopy was found to be at least equal to 1030 with the corresponding formula $UO_2(NO_3)_2 \cdot (choline)_2$. The electrolysis was carried out in 2 sep. tubes, joined by a siphon, with Pt electrodes releasing NO_2 at the anode, and a gaseous discharge at the cathode with the deposit of UO_3 and the liberation of choline; the respective proportions of U and choline remained the same at the anode, cathode, and in the siphon at the start and at the end of the electrolysis. The reaction tended to prove that U and choline were displaced together under the action of an electric field; the substance isolated would then be the nitrate of a complex of U and choline.

- 3706 Spedding, F. H., Newton, A. S., Warf, J. C., Johnson, O., Nottorf, R. W., Johns, I. B., and Daane, A. H. "Uranium Hydride I." Nucleonics 4, 4-15(1949) Jan. This paper is similar to report MDDC-1585(1947).

- 3707 Spence, R. W. Current Radiochemical Research at Los Alamos. Declassified June 6, 1949. 7p. (AECD-2625)

An investigation to discover any changes in the fission yield vs. mass curve for U^{235} when the neutron energy was raised from thermal energies to 14 mev was carried out. It is shown that symmetrical fission is about 100 times more probable for a 14-mev fission than for a thermal fission. It is apparent also that the heavy peak has shifted to lighter mass nos., while the position of the light peak can be noticed, however; e.g., mass 99 has dropped relative to mass 97 by about 8%. Other results are discussed. An attempt to measure the (n,2n) cross section in U^{238} by a detn. of the U^{237} formed, and an attempt to det. the mass no. of the 17-hr Zr activity are discussed. No definite conclusions have been reached in regard to these investigations.

- 3708 Sprague, G. F. Jr., Pettengill, A., Brown, B., and Stokinger, H. E. A Second-Year Inhalation Toxicity Study of Animals Employing Uranyl Nitrate Hexahydrate at 4 mg/m³. Dec. 19, 1948. Declassified Jan. 18, 1949. 56p. (AECD-2442)

The chronic toxicity of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ has been studied for a second yr in 23 dogs and 70 rats. The exposure conditions and toxicologic procedures resembled closely those of the previous yr, but considerably more study was given to the detn. of particle size of the nitrate dust. As a result of the exposure to $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ dust at 4 mg/m³ daily for a second yr, the following observations are made. The mortality among dogs and rats that probably could be attributed to U exposure was confined to 2 dogs previously exposed to UO_2 and 1 rat exposed to the nitrate, although the over-all mortality amounted to 65% of all animals dying or sacrificed because of advanced age or disease. Little change occurred in wt. response in any of the animal groups with the exception of the dogs exposed previously to UO_2 and UF_4 . Dogs exposed previously to UF_6 showed the greatest wt. gain at the end of the second yr; rats previously exposed to this cpd. were the only ones to lose wt. A greater no. of abnormal values among biochem. constituents both in blood and urine appeared in the animals during the second yr than during the first yr. The greatest no. and degree of changes occurred among those animals exposed to U cpds. that produced the least effect during the first yr, namely UO_2 and UCl_4 . Animals previously exposed to the same level of the nitrate as in the current study showed fewest changes. Renal injury was found in all animals exposed, characterized, resp., by necrosis, cellular desquamation, and regeneration or tubular atrophy. The hematologic finding of anemia among both dogs and rats was noteworthy. Again this anemia was most marked in animals whose prior exposure had been to UO_2 , UF_4 , and UCl_4 . The anemias observed were confined to decreases in red-blood-cell count and hemoglobin content, and were not associated with a rise in the % reticulocytes. One of the more important observations from the second-yr study was the deposition of U in the tissues. Among the important depots of U storage were the bones and teeth.

- 3709 Sterett, C. C. and Calkins, V. P. The Ionic Absorption Spectra of the Uranium Chlorides in a Polar, Aqueous Solvent. Mar. 4, 1949. 11p. (AECU-352)

The absorption spectra of the following U chlorides have been measured in water: UCl_3 , UCl_4 , UCl_5 , UCl_6 , and UO_2Cl_2 . All these chlorides were found to be sol. in H_2O . Only 2 basically different spectra were shown, that of the $(\text{UO}_2)^{++}$, given by UO_2Cl_2 and the UCl_6 , and that of the U^{+4} , given by UCl_3 and UCl_4 . UCl_5 clearly showed a combination of the 2 basic spectra. The existence of UCl_5 as a double cpd. of the UCl_6 and UCl_4 readily explains the spectra observed for UCl_5 . Comparisons of these spectra have been made with those of various U halides in a polar, nonaq. solvent such as MeOAc .

- 3710 Sterett, C. C. and Calkins, V. P. Spectrophotometric Evidence for the Existence of UCl_5 as the Double Compound $\text{UCl}_6 \cdot \text{UCl}_4$. Nov. 4, 1948. Declassified Jan. 19, 1949. 12p. (AECD-2443)

Spectrophotometric evidence for the existence of UCl_5 as a double cpd. of UCl_4 and UCl_6 has been obtained by studying the absorption spectra of these chlorides in CCl_4 and SOCl_2 solns. in the visible and ultraviolet regions of the spectrum.

- 3711 Stohr, J. A. "The Manufacture of Billets of Uranium Oxide." Atomes 4, 57-8(1949) Feb. The billets for the French pile are constructed of Al tubes filled with brown UO_2 obtained by the reduction of UO_3 in a stream of H_2 . The d. of the brown powder is increased by using a press and a mold to a specific gravity of approx. 6. The d. of the compressed pieces are further increased by a fritting process which in brief consists in heating them to high temp. (around 1600°C) in a H_2 and N_2 atm. until a specific gravity of approx. 10 is reached.

- 3712 Stokinger, H. E. Toxicity Following Inhalation for One and Two Years. Introduction. Declassified Dec. 22, 1949. 9p. (AECD-2779)

In this introduction, the previous 30-day exposure studies are briefly reviewed and the purposes and method of attack for 1- and 2-yr chronic exposure studies are discussed.

- 3713 Stokinger, H. E. Discussion and Interpretations [Chronic One-Year Uranium Compounds Inhalation Studies.] Release approved Dec. 22, 1949. 39p. (AECU-668)

The data from 13 1-yr inhalation studies and a single 2-yr pilot study have been evaluated and the following goals are discussed: (1) the characteristics of animal response to 1 and to 2 yrs' exposure to U dusts; (2) the extent of the deposition, retention, and elimination of U by the animal body under known conditions of exposure for 1 and 2 yrs; (3) the safe limits of exposure and borderline levels for 1 yr for 3 typical sol. U cpds., $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, UCl_4 , and UF_6 , and for 2 representative insol. dusts, UF_4 , and UO_2 .

- 3714 Stokinger, H. E. The Relation between Mean Particle-Size and the Toxicity of Particulate Uranium Dioxide. Declassified Dec. 22, 1949. 81p. (AECD-2782)

Particulate UO_2 was sepd. into 7 fractions differing in particle size over the range 11 to 0.35μ . Equal wts. of these fractions were administered to white rats by intratracheal injection, and the magnitude of the ensuing response was estd. by measurement (a) of wt. change, (b) of accumulation of nonprotein N in the blood, and (c) of the ability of the kidney to excrete phenolsulphonophthalein. The quantity of U in the lungs, kidneys, and femurs was detd. analytically. The following conclusions are reported: (1) administration of UO_2 in the lungs of rats leads to a typical response originating primarily in the damage which is produced in the kidney; (2) the intensity of this response is a function of the particle size of the UO_2 such that the greater response is associated with the smaller particles and the lesser response with the larger particles; (3) particles smaller than 1μ are relatively more active in causing damage than are particles greater than 1μ ; and there is no indication that a limit had been reached at 0.35μ which was the smallest size tested; (4) the intensity of the reaction in the kidney is proportional to the quantity of U present in the kidney; (5) the variation of toxicity which is associated with variation in particle size reflects a corresponding variation in the quantity of U which gains access to the systemic circulation; (6) the quantity of U entering the systemic circulation cannot be measured by following the changes in the U content of the lung; (7) appreciable fractions of an administered dose of UO_2 are removed by some route which does not involve the circulating blood; (8) the amt. of U removed by this route is a function of particle size such that the eff. is greater for larger particles and lesser for smaller particles; (9) the rate of soln. of UO_2 in the lung could not be shown to be proportional to the amt. of surface available, since large increases in surface led to relatively small increases in the amt. of systemic U recovered; (10) a concept is offered for the distinction between deposition as an entity differing from retention in the lung. 48 references are shown.

- 3715 Stokinger, H. E. Summary and Conclusions [Chronic One-year Uranium Compounds Inhalation Studies.] Release approved Dec. 22, 1949. 71p. (AECU-669)

An extensive study of the toxicologic effects appearing in animals exposed by inhalation daily for 1 yr to 5 U dusts has been made and the results evaluated. 3100 animals comprising chiefly dogs and rats and supplemented with smaller nos. of rabbits and guinea pigs were used for the test of the effects at 12 concn. levels involving the 5 dusts. The toxic effects sought were those of min. or no injury for 1 yr from which recommendations would be formulated as to what dust concns. might be proposed as the max. allowable concns. for each of these materials. At the same time, evidence could be cited as to the probable margin of safety between the max. allowable concn. and the lowest dust concn. which will consistently evoke toxic responses in even a resistant species. Accordingly, exposure levels for the 3 sol. toxic U dusts, $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, UF_6 , and uranium chloride, included concns. as low as 0.04 to 0.2 mg U/m^3 ; for the insol., less toxic dusts, UF_4 and UO_2 , levels were from 0.5 to 10 mg U/m^3 , selected on the basis of considerable past experience with U-dust exposures of a short-term, acute nature. A control study in which no toxic dusts were inhaled was performed for 1 yr concomitantly with the U exposures on similar groups of animals and on which the same tests and criteria were employed as were used in the 1-yr dust-inhalation studies. From a comparison of the responses among the U-exposed animals with those of the control animals, several important conclusions have been reached. Incidental to the main conclusions was the finding that a conditioning period of about 4 mos. was required to ensure the inclusion of all individual animal data within a reasonable variation from the mean and thus establish a satisfactory base line for comparison with responses from exposure.

- 3716 Studier, M. H. The Radiation Spectrum of the Transition $U^{233} - Th^{229}$. Mar. 10, 1947. Declassified Jan. 18, 1949. 22p. (AECD-2444)

A complex radiation spectrum consisting of 310-, 80-, and 40-kev γ rays, L-level x rays, and conversion electrons is shown to be associated with the transition $U^{233} - Th^{229}$. The 80- and 40-kev γ rays seem to be largely converted.

- 3717 Sugarman, N., ed. (Papers for Vol. 9B, PPR - 7.57.4, 7.57.15, 7.57.2, 7.57.3, 7.57.5, 7.57.6, 7.57.7, 7.57.8, 7.57.9, 7.57.10, 7.57.11, 7.57.12, 7.57.13, 7.57.14, 7.57.16, 7.57.17, 7.57.18, 7.57.19 and 7.57.20) Declassified Mar. 25, 1949. 71p. (AECD-2555)

Papers included are: "Determination of Absolute Slow Fission Yields in Pu^{239} . I and II." by D. W. Engelkemeir, M. S. Freedman, J. A. Seiler, E. P. Steinberg, and L. Winsberg, 7.57.2; "Determination of Absolute Slow Fission Yields in Pu^{239} . III." by M. S. Freedman and E. P. Steinberg, 7.57.3; "Determination of Absolute Slow Fission Yields in Pu^{239} . IV." by A. Goldstein, E. J. Hoagland, S. Katcoff, C. Schwob, J. Seiler, N. Sugarman, and L. Winsberg, 7.57.4; "Determination of Absolute Fast Fission Yields in Pu^{239} ," by D. W. Engelkemeir, M. S. Freedman, J. A. Seiler, E. P. Steinberg, and L. Winsberg, 7.57.5; "Determination of Absolute Slow Fission Yields in Uranium. I." by D. W. Engelkemeir, T. B. Novey, and D. Schover, 7.57.6; "Determination of Absolute Slow Fission Yields in Uranium. II." by M. S. Freedman and D. W. Engelkemeir, 7.57.7; "Relative Fission Yield Experiments. Introduction" by E. P. Steinberg and M. S. Freedman, 7.57.8; "Relative Slow Fission Yields in Plutonium. I." by D. W. Engelkemeir, J. A. Seiler, E. P. Steinberg, and L. Winsberg, 7.57.9; "Relative Slow Fission Yields in Plutonium. II." by D. W. Engelkemeir, J. A. Seiler, E. P. Steinberg, and L. Winsberg, 7.57.10; "Relative Slow Fission Yields in Plutonium. III." by M. S. Freedman and E. P. Steinberg, 7.57.11; "Relative Slow Fission Yields in Plutonium. IV." by M. S. Freedman and E. P. Steinberg, 7.57.12; "Relative Slow Fission Yields in Plutonium. V." by M. S. Freedman, R. P. Schuman, and E. P. Steinberg, 7.57.13; "Relative Slow Fission Yields in Plutonium. VI." by R. P. Schuman and E. P. Steinberg, 7.57.14; "Relative Slow Fission Yields in Plutonium. VII." by S. Katcoff, E. J. Hoagland, C. Schwob, J. A. Seiler, and N. Sugarman, 7.57.15; "Relative Slow Fission Yields in Plutonium. VIII. The Fission Chain of Mass Number 72" by J. A. Seiler, 7.57.16; "Relative Slow Fission Yields in Plutonium. IX. The Determination of Pu Yields Relative to U Yields" by E. Finkle, E. Hoagland, S. Katcoff, and N. Sugarman, 7.57.17; "Thermal U^{235} Fission Yields" by D. W. Engelkemeir, J. Seiler, E. P. Steinberg, and L. Winsberg, 7.57.18; " U^{238} Fission Yields" by D. W. Engelkemeir, J. Seiler, E. P. Steinberg, and L. Winsberg, 7.57.19; "Summary of Results of Fission Yield Experiments" by E. P. Steinberg and M. S. Freedman, 7.57.20. (These papers also appear in National Nuclear Energy Series, Division IV, Volume 9 (in press).)

- 3718 Sutton, J. "The Hydrolysis of the Uranyl Ion." J. Chem. Soc. Suppl. No. 2, 275-88(1949). Cryoscopic measurements prove conclusively that the hydrolysis of uranyl salts leads to the formation of the ions $(U_2O_5)^{++}$ and $(U_3O_8)^{++}$, and not $(UO_2OH)^+$ and $UO_2(OH)_2$. Measurements of pH of UO_3 in solns. of uranyl salts, pH titrations of uranyl perchlorate and NaOH, and the cond. and absorption spectra of these solns., point to the formation of further ions $(U_3O_8OH)^+$, $U_3O_8(OH)_2$, and $[U_3O_8(OH)_3]^-$. More highly charged anions may be formed, but the evidence is still inconclusive. The equil. consts. for the formation of some of these ions have been detd.

- 3719 Sykes, C. Some Properties of Uranium. Apr. 19, 1943. Declassified August 1949. 6p. (BR-203A)

Two specimens of U in disk form, 3 cm in diam and 1 cm thick, were examined. The microstructure of the material was detd., thermal curves were prepd., hardness is reported from 20 to 400°, and expts. were undertaken to detn. the forgeability of U at room and elevated temps.

- 3720 Tanford, C., Tichenor, R. L., and Young, H. A. The Reaction between Calcium Hydroxide and Uranyl Nitrate Solutions. Feb. 19, 1945. Declassified July 12, 1949. 15p. (AECD-2653)

This paper reports potentiometric titrations of $UO_2(NO_3)_2$ solns. with $Ca(OH)_2$, changes in the absorption spectrum during the titrations, conclusions about the hydrolysis of $(UO_2)^{++}$ ion, observations on the ppt. formed, a study of its slow conversion to "calcium diuranate" and an investigation of the soly. of these various ppts. in $Ca(OH)_2$ solns.

- 3721 Thommeret, J. "Evaluation of the Uranium Content of Minerals by the Measurement of the Nuclear Radiations." *J. phys. radium* (8), 10, 249-52(1949).
A brief report is given of a direct method of estg. the U content of minerals free of Th by means of 2 activity measurements made with 2 Geiger-Müller counters. The method is applicable to all the minerals which are in the natural state or have undergone mechanical treatment such as washing or flotation. Tabulated data which were obtained by this method are given for a no. of minerals; these are compared with the results of chem. detns. of the U content and the abs. and relative errors are tabulated.
- 3722 Tolansky, S. Preliminary Report Number MSN-2 on the Examination of the Spectrum of Uranium Metal for Hyperfine Structure. Dec. 7, 1943. Declassified March 1949. 3p. (BR-375)
Notes are presented on the difficulties encountered and the results obtained upon examining the 7000 to 4500 Å region, using the hollow cathode with He-A excitation and a silvered Fabry-Perot interferometer.
- 3723 Tolansky, S. Report upon the Nuclear Spin of Weak U Metal Isotope. Declassified March 1949. 5p. (BR-375A)
It has been found that the U-metal spectrum can be excited with very great intensity in a suitably controlled hollow cathode discharge. An extensive rich lined spectrum is given out. Observation has so far been restricted to the visible. The hollow cathode emission is practically that given in Kayser's *Handbuch der Spectroskopie* with the important and valuable distinction that some line groups are enhanced in intensity, as anticipated.
- 3724 Tolansky, S. Report upon the Nuclear Spin of Weak U Metal Isotope. Declassified March 1949. 5p. (BR-392)
It has been found that the U-metal spectrum can be excited with very great intensity in a suitably controlled hollow cathode discharge. An extensive rich lined spectrum is given out. Observation has so far been restricted to the visible. The following was ascertained. The hyperfine structure observed in the strong unclassified line 5027 is attributed to the weak odd isotope U^{235} . The estd. abundance ratio is less than 1 in 95. It is probable that this ratio is understd. by up to 50%. Hence, the abundance is probably between 1 in 95 and 1 in 140. The spin exceeds $1/2$ and the value $3/2$ is excluded. From the estd. intensities of an admittedly partially resolved hyperfine structure pattern the spin appears to be $>5/2$. The size of the structure indicates a moderately large magnetic moment of the nucleus of approx. av. value. The above conclusions as to spin are tentative and based upon little material.
- 3725 Tucker, C. W. Jr. The Crystal Structures of Metallic Uranium. July 21, 1949. Declassified Sept. 23, 1949. 17p. (AECD-2716)
U metal exhibits 3 cryst. forms before melting at 1133°C (2071°F). The α phase is stable up to 640°C (1184°F). It crystallizes in the orthorhombic system with space group D_{2h}^{17} and $a_0 = 2.852$ Å, $b_0 = 5.865$ Å, $c_0 = 4.945$ Å. Its structure may be regarded as being formed by the stacking of corrugated sheets of atoms. The binding within the corrugated sheets appears to be largely covalent, thus forming a layer structure analogous to that found in the structures of As, Sb, and Bi. The β phase is stable between 640°C (1184°F) and 760°C (1400°F) and its crystal structure is not yet known. The structure is complex and appears to involve a unit cell much larger and of lower symmetry than the α phase. The γ phase is stable from 760°C (1400°F) up to the m.p. It crystallizes in the body-centered cubic structure with $a_0 = 3.474$ Å. Some of the phys. properties of the 3 phases are readily understood in terms of their crystal structures.
- 3726 U. S. Atomic Energy Commission and U. S. Geological Survey. Prospecting for Uranium. Washington, U. S. Government Printing Office, 1949. 123p.
This booklet provides information for U prospectors on the U-bearing minerals (classification; primary, secondary); where to look for U (vein deposits, deposits in sedimentary rocks, placer deposits, pegmatite deposits); testing for U (fluorescence, radioactivity); prospecting with the Geiger counter (background count, general reconnaissance, grid survey, care of the counter); lab. assays and selling procedures (sending samples for assay, offering U for sale); laws and regulations (licenses, public lands, staking claims, government rights and powers, executive orders); questions frequently asked and glossary; appendixes on sources of additional information, manufacturers and distributors of portable Geiger counters, domestic price schedules, licensing regulations, mining claims on the public domain, laws and special orders.

3727 Vaes, J. F. "Sengierite. A Preliminary Description." *Am. Mineral.* 34, 109-20(1949).
A hydrous Cu, U, V mineral from Katanga, Belgian Congo, with the formula $2\text{CuO} \cdot 2\text{UO}_3 \cdot \text{V}_2\text{O}_5 \cdot 10\text{H}_2\text{O}$, is believed to be a new mineral and is called sengierite. X-ray diffraction, chem. analysis, spectrographic study, crystallographic measurement, and optical study combine to suggest that the material described is related to carnotite and tyuyamunite, but differs chemically in that it is a definite Cu-bearing species. In crystn. it may be quite similar to the other two minerals.

3728 Van den Bosch, J. C. "New Levels in the Uranium Spark Spectrum (U_{II})." *Physica* 15, 503-22 (1949).

On the basis of the known classification of the U_{II} spectrum, a systematic investigation has been made of several well-known differences throughout the spectrum in order to det. the relationships between the two groups of lines which have already been classified. Although the distance between the 2 lowest levels was not found, 17 levels were added to group A, and 63 levels were added to group B; a total of 392 lines were added to the list of classified lines. Thus, the classification of 743 lines in the U_{II} spectrum is known; these include 756 combinations between 8 odd and 24 even levels in group A, and between 16 odd and 115 even levels in group B. All of the levels and classifications are given.

3729 Van den Bosch, J. C. and Van den Berg, G. J. "The Zeeman Effect in the Arc and First Spark Spectrum of Uranium." *Physica* 15, 329-49(1949).

New Zeeman-effect measurements have been made in the 2500 to 5300 Å range. From these data it was possible to calc. addn. g values, as well as to confirm a preliminary analysis of U_{I} and U_{II} which had been made. Portions of the spectrum are shown and extensive tabulated data are given. 4 tables and 9 references are included.

3730 Van der Maas, G. J. and Yntema, J. L. "A Determination of the Mean Range of the Alpha Particles of ^{235}U ." *Physica* 15, 807-24(1949).

A method of detg. the mean range of U^{235} using a deep ionization chamber connected to a linear amplifier is described. The measurements were made on a nonenriched U sample. A special method was developed for the detn. of the relationship between residual range in the chamber and the deflection of the oscillograph. Taking the mean range of U^{238} to be 27.02 mm (760 mm Hg 15°C), the mean range of U^{235} was found to be 29.00 ± 0.20 mm. The ratio of the no. of α particles of U^{235} and U^{238} is in good agreement with the results of Nier (*Phys. Rev.* (2) 55, 150-3(1939)).

3731 Voegtlin, C. and Hodge, H. C., eds. *Pharmacology and Toxicology of Uranium Compounds*. New York, McGraw-Hill, Book Company, Inc., 1949. 2 vols. (National Nuclear Energy Series, Division VI, Volume 1)

The individual chapters of this book have, for the most part, been listed separately under the appropriate report number. The table of contents follows: Chap. 1, "The Chemistry of Uranium Compounds" by A. L. Dounce and J. F. Flagg, MDDC-422(1946); Chap. 2, "Analytical Methods for Determining Uranium and Fluorine" by J. F. Flagg, MDDC-321(1946); Chap. 3, "Statistical Methods" by D. V. Tiedeman, L. S. Kegan, and M. J. Wantman, MDDC-332(1946); Chap. 4, "Pathological Anatomy Following Uranium Poisoning" by T. B. Barnett and R. G. Metcalf, MDDC-249(1946); Chap. 5, "Characteristics of Uranium Poisoning" by J. H. Wills, MDDC-271(1946); Chap. 6, "Toxicity Following Parenteral Administration of Certain Soluble Uranium Salts" by F. Haven and H. C. Hodge, MDDC-258(1946); Chap. 7, "Studies of Toxicity of Various Uranium Compounds When Fed to Experimental Animals" by E. A. Maynard and H. C. Hodge, MDDC-263(1946); Chap. 8, "The Toxicology of Compounds of Uranium Following Applications to the Skin" by J. A. Orcutt, MDDC-266(1946); Chap. 9, "The Toxicology of Uranium Compounds Following Application to the Eye" by J. A. Orcutt, MDDC-265(1946); Chap. 10, "Toxicity Following Inhalation" by H. E. Stokinger, A. Rothstein, E. Roberts, C. J. Spiegl, H. P. Dygert, C. W. LaBelle, and G. F. Sprague, Jr., MDDC-376(1946); Chap. 11, "The Distribution and Excretion of Uranium" by W. F. Neuman, MDDC-264(1946); Chap. 12, "Tolerance to Uranium Compounds" by F. Haven, MDDC-257(1946); Chap. 13, "The Action of Uranium on Enzymes and Proteins" by A. L. Dounce and T. H. Lan, MDDC-423(1946); Chap. 14, "Catalasuria as a Sensitive Test for Uranium Poisoning" by A. L. Dounce, E. Roberts, and J. H. Wills, MDDC-252(1946); Chap. 15, "The Mechanism of Action of Uranium

Compounds in the Animal Body" by A. L. Dounce, MDDC-253(1946); Chap. 16, "Studies of Human Exposure to Uranium Compounds" by J. W. Howland, MDDC-260(1948); Chap. 17, "Toxicity Following Inhalation of Fluorine and Hydrogen Fluoride" by H. E. Stokinger, MDDC-330(1946).

3732 Wainwright, W. W. "Dentistry and the Atomic Energy Program." N. Y. J. Dentistry **19**, 325-32(1949).
U²³³, Pu²³⁹, and Am²⁴¹ were shown by radioautographs to localize in dental tissues.

3733 Warf, J. C. Uranium Trifluoride. A Summary Report. Declassified Mar. 10, 1949. 9p. (AECD-2523)

A short history of attempts to prep. UF₃ is given. It was shown that UF₄ is not reduced by H₂, and that treatment of UBr₃ or UCl₃ with HF also fails to give UF₃. Karle and Zachariasen have reported that some UF₃ can be prepd. by reduction of UF₄ with atomic H. The most convenient method of producing the UF₃, however, is by the reduction of UF₄ with U from UH₃, in Ni vessels at about 1100°. The product thus formed is a black, cokelike solid, and is identified by analysis and x-ray studies. A résumé of the phys. and chem. properties of UF₃ is given, as well as a discussion of the x-ray-diffraction studies.

3734 Warf, J. C., Newton, A. S., Butler, T. A., and Spedding, F. H. "Uranium Hydride. III. Dispersions in Mercury." Nucleonics **4**, 43-7(1949)March.

The information presented in this paper is similar to that in report MDDC-1586(1947).

3735 Wathen, T. Corrosion of Uranium Metal in Air and Steam at Various Temperatures. May 13, 1943. Declassified November 1949. 10p. (BR-223A)

The corrosion of U metal in both air and steam has been detd. at temps. up to 500°C. Penetrations increase with temp. and reach 543 mm/yr in air and 7360 mm/yr in steam at 400°C. The % of different oxides formed in air at 20 to 500°C and in steam at 150 to 400°C are listed.

3736 Way, K. Comments on Photofission Threshold Measurements. Declassified Dec. 5, 1949. 4p. (AECD-2752)

Photofission threshold measurements for Th²³², U²³³, U²³⁵, U²³⁸, and Pu²³⁹, by Koch et al. (AECD-2699 (1949) are discussed. The values seem to lack sufficient variation from one target nucleus to another, contrary to predictions of the liquid drop model (Bohr and Wheeler, Phys. Rev. (2), **56**, 426 (1939)). Assumptions are made, however, which make the values consistent with known β - and α -decay energies.

3737 Wilhelm, H. A. and Carlson, O. N. The Uranium-Manganese and Uranium-Copper Alloy Systems. Declassified Sept. 30, 1949. 20p. (AECD-2717)

The U-Mn system has been investigated by thermal, micro., and x-ray methods. Two cpds., U₆Mn and UMn₂, have been identified from x-ray and micro. data. From thermal data and microstructures it has been established that U₆Mn is formed by a peritectic reaction at 726°C (1335°F), while UMn₂ is stable with a m.p. of 1120°C (2050°F). There is a eutectic between these two cpds. at 6.0 wt. % Mn and 716°C (1287°F). A second eutectic existing at 55% Mn between UMn₂ and Mn has a eutectic temp. of 1035°C (1870°F). It has been estd. from microstructures that the max. soly. of Mn in γ U is less than 1%. The soly. decreases in the β region with a eutectoid at 0.25% Mn and 626°C (1155°F). Although the soly. of U in Mn has not been investigated thoroughly, there is evidence for some soly. In the U-Cu system, one cpd., UCu₅, has been identified. This cpd. decomps. peritectically at 1052°C (1925°F), oxidizes slowly in air, is extremely brittle, and has a d. = 10.6 g/cc. It is face-centered cubic with a₀ = 7.0208 Å. A eutectic exists between the cpd. and pure Cu at 75 wt. % Cu and 950°C (1740°F). Liq. immiscibility occurs between U and the cpd. There is no evidence of solid soly. of Cu in U, U in Cu, or of either primary constituent in the cpd.

- 3738 Wilhelm, H. A., Chiotti, P., Snow, A. I., and Daane, A. H. "The Carbides of Uranium and Thorium." J. Chem. Soc. Suppl. No. 2, 318-21(1949).

U carbides corresponding to UC (C, 4.8%) are shown to exist. There is no evidence of soly. of U in the UC. UC is stable at room temp., and UC₂ is stable at high temp. but partly decomp. into UC and C at lower temps. There is evidence of soly. of C in UC₂ at high temp. At high temp. and at compns. in the neighborhood of 7% C there is a possibility either that a cpd., U₂C₃, exists, which dissolves UC and UC₂, or that the last two carbides form a continuous solid soln. Although the Widmanstätten-type microstructure indicates that "U₂C₃" consists of one phase at high temp., all attempts to retain this 1-phase structure by quenching have been unsuccessful. Metallographic and x-ray investigations indicate that no cpds. other than those listed above occur between U and C. Th carbides, ThC and ThC₂, are shown to exist.

- 3739 Wilson, A. S. and Rundle, R. E. "The Structures of Uranium Metal." Acta Cryst. 2, 126-7 (1949).

X-ray diagrams of β and γ U at high temps., and at room temp., have been obtained. β U produces an x-ray diagram similar to, but even more complex than, α U. With the powder data available, the authors have, thus far, been unable to det. the structure of lattice. In view of the similarity of the low-order reflections it seems likely that the β and α structures are related. At 800°C the lattice const. for U is 3.48 kX. The lattice const. of γ U at room temp. has been studied as a function of Mo content, using a symmetrical, self-focusing powder camera of 5 cm radius. Graphical extrapolation to pure U leads to a lattice const. of 3.467 ± 0.005 kX and a room-temp. d. = 18.89 ± 0.05 g cm⁻³, slightly less than that of α U at the same temp.

- 3740 Wilson, H. B. and Sylvester, G. The Effects of Exposure of Rabbits and Rats to Inhalation of Uranium Dioxide Dust at 22 mg/M³ Concentration and 0.5 μ Particle Size. Declassified Dec. 22, 1949. 15p. (AECD-2781)

Rats and rabbits were exposed to UO₂ of mass-median particle size of approx. 0.5 μ and at a concn. of 22 mg/m³ for a total of 140 hrs during a 28-day period. No evidence of toxicity was found in the rat. Slight toxic effects were noted in the rabbit. Five of 16 showed very mild renal injury on micro-pathological examn. Five rabbits revealed a slight tendency to proteinuria; whereas possible significant elevation of amino acid N-creatinine ratios was observed in 2 cases. Wt. response was normal for both species. Deposits of U in the tissues of rabbits subjected to the full 140 hrs of exposure were found to av. 8, 1.0, and 1.8 μ g/g of tissue for lung, kidney, and femur, resp.; 30, 2.0, and 1.2 were the corresponding values for the rats.

- 3741 Wilson, H. B. and Sylvester, G. The Effects of Exposure of Rabbits and Rats to Inhalation of Uranium Dioxide Dust at 80 mg/m³ Concentration and 2 μ Mass Median Particle Size. Release approved Dec. 22, 1949. 22p. (AECU-670)

The size effect of an insol. U dust, UO₂, on its retention in the lung and its resultant toxicity has been detd. in rats and rabbits for dust with a particle size of 2 μ at an air concn. of 80 mg/m³. This is the 4th of a series of similar studies that adds more evidence to indications already obtained that dust of larger particle size (2 μ) is retained to a smaller extent from inhaled air and creates a lesser toxicity problem than do dusts of smaller size (less than 1 μ). UO₂ with a mass-median particle size of 2 μ at 80 mg/m³ concn. was not toxic to rats and only very slightly toxic to rabbits. This presents a contrasting picture with that found in the same animal species but exposed to a particle size smaller than 1 μ . Here toxicity in both species was amply evident. Evidence from (1) almost complete lack of change from normal weight response, (2) almost negligible changes in urinary protein, (3) no change in urinary amino acid, (4) no change in blood nonprotein N, and (5) only slight evidence of renal injury in a minority of rats and rabbits exposed daily for a period covering 37 days, aid confirmation to the above observation. Retention in the lung was decidedly less from the 2- μ particles in the present study than from the smaller sizes at the same level of exposure concn. For the rabbit lung, this amounted to nearly 50 times less; the rat lung differences arising from particle size were not so striking but still amounted to approx. 8 times less. No distinction according to particle size arising from transport of the U from the lung was noted in either the femur or the kidney. U content of these tissues was of a far lower order of magnitude than that found in the lung and did not vary appreciably with particle-size change.

- 3742 Yaffe, L. "Solubility of Uranyl Nitrate Hexahydrate and Thorium Nitrate Tetrahydrate in Organic Solvents at 20°C." Can. J. Research B 27, 638-45(1949).
A study has been made of the soly. of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ and $\text{Th}(\text{NO}_3)_4 \cdot 4\text{H}_2\text{O}$ in various org. solvents at 20°C. In all the solvents investigated no case was found where the $\text{Th}(\text{NO}_3)_4 \cdot 4\text{H}_2\text{O}$ was more sol. than the $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$. Hydrocarbons do not dissolve either cpd. to an appreciable extent. Addn. of a ketone, aldehyde, or alc. group enhances the soly. considerably. The simpler the cpd. the greater the soly. of the nitrate in any given family.
- 3743 Young, H. S. and Grady, H. F. (rev. by C. D. Susano). Physical Constants of Uranium Tetrachloride. Apr. 1, 1947. Rev. Oct. 3, 1949. Declassified Nov. 22, 1949. 13p. (AEC-2745)
Exceedingly pure UCl_4 was prepd. for use in detg. the phys. consts. of the cpd. Prepn. of the UCl_4 was in a glass app, and it was purified by subln. and fractional condensation of the vapors, also in a glass app. Measurements were made of the m.p. and the b.p. of UCl_4 at pressures ranging from 746 mm of Hg to the triple-point pressure, 19.5 mm. The av. value, 590°C, was also taken as that of the normal m.p. Extrapolation of the b.p. curve gives 792°C as the normal b.p. Calcns. have been made of the vapor-pressure equation of the liq., the heat of vaporization (33×10^3 cal/mole), molar b.p. elevation (26°C), the vapor-pressure equation of the solid, and the crit. temp. (estd. value, 1325°C).
- 3744 Zachariasen, W. H. "Crystal Studies of the 5f-Series of Elements. VIII. Crystal Structure Studies of Uranium Silicides and of CeSi_2 , NpSi_2 , and PuSi_2 ." Acta Cryst. 2, 94-9(1949).
This paper is similar to report AEC-2092(1948).
- 3745 Zachariasen, W. H. "Crystal Chemical Studies of the 5f-Series of Elements. X. Sulfides and Oxsulfides." Acta Cryst. 2, 291-6(1949).
This paper contains information similar to parts of report AEC-2141(1948).
- 3746 Zachariasen, W. H. "Crystal Chemical Studies of the 5f-Series of Elements. XI. The Crystal Structure of $\alpha\text{-UF}_5$ and of $\beta\text{-UF}_5$." Acta Cryst. 2, 296-8(1949).
This paper is similar to report MDDC-1674(1948).
- 3747 Zimmerman, P. W., Hitchcock, A. E., Weed, R., Kirkpatrick, H., and Zachar, I. Atomic Energy Commission Project at Boyce Thompson Institute. Apr. 11, 1949. 19p. (M-4475)
Results are reported for an investigation to det. the toxic effects of uranyl nitrate, UF_4 , and UO_2 , the movement of these chemicals in plant stems and other tissues, the amts. stored in various tissues, quantities causing injury, and tolerance of different species. The three cpds. were applied to plants in a variety of ways.

PUBLICATIONS LOCATED IN 1950

- 3748 "Abstracts of Papers Accepted for Presentation at the Forty-first Annual Meeting of the [American Phytopathological] Society, New York City, New York, Dec. 28 to 30, 1949." Phytopathology 40, 1-33(1950).
"Cultural Characters of Uranium-Nitrate-Induced Mutants of Ustilago zeae," J. M. Daly and S. I. Lu. This paper presents the results of a study of 13 characters of 198 mutants from the monosporidial, unisexual line 17D4 of Ustilago zeae. Plus or minus deviations in color, topography, radial growth, rate of growth, elevation, and other characteristics are included.
- 3749 Agron, P. A. and Weller, S. W.—assigned to U. S. Atomic Energy Commission. Methods of Producing Uranium Fluorides and a Compound Produced Thereby. June 6, 1950. (U. S. Patent 2,510,850)
A new chem. cpd. U_4F_{17} , tetrauranium heptadecafluoride, is produced by subjecting UF_4 to the action of UF_6 gas in a vessel contg. pulverized UF_4 under certain conditions of temp. and pressure.
- 3750 Allendörfer, A. "Determination of the Melting Point of Uranium." Z. Naturforsch. 5a, 234-5 (1950).
By means of distn. in a high vacuum pure (99.96%) U was produced. The m.p. of the purified product was found, thermoelectrically, to be $1090 \pm 2^\circ C$.
- 3751 Arden, T. V. and McGlone, P. "Absorption Spectra of the Sodium Peruranates." Nature 166, 560-1(1950).
The presence of $(HCO_3)^-$ in solns. of Na peruranate formed by the addn. of excess H_2O_2 to Na uranyl tricarbonate soln. causes errors in the absorption spectrum method of detg. U. Solns. of UO_3 in Na_2CO_3 and excess NaOH, Na_2CO_3 , equal quantities of Na_2CO_3 and $NaHCO_3$, and $NaHCO_3$ with large excesses of H_2O_2 were investigated, and the variations in absorption for wavelengths from 300 to 500 $m\mu$ are reported in graphical form. These changes are proposed to be due to changes in the proportions of the 3 Na peruranates in the soln.
- 3752 Arnott, R. J. "X-Ray Diffraction Data on Some Radioactive Oxide Minerals." Am. Mineral. 35, 386-400(1950).
X-ray powder photographs and specific gravity detns. of specimens belonging to the uraninite-thorianite series and the pyrochlore-microlite series gave, for the former, $a = 5.403$ to 5.575 A, $G = 6.43$ to 9.55 A, and for pyrochlore-microlite, $a = 10.296$ to 10.441 A. Indexed powder data are given for uraninite and for ignited microlite. The powder pattern of orthorhombic euxenite (ignited at $1000^\circ C$) is interpreted with the aid of established morphological descriptions. An indexed powder pattern is given. The latter two minerals are termed metamict since they show external cryst. form but are amorph. to x rays. Heating to a glow restores the cryst. behavior.
- 3753 Baenziger, N. C., Rundle, R. E., Snow, A. I., and Wilson, A. S. "Compounds of Uranium with the Transition Metals of the First Long Period." Acta Cryst. 3, 34-40(1950).
This paper is similar to report AECD-2598(1949).
- 3754 Bain, G. W. "Geology of the Fissionable Materials." Econ. Geol. 45, 273-323(1950).
A thorough summary is made of the types of U and Th occurrences and their regional distribution throughout the world. The relative abundance and difficulty of recovery of the 2 elements in their various forms are discussed. The Witwatersrand gold mines of South Africa are indicated as the most economical source of industrial U for the immediate future.
- 3755 Ballenger, H. F. Air-Borne and Short-Wave Radiation Hazards in the Project at the University of California. Sept. 10, 1945. Declassified June 12, 1950. 27p. (AECD-2858)
This report brings together the results of approx. 2 yr of study on the problem of detecting and eliminating sources of hazard due to the presence of toxic gases or vapors, of U and its products, and radiation. The report is sepd. into two main divisions: first, a summation of the dust, vapor, and gas

hazard problem and second, a summation of the radiation problem. Methods of collection, analysis, and study of hazards for U dust, Hg vapor, and CO are discussed. Methods for detection of radiation and methods to eliminate hazards of α and β particles, γ rays, x rays, and neutrons are included.

- 3756 Bartlett, T. W., Bauder, R. B., Lykins, J. H., Olszewski, E. B., and Lafferty, R. H. Jr. The General Electric X-Ray Photometer and Its Application to the Determination of Uranium.

I. Instrument Modifications. Mar. 4, 1949. Declassified Jan. 3, 1950. 26p. (AECD-2765)

A brief discussion of the theory of x-ray absorption, a description of the x-ray photometer, and a summary of the work done at the K-25 labs. with this instrument are presented. Several changes were made in the instrument, including changes in absorption cells, the method of reading, and the x-ray tube. A power supply with Thyatron-regulated voltage was tried but found to be less satisfactory than line voltage. Data on the sensitivity and the precision of the instrument are presented, and factors affecting sensitivity are discussed. The max. sensitivity obtained was 28 scale divisions/g U/1 and the 95% symmetric confidence interval for a single reading was approx. 3%. A photograph and a diagram of the instrument, calibration curves for U solns., and photographs of absorption cells are presented.

- 3757 Bates, L. F. and Mallard, J. R. "The Magnetic Properties of Uranium and Uranium-Iron Alloys." Proc. Phys. Soc. (London) 63B, 520-6(1950).

Measurements have been made of the magnetic susceptibility of fairly pure U and of 5 and 10 at. % alloys of Fe and U. Using a modification of the Curie method, with special pole pieces and electro-magnetic dynamometer control, the specimens were found to be paramagnetic with no trace of ferromagnetism in the temp. range 20 to 350°C. At 20°C the susceptibility of pure U is $+1.740 \times 10^{-6}$ e.m.u./g increasing to $+1.804 \times 10^{-6}$ at 350°C; the results fit the equation

$$\chi_U = 32 \times 10^{-11} T + 1.564 \times 10^{-6} + 24.0 \times 10^{-6}/T$$

Assuming that the Fe is present in form of the cpd., U_6Fe , it is found that the latter has a susceptibility of $+2.036 \times 10^{-6}$ e.m.u./g at 20°C, which remains practically const. with temp.

- 3758 Bauer, S. H. "The Structure of Uranium Hexafluoride as Determined by the Diffraction of Electrons on the Vapor." J. Chem. Phys. 18, 27-41(1950).

This paper is similar to report MDDC-415(1946).

- 3759 Betts, R. H. and Leigh, R. M. "Ionic Species of Tetravalent Uranium in Perchloric and Sulphuric Acids." Can. J. Research B. 28, 514-25(1950).

A quant. study of the extrn. of U^{+4} into benzene by the action of the org. chelating agent thiophenoyl trifluoroacetone is described. Data are presented to show that the U^{+4} exists mainly in the quadruply charged form in solns. of $HClO_4$. It is extrd. into benzene as a neutral mol. contg. 4 chelate groups per metal atom. At least 2 complex species, $[U(SO_4)]^{++}$ and $[U(SO_4)_2]$ are present in H_2SO_4 solns. Values of the association consts. for the formation of these complex species are given.

- 3760 Birks, F. T. The Spectrographic Determination of Silicon in Uranyl Nitrate Solutions. April 1950. 4p. (AERE-C/R-515)

Si was detd. to an accuracy of $\pm 10\%$ within the range 10 to 5000 ppm by a complete burn procedure on U_3O_8 , using the U line, 2519.0 Å, as internal std. for the analysis line of Si, 2516.1 Å. Risks of contamination in handling were reduced by evapn. and ignition of the samples directly on graphite electrodes.

- 3761 Bose Research Institute. Annual Report for the Year 1949-1950. Calcutta, The Institute, 1950. 39p.

In the section describing the work on nuclear physics, attempts to extract Pu from Canadian pitchblende (21.04% U_3O_8) are reported. A concn. of 1 to 3.14×10^{13} was found. Brief mention is made of attempts to detn. how much, if any, U^{233} is in natural U, and attempts to prep. spectroscopically pure U_3O_8 from commercial Na_2UO_4 . (See p. 7.)

- 3762 Boullé, A., Jary, R., and Dominé-Bergès, M. "The Oxides of Uranium Resulting from the Decomposition of Uranyl Oxalate." Compt. rend. 230, 300-02(1950).
Expts. investigating the decompn. of uranyl oxalate with and without vacuum, the decompn. of uranyl oxalate by reduction, and the reduction of UO_3 with CO are discussed. The x-ray spectra of the resulting U oxides are compared, and an explanation of the mechanism of the decompn. of U oxalate is attempted.
- 3763 Brewer, L., Sawyer, D. L., Templeton, D. H., and Dauben, C. H. The Borides of Uranium and Thorium. Feb. 14, 1950. Declassified Mar. 23, 1950. 9p. (AECD-2823)
The phases of the U-B and Th-B systems were investigated by means of x-ray powder-diffraction patterns of samples varying in compn. from 25 to 85 at. % B. The samples were in the form of finely divided powders, and the x-ray diffraction patterns were taken on a 9-cm back-reflection camera with $\text{CuK}\alpha$ radiation $\lambda = 1.5418 \text{ \AA}$. The U-B system has 3 intermediate phases, UB_2 , UB_4 , and UB_{12} . UB_{12} is not stable enough to be of use as a refractory. Both UB_2 and UB_4 are high melting, with UB_4 apparently being the higher melting. The U- UB_2 eutectic temp. is probably close to 1132°C . The UB_2 - UB_4 eutectic temp. is well above 1565°C . The Th-B system has 2 intermediate phases, ThB_4 and ThB_6 . ThB_6 is not stable enough to be of use as a refractory. ThB_4 probably has a m.p. well above 2500°C . The Th- ThB_4 eutectic temp. is around 1550°C . ThO_2 apparently forms extensive solid solns. with boride.
- 3764 Brody, J. K. Some Applications of Photomultiplier Tubes in Spectrographic Analysis. August 1950. Declassified Oct. 12, 1950. 25p. (AECD-2994)
A flexible mounting for 2 photomultiplier photocells for use in a direct-reading spectrograph has been constructed. Each photomultiplier tube may be independently engaged to a screw which is turned by a synchronous motor. Provisions are made for disengaging each tube and locking it in position. Each tube mounting is provided with a means of rotation so that the tube may be made to lock at any rotation of the grating and any position of the plateholder. The tube may also be moved with respect to the pick-up slit so that light falls on the photosensitive cathode. The scanning speed may be changed by changing the gear ratio on the screw drive. Automatic limit switches are provided to reverse the tube as it approaches the limit of its movement. Three types of analytical procedures have been carried out successfully with the photomultiplier: Li detns. in the flame, U isotopic detns., and Sc in the Cu spark. All these methods have one thing in common: the sample spectrum is excited continuously for a period of 30 sec or longer. Any sample that volatilizes and escapes rapidly must be continuously resupplied in the source. The application of photomultipliers has proved quite valuable because of the improved accuracy and economy of time.
- 3765 Brown, K. B., Coleman, C. F., and Susano, C. D. Progress Report on Carnotite Studies. Carbonate Process. June 1949. July 6, 1949. Declassified Oct. 9, 1950. 30p. (AECD-2955)
Carbonate (Monticello) Process. Further studies have been made of the build-up of U and V in a recycling Na_2CO_3 leach of calcines from the salt roast, and the soly. of certain U cpds. in soln. systems with Na_2CO_3 , NaCl, and NaVO_3 . Recovery of U and V from Carbonate Liquors. Pptn. tests have been cont. with synthetic solns. and with actual leach liquors. The satisfactory pptns. of yellow cake with low V concns., previously reported, were supplemented by tests of solns. low in U and in both U and V. No difficulties attributable to the low concns. were encountered. In the red-cake pptn. studies, prepn. of time concn. curves was cont. The results show the initial rates varying with the concn. and the curves approaching each other closely after several hrs. No crit. concn. or abrupt change in the effectiveness of the pptn. was found. A brief study is being made of possible V recovery by reduction and hydrolytic pptn. Analytical Services. Improvements in the gravimetric and spectrophotometric detn. of Na and in the colorimetric and gravimetric detn. of Al in carnotite are reported briefly.

- 3766 Brunton, D. C. and Hanna, G. C. "Energy Distribution of Fission Fragments from U^{235} and U^{233} ." Can. J. Research A, 28, 190-227(1950).

New measurements have been made of the energy distribution of fission fragments. A coincident pulse technique has been used which measures simultaneously the energies of both fragments of a fission pair. Previous work in this field was limited in statistical accuracy owing to low fission rates. With the Chalk River high-flux pile and a 30-channel pulse analyzer, a rapid accumulation of data is made possible. The improved statistical accuracy has led to new results on the detailed association of fragment pairs and on the energy variation occurring in each fission mode. A careful comparison of U^{233} and U^{235} has been made.

- 3767 Burkhart, L. E. A Method for the Spectrographic Determination of Impurities of High Concentration in Uranium Oxides. Jan. 15, 1948. Declassified Apr. 7, 1950. 12p. (AECD-2819)

An analytical method for detg. impurities of high concn. in U oxide is described which is dependent on the differences of intensity of the U spectrum and the intensity of the spectrum of the impurities. This method employs a rotating sector to reduce the exposure in order to produce a spectrum of the principal lines of the elements present, thus rendering a considerable range of concn. determinable by spectrographic method. Stds. are used with the plates, and results are interpreted by densitometering. The method provides an analysis generally accurate to $\pm 10\%$ for Si as high as 0.5%, Cr 0.5%, Al 1%, Mo 1%, Sn 0.5%, Ca 2%, V 0.5%, Fe 5%, Ni 0.5%, and Ti 1%.

- 3768 Burstall, F. H. and Williams, A. F. Handbook of Chemical Methods for the Determination of Uranium in Minerals and Ores. London, H. M. Stationery Office, 1950.

This handbook describes procedures designed to deal with any type of ore contg. from 0.1% U oxide to high-grade pitchblende, which may contain 80% U oxide. The recommended methods are based on the results of 4 yr of experience at the Teddington Chemical Research Laboratory. They include new chromatographic techniques developed for the detection and detn. of U and other metals. The first part contains a concise description of the various methods. The second describes the working details which are recorded very fully for the benefit of chemists with little or no previous experience in this type of work. Analysts engaged in this field will have a selection of reliable methods to use, the choice depending on the nature of the material to be examined and lab. facilities which are available. The handbook was prepd. at the request of the Division of Atomic Energy, Ministry of Supply. The methods described are those which have been found most satisfactory in the practice at the Teddington Laboratory.

- 3769 Carlson, A. B. and Neuman, W. F. The Removal of Uranium Compounds from Cloth. [1950] 13p. (UR-108)

This paper is a summary of a thesis entitled The Removal of Uranium Compounds from Cloth, A Laundry Problem, by A. B. Carlson. Expts. were undertaken to develop an efficient, yet economical, means of rendering clothing contaminated with U hazard-free. It has been shown that U was absorbed by cloth fibers, presumably by a process of cationic exchange. This adsorbed material was not removed by ordinary laundry methods; the presence of some complexing agent was required. The cheapest effective agent was found to be $NaHCO_3$. Clothing washed in a reasonable vol. of H_2O (with or without soap) containing $NaHCO_3$ (>0.03%) and a suitable oxidizing agent can be considered toxicologically "safe." 10 references are included. See thesis for more complete data.

- 3770 Carter, J. H. and Daane, A. H. — assigned to U. S. Atomic Energy Commission. Method of Forming Uranium Carbon Alloys. Oct. 24, 1950. (U. S. Patent 2,526,805)

This invention relates to a method for forming U-C alloys by heating U powder and C powder in contact with each other at a temp. in excess of the m.p. of U.

- 3771 Center, E. J. Topical Report on the Direct Micro Determination of Uranium Using a Modified Fluorophotometer. June 30, 1948. Declassified Nov. 20, 1950. 43p. (AECD-3006)

The fluorescence method described is rapid and moderately accurate. One analyst can easily make 50 to 75 soln. detns. for U/8-hr day, on solid samples about 15 to 20 detns./man/8-hr day. Although contamination is a crit. factor, it is easily controlled. A probable error of 5% or less may be expected

with this fluorescence method. The fluorescence method is compared with other methods and appears to be quite consistent. 12 figures and tables are included.

- 3772 Chesterman, C. W. "Uranium, Thorium, and Rare-Earth Elements." In Mineral Commodities of California. Geologic Occurrence, Economic Development, and Utilization of the State's Mineral Resources. San Francisco, Department of Natural Resources Div. of Mines, August 1950. p.361-3. (Bulletin 156)

Information on the occurrence, value, and utilization of the pitchblendes, carnotites, and monazites known to occur is given in brief form with some information on the appearance of the minerals and their basic compns.

- 3773 Chisholm, E. O. Radioactive Occurrences in the Kenora Area. Ottawa, Ontario Dept. of Mines, January 1950. (Preliminary Report)

Disseminated radioactive material has been located by means of the Geiger counter in granitic rocks at 13 points within a radius of 40 miles from Kenora. With one exception the occurrences bear a remarkable similarity. They consist of submicro. grains of radioactive material as a constituent part of narrow pegmatitic stringers and dikes; they have a large amt. of black biotite associated with them; they have a small amt. of molybdenite flakes in the pegmatite; they show a lemon-yellow radioactive stain in the jointing planes of the host rock; and they have radioactive equiv. assays less than 0.5% U_3O_8 . Descriptions of the individual locations are given. It is believed that pitchblende vein material might be found in the area.

- 3774 Coleman, C. F. Studies of Recovery Processes for Western Uranium Bearing Ores. Part V. Tests of Specific Leaching of Carnotite Ores. Oct. 31, 1949. Declassified May 12, 1950. 16p. (AECD-2846)

The results of empirical leaching tests of various reagents on carnotite ores are summarized. Most of the reagents tested fall into four general classes—dicarboxylic acids, aryl orthohydroxy and -amino cpds., polyhydroxy cpds., and cpds. related to the peptide linkage. Tables of results are presented. No reagent was found sufficiently effective and specific for practical use on low-grade ores.

- 3775 Colin, L. L. "The Use of Tannin in Chemical Analysis." J. Chem. Met. Mining Soc. S. Africa 314-19(1950).

Methods for the use of tannin in the following are reported: the analysis of tantaloniobates, the detn. of U in radioactive ilmenites and complex minerals, the sepn. of Ti from Y, and the detn. of V in roscoelite. Tannin is found to ppt. U from alk. soln. as a brown flocculent ppt. which can be filtered off very readily. Under certain circumstances, tannin quantitatively seps. U from Ti. Diagrammatic procedures are included.

- 3776 Conybeare, C. E. B. and Ferguson, R. B. "Metamict Pitchblende from Goldfields, Saskatchewan, and Observations on Some Ignited Pitchblendes." Am. Mineral. 35, 401-06(1950).

Seven metamict pitchblendes, apparently the first to be reported, are described from 3 localities in the Goldfields area of Saskatchewan. The changes in x-ray powder pattern and color of the powder after ignition are tabulated for these and two other pitchblendes; the principal changes are the restoration of the structure of metamict specimens and the occasional development of U_3O_8 with, or in place of, UO_2 . On the basis of these changes the 9 pitchblendes examined are classified into 5 distinct types.

- 3777 Cook, O. A. and Eastman, E. D. Thermodynamic Studies of the $U^{3+} - U^{4+}$ Half Reaction. September 1944. Declassified Feb. 7, 1950. 9p. (AECD-2803)

Exptl. e.m.f. measurements have been made to obtain the thermodynamic data for U chlorides. The results are discussed in regard to interpretation and reliability of the data.

- 3778 Crouse, D. J. and Brown, K. B. Studies of Recovery Processes for Western Uranium Bearing Ores. Part VII. Wet Concentration. Dec. 6, 1949. Declassified May 9, 1950. 34p. (AECD-2849)

Studies were made of the susceptibility of certain carnotite ores to wet concn. techniques. By scrubbing for long periods, over 90% of the U and V can be obtained in the slime concs. With brief scrubbing, about 75% of the values are obtained. Tests on the effect of surface active agents, using commercial wetting agents and detergents, on increasing the eff. of the scrubbing action showed that none of them were materially superior to the simple H₂O treatment. The slimes were found to be amenable to the usual mill processes for carnotite ores. Tables and graphs of results are included.

- 3779 Dallemagne, M. J. "The Physiology of Supporting Tissue." Ann. Rev. Physiol. **12**, 101-18 (1950).

The author reviews the recent contributions to the field and discusses the use of radioisotopes (P, Ca, Sr, Y, Ce, U, C) in the study of bone metabolism. 242 references are included.

- 3780 Dasgupta, A. K. and Gupta, J. "A New Reagent for Uranium." J. Sci. Ind. Research (India) **9B**, 237(1950).

This is a brief communication and is reproduced below in its entirety.

"Oxalo-hydroxamic acid is found to give deeply coloured complexes with a number of cations in slightly acid or ammoniacal solutions. Special attention has been given to uranium with which the reagent gives an orange complex. The formation of this complex has been found to provide a very effective method, both for detection and colorimetric estimation of uranium. In the absence of excess of electrolytes or in the presence of peptizing agents, the orange complex can be kept in solution even in moderate excess of ammonia and serves as a very suitable reagent for colorimetry. The maximum absorption of the coloured solution is at 420 mμ and obeys Beer's law closely. The limit of identification determined on a spot plate is 0.2 γ and the limit of dilution is 1:2,40,000 [?]. The applicability of this reagent in uranium ore analysis and the effect of ions like phosphates, oxalates, iron, vanadium, alkaline earths, etc., are being studied and a paper giving complete details will shortly follow."

- 3781 Dawson, J. K. The Magnetic Susceptibilities and Electronic Structures of the Halides of Ter- and Quadri-Valent Uranium. September 1950. 4p. (AERE-C/R-578)

UF₄, UCl₄, and UBr₄ obey the Weiss-Curie law over the temp. range 77 to 550°K. The values obtained for the magnetic moment of U⁺⁴ indicate that in these cpds. the ion has a 5f² electron configuration. UI₃, UBr₃, and UCl₃ deviate from the Weiss-Curie law below about 350°K and are antiferromagnetic; the results are interpreted as arising from a 5f²6d¹ electron configuration for UBr₃ and UI₃, but the electron assignment is not conclusive for UCl₃.

- 3782 Dawson, J. K. and Lister, M. W. A Magnetic Susceptibility Study of the U-O System. February 1950. 30p. (AERE-C/R-447)

A balance is described by means of which magnetic susceptibility may be measured on mg amts. of solids by a modification of the Faraday method. With a max. field strength as low as 2500 gauss, the susceptibility of a 10-mg sample of specific susceptibility 1×10^{-6} is measurable to $\pm 0.5\%$. Apart from its obvious applicability to investigations on cpds. of the elements beyond U, the method is advantageous even in systems which are more readily available. It has provided an additional line of approach to the system of nonstoichiometric U oxides, and in the present investigation the magnetic susceptibilities of UO₂ and intermediate oxides up to U₃O₈ have been measured over the approx. temp. range 90 to 570°K. Oxides between UO₂ and UO_{2.3} follow the Weiss-Curie law with relatively high values of Δ, and the susceptibilities are consistent with the view that these oxides contain U⁺⁴ and U⁺⁶ but not U⁺⁵. The susceptibility-temp. relationship of U₃O₈ appears to have the form (X-K)(T+Δ)=C. It has a magnetic moment much below that predicted for UO₂·2UO₃ and agrees more nearly with that to be expected from U₂O₅·UO₃. The magnetic moment of UO₂ has a value corresponding to a 5f² (or possibly 5f¹6d¹) rather than a 6d² electron configuration for U⁺⁴. UO, however, from

measurements on UO/UO_2 mixts. appears to have its unpaired electrons in 6d orbits, although it is possible that deductions of this nature are not valid in such a "magnetically concd." cpd.

- 3783 Dawson, J. K. and Lister, M. W. "Magnetochemistry of the Heaviest Elements. Part II. The Oxides of Uranium." *J. Chem. Soc.* 2181-7(1950).

This paper is similar to report AERE-C/R-447(1950).

- 3784 Dawson, J. K., Ingram, D. W., and Bircumshaw, L. L. "The Reduction of Uranium Hexafluoride with Hydrogen." *J. Chem. Soc.* 1421-2(1950).

Theoretical and exptl. studies of the reaction

are reported. Theoretically (from entropy considerations) the reaction is expected to take place to completion. Exptl. attempts do not bear out this expectation. Attempts to reduce the material at temps. from 226 to 331° yielded reductions of 3.8 to 59.1%, resp. At temps. above 350° a purple deposit was obtained but not identified.

- 3785 de Almeida Rolff, P. A. M. "Radioactive Minerals." *Química industria (São Paulo)* 18, 14-15 (1950) June-July.

This is an elementary discussion of the occurrence and identification of U and Th minerals. Detection by scintillation, fluorescence, and radioactivity counting is discussed, and the occurrence in Rio Grande do Norte and Barboremo is mentioned.

- 3786 De Juren, J. and Knable, N. "Nuclear Cross Sections for 95-Mev Neutrons." *Phys. Rev.* (2), 77, 606-14(1950).

This paper is similar to report AECD-2705(1949).

- 3787 De Juren, J. Nuclear Cross Sections for 270 Mev Neutrons. II. Jan. 26, 1950. Declassified May 22, 1950. 12p. (AECD-2854)

The total cross sections of H, D, Be, C, O, Al, Cu, Sn, W, Pb, U, and H + D were measured for the neutrons resulting from the bombardment of a 2-in. Be target by the 350-mev protons of the 184-in. cyclotron. Values obtained were 0.038, 0.057, 0.229, 0.288, 0.372, 0.555, 1.145, 1.87, 2.61, 2.84, 3.29, and 0.019 barns, resp. Bi fission ionization chambers served as the neutron detectors and had an estd. mean neutron detection energy of 270 mev for the measurements. "Poor" geometry cross sections of C, Cu, and Pb were also measured.

- 3788 De Juren, J. and Moyer, B. J. Variation with Energy of Nuclear Collision Cross Sections for High Energy Neutrons. Aug. 30, 1950. Declassified Oct. 23, 1950. 20p. (AECD-2987)

The total cross section σ_t for U for 190-mev neutrons is reported to be 3.28 ± 0.13 barns. Data for other elements at the same and different neutron energies and information on the methods of measurement (Bi fission chamber) are included.

- 3789 de Keyser, W. L., Cypres, R., and Herrmann, M. Contribution à l'étude de la solubilité du nitrate d'uranyle dans les solvats organiques. Brussels, Université libre, April 1950. 13p. (Bull. centre phys. nucl. univ. libre Bruxelles No. 17)

The soly. of $\text{UO}_2(\text{NO}_3)_2$ in various ethers, esters, alcohols, and ketones at 20° is reported. The $\text{H}_2\text{O}-\text{UO}_2(\text{NO}_3)_2-\text{EtOAc}$ system was studied in great detail. The variation of the partition coeff. and the ternary compn. in each phase, at const. temp., as a function of the salt concn. and the variation of the partition coeff., at const. salt concn., as a function of the equil. temp. were measured.

- 3790 "Determination of Physical Properties of Uranium." *KAPL News* 3, No. 24, 3(1950).

Notes are given on the NBS detn. of freezing point of U metal of 99.99% purity. The value reported is $1133 \pm 2^\circ\text{C}$. Special precautions and techniques used to assure as pure a material as possible are mentioned.

- 3791 "Diamond Drilling for Uranium." Eng. Mining J. 151, 86-8(1950)Oct.

With diamond drilling going on at the rate of 300,000 to 400,000 ft/yr in the Colorado Plateau area, much has been learned about the best techniques suited to that area. The article describes the nature of the formations drilled, the circumstances under which drilling is being done, and drilling methods employed by contractors in the area. At present 8 contractors operating about 50 drills are active on the Plateau. Prospect drilling is now going on in Mesa, Montrose, and San Miguel counties in Colorado, and San Juan and Grand counties in Utah. A map is attached.

- 3792 Dominé-Bergès, M. "Preparation of Pure Oxides by Electrolysis." Ann. chim. (12), 5, 106-49 (1950).

An electrolytic method of prepn. of pure oxides and hydroxides is described, based on Jolibois' theory of the electrolysis of salt solns., according to which, and contrary to the accepted views, the pptn. of a metal on the cathode is a secondary process, the primary reaction being the formation of a hydroxide that in many cases is pptd. upon the cathode. By using high voltages (up to 2000 v), the cathode can be surrounded by pure H_2O ; the contamination of the hydroxide by foreign ions is thus avoided, and the product obtained is very pure. Through calcination the hydroxide can be converted into one or several oxides, the transformations from one oxide to the next one being controlled by a thermogravimetric setup. Among substances that are well adapted to this technique are U salts (nitrate and sulfate). The hydroxide obtained is $UO_3 \cdot H_2O$, which, upon calcination, yields UO_3 (amorp.), followed by a solid soln. $UO_{2.90}$ (cryst.), then by U_3O_8 (cryst.); the latter presents two forms, one susceptible to a reversed process of reoxidation, the other nonreoxidable (see Boullé and Dominé-Bergès Compt rend. 227, 1365, 1949(1948); 228, 72(1949)).

- 3793 Duke, F. R. and Pinkerton, R. C. Reactions Involving Like-Charged Ions. II. The Rate of Disproportionation of Uranium(V) in Deuterium Oxide. Declassified Sept. 6, 1950. 7p. (AECD-2921)

A polarographic method of Kern and Orlemann (J. Am. Chem. Soc. 71, 2102(1949)) has been used to study the stated reaction. It is tentatively concluded that the reaction does not proceed by the mechanism of H^+ transfer but that a hydroxyl radical transfer or its equiv. seems most likely. 10 references are given.

- 3794 Eastman, E. D., Brewer, L., Bromley, LeR. A., Gilles, P. W., and Lofgren, N. L. "Preparation and Properties of the Sulfides of Thorium and Uranium." J. Am. Chem. Soc. 72, 4019-23 (1950).

The stable phase regions of the U and Th sulfides have been detd. Methods of prepn. of the pure cpds. have been found. Many of the properties of these sulfides have been studied. Several of the sulfide phases show considerable promise for use as refractory containers. The distribution of "d" and "f" electrons is discussed, and the types of bonding in the semimetallic sulfides of two and three oxidation states are discussed.

- 3795 Elliott, N. and Lewis, W. B. Magnetic Susceptibilities of Some Uranium and Plutonium Salts. [1950]. 1p. (LACD-806)

The document is in abstract form; it is reproduced below in its entirety.

"Magnetic susceptibilities of several uranium and plutonium salts have been measured over the temp. range 75 to 300°K. The susceptibilities follow the Weiss-Curie law $X = c/T + \Delta$, with Δ varying between 100 and 400°. The magnetic moments calculated from these data are not in agreement with the theoretical values for free ions involving 5f electrons or with the 'spin only' moments."

(See AECD-2910 (1950) for complete document.)

- 3796 Elliott, N. and Lewis, W. B. Magnetic Susceptibilities of Some Uranium and Plutonium Salts. Aug. 12, 1950. Declassified Aug. 29, 1950. 6p. (AECD-2910)

This is the document of which report LADC-806(1950) is an abstract. The cpds. examined were UCl_4 , PuF_3 , PuF_4 , $\text{Rb}_4\text{Pu}(\text{SO}_4)_4 \cdot 2\text{H}_2\text{O}$, $\text{Pu}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$, $\text{Pu}(\text{C}_2\text{O}_4)_2 \cdot 6\text{H}_2\text{O}$, $\text{Pu}_2(\text{C}_2\text{O}_4)_3 \cdot 9\text{H}_2\text{O}$, and $\text{NaPu}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$. The values, in c.g.s. units reported for UCl_4 at 76 and 191°K are 10,280 and 4,960, resp. (This paper was presented at the September 1950 meeting of the American Chemical Society in Chicago.)

- 3797 Facchini, U. and Gatti, E. "Measurement of the Cross Section of Uranium for Fission with Thermal Neutrons." Nuovo cimento (9), 7, 589-605(1950).

The ratio between U fission cross section and Li cross section of the $\text{Li}^6(n,\alpha)\text{H}^3$ reaction for thermal neutrons is detd. The measurement is made exposing a no. of Li and U layers to a const. flux of thermal neutrons in an ionization chamber and comparing the no. of fission products emitted by U with the no. of α and H^3 particles emitted by Li. The no. of U nuclei present in each layer is deduced by counting the no. of α particles emitted by each layer, while the no. of Li nuclei is found by weighing the Li layers. Assuming the law $\sigma = \sigma_0 \nu_0 / \nu$ for the fission thermal neutron cross section of U the ratio $\sigma_{\text{U}} / \sigma_{\text{Li}}$ results in $\sigma_{\text{U}} / \sigma_{\text{Li}} = 0.0596 \pm 2.5\%$. Assuming $\sigma_{\text{Li}} = 66.6 \pm 2$ barns, we get $\sigma_{\text{U}} = 3.97 \pm 0.12$ barns, and for the U^{235} $\sigma_{\text{U}^{235}} = 551 \pm 17$ barns.

- 3798 Fassel, V. A., Tuthill, S. M., and Buckheim, O. J. The Spectrophotometric Determination of Iron in Uranium and Its Compounds. July 1947. Declassified Aug. 18, 1950. 19p. (AECD-2937)

A spectrophotometric detn. of Fe employing the ferrous-1,10-phenanthroline complex has been developed. The colored complex is measured at a wavelength where interference of the yellow $(\text{UO}_2)^{++}$ is a min. Recommended procedures and analytical results using these procedures are given. Data are presented which indicate that the Fe in the acid-insol. residue is negligible. A method for the detn. of Fe in $(\text{NH}_4)_2\text{C}_2\text{O}_4$ is included.

- 3799 Feldman, L., Neuman, W. F., and Harvill, J. R. Spectrophotometric Studies of the Uranyl Citrate Complex. Aug. 25, 1949. Declassified Apr. 14, 1950. 21p. (AECD-2829)

Spectrophotometric studies of the uranyl citrate complex in acid and in basic solns. have been made. The stability of the complex in acid was confirmed, and its stability in basic soln. was demonstrated. The absorption spectra of uranyl citrate and of UO_2Cl_2 were obtained for the wavelength region 320 to 440 m μ , and the effect of pH on the absorption by the complex was detd. from pH = 2 to 12 and for UO_2Cl_2 from pH = 3 to 6.5. The existence of the $(\text{UO}_2\text{OH})^+$ from pH = 4 to 4.7 has been confirmed. The stoichiometric ratio of U to citrate in the complex is unity from pH = 3 to 4.5 and probably has a value greater than unity in neutral and basic soln. The dissocn. const. of the complex was redetd. spectrophotometrically over the pH range 3.0 to 3.7; and the value obtained was 0.046 ± 0.009 . The complex is only slightly dissocd. at about pH = 7.

- 3800 Fields, P. R. and Pyle, G. L. Detection of Trace Amounts of Radioactive Materials. June 7, 1950. Declassified June 29, 1950. 15p. (AECD-2876)

Some general considerations in detg. micro. quantities of radioactive isotopes are discussed. U is chosen as an example of a typical α emitter and I^{131} as an example of a typical β emitter. A hypothetical unknown soln. is analyzed for U. Use is made of the fluorophotometric method which takes advantage of the fluorescence of U cpds. when fused with NaF. Quantities as low as 10^{-7} mg of U can be detected in this fashion. In order to illustrate the problems of analysis based on α counting, a radiochem. method is described. Both direct evapn. and Fe carrier can be used to conc. the U from the soln. Owing to the seriousness of "self-absorption" when counting α particles, the U is purified from inert materials by solvent extrn. using methyl isobutyl ketone or Et_2O as the solvent. The differential α pulse analyzer is then employed to det. the no. of U α particles in the possible presence of other α -emitting elements. This instrument, used to det. the relative quantity of various α particles being emitted from a sample, analyzes them on the basis of their different energies. Some of the problems encountered in analyzing for β -emitting isotopes are illustrated by isolating I^{131} from the hypothetical soln.

- 3801 Fischer, R. P. "Uranium-Bearing Sandstone Deposits of the Colorado Plateau." Econ. Geol. 45, 1-11(1950).

The U-bearing sandstone deposits of the Colorado Plateau, commonly referred to as "carnotite deposits," have a wide but spotty distribution. The deposits are irregularly tabular on lenticular but vary widely in size and grade of ore. The author describes geological formations and colorations which furnish clues in prospecting and outlines the long-range program of diamond-drill exploration being conducted by the Geological Survey on behalf of the USAEC.

- 3802 Fletcher, M. H. and May, I. An Improved Fluorimeter for the Determination of Uranium in Fluoride Melts. Washington, U. S. Geological Survey, June 1950. 16p. (USGS-TEI-120)

The fluorimeter is described in some detail as are the trials with samples of known U content. The instrument itself is a modification of the app. constructed at the USAEC Y-12 Electromagnetic Separation Plant. Trials with stds. of 0 to 1 γ U/g melt were successfully made, and the performance of the instrument over the concn. range 0 to 0.066% U (in two curves, 0 to 0.019% and 0 to 0.066% U) is reported. One scale division on the more sensitive scale represents 0.00022% U. Three drawings of the instrument are included.

- 3803 Folger, R. L. Determination of the Half-Life of Ra²²⁷. [1950]. 1p. (UCRL-937)

The report is reproduced below essentially in its entirety. A U target was bombarded for approx. 1 hr with 190-mev deuterons. 1.5 mg of Ba was used to carry the Ra through chem. purification. The Ba and Ra were sepd. on an ion-exchange column by elution with 0.5M citrate at pH = 7.75 (Tompkins, AECD-1998, Oct. 1947). The Ra fraction was located by means of its α decay. Ra²²³ and Ra²²⁴ were identified by α -pulse analysis. Geiger decay of the Ra fraction showed the presence of a 2-hr β emitter with β energy in the region 0.7 to 1.2 mev. This isotope appears to be the predicted, short-lived Ra²²⁷.

- 3804 Fox, C. S. "Mineral Supplies for Atomic Energy." Mining J. (London) 234, 310-12(1950). In a preliminary discussion the author describes the process of fission and discusses the materials required. Geological considerations are presented along with information regarding the occurrences of Th and U deposits. The chief sources of U ore are the Belgian Congo, the Great Bear Lake in Canada, the Erzgebirge in Bohemia, and the low-grade carnotite ore in Colorado, and possibly a deposit in Siberia. The monazite sands of Travancore are the most useful source of thorium today. The world's supply of U is somewhat under 10,000 tons of ore annually and that of Th approx. 5000 tons of suitable monazite sand.

- 3805 Freed, S. and Sancier, K. M. Spectra of Uranium and Rare Earth Salts in Solutions Fluid at 77°K. [1950]. 1p. (AECU-958)

The document is reproduced here essentially in its entirety.

The absorption spectra of solns. at 77°K of anhyd. salts of U and hydrated salts of Gd, Sm, and Nd were taken in the visible and ultraviolet regions of the spectrum. The solvent consisted mainly of propane and propene and a few % of *n*-propyl alc. The spectrum of anhyd. UCl₄ in soln. had the characteristics of rare-earth spectra, lines gathered into groups; but the line widths were greater in general than those from rare earths. On the other hand, the spectrum of the soln. of GdBr₃·6H₂O was sharper than most rare earths show from the cryst. state at the low temp., about 1 to 2 Å wide. The spectrum of the soln. of UCl₄ possesses a continuum, rather sharply limited at about 3000 Å. When continuous ultraviolet radiation extending beyond this limit is absorbed by the soln. at 77°K, a photochem. transformation occurs yielding a bright-red soln.

- 3806 Freymann, M., Freymann, R., Rohmer, R., and Hamon, P. "Adsorption Spectra of Tetra-valent Uranium Salts. Proposed Classification Based on the Vibration Frequencies." Compt. rend. 230, 1524-6(1950).

Research on the uranyl salts has led to a classification scheme for their fluorescence and adsorption bands; this classification involves the vibration freqs. of $(\text{UO}_2)^{+2}$ (Dieke and Duncan. Spectroscopic Properties of Uranium Compounds. New York, McGraw-Hill Book Company, Inc., 1949. 290p.) The authors have studied the spectra of UCl_4 and of UBr_4 and propose a classification of their adsorption bands in the visible region, involving the vibration freqs. of these mols.

- 3807 Freymann, M. and Freymann, R. "Dielectric Properties of Uranium Oxides UO_2 , U_3O_8 , UO_3 ." Compt. rend. 230, 2094-6(1950).

Radiofreq. absorption measurements were made with UO_2 , U_3O_8 , and UO_3 at temps. ranging from +20 to -160° and for the freqs.: 1, 2, 5, 10, and 16 kc. The absorption is plotted as a function of temp. for families of curves representing these freqs. The results are: (1) UO_3 has zero absorption; (2) UO_3 shows a strong absorption which decreases rapidly as the temp. is lowered; (3) the absorption curve for U_3O_8 goes through a min. and then a max. as the temp. is lowered, which cannot be attributed to an electronic origin. Further studies of U oxides intermediate between UO_2 and UO_3 are in progress.

- 3808 Fried, S. and Davidson, N. R. The Reaction of UF_4 with Dry O_2 . A New Synthesis of UF_6 . May 1945. Declassified Oct. 18, 1950. 10p. (AECD-2981)

UF_4 reacts with dry O_2 at 800°C according to the reaction: $2\text{UF}_4 + \text{O}_2 \rightarrow \text{UF}_6 + \text{UO}_2\text{F}_2$. At 350°C there is no rapid reaction. The reaction is a new method of synthesis for UF_6 , not requiring the use of elementary F. When the reaction was carried out in a Ni tube, the yield of UF_6 varied between 16% and 40%. The UO_2F_2 appeared to be somewhat volatile at 800°C and to subl. from the Pt boat used for the UF_4 . From these data it appears that the success of the common analytical procedure of igniting UF_4 to U_3O_8 without loss at about 800°C is due to hydrolytic conversion of the fluoride to oxide by H_2O . Calcns. of the free-energy changes for the reactions

as a function of temp. are presented.

- 3809 Friedland S. On the Energy Distribution of the Fission Fragments of U^{235} Produced by 2.5-Mev and 14-Mev Neutrons. Mar. 10, 1950. 10p. (AECD-929)

The method used in this expt. was to compare the ionization produced by the fission fragments to the ionization produced by α particles of known energy. A fission chamber similar to the one described by Fowler and Rosen (Phys. Rev. 72, 926(1947)) was used. For the 14-mev neutrons, the $\text{H}^3(\text{H}^2, \text{n})\text{He}^4$ reaction was used, while for the 2.5-mev neutrons, the $\text{H}^2(\text{H}^2, \text{n})\text{He}^3$ reaction was used. Results show that the depth of the valley between the two energy peaks decreases with increasing energy and also that the ratio of the two peak heights approaches unity with increasing neutron energy.

- 3810 Frondel, C. "Studies of Uranium Minerals. I. Parsonite and Randite." Am. Mineral. 35, 245-50(1950).

Parsonite, $\text{Pb}_2(\text{UO}_2)(\text{PO}_4)_2 \cdot 2\text{H}_2\text{O}$, is described from the Ruggles pegmatite, New Hampshire, and from Wölsendorf, Bavaria. The New Hampshire material occurs as crusts of micro. monoclinic crystals. Analysis gave PbO 47.43, UO_3 34.68, P_2O_5 14.46, H_2O 3.43 and 5.64% quartz. Parsonite also occurs at Wölsendorf as micro. yellow crystals identical in habit with the Belgian Congo and New Hampshire

material. Randite is claimed to be a mixt. consisting principally of calcite and β uranotil with some tyuyamunite and not carbonate of Ca and U as originally described by Koenig in 1878.

- 3811 Evans, H. T. Jr. and Frondel, C. "Studies of Uranium Minerals. II. Liebigite and Uranothallite." Am. Mineral. 35, 251-4(1950).

Liebigite, $\text{Ca}_2\text{U}(\text{CO}_3)_4 \cdot 10\text{H}_2\text{O}$, from Joachimsthal, Bohemia, has a_0 16.71 Å, b_0 17.55, c_0 13.79; $a_0:b_0:c_0 = 0.952:1:0.786$. The x-ray powder data, morphological data, and new measurements of the optical consts. are tabulated. Uranothallite is shown to be identical with liebigite. A new occurrence of liebigite at Wheal Basset, Redruth, Cornwall, England, is noted and the occurrence at Schneeberg, Saxony, is verified.

- 3812 Morse, M. E. "Studies of Uranium Minerals. III. Saleeite from Schneeberg, Saxony." Am. Mineral. 35, 525-35(1950).

Saleeite from Schneeberg, Saxony, has the compn. $\text{Mg}(\text{UO}_2)_2(\text{P,AsO}_4)_2 \cdot 10\text{H}_2\text{O}$, with P:As = 84.4:18.8, and is isostructural with fully hydrated artificial autunite, $\text{Ca}(\text{UO}_2)_2(\text{PO}_4)_2 \cdot 10\text{H}_2\text{O}$. Crystals are flat tablets on (0,0,1) with (0,1,0) and (0,1,2) and are found by x-ray and optical study to be tetragonal. The unit cell dimensions are $a_0 = 6.890$ Å, $c_0 = 19.813$ ($a_0:c_0 = 1:2.839$; $a:c = 1:2.840$ morphology), with the space group, if holohedral, 14/mmm. The calcd. and measured specific gravity is 3.27. Its color is yellow to lemon-yellow. The plane of perfect cleavage is (0,0,1). It is optically uniaxially neg. with $n_O = 1.574$ (pale yellow), $n_E = 1.559$ (nearly colorless). The original saleeite from Katanga has the compn. $\text{Mg}(\text{UO}_2)_2(\text{PO}_4)_2 \cdot 8\text{H}_2\text{O}$ and appears from the available evidence to be a lower hydrate that is isostructural with metaautunite-I.

- 3813 Hurlbut, C. S. Jr. "Studies of Uranium Minerals. IV. Johannite." Am. Mineral. 35, 531-5 (1950).

X-ray Weissenberg study of johannite gave the following characteristics for the triclinic face-centered cell corresponding to the pseudomonoclinic morphological cell of Peacock (Z. Krist. 90, 112(1935)):

- (1) $a_0 = 16.51$ kX, $b_0 = 17.98$, $c_0 = 6.83$ with $\alpha = 90^\circ 54'$, $\beta = 90^\circ 38'$, $\gamma = 110^\circ 37'$ (from morphology).
 (2) Cell contents $\text{Cu}_4\text{U}_8(\text{SO}_4)_8(\text{OH})_{40} \cdot 8\text{H}_2\text{O}$. (3) Specific gravity 3.32 (measured), 3.27 (calcd.). (4) Transformation, face-centered to primitive triclinic cell: $(\frac{1}{2}, 0, \frac{1}{2}) / (0, \frac{1}{2}, \frac{1}{2}) / (0, 0, 1)$. (5) Elements of the primitive cell: $a_0:b_0:c_0 = 0.9382:1:0.7143$, $\alpha = 108^\circ 50'$, $\beta = 112^\circ 3'$, $\gamma = 64^\circ 52'$.

- 3814 Frondel, C. "Studies of Uranium Minerals. V. Phosphuranylite." Am. Minerals. 35, 756-63 (1950).

The ill-defined U mineral phosphuranylite, hitherto known only from North Carolina on the basis of the original description by Genth (1879) and a later optical description by Larsen (1921), is redescribed from 12 new localities. Phosphuranylite is isostructural with dewindtite, $\text{Pb}_3(\text{UO}_2)_5(\text{PO}_4)_4(\text{OH})_4 \cdot 10\text{H}_2\text{O}$, and its ideal formula is presumed to be $\text{Ca}_3(\text{UO}_2)_5(\text{PO}_4)_4(\text{OH})_4 \cdot 10\text{H}_2\text{O}$. Analyses show much less Ca than required by this formula. It occurs as dense, golden-yellow films composed of micro. rectangular plates and is found principally in the weathered zone of pegmatites containing uraninite. Crystals are tetragonal or orthorhombic. Optically it is biaxial neg. with somewhat variable indices: $n_X = 1.660$ to 1.690 (colorless to pale yellow), $n_Y = 1.696$ to 1.724 (golden yellow), $n_Z = 1.698$ to 1.724 (golden yellow); $2V = 0$ to 35° ; $r > v$ strong. Pb substitutes for Ca in some varieties with accompanying increase in indices of refraction.

- 3815 Frondel, J. W. and Fleischer, M. A Glossary of Uranium- and Thorium-Bearing Minerals. U. S. Department of the Interior, April 1950. 19p. (Geological Survey Circular 74)

The glossary is divided into 4 categories: (1) minerals contg. U and Th as major constituents, (2) minerals containing minor amts. of U and Th, (3) minerals that, if investigated by modern analytical methods, might show U or Th content, and (4) minerals that are non-U- or non-Th-bearing, but that have been reported to contain impurities or intergrowths of U, Th, or rare-earth minerals.

- 3816 Fumi, F. G. and Castellan, G. W. "On the Molecular Structure of Uranium Hexafluoride." *J. Chem. Phys.* **18**, 762(1950).

Recently Bauer (*J. Chem. Phys.* **18**, 27(1950)) studied the mol. structure of UF_6 by means of electron diffraction. The authors make an attempt to interpret his results theoretically and arrive at the conclusion that either of 2 models of the structure of UF_6 is probable. One of the models is obtained by distortion of a trigonal antiprism of symmetry C_{3v} , the other by distortion of an octahedron of symmetry C_{2v} .

- 3817 Furman, N. H., Mundy, R. J., and Morrison, G. H. The Use of Ether Extraction for the Analytical Separation of Uranium. Declassified June 21, 1950. 20p. (AECD-2861)

The study of the behavior of various salting or addn. agents in causing $\text{UO}_2(\text{NO}_3)_2$ to be effectively distributed from aq. soln. into Et_2O has led to its application to analytical problems. The distributions of the majority of the elements of the periodic system along with U under certain conditions have been measured as a guide to their behavior in an analytical scheme. Analysis of high-grade materials is most effectively performed by means of a continuous extrn. using NH_4NO_3 as the salting agent. Low-grade products are best extrd. in a separatory funnel using $\text{Ca}(\text{NO}_3)_2$ as the salting agent. The final detn. of the U is made by a sensitive method; e.g., colorimetric or polarographic. Effective continuous extractors of various designs have been constructed and tested. Both single- and multiple-effect extractors have been used. The Et_2O method is in good agreement with the std. cupferron-ceric method for various products ranging from less than 1% up to 97% black oxide (U_3O_8).

- 3818 Furman, N. H., Mundy, R. J., and Morrison, G. H. The Distribution of Uranyl Nitrate from Aqueous Solutions to Diethyl Ether. Declassified Sept. 6, 1950. 72p. (AECD-2938)

The results of the extensive studies by the Princeton Univ. Analytical Group on the extrn. of $\text{UO}_2(\text{NO}_3)_2$ which were initiated early in the Manhattan Project and reported in numerous papers are presented in collected form. The original intention was to study the distribution to solvents other than Et_2O and preliminary expts. were made along these lines. The urgent need for data soon made it advisable to confine the work to Et_2O as the extg. agent. It is believed that the effectiveness of salting agents other than NH_4NO_3 was first presented in this series of investigations. Useful procedures have been developed for the efficient recovery of large or small amts. of U. The extent to which other substances may extr. along with $\text{UO}_2(\text{NO}_3)_2$ has been studied to as great an extent as the circumstances permitted. The distribution coeffs. of some 40 elements have been estd. Special study was given to the distribution of Cu, the rare earths, Zr, Ti, Th, Nb, H_3BO_4 , and Ra. The complicating factor of the presence of anions other than nitrate has been studied; the effect of $(\text{PO}_4)^{-3}$ is the most serious as far as retarding the extrn. of $\text{UO}_2(\text{NO}_3)_2$ is concerned. At least a partial soln. of the difficulty has been found in the use of $\text{Fe}(\text{NO}_3)_3$ as a salting agent, along with $\text{Ca}(\text{NO}_3)_2$ in continuous extrns. 32 tables and 78 references are included.

- 3819 Galbraith, W. J. W. "Energy Spectrum of Fragments from the Spontaneous Fission of Natural Uranium." *Phil. Mag.* (7), **41**, 429-43(1950).

A direct comparison is made between the energy spectrum of fission fragments from the spontaneous fission and from the thermal-neutron-induced fission in the same foils of natural U. The results show that, within the limits of the expt., the two distributions are not significantly different from one another. Calcns. are made which indicate the magnitude of the distortion of the energy spectrum to be expected, and the theory is found to agree satisfactorily with expt. As a subsidiary result to the main expt., the rate for the spontaneous fission of natural U is found to be $24.2 \pm 1.5/\text{hr/g}$.

- 3820 Gibson, G. and Katz, J. J. The Reactions of Uranium Oxides and Liquid Nitrogen Tetroxide. June 5, 1950. Declassified June 29, 1950. 10p. (AECD-2877)

Liq. NO_2 reacts with U oxides at 25°C and 1.2 atm. to form uranyl nitrates contg. varying quantities of NO_2 . The anhyd. oxides, such as UO_3 (Mallinckrodt, red and active forms) and U_3O_8 react slowly and only partially to yield $\text{UO}_2(\text{NO}_3)_2 \cdot 2\text{NO}_2$. The dihydrates, $\text{UO}_3 \cdot 2\text{H}_2\text{O}$ and $\text{UO}_4 \cdot 2\text{H}_2\text{O}$, react rapidly and completely to form, as a limiting case, $\text{UO}_2(\text{NO}_3)_2 \cdot \text{NO}_2 \cdot 2\text{H}_2\text{O}$. This cpd. is unstable even in dry air,

losing NO_2 at -42°C and 5×10^{-4} mm as well as at 25°C and 760 mm. The monohydrate, $\text{UO}_3 \cdot \text{H}_2\text{O}$, with NO_2 behaves like the dihydrates. Analytical data indicate a cpd. of the compn. $\text{UO}_2(\text{NO}_3)_2 \cdot 2\text{NO}_2 \cdot \text{H}_2\text{O}$. All of these NO_2 -contg. uranyl nitrates are sensitive to H_2O and lose NO_2 readily on contact with moist air of H_2O .

- 3821 Gibson, M. The Determination of Copper in Uranium Copper Alloys. May 1950. 6p. (AERE-C/R-526)

The alloy is dissolved in the min. amt. of HNO_3 , the acidity of the soln. is adjusted and an electrolysis at approx. 2 amp is carried out. The deposit is redissolved and then re-electrolyzed. The method is suitable for the detn. of Cu over the range 0.1 to 100%. In the higher % an aliquot should be chosen so that the weight of Cu does not exceed 0.3 g. The uncertainty of the method should not be worse than $\pm 0.2\%$ in the high % and not worse than $\pm 4.0\%$ in the lower regions.

- 3822 Goodman, B. B. and Shoenberg, D. "Superconductivity of Uranium." Nature 165, 441-2 (1950)

The authors report that various samples of U were observed to become superconductors at temps. ranging from 0.75 to 1.3°K , thus corroborating data previously reported by Justi (Physik. Z. 43, 207 (1942)). The temp. of the transition appears to depend on the purity of the sample. The recent results of Heer and Daunt (Phys. Rev. (2), 76, 715(1949)) indicate a similar situation for Ti. In the course of the expts. it was noted that large magnetic fields (of the order of 2000 gauss/ $^\circ\text{K}$ below the transition temp.) were required to destroy the superconductivity of the samples. It is probable that these high fields are not true thermodynamic crit. fields, but are of the same nature as the apparent high crit. fields of impure superconductors.

- 3823 Gordon, P. and Kaufmann, A. R. "Uranium-Aluminum and Uranium-Iron." J. Metals (N. Y.) 188, 154-61(1950).

This paper is similar to AECD-2683(1949).

- 3824 Govaerts, J. and Jordan, P. "Chemical State of Atoms Formed from U^{238} during the (n,γ) Reaction and during the Natural α Disintegration." Experientia 6, 329-30(1950).

A pyridine soln. of uranyl-salicylaldehyde-*o*-phenylenediimine was irradiated with neutrons, and the behavior of radioactive atoms formed by Szilard effect was observed in an elect. field. It was found that UX_1 atoms, produced by the natural α decay of U, are charged and are deposited on the cathode, while U^{239} atoms, formed by neutron capture, are neutral and remain in the soln. as an oxide.

- 3825 Gow, W. A. Flotation of Acid Consuming Minerals from Ore 101-B. Ottawa, Dept. of Mines and Technical Surveys, Mines Branch, Mar. 13, 1950. 10p. (AEC File No. NP-1597; Topical Report No. 40)

Details of tests to det. the feasibility of floating a higher % of carbonate minerals from U ore at a coarser grind, without using sodium silicate, and with a lower reagent consumption are reported. The effects of various flotation agents, presence of soda ash, size of grind, pulp modifiers, and supplementary frothers are discussed. Flotation agents oleic acid, Neo-Jat no. 3, and tall oil were investigated. The results of trials with many combinations of these materials are reported.

- 3826 Grimaldi, F. S. and Levine, H. The Rapid Fluorimetric Determination of Uranium in Low-Grade Ores. A Preliminary Report. April 1948. Declassified Apr. 11, 1950. 13p. (AECD-2824)

A simple and very rapid fluorimetric procedure is described for the detn. of U in low-grade shale and phosphate ores. The best working range is from 0.001 to about 0.04% U. The procedure employs batch extrn. of $\text{UO}_2(\text{NO}_3)_2$ by EtOAc, using $\text{Al}(\text{NO}_3)_3$ as the salting agent, prior to the visual fluorimetric estn. The procedure is especially designed to save reagents, only 9.5 g of $\text{Al}(\text{NO}_3)_3$ and 10 ml of EtOAc being used for one analysis. The soln. of the sample by means of a fusion with NaOH- NaNO_3 flux is rapid. After fusion, the sample is immediately extrd. without removing silica and other hydrolytic ppts. $\text{Al}(\text{NO}_3)_3$ very effectively ppts. F and P, thus eliminating steps required for their removal.

- 3827 Grimaldi, F., Ward, F. N., and Kreher, R. A Direct Quantitative Fluorimetric Method for the Determination of Small Amounts of Uranium in the Field and Laboratory. June 1949. Declassified Apr. 12, 1950. 13p. (AECD-2825)

This paper describes a quant. fluorimetric method for the detn. of small amts. of U (0.001 to 0.01%) useful for field and lab. A small sample is fused directly with a fluoride flux, and the fluorescence of the U melt is measured photometrically or visually. Nb and other elements tested for interference with an excitation of 3600 Å do not give any fluorescence in this procedure. Enhancement of the U fluorescence was observed in some samples.

- 3828 Grimes, W. R. The Determination of Uranium by Potentiometric Titration with Ferric Sulfate. Apr. 1, 1947. Declassified Feb. 8, 1950. 35p. (AECD-2804)

Titration of U with $\text{Fe}_2(\text{SO}_4)_3$ through the $\text{U}^{+3}/\text{U}^{+4}$ and $\text{U}^{+4}/\text{U}^{+6}$ potentiometric end points has been shown to be a rapid and accurate method of detg. this element in solns. free from interfering ions. Reduction of U in acid soln. by passage at room temp. through a Jones reductor suffices to give a mixt. of U^{+3} and U^{+4} for the titration. The titration is best conducted by addn. of $\text{Fe}_2(\text{SO}_4)_3$ in 5% (by vol.) H_2SO_4 to the reduced U in acid of the same compn. maintained at $92 \pm 2^\circ\text{C}$ under an atm. of CO_2 . The calomel-Pt electrode system has been shown to be satisfactory for the e.m.f. measurements. Addn. of 0.10 g of Cr as $\text{Cr}_2(\text{SO}_4)_3$ in 5% H_2SO_4 to the reduced soln. provides a more reproducible first end point. By use of these conditions, titrations which are accurate within $\pm 0.1\%$ may be made at the rate of 2 or 3/hr by an experienced analyst. The titration may be conducted with $\text{Fe}_2(\text{SO}_4)_3$ in 10% (by vol.) HClO_4 to U in this medium or with FeCl_3 in 20% HCl to an HCl soln. of U under the conditions described for titration in H_2SO_4 at some expense in accuracy. Nitrate, fluoride, and large amts. of phosphate (more than 1:1 of $(\text{PO}_4):\text{U}$) interfere with this method of detn. although repeated evapn. of the soln. to fumes of SO_3 is sufficient to remove the first two listed. Fe, Cr, Ni, Cd, Mn, and Al do not interfere with this detn. V, Mo, W, Cu, and Sn interfere in various ways and must be removed, with the exception of V whose interference is stoichiometric and may be corr. after a sep. detn. of this element. Ti introduces a third end point, but no error results if all three are detected and the titer between the last two is assumed to be equiv. to the U present. Application of the method to analysis of pure U cpds. and to U recovered from contaminated solns. by suitable procedures is briefly discussed. 21 references are given.

- 3829 Grogan, J. D. "The Uranium-Iron System," with an appendix by C. J. B. Clews, "An X-Ray Examination of Uranium-Iron Alloys." J. Inst. Metals 77, 571-80(1950).

The soly. of Fe in solid U increases with temp. from about 0.004 wt.% (0.118 at.%) at 600°C to about 0.35 wt.% (1.5 at.%) at 805°C , the temp. at which the solid-soly. curve meets both the solidus and a peritectic horizontal line where liq. reacts with solid U to form the cpd. U_6Fe . No discontinuous change in soly. has been detected at the transformation of α - into β -U, but at the transformation of β - into γ -U the soly. increases from 0.1 to 0.2 wt.% (0.4 to 0.8 at.%). The liquidus meets the peritectic horizontal at about 5 wt.% (18 at.%) Fe. The cpd. U_6Fe forms with another cpd., UFe_2 , a eutectic which contains about 11 wt.% (34 at.%) Fe and melts at 725°C . The cpd. UFe_2 m. 1230°C and forms, with Fe, a eutectic which contained about 47 wt.% (78 at.%) Fe and m. 1055°C . X-ray examn. has confirmed the existence of these two cpds. The structure of UFe_2 is discussed.

- 3830 Guenther, R. and Gale, R. H. The Trace Analysis of Silicon in Vanadium and Uranium. A Spectrophotometric Method. Nov. 8, 1949. Declassified Jan. 30, 1950. 10p. (AECD-2792)

A spectrophotometric method for the detn. of Si in V and U metals has been developed. The metal is removed by CHCl_3 extrn. of its cupferrate, the silicomolybdate color is developed in the residual soln., and the transmittancy is detd. at 390 m μ . The system shows an adherence to Beer's law over the range of 0.02 to 0.28 mg Si/100 ml with a reproducibility of ± 0.004 mg Si/100 ml.

- 3831 Guenther, R. and Gale, R. H. "Determination of Traces of Silicon in Vanadium and Uranium." Anal. Chem. **22**, 1510-11(1950).

This paper is similar to report AECD-2792(1950).

- 3832 Guenther, R. and Gale, R. H. Determination of Zirconium in the Presence of Uranium, a Spectrophotometric Method. Mar. 10, 1950. 9p. (KAPL-305)

The formation of the Zr-alizarin lake by the interaction of zirconyl and alizarin sulfonate ions and the measurement of absorbency of the lake have been investigated. A modified procedure, based on the method of Green, has been evolved for the detn. of Zr in U-Zr alloys. The modification permits the detn. of Zr in a 2000-fold excess of U. The characteristics of the Zr alizarin lake have been reported frequently, the most recent discussion being that of Flagg, Liebhafshy, and Winslow.

- 3833 Haberlandt, H., Hernegger, F., and Scheminzky, F. "The Fluorescence Spectra of Uranium Minerals in Filtered Ultraviolet Light." Spectrochim. Acta **4**, No. 1, 21-35(1950).

A survey of the fluorescence spectra of various U minerals leads to a new classification of the spectra into 5 groups which show some relationship with the chem. compn. of the minerals. By rewriting some of the formulas the discontinuous band spectra can be related to the $(\text{UO}_2)^{++}$ complex, and the continuous fluorescence spectra can be ascribed to a uranate-uranyl complex. Finally the part played by the anions, cations, and water of crystn. in the intensity and spacing of the fluorescence spectra is indicated.

- 3834 Haeberle, F. "A Survey of the Uranium Resources of the World." Texas J. Sci. **2**, 148-55 (1950).

The various U minerals and their geologic distribution are briefly described. The 3 most productive areas at present are the Katanga region of the Belgian Congo, Great Bear Lake in Canada, and Joachimsthal in Czechoslovakia. In all 3 deposits the ore occurs in veins cutting pre-Cambrian sedimentary rocks, and is associated with Co, and the principal gangue minerals are quartz and carbonates.

- 3835 Hagemann, F., Katzin, L. I., Studier, M. H., Seaborg, G. T., and Ghiorso, A. "The $4n + 1$ Radioactive Decay Series. The Decay Products of U^{233} ." Phys. Rev. (2), **79**, 435-43(1950).

This paper is similar to report AECD-2300(1948).

- 3836 Ham, J. L. Arc-Cast Molybdenum-Base Alloys, (First Annual Report). Climax Molybdenum Company of Michigan. Apr. 1, 1950. 166p. (AEC File No. NP-1652)

A short section on Mo-U alloys is included (p.125-7). This section discusses briefly the prepn. and characteristics of these alloys, with references to two other papers on them.

- 3837 Haney, D. W. Preliminary Experiments on Continuous Radioassay of Radioactive Ores and Mill Products. June 14, 1950. 24p. (MITG-A94)

The application of γ counting to the continuous radioassay of radioactive ores and mill products was investigated. Pulp counting was found to be superior to counting over feed belts because of greater sensitivity and immunity from large temp. fluctuation. A radioassay tank for flowing pulp was constructed, suitable for a 100- to 350-ton mill. The assay range is from 0.006 to 0.5% U_3O_8 ore. The upper limit may be extended through the judicious use of metallic absorbers.

- 3838 Haney, D. W. and Rubino, E. M. Further Study of Simultaneous Radiometric Assay for Thorium and Uranium, Including the Use of the Cooke-Yarborough Quenching Circuit. Oct. 18, 1950. 22p. (MITG-237)

A further study of the simultaneous β - and γ -activity radiometric technique for Th and U detn. in ores shows an av. accuracy of 21%. The error is larger for the minor constituent. The advantage of the technique lies in the short time in which the assays may be executed. Moderate accuracy may always be expected even though the ores being assayed are out of radioactive equil.

- 3839 Harwood, J. L. and McMahon, C. Use of a High-Pressure Ionization Chamber in Assaying Uncrushed Ore Samples. Ottawa, Department of Mines and Technical Surveys, January 1950. 18p. (AEC File No. NP-1528; Memorandum Series No. 106)

The ionization chamber used is type T.P.J. (CRTec-276). It has a collecting vol. of 996 cc enclosed in a cylinder 20 cm long. A is used as the filling gas. The app. has been in use daily for 12 mo. with consistent results. Over a period of 1 mo. the av. variation in sensitivity was 0.5%, the greatest departure being less than 2%. Operation of the app. is described, and some routine analytical results are compared with those from G-M counter and chem. analysis results. Two systems of measurement are used: (1) deflection method, for use with very strong samples or where a continuous record of the sensitivity of the app. is required; (2) charge time method, for rapid screening of samples or where the sample is very weak.

- 3840 Hazel, F. and McNabb, W. "Application of the Lead Reductor to Determination of Uranium." Anal. Chem. 22, 654-5(1950).

U can be reduced quantitatively to U^{+4} with Pb. High concns. of H_2SO_4 can be tolerated, provided a sufficient concn. of HCl is present. Reduction is rapid and amalgamation of the metal is unnecessary. The U^{+4} is detd. indirectly by the addn. of an excess of Fe^{+3} and subsequent titration of Fe^{++} with std. $(Cr_2O_7)^{--}$ soln.

- 3841 Hee, A., Jarovoy, M., and Kleiber, J. "Study of the Photographic Method of Active Deposits of Various Radioactive Substances." Compt. rend. 230, 1520-2(1950).

Several substances rich in U and Th (Colorado carnotite, Tonkin autunite, and Ceylon thorianite) were electrically deposited on metal disks which were then placed in contact with Ilford plates for periods ranging from about 4 hr to about 4 days. The authors then made a statistical study of lengths of the α tracks found in the plates after various exposure times. On the basis of this study they have identified the radioactive elements contained in these minerals.

- 3842 Hodge, H. C. "Pharmacologic Tools in the Study of the Mechanism of Uranium Poisoning." Arch. Ind. Hyg. Occupational Med. 2, 300-11(1950).

Some of the high lights of the mechanism of U poisoning are presented. When U as $(UO_2)^{++}$ enters the body, it is carried in the blood stream partly as a nondiffusible protein complex and partly as a diffusible bicarbonate complex. A substantial part of the U is deposited in bone through being exchanged with Ca^{++} at the surface of the bone mineral; each adsorbed $(UO_2)^{++}$ apparently complexes with 2 adjacent phosphate groups. Most of the U is excreted in the urine; however, some of the U reacts with the cells lining the renal tubules and injures or kills these cells. With small or moderate doses, the distal portion of the proximal convoluted tubule receives the severest injury. If death ensues, it follows a typical uremia; if the animal survives, cellular regeneration restores much of the kidney tissue and function. A few of the pharmacologic tools that have been brought to bear on this problem are (a) fluorophotometric analysis for U, (b) ultrafiltration of bicarbonate complex, (c) protein pptn., (d) radioisotopes in exchange adsorption studies of bone, (e) radioautographs of kidney, (f) renal clearance studies, (g) histopathology, (h) enzymatic activity in the urine, and (i) cell physiology, particularly the inhibition of metabolism as investigated in enzyme studies and kinetic studies.

- 3843 Hoekstra, H. R. and Katz, J. J. Studies on the Uranium-Oxygen System. Aug. 10, 1950. Declassified Oct. 18, 1950. 15p. (AECD-2954)

The U-O system is complicated by the existence of a multiplicity of cryst. forms and extensive regions of solid soln., with both reversible and irreversible decompn. regions. The present paper discusses that portion of the system extending from UO_3 down to UO_2 . After reviewing the conflicting phase relations found in the literature, the authors report some exptl. studies on the phase systems of O with Mg, Ca, Sr, and Ba diuranates and on the thermal decompn. of the cryst. phases of UO_3 . Similarities between the alk. earth diuranate and the U-O systems are shown, and some thermodynamic data on the phase transformations are presented.

- 3844 Holmes, J. A. —assigned to U. S. Atomic Energy Commission. Production of Uranium Triiodide. Oct. 3, 1950. (U. S. Patent 2,524,384)

A process for producing UI_3 is disclosed. By reacting U metal and I vapor at an elevated temp. to form UI_4 and then passing the UI_4 through a lower temp. region while maintaining this region at a relatively low partial pressure of I, a simultaneous condensation and shift in equil. is effected and UI_3 is produced.

- 3845 Howland, J. Jr., and Calvin, M. "Paramagnetic Susceptibilities and Electronic Structures of Aqueous Cations of Elements 92 to 95." J. Chem. Phys. 18, 239-43(1950).

This paper is similar to report AECD-2440(1949).

- 3846 Hurwitz, L. A Kinetic Study of Normal and Uranium Inhibited Hexose Metabolism in Yeast. May 3, 1950. Declassified June 15, 1950. 108p. (AECD-2857)

Kinetically, glucose appears to form a loose complex with the active cell groups involved in aerobic and anaerobic metabolism, leaving the glucose mostly in the free state. The K_S (dissocn. const.) for aerobic metabolism is 3.6×10^{-3} and for anaerobic metabolism 4.4×10^{-3} . Fructose was also found to form a loose complex with the active cell groups under anaerobic conditions. Its K_S is 1.9×10^{-2} . The max. velocities of anaerobic glucose and fructose metabolism are equal. The value is approx. $28 \mu l CO_2/mg$ yeast/hr at $25^\circ C$ and $pH = 3.5$. This may indicate that a single enzyme system or that equal concns. of two different enzymes dominate the rate-limiting step in the metabolic scheme. The rate-limiting step in the aerobic metabolism of glucose is slower than in the anaerobic metabolism of glucose. Its velocity is $13.30 \mu l/mg$ yeast/hr at $25^\circ C$ and $pH = 3.5$. It has been shown that the anaerobic production of CO_2 by yeast is proportional to the anaerobic utilization of glucose. Evidence was presented to show that the rate-limiting process on the yeast-cell surface is an enzymatic reaction, thus lending support to the theory of active transfer of material across the cell membrane. Anaerobically, there exists for the most part a noncompetitive inhibition of glucose metabolism by U. However, some degree of competition can be found in both aerobic and anaerobic glucose metabolism. In the fermentation of fructose, competition is apparently due to a U-substrate combination. The temp. characteristics of aerobic glucose metabolism is about 12,700 cal/mole between 18 and $30^\circ C$ and 20,850 cal/mole between 18 and $10^\circ C$. When U is added the temp. characteristic becomes 23,400 cal/mole throughout the whole temp. range measured with no break at $18^\circ C$. In the anaerobic metabolism of both glucose and fructose, the temp. characteristics are about the same. They increase as temp. decreases whether U is present or not. In the control data, av. (μ) values are about 21,800 cal/mole between 20 and $25^\circ C$, and 10,700 cal/mole between 25 and $30^\circ C$. In the presence of U, the anaerobic metabolism of fructose and glucose has an av. temp. characteristic of 17,000 cal/mole between 20 and $25^\circ C$ and 23,000 cal/mole between 25 and $30^\circ C$. The increase in aerobic (μ) values when U is added amts. in effect to a reversal of inhibition as the temp. is raised between 18 and $30^\circ C$. This also holds true for anaerobic glucose and fructose metabolism between 25 and $30^\circ C$. U forms a complex in a 1:1 ratio with active groups in the anaerobic glycolytic system. The initial steps in the respiration and fermentation of glucose are accomplished by different systems, each possessing widely different characteristics. It has been postulated that either the aerobic, anaerobic, or both systems associated with glucose metabolism may be the composite of a no. of dissimilar processes. 33 references are shown.

- 3847 Inghram, M. G., Hayden, R. J., and Hess, D. C. Jr. "U-235 Fission Yields in the Rare Earth Region." Phys. Rev. (2), 79, 271-4(1950).

This paper is similar to report AECD-2759(1949).

- 3848 Jacobs, S. A Study of the Determination of Uranium by Measurement of Fluorescence. April 1950. 33p. (CRL/AE-54)

The fluorometric detn. of U has been made on samples contg. the element in quantities varying between 10 and $0.01 \mu g$. The samples analyzed by this method included eluates from cellulose paper strips and cellulose columns, extrs. from phosphate ores treated with $Et_2O-H_2SO_4$ mixts., and leach solns. from certain ores. This paper describes the method of fusion for each of several fluxes used. A simple baffle with fixed aperture makes possible the examn. of samples contg. $10 \mu g$ without causing

fatigue in the electron-multiplier photocell. The uniform fusion process for multiple samples was facilitated by the use of an in-line jet gas burner. A study has been made of the quenching of the fluorescence of U, also of the anomalous enhancement of the fluorescence of U in alk. carbonate fluxes contg. NaF. A crit. examn. of the fluorescence spectra of U-NaF phosphors contg. other elements has been made. The results of this study suggest an explanation for the anomalous enhancement of the fluorescence in terms of the spectral response curve of the phototube and the transmission curve of the optical filter used in the fluorimeter.

3849 Jaffey, A. H., Lerner, J., and Warshaw, S. Report on Radiations of UY. Feb. 2, 1949. Declassified Dec. 19, 1950. 9p. (AECD-3022)

Th²³¹ was sepd. from purified enriched U contg. about 95% U²³⁵ using a LaF₃ carrier method with zirconium iodate, and its decay was investigated. The results indicate that the following components are probably present with approx. equal intensity (within perhaps 25%): 0.20-mev β , L-level x rays, M-level x rays, 50-kev conversion electrons, 35-kev γ . In addn. there seems to be evidence for the existence of a highly converted γ in the range 60 to 70 kev and of a low-intensity γ with an energy of 100 kev or greater. Despite the scanty evidence, a tentative decay scheme is presented. The half-life of Th²³¹ was measured as 25.64 ± 0.1 hr.

3850 James, W. F., Lang, A. H., Murphy, R., and Kesten, S. N. "Canadian Deposits of Uranium and Thorium." Mining Eng. 187, 239-55(1950).

The authors give a summary of information on Canadian deposits of U and Th up to the end of 1948, prepd. by geologists of Eldorado Mining and Refining, Ltd., and by the specialist on U deposits for the Geological Survey of Canada. A history of Canadian U and Th discoveries, a working classification of the deposits, fairly detailed descriptions of the Eldorado mine and of properties in northern Saskatchewan, and shorter accounts of several other discoveries are presented.

3851 Johnson, J. C. "Uranium Procurement Policies." Earth Sci. Digest 5, 13-17(1950)Sept. The status of the mining industry on the Colo. plateau, with reference to the production of V-U ores, is briefly indicated. U. S. Government policy on ore purchases is reviewed, and an ore-buying schedule for ores having a U content of 0.20% U₃O₈ or more is presented.

3852 Kaplan, L., Hildebrandt, R. A., and Ader, M. The Trinitratouranyl Complex in Ketonic Solvents. Oct. 1, 1950. Declassified Dec. 6, 1950. 28p. (AECD-3015)

The formation of a stable trinitratouranyl anion, $[\text{UO}_2(\text{NO}_3)_3]^-$, in acetone and methyl isobutyl ketone solns. has been demonstrated spectrophotometrically as well as by studies of soly., electrolytic transference, and partition between solvents. This complex is responsible for the enhancement of $\text{UO}_2(\text{NO}_3)_2$ extrn. into methyl isobutyl ketone by hydrazine, high-mol.-wt. amines, and quaternary ammonium salts. The stability of the anionic complex has been found to depend on the nature of the associated cation and to decrease with increasing H₂O content of the solvent. The existence of a stable anionic Th nitrate complex has been inferred from the effect of $\text{Th}(\text{NO}_3)_4$ on the spectra of $\text{UO}_2(\text{NO}_3)_2$ solns. and from the increased extrn. of $\text{Th}(\text{NO}_3)_4$ into methyl isobutyl ketone in the presence of solvent-sol. nitrate salts.

3853 Kaplan, L., Hildebrandt, R. A., and Ader, M. The Absorption Spectra of Uranyl Nitrate in Organic Solvents. Oct. 1, 1950. Declassified Dec. 11, 1950. 19p. (AECD-2920)

The absorption spectra of $\text{UO}_2(\text{NO}_3)_2$ have been measured in the following solvents: H₂O, acetone, dioxane, EtOH, PrOH, CHCl_3 , pyridine, nitroethane, EtOAc, glacial HOAc, and tetraethylene glycol dibutyl ether. The spectra of the solns. have in common a broad absorption band, extending from about 380 to 500 m μ with a max. around 425 m μ , and exhibit more or less fine structure. Differences among the spectra are explained in terms of a series of (hydrated, solvated) nitrate complexes, $(\text{UO}_2)^{++}$, $\text{UO}_2(\text{NO}_3)^+$, $\text{UO}_2(\text{NO}_3)_2$, and $\text{UO}_2[(\text{NO}_3)_3]^-$, the relative concns. of which depend on the nature of the solvent, its H₂O content, and the concn. of added nitrates. In concd. aq. HNO₃ the predominant species is the dinitrate complex, $\text{UO}_2(\text{NO}_3)_2$. The spectrum of uranyl perchlorate in methyl isobutyl ketone is included, showing the effect of adding various concns. of tetrabutylammonium nitrate. The soln. in acetone is stated to be quite similar.

- 3854 Katzin, L. I., Simon, D. M., and Ferraro, J. R. Heats of Solution of the Uranyl Nitrate Hydrates in Water and in Organic Solvents. May 12, 1950. Declassified June 8, 1950. 15p. (AECD-2894)

The heats of soln. of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, $\text{UO}_2(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$, and $\text{UO}_2(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}$ in H_2O and in isobutyl alc. Et_2O , tetrahydrofuran, ethylene glycol diethyl ether, ethylene glycol monoethyl ether, acetone, methyl isobutyl ketone, ethyl malonate, ethyl propionate, and ethyl oxalate have been detd. It is pointed out that the heat of soln. of the dihydrate in org. solvents seems largely influenced by the functional group of the solvent. Certain relations between the heats of mixing of solns. of the salt and H_2O in the org. solvent and the base strengths of the solvents are pointed out.

- 3855 Katzin, L. I., Van Winkle, Q., and Sedlet, J. Analysis of Ore Residues for Ionium and Protactinium. Dec. 2, 1946. Declassified Mar. 28, 1950. 10p. (AECD-2811)

This report deals with analysis of some pitchblende ore residue fractions which have not previously been considered as sources for Pa^{231} and Th^{230} , but which are found to be convenient sources of these materials. A brief discussion of the ore processing for U is given, with the possible sources of these isotopes described. The analytical results are summarized.

- 3856 Kaufman, D. and Perkins, C. W. Jr. The Spectrographic Determination of Uranium in Ores and Ore Products. Aug. 25, 1948. Declassified Apr. 25, 1950. 25p. (AECD-2834)

A spectrographic method for the detn. of U in ores and mill products was investigated using a d.c. arc for excitation. Direct burning of a 10-mg sample gave a sensitivity limit of only 0.05% U_3O_8 and was subject to numerous interferences. Simple chem. concn. procedures were also unsatisfactory. Complete sepn. of U by Et_2O extn. gave consistent results; however, if complete sepn. of U is accomplished, colorimetric or fluorimetric methods of analysis are more convenient than spectrographic means. Selective volatilization of U as fluoride was unsuccessful. By the addn. of AgCl , most of the material was volatilized in a preburning period, and the U, which was not volatilized, was accurately detd. down to 0.05% U_3O_8 on what was left. Incorporation of simple chem. concn. procedures prior to AgCl volatilization should be tried. A few preliminary tests indicated that some increase in sensitivity can be provided by volatilizing the sample rapidly into the arc stream by the addn. of Pb or Hg salts. There are no data to show whether or not this rapid volatilization will eliminate any of the difficulties encountered when using the other techniques.

- 3857 Kaufman, L. A. "The Radiogenic Concentration of Uranium Ores." Can. Mining Met. Bull. No. 460, 450-3(1950).

The Bureau of Mines, Ottawa, in conjunction with Eldorado Mining and Refining (1944), Ltd., has developed an automatic concentrator for U ores. A brief review of radioactivity is given which shows the present limitations for obtaining good results by electronic concn. The ores, after being mined, or at any other stage of a concg. process, can be analyzed for the U dissemination, and from these results the possibility of an economical concn. can be estd. The electronic and mechanical parts of the equipment are described. Difficulties in the operations, and means by which they have been and are being overcome, are discussed. The capacity of the units, the results obtained, the man power required, and other pertinent data are presented. Simple control analysis on the % U_3O_8 has been developed. Research is continuing along lines to develop a more completely automatic unit using a scintillation detector and applying a few new ideas and some devices that have been developed in color sorting.

- 3858 Keevil, N. B. "Radioactivity and Mineral Deposits." Am. Mineral. 35, 816-33(1950). Most of the information included deals with age detn. in rock, He detn., etc. Brief information on the deposits contg. U in the western U. S. and the Great Bear Lake region of Canada is given.

- 3859 Kehoe, E. J., Brannigan, F. L., and Eisenbud, M. Fire Protection Precautions for Handling Uranium Turnings, Chips, Borings, Sawdust, and Powder. Mar. 1, 1950. 10p. (NYOO-1505)

This report discusses the fire properties of U scrap with emphasis on its pyrophoricity. Safe procedures for storage, lab. handling, disposal, and shipment are suggested. Existing Interstate Commerce

Commission rules for shipment on common carrier are reviewed. The effect of various extinguishing agents on burning U scrap is described. (This information is also available in Nucleonics 6, 34-6 (1950)May.)

3860 Kehoe, E. J., Brannigan, F. L., and Eisenbud, M. "Fire Protection Precautions for Uranium Scrap and Powder." Nucleonics 6, 34-6(1950)May.

This paper contains information similar to that in report NYOO-1505(1950).

3861 Keston, S. N. "Radioactive Occurrences, Sault Ste. Marie Area, and Some Considerations Affecting Exploration Practice." Can. Mining J. 47, 46-53(1950)Aug.

3862 Kingdon, K. H. "Production of Enriched Nuclear Fuel." Gen. Elec. Rev. 53, No. 5, 11-12 (1950).

A brief review on U isotope sepn. and metal prodn. is given.

3863 Klinsenberg, P. F. A. "Magnetic Enhancement of Spectral Lines From Ions, with an Application to the Th IV-Spectrum." Physica 16, 185-97(1950).

It is shown that the tentative term 8^2P in the Th(IV) spectrum given previously is correct. The wavelengths of the combinations with lower terms are accurately measured and the relative level values improved. The observed Zeeman patterns agree with theoretical anticipation within exptl. error, assuming normal g values. The σ splitting of λ 6901 ($5^2F_{5/2} - 6^2D_{5/2}$) of U^{+6} are predicted from the isoelectric sequence $Ra^{+2} - Th^{+4} - U^{+6}$. A description and qual. explanation of the phenomenon of the magnetic enhancement of lines in ion spectra are given.

3864 Knipp, J. K., Leachman, R. B., and Ling, R. C. Ionization Defects of Fission Fragments. [1950]. 4p. (AECU-977)

The mean total kinetic energy of fission fragments produced from U^{235} by thermal neutrons is still uncertain. Ests. based on ionization yields are appreciably less than the only direct (calorimetric) measurement. Evidence is presented that about 2.5 mev for the av. light fragment and about 4.2 mev for the av. heavy fragment escape detection in the usual ionization expts. These ionization defects occur because the light fragment loses about 5 mev, and the heavy fragment about 8 mev, to recoiling gas atoms, which themselves have a reduced ionization eff. because they in turn produce recoil atoms, etc. An equation is presented for the ionization defect of a heavy particle stopped in a gas. Numerical integration of this equation based on certain approximations leads to 0.94 and 0.975 as probable values of the ionization effs. in A gas of the heavy and light fission fragments from U^{235} by thermal neutrons. The remarkable agreement with that found from analysis of fragment pair distributions must be regarded as largely accidental, because of the approx. nature of both considerations.

3865 Knox, W. J. Relative High Energy Neutron Yields from Targets Bombarded with Protons and Deuterons. Sept. 19, 1950. 23p. (UCRL-440 rev.)

Relative neutron yields in the forward direction from various target elements bombarded with 340-mev protons and 190-mev deuterons have been measured. Bi fission chambers with a threshold of about 50 mev were used to detect the high-energy neutrons. When a deuteron beam is used, the neutron yields for light elements agree with the values predicted by the deuteron stripping theory. For the heavy elements, the observed values are fitted best by adding a function proportional to Z^2 to the stripping theory values. This may be interpreted as evidence for the production of high-energy neutrons by the electric field disintegration of the deuteron. The neutron yields from the proton beam vary approx. as $(A-Z)^{2/3}$ for target elements from C to U. This indicates that the heavy elements are not completely transparent to 340-mev protons. Be has an anomalous neutron yield 50% higher than that for C.

- 3866 Koch, H. W., McElhinney, J., and Gasteiger, E. L. "Experimental Photo-Fission Thresholds in $^{92}\text{U}^{235}$, $^{92}\text{U}^{238}$, $^{92}\text{U}^{233}$, $^{94}\text{Pu}^{239}$, and $^{90}\text{Th}^{232}$." Phys. Rev. (2) **77**, 329-36(1950).
This paper is similar to report AECD-2699(1949).

3867 Kotin, C. M. "Nuclear Fission. II." Ciencia invest. (Buenos Aires) **6**, 491-500(1950).
A short review is given of some of the results obtained during the investigation of the products of nuclear fission reactions including those of U^{235} . Charge and mass distributions of the fragments, their energy, and the emission of delayed neutrons are among the topics examined. 42 references are given.

- 3868 Kraus, K. A. and Nelson, F. "Hydrolytic Behavior of Metal Ions. I. The Acid Constants of Uranium(IV) and Plutonium(IV)." J. Am. Chem. Soc. **72**, 3901-06(1950).
This paper is similar to report AECD-2742(1949).

- 3869 Lang, A. H. "Summary Account of Canadian Uranium Deposits." Can. Mining Met. Bull. No. 460, 426-33(1950).

The great interest taken in U in Canada during the past few yr has resulted in the discovery of a very large no. of occurrences and in much research that has added to the knowledge of the mineralogy and geology of U deposits. The object of this paper is to present that information in condensed form. Some of it has been published before, but it is brought together, and more recent unpublished data have been added. The paper contains short accounts of the mineralogy of U and of the types and distribution of occurrences; brief regional descriptions, including information on some of the characteristic deposits; and conclusions regarding prospecting and development possibilities.

- 3870 Lapointe, C. Equilibrium Corrections in Geiger Analysis. Ottawa, Dept. of Mines and Technical Surveys, Mar. 16, 1950. 9p. (AEC File No. NP-1600)

Detn. of U in ores and concns. may be made by a comparison of either the β or the γ radiation emitted by the sample with that emitted by a std. of known U content. The β method is best suited for low-grade material, and the γ method is used mostly for high-grade ores or concns. Since milling processes may disturb the secular equil. of the ores by removal of Rn or Ra, a method has been devised for detg. the state of equil. This consists in measuring the ratio of the β activity to the hard γ radiation of the Ra family. Although the method of equil. does not possess the high degree of accuracy that could be expected from a chem. analysis, and may sometimes lead to errors because of faulty interpretation of the results, it seems that it is completely suitable for routine detns., where the measurements need not be more accurate than the sampling. The presence of the Th radioactive family introduces errors in the phys. measurements, and before the equil. method is used, one has to know the amt. of Th present in the sample.

- 3871 Lapointe, C. "Equilibrium Corrections in Geiger Analysis." Can. Mining Met. Bull. No. 460, 465-8(1950).

This paper contains information similar to that in report AEC File No. NP-1600. (See also Radioactivity Division, Mines Branch, Department of Mines and Technical Surveys. Can. Mining Met. Bull. No. 460, 461-4(1950).)

- 3872 Lassen, N. O. "Total Charges of Fission Fragments in Gaseous and Solid Media." Phys. Rev. (2), **79**, 1016-17(1950).

Fission fragments emerging from a U layer were allowed to travel through A or other gases in a deflection chamber. At suitably low gas pressures, equil. between capture and loss of electrons was established in the first few mm of the 200-mm path, and variations in velocity and mean charge could be neglected. The magnetic deflection of a fragment was proportional to the mean charge of the fragment in the gas. With a vacuum in the chamber, on the other hand, the charges of the fragments in U detd. their deflection, and, with a thin cover layer of another metal over the U in vacuum, the charges in that metal were controlling. Fragments in the heavy group were found to have higher charges in

solids and lower charges in gases than did those in the lighter group. The charges in general were much lower in gases than in solids. The mean charge reached equil. at ~1 mm Hg in A and then rose very slowly with increasing pressure.

- 3873 Lauterbach, K. E., Laskin, S., and Leach, L. "Specific-Surface Determinations of Uranium Dusts by Low-Temperature Adsorption of Ethane." J. Franklin Inst. 250, 13-24(1950).

This paper is similar to report AECD-2244(1948).

- 3874 Loriers, J. "The Law of Oxidation of Metallic Cerium and Its Generalization to Other Metals." Compt. rend. 231, 522-4(1950).

The aggregate oxidation of cubic Ce is the sum of the sep. reactions $2\text{Ce} + 3\text{O} \rightarrow \text{Ce}_2\text{O}_3$ (cubic) and $\text{Ce}_2\text{O}_3 + \text{O} \rightarrow 2\text{CeO}_2$. The law of equiv. vols. indicates that the sesquioxide should form a continuous layer on the metal, the oxidation proceeding by diffusion following a parabolic law. In contrast, the less voluminous dioxide should allow the Ce_2O_3 to come into direct contact with the O_2 , the resultant reaction rate being linear. On the basis of these hypotheses, a reaction rate law is derived which gives the progress of the oxidation of Ce in the dry state at various temps. Exptl. evidence has confirmed these assumptions. The law which has been derived has been verified only for the oxidation of Ce, but it should be applicable to the oxidation of U or other metals, the oxidation of which follows a similar mechanism.

- 3875 McElhinney, J. and Ogle, W. E. Relative Photofission Cross-Sections of Several Fissionable Materials. 1950. 11p. (LADC-856)

Values were measured by the "catcher" method. Results with reference to U^{238} are reported for U^{233} , 2.49; U^{235} , 1.49; Pu^{239} , 2.51; Th^{232} , 0.257; and Io^{230} , 0.847.

- 3876 McKelvey, V. E. and Nelson, J. M. "Characteristics of Marine Uranium-Bearing Sedimentary Rocks." Econ. Geol. 45, 35-53(1950).

This is a summary of general information on the occurrence of U in marine shales and phosphorite formations. Such deposits are large but low-grade, but Sweden and possibly Russia are now recovering U from them. Marine deposition of U was favored in certain geological periods, and rocks of the appropriate ages occur in most parts of the U.S.

- 3877 Macnamara, J., Collins, C. B., and Thode, H. G. "The Fission Yield of Xe^{133} and Fine Structure in the Mass Yield Curve." Phys. Rev. (2), 78, 129-34(1950).

A mass spectrometer investigation of the Xe isotopes formed from U^{235} fission has been made, and the fission yield and half-life of Xe^{133} have been detd. The fission yield of Xe^{133} was found to be $6.29 \pm 0.01\%$ which is 20% higher than that expected from the mass yield curve. This is further evidence of fine structure in the mass fission yield curve. The half-life value of Xe^{133} was found to be 5.270 ± 0.002 days.

- 3878 McQuiston, F.W. Jr. "Processing Uranium Ores. Hydrometallurgical Methods Used to Treat Domestic Materials." Mining Congr. J. 36, 28-30(1950)Oct.

- 3879 Marble, J. P. "Lead-Uranium Ratio and Possible Geologic Age of Allanite from Greenwich, Massachusetts." Am. Mineral. 35, 845-52(1950).

Allanite from a pegmatitic lens in the Monson granodiorite at Greenwich, Mass., contains 0.03% Pb, 1.53% Th, 0.095% U. The results of other studies are outlined, and a max. possible age of $\sim 3.9 \times 10^8$ yr is calcd.

- 3880 Marshall, E. D. and Widing, R. A. Some Properties of Sodium Borohydride Solutions. June 30, 1950. Declassified Sept. 25, 1950. 2p. (AECD-2914)

Some of the properties of NaBH_4 solns. were investigated to det. the feasibility of using this reagent to replace the Jones reductor in the volumetric detn. of U, and in other procedures involving the reduction of cations. Polarographic and volumetric data are given to show that U^{+6} is reduced by NaBH_4 in alk. complexing media and that Cu^{++} is reduced in NH_3 media, whereas Cd^{++} , Zn^{++} , and Ag^+ are not reduced. Pb^{++} , Cr^{+6} , and Tl^+ are not reduced in 1M NaOH. NaBH_4 exhibits 2 anodic polarographic waves in alk. media. The wave at -0.15 v(vs. the satd. calomel electrode) is 65 times the magnitude of the wave at -0.64 v.

- 3881 Marshall, W. L. Jr., Gill, J. S., and Secoy, C. H. The Uranyl Nitrate-Water System above 60°C . Sept. 18, 1950. 10p. (ORNL-797)

Revised soly. data are presented for the system $\text{UO}_2(\text{NO}_3)_2\text{-H}_2\text{O}$ from 60 to 184°C . The $\text{UO}_2(\text{NO}_3)_2\cdot 3\text{H}_2\text{O}$ is shown to have an incongruent m.p. at 113°C and the dihydrate to have a stable m.p. at 184°C in contradiction to information presented in the literature. Special precautions were taken to ensure the correct stoichiometric ratio between UO_3 and HNO_3 in the salt, an excess of either free acid or oxide having a marked effect on the soly.

- 3882 "Marysvale Uranium Review, AEC Ore Purchasing Depot and Uraninite Discovery Spark Activity at Nation's Second Uranium Producing District." Mining World 12, No. 8, 10-13 (1950).

This is a discussion of the working, discoveries, and minerals in the Marysvale, Utah, district. The location and identification of autunite, torbernite, schroeckingerite, and metatorbernite are briefly mentioned.

- 3883 Maynard, E. A., Hodge, H. C., and Downs, W. L. Demonstration of Antidotal Action of Polyphosphate in Metal Poisoning. Declassified Aug. 28, 1950. 2p. (AECD-2905)

$\text{UO}_2(\text{NO}_3)_2\cdot 6\text{H}_2\text{O}$, when fed at a 2% dietary level, causes lethal kidney injury in male albino rats. Since polyphosphate forms a very stable complex with UO_2 , and Ca polyphosphate is in part excreted in the urine, the use of this cpd. as an antidote for U poisoning has been investigated. The intraperitoneal administration of Ca polyphosphate to rats on the first day of a 2% $\text{UO}_2(\text{NO}_3)_2$ diet delayed death; treatment on each of the first 5 days greatly reduced mortalities even after 45 days on the diet.

- 3884 Meinke, W. W. and Seaborg, G. T. Extension of Alpha- and Beta-Decay Systematics of Protactinium Isotopes. Jan. 30, 1950. Declassified Mar. 27, 1950. 7p. (AECD-2812)

Some pertinent new measurements are reported for Pa isotopes, obtained by low-energy deuteron and proton bombardments of natural U. The Pa was chemically sepd. by a procedure which involved a no. of MnO_2 cycles coupled with extrns. of Pa from aq. into org. solvents. The Pa from the 19-mev deuteron bombardment contained 23.7 ± 0.5 -min and 27-day β -particle emitters. The 23.7-min activity was assigned to Pa^{235} , and the 27-day activity was assigned to Pa^{233} . The 23.7-min activity was also found in the Pa fraction from the bombardment of natural U with 9.5-mev protons. A partial half-life for α -particle emission of about $1400 \text{ yr} \pm 20\%$ was found for Pa^{230} obtained by 60-mev deuteron bombardment of a thick Th target. This half-life was inferred by measuring the equil. amt. of the Pa^{230} α -disintegration product, the β particle emitting 29-hr Ac^{226} .

- 3885 Meitner, L. "Fission and Nuclear Shell Model." Nature 165, 561(1950).

It seems likely that closed shells consisting of 50 or 82 neutrons may persist as a definite structure in nuclei even when the nuclei are moderately excited. If this is true, it is to be expected that the U fission fragments should contain closed shells of 50 and 82 neutrons, with the extra neutrons being equally distributed between the two fragments. Since the closed shell of 50 neutrons is connected with $Z \geq 36$, and 82 neutrons with $Z \geq 54$, it follows that, for the lighter fragment the charge must lie between 36 and 38, while for the heavier fragment the charge must be between 56 and 54. These conclusions agree very well with the exptl. results. Because of the evapn. of neutrons which precedes fission in Bi, there are not enough neutrons present after fission to form shells of 50 and 82 neutrons, so both fragments contain shells of 50 neutrons. It is pointed out that the shell structure cannot persist in

highly excited nuclei, and the fission induced by fast neutrons in U usually results in more nearly equal fission fragments for this reason.

- 3886 Merritt, P. L. "Uranium Exploration in the United States." Can. Mining Met. Bull. No. 460, 438-43(1950).

The efforts of the USAEC sponsored exploration program has (1) located many additional deposits of carnotite on the Colorado Plateau as a result of intensive exploration and mining activity; (2) established the fact that primary U vein deposits do exist in the U. S. These have been found in the Colorado Front Range, in the Coeur d'Alene mining district in Idaho, and in the Upper Peninsula of Michigan; (3) led to the discovery of numerous occurrences of both primary and secondary U minerals in western areas off the Colorado Plateau, such as those at Marysvale, Utah; and (4) developed extensive information concerning low-grade U deposits in shales and phosphates. This information indicates that under certain conditions it might become feasible to mine and recover U from these very low-grade ores.

- 3887 Miller, R. D., Sewell, D. C., and Wright, R. W. The Angular Distribution of High Energy Neutrons from Targets Bombarded by 330-Mev Protons. June 22, 1950. Declassified Aug. 2, 1950. 17p. (AECD-2884)

The angular distribution of neutrons with energies above 20 mev produced by bombardment with the 350-mev proton beam in the 184-in. cyclotron of Be, Al, Cu, and U targets has been measured with C detectors. The full widths at half max. obtained are 54° for Be, 59° for Al and Cu, and 58° for U. Exptl. details and the resulting curves are given. 11 references are included.

- 3888 Moses, C. and Longabaugh, G. M. "Rapid Production of Atherosclerosis by Administration of Uranium in Presence of Hypercholesterolemia." Proc. Soc. Exptl. Biol. Med. 74, 92-3(1950). Rabbits were fed doses of cholesterol to produce a condition of hypercholesterolemia after which U acetate was administered subcutaneously to cause kidney damage. Two to 14 days after the administration of the U the animals were sacrificed and the aorta was examined microscopically. In almost all cases atherosclerosis was very marked.

- 3889 Muench, O. B. "Recent Analyses for Age by Lead Ratios." Bull. Geol. Soc. Am. 61, 129-32 (1950).

The Pb, U, and Th in the following radioactive minerals were detn., and the Pb-U ratio was calcd.; pitchblende from Wood's Mine, Central City, Colo., 0.0147; pitchblende from Gilpin County, Colo., 0.0167; monazite from the Huron claim, Manitoba, 0.257; monazite from Bull Creek, about 15 miles from Los Vegas, N. Mex., 0.106; euxenite from Trout Creek Pass, Colo., 0.059. A complete analysis of the euxenite is given. The age of the pitchblende from Central City was calcd. from the log formula of Holmes (Natl. Research Council (U. S.), Bull. 80, 124-459) to be 11.1×10^7 yr.

- 3890 Muilenberg, G. A. and Keller, W. D. "Carnotite and Radioactive Shale in Missouri." Earth Sci. Digest 4, 24(1950)March.

A deposit of carnotite and an unidentified radioactivity in black shale have been found in a limestone quarry near Ste. Genevieve, Mo.

- 3891 Müller, A. "On Complex-Like Organic Uranyl Compounds." Z. anorg. Chem. 261, 210-12 (1950).

Continuing a study on complex-like org. uranyl cpds. (J. prakt. Chem. (2) 157, 89(1940)), 3 new products were prep'd., viz., uranyl 2-ketodiacetonegluconate, uranyl 2-ketodiacetonegluconate, and uranyl diethy-citrate. The corresponding acids were treated first with NaHCO_3 (or BaCO_3), then with $\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$. The first two products did not crystallize from the viscous liq. obtained, while the third one crystd. readily. As has been expected from previous experience, the first named cpd. is more intensely colored and is more resistant to the action of light than the second one. The third product is easily decompd. by sunlight; a characteristic trait is its insoly. in alc.

- 3892 Murray, P. A General Interpretation of the pH-Viscosity Relationship for Amphoteric Ceramic Oxide Slips. April 1950. 18p. (AERE-M/R-507)

The pH-viscosity and pH-sedimentation vol. relationships have been detd. for concd. UO_2 slips and show a marked similarity to each other and to the pH-viscosity curve obtained by other workers for alumina. The shapes of the curves for UO_2 are tentatively explained on the assumption that U hydroxide possesses amphoteric characteristics and that the solid particles of the slip can adsorb complex metal anions or cations. Calcns. based on this hypothesis give pH-neutralization curves which agree with the exptl. viscosity and sedimentation curves. An analogy has been noted between this phenomena and the pH-soly. curve for silver oxide. Satisfactory UO_2 crucibles can be made by slip casting at pH = 2.1.

- 3893 Nelson, F. and Kraus, K. Chemistry of Aqueous Uranium (V) Solutions. III. The Uranium (IV)-(V)-(VI) Equilibrium in Perchlorate and Chloride Solutions. June 12, 1950. Declassified June 29, 1950. 17p. (AECD-2879)

The equil. const., K_{eq} , for the reaction $2(\text{UO}_2)^+ + 4(\text{H}_3\text{O})^+ \rightleftharpoons (\text{UO}_2)^{++} + \text{U}^{+4} + 6\text{H}_2\text{O}$ was obtained as a function of ionic strength for $(\text{ClO}_4)^-$ and Cl^- solns. using polarographic, spectrophotometric, and potentiometric methods. A modified Debye-Hückel expression was found to represent the data up to $\mu = 1.0$ and the activity const.

$$K_{\text{eq}}^0 = K_{\text{eq}} \frac{\gamma(\text{UO}_2)^{++} \gamma \text{U}^{+4}}{\gamma^2 (\text{UO}_2)^+ \gamma^4 (\text{H}_3\text{O})^+} = (1.7 \pm 0.3) \times 10^6 \text{ was evaluated. The stability const. of the uranyl}$$

chloride complex $(\text{UO}_2\text{Cl})^+$

$$K_{\text{c}}^{0(\text{VI})} = \frac{(\text{UO}_2\text{Cl})^+ \gamma (\text{UO}_2\text{Cl})^+}{(\text{UO}_2)^{++} (\text{Cl})^- \gamma (\text{UO}_2)^{++} \gamma \text{Cl}^-} = 2.4 \text{ was estd. from a comparison of } K_{\text{eq}} \text{ for } \text{Cl}^- \text{ and } (\text{ClO}_4)^-$$

solns. Some observations on the polarography of U^{+5} and U^{+6} have been included. The diffusion current consts. of U^{+6} and the ratio of the diffusion current consts. of U^{+5} and U^{+6} were evaluated as a function of ionic strength. 14 references are included.

- 3894 Neuman, W. F. "Urinary Uranium as a Measure of Exposure Hazard." Ind. Med. Surg. **19**, 185-91(1950).

This paper is similar to report AECD-2786(1949).

- 3895 Neuman, W. F., Neuman, M. W., and Mulryan, B. J. "A Note on the Failure of Non-Isotopic Uranium to Inhibit Resorptive Processes in the Rat Femur." J. Biol. Chem. **182**, 151-2(1950).

This paper is similar to report AECD-2580(1949).

- 3896 Newton, A. S. — assigned to U. S. Atomic Energy Commission. Method of Purifying Inert Gases. Sept. 12, 1950. (U. S. Patent 2,521,937)

This patent discloses a method for purifying an inert gas by passing the gas over metallic U at controlled temps. H-nonmetal cpds may be removed by heating the inert gas with U at a temp. sufficiently high to form a cpd. of U and the nonmetal and further heating the gas with U at a lower temp. to form UH_3 .

- 3897 Newton, A. S. — assigned to U. S. Atomic Energy Commission. Purification of Hydrogen. May 12, 1950. (U. S. Patent 2,533,138)

A process for purifying H_2 contg. various gaseous impurities by passing the H_2 over a large surface of U metal at a temp. above the decompn. temp. of UH_3 and below the decompn. temp. of the cpds. formed by the combination of the U with the impurities in the H_2 is disclosed. (Application serial No. 594,587, filed on May 18, 1945)

- 3898 Nottorf, R. W. Some Problems in the Chemistry of Uranium and Thorium of Interest to the Development of Atomic Power. Ph.D. dissertation, Iowa State College, 1945. 149p. (This is report AECD-2984, which was declassified Oct. 13, 1950.)

Detailed results of certain investigations performed during the early days of the U. S. atomic energy program are presented. A procedure is given for the detn. of Ba and Sr activities in U fission product material which also provides for the recovery of the other fission products. The vapor pressure of UBr_4 was detd. by the transpiration method from 450 to 650°C. Heats of subln., fusion, and vaporization of UBr_4 were calcd. Phys. studies of the hydrides of Th and U included detns. of the dissocn. pressures in the $\text{U-UH}_3\text{-H}_2$ system, vol. of the U-UH_3 and U-UD_3 systems, fractionation of H_2 and D_2 , dissocn. pressures of the Th-H_2 system, and the existence and heats of formation of two Th-H cpds.

- 3899 Noyce, W. K. and Daane, A. H. The Uranium-Cobalt System. Mar. 1, 1946. Declassified Apr. 18, 1950. 10p. (AECD-2826)

A phase diagram for the U-Co system has been constructed, based on thermal, micro., x-ray, and chem. data. The results indicate the existence of 3 cpds. and 2 eutectics, one of which shows a lowering of the m.p. of U by approx. 400°C. 16 references are included.

- 3900 Ogle, W. E. and McElhinney, J. The Resonance Photofission Cross Section for U^{238} . 1950. 13p. (LADC-857)

An attempt is made to det. the shape of the U^{238} photofission cross section up to a γ energy of 22 mev by an analysis of the excitation function obtained by varying the peak intensity of the bremsstrahlung from a 22-mev betatron. A resonance for the photofission process is indicated in the region of 15 mev.

- 3901 O'Malley, G. B. "The Promise of the Newer Metals for Engineering and Chemical Applications, and Some Problems Associated with Their Production." Roy. Australian Chem. Inst. J. Proc. 17, 218-19(1950).

This is the summary of a lecture.

The metals considered were Ti, Zr, Be, Ta, Li, and U. The interatomic distances in the crystal structures of the various metals affect their ability to alloy with one another. Metals like Ti, abundant in the earth's crust, may be available in quantity in the future. Others like Be, rare and hard to isolate, will never have more than a limited availability. Ti metal has both good structural and chem. properties, an example of the latter being its high resistance to sea-water attack. The metallurgy of Zr is similar to that of Ti. It is at present mostly used in the unalloyed form. It is of importance for its chem. durability, and for its workability. Be is best prepd. by chloride metallurgy, and its practical isolation has presented some extremely difficult problems. Ta also involves a complicated prepn. and it is used in practice because it has high chem. resistance and it is one of the most workable of metals. It has unique uses in surgery. Li is one of the softest metals, with the low specific gravity of 0.53. Its greatest promise is in alloys with "stiff" metals like Mg, where a compromise between strength and workability is possible. Such alloys in sheet form have unsurpassed resistance per unit weight. Various U alloys have been investigated, such as those with Al, W, and Ta.

- 3902 Orr, J. B. " U^{235} in Thucholite." Phys. Rev. (2), 79, 401-02(1950).

In a previous letter (Phys. Rev. (2), 76, 155(1949)), the author suggested that the lower ratio of U^{235} to U^{238} in thucholite, compared with that in other U sources, might be due to a former chain reaction, the C content acting as a moderator. New comparisons of thucholite with uraninite, made by means of fission counts induced by a moderated Ra-Be neutron source, show, however, that any real difference in the U^{235} compn. must be less than 6%.

- 3903 Page, L. R. "Uranium in Pegmatites." Econ. Geol. 45, 12-34(1950).

A study of U minerals in domestic pegmatites has been carried out by the U. S. Geologic Survey. None of the known domestic deposits warrants mining for U alone, and it will probably continue to be a by-product with no appreciable production expected from these sources. Known geological relationships are described which might serve as guides in finding new pegmatite deposits at least as commercially favorable as those of Madagascar.

- 3904 Pannell, J. H. Progress Report A-28. Radioassay Techniques for Low-Grade Uranium Ores and Mineral-Dressing Products. May 12, 1947. Declassified July 27, 1950. 22p. (AECD-2889)

The equipment used is similar to that found in other labs. organized under the Manhattan Engineer District, consisting essentially of a Geiger-Mueller counter and Higinbotham Scale of 64. The counter is a cylindrical β detector having a cathode area of about $7\frac{1}{2}$ in.² and a wall thickness in terms of mass of 30 mg/cm², enabling it to count some electrons in the 350-kev range. Samples are weighed (vol. measures may be inaccurate) into shallow brass cups which are placed directly beneath the sensitive region of the counting tube which lies at the axis of a horizontal Pb chamber. The sample is customarily spread evenly over the bottom of the cup and is smoothed with a Lucite tamper. Expts. show, however, that this is not necessary in order to obtain reproducible results; no detectable variations due to differences of d. are observed when const. wts. are used. Errors in radioassays are due to positioning, sampling, and statistical fluctuations. The procedure, regardless of the actual type of sample holder or counting device, is based upon the comparison of net counts for unknown samples against those for "standard" samples under identical conditions. The reasonable assumption that activity is proportional to amt. of U present presupposes at least four conditions: (1) equal wts. of different samples must have the same absorption properties, (2) the U present must be in equil. with its daughter elements, (3) all the activity measured must be derived from the U disintegration series, and (4) no appreciable % of the ionizations produced can be lost by coincidences. The net counting rate due to the sample alone is employed; i.e., the background is always subtracted from the total counting rate.

- 3905 Pant, D. D. "Intensity Relationships in the A and B Bands in the Absorption and Fluorescence Spectra of Some Uranyl Salts at Various Temperatures." Proc. Indian Acad. Sci. A **31**, 103-06 (1950).

The author made a spectrographic analysis of the absorption and fluorescence spectra of uranyl sulfate and uranyl fluoride II according to a method described previously (Proc. Indian Acad. Sci. A, **22**, 95 (1945)). The intensities of the various bands of the spectra were obtained at a no. of different temps. ranging from -185 to 25°C.

- 3906 Parsons, R. W. and Collie, C. H. "Photodisintegration of the Heavy Elements." Proc. Phys. Soc. (London) **63A**, 839-44(1950).

The photothresholds for the emission of neutrons by the following elements have been detn.; the threshold in mev is given in the parens. following the symbol: Pt(6.1 ± 0.1), Au(8.1 ± 0.1), Hg(6.6 ± 0.2), Tl(7.3 ± 0.25), Pb(6.9 ± 0.1), Bi(7.2 ± 0.1), Th(6.0 ± 0.15), U(5.8 ± 0.15). The neutrons were detected by the Szilard-Chalmers method of chem. concn. and the γ rays were obtained from a small betatron. Rough values of the total cross sections can be estd. from the results.

- 3907 Peppard, D. C., Studier, M. H., Gergel, M. V., Mason, G. W., Sullivan, J. C., and Mech, J. F. Isolation of Microgram Quantities of Naturally-Occurring Plutonium and Examination of Its Isotopic Composition. June 2, 1950. Declassified June 30, 1950. 11p. (AECD-2890)

The Pu content of a Belgian Congo pitchblende conc. (45.3% U) has been detd. as 7.0 ± 0.7 parts Pu²³⁹/10¹² parts conc. This value is 700 times the value reported for the Pu²³⁹ content of a Canadian pitchblende conc. The quantity of Pu²³⁹ found is probably too high to be accounted for by the absorption by U²³⁸ of neutrons formed by spontaneous fission of U. A mechanism involving interaction of the more energetic α 's of the U series and light elements such as O, Mg, and Si to yield neutrons is suggested as a further source of neutrons. No isotopes of Pu other than Pu²³⁹ have been demonstrated to be present in the product. Upper limits are set. The methods used to sep. chemically the microgram quantities of Pu and to study the isotopic compn. are described.

- 3908 Perlman, I. and Ypsilantis, T. J. "Consistency of Nuclear Radii of Even-Even Nuclei from Alpha-Decay Theory." Phys. Rev. (2), **79**, 30-4(1950).

It is shown possible to obtain a consistent function for nuclear radii if the quant. treatment of the α -decay process is applied to even-even isotopes of the heavy elements. The nuclear radii so calcd. for even-even isotopes of Rn, Ra, Th, U, Pu, and Cm conform to the expression $r = 1.48 A^{1/3} \times 10^{-13}$ cm

which defines the normal nuclear radii. The agreement is within 1% for the majority of the cases and there is reason to question the exptl. data used in the calcns. for at least part of those which do not show such close agreement. In cases of fine structure in α decay of even-even nuclei, the radii calcd. from the sep. α groups are compatible. The Po isotopes and Rn²¹² form a special group showing departures from normal nuclear radii explainable by consideration of shells in nuclear structure.

- 3909 Perry, C. H. Internal Dose Determinations of Several Radioisotopes. Feb. 27, 1950. 97p. (ORNL-591)

Part I. Methods of calcn. and tabulated results are presented for tissue doses produced by radioisotopes of those elements which are common to body metabolism. Factors of safety are suggested. Part II. Calcns. are presented for tissue doses produced by dusts of insol. and sol. cpds. of radioactive U isotopes (U²³⁴, U²³⁵, and U²³⁸). These calcns. are based on exptl. data on UO₂ dust.

- 3910 Pfeil, P. C. L. "The Constitution of Uranium-Molybdenum Alloys." J. Inst. Metals 17, 553-70(1950).

The U-Mo system has been examined experimentally, using micrographic, x rays, and thermal-analysis methods. No intermediate phases were recognized in this system. As predicted, the solid soln. of Mo in γ U is relatively extensive, and is in equil. with a Mo-rich solid soln. contg. a small quantity of U. With approx. 19 at. % Mo the γ body-centered cubic modification is stabilized to room temp. The γ phase can be retained down to room temp. by quenching alloys contg. above approx. 9 at. % Mo, but lower Mo contents decomp. to α modification by a martensitic type of reaction. The solid soly. of Mo in β U is restricted, while that in the α modification is intermediate between that in the β and γ modifications. This leads to a direct transformation between γ and α U, not involving the β phase, in alloys contg. more than 2 at. % Mo. The $\alpha/(\alpha + \gamma)$ phase boundary falls to room temp. with increasing Mo contents. The exptl. results, particularly the solid soly. of Mo in the three allotropic modifications of U, are discussed in terms of the general theory of the alloying behavior of U.

- 3911 Physics Division, Oak Ridge National Laboratory. Quarterly Progress Report for Period Ending June 15, 1950. Oct. 4, 1950. 96p. (ORNL-782)

The summary states that the crystal structure of UC₂ is similar to that of CaC₂. No further information on the subject is given.

- 3912 Pribil, R. and Malat, M. "Use of Complexones in Chemical Analysis. VII. Determination of Molybdenum by Means of 8-Hydroxyquinoline." Collection Czechoslov. Chem. Commun. 15, 120-31(1950).

The influence of 8-hydroxyquinoline on the complex cpds. formed from a no. of cations and ethylenediaminetetraacetic acid (complexone) has been studied. It was found that in the presence of complexone in HOAc and NH₄OAc medium, 8-hydroxyquinoline ppts. only Mo⁺⁶, W⁺⁶, U⁺⁶, and V⁺⁵, the other cations being completely "screened." On the basis of these facts a method has been worked out for the selective detn. of Mo in the presence of Pb, Bi, Hg⁺⁺, Cu, Fe, Al, Cr, Be, Ti, U, Co, Zn, Mn, and Ni. The pH conditions were detd. for the sepn. and simultaneous estn. of Mo and U, Mo and Cu, and also Mo and Fe, each also in the presence of the foregoing elements. Examples are given of analyses of Mo minerals and alloys by the method described.

- 3913 Price, G. R., Ferretti, R. J., and Schwartz, S. The Fluorophotometric Determination of Uranium. Declassified Feb. 1, 1950. 90p. (AECD-2870)

The brilliant yellow-green fluorescence of (UO₂)⁺⁺ salts provides a means for U detn. which offers advantages possessed by few other analytical methods for any element. The analytical system in use at the Argonne National Lab. (April 1947) is described.

From an unknown soln. an aliquot of 0.005 to 0.1 ml is pipetted into a shallow Pt dish about 1.5 cm in diameter, and evapd. to dryness under a heat lamp. If a large residue of readily volatilizable or decomposable material remains, the sample in the dish is heated in a flame; only rarely is any other type of purification employed. To the dry residue in the dish approx. 0.3 g of NaF or NaF-Na₂CO₃

mixt. is added, and the salt is fused by holding the dish in the flame of a Meker burner or by mounting it on a gas stove. After cooling, the disk of fused salt, either still in the Pt dish or "tapped out" from the dish, is irradiated with light from the 365-m μ Hg line, and the yellow-green fluorescence is measured by a photoelectric fluorophotometer. From the reading obtained for the fluorescence of the sample, the av. value for the fluorescence of blanks is subtracted, and the difference is multiplied by a previously detd. calibration factor to give the amt. of U in the sample. If there is reason, because of the presence of color in the fused flux or from knowledge of the compn. of the soln. being analyzed, to suspect interference with the fluorescence, one can to a considerable degree remove this quenching by diln. by employing a smaller aliquot, or can correct for it by "spiking," by adding a known amt. of U to an identical aliquot in another dish. The useful range of the method is for a sample size of from about 10 to 0.0001 γ U; work below 0.001 γ requires great care in avoiding contamination. Usually analyses are run in duplicate; for routine work the std. error of the mean of the pair is generally below 10% except when the sensitivity is near its limit or when unusually large amts. of interfering substances are present, and by employing certain refinements in technique it is frequently possible to reduce the std. error to less than 5%. No element besides U has been shown to produce detectable fluorescence under the conditions recommended in this paper. Included also are a survey of work at other labs., sensitivity, accuracy of various expts., and detailed instructions for the analytical procedure.

3914 Price, T. "The Uranium Pile." Atomics 1, 99-106(1950).

This is a review of various phys. and engineering problems involved in the construction and operation of a U pile. Special topics discussed include the fission process, the reproductive cycle in a natural U pile, the choice of a moderator, elementary pile theory, delayed neutrons, the design of control rods, safety systems, and heat removal. Some remarks are devoted to piles constructed in Great Britain.

3915 Quill, L. L., ed. The Chemistry and Metallurgy of Miscellaneous Materials. New York, McGraw-Hill Book Company, Inc., 1950. 329p. (National Nuclear Energy Series, Division IV, Volume 19B)

The individual papers of interest have been abstracted separately. The papers included are listed below; all were declassified on Oct. 9, 1946. Paper 1. Investigations in the Liquid-Solid Equilibria of the Two-component Systems Composed of the Bromides and Iodides of Strontium and Barium. By E. D. Eastman, N. C. Melchoir, and A. E. Strickland, MDDC-438-A. Paper 2. Temperature-Composition Diagrams of Metal-Metal Halide Systems. By E. D. Eastman, D. D. Cubicciotti, and C. D. Thurmond, MDDC-438-B. Paper 3. The Thermodynamic and Physical Properties of the Elements. By L. Brewer, MDDC-438-C. Paper 4. Thermodynamic and Physical Properties of Nitrides, Carbides, Sulfides, Silicides, and Phosphides. By L. Brewer, L. A. Bromley, P. W. Gilles, and N. L. Lofgren, MDDC-438-D. Paper 5. The Thermodynamic Properties of Common Gases. By L. Brewer, MDDC-438-E. Paper 6. The Thermodynamic Properties of the Halides. By L. Brewer, L. A. Bromley, P. W. Gilles, and N. L. Lofgren, MDDC-438-F. Paper 7. The Fusion and Vaporization Data of the Halides. By L. Brewer, MDDC-438-G. Paper 8. The Thermodynamic Properties of Molybdenum and Tungsten Halides and the Use of These Metals as Refractories. By L. Brewer, L. A. Bromley, P. W. Gilles, and N. L. Lofgren, MDDC-438-H. Paper 9. The Heats of Formation of CeS, C₃S₄, and Ce₂S₃ at 25°C. By M. W. Evans, MDDC-438-I. Paper 10. The Heat of Reaction of the Cerous-Ceric Couple in 0.5 Molal Perchloric Acid at 25°C. By B. J. Fontana, MDDC-438-J.

3916 Radioactivity Division, Mines Branch. Analysis of Uranium in Ores by Geiger Methods. Ottawa, Department of Mines and Technical Surveys, Mar. 10, 1950. 13p. (AEC File No. NP-1601)

Detns. of U in ores may be made by measurement of the radioactivity of these ores. (a) The most commonly used method is that of measuring β radiations with the trap-type β counter. This will give an accurate U detn. providing the sample does not contain Th and that the β and γ activities have not been disturbed from their natural state of equil. Such a loss of equil. will result from milling the ore or from the weathering of the surface rock. (b) A method is described which corrects for errors which would otherwise exist due to loss of equil. The β and γ activities are measured simultaneously in one

simple operation. This method is recommended for assaying samples resulting from milling operations and is limited only by the presence of Th in a ratio greater than 1 part of Th to 20 parts of U. (c) A third method is recommended for the analysis of exploration samples and diamond-drill cores, which may be assayed in the uncrushed state. Rapid detn. of a large no. of samples is possible with the pressure ionization chamber which is sensitive to γ activity.

3917 Radioactivity Division, Mines Branch, Department of Mines and Technical Surveys. "Analysis of Uranium Ores by Geiger Methods." Can. Mining Met. Bull. No. 460, 461-4(1950).

This paper contains information similar to that in report AEC File No. NP-1601(1950).

3918 Radioactivity Division, Mines Branch. Concentration and Extraction of Uranium from Several Types of Canadian Ores. Ottawa, Department of Mines and Technical Surveys, Mar. 3, 1950. 26p. (AEC File No. NP-1599)

This paper is intended as an interim report on some of the test work that has been carried out at the Mines Branch on the economical extrn. of U from ores, including low-grade ores. This line of research is new, and no claim is made to an answer to the treatment of all ores. For some ores the problem is simple, but for others a more extensive study is required. The work on leaching of Canadian ores has only recently, within the last yr, been able to proceed at a satisfactory rate. The difficulties in accurate and rapid analysis for U have previously retarded the progress. The research labs. in the U.K. and U.S.A. have made tremendous strides in the last 2 yr in the field of chem. analysis of U, but Canadian labs. have also made worth-while contributions in adopting these methods to the complex Canadian ores. In the field of phys. analysis for U, Canadian research has shown important results. Such analyses are entirely adequate for testwork on gravity concn. and flotation. The economic possibilities of the amazing no. of new U discoveries that have been made in the last year or two are mentioned. U can be extrd. from all ores by relatively simple processes, but the usual factors of operating costs and ore reserves must be closely examined in order to arrive at a sound est.

3919 Radioactivity Division, Mines Branch, Department of Mines and Technical Surveys. "Concentration and Extraction of Uranium from Several Types of Canadian Ores." Can. Mining Met. Bull. No. 460, 454-60(1950).

This paper contains information similar to that in report AEC File No. NP-1599(1950).

3920 "Radioactivity in Ontario." Mining Mag. 83, 61-2(1950)

This is a review of a preliminary report (P. R. 1950-5) from the Ontario Department of Mines by E. W. Nuffield. The discussion in the report indicates that diabase dikes are the best prospecting possibilities. In the areas covered by overburden the dikes can often be traced both on the ground, with the aid of aerial photographs, as shallow valleys or by the persistence of prominent granite faces. Magnetometer surveys to locate dikes will prove useful except in areas of granite that contain large nos. of pre-Algonian inclusions. The pitchblende type of radioactive deposit in the area differs from the granite type with respect to age, method of formation, mineral compn., and economic interest. At the present time the pitchblende deposits offer the better prospecting possibilities.

3921 Rasin-Streden, R. "A Rapid Determination of Uranium." Anal. Chim. Acta 4, 94-106(1950). A photometric method for the detn. of U has been described, based on a reaction published by Hackl (Z. anal. Chem. 119, 321(1940)), i.e., the yellow coloration given to a soln. of $(\text{UO}_2)^{++}$ in an excess of Na_2CO_3 by H_2O_2 . The conditions and properties of this coloration have been investigated; the coloration complies with Beer's law and is not interfered with generally, except by V, appreciably large amts. of Cr, and a bulk of Al, which involve a change of the procedure. This photometric method has been examined thoroughly for more than 2 yr and a great number of samples have been analyzed. The results closely checked those obtained by gravimetric analyses. The method covers a wide range (from 0.2 up to 85% U_3O_8), the av. error is not exceeding 2 or 3%. An outstanding feature is the versatility and simplicity of performance and the short time (20 to 90 min) required, which make it especially suitable for routine analyses.

3922 Ravits, B. "American Uranium. Government Support Spurs Interest in Domestic Exploration." Barron's Weekly 30, 11(1950)Nov. 20.

3923 Ravits, B. "Uranium Find. New Canadian Pitchblende Deposits Strategically Significant." Barron's Weekly 30, 5(1950)Aug. 28.

3924 Robinson, R. F. "Uraninite in the Coeur d'Alene District, Idaho." Econ. Geol. 45, 818-19 (1950).

This is a discussion of previous papers by Thurlow and Wright(1950), and Ransome and Calkins(1908). Disagreement with statements on the occurrence of uraninite, or U, in various strata of the Sunshine Area is indicated. The occurrence with high Ag ore is discussed.

3925 Rodden, C. J., ed. Analytical Chemistry of the Manhattan Project. New York, McGraw-Hill Book Company, Inc., 1950. 748p. (National Nuclear Energy Series, Division VIII, Volume 1) The appropriate individual chapters of this book have, for the most part, been listed separately under the appropriate report number. The table of contents follows: Chap. 1, "Uranium" by C. J. Rodden and J. C. Warf, no report number; Chap. 2, "Thorium" by C. J. Rodden and J. C. Warf, AECD-2701 (1949); Chap. 3, "Nitrogen" by K. J. Jensen and R. J. Mundy, MDDC-572(1946); Chap. 4, "Silicon" by K. J. Jensen and C. J. Rodden, MDDC-1373(1949); Chap. 5, "Fluorine and Fluorocarbons" by G. W. Busch, R. C. Carter, F. E. McKenna, H. F. Priest, and E. Staple, AECD-2604(1949); Chap. 6, "Carbon, Hydrogen, and Oxygen" by C. J. Rodden, MDDC-581(1946); Chap. 7, "Chlorine, Bromine, and Iodine" by R. G. Mansfield and D. H. Templeton, AECD-2607(1949); Chap. 8, "Sulfur, Selenium, and Tellurium" by F. E. McKenna and D. H. Templeton, MDDC-1379(1949); Chap. 9, "Phosphorus, Arsenic, Antimony, and Bismuth" by D. H. Templeton and L. G. Bassett, MDDC-1389(1949); Chap. 10, "Sodium, Potassium, Rubidium, and Cesium" by L. G. Bassett and W. Byerley, MDDC-1132(1947); Chap. 11, "Beryllium, Magnesium, Calcium, Strontium, Barium, and Radium" by L. W. Neidrach, A. M. Mitchell, and C. J. Rodden, AECD-2159(1948); Chap. 12, "Germanium, Tin, and Lead" by R. E. Telford and N. H. Furman, AECD-2612(1949); Chap. 13, "Aluminum, Gallium, Indium, and Thallium" by L. G. Bassett and F. S. Tomkins, AECD-2599(1949); Chap. 14, "Zinc, Cadmium, and Mercury" by N. H. Furman and K. J. Jensen, MDDC-755(1947); Chap. 15, "Copper, Silver, and Gold" by T. D. Price and R. E. Telford, MDDC-372(1946); Chap. 16, "Iron, Cobalt, and Nickel" by R. W. Bane and W. R. Grimes, MDDC-596 (1947); Chap. 17, "Manganese, Technetium, and Rhenium" by R. W. Bane and C. J. Rodden, MDDC-482(1946); Chap. 18, "Chromium, Molybdenum, and Tungsten" by K. J. Jensen and B. Weaver, MDDC-492(1946); Chap. 19, "Vanadium, Columbium, and Tantalum" by S. W. Rasmussen and C. J. Rodden, MDDC-373(1946); Chap. 20, "Titanium, Zirconium, and Hafnium" by R. L. Barnard and R. E. Telford, MDDC-483(1946); Chap. 21, "The Platinum Metals" by G. W. Cressman and C. J. Rodden, MDDC-369 (1949); Chap. 22, "Scandium, Yttrium, and the Rare Earths" by L. L. Quill and C. J. Rodden, AECD-2618(1949); Chap. 23, "Electrolytic Separation Methods" by C. C. Casto, AECD-2617(1949); Chap. 24, "Photometric Methods" by M. Fred and C. J. Rodden, MDDC-751(1949); Chap. 25, "Electrometric Methods" by N. H. Furman and J. I. Watters, AECD-2623(1949); Chap. 26, "Spectrochemical Methods" by M. Fred and B. F. Scribner, MDDC-752(1947); Chap. 27, "Low-pressure Methods" by D. H. Templeton and J. I. Watters, AECD-2522(1949); Chap. 28, "Radiochemical Analytical Methods" by G. E. Boyd and D. N. Hume, MDDC-365(1946); and Chap. 29, "Other Methods" by J. Schubert, F. E. McKenna, L. L. Quill, and J. C. Warf, AECD-2676(1949).

3926 Rosen, L. and Hudson, A. M. "Symmetrical Tripartition of U^{235} by Thermal Neutrons." Phys. Rev. (2), 78, 533-8(1950).

This paper is similar to report AECD-2725(1949).

3927 Rosen, R. — assigned to U. S. Atomic Energy Commission. The Electrolytic Production of Metallic Uranium. Aug. 22, 1950. (U. S. Patent 2,519,792)

This patent covers a process for producing metallic U by electrolyzing UF_4 at an elevated temp. in a fused bath consisting essentially of mixed alk. and alk. earth halides.

3928 Rosenblum, S. "Radioactive Intensifying of Spectral Lines." Compt. rend. 230, 1766-7(1950). It is known that U salts are used in photography as intensifiers of the darkening. Since U is radioactive, a film so intensified can be used for the reproduction of the photograph by applying the film against a photographic plate sensitive to α rays. Unfortunately, owing to the weak radioactivity of U such reproductions require very long exposures (days and mos.). The authors added 10 to 15 γ Pu (as nitrate) to an intensifying soln. contg. 10 mg uranyl nitrate. Tests were made with photographs of a strong spectral line of Pb^{212} and of 3 lines of Ac. Good reproductions were obtained in a few hr. The authors think that β emitters could probably be used for the same purpose, and that a photometry of α - or β -intensified photographs, utilizing counters or track-counting, could be devised.

3929 Rothstein, A., Frenkel, A., and Larrabee, C. Isotope Techniques for Determining the Uranium Content of Biological Materials. May 9, 1949. Declassified Apr. 6, 1950. 25p. (AECD-2815)

The radiometric technique for U analysis, with modifications, can be applied to biol. materials. The sensitivity depends on the degree of enrichment of the U sample with U^{233} or U^{234} . For natural U the limiting sensitivity is 5 γ . In the present work the limiting sensitivity for a natural U sample enriched 1/200 with U^{233} was about 0.1 γ . This is not quite so sensitive as the photofluorometric method. Recoveries of stds. contg. 0.1 to 10 γ averaged 93%, with better recoveries associated with larger initial quantities of U. The limit on sensitivity of 0.1 γ is imposed by the α activity of the sample, rather than the electroplating technique. With pure U^{233} , the limit of sensitivity could be as low as 0.00035 γ , if such quantities could be quantitatively electroplated. No attempts were made in the present study to evaluate plating effs. for amts. of U below 0.1 γ . Std., solns. contg. little org. matter or salts, particularly Ca and phosphate (including some urines), can be directly plated without any prior treatment because the technique is insensitive to low concns. of contaminants. This is a distinct advantage. Soft tissues, feces, and urines with a high Ca content, phosphate, and org. material must be ashed prior to plating, but usually require no isolation of the U. The recoveries are not so high as in the case of stds., but are satisfactory. Hard tissues, and in some cases, soft tissues, require both ashing and isolation. Copptn. with Ca phosphate, followed by extrn. with ether-acetone mixts. has proved satisfactory. Total carcass recoveries from rats ranged from 75 to 105%, following administration of 94 to 200 γ of U. More than half of the dose was excreted in the urine. The excretion data by this technique were consistent with those obtained by other methods. This technique requires considerable care on the part of the user if erratic data are to be avoided. 11 references are included.

3930 Rothstein, A., Meier, R., and Larrabee, C. The Relationship of the Cell Surface to Metabolism. The Chemical Nature of Uranium-Complexing Groups of the Cell Surface. May 18, 1950. Declassified Aug. 1, 1950. 50p. (AECD-2886)

$(UO_2)^{++}$ forms complexes with a large variety of substances of biol. interest. These can be grouped into two large classes, the org. acids and the phosphorylated cpds. In addn. certain hydroxyl groups can contribute to the stability of the complexes. The stability of the U complexes varies widely at pH = 3.5. The least stable complexes are formed by substances such as fructose and mannose which have two hydroxyl groups in the 2 and 3 position in the cis position. In the case of the org. acids, the monocarboxylic acids such as acetate are relatively unstable, whereas the dicarboxylic acids (maleic) and tricarboxylic (citrate) are relatively more stable. The proteins (albumins) owe their complex ion action to free carboxyl groups plus accessory groups and possibly to the phosphate ion. The stability of the protein complexes is at least as high or higher, depending on the method of calcn., as that of the citrate complex. Among the phosphate cpds., orthophosphate and phosphate esters form moderately stable complexes. Phosphate polymers such as pyro- and triphosphate, adenosine triphosphate, and polymerized desoxyribonucleic acid form very stable complexes. Higher polymers of phosphate, such as hexametaphosphate, and high mol.-wt. polymer form the most stable complexes of any of the substances tested. In the presence of an excess of complexing agent, the mole ratio of U to agent is 1:1 except in the case of orthophosphate and glycerophosphate in which the ratio is 1:3, indicating an anionic complex. In the presence of an excess of U, complexes with a higher % U can be formed. In the case of egg albumin each mol. can take up 8 mols. of U, compared to 16 for serum albumin. Pyrophosphate, tripolyphosphate, and adenosine triphosphate can each take up 2 mols. of U.

Hexametaphosphate forms a complex with a ratio of P:U of 3:1 and the high mol.-wt. polymer and desoxyribonucleic acid, 4:1. The U complexes with the higher polymers of phosphate have similar properties of stability (dissozn. const.) and mole ratio (1:1) to that with the cell-surface loci of yeast. The other substances tested form much less stable complexes. Other bivalent cations such as Ba^{++} , Ca^{++} , Be^{++} , Mg^{++} , and Zn^{++} can compete with $(\text{UO}_2)^{++}$ for the cell-surface loci. Na^+ and K^+ do not. The data presented are consistent with the hypothesis that $(\text{UO}_2)^{++}$ inhibits sugar metabolism by forming relatively undissocd. complexes with polyphosphates (possibly replacing Ca^{++} or Mg^{++}) which are necessary for the phosphorylation of sugar at the surface of the cell. The phosphorylation system is presumably part of a mechanism for the active transport of sugars into the cell. 40 references are given.

3931 Rowe, E. H. "Uranium as a Metallographic Aid." Metal Progress 57, 336(1950).
U has been substituted for Cr in electron microscope work for "shadow casting." In this technique a very thin metal layer is desirable in order to keep the distortion to a min. The high at. no. and great d. of U has been found to be the best material for this job.

3932 Schramm, C. H., Gordon, P., and Kaufmann, A. R. "The Alloy Systems Uranium-Tungsten, Uranium-Tantalum, and Tungsten-Tantalum." J. Metals (N. Y.) 188, 195-204(1950).
This paper is similar to report AECD-2686(1949).

3933 Scott, J. M. C. and Titterton, E. W. Search for the Negative Proton in Fission. May 1950. 4p. (AERE-G/M-51)
The possibility of neg. proton emission in fission, as an alternative to β^- and delayed neutron emission, is discussed theoretically, and an analogy is made with positrons by applying Dirac's equation of the electron to the proton (even though the Dirac equation does not give the proper magnetic moment for the proton). The probability of finding tracks associated with neg. protons in emulsions impregnated with U and bombarded with slow neutrons is estd. A search for neg. protons in these emulsions led to the conclusion that neg. proton emission in fission is an extremely improbable process. Accepting 0.8% (Hughes et al., Phys. Rev.(2), 73, 111(1948)) as the yield of delayed neutron emitters in the slow neutron fission of U^{235} the expt. alloys an upper limit of 1 in 5×10^3 to the probability of neg. proton emission relative to delayed neutron emission from these fragments.

3934 Scott, J. M. C. and Titterton, E. W. "Search for the Negative Proton in Fission." Phil Mag. (7), 41, 918-20(1950).
This paper is similar to report AERE-G/M-51(1950).

3935 Scott, T. R. "The Effect of Bicarbonate on the Colorimetric Determination of Uranium." Analyst 75, 100-04(1950).
When peruranate colors are to be developed in Na_2CO_3 solns. in the H_2O_2 method of detg. U, the presence of bicarbonate in the soln. causes errors. Their magnitude and means of avoiding them are considered. They may be eliminated by conducting the preliminary neutralization of the soln. with NaOH and measuring the peruranate color within a few hr of making the soln. alk. with Na_2CO_3 . If readings are made at 445 $\text{m}\mu$, no error occurs even in presence of bicarbonate, but the sensitivity is much less than at 360 $\text{m}\mu$. The decrease in color at this lower wavelength is attributed to the conversion of higher to lower peruranates, the latter increasing in amt. as the pH of the solns. is decreased.

3936 Secoy, C. H. "The System Uranyl Sulfate-Water. Part II. Temperature-Concentration Relationships above 250°C." J. Am. Chem. Soc. 73, 3343-5(1950).
This paper is similar to report AECD-2265(1948).

3937 "The Separation of Uranium. Mineral Technique Developed by the Chemical Research Laboratory." Chem. Age (London) 63, 648-50(1950).

- 3938 Shea, J. F., Stephens, F., and Richardson, A. C. A Proposed Routine Method for Determining Uranium in Leach Liquors Containing Vanadium. Feb. 15, 1949. Declassified Mar. 15, 1950. 17p. (AECD-2838)

A method is described to shorten the time of analysis of U by eliminating either one or both of the pptn. steps used to free the U from V, depending on the amt. of V present. The procedure consists in reducing the U by means of Bi-Hg and titrating the reduced soln. with std. V^{+5} soln. in slight excess and detg. the excess by back titration with std. Fe^{++} soln. If the amalgam is reused, reduction of the U takes a little longer. However, the controlling factor seemed to be the thoroughness with which the amalgam is dispersed into globules by shaking. The accuracy of the method decreases if V is present in high proportions. 11 references are given.

- 3939 Sheft, I., Fried, S., and Davidson, N. "Preparation of Uranium Trioxide." J. Am. Chem. Soc. **72**, 2172-3(1950).

The method for the prepn. of UO_3 described here is considered to be superior to those commonly used because the purity of the product is dependent only on the purity of the original U_3O_8 , which should be high for good results, and the product is obtained in 100% yield. The O_2 is dried and purified during the liquefaction so that this presents no problem, while U_3O_8 is generally obtained sufficiently pure. Within wide limits the temp. at which the reaction is run is not crit. The upper temp. limit, however, is important. Expts. run at 750° yielded oxides intermediate between U_3O_8 and UO_3 . Even at 750° , however, UO_3 can be prepd. by going to pressures over 400 psi. Preps. made at temps. as low as 550° also yielded UO_3 , but required somewhat longer time for complete reaction.

- 3940 Smith, G. H. and Williams, A. F. A Rapid Semimicro Procedure for the Determination of Uranium in Minerals and Ores by Extraction Methods. January 1950. 10p. (CRL/AE-46)

A semimicro procedure is described for the detn. of U in minerals, ores, and other products with particular application to materials contg. 0.02 to 1.5% U_3O_8 . In this method, a 0.05- to 0.01-g sample is fused with KOH, and the melt is treated with HNO_3 , evapd., and extd. with Et_2O contg. 5% HNO_3 . The solvent extr. is passed through a small column contg. cellulose and alumina and the U in the eluent is detd. by colorimetric or polarographic procedures. The method is rapid, reasonably accurate ($\pm 6\%$), and well suited to routine detns. on a variety of ores.

- 3941 Soye, C. "On the Formation of the Complex $[(NO_3)_2UO_2C_5H_{15}O_2]_n$." Compt. rend. **251**, 349-50(1950).

This paper contains a study of the variation of pH in solns. of $UO_2(NO_3)_2$ at various dilns. A similar study with choline in the soln. is also reported, and hence, information on the complex between choline and uranyl nitrate.

- 3942 Spice, E. B. "Possibilities and Limitations of Gravity Concentration as Applied to Pitchblende Ores at Port Radium, N. W. T." Can. Mining. Met. Bull. No. 460, 446-9(1950).

In general, it may be said that when the pitchblende occurs free, to a large extent, from sulfides, or arsenides of high specific gravity, and when the bulk of the pitchblende is localized rather than disseminated, excellent recoveries, high ratios of concn., and good grades of concs., will result from proper gravity concn. On the other hand, if the ore contains pitchblende intimately or otherwise mixed with large quantities of arsenides or sulfides, or if the pitchblende is finely disseminated, gravity concn. alone will yield high recoveries only at the expense of very low-grade concs. and low ratios of concn. Due to the rarity of occurrences of economic deposits of pitchblende, it is not likely that the milling of pitchblende ores will ever be an important part of the ore-dressing field.

- 3943 Srinivasan, N. R. "Uranium Minerals of India." Current Sci. (India) **19**, 141-2(1950).

The various U minerals are listed and a brief remark is made as to the occurrence of each in India. A note on p. 145 of the same issue announces rewards by the Indian Government for discoveries of U and Be.

- 3944 Stead, F. W. "Airborne Radioactivity Surveying Speeds Uranium Prospecting." Eng. Mining J. 151, 74-7(1950)Sept.

- 3945 Stevenson, J. S. "Some Notes on Uranium in British Columbia." Can. Mining Met. Bull. No. 460, 434-5(1950).

Where U-bearing veins have been found in British Columbia, the U mineral is the cryst. variety of U oxide, uraninite, rather than the massive, noncryst. variety, pitchblende, such as is found in the Great Bear Lake deposit and in other similar deposits along the southwestern margin of the Pre-Cambrian shield. The principal occurrences of U known so far in British Columbia are associated with bodies of granodiorite and quartz diorite along the eastern side of the Coast Range belt of batholiths. In this part of the province, interesting amts. of U occur on the Gem property in the Bridge River area and on the Victoria property south of Hazelton; and smaller amts. occur on the Red Rose, Rocher Déboulé, Delta, and Ohio properties, also south of Hazelton. At the Gem and the Victoria, the U mineral, identified as uraninite, occurs in deposits that also contain abundant Co-Ni sulfarsenides, and molybdenite. At these properties, the uraninite occurs as clusters of small black crystals of submetallic luster that may be seen upon careful searching of a highly radioactive specimen with a hand lens.

- 3946 Stukenbroeker, G. L. and McNally, J. R. Jr. Preliminary Results on the Spin of U²³⁵. Dec. 2, 1949. Declassified Jan. 19, 1950. 5p. (AECD-2797)

Preliminary spectroscopic studies on U enriched in U²³⁵ indicate a nuclear spin of 5/2.

- 3947 Suits, C. G. "Development of Useful Power from Nuclear Fission." Elec. Eng. 69, 523-8 (1950).

The author discusses, in nontechnical terms, the fission process resulting from neutron capture in U²³⁵ and the conditions under which this process may produce a stable and continuous release of energy. He then describes the other types of reactions essential to the operation of breeder piles and possible methods for utilizing commercially the heat generated in U piles, treating such problems as health hazards to personnel and to the surrounding community.

- 3948 Sun, K. H., Charpie, R. A., Pecjak, F. A., and Jennings, B. Delayed Neutrons from U²³⁸ and Th²³² Fission. [1950]. 12p. (AEC-File No. NP-1464; Westinghouse Research Laboratories Scientific Paper No. 1498)

The half-lives of the delayed neutron emitters from U²³⁸ and Th²³² fission were found to be 0.4, 1.7, 5.8, 22.6, and 55.2 and 0.41, 1.4, 4.4, 20, and 56 sec, resp., by using fast neutrons from the reaction of 15-mev cyclotron deuterons on a thick carbon target. These, when compared with those from the slow neutron fission of Pu²³⁹ and U²³⁵, indicate that delayed neutron emitters from fission of Pu²³⁹, U²³⁵, U²³⁸, and Th²³² are identical. The delayed neutron yield after satn. bombardment was about 8/100 fissions. A preliminary survey indicated that the 22- and 56-sec half-lives were also present when LiF or B₄C instead of C was used as the cyclotron target for producing faster neutrons.

- 3949 Sundberg, I. and Sillén, L. G. "On the Crystal Structure of KUO₂VO₄ (Synthetic Anhydrous Carnotite)." Arkiv Kemi 1, 337-51(1950).

The 2 important U ores, the vanadate carnotite (Colorado and Utah) and tyuyamunite (East Turkestan) have the accepted compn. K(UO₂)VO₄(H₂O)_{1.5} and Ca_{0.5}(UO₂)VO₄·(H₂O)₂, resp.; however, the H₂O content may vary, and K and Ca ions may partially replace each other. The authors established the crystal structure of a synthetic anhyd. carnotite K(UO₂)VO₄, prepd. by melting together K₂CO₃, V₂O₅, and UO₂(NO₃)₂. The x-ray analysis of the yellow monoclinic plates resulted in the following interpretation of the crystal structure: (VO₄)⁻³ tetrahedra, intermingled with linear (UO₂)⁺⁺ groups, form together layers of (UO₂VO₄)⁻; these are sepd. by sheets of K⁺. It seems probable that the same fundamental scheme underlies the structure of natural carnotite.

3950 "Symposium on Uranium." Can. Mining Met. Bull. No. 460, 424-68(1950).

This symposium was presented at the annual general meeting of the Mining Society of Nova Scotia. The papers appropriate to this bibliography have been included as individual references.

3951 Templeton, C. C. and Hall, N. F. "On the Solubility of Thorium Nitrate Tetrahydrate and Uranyl Nitrate Hexahydrate in Organic Solvents." Can. J. Research B. 28, 156-60(1950).

The values reported by Yaffe for the solys. of $\text{Th}(\text{NO}_3)_4 \cdot 4\text{H}_2\text{O}$ and $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ in various org. solvents are compared with those previously reported by Templeton and Hall, the former having been much lower than the latter. Some of the accessory expts. of the latter authors are presented in support of the position that their values more closely correspond to equil. than the values of Yaffe. The method is described. The results are presented in a graph of the $\text{Th}(\text{NO}_3)_4 \cdot 4\text{H}_2\text{O}$ soly. plotted against the no. of days of agitation for ethyl butyrate, isoamyl alc., and propiophenone used as solvents, and in a table of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ soly. in isoamyl alc., methyl-n-hexyl ketone, and ethyl butyrate, detd. after agitation of the solns. for 5 days at 25°C.

3952 Thomas, H. C. and Tomcufcik, A. S. — assigned to U. S. Atomic Energy Commission. Treatment of Pitchblende Ores. May 9, 1950. (U. S. Patent 2,506,945)

A process for recovering Ra and U from pitchblende ores comprising comminuting the ore, reacting with HNO_3 contg. as an additive NH_4NO_3 , NaNO_3 , or a mixt. of the two, adding H_2SO_4 to the sepd. soln. to ppt. insol. sulfate, and sepg. the Ra contg. ppt. from the U-contg. soln. is described in this patent.

3953 Thurlow, E. E. and Wright, R. J. "Uraninite in the Coeur d'Alene District, Idaho." Econ. Geol. 45, 395-404(1950).

3954 Tucker, C. W. Jr. "An Approximate Crystal Structure for the Beta Phase of Uranium." Science 112, 448(1950).

This is an abstract of a paper delivered at the Oct. 9 to 12, 1950, meeting of the National Academy of Sciences, in Schenectady, N. Y. It is reproduced below essentially in its entirety. An approx. crystal structure for the β phase of U metal (stable between 660 and 760°) has been deduced from x-ray diffraction measurements made on single crystals retained in an alloy contg. 1.4 at. % Cr and rapidly cooled from approx. 720°C. The diffraction data and other measurements show that the unit cell of the β phase is tetragonal with $a_0 = b_0 = 10.52$ A, $c_0 = 5.57$ A, and contains 30 atoms. Of the 3 possible space groups (D_{4h}^{14} , C_{4v}^4 , and D_{2d}^8), D_{4h}^{14} appears definitely excluded; of the remaining two, C_{4v}^4 , thus far, appears to account adequately for the diffraction intensities. Approx. positions of the 30 atoms in the unit cell have been deduced using the Patterson and Patterson-Harker F^2 syntheses and the Fourier electron d. synthesis. The structure of the β phase is a layer structure, with the layers being parallel to the a_0b_0 plane of the unit cell at $1/4 c_0$ and $3/4 c_0$. Approx. midway between the layers are atoms that are linked to the atoms in the adjacent layers but not to each other. The layers are quite closely related to those found in the base planes of the familiar hexagonal close-packed structure except that atoms at the center of certain hexagons are displaced normal to the layers to form the set of atoms found midway between the layers. The low symmetry and complexity of the structure account for the hard, brittle nature of the phase. The interrelations between the α , β , and γ phases of the metal are clear from the β -phase crystal structure, but the precise mechanism of the transformations has not yet been studied.

3955 "Uranium Ore in North Wales." Chemical Trade J. 127, 576(1950).

A deposit of U, said to be the richest in the British Isles, was found in North Wales. A report is being prepd. for the British Government by the Geological Survey Team.

3956 Walsh, A. "Spectrographic Analysis of Uranium." Spectrochim. Acta 4, No. 1, 47-56(1950).

A tentative method for the spectrographic detn. of impurities in U has been developed (1945) using an "arc-like" discharge between metal electrodes, and an est. is made of the degree of accuracy and sensitivity obtainable. All the quant. data so far available are limited to the detn. of Fe, Si, Mn, Cu,

and Ni, but it is anticipated that the technique described will be applicable to other impurities. Suggestions are made for further improvement of the method.

- 3957 Wamser, C. A., Belle, J., Bernsohn, E., and Williamson, B. The Constitution of the Uranates of Sodium. Declassified Aug. 2, 1950. 11p. (AECD-2933)

Chem. and x-ray diffraction analyses and the interpretation of pH and cond. data indicate that two uranates, $\text{Na}_2\text{U}_7\text{O}_{22}$ and $\text{Na}_6\text{U}_7\text{O}_{24}$ (or mixts. thereof) are obtained in the pptn. of uranate with NaOH from $\text{UO}_2(\text{NO}_3)_2$ soln.

- 3958 Warf, J. C. Chemical Properties of Uranium Hydride. Sept. 29, 1949. Declassified Nov. 6, 1950. 115p. (AECD-2997)

Pure U metal reacts rapidly with H_2 at 250°C yielding a fine, black, pyrophoric powder of the hydride. Analysis shows a compn. corresponding to the formula $\text{UH}_{2.97}$, but when the effects of impurities in the metal are taken into account, the formula of the cpd. formed is shown to be UH_3 . Deuterium reacts in the same manner, forming UD_3 . UH_3 is also formed by the action of steam, or of certain org. cpds., such as tetralin, on U. The phys. and thermodynamic properties, x-ray analysis, and the chem. compn. of UH_3 indicate that it is not a solid soln. or interstitial cpd. UH_3 may be thermally decompd. yielding U metal powder which is exceedingly reactive. The general chem. properties of UH_3 are those of a strong reducing agent; it readily reacts with oxidizing agents of all types, as well as certain org. cpds. Some reactions in aq. medium serve to prep. uranyl salts. UH_3 reacts with a wide variety of gases, yielding in certain cases U cpds. difficult to prep. by other means. The techniques are simple and are recommended prepn. methods. U metal or its hydride or certain cpds. prepd. from it are conveniently employed in the purification of several lab. gases. By mixing the finely subdivided UH_3 with other substances also in the form of a fine powder and heating, the hydride is decompd., leaving U powder intimately mixed with the other substance, with which it may react on stronger heating. When C black in the proper proportion is used, UC is formed. Employing this technique with UF_4 caused its reduction to UF_3 , previously unknown. UF_3 is a black, cokelike solid. UH_3 readily forms "amalgams"; the evidence shows that the preps. are not true solns. in Hg or true amalgams, but suspensions. The amalgams vary in consistency from a fluid through a semisolid to a dark solid, as the UH_3 concn. is raised. Air, H_2O or H_2S serves to cause the hydride to ppt. from its amalgam. Several applications of UH_3 and the hydride reactions are lab. source of pure H_2 or D_2 , prepn. or powd. U; prepn. of U cpds.; isolation of intermetallic cpds. of U; etching metallographic specimens; maintaining a given H_2 or D_2 pressure; and analysis of metallic U for the free element. Many references are given.

- 3959 Watt, G. W., Achorn, S. L., and Marley, J. L. "Some Chemical and Physical Properties of Uranium Peroxide." J. Am. Chem. Soc. 72, 3341-3(1950).

Two different cryst. forms of $\text{UO}_4 \cdot 2\text{H}_2\text{O}$ are formed by the reaction between excess $\text{UO}_2(\text{NO}_3)_2$ and H_2O_2 and between $\text{UO}_2(\text{NO}_3)_2$ and excess H_2O_2 . The U-U distance is the same in both types of crystal. The pptn. of U as the $\text{UO}_4 \cdot 2\text{H}_2\text{O}$ is substantially quant. at pH = 2.5 and 3.5. The product obtained at an initial pH = 4.5 (following addn. of NH_4OH) consists of $\text{UO}_4 \cdot 2\text{H}_2\text{O}$, $(\text{NH}_4)_2\text{U}_2\text{O}_7$, and at least one other cryst. solid. At pH ≤ 1 , $\text{UO}_4 \cdot 2\text{H}_2\text{O}$ and at least one additional cryst. product are formed. $\text{UO}_4 \cdot 2\text{H}_2\text{O}$ is dissolved without gas evolution by aq. solns. of sulfites to form an intensely yellow soln. and (under appropriate conditions of concn.) a similarly colored solid which is apparently a mixt. The sol. product responsible for the color of the soln. has been shown to consist of uranyl sulfite, which has not been reported previously. 14 references are given.

- 3960 Watt, G. W., Jenkins, W. A. Jr., and McCuiston, J. M. "Reactions of Some Thorium and Uranium Compounds in Liquid Ammonia." J. Am. Chem. Soc. 72, 2260-2(1950).

$\text{Th}(\text{NO}_3)_4 \cdot 4\text{H}_2\text{O}$ reacts with liq. NH_3 at -33.5° to form NH_4NO_3 and, probably, hydrated Th^{+4} oxide. The ammonolysis of Th^{+4} sulfate by liq. NH_3 at -33.5° yields $(\text{NH}_4)_2\text{SO}_4$ and other products believed to be basic sulfates of Th. The solys. of Th^{+4} iodate and $\text{Th}(\text{C}_2\text{O}_4)_2 \cdot 2\text{H}_2\text{O}$ in liq. NH_3 at 25° have been measured. These salts are unreactive toward liq. NH_3 at 25° and at -33.5° . $\text{UO}_4 \cdot 2\text{H}_2\text{O}$ does not react

with liq. NH_3 or with liq. NH_3 solns. of ammonia bromide at -33.5° . The peroxide reacts with potassium amide to form $\text{K}_2\text{U}_2\text{O}_7$, but is only slowly reduced by solns. of K. 6- and 2-hydrates of $\text{UO}_2(\text{NO}_3)_2$ react with liq. NH_3 at -33.5° to form $(\text{NH}_4)_2\text{U}_2\text{O}_7$, e.g., $2\text{UO}_2(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O} + 6\text{NH}_3 \rightarrow (\text{NH}_4)_2\text{U}_2\text{O}_7 + 4\text{NH}_4\text{NO}_3 + \text{H}_2\text{O}$. UCl_3 , UCl_4 , UBr_3 , and UBr_4 are ammonolyzed by liq. NH_3 at -33.5° , and the resulting ammonolysis products are not reduced to elemental U by solns. of K. The prepn. of $\text{UO}_2(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O} \cdot 3\text{NH}_3$ is described.

- 3961 Watt, G. W. and Machel, A. R. "Coordination Compounds of Uranyl Nitrate." J. Am. Chem. Soc. **72**, 2801(1950).

This article describes an attempt at prepg. anhyd. $\text{UO}_2(\text{NO}_3)_2$ by dissolving $\text{UO}_2(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}$ in anhyd. methyl isobutyl ketone. However, a monohexone solvate of uranyl nitrate was obtained. A short description is given of the method of prepg. other coordination cpds. of uranyl nitrate from $\text{UO}_2(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}$ by using (1) hexamethylenetetramine dissolved in Et_2O ; (2) excess ethylenediamine; and (3) ethylenediamine in the presence of $(\text{PO}_4)^{-3}$.

- 3962 Well, H. "Chromatographic Technology in Radioisotope Separation. Part II. Applications." Atomics **1**, 345-56(1950).

This is a survey of the applications of the technique of sepn. A section on Th and U is included along with sections on many other element pairs and groups including the transuranium group and the actinide and lanthanide series as such. A bibliography of over 100 references is included.

- 3963 Wexler, S. Sample Temperature in the Carrier-Distillation Arc. [1950]. 8p. (AECU-871) Sample temps. during arcing in the carrier-distn. procedure have been detd. by thermocouple and optical pyrometer methods. Synthetic U_3O_8 charges with added carrier show a steady-state range of 1300 to 1400°C, and about 1100°C without carrier.

- 3964 Wylie, A. W. "Composition of Some Australian Monazites." Australian J. Applied Sci. **1**, 164-71(1950).

The compn. of some Australian monazites has been detd. by spectrophotometric analysis and compared with that of monazite from other localities. The results show that natural fractionation processes cause only small variations in the relative abundance of the lighter lanthanons ("cerium-group" elements), which abundance falls within the range (total 100) La_2O_3 , 21 to 30; Ce_2O_3 , 43 to 48; Pr_2O_3 , 4.8 to 6.1; Nd_2O_3 , 18 to 24; Sm_2O_3 , 3.7 to 5.0. An approx. method is described for correcting for contamination of the heavier lanthanons ("yttrium-group" elements) with the lighter lanthanons in the fractional pptn. of the lanthanons with Na_2SO_4 .

- 3965 Yaffe, L. "Note on the Solubility of Thorium Nitrate Tetrahydrate and Uranyl Nitrate Hexahydrate in Organic Solvents." Can. J. Research B. **28**, 171(1950).

This is a note concerning the paper by Templeton and Hall (Can. J. Research B. **28**, 156(1950)) concerning the fact that the previous investigators were both attempting to establish general relationships between the solys. of the nitrates of heavier metals rather than attempting to establish definite solys.; the author comments that the establishment of abs. soly. necessitate the use of a very rigorous purification procedure which was not attempted in any way.

- 3966 Yasaki, T. and Miyatake, O. "A Note on Asymmetric Fission." Phys. Rev. (2), **79**, 740-1 (1950).

An investigation on the mechanism of fission has been carried out on the assumption that the nucleus consists of two concentric spherical parts of different charge ds., with uniform mass d. and a const. vol. for all distortions. The cpd. nucleus U^{236} is assumed to have 27 protons and 50 neutrons in its inner part (core), whose radius is 69% of that of the nucleus, and its outer part to consist of 65 protons and 94 neutrons. The charge d. is supposed to be uniform in each part. The greatest value for the total kinetic energy of fragments, sepd. by twice the radius of the cpd. nucleus, occurs when the ratio of their masses is 3:2. The existence of the core is effective when the excitation energy is low, but it

is less effective for high-energy excitation. Thus, symmetric fission becomes more favorable when heavy nuclei are bombarded by fast particles.

- 3967 Zalkin, A. and Templeton, D. H. The Crystal Structures of CeB₄, ThB₄, and UB₄. Nov. 22, 1949. Declassified Jan. 4, 1950. 4p. (AEC-2762)

The compounds CeB₄, ThB₄, and UB₄ have been shown to crystallize in a new structure, which has been worked out from x-ray-diffraction patterns. This structure is designated as the "ThB₄-type structure," since that was the cpd. first observed. These borides were prepd. by heating the metals and B together in vacuum at about 1500°C. Powder diffraction patterns were obtained of the 3 cpds. They were assigned formulas of the type MB₄, in agreement with the deduction, from the phases observed in various preps., that the compn. is between MB₂ and MB₆. (This paper is also available in J. Chem. Phys. 18, 391(1950).)

- 3968 Zalkin, A. and Templeton, D. H. "The Crystal Structures of CeB₄, ThB₄, and UB₄." J. Chem. Phys. 18, 391(1950).

This paper is similar to report AEC-2762(1950).

- 3969 Zimmer, E. "Preparation of Thin Films of Uranium Oxides for Radioactivity Measurements." Nuovo cimento (2), 7, 520-3(1950).

The author obtains thin (less than 0.2 mg/cm²) films of U oxides (predominantly UO₂) by electrolytic deposition on stainless-steel disks from a dil. aq. soln. of UO₂(NO₃)₂ and NH₄NO₃ at 65°C. The horizontally placed cathode disk rotates in the upper part of the soln., a Pt wire forming the anode, the c.d. being about 0.7 amp/dm² and the duration of the electrolysis about 10 min. . has been found that, under these conditions, the quantity of pptd. matter is proportional to the quantity of UO₂(NO₃)₂ originally employed and that, owing to the growing acidity of the soln., the thickness of the deposit cannot exceed 0.2 mg/cm².

- 3970 Zimmerman, J. B. Investigation of the Possibilities of a High Frequency Induction Furnace for Fusing Sodium Fluoride Beads in the Fluorimetric Determination of Uranium in Ores. Ottawa, Dept. of Mines and Technical Surveys, Apr. 17, 1950. 4p. (AEC File No. NP-1475; Topical Report No. 46/50)

The following conclusions were detd. by the investigation: (1) a 5-kw furnace is required to fuse 6 beads; (2) beads must be fused in an inert atm.; (3) a considerable amt. of exptl. work would be required to produce a satisfactory work coil; (4) line-voltage stabilization would be expensive; and (5) operating costs would be low.

AUTHOR INDEX

This index to the authors of papers listed in this bibliography is arranged alphabetically by the Anglicized form of the name; consequently, the prefixed names such as de Gramont and von Hevesy are alphabetized from the first letter of the prefix. Accent marks, including the umlaut, have been ignored in the arrangement.

Since original research is almost always published under personal credit lines, no impersonal authors such as corporate patentees or administrative subdivisions of organizations are listed.

The transliteration of non-Roman alphabets is not entirely consistent. This results from the attempt to show the name of the author in the manner in which it occurs when he, himself, supplies the transliteration; e.g., a Russian author publishing in a German periodical. When direct transliteration was necessary, the scheme used by Chemical Abstracts was adopted. The attempt has been made to collect the papers prepared by one individual under only one form of his name, and it is hoped that the minor differences between transliteration methods will not cause undue difficulty in the use of this index.

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SUBJECT INDEX

This index should be used as the starting point in locating data included in the literature listed and summarized in this bibliography. Considerable care has been exercised in the indexing so that reference will be had to all information of any consequence, excluding that not dealing specifically with uranium, which is included. Reference is not made in this index to duplicating citations.

Double indexing has been used in many instances in which it seemed desirable to do so; however, only single indexing will be found for such subjects as the absorption spectrum of UO_2SO_4 solutions. This kind of information is indexed under the compound only. This index, however, should not be considered to be a materials index, since such topics as the determination of uranium in spring waters will be found under the general heading "determination of," and the subheading "in waters."

In the cases of uranium compounds to which few references were located, all references are listed under the general heading for the material. In other cases, many subdivisions are used in order to indicate more exactly the topic which is covered.

The subheading "toxicity of" found under many of the compounds contains incomplete lists of the references on that topic, and reference to the headings for the various manifestations of uranium toxicity is recommended. This is particularly true of the toxicity studies involving the uranyl acetates and nitrates, and results from lack of specific information on the compound used in either the original paper or the abstract or summary which was consulted.

The attention of the user is also directed to the method of indexing complexes and less common organic compounds of uranium. In both cases, and indiscriminately, these materials are indexed under the organic or complexing portion of the molecule; e.g., uranyl malate will not be found with other uranyl compounds, but is listed under the heading "malate complexes." This general rule has been followed in order to avoid controversy and detailed literature searching to determine the accepted status of each combination of uranium and an organic radical or compound. The technical impropriety of this method should cause no difficulty in the actual use of this bibliography.

The numbers following the subjects listed in this index correspond to the sequential numbers used to locate each reference listed in the bibliography. In considering the likelihood of applicability of references to a problem at hand, the user will do well to bear in mind that this bibliography covers the period 1789 to 1950, and to remember the correspondence of sequential number with publication date which is shown in the brief table below:

Sequential number	Year of publication
250	1860
500	1882
750	1899
1000	1909
1500	1922
2000	1930
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3000	1947
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The compiler will greatly appreciate receiving suggestions from users on improvements which might be incorporated to make this index more useful in the revision which is planned.

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ABBREVIATIONS USED FOR PERIODICALS CITED

This list is arranged by abbreviation, in a letter-by-letter alphabetical order. An attempt has been made to give clear, complete titles for all of the periodicals, but more detailed bibliographic data have been omitted except when required for identification. The portion of the title used in the abbreviation has been underlined.

- Acta Brevia Neerlandica de Physiologia, Pharmacologia, Micro-
biologia
- Acta Chemica Scandinavica
- Acta Crystallographica
- Acta Physicochimica U.R.S.S.
- Acta Physica Polonica
- A E G Mitteilungen
- Agricultural News. (Barbados)
- American Chemist; a Monthly Journal of Theoretical Analytical and
Technical Chemistry.
- American Chemical Journal
- American Dyestuff Reporter.
- American Journal of Diseases of Children
- American Journal of the Medical Sciences.
- American Journal of Pathology.
- American Journal of Pharmacy.
- American Journal of Physiology.
- American Journal of Roentgenology and Radium Therapy.
- American Journal of Science.
- American Mineralogist
- American Review of Tuberculosis, The
- American Society for Testing Materials, Proceedings
- Anais da associacao quimica do Brasil.
- Analytical Chemistry.
- Analytica Chimica Acta
- Anales de la asociacion quimica argentina.
- Anales de física y química (Madrid)
- Anales de la sociedad científica argentina.
- Anales de la sociedad española de física y química (Madrid).
- Analyst, The.
- Anatomical Record, The.
- Angewandte Chemie.
- (Justus Liebig's) Annalen der Chemie.
- (Justus Liebig's) Annalen der Chemie und Pharmacie.
- Annaes da academia brasileira de ciencias.
- Annales agronomiques.
- Annales d'anatomie pathologique et d'anatomie normale médico-
chirurgicale.
- Annali di botanica.
- Annales de chimie.
- Annales chimie analytique.
- Annales de chimie analytique et de chimie appliqué et Revue de
chimie analytique
- Annali di chimica applicata.
- Annales de chimie et de physique.
- Annales of Internal Medicine.
- Annales de médecine légale de criminologie, police scientifique,
médecine sociale, et toxicologie.
- Annales des mines ou Recueil de mémoires sur l'exploitation
des mines et sur les sciences et les arts qui s'y rattachent.
(France).
- Annalen des kaiserlich koniglich naturhistorischen Hofmuseums.
- Annals of the New York Lyceum of Natural History.
- Annales pharmaceutiques françaises.
- Annals of Philosophy
- Annales de physique.
- Annalen der Physik
- Annalen der Physik und Chemie (Poggendorf)
- Annalen der Physik und Chemie (Wiedemann) [with title
variations].
- Annalen der Physik. (Gilbert) [with title variations].
- Annual Review of Physiology
- Annales des sciences naturelles, comprenant la physiologie animale
et végétale, l'anatomie comparée des deux regnes, la zoologie,
la botanique, la minéralogie, et la géologie.
- Annales scientifiques de l'universitè Jassy.
- Annales de la société géologique de Belgique, Bulletin.
- Annales de la société géologique de Belgique, Publications re-
latives au Congo Belge et aux régions voisines.
- Annales de la société scientifique de Bruxelles, Serie I. Sciences
mathématiques, physiques et astronomiques; Serie II. Sciences
naturelles et médicales; Serie III. Sciences économiques.
- Anzeiger der Akademie der Wissenschaften in Wien, Mathematisch-
naturwissenschaftliche Klasse.
- Arbeiten aus der anatomisches Institut der Tôhoku Imperial
University.
- Arbeiten des pharmakologischen Institutes zu Dorpat.
- Archiv für experimentelle Pathologie und Pharmakologie
- Archivos de facultad de medicina del Saragossa casa del médico.
- Archivio di farmacologia sperimentale e scienze affini
- Archives of Industrial Hygiene and Occupational Medicine.
- Archives of Internal Medicine.
- Archives internationales de pharmacodynamie et de therapie.
- Archives internationales de physiologie.
- Archives des maladies des reins et des organes génito-urinaires.
- Archiv for Mathematik og Naturvidenskab
- Archivo da medicina legal. (Lisbon)
- Archives néerlandaises de physiologie de l'homme et des animaux.
- Archives of Ophthalmology. (Chicago)
- Archives of Pathology.
- Archiv für pathologische Anatomie und Physiologie, und für klinische
Medizin. (ed. by R. Virchow and B. Reinhardt)
- Archiv der Pharmazie.
- Archiv der Pharmazie und Berichte der deutschen pharmazeutischen
Gesellschaft.
- Archives des sciences physiques et naturelles. [title varies con-
siderably for early series].
- Archivos de la sociedad de biologia de Montevideo.
- Archiv für wissenschaftliche Kunde von Russland. (ed. by A. Erman)
- Argile, L' (Journal des céramistes. Travaux publics et bâtiments.
Mines et carrières).
- Arkiv för Kemi.
- Arkiv för Kemi, Mineralogi och Geologi.
- Arkiv for Matematik, Astronomi och Fysik.
- Astrophysical Journal, The.
- Atomes.
- Atomics.
- Atti della accademia nazionale dei Lincei. Rendiconti, Classe di
scienze fisiche, matematiche e naturali.
- Atti e memorie della reale accademia di scienze, lettere ed arti,
Modena.
- Atti della reale accademia dei Lincei.
- Atti della reale accademia nazionale dei Lincei.
- Atti della società italiana per il progresso delle scienze.
- Australian Journal of Applied Science.

- Barron's National Business and Financial Weekly
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