MASTER
SELECTED
BIBLIOGRAPHY
for the
EXTRACTION
of
URANIUM
from
SEAWATER:
EVALUATION
of
URANIUM RESOURCES
and
PLANT SITING,
Volume II

EXXON NUCLEAR COMPANY, Inc.

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BENDIX FIELD ENGINEERING CORP.

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and by

OREGON STATE UNIVERSITY

Under Contract

SELECTED BIBLIOGRAPHY FOR THE EXTRACTION OF URANIUM FROM SEAWATER:
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SELECTED BIBLIOGRAPHY FOR THE EXTRACTION OF URANIUM FROM SEAWATER
EVALUATION OF URANIUM RESOURCES AND PLANT SITING

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ABSTRACT

This bibliography contains 471 references pertaining to the evaluation of U. S. territorial ocean waters as a potential uranium resource and to the selection of a site for a plant designed for the large scale extraction of uranium from seawater. The work was sponsored by the U. S. Department of Energy.

The bibliography is a companion work to a report on the subject which contains the background discussion and conclusions. That report is:

"EXTRACTION OF URANIUM FROM SEAWATER: EVALUATION OF URANIUM RESOURCES AND PLANT SITING, VOLUME I" by Michael R. Rodman, Louis I. Gordon, and Arthur C.-T. Chen (Exxon Nuclear Company Publication Number XN-RT-14, Vol. I)

Both that document and the present bibliography together with two additional documents form the final report of the project. The other two documents deal with the selection of an industrial process for the extraction of uranium from seawater, the design of a suitable plant to carry out the process, and a study of the economic feasibility of such an endeavor. The other two documents are:

"EXTRACTION OF URANIUM FROM SEAWATER: CHEMICAL PROCESS AND PLANT DESIGN FEASIBILITY STUDY" by M. H. Campbell, J. M. Frame, N. D. Dudey, G. R. Kiel, V. Mesec, F. W. Woodfield, S. E. Binney, M. R. Jante, R. C. Anderson, and G. T. Clark.

and

"SELECTED BIBLIOGRAPHY FOR THE EXTRACTION OF URANIUM FROM SEAWATER: CHEMICAL PROCESS AND PLANT DESIGN FEASIBILITY STUDY" by S. E. Binney, S. Polkinghorne, M. R. Jante, M. R. Rodman, A. C.-T. Chen, and L. I. Gordon.

These documents are Exxon Nuclear Company Report Number XN-RT-15, Volumes I and II and Oregon State University Department of Nuclear Engineering Report Number OSU-NE-7901, Volumes I and II.

This bibliography was prepared using machine literature retrieval, bibliographic, and word processing systems at Oregon State University. The literature cited is listed by author with indices to the author's countries, geographic areas of study, and to a set of keywords to the subject matter.

SELECTED BIBLIOGRAPHY FOR THE EXTRACTION OF URANIUM FROM SEAWATER:
EVALUATION OF URANIUM RESOURCES AND PLANT SITING

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INTRODUCTION

CHAPTER 1

INTRODUCTION

1.1 Background

This section gives a brief statement of the purpose of this report, its relation to other documents, a short background statement on the extraction of uranium from seawater and a general description of the organization of this report.

1.1.1 Purpose of this report

The report is one result of a U. S. Department of Energy (DOE) project sponsored through Bendix Field Engineering Corporation (BFEC). The project's objective was to examine the feasibility and economics of the extraction of uranium from territorial waters of the United States of America on a scale large enough to meet a significant fraction of projected national energy needs. It was a joint effort between Exxon Nuclear Company, Inc. (ENC) and Oregon State University (OSU).

The overall reporting on the project consists of two documents, each in two volumes. This is the second volume of the first document. Volume I is the report proper, while this, Volume II, is a selected bibliography companion to it. It is a bibliography of material relevant to the evaluation of U. S. territorial ocean waters as a uranium resource and to the selection of a suitable site for a plant designed for the large-scale extraction of uranium from seawater. Much, but not all, of this bibliographic material was employed in the preparation of Volume I. Volume I is:

"EXTRACTION OF URANIUM FROM SEAWATER: EVALUATION OF URANIUM RESOURCES AND PLANT SITING, VOLUME I" By Michael R. Rodman, Louis I. Gordon and Arthur C.-T. Chen (Exxon Nuclear Company Publication Number XN-RT-14. Vol. I)

Both that document and the present bibliography together with two additional documents form the final report of the project. The other two documents deal with the selection of an industrial process for the extraction of uranium from seawater, the design of a suitable plant to carry out the process, and a study of the economic feasibility of such an endeavor. The other two documents are:

"EXTRACTION OF URANIUM FROM SEAWATER: CHEMICAL PROCESS AND PLANT DESIGN FEASIBILITY STUDY" by M. H. Campbell, J. M. Frame, N. D. Dudey, G. R. Kiel, V. Mesec, F. W. Woodfield, S. E. Binney, M. R. Jante, R. C. Anderson, and G. T. Clark.

and

"SELECTED BIBLIOGRAPHY FOR THE EXTRACTION OF URANIUM FROM SEAWATER: CHEMICAL PROCESS AND PLANT DESIGN FEASIBILITY STUDY" by S. E. Binney, S. Polkinghorne, M. R. Jante, M. R. Rodman, A. C-T. Chen, and L. I. Gordon.

These documents are Exxon Nuclear Company Report Number XN-RT-15, Volumes I and II and Oregon State University Department of Nuclear Engineering Report Number OSU-NE-7901, Volumes I and II. They constitute part of the low-level uranium resource study conducted by DOE/BFEC as part of the National Uranium Resource Evaluation (NURE) program.

1.1.2 Background for the extraction of uranium from seawater

The Department of Energy projections for low cost uranium resources in the United States range from 2.2 to 4.1 million tonnes [285] whereas, the oceans contain over 4 billion tonnes of uranium in the dissolved form. The possibility that this practically unlimited amount of uranium in seawater can be extracted has intrigued many investigators.

In the mid 1960's, British investigators considered a number of possibilities for uranium recovery from seawater as a consequence of their decision to begin a nuclear power program and their total lack of domestic reserves of uranium. Similar studies were soon undertaken in Russia, India, Germany, Pakistan and Japan. These foreign countries appear to be a few steps ahead of the United States in this aspect.

INTRODUCTION

1.1.3 Organization of this report

In the present bibliography, a total of 471 references from various countries have been collected. This report contains, for the most part, references related to uranium resources in seawater, river water, marine organisms, sediments and mineral deposits in the oceans; references dealing with the uranium resource available through treatment of seawater pumped in such operations as desalination and power plant cooling; and references concerning the site selection criteria for the construction of a large scale uranium extraction plant. Some other pertinent references, for example, the resource evaluation of potential co-products and consideration of the environmental and social impacts are also listed. Apparently outmoded data or data obtained by using unreliable methodology have been excluded.

The references in this bibliography have been arranged alphabetically according to the name of the first author. A small supplemental bibliography is added at the end. The articles referenced in the companion report "EXTRACTION OF URANIUM FROM SEAWATER: EVALUATION OF URANIUM RESOURCES AND PLANT SITING" are all listed in the present report. The present report lists many references that are not directly referenced in the companion report.

1.2 Compilation Methodology

This bibliography was compiled using a machine literature retrieval system, a computerized bibliographic system, and a computer word processor system. These are described in the following sections.

1.2.1 Literature retrieval system

In order to facilitate thorough and efficient retrieval of reference material dealing with the uranium resources and U.S coastal site characteristics, the Oregon State University Kerr Library Information Retrieval Service (LIRS) was used. LIRS provided on-line bibliographic searching through remote access terminals, which connect with data bases such as that of the Lockheed Information Systems and Systems Development Corporation. These data bases provided information from a number of indices and directories, e.g., Chemical Abstracts and Oceanic Abstracts, programmed for retrieval by computer. Although these data bases covered various subject areas, the searches focussed upon the relevant chemistry, engineering and earth sciences. The data bases accessed were the NTIS (1964-1978); Oceanic Abstracts (1964-1977); Nuclear Science Abstracts (1966-1976); Energy Data Base (1976-1978); Chemical Abstracts (1972-1978) and Dissertation Abstracts (1953-1976).

After searching these data bases and evaluating accessible background information, secondary references were developed and, experts contacted in the relevant fields to complete the data base.

1.2.2 Bibliographic data system

As bibliographic information and actual reprints and copies of articles were acquired, appropriate bibliographic data were entered into the FAMULUS bibliographic data management system available through the Oregon State University Computer Center. This system provided the capacity for entry and storage of the bibliographic data, editing capability, listing and numbering after sorting (in this case by alphabetical order of authors), indexing according to the authors's countries, geographical areas of study for field work and the keywords listed in Section 1.3, and finally printing out in useable format the data list and indices which comprise Chapter 2 and the Appendix of this report. A sample of one bibliographic entry and listing by FAMULUS is shown and described in Section 1.3.

1.2.3 Text processor system

When all bibliographic data were in order, the front matter and text of this report were prepared using the RNF word processor system available at the Oregon State University Computer Center. This enabled text entry, storage and editing capability. RNF proved to be especially valuable in preparing this report in the short time period available.

1.3 Explanation of Format

Included below is a sample of the bibliographic entries found in Chapter 2:

111 AUTH Davies,R.V.; Kennedy,J.; McIlroy,R.W.; Spence,R.; and Hill,K.M.
DATE 1964
TITL Extraction of uranium from sea water.
CITA Nature 203: 1110-1115 (1964).
COUN UK
AREA Menai Straits, Portland Harbour
ABST A summary of the program to separate uranium from sea water by continuous counter-current extraction is presented. (This is a sample abstract only.)
KEY extraction, uranium, seawater, plant design, concentration, chemical species

Each reference has an identification number (111 in the example above) internal to this bibliography. Each reference is further identified by eight field descriptors as follows:

- AUTH The authors of the reference are listed as cited (in this example, Davies, Kennedy, McIlroy, Spence, and Hill). Section 3.1 contains an index which sorts all of the bibliographic entries alphabetically by the last names of all the authors of each of the references.
- DATE This field descriptor refers to the year in which the reference was published (1964, for this citation).
- TITL This refers to the title of the bibliographic entry as published.
- CITA Listed in this entry is the journal or technical report citation. For example, the article entitled "Extraction of Uranium from Sea Water" was published in Nature, volume 203, pages 1110 to 1115, in 1964. If the citation was in a language other than English, it is so indicated.
- COUN The country listed refers to the country of the authors. This entry was included because so much of the work on the extraction of uranium from seawater has been performed in countries other than the United States. Section 3.2 contains a sorting of the bibliographic entries by country of the author.

- AREA The geographical area in which the work was performed is included, if it pertains specifically to a certain oceanic region. In the example shown, reference was made to studies in the Menai Straits of Wales and Portland Harbour, England. A sorting of the bibliographic entries according to area is included in Section 3.3.
- ABST An annotation is included for each reference. Often this is the abstract as found in the particular abstracting source from which the citation was obtained.
- KEY Keywords are included in order to provide sortings of the bibliographic entries according to subject material. If not already listed in the abstracting source, keywords were added to represent the important topics covered in the reference. A sorting of the bibliographic entries according to keyword is included in Section 3.4.

Keywords were assigned to each reference in order to facilitate access to the bibliography by topic. The keywords have been chosen and assigned to represent as closely as possible, the subject or subjects covered in each reference. The keywords contain examples or topics from all the major areas concerned in this investigation including such fields as economics, engineering and regulations as they pertain to the study.

GENERAL KEYWORDS

absorption	- refers to any kind of extraction method which works primarily by an absorption process.
adsorbent	- refers to work done with any adsorbent such as alumina, basic zinc carbonate, carbon, chitin, iron hydroxide, lead sulfide, molecular sieves, silica (gel), titania or zeolites.
adsorption	- refers to any kind of extraction method which works primarily by an adsorption process.
analysis	- refers to any work in which an analytical method for measurement of uranium is outlined.
biological productivity	- refers to any work involving estimations of or descriptions of any kind of biological productivity.
capacity	- refers to any work on loading capacities of adsorbents or absorbents.
chemical species	- refers to work dealing with the form, state or speciation of uranium in seawater.
chemistry	- refers to work describing the chemical environment via such parameters as alkalinity, dissolved oxygen , pH and sulfide.
climate	- refers to information on weather conditions in some area of interest.
concentration	- refers to some measurement or work done to evaluate the concentration of uranium in seawater.
current	- refers to information on current flow including parameters like direction, speed, transport etc.
economics	- refers to estimations involving the economics of uranium extraction including topics like energy requirements and output capacities.

elution	- refers to work done in eluting uranium from adsorbents and/or includes tests of various eluents.
environmental impact	- refers to any work that examines the environmental impact of a uranium extraction process or plant.
estuary	- refers to information or description of any estuary or estuaries of interest.
existing system	- refers to information dealing with the uranium resource potential of existing water treating plants such as power plants or desalination facilities.
farming systems	- refers to information about or work on biological farming systems in the oceans.
filtration	- refers to work on or descriptions of seawater filtration methods and technology.
fouling	- refers to information on any type of fouling by biological or chemical processes and includes such topics as blinding, scaling and clogging.
geography	- refers to information involving the geography of some location of interest.
geology	- refers to information involving the geology of some location of interest.
interstitial water	- refers to analysis of or information about interstitial waters.
ion exchange	- refers to any work done on an ion exchange method of uranium extraction.
marine organisms	- refers to any kind of information about marine organisms including algae, biology, biomass, biota, fish, phytoplankton and zooplankton.
multi-purpose process	- refers to information about or descriptions of any possible process which would develop a co/by-product with the uranium extraction.
nearshore	- refers to any information about seawater characteristics or current data that takes place in a nearshore location.
net systems	- refers to any uranium extraction process which uses some type of net for a support medium.
nutrients	- refers to information concerning nutrients, nutrient

usage, distribution etc.

offshore	- refers to any information about seawater characteristics or current data that takes place in an offshore location.
organics	- refers to work done on uranium extraction using organic materials.
particulate	- refers to information dealing with particulate matter or detritus.
plant design	- refers to any work done or proposed in designing an extraction plant.
plant productivity	- refers to estimations of possible or required productivity of an extraction plant.
platform systems	- refers to information or work done on a system for extraction based on a floating platform.
pumped system	- refers to information or work done on a system for extraction using pumped seawater.
regulations	- refers to any information on restrictions or regulations such as environmental, land use, zoning etc.
river	- refers to any kind of data on rivers or streams including such items as flow volumes and uranium concentrations.
salinity	- refers to physical oceanographic data on salinities.
seawater	- refers to anything of interest as it is found in seawater.
sediments	- refers to information or data concerning uranium in marine sediments.
shipboard systems	- refers to any information or work done on a system of uranium extraction that is based aboard a ship.
temperature	- refers to data on temperatures.
tidal systems	- refers to work or information on a uranium extraction system based on tidal water movement.
tide	- refers to physical oceanographic data on tides.
titanium	- refers to data on the chemistry and use of titanium.

trace metals	- refers to data on trace metals in relation to co-products or biological concentration.
uranium	- refers to any information involving uranium.
vanadium	- refers to data on vanadium in waters, seawater, biological forms, etc.
water	- refers to data on various elements in water other than seawater.

GEOGRAPHIC KEYWORDS

n atlantic	- Essentially this region is the Gulf of Maine bordered by the states of Maine, New Hampshire and Massachusetts.
mid atlantic	- This region extends from Nantucket shoals in the north to Cape Hatteras in the south and is bordered by the states of Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Delaware, Maryland and Virginia.
s atlantic	- This is the coastal region from Cape Hatteras to the southern tip of Florida and is bounded by the states of North Carolina, South Carolina, Georgia and Florida.
gulf of mexico	- This region has the states of Florida, Alabama, Mississippi, Louisiana, and Texas bordering it. The Florida Keys are included in this region.
caribbean	- Only the islands of Puerto Rico and the U.S. Virgin Islands are included for this area, although the Florida Keys could be included here.
pacific southwest	- This region is southern California.
pacific northwest	- Northern California, Oregon and Washington comprise this region.
alaska	- Many oceanographic provinces are along this coastline: Gulf of Alaska, Bering Sea, Chukchi Sea, and Beaufort Sea.
pacific islands	- The principal region included here is the Hawaiian Islands although others such as Guam and Wake are also considered.

1.4 Acknowledgements

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A long list of people worked in many other areas with us. We are grateful to: Ms. Gail McEwen, Mr. Jerry Bartlemay, Ms. Dee Gordon, Mr. Joe Jennings, Mr. Joe Orzech, Ms. Meg Gruwell, Ms. Cathy Ramsey, and Ms. Judy Gordon, for their assistance in entering the bibliographic data into FAMULUS and numerous other writing tasks; Ms. Pat Streibich, Mssrs. Eric Olson, Michael Thompson, and W. S. Hwang for their fine bibliographic work; Mr. Steve Polkinghorne and Ms. Mary J. Knowler for their help at several stages; and Ms. Ma.Rita R. Jante for her tremendous help in many stages of this project.

Ms. Nancy Nickerson of the OSU Kerr Library Map Room helped us many times in our search for resource materials. Ms. K. Lea Ginnodo of the U. S. Geological Survey in Menlo Park, California similarly helped us. Mr. Roger Anderson and Mr. Tom Clark of Vitro Corporation provided considerable help with site selection considerations.

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Several people graciously assisted with site visits or with regional information which was otherwise very difficult to acquire. These were

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Thanks are extended to Mr. Robert Lewis and Mr. George Shaw and the Oregon State University Department of Printing. Our most special thanks and gratitude are due Ms. Nancy Sarpola whose amazing patience, competence, and sense of humor carried us through this project, especially in its frantic last days of report preparation.

CHAPTER 2

BIBLIOGRAPHIC LISTING

The selected bibliography for this portion of the project is listed in this section in alphabetical order according to the last name of the first author of each entry. A sample format is shown in Chapter 1.3. The listing is in two parts, a main listing which contains all but a few of the entries, and a supplementary listing.

2.1 Main Listing

- 1 AUTH Abrao, A.; Franca, J.M.Jr.
DATE 1970
TITL Pilot plant for purification of uranium by ion exchange in IEA operations.
CITA Instituto de Energia Atomica Report IEA-219: 94p (1970). (Portuguese).
COUN Brazil
ABST The installation and operation of a pilot plant for uranium purification based on an ion-exchange process are described. The preparation of uranyl nitrate solution, used to feed the ion-exchanger columns, is performed by fractional dissolution of raw sodium diuranate. The decontamination of thorium plus rare earth elements is achieved by oxalic acid precipitation directly in the bulk of uranyl nitrate. The decontamination of various impurities is enhanced by an EDTA-complex formation before the uranyl load on the strong cationic resin bed. The uranyl sulfate obtained by eluting the resin column with ammonium sulfate is reverse precipitated to avoid sulfate coprecipitation in the nuclear grade ammonium diuranate obtained.
KEY uranium, ion exchange, trace metals, elution, plant design, extraction
- 2 AUTH Adam, J.; Stulikova, M.
DATE 1974
TITL Selective extraction and determination of uranium using diphenyl acetic acid.
CITA Collect. Czech. Chem. Commun. 39(9): 2576-2580 (1974).
COUN Czechoslovakia
ABST A benzene solution of diphenyl acetic acid is suitable for the extraction of uranyl ions from alkaline aqueous solutions. Addition of nitrilotriacetic acid to the aqueous phase renders the extraction selective for uranium in the presence of iron(III), nickel(II), lead(II), zinc(II), cobalt(II), cadmium(II), manganese(II), copper(II), chromium(IV), and molybdenum(VI) by selective masking of these ions. Gold(III) and platinum(IV) were found to interfere slightly. Transfer of the uranium into the organic phase is virtually quantitative after two extractions. Polarographic and spectrophotometric determinations were studied; in the latter case, dibenzoylmethane is added to the organic extraction phase as a colorimetric reagent. The polarographic determination is preferably performed after re-extraction of the uranium into aqueous solution (0.5M-KCl-0.5M-HCl). The former method provides a wider useful concentration range (10^{-5} to $5 \cdot 10^{-3}$ M-U(VI) in the extract) than the latter (10^{-5} to $2 \cdot 10^{-4}$ M-U(VI) in the extract); however, the latter has greater accuracy ($\pm 3\%$) than the former ($\pm 5\%$) as well as being more simple.
KEY extraction, uranium, trace metals, analysis, water, concentration

- 3 AUTH Adams, W.H.; Buchholz, J.R.; Christenson, C.W.;
Johnson, G.L.; Fowler, E.B.
DATE 1975
TITL Studies of plutonium, americium, and uranium in
environmental matrices.
CITA Report by Los Alamos Scientific Lab, LA 5661: 26p (1975).
COUN USA
ABST A nitric acid-hydrofluoric acid treatment for
dissolution of plutonium oxides in soils has been
developed; its adaptation to other biological matrices
is discussed. Plutonium recoveries of 94 to 99% from
1-g samples of spiked and heated soils are reported.
Adaptation of the acid solution to subsequent anion
exchange separation of plutonium, followed by coupling
to known electroplating techniques, is described. The
uptake of plutonium, americium, and uranium from spiked
soils by alfalfa, beans, radishes, lettuce, tomatoes,
and barley is reported. The "apparent" solubility of
 $Pu(238)O_2$ in tap water was measured, and the deposition
of plutonium in fish, algae, and snails in aquaria
containing $Pu(238)O_2$ microspheres is reported.
KEY ion exchange, uranium, environmental impact, extraction,
marine organisms, organics
- 4 AUTH Agrawal, Y.K.
DATE 1975
TITL Extraction and photometric determination of uranium (VI)
with N-p-tolylbenzohydroxamic acid (p-TBHA).
CITA Anal. Lett. 8(4): 257-267 (1975).
COUN India
ABST A rapid method for the simultaneous solvent extraction
and spectrophotometric determination of hexavalent
uranium with N-p-tolylbenzohydroxamic acid is described.
The intense red complex with uranium can be extracted by
chloroform at pH approx. 4.3. The red colored complex
obeys Beer's law at 515 nm. A satisfactory separation
from many commonly occurring metal ions is easily
accomplished. Effects of acidity, reagent concentration
and diverse ions on the visible absorption spectrum of
the extracted complex have also been investigated.
KEY extraction, uranium, analysis, chemistry
- 5 AUTH Agrawal, Y.K.
DATE 1975
TITL Solvent extraction of uranium (VI) by
N-m-tolyl-o-methoxybenzohydroxamic acid.
CITA Sep. Sci. 10(2): 167-173 (1975).
COUN India
ABST A simple and rapid spectrophotometric determination of
uranium (VI) is described. The uranium (VI)
N-m-tolyl-o-methoxybenzohydroxamic acid complex is
extracted with chloroform at pH 5.3 to 5.5 from aqueous
solution. Maximum absorption of orange-red extract
occurs at 510 nm. The colored complex obeys Beer's law

(CONT.)

over the range 0.3 to 20 ppm of uranium. The effect of acidity, reagent concentration, and diverse ions on the visible absorption of extracted complex has been studied.

KEY extraction, uranium, chemistry, water, concentration

- 6 AUTH Ahrlund, S.
 DATE 1949
 TITL On the complex chemistry of the uranyl ion. 1. the hydrolysis of the six-valent uranium in aqueous solutions.
 CITA Acta Chemica Scand. 3: 374-400 (1949).
 COUN Sweden
 ABST It has been shown by extinctionometric measurements that the uranyl ion UO_2^{2+} is the only existing complex of six-valent uranium in aqueous solution from $p[H^+] = 0.1$ (the lowest investigated) up to $p[H^+] = 2$. Over that $p[H^+]$ further hydrolysis complexes are gradually formed. So UO_2^{2+} may be regarded as a complex forming central group, and formulas for its complex formation have been developed in a manner analogous to other metal ions. The extinction curve of UO_2^{2+} has been determined; by this the data of the literature have been found to be erroneous. Much investigation has been done of the further hydrolysis of UO_2^{2+} .
 KEY uranium, water, chemistry, analysis, concentration, trace metals, chemical species, extraction

- 7 AUTH Ahrlund, S.; Hietanen, S.; Sillen, L.G.
 DATE 1954
 TITL Studies on the hydrolysis of metal ions: X. the hydrolysis of the uranyl ion, UO_2^{2+} .
 CITA Acta Chemica Scand. 8: 1907-1916 (1954).
 COUN Sweden
 ABST All complexes from the hydrolysis of UO_2^{2+} which formed in appreciable amounts can be written in the form: $UO_2((OH)_2 UO_2)_n^{2+}$, or, which is equivalent, $UO_2(OUO_2)_n^{2+} \cdot (H_2O)_n$. A direct analysis of the $Y(X)$ curve ($Y = 1/2 Z$) showed that several complexes with different n are formed. In view of X-ray evidence on the structure of compounds that may be precipitated from uranyl solutions, it seems reasonable that the complexes are sheet-like, probably with double OH bridges. The most correct formula would thus be $UO_2((OH)_2 UO_2)_n^{2+}$.
 KEY uranium, water, chemistry, analysis, concentration, chemical species, extraction

- 8 AUTH Alder, J.F.; Das, B.C.
 DATE 1978
 TITL Determination of low-levels of uranium by an indirect flame and electrothermal AAS procedure after ion-exchange preconcentration.
 CITA At. Absorpt. News. 17(3): 63-64 (1978).

(CONT.)

COUN UK

ABST Low levels of U in water are concd. by passage through an ion exchange column followed by elution with 3M H₂SO₄. The U is detd. by both flame and graphite furnace at. absorption spectrophotometry (AAS) using an indirect method based on the redn. of Cu(II) by U(IV) followed by complexation of the Cu(I) with 2,9-dimethyl-1,10-phenanthroline and finally, detn. of the Cu by conventional AAS. Solns. contg. ≥ 25 ppb U can be detd. by flame AAS and 2 ppb by the nonflame method. Various interferences have been studied; only Fe(III) presented a problem which can be overcome by complexation of the Fe with citrate.

KEY uranium, analysis, ion exchange, extraction, elution

9 AUTH Almagro Huertas, V.

DATE 1974

TITL Comparative study of some electrochemical methods used in the determination of U.

CITA Energ. Nucl. (Madrid) 19(88): 103-108 (1974). (Spanish).

COUN Spain

ABST An experimental study was made of the various methods for the evaluation of U using electroanalytical techniques. The values obtained in routine use of these methods were compared. The techniques used were amperometric, coulometric, and classical and automated potentiometric methods. A study on the final results obtained in the polarography of U was included.

KEY uranium, analysis

10 AUTH Ames, D.P.; Sedlet, J.; Anderson, H.H.; Kohman, T.P.

DATE 1949

TITL Rapid radiometric assay for radium and application to uranium ore process solutions.

CITA IN: The Trans-uranium Elements, ed. by G.T. Seaborg, J.J. Katz and W.M. Manniny, National Nuclear Energy Series. McGraw Hill. 1949.

COUN USA

ABST A rapid method of assay for radium in solution, based on the precipitation of radium with barium as carrier and counting of its α -particles, has been described. In sulfate-free solutions (Ba, Ra) Cl₂ is precipitated with concentrated HCl and ether. In sulfate-containing solutions (Ba, Ra) SO₄ is first precipitated, followed by a (Ba, Ra)Cl₂ precipitation. The chloride is converted to the sulfate on a pyrex disk for α -particle counting in a parallel-plate ionization chamber. The method is general for all α -emitting radium isotopes, is sensitive to 10^{-12} g of Ra-226, and is accurate to 3 to 10%. It separates radium from all other α -emitting substances accompanying it in nature. Applications of this method to uranium ore process solutions have also been described. The method is suitable for certain

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control problems in which knowledge of approximate radium concentrations is required in 30 to 60 minutes. In this application the sensitivity is limited by interfering activities to 10^{-10} g radium/liter.

KEY uranium, concentration, trace metals, extraction, analysis

- 11 AUTH Anonymous
DATE 1963
TITL Oceanographic atlas of the North Atlantic Ocean; section IV, sea & swell.
CITA U.S. Naval Oceanographic Office; pub. no. 700.
COUN USA
AREA North Atlantic
ABST Frequency roses and contours are given for sea, swell, and wind.
KEY climate, water, seawater, n atlantic, mid atlantic, s atlantic, caribbean
- 12 AUTH Anonymous
DATE 1965
TITL Oceanographic atlas of the North Atlantic Ocean; section V, marine geology.
CITA U.S. Naval Oceanographic Office, pub. No. 700.
COUN USA
AREA North Atlantic
ABST Marine geology, profiles and bottom gradients are given.
KEY geology, n atlantic, s atlantic, mid atlantic, caribbean, seawater, water
- 13 AUTH Anonymous
DATE 1965
TITL Oceanographic atlas of the North Atlantic, section I, tides & currents.
CITA U.S. Naval Oceanographic Office, pub. no. 700
COUN USA
AREA North Atlantic
ABST Both tides and currents are contoured, frequency and vertical profiles given and this is for seasons.
KEY current, tide, n atlantic, s atlantic, mid atlantic, caribbean, sea water, water
- 14 AUTH Anonymous
DATE 1967
TITL National conference on the technology of the sea and sea-bed.
CITA Atom, No. 123: 113-116 (1967).
COUN UK
ABST Exploitation of the resources of the sea and sea-bed was the theme of a conference organised by the United Kingdom Atomic Energy Authority on behalf of the Ministry of Technology. Among the subjects covered were the technology of gaining food from the sea; movement

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- and control of the sea-bed; sea rigs and platforms; information handling for oceanography and for meteorology over the oceans. Abstracts of the conference papers are published here. The full proceedings will be made available through H.M.S.O. seawater, sediments, trace metals, extraction
- KEY
- 15 AUTH Anonymous
DATE 1967
TITL Oceanographic atlas of the North Atlantic Ocean; section II, physical properties.
CITA U.S. Naval Oceanographic Office; pub. no. 700.
COUN USA
AREA North Atlantic
ABST Temperature, salinity plots are contoured on the horizontal and vertical for seasons.
KEY temperature, salinity, seawater, water, n atlantic, s atlantic, mid atlantic, caribbean
- 16 AUTH Anonymous
DATE 1972
TITL Environmental-acoustics atlas of the Caribbean Sea and Gulf of Mexico; VII, marine environment.
CITA U.S. Naval Oceanographic Office; sp-189II.
COUN USA
AREA Caribbean, Gulf of Mexico
ABST Charts of water masses, sound velocity, bathymetry, waves are given. Some of these are for seasons.
KEY climate, current, temperature, salinity, geology, caribbean, gulf of mexico, seawater, water
- 17 AUTH Anonymous
DATE 1974
TITL Quality of surface waters of the United States, 1969. 3. U.S. Geological Survey.
CITA U.S. Geol. Surv., Water-Supply Pap. (2143): 371p (1974).
COUN USA
ABST The composition and properties of water of rivers in Alabama, Georgia, Illinois, Indiana, Kentucky, Maryland, New York, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia are given.
KEY water, river, analysis
- 18 AUTH Anonymous
DATE 1975
TITL Apparatus and method for extracting uranium from sea water.
CITA Fr. Demande 2,243,264 (Cl. C22B, A01H), Ger. Appl. P 23 45 430.0, 08 Sep 1973: 7p (1975).
COUN West Germany
ABST A mutant strain of unicellular green algae is prepd. from a sea water culture to which $UO_2(NO_3)_2$ is progressively added until the culture contains 250 mg/l.

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U [7440-61-1]. These algae can tolerate high concns. of U and are capable of concg. U in sea water from 6 to 6000 ppm. A cage filter in which the opposite walls are made of sieves with 50-100 μ openings is used to allow sea water to be circulated through the mutant algae.

KEY uranium, seawater, extraction, capacity, concentration, marine organisms

- 19 AUTH Anonymous
 DATE 1975
 TITL Japan plans U₃O₈ extraction from sea.
 CITA Industrial Research, September 1975.
 COUN Japan
 AREA Japan
 ABST A news statement of Japanese plans to construct an extraction plant.
 KEY uranium, extraction, pumped system
- 20 AUTH Anonymous
 DATE 1975
 TITL Temperature, salinity, oxygen, and phosphate in waters off eastern central America and northern central South America.
 CITA U.S. Dept. of Commerce, NOAA, Environmental Data Service.
 COUN USA
 AREA Caribbean
 ABST Horizontal plots, vertical plots, and scatter diagrams are given for the various parameters for seasons.
 KEY temperature, salinity, nutrients, seawater, water
- 21 AUTH Anonymous
 DATE 1976
 TITL Is there enough uranium.
 CITA S. Afr. J. Sci. 72(4): 101 (1976).
 COUN South Africa
 ABST Published in summary form only.
 KEY uranium, economics, existing plants
- 22 AUTH Anonymous
 DATE 1977
 TITL Hot plankton.
 CITA Newsweek, p.81, December 12, 1977.
 COUN USA
 ABST A deposit of uranium covering more than 100,000 square miles was discovered in the Black Sea. The uranium is bound up in the proteins and sugars of free-floating coccolith plankton (species Umbilicosphaera), and the uranium is concentrated ten thousand fold. The plankton die and sink to the bottom, where the uranium is deposited. Recovery might be accomplished with a vacuum system, and possible isolation and synthesis of the binding sugars is being examined.

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- KEY   uranium, marine organisms, sediments
- 23   AUTH   Anonymous
      DATE   1978
      TITL   Microorganism cultures for extracting uranium from
             seawater.
      CITA   Brit. 1,507,003 (Cl. A01H13/00), Ger. Appl. 2,509,943,
             07 Mar 1975: 3p (1978).
      ABST   U was extd. from sea water using mutants of the
             blue-green algae *Oscillatoria* or the fungus *Aspergillus*
             niger capable of absorbing U from sea water to a greater
             extent than the naturally occurring organisms. Thus,
             U-absorbing mutants of *A. niger* were selected following
             x-irradn. and adapted to sea water. Cultivation of the
             mutant strain on artificial sea water contg. 0.006 ppm U
             gave dry fungal mass after 24 h contg. 10-40 mg U/kg.
      KEY   marine organisms, extraction, uranium, seawater,
             capacity, concentration
- 24   AUTH   Anonymous
      DATE   1978
      TITL   Surface currents, west central north Atlantic Ocean &
             east coast of U.S.
      CITA   Dept. of Navy, NSTL station, Mississippi.
      COUN   USA
      AREA   North Atlantic
      ABST   Only sea surface currents by 1 degree squares are given.
      KEY   current, seawater, water, n atlantic, s atlantic, mid
             atlantic
- 25   AUTH   Anonymous
      DATE   1978
      TITL   World list of nuclear power plants.
      CITA   Nuclear News, August 1978, p. 79-84.
      AREA   world
      ABST   Water flow data for nuclear power plants.
      KEY   seawater, multipurpose
- 26   AUTH   Anonymous
      DATE   1976
      TITL   Uranium-from-sea plant begins operation in Japan.
      CITA   Nuclear News, p.66. January 1976.
      ABST   Reports from Japan indicate that the Ministry of
             International Trade and Industry recently began
             operation of experimental plant to recover uranium from
             seawater. Located on Shikoku island, the
             first-of-a-kind plant circulates 40 tons of water per
             day over an adsorber made of activated carbon and
             titanitic acid. The seawater is circulated several
             hundred times while being stirred by an electric rotor.
             Uranyl carbonate extracted from the seawater is trapped
             by the adsorber and treated chemically. Reports
             indicate the experimental plant is expected to extract

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only about 10 grams of uranium a year. Earlier estimates of similar processes concluded that uranium produced from seawater would have to cost several hundred dollars per kilogram. The Japanese plant is designed to obtain basic technical information for a larger facility planned by the Resources and Energy Agency.

KEY Uranium, seawater, adsorbent, extraction, economics

- 27 AUTH Anonymous
 DATE 1973
 TITL Apparatus and Method for Extracting Uranium from Sea Water.
 CITA Fr. Demande 2,243,264 (Cl. C22B, A01H), April 4, 1975, Ger. Appl. P 23 45 430.0, Sept. 8, 1973; 7pp.
 (Abstracted in chemical abstracts 84:7908v,)
 COUN West Germany
 ABST A mutant strain of unicellular green algae is prepared from a sea water culture to which uranyl nitrate is progressively added until the culture contains 250 mg/l. U [7440-61-1]. These algae can tolerate high concns. of U and are capable of concg. U in sea water from 6 to 6000 ppm. A cage filter in which the opposite walls are made of sieves with 50-100 micron openings is used to allow sea water to be circulated through the mutant algae.
 KEY uranium, extraction, biological, marine organisms, algae.
- 28 AUTH Anonymous
 DATE 1973
 TITL Appendix: Principal coastal zone power stations in operation, construction, or planning.
 ABST Principal coastal zone power stations in operation, construction, or planning, including most fossil and nuclear plants of 200 MWe capacity or larger. The expected date of commercial operation is given under "Status" for plants not yet on line. The maximum design flow of cooling water is given under "Intake cfs". Multi-cooling system is once-through, except where noted C.T.--cooling tower, or C.C.--cooling channel. Under "Fuel," C/O/G indicates alternate use of coal, oil, or gas; foss. indicates unspecified fossil fuel.
 KEY existing system
- 29 AUTH Anonymous
 DATE 1974
 TITL Water resources data for Puerto Rico, part 1, surface water records.
 CITA USGS and the Commonwealth of Puerto Rico and other agencies.
 COUN USA
 AREA Puerto Rico

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(CONT.)

- ABST Stream flow data for days of the year is given as well as characteristics of the drainage basins.
KEY water, river, caribbean
- 30 AUTH Antal, P.S.
DATE 1964
TITL Complexing of uranium in sea water.
CITA I. Geochemical Evidence for Stabilization in the Oceans. II. UO_2^{++} Hydrolysis. 23p. (University of Miami, Institute of Marine Science, Technical Report, 64-5, October 1964).
ABST The relatively high uranium concentration of sea water is discussed in terms of a supply-removal steady state. The comparison of average abundances of uranium and other elements indicates that complexation by sea water constituents makes uranium (VI) difficult to remove from solution. (II. UO_2^{++} Hydrolysis). Hydrolytic quotients of uranium (VI) complexes $(UO_2)_q(OH)_m^{2q-m}$ are critically reviewed; for computation in sea water medium the following values are recommended: $KO-1=6\pm4 \cdot 10^{-9}$, $KO-2/2=1.0\pm0.2 \cdot 10^{-11}$, $KO-4/3=2.3\pm0.2 \cdot 10^{-15}$, $KO-5/3=1.8\pm0.2 \cdot 10^{-18}$. The concept of reduced instability quotients, $B=K-p\beta_{m,q}/m$, is introduced as a measure of hydroxyl bonding strength. B decreases (logarithmic scale) from 11.02 in the 2-2 complex, to 10.50, 10.43, 10.05, in the 4-3, 5-3, 6-3 complexes, respectively. Further substitution reduces it to 9.68 in the 7-3 compound, and to 8.64 in $[(OH)_8(UO_2)_3]^{2-}$. Computation of complex concentrations in sea water indicates that only UO_2OH^+ adds significantly to the species distribution. Hydrolysis reduces the average charge of uranium species, but condensation does not proceed in the presence of complexing anions: the net effect is stabilization of uranium in sea water.
KEY uranium, seawater, concentration, chemical species
- 31 AUTH Aravamuthan, V.
DATE 1978
TITL Some thoughts on the recovery of freshwater and marine chemicals from seawater.
CITA Indian Chem. J. 12(9): 19-34 (1978).
COUN India
ABST The review, with 4 refs., covers unified schemes for desalting water, recovering Br, I, B, and U, producing NPK fertilizer, alkali metals, and Mg sulfates and using tidal and thermal energy.
KEY seawater, extraction, existing system, trace metals, uranium, tidal system
- 32 AUTH Armitage, B.; Zeitlen, H.
DATE 1971
TITL The Preconcentration of various trace elements in seawater by solvent extraction and ring oven.

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CITA Analytica Chimica Acta, 53:47-53.
 COUN USA
 ABST A procedure was described for the preconcentration from seawater without pre-treatment of six trace elements, uranium, copper, nickel, cobalt, iron and manganese through solvent extraction with an 8-hydroxyquinolone-chloroform mixture. Extracted samples are deposited on filter-paper disks with the aid of a kinetic clamp pump and a ring oven, and the 6 elements are determined non-destructively by x-ray fluorescence. Virtually complete extraction was achieved.
 KEY seawater, uranium, trace metals, extraction, analysis, concentration.

33 AUTH Aten, A.H.W. Jr.; Umans, H.J.L.; De Jong, W.M.C.
 DATE 1961
 TITL Concentration of uranium in sea fish.
 CITA Health Physics 5: 225-230 (1961).
 ABST Several types of fish, gurnard, mackerel, haddock, whiting, plaice and herring were tested for uranium content in their flesh. Uranium content was roughly 2.1×10^{-5} mg U /g in the fish, and error was between 0.5×10^{-5} mg U /g and 1.0×10^{-5} mg U /g. The seawater had a concentration of 1.1×10^{-6} mg U /ml, indicating a concentration factor of 20. Combining the concentration factor with the allowable concentration limit for the population at large, a maximum permissible calculation of uranium in seawater of 9 μ g U /ml was calculated, safety factors notwithstanding.
 KEY uranium, concentration, marine organisms, analysis

34 AUTH Atkinson, L.P.
 DATE 1978
 TITL The results of four oceanographic cruises in the Georgia Bight.
 CITA Georgia Marine Science Center, Technical Report Number 78-1, Savannah, 71 p. (1978).
 COUN USA
 AREA Georgia, South Atlantic
 ABST Vertical sections, horizontal sections, scatter diagrams and a summary are given. Temperature, salinity, density, oxygen, phosphate, silicate and nitrate are plotted.
 KEY current, nearshore, offshore, nutrients, salinity, chemistry, seawater, s atlantic

35 AUTH Atkinson, L.P.; Wallace, D.
 DATE 1975
 TITL The source of unusually low surface salinities in the Gulf Stream off Georgia.
 CITA Deep-Sea Research 23: 913-916 (1975).

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- COUN USA
 AREA Georgia, S Atlantic
 ABST In September 1973, surface water salinities of the Gulf Stream off Georgia were observed to be anomalously low. Salinity values of 35.5 to 36.4‰ are typical for this area but values as low as 34.5‰ were observed. A conservative estimate of the observed volume flux of freshwater in the Gulf Stream was $1.2 \text{ km}^3 \text{ day}^{-1}$. A possible source is runoff from the southeast United States; however, the total runoff flux is ca. $0.1 \text{ km}^3 \text{ day}^{-1}$, which is not sufficient to supply the observed flux. Therefore, it is hypothesized that the low salinity water is of Mississippi River origin. This argument is further strengthened by observations of northern extensions of the Gulf of Mexico Loop Current and low salinity water in the Straits of Florida.
 KEY current, salinity, seawater, s atlantic
- 36 AUTH Aumento, F.; Hyndman, R.D.
 DATE 1971
 TITL Uranium content of the oceanic upper mantle.
 CITA Earth Planet. Sci. Lett. 12(4): 373-384 (1971).
 COUN Canada
 AREA Mid-Atlantic Ridge
 ABST Fission track detns. of both the whole rock contents and the distribution of U in individual phases were made on 20 serpentinized ultramafic rocks from the Mid-Atlantic Ridge at 45° N (Hudson Geotraverse) and 52° N (Gibbs Fracture Zone). The rocks are thought to represent uppermost oceanic upper mantle material. Whole rock U concns. varying from 0.19 to 0.70 ppm were found. Most of the U is homogeneously distributed in primary orthopyroxenes (1 ppm), and to a lesser extent (0.2 ppm) in primary clinopyroxenes. Primary olivine is relatively depleted in U (0.03 ppm), as is primary chrome spinel (0.09 ppm).
 KEY uranium, analysis, concentration, m atlantic
- 37 AUTH Babinets, A.E.; Zhorov, V.A.; Bezborodov, A.A.; Kobylyanskaya, A.G.; Solov'eva, L.V.; Urdenko, V.A.
 DATE 1975
 TITL Uranium in the Black Sea.
 CITA Geol. Zh. 6: 16-26 (1975). (Russian).
 COUN USSR
 AREA Black Sea
 ABST Water samples for uranium analysis have been collected over the entire Black Sea, from the surface to the sea floor. As distinct from the previously known facts, it has been established that the uranium content in different parts of the sea appears to vary both in extent and with depth. The behavior of uranium is governed by redox conditions of the environment. A decrease in pH value of water to 7.5 and a change of Eh

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value from +0.4 to -0.2 V lead to reduction of U(VI) to U(IV) and ensure higher sorption properties of the solid phases. The reducing reaction is proved possible through the calculated data. It is shown that the rate of uranium isolation is increasing with depth and its content is going down. Using optical properties of water, a hydrogeochemical behaviour of organic matter and uranium in water depths is explained. Role of organic matter and mineral components in the uranium deposition is described. Sorption of U(VI) ions on twelve components, which constitute a base of suspensions and floor sediments, has also been studied.

KEY uranium, analysis, chemistry, organics, sediments, seawater

- 38 AUTH Babko, A.K.; Kodenskaya, V.S.
 DATE 1960
 TITL Equilibria in solutions of uranyl carbonate complexes.
 CITA Russian Journal of Inorganic Chemistry 5(11): 1241-1244 (1960).

COUN USSR

ABST Stability constants of $UO_2(CO_3)_2^{2-}$ and $UO_2(CO_3)_2^{4-}$ have been measured in the aqueous solution. It is concluded that uranyl ions in carbonate solutions will form these two complexes when the carbonate ion is present in excess and the pH is greater than 7.

KEY uranium, chemistry

- 39 AUTH Bals, H.G.
 DATE 1976
 TITL Uranium extraction from seawater.
 CITA INIS-mf-3844: 149p (1976).

COUN West Germany

ABST After an introduction to the physics and chemistry of the sea and an estimation of the chances for the absorption of uranium from rivers, the material-specific characteristics of the adsorber technology are described in detail. Then, the methods used for gaining uranium from seawater are described with special regard to the tidal and the so-called serial (sequency) method. Whether all methods described can be realised is an economic problem since very high quantities of water are necessary because of the low contents of uranium. A positive energy balance (gained energy/lost energy) is not definitely ensured yet for the production methods used. The development measures to be taken to obtain a positive energy balance are briefly described, and the research programme of the UEBG is mentioned.

KEY uranium, seawater, economics, river, adsorbent, tidal system, extraction, adsorption.

- 40 AUTH Bals, H.G.
 DATE 1978

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- TITL Uranium extraction from seawater.
 CITA Contribution to WG 1B of INFCE by the Delegation of the Federal Republic of Germany: 10p (1978).
 COUN West Germany
 ABST In view of the order of magnitude of the total uranium requirement to be expected the Federal Republic of Germany has made great efforts in the field of uranium prospection. The following study delineates a new process (UEB process) for the extraction of uranium from seawater which in our view is particularly promising. This process does no longer work with immobile adsorber granules packed in a solid bed through which seawater flows, but rather with mobile particles in a fluidized bed. There the adsorber granules are almost kept suspended by the deflected sea current, at the same time migrating from the feeding to the discharge station at right angles to the current. Thus allowance is made for the fact that mobile adsorber particles are more likely to come into contact with uranium molecules than fixed ones. The special advantage offered by this working principle is that it permits the conception of adsorber units which, installed at greater depths, take the entire process energy required for adsorption from the sea current.
 KEY economics, extraction, uranium, seawater, adsorbent, current, concentration, river, trace metals, environmental impact, plant productivity, capacity, titanium, tidal system, pumped system, shipboard systems, plant design
- 41 AUTH Baranov, V.I.; Khristianova, L.A.
 DATE 1959
 TITL Radioactivity of the waters on the Indian Ocean.
 CITA Geochemistry: 765-769 (1959).
 COUN USSR
 AREA Indian Ocean
 ABST A direct determination of uranium content in some tens of water samples of the Indian Ocean has been carried out. It is found that the uranium content in the central areas of the ocean averages $1.8 \cdot 10^{-6}$ g/l. In the south-western part the content is somewhat higher (1.0×10^{-6} g/l). By calculation the concentrations of thorium (1.0×10^{-8} g/l) and of ionium (6×10^{-13} g/l) have been estimated for water in the central part of the ocean where a distinct disturbance of the radioactive equilibrium is established in the uranium family towards a considerable ionium deficiency compared to uranium.
 KEY seawater, concentration, uranium, analysis, temperature, salinity
- 42 AUTH Barans, C.A.; Roumillat, W.A.
 DATE 1976
 TITL Surface water drift south of Cape Lookout, North

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- Carolina.
 CITA South Carolina Wildlife and Marine Resources Department
 Technical Report Number 12, Charleston, 12 p. (1976).
 COUN USA
 AREA South Carolina, Georgia
 ABST Drifter bottle results show variable current structure
 but generally a southward flow.
 KEY current, nearshore, offshore, seawater, s atlantic
- 43 AUTH Barbano, P.G.; Rigali, L.
 DATE 1978
 TITL Spectrophotometric determination of uranium in sea water
 after extraction with Aliquat-336.
 CITA Anal. Chim. Acta 96(1): 199-201 (1978).
 COUN Italy
 ABST A 5% (wt./vol.) soln. of monomethyltricaprylammonium
 chloride was satisfactory for extg. U from seawater
 contg. 3.5M LiCl prior to concn. The detn. was made
 spectrometrically.
 KEY uranium, seawater, analysis, extraction
- 44 AUTH Batrakov, G.F.; Yeremeyev, V.N.; Zemlyanov, A.D.;
 Ivanova, T.M.
 DATE 1977
 TITL Strontium-90 and vertical transport of admixtures in the
 Caribbean Sea.
 CITA Oceanology 17(6): 661-663 (1977).
 COUN USSR
 AREA Caribbean Sea
 ABST The vertical structure of the field of concentration of strontium-
 90 and its relation to the hydrology of the waters are described on
 the basis of investigations in the Caribbean Sea during the 6th and
 7th cruises of the R/V Akademik Vernadskiy (1972-1973)
 KEY caribbean, seawater
- 45 AUTH Baturin, G.N.
 DATE 1970
 TITL Uranium in the surface layer of sediments of the
 northwestern Indian Ocean.
 CITA Oceanology, 9(6): 828-833.
 AREA Indian Ocean
 ABST The average uranium content of sediments in the
 northwestern part of the Indian Ocean corresponds to
 that of sedimentary land rocks. A higher uranium
 content was observed in two samples with a high C_{org} .
 content and in fish scale. It is independent of the
 amounts of the pelitic fraction, is inversely
 proportional to the $CaCO_3$ content, and correlates with
 C_{org} and P. The Eh of the sediment has a limited effect
 on the uranium content. Relatively high amounts of
 uranium gravitate toward the shelf and continental slope
 zones. The uranium contents are minimal in sediments of
 abyssal plains.

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KEY uranium, concentration, sediments

- 46 AUTH Baturin, G.N.; Kochenov, A.V.
 DATE 1969
 TITL Migration of uranium in rivers and the time of its presence in waters of the world ocean, of seas and lakes.
 CITA Geokhimiya 6: 715-723 (1969) (Russian).
 COUN USSR
 AREA Russia
 ABST The average uranium content in the total amount of dissolved and suspended materials of river run-off is similar to its average content in rocks of the Earth crust. The rivers of the Earth every year supply the World ocean with approximately 20,000 tons of dissolved uranium and approximately as much of suspended uranium; the ratio between the first and the second is 1:1. In final run-off basins the prevailing part of dissolved uranium is precipitated together with terrigenous material on shelves and continental slopes. The time dissolved uranium stays in waters of the basins varies from tens of years to hundreds of thousands of years and depends on their depth.
 KEY river, concentration, water, uranium
- 47 AUTH Baturin, G.N.; Kochenov, A.V.
 DATE 1973
 TITL Uranium in interstitial waters of marine and oceanic sediments.
 CITA Geokhimiya (10): 1529-1536 (1973). (Russian).
 COUN USSR
 AREA Atlantic Ocean, Pacific Ocean, Black Sea
 ABST Uranium content in interstitial waters from sediments of the Atlantic and Pacific Oceans and the Black Sea varies from 1.3 to 650×10^{-8} g/l, which confirms the relative diagenetic uranium mobility. To the factors determining uranium content in interstitial waters belong: pH, Eh, the U and C_{org.} content in sediments, the content of dissolved organic matters, and CO₂ in interstitial waters. The dependence of uranium content in interstitial waters upon C_{org.} in sediments permits the assumption that some of the dissolved uranium is present in the form of metalloorganic complexes.
 KEY uranium, interstitial waters, concentration, sediments, chemistry, chemical species, organics
- 48 AUTH Beardsley, R.C.; Bolcourt, W.C.; Hansen, D.V.
 DATE 1976
 TITL Physical oceanography of the Middle Atlantic Bight.
 CITA Middle Atlantic Continental Shelf and the New York Bight, American Society of Limnology and Oceanography, Proceedings of Symposium American Museum of Natural History, 3, 4 and 5 November 1975. p.20 (1976).

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COUN USA
 AREA Middle Atlantic Bight
 ABST Kinetic energy spectra from moored current meters in the mid-Atlantic Bight reveal marked differences in current variability between the inner shelf and the outer shelf and slope regions. A simple conceptual model is presented to explain how intense winter low pressure systems ("northeasters") drive strong alongshore currents which are coherent over much of the bight. A map of "mean" currents measured in recent moored array experiments demonstrates subsurface water flow along the shore toward the southwest. The average currents generally increase in magnitude offshore and decrease with closeness to bottom. At most sites, the mean current veers toward shore with increasing depth. The alongshore volume transport measured at three transects across the bight shows surprising uniformity, considering the possible sources for discrepancy. This transport (order $2.0 \times 10^5 \text{ m}^3 \text{ s}^{-1}$) of water within the 100-m isobath implies a mean residence time of the order 3/4 year. Much of the shelf water observed flowing westward south of New England must originate in the Gulf of Maine-Georges Bank area.

KEY mid atlantic, climate, current, nearshore, temperature, seawater, river

49 AUTH Belyaev, L.I.
 DATE 1966
 TITL Distribution and content of trace amounts of heavy metal elements in Black Sea waters.
 CITA Tr. Morsk. Gidrofiz. Inst., Akad. Nauk Ukr, SSR 37: 199-213 (1966).
 COUN USSR
 AREA Black Sea
 ABST Black Sea water was found to contain Ni 1.2, Cu 5.6, V 0.6, Mo 2.2, Ti 0.7, Al 10.2, Fe 19.0, Pb 3.6, and Mn 2.1 ppb. These values represent an av. of detns., made in the course of 5 years at a no. of sites.
 KEY trace metals, titanium, vanadium, seawater, concentration

50 AUTH Bernat, M.; Bieri, R.H.; Koide, M.; Griffin, J.J.; Goldberg, E.D.
 DATE 1970
 TITL Uranium, thorium, potassium and argon in marine phillipsites.
 CITA Geochimica et Cosmochimica Acta 34: 1053-1071 (1970).
 COUN USA
 ABST Analyses of elements at trace levels in phillipsites from Pacific Ocean deposits indicate the mineral continues to grow within the sedimentary column. The thorium and uranium concentrations decrease while the mineral concentrations increase with depth in the deposit.

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This observation can be explained by a continuous growth of the phillipsite within the deposits. The varying concentrations of uranium and thorium in phillipsite, fish teeth and clay minerals from given levels of the core indicate a competition by such substances for the dissolved phases of these elements. .

KEY uranium, concentration, sediments, trace metals, analysis

51 AUTH Bernstein, R.L.; Breaker, L.; Whritner, R.

DATE 1977

TITL California current eddy formation: ship, air, and satellite results.

CITA Science, 195: 353-359.

COUN USA

AREA Southern California

ABST Satellite remote sensing combined with conventional tools improves the ability to observe ocean currents.

KEY current, temperature, salinity, water, seawater, offshore

52 AUTH Bertine, K.K.; Chan, L.H.; Turekian, K.K.

DATE 1970

TITL Uranium determinations in deep-sea sediments and natural waters using fission tracks.

CITA Geochimica et Cosmochimica Acta 34: 641-648 (1970).

COUN USA

ABST Uranium determinations by induced fission track analysis were done rapidly utilizing a discharge counter instead of visual counting. Sediments, rocks, freeze-dried river salts (with Na_2CO_3 carrier) and one freeze-dried sea salt were analyzed by this technique. Comparisons with samples whose uranium concentrations were determined independently indicate that the method is accurate. The uranium concentration in deep-sea sediments varies widely with oceanic depth and depth in the core ranging from 0.5-40 ppm U on a calcium carbonate-free basis. Seventeen river water samples range between <0.01 and $1.2 \mu\text{g U/l}$ with an average value of $0.27 \mu\text{g U/l}$.

KEY uranium, concentration, water, sediments, analysis, river, seawater

53 AUTH Bertrand, D.

DATE 1950

TITL The biogeochemistry of vanadium.

CITA Bulletin of the American Museum of Natural History Vol 94: Article 7: New York: 1950 pp 407-455

ABST This is a short article on vanadium in the environment
KEY vanadium

54 AUTH Bettinali, C.; Pantanetti, F.

(CONT.)

DATE 1976
 TITL Uranium from sea-water. Possibilities of recovery, exploiting slow coastal currents.
 CITA Uranium ore processing. Proceedings of an advisory group meeting organized by the IAEA and held in Washington, D.C., 24-26 November 1975. ISBN-92-0-041176-2. IAEA, Vienna: 213-229 (1976).
 COUN Italy
 AREA Mediterranean Sea
 ABST The authors analyse the interest in uranium recovery from sea-water within the framework of uranium world supply problems. The most reliable methods proposed for recovery are summarized and discussed, both from the chemical and the plant project points of view. Tides as a source of energy for water movement cannot be used in the Mediterranean and therefore only currents can be taken into account. The acceptable cost of an exchanger, in relation to the uranium price, is considered and related to known exchangers. The characteristics of exchanging elements are examined and the influence of the speed of sea currents discussed. The extractable uranium is a function of the exchange rate and of the speed of the flow inside the exchanging system; therefore it is quite clear that the current speed is not a prerequisite and that coastal currents around Italy are suitable. Exchanging elements built with sheets parallel to the flow, exchanging pans containing granular or fibrous exchangers have been considered. The main characteristics of a 1000 t/a plant are discussed considering different possibilities. The most acceptable seems to be the continuous extraction system. The parameters needed to calculate the dimensions of such a plant are given and the relation between the length and speed of the moving chain discussed. A rough economic evaluation of the plant cost - starting from known technologies - and of the final cost of the uranium oxide produced is made.
 KEY uranium, seawater, plant design, tide, current, ion exchange, adsorbent, economics, extraction, nearshore, plant productivity

- 55 AUTH Betts, R.H.; Michels, Rita K.
 DATE 1949
 TITL Ionic association in aqueous solutions of uranyl sulphate and uranyl nitrate.
 CITA J. Chem Society, Suppl. No 2 : 286-294 (1949)
 ABST Spectrophotometric methods have been used to study ionic association in aqueous solutions of uranyl nitrate and uranyl sulphate. The stoichiometric association constants for the equilibria $\text{UO}_2^{2+} + \text{HSO}_4^- \rightleftharpoons \text{UO}_2\text{SO}_4 + \text{H}^+$ and $\text{UO}_2^{2+} + \text{NO}_3^- \rightleftharpoons \text{UO}_2\text{NO}_3^+$ were found to be 5.0 ± 0.34 and 0.21 ± 0.01 , respectively. These values were obtained for solutions 2.00M in hydrogen ion. Results for concentrations of nitrate greater than 3M could not be interpreted unequivocally. In this region, either small amounts of $\text{UO}_2(\text{NO}_3)_2$ are formed, or, more probably, the value of the association constant changes slightly with the ionic environment.
 KEY chemical species, uranium.

BIBLIOGRAPHY OF URANIUM RESOURCES

- 56 AUTH Bhat,S.G.; Krishnaswamy,S.; Lal,D.; Rama, Moore,W.S.
 DATE 1969
 TITL Th-234/U-238 ratios in the ocean.
 CITA Earth and Planetary Science Letters 5: 483-491 (1969).
 COUN India
 ABST The activity of the short-lived Th-234 (half-life = 24 days) is found to be in marked radioactive disequilibrium with respect to the concentration of its parent, U-238, in the top hundred meters of the sea water column; values above and below secular equilibrium exist. The mechanisms responsible for the observed distribution of Th-234 are discussed and their rates are evaluated.
 KEY concentration, uranium, seawater, analysis, trace metals, adsorption, particulate
- 57 AUTH Bilal,B.A.; Braetter,P.; Muehlig,B.; Roesick,U.; Zimen,K.E.
 DATE 1971
 TITL Activation-analytical determination of uranium traces in marine systems with separation of neptunium-239 by countercurrent ion migration.
 CITA Radiochim. Acta 16(3-4): 191-192 (1971). (German).
 COUN West Germany
 ABST The U in sea water was detd. by thermal neutron irradiation. (5.1×10^{11} n/cm². sec) followed by β -spectrometry with a Ge(Li) detector and a multichannel analyzer. The sample was then sep'd. into an anion, a cation, and a Np fraction by countercurrent ion migration. The Np oxalate complex is readily sep'd. from other cations, and can be detd. quant. by β -spectrometry. By this method, U was detectable in sea water in amounts of <0.05 ppb.
 KEY uranium, seawater, analysis, concentration, extraction
- 58 AUTH Binney,S.E.
 DATE 1976
 TITL Extraction of uranium from seawater, phase I.
 CITA Project Report, Nov. 11, 1976, Dept. of Nuclear Engineering, O.S.U.
 COUN USA
 ABST Tasks for this project included developing an analytical method for measuring uranium at very low concentrations, evaluating resins and adsorbents for their ability to selectively remove uranium from sea water, and evaluating processes for eluting the uranium from promising resins or adsorbents. The delayed fission neutron (DFN) counting method was the best analytical method of four tested, the other three being gamma ray spectrometry, x-ray spectrometry, and x-ray fluorescence. A thorough explanation of DFN's equipment, calibration and performance is given. Resins and adsorbents tested include chitosan, crushed crabshell, Duolite ES-I3I, blotter grade and laft grade cellulose, activated charcoal, polyacrylamide, silica gel and peat moss. Additional data are being collected on silica and peat moss, which had the highest loading

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capacities. Solutions of sodium carbonate, ammonium carbonate and ammonium hydroxide were the best eluting agents, as all were successful, but ammonium hydroxide may be the most promising since it is easily recoverable.

KEY   uranium, seawater, analysis, adsorbent, capacity, elution, concentration, economics, extraction

- 59   AUTH   Binney, S.E.
       DATE   1977
       TITL   Extraction of uranium from seawater, phase I.
       CITA   Project Report, July 22, 1977, Dept. of Nuclear Engineering, O.S.U.
       COUN   USA
       ABST   Present refinements and possible future improvements of the delayed fission neutron (DFN) technique for measuring uranium content in seawater are discussed. Titanium hydroxide and silica gel were found to be the best agents for adsorbing the uranium from the seawater. $Ti(OH)_4$ had a higher loading capacity, but the silica gel was far more consistent. Acetic acid was found to be about ten times better than ammonium hydroxide as an elution solution for silica gel. A cost comparison between the $Ti(OH)_4$ adsorption and that of silica gel showed that costs were approximately the same in either case. Future plans include further analysis of silica gel as an adsorber, and testing of a more crystalline silica gel based on ionic radius information.
- KEY   analysis, adsorbent, elution, economics, titanium, uranium, seawater, concentration, extraction, capacity
- 60   AUTH   Biscaye, P.E.; Olsen, C.R.
       DATE   1976
       TITL   Suspended particulate concentrations and compositions in the New York Bight.
       CITA   Middle Atlantic Continental shelf and the New York Bight, ed. by M. Grant Gross. Proceedings of the Symposium American Museum of Natural History, New York City, 3, 4 and 5 November 1976. p. 124-137 (1976).
       COUN   USA
       AREA   NY Bight
       ABST   Suspended particulate concentrations in the New York Bight during 1973-1975 decrease seaward across the shelf, decreasing more rapidly in surface than in bottom waters. Resuspension of fine-grained sediments causes local high concentrations of suspended particles in near-bottom waters. Horizontal displacement of these high concentration plumes from their sources suggests short residence times for suspended particles. Vertical mixing of resuspended particles is limited by

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the thermocline. Along the upper continental slope over a depth range of $\approx 1,000$ m, there is a minimum in near-bottom suspended particulate concentrations suggesting horizontal mixing with waters from the open ocean. Some of this variability may be seasonal. Surface water suspended matter has a higher proportion of biogenic (inorganic skeletal as well as organic) particles than near-bottom suspended matter which is dominantly nonbiogenic (principally aluminosilicate). Skeletal debris is primarily siliceous in shelf waters, becoming more carbonate-rich seaward of the shelf break. Aluminosilicate suspended particles in shelf waters are predominately K-rich whereas Mg-Ca-K-Fe-rich aluminosilicates dominate beyond the shelf break.

KEY chemistry, estuary, fouling, nearshore, particulate, seawater, mid atlantic, sediments

- 61 AUTH Bjornberg, T.K.S.
 DATE 1971
 TITL Distribution of plankton relative to the general circulation system in the area of the Caribbean Sea and adjacent regions.
 CITA Symposium on Investigations and Resources of the Caribbean Sea and Adjacent Regions, Organized Jointly by UNESCO and FAO, Willemstad, Curacao, Netherlands Antilles, 18-26 November, 1968. (1971).
 COUN Brazil
 AREA Caribbean
 ABST The major circulation and property distribution features of the Caribbean and Gulf of Mexico are reviewed. The major plankton species are tabulated and community associations described. The flora is essentially that of the North Equatorial Current. Quantitative profiles all show maxima at or near 80 m.
 KEY caribbean, gulf of mexico, marine organisms
- 62 AUTH Black, W.A.P.; Mitchell, R.L.
 DATE 1951
 TITL Trace elements in the common brown algae and in sea water.
 CITA Journal of Marine Biological Association of the United Kingdom 30: 575-584 (1951).
 COUN UK
 ABST Sea water probably contains all the chemical elements, although a number of them have not yet been detected. Considerable information is available on the occurrence of various elements in marine plants and animals, but it is far from complete for any one biological group. Except for recent work by Spooner (1949), on the absorption of radioactive strontium and yttrium by marine algae, no detailed study of the trace elements in the brown algae, nor any attempt to correlate the trace elements in sea water with those in algae, appears to

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have been carried out. The following is a brief resume of the work that has been done in this field. .

KEY multi-purpose process, seawater, marine organisms, adsorption

- 63 AUTH Blake, C.A.; Coleman, C.F.; Brown, K.B.; Hill, D.G.; Lowrie, R.S.; Schmitt, J.M.
 DATE 1956
 TITL Studies in the carbonate-uranium system.
 CITA Journal of the American Chemical Society 78: 5978-5983 (1956).
 COUN USA
 ABST Portions of the phase diagram for the four component system $\text{UO}_3\text{-Na}_2\text{O-CO}_2\text{-H}_2\text{O}$ have been investigated at 26°. Solubilities have been determined for UO_2CO_3 in sodium carbonate solutions and for $\text{Na}_4\text{UO}_2(\text{CO}_3)_3$ in sodium carbonate and other salt solutions as a function of the concentration of co-solute. A solubility of 320 g. U/l. wa/l was obtained at molal ratio $\text{CO}_2\text{:Na:U}$ close to 2:2:1 and pH close to 7. From solubilities and spectrophotometric measurements, evidence has been obtained for the existence of $\text{UO}_2(\text{CO}_3)_2^{-2}$ and $\text{UO}_2(\text{CO}_3)_3^{-4}$, with an estimate of the stability of the latter, and also for an additional complex ion having the molar ratio $\text{CO}_2\text{:U} = 0.5$.
 KEY uranium, concentration, salinity, analysis, chemistry
- 64 AUTH Blanchard, R.L.
 DATE 1965
 TITL U-234/U-238 ratios in coastal marine waters and calcium carbonates.
 CITA Journal of Geophysical Research 70: 4055-4061 (1965).
 COUN USA
 ABST Water and live molluscan shell samples were collected simultaneously at seven locations on the seacoast of the United States. Samples of silt, water, and shells from an estuary were also included in the study. The water samples were analyzed for U-238, U-234, calcium, and salinity; the shell samples were analyzed for U-238, U-234, calcium and crystal structure. All water samples, regardless of salinity or total uranium content, were found to have uranium activity ratios, Au-234/Au-238 , within the experimental uncertainty of the 1.15 value accepted for an oceanic environment. The results indicate that the normally higher uranium activity ratio of rivers does not increase the ratio of coastal waters above the 1.15 oceanic value. The activity ratios of all except two shell samples analyzed were similar to those of the surrounding seawater and to the oceanic 1.15 value. The application of the results of the study to the determination of geologic age via uranium-uranium daughter equilibrium is discussed.

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- KEY seawater, uranium, salinity, marine organisms, estuary, analysis, concentration, geology, nearshore, river
- 65 AUTH Blanchard, R.L.; Dakes, D.
DATE 1965
TITL Relationships between uranium and radium in coastal marine shells and their environment.
CITA Journal of Geophysical Research 70(12): 2911-2921 (1965).
COUN USA
ABST Samples of seawater and bivalve molluscan shells were collected from 14 locations in the coastal waters of the U.S. and from one location near the Galapagos Islands off Ecuador. The seawaters were analyzed for chlorinity, radium 226, and uranium and the shells were analyzed for calcium, radium 226, uranium and crystal structure.
- KEY seawater, uranium, concentration, marine organisms, trace metals, analysis, chemical species, temperature, nearshore
- 66 AUTH Blanton, J.
DATE 1969
TITL Energy dissipation in a tidal estuary.
CITA Journal of Geophysical Research 74(23): 5460 (1969).
COUN USA
AREA Oregon
ABST The extent and mechanism of the dissipation of tidal energy were studied for Coos Bay, a coastal plain estuary located on the central Oregon coast. The energy required to provide the observed mixing and increase in potential energy has been compared with the energy lost through tidal damping. The dissipation rate in Coos Bay was measured at 10^{-4} watt/kg.
- KEY estuary, seawater, river, water, tide, nearshore, pacific northwest
- 67 AUTH Blanton, J.D.
DATE 1975
TITL Characteristics of coastal circulation affecting the transport and dispersion of material released from the nuclear industry.
CITA Combined Effects of Radioactive, Chemical, and Thermal Releases to the Environment, Proceedings of a Symposium, IAEA and OECD Nuclear Energy Agency, Stockholm, 2-5 June 1975 (1975).
COUN USA
AREA Great Lakes
ABST Our knowledge of circulation in the coastal zones of oceans and inland seas is hindered by lack of detailed observations in these regions. The shallow zone within a few miles of the coast is the region where the impact of nuclear facilities is likely to be felt. The studies

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reported here represent an attempt to obtain the spatial and temporal resolution necessary to describe the characteristics of circulation in the coastal zone. These studies were conducted in Lake Ontario, one of the Laurentian Great Lakes, and they are thought to be particularly relevant to most large lakes and inland seas such as the Baltic Sea. Some relevance to shallow continental shelf areas is also noted.

KEY current, nearshore, water, seawater

68 AUTH Bomex
DATE 1975
TITL Synoptic weather atlas.
CITA U.S. Dept. of Commerce, NOAA, Environmental Data Service
COUN USA
AREA Caribbean, Western North Atlantic
ABST Charts of sea level and other level pressure are given. Also charts for the top of the Ekman layer are presented.
KEY climate, caribbean, s atlantic, seawater, water

69 AUTH Bonatti, E.; Fisher, D. E.; Joensuu, O.; Rydell, H. S.
DATE 1971
TITL Postdepositional mobility of some transition elements, phosphorus, uranium and thorium in deep sea sediments.
CITA Geochimica et Cosmochimica Acta 35: 189-201 (1971).
COUN USA
ABST Deep sea hemipelagic sediments from the east Pacific show an oxidized upper zone of variable thickness and a reduced zone below. The geochemistry of a core from this region was studied in detail. The Eh of the upper zone is close to +100 mV, while in the lower zone it reaches about -400 mV. Reducing conditions in the lower section of the core are related to the oxidation of organic matter in the sediment, as indicated by the gradual decrease with depth of the concentration of nitrogen in the upper part of the core. Various elements, such as Mn, Ni, Co, P and La, are enriched in the upper oxidized zone, while Cr, V, U and S are enriched in the lower reduced zone. Postdepositional mobility of the elements in question, mainly by diffusion in the interstitial solutions, can explain their distribution in the core. Redox reactions can account directly for the mobilization of Mn, Ni, Co, Cr, V and U, indirectly for that of P and La. Fe and Cu do not migrate significantly, since they are immobilized as sulfides in the reduced zone. Th appears not to be affected by diagenetical mobility.

KEY sediments, uranium, vanadium, chemistry, organics, interstitial water, trace metals, analysis, geography

70 AUTH Borole, D. V.; Krishnaswami, S.; Somayajulu, B. L. K.
DATE 1977
TITL Investigations on dissolved uranium, silicon and on

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- particulate trace elements in estuaries.
 CITA Estuarine Coastal Marine Science 5(6): 743-54 (1977).
 COUN India
 ABST The concentrations of dissolved uranium and silicon and the chemical composition of suspended phases in the Nerbada, Tapti and Godavari estuaries have been measured as a function of chlorosity. The results suggest the uranium behaves conservatively in all the three estuaries whereas silicon shows conservative behaviour in Nerbada and Tapti estuaries and non-conservative in the Godavari estuary. The variation of chemical composition of particles with chlorosity does not show any systematic trend; the observed scatter can be attributed to variations in mineralogy and size distribution of these particles. The data on chemical composition also indicate that in these estuaries the degree of desorption of elements from particles is much less than those reported for European estuaries.
 KEY concentration, uranium, estuaries, particulate, trace metals, chemistry, adsorption
- 71 AUTH Bostrom, K.; Fisher, D.E.
 DATE 1971
 TITL Volcanogenic uranium, vanadium and iron in Indian Ocean sediments.
 CITA Earth and Planetary Science Letters 11: 95-98 (1971).
 COUN USA
 ABST About one hundred U, V and Fe analyses of Indian Ocean sediments indicate that enrichments of U and V occur in hemipelagic sediments close to the continents, probably associated with biogen constituents. The highest concentration, however of U, V and Fe occur in active ridge sediments, suggesting that submarine volcanism is an important source of these elements.
 KEY uranium, concentration, sediments, vanadium, trace metals, analysis
- 72 AUTH Bourke, R.H.; Glenne, B.; Adams, B.W.
 DATE 1971
 TITL The nearshore physical oceanographic environment of the Pacific Northwest Coast.
 CITA Oregon State University Press, February 1971, 127 p.
 COUN USA
 AREA Pacific Northwest
 ABST Nearshore physical oceanographic conditions off the coasts of Washington, Oregon, and California are summarized. Bottom topography, wind, river discharge, currents, temperature, salinity, and wave distributions are discussed.
 KEY current, salinity, temperature, seawater, pacific northwest, river, climate, geography, nearshore, particulate

- 73 AUTH Bowen, V.T.; Metcalf, W.G.; Burke, J.C.
DATE 1972
TITL Shallow-water strontium-90 anomaly about the Antilles Arc-1970.
CITA Journal of Marine Research 30(1): 112-120 (1972).
COUN USA
AREA Caribbean
ABST Vertical profiles about the southeastern approaches to the Caribbean in early 1970 have shown a consistent Sr-90 inversion, with the maximum concentrations at depths of about 100 m. It appears that four water masses may be involved, in this area, in a very complicated mixing and overlaying phenomenon.
KEY current, seawater, caribbean
- 74 AUTH Bowman, M.J.; Wunderlich, L.D.
DATE 1976
TITL Distribution of hydrographic properties in the New York Bight apex.
CITA Middle Atlantic Continental shelf and the New York Bight, American Society of Limnology and Oceanography, Proceedings of the Symposium American Museum of Natural History, 3, 4 and 5 November 1975. p. 58-68 (1976).
COUN USA
AREA NY Bight
ABST Seasonal hydrographic cycles are interpreted through a series of isometric block diagrams and planimetric projections illustrating the distributions of temperature, salinity, and density in the bight apex. Seasonal cycles are typical of those found in coastal seas near river mouths in drowned river valleys in temperate latitudes. The prevailing southwest coastal drift, the right-angle bend of the coastline, seasonal and short term wind patters, and the presence of the Hudson Shelf Valley, all influence the nearshore circulation.
KEY current, nearshore, offshore, salinity, temperature, seawater, mid atlantic
- 75 AUTH Broecker, W.S.
DATE 1963
TITL A preliminary evaluation of uranium series in-equilibrium as a tool for absolute age measurement on marine carbonates.
CITA Journal of Geophysical Research 68(9): 2817-2834 (1963).
COUN USA
ABST Experimentally determined ratios of Ra-226 to U-238 for marine carbonates are compared with ratios predicted on the basis of the age of the sample as determined by radiocarbon. Three major conclusions may be drawn: a) fossil mollusks contain appreciably more uranium than their contemporary equivalents, b) acid leach fractions have considerably higher Ra-226/U-238 ratios than the residual material and, c) the Ra-226/U-238 ratios are

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either within experimental error of, or in excess of, the predicted ratios (hence ages computed from the Ra-226/U-238 ratio would be equal to or greater than the corresponding C-14 ages.) Measurements of Th-230, Th-232, U-234, and Pa-231 are necessary before any elaborate interpretation of the observed anomalies is attempted.

KEY uranium, trace metals, concentration, analysis, marine organisms

- 76 AUTH Broida, S.
DATE 1969
TITL Geostrophy and direct measurement in the Straits of Florida.
CITA Journal of Marine Research 27(3): 278-292 (1969).
COUN USA
AREA Florida Straits, Bahamas
ABST Quantitative agreement between geostrophic computations and direct measurements of current and transport in the Straits of Florida, and elsewhere as well, is found only when observations are made under synoptic conditions. Under other conditions, geostrophic computations often show a multi-axial structure (i.e., bands of current) not found with direct measurements; this apparent multi-axial structure could be caused largely by periodic disturbances related to the tides. The reference level must be determined by direct measurement in order to obtain reasonable agreement between direct and geostrophic methods of transport determination. Another mandatory condition for good agreement between the two methods is that sampling bottles must be properly spaced in the upper layers; otherwise interpolation of the observed parameters may result in a false picture of the density field.
- KEY current, offshore, temperature, salinity, s atlantic, seawater

- 77 AUTH Brokaw, R.; Dertel, G.F.
DATE 1976
TITL Suspended sediment data from nearshore waters of Georgia.
CITA Georgia Marine Science Center, Technical Report Number 76-3, Savannah, 42 p. (1976).
COUN USA
AREA Georgia
ABST Profiles of suspended sediment concentrations are given us both depth and distance offshore. Histograms of % organic is also given. Several satellite photos are shown.
- KEY concentration, fouling, particulate, s atlantic, seawater, nearshore, offshore, sediments

- 78 AUTH Brooks, I.H.; Niiler, P.P.

(CONT.)

DATE 1975
TITL The Florida Current at Key West: summer 1972.
CITA Journal of Marine Research 33(1): 83-92(1975).
CDUN USA
AREA Florida Strait, Key West
ABST Sixteen dropsonde cross-sections of the Florida Straits at the Key West, Florida, longitude are used to examine the persistent features and large-scale variations of the temperature, salinity, and horizontal velocity structures of the Florida Current. A persistent counterflow was found along the northern shore of the Current, which can be interpreted from the salinity distribution as cyclonic recirculation of the Florida Current water. Analysis of the temporal variations indicate that a downstream acceleration of the Current is accompanied by a warming trend.
KEY current, offshore, seawater, temperature, salinity, gulf of mexico

79 AUTH Brooks, I.H.; Niller, P.P.
DATE 1977
TITL Energetics of the Florida Current.
CITA Journal of Marine Research 35(1): 163-191 (1977).
CDUN USA
AREA Florida Straits
ABST During the summer of 1974, fifty free-drop transport profiles and STD/XBT profiles were carried out in the Florida Current at 14 stations along the 25°51.00' N latitude. From these data and from the historical free-drop data 12 km to the south, a computation is made of the energy flow from the mean current to the fluctuations over the entire cross-section of the Florida Straits. Statistically significant areas of both potential and kinetic energy conversion are computed. In the absence of the influence of pressure gradients on the energy flux, a local transfer can occur both to and from the fluctuations. The net flux over the cross-sectional area is not significant; it would lead to a decay time of total perturbation energy in 50 days which is far in excess of the time required for the water mass of the Florida Current to travel through the Straits of Florida. We conclude that pressure forces must locally balance the energy flow so that an equilibrium exists between the fluctuations and the mean Florida Current.
KEY current, offshore, salinity, temperature, seawater, gulf of mexico

80 AUTH Brower Jr., W.A.; Diaz, H.F.; Prechtel, A.S.; Searby, H.W.; Wise, J.L.
DATE 1977
TITL Climatic atlas of the outer continental shelf waters and coastal regions of Alaska. Vol 1- Gulf of Alaska, Vol 2-

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- Bering Sea, Vol 3-Arctic Ocean.
- CITA Arctic Environmental Information and Data Center-University of Alaska, Anchorage, National Climatic Center-Environmental Data Service, Asheville, N.C., NOAA.
- COUN USA
- AREA Alaska
- ABST A good atlas to find such quantities as nearshore currents, shore stations with weather conditions by month (winds, clouds, temperature, precipitation etc.) and average condtions. Various hazardous factors such as earthquakes, sea ice, and surge are treated also.
- KEY current, climate, estuary, geology, nearshore, offshore, river, seawater, tide, alaska
- 81 AUTH Brucks, J.T.
- DATE 1971
- TITL Currents of the Caribbean and adjacent regions as deduced from drift-bottle studies.
- CITA Bulletin of Marine Science 21(2): 455-465 (1971).
- COUN USA
- AREA Gulf of Mexico, S Atlantic, Caribbean
- ABST Drift bottles were released in the Caribbean Sea and adjacent Atlantic Ocean in 1967 and 1968 from vessels of the Tropical Atlantic Biological Laboratory of the Bureau of Commercial Fisheries (now known as the National Marine Fisheries Service) and FAO Caribbean Fisheries Development Project. An analysis of the drift-bottle tracks, supplemented by horizontal sections of thermocline depth and dynamic height, reveals variations in the surface currents that are not shown in atlases of average conditions.
- KEY current, seawater, caribbean, gulf of mexico
- 82 AUTH Bruland, K.W.; Koide, M.; Goldberg, E.D.
- DATE 1974
- TITL The comparative marine geochemistries of lead-210 and radium-226.
- CITA Journal of Geophysical Research 79(21): 3083-3086 (1974).
- COUN USA
- ABST The Ra-226 and Pb-210 concentrations in the Gulf of California and eastern North Pacific seawaters appear to be governed by the extents of upwelling and by the consequential biological productivities. The residence times of Ra-226 and Pb-210 in the highly productive Gulf of California surface waters are calculated to be a few months and less than a month, respectively, on the basis of upwelling rates.
- KEY concentration, trace metals, seawater, biological productivity, analysis, marine organisms, sediments, chemistry,

- 83 AUTH Bumpus, D.F.
DATE 1973
TITL A description of the circulation on the continental shelf of the east coast of the United States.
CITA Progress in Oceanography Vol. 6, ed. by B.A. Warren, Pergamon Press, New York, p. 111-158 (1973).
COUN USA
AREA US East Coast
ABST The circulation on the continental shelf of the east coast of the United States is discussed, including the historical development of the concepts, and the surface and bottom circulation based on drift-bottle data and sea-bed drifter data. Suggestions for future research to further our understanding of the circulation problem are offered.
KEY temperature, salinity, current, nearshore, seawater, estuary, river, tide, n atlantic, mid atlantic, s atlantic
- 84 AUTH Burnham, J.B.
DATE 1974
TITL Assessment of uranium and thorium resources in the United States and the effect of policy alternatives.
CITA Battelle-Pacific Northwest Laboratories. Prepared for National Science Foundation. December 1974, PB-238,658.
COUN USA
ABST Presently, uranium extraction cannot be operated economically. Little research is being done at this time, and most firms that had been conducting studies have placed them on inactive status. For any of the processes, the pumping costs alone are many times the price now being obtained for uranium. Studies of tidal power have indicated a very high initial capital investment, which places some question as to the feasibility of this concept. With present technology and current economics, seawater uranium can only be viewed as a potential future source. Economic studies show that 4.8 million cubic feet of water must be moved to produce 1 lb of uranium at 100% efficiency, and for 1 year's production, estimated pumping costs alone would be \$33/lb of uranium produced. A survey is given of the six basic extraction methods studied so far: adsorption, absorption, ion exchange, solvent extraction, coprecipitation, and complexing.
KEY uranium, extraction, economics, capacity, concentration, current, elution, ion exchange, plant design, plant productivity, pumped system, seawater, tidal system, tide, titanium
- 85 AUTH Burnside, S.S.; Wenrich-Verbeek, K.J.
DATE 1976
TITL Chemical analysis and statistical data for water samples collected in Colorado, New Mexico, and Arizona as part of a study of surface-water and stream-sediment sampling

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- techniques used in uranium exploration.
 CITA Report USGS-OFR-76-851: 314p (1976).
 COUN USA
 AREA Colorado, New Mexico, Arizona
 ABST Anal. data for surface-water samples taken from 16 sampling sites are presented. A statistical treatment of the data showing histograms and frequency distributions, is also included. Samples were collected in the spring and summer of 1975 as part of a water and stream-sediment study to establish methods of sampling for U and other elements in surface waters. Stream sediments have been collected along with water samples at each site, and a similar statistical study of the corresponding data for sediment samples is in progress.
 KEY analysis, water, sediments, uranium, trace metals
- 86 AUTH Cagle, G.W.
 DATE 1977
 TITL Oak Ridge analytical program.
 CITA Report CONF-770314-7: 24p (1977).
 COUN USA
 ABST The anal. procedures were selected for use based on the elements to be detd. and the relative accuracy. U is detd. by fluorescence spectroscopy, mass spectrometry, and neutron activation. The As and Se, frequently assocd. with U, are detd. by flameless at. absorption spectroscopy. Water samples are analyzed by emission spectroscopy. In addn., elec. cond. and SO_4^{2-} concns. are detd. in water samples. The sample flow, data flow, and quality control are also briefly discussed.
 KEY uranium, analysis, trace metals, water
- 87 AUTH Carder, K.L.; Schlemmer, F.C.II.
 DATE 1973
 TITL Distribution of particles in the surface waters of the eastern Gulf of Mexico: an indicator of circulation.
 CITA Journal of Geophysical Research 78(27): 6826-6299 (1973).
 COUN USA
 AREA Eastern Gulf of Mexico
 ABST Laboratory measurements of the cumulative particle size distribution (volume $> 1.34 \mu\text{m}^{-3}$) and of the volume scattering function were made on preserved near-surface (0.5-meter depth) seawater samples collected from 51 stations in the eastern Gulf of Mexico during May 1970. The sea surface distribution of suspended particles was found to be very dependent on the loop current, a paucity of particles being found near its center and maximums being found in the upwelling regions of its borders. These two phenomena provided enough parametric contrast that the position of the loop current could easily be identified.
 KEY current, particulate, seawater, gulf of mexico

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- 88 AUTH Carter, L.J.
DATE 1974
TITL Floating nuclear plants: power from the assembly line.
CITA Science 183(4129): 1063-1065 (1974).
COUN USA
AREA Florida
ABST The possibilities for the production of floating nuclear power plants by standardized assembly line methods are discussed. Some of the questions concerning public policy toward such a program are examined.
KEY regulations, existing system, offshore
- 89 AUTH Chan, K.M.; Riley, J.P.
DATE 1966
TITL The determination of vanadium in sea and natural waters, biological materials and silicate sediments and rocks.
CITA Analytica Chimica Acta, 34: 337-345.
COUN UK
ABST Coprecipitation with iron (III) hydroxide was used to concentrate vanadium from sea and natural waters. Separation from the iron and other elements was done via ion exchange and the use of hydrogen peroxide as a selective eluant. Photometric determination with diaminobenzidine was the analytical method. Silicate rocks and marine plants were analyzed. The levels of vanadium in seawater, marine sediments and marine plants were, respectively, $1.8 \mu\text{g/l}$, $.57 \mu\text{g/g}$ and $2.2 \mu\text{g/g}$. The respective coefficients of variation were 2.8%, 1.3% and 2.5%.
KEY vanadium, ion exchange, marine organisms, seawater, analysis, sediments, extraction, elution, concentration
- 90 AUTH Cheng, C.H.; Lu, T.H.; Su, C.S.
DATE 1972
TITL Uranium determinations in river water and underground water by fission track counting.
CITA Ho Tzu K'io Hsueh 9(3-4): 22-28 (1972).
COUN Taiwan
AREA Taiwan Rivers
ABST The concn. of U in rivers, wells, and hot springs was detd. by counting neutron-induced fission tracks with visual and automatic spark counting methods. The concns. in Taiwan are in the range of 0.13 – $2.69 \mu\text{g/l}$.
KEY river, concentration, uranium, analysis, interstitial water
- 91 AUTH Cheng, C.S.; Huang, T.C.
DATE 1975
TITL Extracting uranium from sea water.
CITA K'io Hsueh Shih Yen (7): 251-253 (1975). (Chinese).
COUN Taiwan
ABST Three methods are suggested for further research in extracting uranium from seawater: precipitation

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adsorption, ion exchange resin, and bubble separation. Titanium hydroxide is suggested as an adsorbent in precipitation adsorption. The ion exchange resin involves a chelate reaction in which there is an exchange of the uranyl ion with the resin. Acid phosphate ester is suggested as an active agent to produce bubbles for bubble separation. Research on how marine organisms, such as a kind of brown seaweed, concentrate uranium from seawater could be a promising approach. Future developments may also include constructing tidal basins with adsorption beds to extract uranium from seawater.

KEY uranium, seawater, ion exchange, titanium, adsorbent, marine organisms, extraction, tidal system

- 92 AUTH Chernyaev, I.I.; Golovnya, V.A.; Ellert, G.V.
 DATE 1961
 TITL Preparation of compounds of the type $M_3^+ [(UO_2)_2(OH)(CO_3)_3(H_2O)_5]^{3-}$.
 CITA Russian Journal of Inorganic Chemistry 6(2): 196-200.
 COUN USSR
 ABST Potentiometric titration of ammonium uranyl tricarbonato solution with hydrochloric acid and uranyl nitrate solution has proved the formation of compounds with $U:CO_3$ ratios of 1:2.5, 1:2.0, 1:1.5, and 1:1.0. Triammonium tetraoxohydroxotricarbonato-penta-aquodiuranate, $(NH_4)_3 [(UO_2)_2(OH)(CO_3)_3(H_2O)_3]$, and the compounds $Ba_3 [(UO_2)_2(OH)(CO_3)_3(H_2O)_5]_2 \cdot 4H_2O$, $Ag_3 [(UO_2)_2(OH)(CO_3)_3(H_2O)_5]$ and $Tl_3 [(UO_2)_2(OH)(CO_3)_3(H_2O)_5]$ have been prepared for the first time. The compositions of these compounds have been established, and some of their properties studied.
- KEY chemistry, uranium
- 93 AUTH Chernyaev, I.I.; Golovnya, V.A.; Ellert, G.V.
 DATE 1961
 TITL Synthesis of complex monocarbonates of the type $M^{n+} [(UO_2)(OH)(CO_3)(H_2O)_3]^{n-1}$
 CITA Russian Journal of Inorganic Chemistry 6(2): 191-196 (1961).
 COUN USSR
 AREA lab
 ABST A method has been developed for the separation in the solid state of compounds belonging to the second type of complex in the genetic series of uranyl carbonates. The ammonium, thallium, silver and barium dioxohydroxocarbonato triaquouranates: $NH_4 [(UO_2)(OH)(CO_3)(H_2O)_3]$, $Tl [(UO_2)(OH)(CO_3)(H_2O)_3]_2$, $Ag [(UO_2)(OH)(CO_3)(H_2O)_3]$, $Ba [(UO_2)(OH)(CO_3)(H_2O)_3]_2$, have been prepared for the first time and characterized. It has been shown that in aqueous solution, ammonium uranyl tricarbonato, $(NH_4)_4 [UO_2(CO_3)_3]$, is more stable towards hydrolysis than $K_4 [UO_2(CO_3)_3]$ or $Na_4 [UO_2(CO_3)_3]$.

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KEY chemistry, uranium

- 94 AUTH Chernyaev, I.I.; Golovnya, V.A.; Molodkin, A.K.
 DATE 1961
 TITL Hexa-ammonium pentacarbonatothorate (trihydrate).
 CITA Russian Journal of Inorganic Chemistry 6(2): 200-202 (1961).
 COUN USSR
 ABST Hexammonium pentacarbonatothorate trihydrate, $(\text{NH}_4)_6[\text{Th}(\text{CO}_3)_5] \cdot 3\text{H}_2\text{O}$, has been prepared, and some of its properties have been studied. Cation replacement reactions showed that compounds of type $\text{M}_6[\text{Th}(\text{CO}_3)_5] \cdot n\text{H}_2\text{O}$ are formed when thorium nitrate or hydroxide dissolves in ammonium carbonate solution. The stability of such compounds increases in the order of cations: $6\text{NH}_4^+ < 2[\text{Co}(\text{NH}_3)_6]^{3+} < [(\text{CN}_3\text{H}_6)_3(\text{NH}_4)_3]^{6+} < 6\text{Ti}^+$.
 KEY chemistry, uranium
- 95 AUTH Cherry, R.D.
 DATE 1964
 TITL Alpha-radioactivity of Plankton.
 CITA Nature 203(4941): 139-143 (1964).
 COUN South Africa
 ABST An experimental setup which consists of a phosphor-sample system provides measurement of total α -activity, and an estimate of the percentage of this activity which is due to the thorium series. Activities for plankton of different types and in different locations are discussed and summarized, and polonium, thorium and uranium are considered as α -emitting elements. 1-2 pc./g of α -activity in dry plankton was attributed to uranium and 1.6 pc./g dry plankton would give about 0.1 pc./g wet plankton, and since Picciotto's seawater data shows a concentration of .002 pc./g seawater, this implies a concentration factor of the order 50.
 KEY uranium, seawater, concentration, marine organisms, trace metals, analysis
- 96 AUTH Chew, F.
 DATE 1953
 TITL Results of hydrographic and chemical investigations in the region of the "red tide" bloom on the west coast of Florida in November 1952.
 CITA Bulletin of Marine Science of the Gulf and Caribbean 2(4): 610-625 (1953).
 COUN USA
 AREA Florida, Gulf of Mexico
 ABST Eleven hydrographic stations were occupied in the Gymnodinium bloom area off Fort Myers, Florida, in November 1952. These data provide the basis for a three-dimensional description of the hydrographic environment where the phenomenon occurred. The current

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pattern in the area of study was more complex than is generally thought. There was eddying motion which appears to be seasonal in character. Regions of maximum total phosphorus were found to coincide with water of Gulf origin, while water with greater river influence contained regions of minimum total phosphorus. This pattern implies that the increased phosphorus content probably came from the open Gulf. The total phosphorus changed slowly with depth in a slanting water column, and areas of definite *Gymnodinium* bloom, while high in total phosphorus, did not coincide with areas of maximum observed total phosphorus which was some ten times the normal value. Three mechanisms capable of effecting the observed total phosphorus pattern are given. No proven explanation of the causes of the recurrent plankton blooms is as yet available.

KEY gulf of mexico, seawater, nutrients, biological productivity, river

- 97 AUTH Chew, F.
DATE 1955
TITL The offshore circulation and a convergence mechanism in the red tide region off the west coast of Florida.
CITA Transactions, American Geophysical Union 36(6): 963 (1955).
COUN USA
AREA West Coast of Florida
ABST The offshore water is shown to move as a single column. The sloping bottom and the equation of continuity are then applied to show the existence of a horizontal convergence mechanism which, over a period of several weeks, may effect a general-fold increase in concentration of floating particles. This study contains some modeling.
KEY current, biological productivity, particulate, nearshore, gulf of mexico, seawater
- 98 AUTH Chew, F.
DATE 1961
TITL Some implications of the highly saline water off the south west coast of Florida.
CITA Journal of Geophysical Research, 66(8): 2445 (1961).
COUN USA
AREA Florida, Gulf of Mexico
ABST An extensive body of highly saline water (37.5 per mil and more) was observed off the southwest coast of Florida in the summer of 1956 when drought conditions existed in central and southern Florida. The existence of this water mass is evidence against upwelling and against the adjacent Florida west coast runoff being the source of the less saline water further offshore, two postulated conditions that have sometimes formed the basis of some supposed Red Tide mechanisms in this

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region. Evaporation and precipitation computations indicate that this highly saline mass was formed mainly in the region northwest of Key West. This understanding, together with the known northward advection, enabled us to estimate the magnitude of the lateral eddy diffusion. In turn, this determination is used in discussing the efficacy of a supposed Red Tide convergence mechanism. Estimate of errors is also included.

KEY gulf of mexico , salinity, seawater

- 99 AUTH Chew,F.; Drennan,K.L.; Demoran,W.J.
DATE 1962
TITL Some results of drift bottle studies off the Mississippi delta.
CITA Limnology and Oceanography 7(2): 252-257 (1962).
COUN USA
AREA Mississippi Delta
ABST On the basis of drift bottles released off the Mississippi delta, the surface circulation in the vicinity is found to include: 1) a current bifurcation immediately east of the delta and 2) a stagnant region south of the delta. In addition, extensive "tide rips" of sargassum weeds and debris across which are found a change in color, salinity, and temperature are often observed.
KEY current, marine organisms, nearshore, climate, river, seawater, gulf of mexico

- 100 AUTH Church,T.M.; Bernat,M.
DATE 1972
TITL Thorium and uranium in marine barite.
CITA Earth and Planetary Letters 14: 139-144 (1972).
COUN USA
ABST Analyses of thorium and uranium from deep-sea barites and their sediments show that: (1) Marine barites concentrate thorium relative to their bulk sediments and appear to be growing near the sediment surface. However, some barites are found associated with ferromanganese deposits, and these barites, like continental varieties, are depleted in thorium and may reflect formation or alteration from effects of volcanic processes. (2) While marine barites show Th-210/Th-232 depositional rates analogous to their sediments, they have distinctly lower isotope ratios which may reflect their formation from deep-sea or pore water. (3) Marine barites, like phillipsites and sea water, contain excess amounts of Th-228 and are probably undergoing a continuous exchange chemistry within the thorium series as the result of Ra-228 mobilization in the sedimentary column.
KEY uranium, sediments, analysis, particulate, trace metals, chemistry, concentration, seawater

- 101 AUTH Clark, J.; Brownell, W.
 DATE 1973
 TITL Electric power plants in the coastal zone: environmental issues.
 CITA American Littoral Society Special Publication (7): 112p (1973).
 COUN USA
 ABST Environmental disturbances caused by open-cycle cooling systems of steam electric plants that draw massive quantities of water from public water bodies to cool steam condensers were studied. Topics covered include: estuarine ecology, power plant design, vulnerability of estuarine biota, impacts internal to the plant, impacts external to the plant, federal regulations, and solutions. It was concluded that thermal pollution is not the leading adverse environmental effect from power plants, but the invisible death of masses of small aquatic life that are drawn into the plants with the huge volumes of cooling water withdrawn from public waters. Solutions advanced for this problem are: to locate power plants along the open coast where there is deep water nearby for strategic placement of intake and outlet structures and to reduce the volume of cooling water by requiring plants to use closed-cycle systems which recirculate cooling waters.
 KEY existing system, environmental impact, water, estuary, marine organisms, regulations, plant design
- 102 AUTH Coachman, L.K.; Aagaard, K.
 DATE 1974
 TITL Physical Oceanography of Arctic and Subarctic Seas.
 CITA Marine Geology and Oceanography of the Arctic Seas, ed. by Yuovne Herman, Springer-Verlag, NY, p. 1-72 (1974).
 COUN USA
 AREA Arctic, Subarctic
 ABST A very thorough treatment of many aspects of the oceanography of the Arctic Ocean is included. Sections of temperature and salinity as well as circulation patterns and cross sections are given.
 KEY current, chemistry, climate, offshore, salinity, temperature, seawater, alaska
- 103 AUTH Collins, C.A.; Pattullo, J.G.
 DATE 1970
 TITL Ocean currents above the continental shelf off Oregon as measured with a single array of current meters.
 CITA Journal of Marine Research 28(1): 51-68 (1970).
 COUN USA
 AREA Oregon
 ABST Ocean currents were measured with meters moored above the Oregon continental shelf during four periods of about 25 days each--in July, September, and October 1965 and in February 1966. The data are depicted with histograms and progressive vector diagrams. Velocity variations

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having a frequency lower than one cycle in two days were associated with similar variations in wind in the alongshore direction. At a depth of 20 m, southerly winds were associated with northward-moving currents and northerly winds were associated with southward-moving currents.

KEY current, offshore, climate, pacific northwest, seawater

104 AUTH Collins, C.A.; Mooers, C.N.K.; Stevenson, M.R.; Smith, R.L.; Pattullo, J.G.

DATE 1968

TITL Direct current measurements in the frontal zone of a coastal upwelling region.

CITA Journal of the Oceanographical Society of Japan 24(6): 295-306 (1968).

COUN USA

AREA Oregon

ABST Float and flow current measurements made in September 1965 in a frontal zone associated with coastal upwelling off Oregon are described; flow measurements made the following September, with similar results, are also described. The width of the poleward subsurface flow and of the speed maximum was at least 40 kilometers.

KEY current, tide, temperature, seawater, offshore, pacific northwest

105 AUTH Colon, E.F.

DATE 1971

TITL Estuaries, bays, and coastal currents around Puerto Rico.

CITA Technical Completion Report, Puerto Rico Univ., Mayaguez 47 p. (1971).

COUN USA

AREA Puerto Rico

ABST Article not available but referenced through LIRS.

KEY estuary, nearshore, current, seawater

106 AUTH Commonwealth of Puerto Rico, Oceanographic Program, Area of Natural Resources, Department of Public Works.

DATE 1974

TITL Oceanographic baseline data (1971-72) for the formulation of marine waste disposal alternatives for Puerto Rico.

CITA Vol. I: Main Report; Vol. II: Appendices; (1974).

COUN USA

AREA Puerto Rico

ABST These reports contain hydrographic data for embayments around Puerto Rico including the region of the Yabucoa Valley.

KEY current, temperature, salinity, chemistry, nutrient, particulate, caribbean, seawater

107 AUTH Copeland, B.J.

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- DATE 1973
TITL Policy for location of power plants in coastal areas.
CITA Report of the Governors' Conference on Marine Resources, Coastal Plains Center for Marine Development Services, Charleston, S.C., Dec. 17-18, 1973., p.43-52 (1973).
COUN USA
ABST A panel presentation was made on the topic of siting and licensing power plants. All speakers felt that nuclear power was needed to meet the country's expanding energy requirements. Coastal areas were discussed because of the many environmental and transportation problems of inland nuclear plants. The panel made several recommendations.
KEY environmental impact, offshore, estuary, plant design, marine organisms, regulations
- 108 AUTH Corwin, L.R.; Dahlberg, R.C.
DATE 1978
TITL Nuclear power: a balanced approach (a mix of breeders and advanced converters can best meet the needs of the future)
CITA Science 202(4368): 581-584 (1978).
COUN USA
ABST A proposed technological approach to meeting recognized nuclear power needs is a symbiotic combination of breeders and advanced converter reactors. Breeders, situated in secured areas, would be fueled with and self-sufficient in plutonium. The excess fuel produced in the breeder would be uranium-233, sufficient in quantity to supply several advanced converters located near load centers. This approach is suggested as a balanced way to meet important criteria applicable to the continued development of nuclear power.
KEY uranium, reactors
- 109 AUTH Crouthamel, C.E.; Johnson, C.E.
DATE 1952
TITL Spectrophotometric determination of uranium by the thiocyanate method in acetone medium.
CITA Anal. Chem. 24: 1780-1783 (1952).
COUN USA
ABST The use of an acetone-water soln. for the spectrophotometric detn. of U by the thiocyanate method greatly decreases anionic interference, increases sensitivity and color stability, and makes color development independent of pH in the acid region. Analyses are now possible without sepn. of U from sulfate, citrate, phosphate, fluorsilicate, fluoride, Cu, Zn, Fe, Sn, Hg, Ni, or Mn.
KEY analysis, uranium, chemistry, trace metals
- 110 AUTH Cruickshank, M.J.
DATE 1974

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- TITL Mineral resources potential of continental margins.
CITA Geol. Cont. Margins: 965-1000 (1974).
COUN USA
ABST A review with 106 refs. is presented. All classes of minerals including elements in sea water are discussed; fluid hydrocarbons are excluded.
KEY seawater, trace metals
- 111 AUTH Davies, R.V.; Kennedy, J.; McIlroy, R.W.; Spence, R.; Hill, K.M.
DATE 1964
TITL Extraction of uranium from sea water.
CITA Nature 203: 1110-1115 (1964).
COUN UK
AREA Menai Straits, Portland Harbour
ABST Many different organic and inorganic absorbents were tested for their ability to extract uranium from seawater. Resins were prepared containing mono- and di-basic phosphoric and phosphonic acids, 8-hydroxyquinolone, kojic acid, salicylic acid, amino-carboxylic acid and amino-phosphoric acid functional groups. Samples of chelating resins were also tested, the most promising being a condensation product of formaldehyde and resorcinol arsonic acid resin. The arsonic acid resin had by far the highest loading capacity of all resins, but in any form it steadily lost capacity due to a slow hydrolytic attack on the carbon-arsenic bond. Several inorganic absorbents had uptakes comparable to the arsonic acid resin. These included titanium hydroxide, basic zinc carbonate, and certain lead compounds such as lead sulfide and lead pyrophosphate. Other lead compounds were unstable in seawater, moreover, all lead compounds and the zinc carbonate dissolved too rapidly in seawater to be economically feasible. Titanium hydroxide loss, however, was negligible. Muslin and glass wool were used to support the absorber, and although absorption was faster on muslin, both had the same total uptake. Smaller granules of absorber (0.3 mm) had a much higher uptake than 0.9 mm diameter granules. Elution of uranium from basic zinc carbonate on glass wool was rapid with 1.0 M sodium carbonate, taking four to five bed volumes, but elution with titanium hydroxide was slow. The best eluant was 1 M ammonium carbonate, which gave 93 percent elution in eight bed volumes, other eluants being tested including 1 M sodium carbonate, a 2:1 ratio of sodium bicarbonate and sodium carbonate, and dilute nitric acid. Various schemes were discussed as to the possibility of siting a plant so that the uranium-bearing water would be supplied by natural transport processes. Places considered included the Norwegian Current, the Florida, Japan and Menai Straits, and a tidal power supply was also discussed. It was estimated that the Menai Straits could produce

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1300 short tons of U_3O_8 per year at a cost of 11 - 22 dollars per pound. The possibility of using titanium hydroxide as its own support instead of glass wool was discussed, since glass wool is not suitable for large-scale operation.

KEY uranium, seawater, extraction, adsorbent, titanium, basic zinc carbonate, elution, capacity, economics, current, tide, plant productivity, tidal system

- 112 AUTH Davies, R.V.; Kennedy, J.; Peckett, J.W.A.; Robinson, B.K.; Streeton, R.J.W.
 DATE 1965
 TITL Extraction of uranium from sea water. Part II. Extraction by organic and inorganic absorbers.
 CITA Atomic Energy Research Establishment Report AERE-R-5024: (1965).
 COUN UK
 ABST The organic absorbers that have the highest loading values in seawater are copolymers of formaldehyde and resorcinol arsonic acid (H_2RA_p) with loadings of 1000 to $1100 \mu g$ U/g. With inorganic absorbers optimum loadings were attained by certain compounds of lead, basic zinc carbonate (BZC), and hydrated titanium oxide (HTO), which absorbed 200 to 900, 540, and $280 \mu g$ U, respectively, per g lead, zinc, and titanium in absorber. The solubility of HTO in seawater is $<0.1 \mu g$ Ti/ml and is not sufficiently high to render uneconomic its use as an absorber of uranium from seawater. The resorcinol arsonic acid resins (H_2RA_p) lose approximately 2.3% of their initial arsenic per week in contact with seawater while the losses due to solubility of lead absorbers and BZC in the same medium are not less than $0.5 \mu g$ lead or zinc per ml. These losses are considered too high for the economic use of H_2RA_p resins, lead compounds, and BZC as absorbers of uranium from seawater. Uranium(VI) and resorcinol arsonic acid monomer (H_2RA_m) form the 1:1 complex UO_2RA_m , and an analogous complex (UO_2RA_p) is formed between uranium(VI) and the functional group RA_p of the resin H_2RA_p . Carbonate and bicarbonate ions are liberated into solution during the absorption of uranium(VI) from

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- solutions of sodium uranyl tricarbonate $\text{Na}_4\text{UO}_2(\text{CO}_3)_3$, by BZC and HTO.
- KEY seawater, titanium, adsorbent, extraction, economics, capacity, uranium
- 113 AUTH Degens, E.T.; Ross, D.A., Eds.
DATE 1969
TITL Hot brines and recent heavy metal deposits in the Red Sea.
CITA Springer-Verlag, New York, Inc. 600 p.
COUN USA
AREA Red Sea
ABST An extensive collection of work on the brines, deposits and sediments of the Red Sea is presented. The articles include descriptions of the geochemistry of the sediments which include some reports of uranium concentrations. Brine composition is thoroughly analyzed.
KEY uranium, concentration, salinity, sediments
- 114 AUTH Degens, E.T.; Khoo, F.; Michaelis, W.
DATE 1977
TITL Uranium anomaly in Black Sea sediments.
CITA Nature 269: 566-569 (1977).
COUN West Germany
AREA Black Sea
ABST The upper 90 cm of Black Sea basin sediment with an areal extension of $2.96 \times 10^5 \text{ km}^2$ has an U_3O_8 content of 6.7×10^6 tonnes. Plankton is the prime agent for uranium fixation. Reducing conditions at depth permit uranium to accumulate over the past 5,000 yr. Energetically self-sufficient burning of the top 1-m strata will lead to U_3O_8 concentrations in the order of 100 g per tonne ash.
KEY uranium, sediments, marine organisms, chemistry, concentration, organics, seawater, analysis, geology
- 115 AUTH Deleon, A.; Lazarević, M.
DATE 1971
TITL Possibilities for recovery of uranium as a by-product in the production of phosphate fertilizers and tripolyphosphate.
CITA The Recovery of Uranium, Proceedings of a Symposium on the Recovery of Uranium from its Ores and other Sources, IAEA, Sao Paulo, 17-21 August 1970, p. 351-361 (1971).
COUN Yugoslavia
ABST During the last several years considerable quantities of phosphate fertilizers have been produced in Yugoslavia. In this report results of the distribution of uranium in the various stages of the wet phosphoric acid production process as well as in its products are described. Commercially available solvents have been used as

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- uranium extractants. Two precipitation techniques have been tested for recovering uranium as a by-product in the production of tripolyphosphate.
- KEY   uranium, multi-purpose product, extraction, ion exchange, concentration, analysis
- 116   AUTH   Dement'ev, V.S.
      DATE   1967
      TITL   Absorption of uranium (VI) from natural waters and carbonate-containing solutions by cationites.
      CITA   tr. from Radiokhimiya 9(2): 156-161 (1967).
      ABST   A study was made of the absorption of uranium from natural waters and carbonate-containing solutions by cationites in relation to the pH, carbonate-concentration, ionic strength of the solutions, and m/v. It was shown that the absorption of uranium from waters and solutions on a cationite in which the uranium is definitely in an anionic form, may reach a substantial value.
      KEY   absorption, uranium, water, chemistry, concentration, analysis, ion exchange, chemical species
- 117   AUTH   Dodimead, A.J.; Favorite, F.; Hirano, T.
      DATE   1963
      TITL   Salmon or the North Pacific Ocean, part II.
      CITA   Bulletin International North Pacific Fisheries Commission, no. 13 (1963).
      COUN   Canada
      AREA   North Pacific Ocean
      ABST   This is a complete review of the oceanography of the subarctic Pacific ocean. Distributions and many graphical displays of the following parameters are presented and discussed: temperature, salinity, oxygen, nutrients, currents, and weather. An historical summary of works is also given.
      KEY   biological productivity, climate, chemistry, current, offshore, nutrients, salinity, seawater, temperature, pacific northwest, alaska
- 118   AUTH   Doi, K.; Aoyama, Y.
      DATE   1973
      TITL   Uranium content in natural water.
      CITA   Kozan Chishitsu (5): 35-45 (1973). (Japanese).
      COUN   Japan
      AREA   Japan, British Columbia (Canada), Australia
      ABST   This report summarizes reconnaissance studies of the geochemical prospecting of U by natural water in the areas of Japan and overseas countries. The Power Reactor and Nuclear Fuel Development Corporation of Japan has been doing this prospecting since 1958. Each U content of water taken from eight geological terrains, hot springs, mineral springs, and rivers of the main island of Japan, central part of British Columbia,

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Canada and four geological terrains of Australia has been determined. The U contents of 14,764 water samples taken from main island of Japan are ranged from 0.00 to 68.5 part per billion (ppb) uranium, 68 water samples from British Columbia are ranged from 0.01 to 24.0 ppb and 246 water samples from Australia are ranged from 0.00 to 95.0 ppb. The content of U in natural water is so variable depending on chemical and physical factors of water that many determinations of the uranium content are necessary to set up the correct background and to evaluate the terrain.

KEY uranium, water, river, concentration

- 119 AUTH Doshi, G.R.
 DATE 1967
 TITL Alkaline earth phosphate as carrier for the determination of trace elements in seawater.
 CITA Indian Journal of Chemistry 5: 580-581 (1967).
 COUN India
 ABST A method is described for the determination of cobalt, zinc and uranium in seawater involving their coprecipitation with alkaline earth phosphate. The individual separation of the elements is achieved by the use of both cation (Dowex-50) and anion (Dowex-1) exchangers. Cobalt and zinc fractions are subjected to a thermal neutron flux in the swimming pool reactor, 'Apsara' and quantitatively determined by gamma spectroscopy. Uranium is determined by fluorimetry.
- KEY uranium, seawater, ion exchange, trace metals, extraction, analysis, concentration, chemistry

- 120 AUTH Drennan, K.L.
 DATE 1966
 TITL Airborne measurements of infrared sea temperature in the Gulf of Mexico.
 CITA Gulf Coast Research Laboratory, Oceanography Section, Technical Report No. 2, Ocean Springs, Mississippi, Office of Naval Research, Contract Nonr 3198. (1966).
 COUN USA
 AREA Gulf of Mexico, Mississippi
 ABST Quasi-synoptic measurements of the radiation temperature of the sea were conducted over the northern Gulf of Mexico. These data indicate the seasonal and spatial variations of surface temperature, Mississippi River Discharge Patterns, the effect of the passage of a severe hurricane on the sea surface temperature field, and the major surface features of the circulation in the northern Gulf.
- KEY current, climate, temperature, nearshore, offshore, seawater, river, gulf of mexico

- 121 AUTH Drennan, K.L.
 DATE 1968

(CONT.)

- TITL Hydrographic studies in the Northeast Gulf of Mexico.
CITA Gulf South Research Institute, Environmental Sciences and Engineering Laboratories, Office of Naval Research Contract N00014-67-C-0514 (1968).
COUN USA
AREA Gulf of Mexico
ABST The major circulatory features and distribution of physical properties in the northeast Gulf of Mexico are presented, based on a series of eight quasi-synoptic surveys. Seasonal changes in hydrography and circulation over the continental shelf are shown and discussed in terms of their relationship to the offshore currents, river discharge, winds, and tides. Surface current speed and direction are determined from an extensive drift bottle study and distribution of density.
KEY current, temperature, salinity, nearshore, offshore, river, seawater, tide, climate, gulf of Mexico
- 122 AUTH Dugger, D.L.; Stanton, J.H.; Irby, B.N.; McConnell, B.L.; Cummings, W.W.; Maatman, R.W.
DATE 1964
TITL The exchange of twenty metal ions with the weakly acidic silanol group of silica gel
CITA The Journal of Physical Chemistry 68(4): 757-760 (1964).
COUN USA
ABST Free energies, heats, and enthalpies are reported for the exchange of 17 metal ions, and free energies for three other ions, with the weakly acidic silanol ($-\text{SiOH}$) groups of the surface of hydrated silica gel. The reaction is that of the formation of a metal-surface complex infinitely dilute on the surface. The acid dissociation constant of $-\text{SiOH}$ is estimated to be 10^{-6} to 10^{-8} ; with this value the free energy of the $-\text{SiO}^-$ metal ion bond is calculated.
KEY ion exchange, trace metals, chemistry
- 123 AUTH Dunsmore, H.S.; Sillen, L.G.
DATE 1963
TITL Hydrolysis of Metal Ions. XLVII, Uranyl ion in 3M NaCl medium.
CITA Acta Chem Scand. 17(10): 2657-63.
COUN Sweden
ABST The "best" set of equil. consts. for the hydrolysis of UO_2^{2+} in 3M NaCl was "computer"-derived for the equation: $q \text{UO}_2^{2+} + p \text{H}_2\text{O} \rightleftharpoons (\text{UO}_2)_q (\text{OH})_p^{(2q-p)} + p \text{H}^+$. Equil. consts. (β_{pq}) for the various complexes are: $\log \beta_{11} = -6.64 \pm 0.04$, $\log \beta_{12} = -12.54 \pm 0.08$, $\log \beta_{13} = -18.07 \pm 0.11$, $\log \beta_{14} = -19.96 \pm 0.21$, and $\log \beta_{15} = -24.91 \pm 0.22$.
KEY uranium, chemical species.
- 124 AUTH Duxbury, A.C.
DATE 1962

(CONT.)

TITL Averaged dynamic topographies of the Gulf of Mexico.
CITA Limnology and Oceanography 7(3): 428-430 (1962).
COUN USA
AREA Gulf of Mexico
ABST Average dynamic topographies for the Gulf of Mexico are presented, based on the assumption that seasonal fluctuations are small. The Loop Current, a north eastern gyre, and a western gyre are the major circulation features apparent in the contoured figures of dynamic height.
KEY gulf of mexico, current, seawater

125 AUTH Edgington, D.N.; Gordon, S.A.; Thommes, M.M.;
Almodovar, L.R.
DATE 1970
TITL The concentration of radium, thorium, and uranium by tropical marine algae.
CITA Limnol. Oceanogr. 15: 945-955 (1970).
COUN USA
AREA Puerto Rico
ABST Twenty species of marine algae were collected between 1961 and 1968 from coastal waters of Puerto Rico and analyzed chemically for total organic material, protein nitrogen, and calcium, and radiochemically for the naturally occurring alpha particle emitters Ra-226, Th-232, U-238. Study of these data suggests that the concentration of radium, thorium, and uranium by tropical marine algae is controlled by two mechanisms: 1) ion-exchange or coprecipitation of the ion with the calcium carbonate matrix, and 2) complex formation with either the protein nitrogen or some other component of the organic fraction. Radium (and possibly thorium) apparently is concentrated by both mechanisms, the dominant one depending on the phylum. For the Rhodophyta and the highly calcified Chlorophyta it is the former and for the Phaeophyta the latter. Uranium is concentrated by the first mechanism.
KEY marine organisms, organics, water, concentration, environmental impact, extraction, ion exchange, uranium, trace metals, analysis

126 AUTH El-Ramly, N.A.; Congdon, C.F.
DATE 1975
TITL Desalting plants inventory report #5.
CITA U.S. Dept. of the Interior - Office of Water Research and Technology. (1975).
ABST This is a list of desalting plants throughout the world. The list includes the respective capacities of the plants in millions of gallons per day.
KEY existing system

127 AUTH Emery, K.D.; Uchupi, E.
DATE 1972

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(CONT.)

- TITL Western North Atlantic Ocean: topography, rocks, structure, water, life, and sediments.
 CITA The American Association of Petroleum Geologists, (Memoir 17) Tulsa, Oklahoma, 532 p. (1972).
 COUN USA
 AREA Western North Atlantic
 ABST A very thorough treatment of most aspects of the geological, geophysical, geochemical, biological and physical oceanography of the Western North Atlantic Ocean is treated. The bibliography is very extensive.
 KEY n atlantic, mid atlantic, s atlantic, salinity, seawater, river, tide, sediments, chemistry, temperature, nutrients, nearshore, offshore, geology, estuary, climate, biological productivity, current
- 128 AUTH ENEA; IAEA
 DATE 1967
 TITL Uranium resources—revised estimates
 CITA A Joint Report by the European Nuclear Energy Agency and the International Atomic Energy Agency, December 1967, 26 p.
 ABST This report is a summary and update of the known and estimated uranium resources in the world. Also included are comments on the reliability of the estimates and a short summary on uranium from the sea. In all, the reserves of 20 countries are presented.
 KEY uranium, extraction
- 129 AUTH Evans, M.W.
 DATE 1971
 TITL Surface salinity and temperature 'signatures' in the Northeastern Pacific.
 CITA Journal of Geophysical Research 76(15): 3456-3461 (1971).
 COUN USA
 AREA Northeast Pacific
 ABST In general, sea-surface temperatures increase to a maximum toward the equator and surface salinity reaches a maximum in the subtropics. Surface waters may be roughly classified into areas where temperature and salinity are positively correlated and areas where they are negatively correlated.
 KEY pacific northwest, pacific southwest, salinity, temperature, seawater
- 130 AUTH Favorite, F.
 DATE 1972
 TITL Flow into the Bering Sea through Aleutian island passes.
 CITA Oceanography of the Bering Sea; Proceedings of International Symposium for Bering Sea Study, 1972. p. 3.
 COUN USA
 AREA Aleutians, Bering Sea
 ABST Present knowledge concerning flow through Aleutian island passes has been accumulated from the records of

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historical oceanographic cruises and expeditions and through the results of oceanographic research conducted in this area. Flow through the various openings in the Aleutian-Commander island arc is shown to be quite variable in direction and magnitude. Westward volume transports in the Alaskan Stream south of the Aleutian Islands in summer vary more than 50 percent, but there is little evidence of the annual winter intensification suggested by wind-stress transports and reflected in sea level data in the Gulf of Alaska. Analyses of volume transport data indicate a mean northward flow of 14 Sv through openings in the Aleutian-Commander island arc east of the Commander Islands.

KEY current, climate, temperature, salinity, alaska, seawater

- 131 AUTH Ferguson Wood, E.J.
DATE 1971
TITL Phytoplankton distribution in the Caribbean region.
CITA Symposium on Investigations and Resources of the Caribbean Sea and Adjacent Regions, Organized Jointly by UNESCO and FAO, Willemstad, Curacao; Netherlands Antilles, 18-26 November 1968 (1971).
COUN USA
AREA Caribbean
ABST The phytoplankton of the Caribbean Sea is essentially derived from the North Equatorial Current, modified, sometimes considerably, by a number of factors which will be discussed in this paper. The overall movement of the water, and therefore of the phytoplankton, is from east to west, and we shall therefore begin this phytoplankton study with a consideration of the hydrology.
KEY caribbean, temperature, salinity, nutrients, offshore, seawater, biological productivity
- 132 AUTH Foley, L.M.; Harris, J.L.; Pittman, D.C.
DATE 1974
TITL Assessment of uranium and thorium resources in the United States and the effect of policy alternatives.
CITA NTIS, PB-238 658: 223p (1974).
COUN USA
AREA United States
ABST Objectives of this study were to analyze the known United States uranium/thorium resources and to determine the effect of various policy options on the availability of these resources. It was concluded from this study that, in general, uranium and thorium resources in the U.S. are extensive, but new or improved technology and higher prices are required before they will become economically viable. Five specific conclusions reached during this study were: (1) Reasonably assured uranium reserves recoverable at a 1974 forward cost of \$15/lb U₃

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- D_8 should be adequate at least through 1985. (2) Uranium resources from conventional sandstone deposits recoverable at a 1974 forward cost of \$30/lb U_3O_8 should be adequate to the year 2000. (3) Thorium resources should be adequate to supply all conceivable needs through the year 2000. (4) Capital and manpower resources may be inadequate in the near future. (5) Production capacity may be inadequate in the short term.
- KEY uranium, economics, extraction, seawater, titanium, tidal system, ion exchange, existing system
- 133 AUTH Foster, R.F.
 DATE 1973
 TITL Sources and inventory of radioactivity in the aquatic environment.
 CITA Report by Battelle Pacific Northwest Lab, June 1973, 26 p.
 ABST In all the oceans of the world there are 500,000 megacuries present and in the freshwater, 15 megacuries. About 2% of the radioactivity in seawater is from the U-235, U-238 and Th-232 chains, and the relative amount of radioactive materials in the oceans added by the nuclear power industry is very small, amounting to only 1 megacurie out of the total of 500,000. From nuclear reactors, the releases of H-3 from pressurized water units greatly overshadows the curie quantities of fission products and corrosion products discharged. Emissions of various radionuclides from several specific plants is discussed.
 KEY trace metals, environmental impact, sea water, uranium
- 134 AUTH Foyn, E.; Karlik, B.; Pettersson, H.; Rona, E.
 DATE 1939
 TITL Radioactivity in seawater.
 CITA Nature 143(3616): 275-276 (1939).
 ABST An attempt was made to accurately measure the content of uranium, radium, and thorium in seawater. According to the results, uranium concentration was 2×10^{-6} g/l, radium concentration was 0.03 to 0.2×10^{-12} g/l (mean = 0.07×10^{-12} g/l), and the thorium concentration, very difficult to measure was certainly less than 10^{-6} g/l and probably less than half that amount.
 KEY uranium, seawater, concentration, analysis, trace metals
- 135 AUTH Franchini, C.
 DATE 1973
 TITL Fluorimetric uranium determination in some Italian seas.
 CITA Arch. Oceanogr. Limnol. 18(1): 39-45 (1973).
 COUN Italy
 AREA Italian Sea
 ABST UO_2^{2+} -8-hydroxyquinoline complex is formed and extd. with $CHCl_3$. The procedure has the advantage of analyzing the yield of the primary extn.,

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selfcalibration, and the use of dild. sea water as a blank. The av. U concn. was $3.3\mu\text{g/l}$.

KEY seawater, analysis, extraction, concentration

- 136 AUTH Galtsoff, P.S, coordinator.
DATE 1954
TITL Gulf of Mexico its origin, waters, and marine life.
CITA Fishery Bulletin of the Fish and Wildlife Service, No. 89, Volume 55, Washington D.C. (1954).
COUN USA
AREA Gulf of Mexico
ABST Summarizes the geology, meteorology, oceanography, and biology of the Gulf of Mexico.
KEY gulf of mexico, biological productivity, temperature, salinity, estuary, current
- 137 AUTH Gentile, J.H.; Cardin, J.; Johnson, M.; Sosnowski, S.
DATE 1976
TITL Power plants, chlorine, and estuaries.
CITA U.S. Environ. Prot. Agency. Off. Res. Dev. Report EPA-600/3-76-055: 28p (1976).
COUN USA
ABST Results of field investigations at a power plant indicated that total residual Cl at >1.0 ppm caused mortality of all pumped phytoplankton and up to 75% of the zooplankton. In lab. studies, concns. of Cl which decreased growth of marine phytoplankton by 50% during a 24-hr exposure were $75-330\mu\text{g/l}$. At 0.15 ppm, Cl decreased phytoplankton photosynthesis by 52%.
KEY existing system, estuary, marine organisms, environmental impact
- 138 AUTH Giese, G.S.
DATE 1971
TITL Physical measurements of the coastal water south of western Puerto Rico.
CITA Symposium on Investigations and Resources of the Caribbean Sea and Adjacent Regions, Organized Jointly by UNESCO and FAO, Willemstad, Curacao, Netherlands Antilles, 18-26 November, 1968. (1971).
COUN USA
AREA Caribbean
ABST Off the southwestern coast of Puerto Rico, the continental shelf is 3 to 8 km wide and about 20 m deep at the shelf edge. Water on the shelf is unstratified Caribbean surface water, warm and highly saline. Wind and tidally driven currents on the shelf attain maximum values of about 13 cm/sec.
KEY caribbean, seawater, temperature, salinity, nearshore, current
- 139 AUTH Gloyna, E.F.; Ewing, B.B.
DATE 1957

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- TITL Uranium recovery from saline solutions by biological
slimes.
CITA Nucleonics 15(1): 78-81 (1957).
COUN USA
ABST The factors affecting the biological concentration of U
by bacterial suspensions include: pH, length of
aeration period, contact time, methods of mixing, stage
of organism growth, condition of sludges, and optimum U
dosage for maximum uptake.
KEY extraction, uranium, water, chemistry, marine organisms,
capacity
- 140 AUTH Gohda, S.
DATE 1975
TITL Improvement of the fluorimetric determination of
uranium.
CITA Nippon Kaisui Gakkai-Shi 28(155): 334-341 (1975).
COUN Japan
ABST Samples contg. μ g quantities of U were fused with fluxes
of various compns. under different conditions of temp.
and time. After fusing, the resultant bead was powd.
finely, fixed in a dish with a quartz plate to give a
flat surface, and subjected to fluorimetry, where the
sample was excited with Hg-line of 365 nm, and
fluorescence of 558 nm was measured. Fusion with NaF-Na₂
CO₃-K₂CO₃ (1:4.5:4.5) or with NaF-Na₂CO₃-LiF
(3:3.5:3.5:0.2) at 630° for 20 min enabled the detn. of
U as small as 0.2 μ g within the error of $\pm 1\%$. The
procedures were applied to the detn. of U in sea water.
KEY uranium, analysis, temperature, seawater
- 141 AUTH Gordon, A.L.
DATE 1967
TITL Circulation of the Caribbean Sea.
CITA Journal of Geophysical Research 72(24): 6207 (1967).
COUN USA
AREA Caribbean Sea
ABST The geostrophic method was applied across the Caribbean
Sea and one across the Yucatan Strait. The baroclinic
mass distribution extends to approximately 1200 meters.
Below this, the flow is weak (<5 cm/sec), except in the
depths of the Cayman and Yucatan basins, where currents
of over 10 cm/sec occur. The volume transport across
the meridional section in the Caribbean is about 31×10^6
m³/sec toward the west. The northern passageways
contribute only a small part of this water. The major
outlet is the Yucatan Strait, where the calculated
geostrophic volume transport corresponds to the
transport through the Straits of Florida.
KEY current, temperature, salinity, seawater, caribbean,
climate
- 142 AUTH Gordon, A.L.; Amos, A.F.; Gerard, R.D.

(CONT.)

- DATE 1976
TITL New York Bight water stratification--October 1974.
CITA Middle Atlantic Continental Shelf and the New York Bight, American Society of Limnology and Oceanography, Proceedings of the Symposium American Museum of Natural History, 3,4 and 5 November 1975. p. 45 (1976).
COUN USA
AREA NY Bight
ABST Thermohaline stratification of New York Bight continental shelf water during October 1974 is basically of the summer regime. Salinity increases markedly with increased distance from the coast.
KEY temperature, salinity, seawater, chemistry, mid atlantic, offshore
- 143 AUTH Gow,W.A.; McCreedy,H.H.; Ritcey,G.M.; McNamara,V.M.; Harrison,V.F.; Lucas,B.H.
DATE 1971
TITL Bacteria-based processes for the treatment of low-grade uranium ores.
CITA The Recovery of Uranium, Proceedings of a Symposium on the Recovery of Uranium from its Ores and Other Sources, IAEA, Sao Paulo, 17-21, August 1970, p. 195-211.
ABST The possibility of utilizing the ability of the ferrobacillus-thiobacillus group of bacteria to oxidize ferrous iron and to produce sulphuric acid and ferric sulphate from pyrite in the treatment of uranium ores has for many years been of interest to uranium hydrometallurgists. This is, of course, because of the effectiveness of ferric sulphate-sulphuric acid solutions in leaching the common uranium minerals. Consequently, a considerable amount of exploratory work has been done to collect the information needed to assess the technical and economic feasibility of bacteria-based leaching processes. This paper describes the work done by the Canadian Department of Energy, Mines and Resources in this field of study and discusses the practical significance of the results.
KEY uranium, ion exchange, extraction, concentration, analysis, chemistry, economics, biological productivity
- 144 AUTH Goya,H.A.; Lai,M.G.; Kubose, D.S.
DATE 1968
TITL Radioactivity release from radionuclide power sources II: Release of strontium titanate to the ocean environment.
CITA U.S. Naval Radiological Defense Laboratory (US NRDL-TR-1042, 24 April 1968), San Francisco, Ca.
COUN USA
ABST The dissolution in an ocean environment of two strontium-85 titanate pellets was studied to determine the rate of release of radioactivity. The experiment was intended to indicate the dissolution behavior of

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strontium-90 radioisotopic fuel in the ocean, as limited by the much lower activity of the specimens and the lack of laboratory control which precluded the coverage of all parameters and highly sensitive dissolution detection.

KEY chemistry, temperature, biological productivity

- 145 AUTH Grabovnikov, V.A.; Samsonova, L.M.
 DATE 1968
 TITL Effect of the form of uranium occurrence in solutions on its sorption by natural mineral formations.
 CITA Geokhimiya (10): 1250-1259 (1968). (Russian).
 COUN USSR
 ABST Natural mineral formations, as a rule, have neg. charged sorbing surface. These formations can ext. from soln. contg. U only that part which is in cation form (UO_2OH^+). This was proven exptl. by passing solns. contg. U^{6+} 0.27-6 ppm through a column, filled with soil. Adsorption of U in the cation form by loam soil followed the Freundlich equation under static and dynamic conditions. The expts. substantiated literature data on high migration capacity of U in supergene zone where it migrated in the form of uranyl carbonate complexes. These complexes are stable in solns. and do not enter in exchange-sorption reactions with natural mineral formations.
 KEY uranium, adsorbent, capacity, chemical species

- 146 AUTH Gray, I.E.; Cerame-Vivas, M.J.
 DATE 1963
 TITL The circulation of surface waters in Raleigh Bay, North Carolina.
 CITA Limnology and Oceanography 8(3): 330-337 (1963).
 COUN USA
 AREA North Carolina
 ABST Returns from helicopter-released drift bottles over Diamond Shoals, in April and August 1962, revealed a definite southwesterly coastal flow from Cape Hatteras, North Carolina. Influenced by northeast winds the flow was more pronounced in late summer than in late spring, some of the bottles rounding Cape Lookout. Recovery of drift bottles from Onslow Bay and Bogue Sound strongly supports the theory that the temporary winter populations of distinctly northern species in the Beaufort, North Carolina, area become established from planktonic larvae that originated north of Cape Hatteras and were transported around the capes. A postulated circulation, involving the influences of Diamond and Lookout shoals, runoff, northeasterly and southwesterly winds, and back eddies from the Florida Current and from wind-induced currents, is presented for Raleigh Bay.
 KEY current, mid atlantic, s atlantic, climate, marine organisms, seawater, offshore

- 147 AUTH Gross, M.G.
DATE 1977
TITL Oceanography, a view of the earth, 2nd ed.
CITA Englewood Cliffs, Prentice-Hall, 497 p. (1977).
COUN USA
ABST This is a general oceanography text covering geology, biology, chemistry, and physics of the sea but also containing information on the atmosphere and continents.
KEY temperature, salinity, particulate, sediments, climate, chemistry, river, seawater, water, current, nutrients, marine organisms, geology, geography, nearshore, offshore, biological productivity
- 148 AUTH Hagmaier, J.L.
DATE 1971
TITL Groundwater flow, hydrochemistry, and uranium deposition in the Powder River Basin, Wyoming.
CITA Abstracted in Dissertation Abstracts International 33(01-B): 274 (1971).
COUN USA
AREA Wyoming
ABST The relation between regional ground water flow, hydro chemistry and uranium distribution in the Powder River Basin indicates that uranium was deposited during the Tertiary Period in ground water recharge areas where the ground water changed from a sulfate-bicarbonate water to a bicarbonate-rich water. Today's regional recharge and discharge areas of ground water flow systems have about the same locations as those of the Tertiary ground water flow systems.
KEY uranium, river, chemistry, concentration
- 149 AUTH Haigh, C.P.
DATE 1974
TITL The extraction of uranium from seawater.
CITA Central Electricity Generating Board, Long Term Study Symp., CERL 1974.
COUN UK
ABST Since the known world reserves of uranium will be gone by the turn of the century, there is some incentive to re-examine the possibility of obtaining the required uranium from the sea. The concentration of U in seawater is 3 ppb, and this low concentration, and therefore the enormous volumes of water necessary, precludes the extraction methods of chemical pretreatment or control or colloid flotation. Only filtration and possibly temperature increase by low grade heat are possibilities. Estimates of various seawater handling schemes and their projected annual uranium output include using desalinization plants (1 tonne U) all CEGB fossil stations (50 tonnes), all Magnox stations (23 tonnes), the Menai Straits (1×10^3 tonnes), the Severn Barrage (1.6×10^3 tonnes), world tidal power locations (2.5×10^4 tonnes) and a pumped

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system (possibly unlimited). The "break-even point" for the pump system (no net energy gain) was calculated to be a head loss of 80 meters of water, but experimentally shown to be only 25 meters. Requirements for sites include constant current, high temperature and low solid content. Many sites were considered, the potentially best being the West Indies and Japan. Cost of uranium produced was at least \$70 per lb. and possibly much greater. The possible future development of absorbent beds, absorbents and eluants was discussed.

KEY uranium, concentration, tidal system, pumped system, adsorbent, elution, filtration, seawater, extraction, temperature, current, economics, multi-purpose process, capacity, chemistry, plant productivity, existing system

- 150 AUTH Haigh, C.P.
 DATE 1976
 TITL Extraction of uranium from seawater.
 CITA CEGB Document R/M/N787: (1976).
 COUN UK
 AREA UK Coastline, The Bahamas, Japan
 ABST Recent predictions of the world demand for uranium fuel for thermal reactors show that known deposits are not sufficient to support demand past the end of the century. For some time consideration has been given to the recovery of uranium from seawater. The volume of seawater required daily to produce sufficient uranium to support even a moderately sized thermal reactor programme is shown to be outside the potential of the UK. Considered on a world wide scale the number of potential tidal power sites which could be adapted for use for uranium recovery is inadequate to support anticipated world demand. The possibility of employing a pumped scheme is discussed in terms of the siting of such a plant and energy balance considerations. An indication is given of areas where the technology of uranium extraction from seawater is considered to require further development.
- KEY uranium, seawater, extraction, tidal system, pumped system, existing system, capacity, temperature, current, economics, adsorbent, elution
- 151 AUTH Haider, B.C.
 DATE 1947
 TITL Studies on complex carbonates of uranium by thermometric and conductometric methods.
 CITA Journal of the Indian Chemical Society 24: 503-510 (1947)
 ABST Both thermometric and conductometric methods indicate the existence in solution of the compounds of the type $R_4UO_2(CO_3)_3$ and $R_2UO_2(CO_3)_2$ (where R=Na or K).
 KEY uranium, chemical species

- 152 AUTH Hansen, R.M.
DATE 1978
TITL Optimizing intake screens for ocean thermal energy conversion power plants.
CITA Master's thesis . Corvallis, Oregon State University. 1978. 108 Numbered leaves.
COUN USA
ABST An Ocean Thermal Energy Conversion (OTEC) power plant requires continuous large volume flow of "clean" warm and cold water. Diverse and abundant marine life may be encountered and effective water intake screening must provide for plant and environmental protection. This study provides information for selecting the optimum screening system based on annual cost. Cost optimization considers channel depth, flow volume, screen type, dimension, materials, operation and maintenance.
KEY fouling, multi-purpose, seawater, platform system
- 153 AUTH Harrington, F.E.; Salmon, R.; Unger, W.E.; Brown, K.B.; Coleman, C.F.; Crouse, D.J.
DATE 1974
TITL Cost commentary on a proposed method for recovery of uranium from sea water.
CITA USAEC Report ORNL-TM-4757: 85p (1974).
COUN USA
AREA Menai Straits
ABST A cost commentary review is presented on a method proposed by U.K. investigators for recovery of uranium from sea water by sorption on hydrous titania. The review follows the original proposal in considering primarily water-sorber contact achieved by tidal flow, in a hypothetical plant at Menai Straits, Wales. Cost analyses of civil works, chemical plant, sorber inventory and makeup, chemical consumption, and other charges were based on available information supplemented with estimates, analogies, and some guesses. (In all uncertainties, the more optimistic value was selected.) Together with computer analysis of tides and flow resistances for the hypothetical site, these led to a minimum cost of about \$300/lb U at a production rate of about 500 tons U/yr. In general, the results indicate that the cost of uranium from sea water is not likely to be at a lower level than hundreds of dollars per pound, and might be at a much higher level.
KEY economics, uranium, seawater, titania, tidal flow, tide, plant productivity, adsorption, elution, plant design, capacity
- 154 AUTH Harris, W.E.; Kolthoff, I.M.
DATE 1947
TITL The polarography of uranium. III. Polarography in very weakly acid, neutral or basic solution.
CITA J. Am. Chem. Society 69: 446-451 (1947).
ABST From polarograms obtained in solutions of uranyl

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chloride containing 0.1 M potassium chloride, either with or without small amounts of acid or alkali it is concluded that the first wave corresponds to the reduction of UO_2^{2+} . The hydrolysis product UO_2OH^+ from UO_2^{2+} is not reduced at the first wave, but is reduced at the second wave together with U^{IV} . At the proper concentration of ammonium carbonate (0.1 M in this experiment) two well-defined waves of U^{IV} are found. Contrary to statements in the literature each reduction wave corresponds to an electron transfer of one.

KEY analysis, concentration, uranium, chemistry

- 155 AUTH Hashimoto, T.
 DATE 1971
 TITL Determination of the uranium content in seawater by a fission track method with condensed aqueous solution.
 CITA Anal. Chim. Acta 56: 347-354 (1971).
 ABST The uranium-detection methods of isotopic dilution, fluorimetry and pulse polarography have all found average uranium values of $3.33 \mu\text{g}$ per liter in all seawater samples, but they all are complicated because they require a careful purification of many other elements. For the fission track method, the uranium content in seawater is determined by counting the fission tracks on muscovite immersed in a condensed aqueous solution during the neutron irradiation. The uranium content in seawater could be determined easily as $3.40 \pm 0.12 \mu\text{g}$ per liter, which is in good agreement with the value of $3.33 \pm 0.08 \mu\text{g}$ per liter by other methods. No further chemical purification was necessary and only 50 ml. portions of seawater were used.
 KEY uranium, seawater, analysis, concentration, extraction, chemistry
- 156 AUTH Haugen, I.
 DATE 1975
 TITL Evaluation and biological field surveys related to the siting of the first Norwegian nuclear power plant.
 CITA Environmental Effects of Cooling Systems at Nuclear Power Plants, Proceedings of a Symposium on the Physical and Biological Effects on the Environment of Cooling Systems and Thermal Discharges of Nuclear Power Stations, IAEA, Oslo, 26-30 August 1974, p. 751-760 (1975).
 COUN Norway
 AREA Norway
 ABST The biological problems arising in connection with siting a nuclear power plant in the Oslo Fjord have been investigated, and the biological guidelines for recipient evaluation are discussed. The benthic flora and fauna were used to assess water quality. This, together with information about the hydrographical conditions, laboratory experiments and other field

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investigations, are used to evaluate the three potential sites for a nuclear power plant in the Oslo Fjord.
 KEY marine organisms, environmental impact, nearshore, seawater

157 AUTH Hayes, E.T.
 DATE 1979
 TITL Energy resources available to the United States, 1985 to 2000.
 CITA Science, 203: 233-239 (1979).
 COUN USA
 ABST Energy and the gross national product have grown hand in hand at 3 to 3 1/2 percent a year for almost 40 years. Our energy growth is slowing down and will essentially level off in the 1990's. Our production of oil and gas passed a peak in the early 1970's, and there is no resource base to justify predictions of increased yields. Coal is the only fossil fuel capable of increased production. There are serious doubts that our uranium resources can support a large light-water reactor program. Finding rates for petroleum, natural gas, and uranium are less than half of what they were 20 years ago.
 KEY uranium, economics

158 AUTH Hazan, I.; Korkisch, J.; Arrhenius, G.
 DATE 1965
 TITL Universal method for the anion exchange separation of uranium and its application to the determination of uranium in sea water, marine sediments and other geological samples.
 CITA Z. Anal. Chem. 213: 182-186 (1965).
 COUN Austria
 ABST Before the fluorimetric determination of uranium in sea water, marine sediments and other geological samples, an ion exchange procedure is used to separate uranium from interfering elements. This separation is best performed on Dowex 1 in a medium consisting of 90% methyl glycol and 10% 6N hydrochloric acid. By means of this method easily reproducible and accurate results of determinations of uranium in as little as 250 ml of sea water or in about 0.1 g amounts of solid samples can be obtained. Because of its universal applicability this technique is to be recommended whenever μ g but also mg quantities of uranium have to be determined.
 KEY uranium, seawater, ion exchange, sediments, geology, analysis, extraction, trace metals, concentration, elution

159 AUTH Hecht, F.; Korkisch, J.; Patzak, R.; Thiard, A.
 DATE 1956
 TITL On the determination of small amounts of uranium in rocks and natural waters.
 CITA Mikro chim. Acta 7-8 : 1283-1300.

(CONT.)

- ABST A method is given for the simple, rapid and quantitative separation of microgram quantities of uranium from those elements which, following a single ether extraction from nitric acid solution, may enter the extract along with the uranium. The uranyl ion forms a negatively charged acetate complex, which is retained on the basic anion exchanger Amberlite I.R.A.-400 (Ac^-). Polarographic determination used after this method was more accurate and less time-consuming than the sodium fluoride bead method.
- KEY uranium, trace metals, concentration, extraction, analysis, ion exchange.
- 160 AUTH Heide, E.A.; Paschke, M.; Wagener, K.; Wald, M.
DATE 1975
TITL Matrix consisting of cultivable mutants of unicellular green algae and method of uranium production using this matrix.
CITA German (F.R.G.) patent document 2345-430/A/Int. Cl. Cl2K 3-00 17 Apr. 1975. 5 P.
COUN West Germany
ABST For uranium production from seawater, a matrix consisting of a cultivable mutant of unicellular green algae is described. The algae are uranium-resistant and are able to take up uranium dissolved in seawater. Unicellular green algae are irradiated with X-rays, then put on culture media with high uranium contents and left there until they form a colony. The matrix is then put into a filter cage whose sieve walls are permeable to seawater but not to the mutants. The filter cage is placed in the sea in such a way that the tidal flows pass through it.
KEY extraction, marine organisms, tidal system, uranium, seawater
- 161 AUTH Heide, E.A.; Paschke, M.; Wagener, K.; Wald, M.
DATE 1975
TITL Matrix of algae, method of fabrication of the matrix, and method of uranium extraction from seawater by means of this matrix.
CITA German (FRG) Patent 2,441,479/B/: (1975). (German).
COUN West Germany
ABST For uranium extraction from seawater, it is suggested to cultivate uranium-resistant algae - especially green algae - and to make seawater flow through a filter cage containing the algae which is permeable to seawater, but not to the algae (cell dimensions between 50 and 100 μm), preferably in counter-flow. This method requires neither large chemicals nor energy expense. Uranium-resistant algae are produced by adding green algae to a seawater solution of high uranium

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concentration (about 25 mg/L.). The following process step is an x-ray irradiation. The remaining algae are sown on uranium-containing culture medium, then further cultivated in a culture solution up to mass culture. The later separation of uranium from the matrix is done by known methods.

KEY uranium, extraction, seawater, marine organisms, concentration

- 162 AUTH Heide, E.A.; Wagener, K.; Paschke, M.; Wald, M.
DATE 1973
TITL Extraction of uranium from sea water by cultured algae.
CITA Naturwissenschaften 60(9): 431 (1973).
COUN West Germany
ABST The uranium uptake from sea water by some mutants of unicellular green algae was tested. Uranium stored under natural conditions by certain marine species should be found concd. in later stages of the food chain. Uranium contents of 34-43 ppm, equiv. to accumulation factors (against sea water) of $1.1-1.4 \times 10^4$, were found in guano from sea birds, the final members of the marine food chain.
KEY uranium, extraction, seawater, marine organisms, concentration
- 163 AUTH Heide, E.A.; Wald, M.; Paschke, M.; Wagener, K.
DATE 1977
TITL Matrix of algae and method of making same and method of obtaining uranium from seawater by said matrix.
CITA U.S. Patent 4,039,445, 08 Sep 1973: (1977).
COUN West Germany
ABST A method is proposed for obtaining uranium from seawater by using a matrix of uranium compatible algae mutants to pick up uranium dissolved in the seawater. The matrix is placed in an area of the sea in which low and high tides pass streams of seawater through the matrix.
KEY uranium, seawater, extraction, marine organisms, tidal system
- 164 AUTH Hela, I.
DATE 1952
TITL Remarks on the climate of southern Florida.
CITA Bulletin of Marine Science of the Gulf and Caribbean 2(2): 438-447 (1952).
COUN USA
AREA Florida, Florida Keys
ABST The climate of the State of Florida is discussed and the distribution of continentality analysed. The unexpectedly high degree of continentality of the Florida Keys is explained in terms of the prevailing winds.
KEY climate, gulf of mexico, s atlantic

- 165 AUTH Hela, I.
DATE 1956
TITL A pattern of coastal circulation inferred from synoptic salinity data.
CITA Bulletin of Marine Science of the Gulf and Caribbean 6(1): 74-83 (1956).
COUN USA
AREA Florida
ABST A synoptic operation was performed during the forenoon and noon hours on December 4, 1954 when 28 vessels occupied 250 limited hydrographic stations off the west coast of Florida. The salinity distributions are shown for the surface and for 40 feet. The pattern of coastal circulation is referred to the cyclonic eddy off the Florida west coast. Two major indrafts of high salinity water toward the shoreline are found.
KEY current, salinity, temperature, nearshore, seawater, gulf of mexico
- 166 AUTH Heye, D.
DATE 1969
TITL Uranium, thorium, and radium, in ocean water and deep-sea sediments.
CITA Earth and Planetary Science Letters 6: 112-116 (1969).
COUN Germany
ABST From the data of 25 deep sea cores it is possible to show that the U/Th ratio of sediments is nearly constant at a low CaCO_3 content. This result and reflections about some other points have led to the assumption that U and Th are being transported into the sediment through the intermediary of minerals. During the transport U, Ra and some Th are leached by ocean water.
KEY uranium, sediments, trace metals, seawater, concentration
- 167 AUTH Hikosaka, S.; Yoshida, S.; Okumoto, J.
DATE 1970
TITL Observations at CSK reference stations--variability of the water temperature and salinity in the subsurface and deep waters.
CITA The Kuroshio: A Symposium on the Japan Current, ed. by John C. Marr, East West Center Press, Honolulu, p. 37-42 (1970).
COUN Japan
AREA North Pacific,
ABST Observations have been made at seven reference stations, I-VII, to monitor the secular change of the Kuroshio system, and for intercalibration of techniques. In addition to the CSK data, existing Japanese station

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data taken within 60 miles of the reference stations are used. Temperature and salinity variations in the waters below the depth of 200 m. are studied.

KEY current, temperature, salinity, offshore, seawater

168 AUTH Hill, K.M.
DATE 1975
TITL Technology assessment and seawater resource engineering.
CITA International Conference Technology Assessment, Monaco.
(1975).

COUN UK

ABST This paper discusses the problems of technology assessment in areas where there is insufficient knowledge, and uses uranium extraction from seawater as its example. In the face of this lack of knowledge and the various pressure groups, a current technology assessment would be general and conservative. The possibilities of tidal US pumped systems are discussed. Potential production at the Menai Straits is estimated at 850 tonnes/year at roughly \$100/lb U_3O_8 . A pumped system promises many more viable locations and a solution to the problems of separating inlet and outlet flows permanently. A simple packed bed is put forth as the most suitable form of absorber plant. A technology assessment of our present knowledge is presented, based on the argument that good engineering is almost always in harmony with the environment. Several possible alternatives for future energy policy are presented, with a fast breeder system recommended due to the uncertainty in the extent of reserves. The author concludes that technology assessment cannot assist in situations where the basic data are lacking; we can make no final conclusions about uranium extraction from seawater until we know more.

KEY uranium, extraction, seawater, tidal system, pumped system, adsorbent, economics, environmental impact, capacity, plant productivity, plant design, regulations

169 AUTH Hill, K.M.
DATE 1977
TITL Technology assessment and seawater resource engineering.
CITA International Conference on Technology
COUN UK
ABST The various proposals for exploiting the resources of sea water, e.g. uranium from sea water, desalination, plankton harvesting, all propose the diversion and handling of vast volumes of sea water. They have other features in common - they are on a large physical scale; they are concerned with world resource problems; they have long gestation periods and push engineering science to its limits; they raise international legal problems; they have potentially large environmental impacts. Many of these proposals depend for their practicability on a

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much deeper knowledge of physical oceanography and the marine environment than we currently possess. The problems of technology assessment of such projects will be illustrated by reference to the design of plants for the extraction of uranium from sea water.

KEY seawater, uranium, existing system, plant design, marine organisms, environmental impact, economics, extraction

- 170 AUTH Hinshelwood, C.N.
DATE 1940
TITL Kinetics of heterogeneous reactions.
CITA Oxford, Clarendon Press, 270.p. (p.209-233)
COUN UK
ABST The kinetics of heterogeneous reactions is discussed. Topics covered include activated adsorption, heterogeneous catalysts, heats of activation, unretarded and retarded reactions, temperature coefficients, and a comparison of homogeneous and catalyzed reactions.
KEY chemistry, adsorption, temperature, concentration
- 171 AUTH Hires, R.I.; Montgomery, R.B.
DATE 1972
TITL Navifacial temperature and salinity along the track from Samoa to Hawaii, 1957-1965.
CITA Journal of Marine Research 30(2): 177-200 (1972).
COUN USA
AREA Equatorial Pacific
ABST Navifacial (sea-surface) temperature is portrayed by isotherms on a graph with latitude and time (9 years) as coordinates, and navifacial salinity is portrayed by isohalines on a similar graph. Anomalously high temperatures, especially within 5° of the equator, occurred during parts of the years 1957-1959 and 1963-1965. Mean annual variations also are portrayed against latitude. Of special interest, the equatorial thermal minimum is found to be lowest twice a year, in February and September, and some evidence is found that this double cycle is related to the strength of the trade winds near the equator. Salinity and precipitation are compared with each other in their variations with latitude and season; the results are inclusive.
KEY temperature, salinity, climate, seawater, offshore
- 172 AUTH Hodge, V.F.; Gurney, M.E.
DATE 1975
TITL Semi-quantitative determination of uranium, plutonium and americium in sea water.
CITA Anal. Chem. 47(11): 1866-1868 (1975).
COUN USA
ABST A method was developed for surveying liter-sized volumes of seawater semiquantitatively for U, Pu, and Am. These elements are precipitated with small amounts of NaOH, electroplated directly from the dissolved precipitate

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onto counting discs, followed by high-resolution alpha counting.

KEY uranium, seawater, analysis, trace metals, extraction, ion exchange, concentration, chemistry

173 AUTH Holland, Heinrich D., Kulp, J. Laurence

DATE 1954

TITL The transport and deposition of uranium, ionium and radium in rivers, oceans and ocean sediments.

CITA Geochimica et Cosmochimica Acta 5: 197-213 (1954)

COUN USA

ABST The important factors controlling the concentration of the radioelements in the oceans are the influx, the rate of radioactive decay, and the rate at which the radioelements are removed by sedimentation. With such data as are available for the concentration of uranium and radium in ocean water, their rates of influx, and their rates of deposition, it is possible to estimate the concentration of ionium in sea water ($3.1 \pm 1 \times 10^{-15}$) gm/cc, and the amount of ionium annually transported into the oceans. It may be further concluded that in the geochemistry of uranium, influx and deposition in shallow water are of major importance while in the case of ionium, influx and deep water deposition seem most important and in the case of radium, the production by radioactive decay of ionium, the disintegration of radium itself, and deep water deposition are important factors. Ionium is not in equilibrium with uranium in ocean water.

KEY Concentration, seawater, sediments, uranium, trace metals, chemistry, river.

174 AUTH Holland, H.D.

DATE 1978

TITL The chemistry of the atmosphere and oceans.

CITA New York, John Wiley & Sons, 351 p. (1978).

COUN USA

ABST This book describes the processes which control the composition of the atmosphere and oceans, and explores the functional relationships that determine the transfer rates of the elements between the atmosphere, the biosphere, the oceans, and the earth's crust and mantle. The concentration and mean residence time of various elements in seawater are given.

KEY uranium, vanadium, concentration, river, seawater, trace metals, water, sediments

175 AUTH Holm, E.; Fukai, R.

DATE 1977

TITL Method for multi-element alpha-spectrometry of actinides and its application to environmental radioactivity studies.

CITA Talanta 24(11): 659-664 (1977).

COUN Monaco

(CONT.)

- ABST A method is proposed for measuring simultaneously several actinide elements by alpha-spectrometry. The actinides in sample solutions are sorbed together on an anion-exchange column from a nitric acid-methanol mixture. After simultaneous elution and electroplating on a disc, the actinides are determined by alpha-spectrometry. Radiochemical yields of the procedure for Th, U, Np, Pu, Am, and Cm are better than 50 percent, all falling within a range of 5 percent. Examples of the application of this method to various marine environmental samples such as sea water, seaweed and marine sediment are presented.
- KEY analysis, adsorbent, ion exchange, elution, uranium, seawater, sediments, marine organisms, trace metals
- 176 AUTH Holmes, C.W., Goodell, H.G.; Osmond, J. K.
DATE 1967
TITL Geochronological investigations of the Southern Pacific.
CITA Sedimentological Research Lab, Florida State University, Aug. 1967: 39p.
COUN USA
AREA S Pacific
ABST This research demonstrates that the assumptions made in the use of the Thorium 230/Thorium 232 and the excess Thorium 230 methods of dating marine sediments are apparently valid. This is particularly valid if only one component of the sediment is used. Although some use was made of diatomaceous material in this investigation, none of the above assumptions were tested on these sediments. A procedure for rapidly estimating the rates of sedimentation was attempted by gamma-spectroscopy. This study apparently yielded valid results, however, because of the lack of proper instrumentation, limitations were reached which resulted in only very rough estimates of the rates of sedimentation. Isotopic determination of manganese nodules both on the surface and with a core yield interesting but inconclusive results. Examination of the data would suggest the possibility of using manganese nodules for determining the length of sedimentary breaks. More data are needed on the origin and geochemistry of these nodules before any proper interpretation can be made.
- KEY uranium, trace metals, concentration, seawater, marine organisms, chemical species, sediments
- 177 AUTH Hughes, Jr., M.V.
DATE 1977
TITL Water requirements and desalting in the United States of America.
CITA Desalination 21: 301-315 (1977).
ABST Water requirements of the U.S.A. and their impact on the need for desalting are presented. The study uses data

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from preliminary figures of the 1975 Water Assessment of the U.S. Water Resources Council. The potential for great increases in desalting exists because of the large and increasing water requirements for industrial, municipal and energy uses. At the same time, water scarcity and pollution limits will require increasing reuse of water.

KEY existing system

- 178 AUTH Hughes, F.W.; Coachman, L.K.; and Aagaard, K.
DATE 1972
TITL Circulation, transport and water exchange in the Western Bering Sea.
CITA Oceanography of the Bering Sea; Proceedings of International Symposium on Bering Sea Study, 1972, p.59
COUN USA
AREA Bering Sea
ABST Drogue measurements in the deep straits of the southwestern Bering Sea indicate a volume transport of $6-8 \times 10^6 \text{ m}^3/\text{sec}$, or three times the computed geostrophic transport relative to 1000 db. Similar differences between measured and computed values were found for southward flow through the western third of Near Strait in summer. The primary driving mechanism for the Bering Sea circulation is concluded to lie in the field of wind stress.
KEY current, temperature, salinity, offshore, seawater, alaska
- 179 AUTH Husby, D.M.
DATE 1970
TITL Seasonal variation of oceanographic conditions from Ocean Station Victor to the Coast of Japan along lat. 34° N .
CITA The Kuroshio: A Symposium on the Japan Current, ed. by John C. Marr, East-West Center Press, Honolulu, p. 43-60 (1970).
COUN USA
AREA North Pacific, Kuroshio
ABST In 1966 and 1967 a line of 16 oceanographic stations along lat. 34° N ., from Ocean Station Victor to near the coast of Japan, was occupied four times S. Coast Guard cutters as part of CSK. Both years the section was occupied in the winter and summer. The water properties of temperature, salinity, and dissolved oxygen content were measured at serial oceanographic stations to a nominal depth of 2,000 m. The line is situated parallel with the axis of the major branch of the Kuroshio extension, which has been said to flow east along lat. 35° N . as far as approximately long. 160° E .
KEY current, seawater, offshore, temperature, salinity, oxygen
- 180 AUTH Huyer, A.
DATE 1977
TITL Seasonal variation in temperature, salinity, and density

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- over the continental shelf off Oregon.
CITA Limnology and Oceanography 22(3): 442-453 (1977).
COUN USA
AREA Oregon
ABST Seasonal variations in the hydrography of the waters over the continental shelf off Oregon were observed in a set of hydrographic data collected along 44°39'N at intervals of a few weeks to a few months from 1961 through 1970. The temperature is determined only partly by the local heating and cooling cycle: at the surface it is low (9°C) in winter, increasing in spring, lowest in summer, highest in early fall, and decreasing in winter; near the bottom, it is highest in winter and lowest in summer. The summer minimum is associated with coastal upwelling and a strong southward geostrophic current. Variations in salinity are governed by runoff, both locally and through the Columbia River effluent, as well as by coastal upwelling and advection. Alongshore geostrophic flow is southward in summer and northward in winter.
KEY current, climate, offshore, pacific northwest, temperature, salinity, seawater
- 181 AUTH Huyer, A.; Pattullo, J.G.
DATE 1972
TITL A comparison between wind and current observations over the continental shelf off Oregon, summer 1969.
CITA Journal of Geophysical Research 77(18): 3215-3220 (1972).
COUN USA
AREA Oregon
ABST Wind and current observations made over the continental shelf off Oregon in the summer of 1969 are compared. It is demonstrated that the wind and current are related at periods longer than 2 days. The wind and current data are both filtered to suppress variations of diurnal and higher frequencies. The current behaves similarly to the wind when the wind varies slowly. The amplitude of the current fluctuations seems to depend on the stratification of the water. The current is roughly parallel to the local bottom contours.
KEY current, climate, pacific northwest, offshore, seawater
- 182 AUTH Huyer, A.; Smith, R.
DATE 1978
TITL Physical characteristics of Pacific Northwestern coastal waters.
CITA The Marine Plant Biomass of the Pacific Northwest Coast, ed. by Robert Krauss. Oregon State University Press. (1978).
COUN USA
AREA Oregon, Washington
ABST The basic physical characteristics of Pacific

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Northwestern coastal waters is discussed, along with the measurement techniques used. Characteristics discussed include circulation, which covers mean circulation seasonal variation, fluctuations with periods of several days, tidal and inertial currents, extreme currents, stratification, turbidity, tides and waves. The currents are highly variable in speed and direction on a time scale of several days. There is also a significant seasonal variation. Mean circulation is greatest over the middle continental shelf, and has a net southward flow of 10 cm/sec at a depth of 25 meters.

KEY current, tide, temperature, salinity, climate, pacific northwest, seawater, offshore

- 183 AUTH Huyer, A.; Smith, R.L.
DATE 1974
TITL A subsurface ribbon of cool water over the continental shelf off Oregon.
CITA Journal of Physical Oceanography 4(3): 381-391 (1974).
COUN USA
AREA Oregon
ABST Observations of the hydrographic regime over the continental shelf off Oregon from the R/V Yaquina during the summer of 1972 showed the presence of an alongshore, subsurface ribbon of relatively cool water. Its properties and its evolution during the 1972 season are described. Examination of earlier observations showed that evidence of the ribbon was found during the upwelling season in almost every year between 1961 and 1971. It is usually observed when the upwelling index (the monthly mean Ekman transport directed offshore) is high. The ribbon can be accounted for by southward advection of subarctic water due to the coastal jet associated with upwelling. A warm temperature anomaly, occurring at somewhat higher salinity, is frequently observed inshore of the ribbon.
KEY current, climate, salinity, temperature, offshore, seawater, pacific northwest
- 184 AUTH Huyer, A.; Hickey, B.M.; Smith, J.D.; Smith, R.L.; Pillsbury, R.D.
DATE 1975
TITL Alongshore coherence at low frequencies in currents observed over the continental shelf off Oregon and Washington.
CITA Journal of Geophysical Research 80(24): 3495-3505 (1975).
COUN USA
AREA Oregon, Washington
ABST Current observations over the continental shelf at locations off central Oregon and southern Washington had the period from July 18 to September 18, 1972, in common. Low-frequency fluctuations (less than one cycle per day)

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in the currents are compared by means of visual display, linear regression, and spectral analysis. The currents are found to be highly coherent over an alongshore separation of 200 km. Correlation between observations is higher for separations in the alongshore direction than in the offshore direction in spite of greater separations.

KEY current, seawater, climate, pacific northwest

- 185 AUTH Ichiye,T.; Bassin,N.J.; Harris,J.E.
 DATE 1972
 TITL Diffusivity of suspended matter in the Caribbean Sea.
 CITA Journal of Geophysical Research 77(33): 6576-6588 (1972).
 COUN USA
 AREA Caribbean Sea
 ABST Total suspended matter (TSM) has been determined by gravimetric analysis at nine stations in the Caribbean Sea. Vertical eddy diffusivities near the surface and bottom are calculated by applying a simplified diffusion equation to the mean vertical profiles of TSM. The eddy diffusivities range from 1 to 8 cm²/sec for the upper layers, and for the bottom regime from .2 to 2 cm²/sec. This paper is a theoretical work.
 KEY particulate, current, offshore, seawater, gulf of mexico
- 186 AUTH Ichiye,T.; Kuo,H.H.; Carnes,M.R.
 DATE 1973
 TITL Assessment of currents and hydrography of the eastern Gulf of Mexico.
 CITA Rept: by Dept. of Oceanography, Collage of Geosciences, Texas A & M University, Contribution No. 601. (1973).
 COUN USA
 AREA Gulf of Mexico
 ABST Physical Oceanography of the Eastern Gulf of Mexico is discussed in some detail, with numerous illustrations. The climate, tides, cyclones, and estuarine systems of the Eastern Gulf are described in terms of their influence on the general circulation. An annotated bibliography is included.
 KEY current, gulf of mexico, climate, temperature, salinity, river, estuary, seawater
- 187 AUTH Ingraham,W.J.Jr.; Bakun,A.; Favorite,F.
 DATE 1976
 TITL Physical oceanography of the Gulf of Alaska.
 CITA Northwest Fisheries Center, Draft of Processed Report, March 1976, Seattle. (1976).
 COUN USA
 AREA Gulf of Alaska
 ABST Water masses and currents are analyzed for this gulf. Wind fields, coastal circulation and seasonal conditions are also described.

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- KEY current, climate, alaska, temperature, salinity,
offshore, nearshore, seawater
- 188 AUTH International Atomic Energy Agency.
DATE 1977
TITL Power reactors (lists).
CITA Power Reactors in Member States, 1977 edition, 898 p.
COUN Australia
ABST A list of nuclear power reactors in International Atomic
Energy Agency member states.
KEY uranium, plant design, existing plants
- 189 AUTH Iyengar, M.A.R.; Markose, P.M.
DATE 1971
TITL Distribution of uranium and daughters in the environment
of a uranium ore processing facility.
CITA Radiat. Radioisotop. Soil Stud. Plant Nutr., Proc. Symp.
1970: 143-153 (1971).
COUN India
AREA India
ABST The distribution of U and its decay products adjacent to
the Jaduguda U processing plant was detd. Quant. data
are given for soils, waters, vegetation, and plant and
animal foods. Atm. concns. of Rn were higher than at
the U processing plants at Trombay and Alwaye. The
water concn. of Ra-226, Th-230, and Po-210 varied widely. A
high activity of Ra-226 occasionally escaped into the
environment. Fish from adjacent waters were
particularly high in natural U. The high radioactivity
of surface waters indicated that farming adjacent to the
Jaduguda plant was undesirable. Confirming previous
reports, aquatic algae concd. high levels of
radioactivity. Milk is not a significant factor for
human intake of radioactive materials since milk
consumption is low in the Jaduguda vicinity.
KEY uranium, water, environmental impact, marine organisms,
concentration
- 190 AUTH Jarrige, F.
DATE 1968
TITL On the eastward flow of water in the western Pacific
south of the Equator.
CITA Journal of Marine Research 26(3): 286-289 (1968).
COUN France
AREA South Pacific, Equatorial Pacific
ABST Research and calculation indicate that there is an
eastward flow of water near 10°S, 170°E, but it is
uncertain how far this current extends toward the east.
The characteristics of this current are highly variable.
Although the current may be 500 m deep, its velocity
core (10-30 cm/sec) is always near the surface. Its
width varies from 330 km to more than 920 km, mean being
650 km. A wider current results in a more northerly

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velocity core, and a higher volume transport is always associated with a lower surface salinity (minimum salinity is 34.0‰ to 34.8‰).

KEY current, salinity, offshore, seawater, flow

- 191 AUTH Jayaram, K.M.V.; Dwivedy, K.K.; Deshpande, A.S.;
Ramachar, T.M.
DATE 1976
TITL Studies on the recovery of uranium from low-grade ores
in India.
CITA Uranium Ore Processing, Proceedings of an Advisory Group
Meeting, Wash. DC., 24-26 Nov. 1975, IAEA, Vienna 1976,
pp.155-170 (1976).
COUN India
ABST Known uranium reserves in the \$15/lb U_3O_8 category, even
when augmented by future discoveries, are insufficient
for the projected demand. Since India has only about
3000 t uranium in the \$10-15/lb U_3O_8 category,
investigations were carried out to utilize the available
para-marginal and low-grade ores - chlorite schists,
amphibolites, carbonate ores, clays and quartzites -
analysing between 0.027 and 0.08% U_3O_8 . In addition,
tests were undertaken on the technical and economic
feasibility of recovering uranium as a byproduct from
the copper flotation tailings and phosphorites. Since
samples of quartz-chlorite schists from the Singhbhum
district, Bihar, analysing about 0.03% U_3O_8 , yielded low
economic recoveries by using ore dressing and hot
agitation leaching techniques, heap and bacterial
leaching tests were conducted.
- KEY uranium, extraction, ion exchange, marine organisms,
economics, multi-purpose process, plant design, analysis
- 192 AUTH Jones, R.S.; Copeland, B.J.; Hoese, H.D.
DATE 1965
TITL A study of the hydrography of inshore waters in the
western Gulf of Mexico off Port Aransas, Texas.
CITA Publications of the Institute of Marine Science. The
University of Texas Marine Science Institute. 10: 22-32
(1965).
COUN USA
AREA Texas
ABST A one-year study of the hydrography was conducted during
1962 and 1963 on a 25 nautical-mile transect running 112
from Port Aransas, Texas. Thermal stratification was
found to exist approximately 50% of the time at most
stations with turnover in October and March. Light
penetration was an effective method of distinguishing
water masses. Optical density profiles increased in slope
near the bottom during summer, indicating more opaque
water on the bottom.

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- KEY gulf of mexico, temperature, seawater, nearshore, offshore, particulate
- 193 AUTH Kaplan, I.R.
DATE 1973
TITL Biological cycling of elements and stable isotopes in marine environments.
CITA Progress Report, April 1, 1972 - May 1, 1973, University of California, 247 p. (1973).
COUN USA
AREA lab
ABST Research effort has been directed toward 4 projects: 1) a rapid technique for measuring uranium content in marine sediments; 2) understanding anaerobic degradation on ocean floor; 3) evaluating magnitude of ionic diffusion constants; 4) developing a monitoring system for dissolved sulfate and pollution of the ocean floor. The Delayed Neutron method, which is described, proved to be an accurate, rapid and non-destructive method for measuring uranium content. This report is only an Introduction, and many other published works used by the author are listed in a bibliography here.
KEY uranium, sediments, chemistry, analysis, concentration, chemical species
- 194 AUTH Karel, S.; Stamberg, J.; Katzer, J.; Prochazka, H.; Nemec, P.; Hulak, P.; Jilek, R.
DATE 1975
TITL The production of sorbents from mycelia of fungi.
CITA Brit. 1,417,901 (Cl. C12K), Appl. 7163/73, 14 Feb 1973: 4 p (1975).
COUN Czechoslovakia
ABST Reinforced fungal mycelia for use as sorbents to sep. metal ions, esp. U [7440-61-1] from soln., were prepd. by crosslinking mycelium biomass with a formaldehyde or high-mol-wt. material. E.g., mycelium of *Penicillium chrysogenum* was crosslinked with HCHO [50-00-0], heat cured, and crushed to a grain size of 0.3-0.75 mm; the capacity of the sorbent for U was 95.7 mg/g.
KEY adsorbent, uranium, extraction, capacity, trace metals, marine organisms
- 195 AUTH Keen, N.J.
DATE 1968
TITL Studies on the extraction of uranium from sea water.
CITA J. Brit. Nucl. Energy Soc. 7(2): 178-183 (1968).
COUN UK
ABST The oceans can be regarded as a vast reserve of a liquid low grade ore of well defined composition containing uranium at 3.344 g/l. Studies were made on extracting U from sea water by absorption on hydrous TiO_2 . The absorber has been developed to a point where, although deficient in some respects, it shows a high capacity for

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absorbing U. Uranium can be eluted from the absorber by $(\text{NH}_4)_2\text{CO}_3$ solution, but a small proportion appears to be held firmly. For a large scale extraction plant, a system of two tidal lagoons, similar to that employed for tidal power schemes, was considered for providing the head of water necessary to pass sea water through the absorber.

KEY uranium, seawater, capacity, extraction, adsorption, concentration, elution, tidal system, titanium, chemistry, analysis, particulate

- 196 AUTH Keen, N.J.
 DATE 1970
 TITL Extracting uranium from sea water.
 CITA Indian East. Eng. 112: 337-339 (1970).
 COUN UK
 AREA Portland Harbor
 ABST Methods for the extraction of uranium from sea water have been examined. Trials have been carried out at Portland harbor with seawater flowing through packed beds of granules of hydrous titanium oxide, which absorb uranium from seawater by ion exchange. The uranium can be leached from the absorber bed by treatment with ammonium carbonate solution and isolated. Several arrangements for presenting the absorber to the sea have received attention. Use of tidal energy to provide a larger head of water is contemplated. Capital costs, engineering difficulties and proper site selection are still some of the unsolved problems. It is hoped that these problems will be overcome and by the turn of the century the extraction of uranium from seawater will prove to be an economic and feasible project.
- KEY extraction, uranium, seawater, titanium, ion exchange, elution, adsorbent, tidal system, economics, trace metals, concentration, capacity, particulate
- 197 AUTH Keen, N.J.
 DATE 1977
 TITL Recovery of uranium from sea water.
 CITA Chem. Ind. (London) (14): 579-582 (1977).
 COUN UK
 ABST Recent estimates indicate that there will be a very large shortfall in known uranium reserves by the end of the century compared with world demand. It has been shown that the concentration of uranium in the ocean is reasonably constant at about three ppb representing a total uranium content of about 4×10^9 t. As such it offers a virtually limitless source of supply and it could be argued that as the grades of ore being exploited on land decrease, the prospects for sea water uranium become enhanced. This paper attempts to place these prospects in perspective. Some of the findings are of general applicability to the winning of other trace elements from the sea.

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KEY extraction, uranium, seawater, concentration, titanium, tidal system, economics, multi-purpose process, capacity, trace metals

- 198 AUTH Keen, N.J.; Miles, J.H.; Spence, R.
DATE 1967
TITL Extraction of uranium and other inorganic materials from sea water.
CITA Atomic Energy Research Establishment Report AERE-R-5500 (Vol.2): 387-398 (1967).
COUN UK
ABST The commercial success of plants for the extraction of magnesium hydroxide and bromine from sea water suggests that others of the more plentiful constituents could be separated if prices were favorable. It seems unlikely however, that this will happen so long as present prices prevail. The same is true of elements present at low concentration although special considerations apply in the case of uranium. Progress has been made towards a process based on absorption on hydrous titanium oxide with the aim of establishing a reserve of medium cost uranium. If a plant using this process became operative it might be possible to extract certain other useful trace elements at the same time.
KEY extraction, seawater, uranium, titanium, trace metals
- 199 AUTH Kennedy, J.
DATE 1965
TITL Extraction of uranium from sea water. Part I. The physical and chemical states of uranium in sea water.
CITA Atomic Energy Research Establishment Report AERE-R-5023: 10p (1965).
COUN UK
ABST Uranium ($3.34 \mu\text{g/l}$) in natural seawater is in true solution as the anionic uranyl tricarbonat complex $\text{UO}_2(\text{CO}_3)_3^{4-}$. Less than 0.1% of the uranium present in sea water is adsorbed on particulate matter.
KEY extraction, uranium, seawater, chemical species, concentration, particulate
- 200 AUTH Kennedy, J.; Davies, R.V.; Robinson, B.K.
DATE 1964
TITL Chemical extraction processes.
CITA Brit. 977,460 (Cl. C 01g, C 22b), Appl. Sept. 4, 1957: 3p (1964).
COUN UK
ABST A process is described for the extn. of δ quantities of U from sea water by using basic Zn carbonate having the empirical formula $\text{ZnCO}_3 \cdot x\text{Zn}(\text{OH})_2$. Basic Zn carbonate was pptd. on glass wool by adding Na_2CO_3 to a batch of glass wool which had been soaked in 0.1M ZnSO_4 soln. until a pH of 8 was attained. The resultant glass wool contg. basic Zn carbonate was packed into glass columns.

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- Sea water was then passed through the packed columns and U from the influent was adsorbed on the Zn carbonate bed. The adsorbed U was then eluted from the columns with 1.0M Na_2CO_3 ; 500-600 μg U was extd. per g. Zn.
- KEY extraction, uranium, seawater, adsorbent, elution, capacity, chemistry
- 201 AUTH Khan, S.
DATE 1972
TITL Extraction of uranium from sea water as a by-product from water desalination plants.
CITA Nucleus (Karachi) 9(1-2): 39-46 (1972).
COUN Pakistan
ABST It may be possible to recover uranium from seawater economically as a by-product from waste saline water of the seawater desalination plants, if the cost of pumping water and cleaning it of organic matter is charged on the desalted product. A desalination plant producing 250 thousand tons of water per day at a brine concentration factor 2:1 would discharge an equal amount of waste saline water containing about 1,500 g of uranium daily. This waste water may be brought into contact with 25 tons of galena (lead sulfide) and the sorbed uranium may be eluted with 10% sodium carbonate solution. After elution, galena grains can be regenerated by washing with dilute hydrochloric acid solution of pH 5.0.
KEY economics, multi-purpose process, marine organisms, adsorbent, elution, uranium, seawater, extraction
- 202 AUTH Khan, S.; Saleem, M.
DATE 1973
TITL Bibliography on the extraction of uranium from sea water.
CITA At. Energy Minerals Centre Report AEMC/Chem. Engg-126: 45p (1973).
COUN Pakistan
ABST A bibliography of 56 references is presented on the extraction of uranium from seawater and other natural waters. References on other pertinent research, for example, the extraction of trace elements from seawater and the marine geochemistry of the uranium isotopes, are included. Abstracts for each reference and an author index are provided.
KEY extraction, uranium, seawater, titanium, adsorbent, trace metals, marine organisms, concentration, chemical species, water
- 203 AUTH Kharkar, D.P.; Turekian, K.K.; Thomson, J.; Forster, W.D.
DATE 1976
TITL Uranium and thorium decay series nuclides in plankton from the Caribbean.
CITA Limnology and Oceanography 21(2): 294-299 (1976).

(CONT.)

COUN USA

ABST Zooplankton (predominantly calanoids and cyclopoids) from the Caribbean were analyzed for U-238, U-234, Th-232, Th-228, Ra-228, Ra-226, Pb-210 and Po-210. The concentration factor in the zooplankton relative to seawater is highest for Po-210. Pb-210 and Th-228 have similar concentration factors and are comparable (when normalized to Ra-226) to reported fiberscavenging experimental data on Pb-210 and Th-234. The dominant transport agent for Po-210 and Pb-210 from the mixed layer to depth cannot be unmodified zooplankton debris.

KEY marine organisms, uranium, concentration, trace metals, seawater, analysis

204 AUTH Kim, Y.S.; Zeitlin, H.

DATE 1971

TITL Separation of trace-metal ions from seawater by adsorptive colloid flotation.

CITA Journal of Chemical Soc. D., No. 13,672 (1971).

COUN USA

ABST An adsorptive colloid flotation process based on a collector-surfactant-air system makes possible the rapid separation of various cationic and anionic metallic species from seawater.

KEY adsorption, seawater, extraction, concentration, trace metals, analysis, capacity, chemistry

205 AUTH Kim, Y.S.; Zeitlin, H.

DATE 1971

TITL Separation of uranium from seawater by adsorbing colloid flotation.

CITA Analytical Chemistry 43(11): 1390-1393 (1971).

COUN USA

ABST A procedure is described for the separation from seawater of uranium present as the stable tricarbonatouranyl anion by an adsorbing colloid flotation technique which utilizes a collector-surfactant-air system. Average recovery of uranium from seawater by this method is 82%.

KEY uranium, seawater, extraction, adsorption, adsorbent, analysis, capacity

206 AUTH Kjerfve, B.

DATE 1976

TITL Circulation and salinity distribution in coastal Louisiana Bayous.

CITA Contributions in Marine Science, University of Texas Marine Science Institute 20: 1-10 (1976).

COUN USA

AREA Louisiana

ABST Time-averaged discharge and salinity distribution in a number of shallow, interconnected bayous in the Barataria basin of coastal Louisiana were determined for

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a 7-day period in June 1971. Measurements of current velocity, electrical conductivity, and water temperature were made at 25 stations, with continuous tide and wind records from one location. From this data, the bayou system may be classified as a type 1a estuary (Hansen and Rattray, 1967). Effective horizontal diffusion accounts for the upstream salt transport in the absence of gravitational circulation and is on the order of $10^3 \text{ m}^2 \text{ s}^{-1}$, indicating the importance of wind-induced as well as tidal mixing in the shallow lakes.

KEY gulf of mexico, nearshore, river, estuary, salinity, temperature, seawater, climate, tide

- 207 AUTH Knauss, J.A.
 DATE 1966
 TITL Equatorial current systems.
 CITA The Sea: Ideas and Observations on Progress in the Study of the Seas, Vol. 2, ed. by M.N.Hill, New York, Interscience Publishers, p. 235-252 (1966).
 COUN USA
 AREA Equatorial Ocean
 ABST The current systems in the equatorial oceans are discussed in terms of their hydrographic and velocity structure.
 KEY current, seawater, temperature, salinity, offshore
- 208 AUTH Koblentz-Mishke, D.J.; Volkovinsky, V.V.; Kabanova, J.G.
 DATE 1970
 TITL Plankton primary production of the world ocean.
 CITA Scientific Exploration of the South Pacific, Proceedings of a Symposium held during the Ninth General Meeting of the Scientific Committee on Oceanic Research, ed. by Waner Wooster, June 18-20, 1968, at Scripps Institute of Oceanography, La Jolla, National Academy of Sciences, Washington D.C. (1970).
 COUN USSR
 AREA World Ocean
 ABST In marine communities it is possible to speak with some validity only of primary production, particularly of primary production of planktonic algae. In this paper the primary production of the Atlantic Ocean and of the Antarctic and North Polar basins is examined in a general way for the first time. As will be shown later, not all the regions of the World Ocean are studied adequately with respect to primary production, so it is often necessary to estimate the level of production on the basis of indirect evidence. The Pacific and Indian Ocean data is from previous work.
 KEY farming systems, marine organisms, nutrients, offshore, nearshore, seawater, biological productivity
- 209 AUTH Koczy, F.F.
 DATE 1964

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- TITL Geochemistry of radioactive elements in the marine environment.
CITA University of Miami, Institute of Marine Science, Final Report, 64-6 (1964).
COUN USA
ABST The geochemical role of the Ra-226 isotope in deep sea sediment and ocean water has been investigated. It has been concluded that radium is a significant tracer of both sedimentary and long range advective processes. In addition, the effect of planktonic uptake may reduce the apparent Ra-226 half-life from 1620 to 950 years. Thus the importance of the geochemical role of plankton in surface water with respect to trace element distribution is clearly established.
KEY marine organisms, seawater, sediments, trace metals, capacity
- 210 AUTH Koczy, F.F.; Tomic, E.; Hecht, F.
DATE 1957
TITL Zur geochemie des urans im ostseebecken.
CITA Geochimica et Cosmochimica Acta 11: 86-102 (1957) (German).
COUN Germany
ABST In order to study the geochemistry of uranium on typical shelf zones, samples of river water and sea water, as well as samples of sediment from the Baltic Sea region, have been examined. The Baltic Sea region was chosen for the investigation since its hydrography is well known, water transport to and from it can be estimated to a high degree of accuracy, and the region can be well sampled.
KEY chemistry, uranium, river, seawater, concentration, trace metals, salinity, organics, sediments, biological productivity, marine organisms, estuary
- 211 AUTH Kolodny, Y.; Kaplan, I.R.
DATE 1970
TITL Uranium isotopes in sea-floor phosphorites.
CITA Geochim. Cosmochim. Acta 34: 3-24 (1970).
COUN USA
ABST Analyses of uranium concentration and U-234/U-238 activity ratios were performed on 40 samples of marine phosphorites, almost all of them dredged from the present sea floor. In each sample, the concentration and isotopic composition of total uranium and U(VI) were analyzed. Uranium concentrations in the analyzed nodules vary between 6 and 524 ppm, tetravalent uranium constituting 38-84 per cent of the total. Whereas the mean activity ratio for total uranium is 0.97, the ratio in the U(IV) uranium is 0.71 and the calculated activity ratio for U(IV) uranium is 1.57. The interpretation of these results has two consequences: (a) All the analyzed nodules are old (probably older than 8×10^5

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yr), and are at the present being eroded rather than deposited; hence, the deposition of phosphorite in the present day ocean is rather doubtful; (b) The difference in isotopic ratios between the two oxidation states of uranium generally confirms previously proposed mechanisms of uranium isotope fractionation. Differential oxidation of U-234 is largely responsible for the measured U-234/U-238 disequilibrium ratios. A model for evolution of uranium isotope activity ratios in different oxidation states is presented.

KEY analysis, uranium, concentration, chemical species, sediments

212 AUTH Kolthoff, I.M.; Harris, W.E.; Matsuyama, G.

DATE 1944

TITL A new method for the polarographic determination of nitrate. .

CITA Journal of American Chemical Society 66: 1782-1786 (1944).

COUN USA

ABST In the presence of uranyl ions, nitrate in dilute solutions of hydrochloric acid is reduced at potentials where the second uranium wave occurs. The diffusion current of nitrate is well-defined and is proportional to the nitrate concentration when the ratio of uranyl to nitrate is at a certain minimum. Advantages to this method over using lanthanum chloride include accuracy over a wider range of nitrate concentrations and lack of interference from sulfate.

KEY concentration, uranium, analysis, chemistry, fouling

213 AUTH Komarov, A.N.; Zhitkov, A.S.; Dmitriev, L.V.; Leonova, L.L.

DATE 1973

TITL Nature of the distribution of uranium in ultrabasites of Indian Ocean rift zones.

CITA Geokhimiya (2): 304-309 (1973). (Russian).

COUN USSR

AREA Indian Ocean

ABST The distribution character and occurrence forms of U in peridotites from the Indian Ocean bottom (Carlsberg and western Indian rift zones) is detd. by means of fragmental radiography (A.N. Komarov, 1969). The Th/U ratio in the ultrabasites of the Indian Ocean is ~ 0.18-0.52; parts enriched by U are nonuniformly distributed in the rocks. Enriching of the ultrabasites by U was caused by hydrothermal and volcanic action. U sorption into the rocks took place after the ultrabasite formation and began at the rock surface.

KEY uranium, chemical species, seawater, analysis

214 AUTH Korkisch, J.

DATE 1965

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TITL Ion exchange separation of uranium and thorium in non-aqueous and mixed media.
CITA (Progress Report on Research project). At (30-1) - 2623. April 1965, 35 p. (1965).
COUN West Germany
AREA lab
ABST A fluorimetric method for determination of U in sea water and other geological samples is described. Ion exchange is used to separate U from interfering elements on Dowex 1 in 90% methyl glycol and 10% 6 N HCl. Determinations of U can be made in 250 ml of seawater or in 0.1 g solid samples. A method of separation of small quantities of U from large excess of Bi is described. In 90% isopropanol - 10% 6 normal HCl, U (IV) is retained on Dowex 50 whereas Bi as an ionic chloride complex passes into the effluent unadsorbed. For the elution of U, 12 N HCl is employed.
KEY uranium, seawater, adsorbent, elution, chemistry, trace metals, analysis, ion exchange, extraction

215 AUTH Korkisch, J.; Goedi, L.
DATE 1974
TITL Use of ion exchange methods for the determination of trace elements in natural waters. IV. Uranium, cobalt, and cadmium.
CITA Talanta 21(10): 1035-1046 (1974). (German).
COUN Austria
AREA Austria
ABST A method is described for separating and determining, by spectrofluorimetric or spectrophotometric measurement, traces of uranium, cobalt and cadmium at ppm levels in natural waters. The sample is acidified with HCl, filtered, and after addition of ascorbic acid and potassium thiocyanate, passed through a column of Dowex 1-X8 anion-exchange resin in the thiocyanate form. The three ions are concentrated on the resin as thiocyanate complexes, being at the same time separated from most of the other ions present in the sample. Elution with a tetrahydrofuranmethyl-glycol-HCl mixture removes other interfering ions, then 6M HCl strips the cobalt, 1M HCl the uranium, and 2M HNO₃ the cadmium. Data are presented for concentrations of uranium (0.01 to 5 ppm) cobalt (0.04 to 1.9 ppm) and cadmium (0.04 to 0.6 ppm) in a large number of water sources in Austria.
KEY ion exchange, uranium, elution, analysis, trace metals, water, concentration, adsorbent, extraction

216 AUTH Korkisch, J.; Koch, W.
DATE 1973
TITL Determination of small amounts of uranium after concentrating by extraction and anion exchange in a solvent system containing tri-n-octylphosphine oxide.
CITA Mikrochim. Acta (1): 157-168 (1973). (German).

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- COUN Austria
 ABST Prior to fluorometric (J. Korkisch and F. Hecht, 1972) or spectrophotometric (K. and K., 1972) detn. of U, U was sepd. and preconcd. by extn. from 1N HCl contg. ascorbic acid into Et₂O and adsorbed from 1:9:10 12N HCl-methyl glycol-0.1N tri-n-octylphosphine oxide (in Et₂O) on a Dowex 1 x 8 anion exchange resin (Cl⁻ form). U was eluted with 1M HCl for detn. The technique was applied to detn. of U in sea water and monazite. The technique was esp. useful for removing Mo prior to U detns.
 KEY uranium, extraction, seawater, analysis, ion exchange, adsorbent, elution
- 217 AUTH Korkisch, J.; Sorio, A.
 DATE 1975
 TITL Determination of seven trace elements in natural waters after separation by solvent extraction and anion-exchange chromatography.
 CITA Anal. Chim. Acta 79: 207-218 (1975).
 COUN Austria
 AREA Austria, Adriatic Sea
 ABST A method is described for the determination of cadmium, cobalt, copper, manganese, lead, uranium, and zinc in samples of natural waters. After acidification with hydrochloric acid, the water sample is filtered and the diethyldithiocarbamates of the trace elements are isolated by extraction with acetone-chloroform (2:5) at pH 5. Following this preconcentration step, the metal ions are adsorbed on a column of the strongly basic anion-exchange resin Dowex 1-X8 (chloride form) using as sorption solution a mixture (5:4:1, v/v) of tetrahydrofuran, methyl glycol and 6 M hydrochloric acid. Successive elution is effected with 6 M hydrochloric acid (Co, Cu, Mn and Pb), 1 M hydrochloric acid (U) and 2 M Nitric acid (Cd and Zn); the metal ions in the eluates are determined by atomic absorption spectrophotometry (except uranium, which is determined fluorimetrically). The procedure was used to determine the trace metals in water and snow samples collected in Austria and to analyze a sample of seawater from the Adriatic Sea.
 KEY extraction, uranium, elution, analysis, trace metals, water, adsorbent, ion exchange, seawater, chemistry
- 218 AUTH Korkisch, J.; Steffan, I.
 DATE 1975
 TITL Determination of uranium in sea water after anion-exchange separation.
 CITA Anal. Chim. Acta 77: 312-314 (1975).
 COUN Austria
 ABST The fluorimetric and spectrophotometric detn. of U in natural waters after preliminary isolation by adsorption of its thiocyanate complex on

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strongly basic anion-exchange resin Dowex 1 is useful for analysis of waters with high salt content, such as sea water.

KEY analysis, uranium, seawater, ion exchange, adsorbent, water

- 219 AUTH Krauss, R.W. (Ed.)
DATE 1977
TITL The marine plant biomass of the Pacific Northwest coast.
CITA Oregon State University Press, Corvallis, Oregon: (1977).
COUN USA
AREA Pacific Northwest
ABST A compilation of the following articles: (1) Growth of Pacific NW marine algae in semi-closed culture, (2) Growth of Pacific NW marine algae on artificial substrate - potential and practice, (3) The domestication of the giant kelp, *Macrocystis*, as a marine plant biomass producer, (4) *Eucheuma* - current marine agronomy, (5) Potential yields from a waste-recycling algal mariculture system, (6) Potential yields of marine algae - with emphasis on European species, (7) Survey of chemical components and energy considerations, (8) Essential considerations for establishing seaweed extraction factories, and (9) Marine plant production and utilization - a systems perspective.
KEY pacific northwest, marine organisms, seawater, nutrients, chemistry, organics
- 220 AUTH Ku, Teh-Lung; Broecker, W.S.
DATE 1967
TITL Uranium, thorium and protactinium in a manganese nodule.
CITA Earth and Planetary Science letters 2: 317-320 (1967)
ABST Isotopic compositions of uranium, thorium, and protactinium have been determined in a manganese nodule dredged from the North Pacific Ocean. The accretion rate of the nodule averaged over the past several hundreds of thousands of years is about 4 mm/10⁶y. The uranium content had an average value of 6.7 ppm for various depths within the nodule.
KEY uranium, concentration, sediments
- 221 AUTH Ku, T.L.; Broecker, W.S.
DATE 1969
TITL Radiochemical studies on manganese nodules of deep-sea origin.
CITA Deep-Sea Research 16: 625-637 (1969).
COUN USA
ABST Manganese nodules from different parts of the ocean floor were analyzed for their uranium, thorium, protactinium, and radium contents. The uranium : thorium ratio in nodules is quite variable, and is 3 to 6 orders of magnitude lower than that in sea water.

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- Uranium concentrations range from 4 to 13 ppm, with most values falling between 6 and 10 ppm.
- KEY trace metals, uranium, concentration, sediments, geography
- 222 AUTH Ku, T.L.; Knauss, K.G.; Mathieu, G.G.
 DATE 1977
 TITL Uranium in open ocean: concentration and isotopic composition.
 CITA Deep-Sea Research 24: 1005-1017 (1977).
 COUN USA
 ABST Uranium concentrations and U-234/U-238 activity ratios have been determined in 63 seawater samples (nine vertical profiles) from the Atlantic, the Pacific, The Arctic, and the Antarctic oceans, using the alpha-spectrometric method for their determinations. Correlation between uranium and salinity is well manifested by the data from the Arctic and the Antarctic oceans, but such a relation cannot be clearly defined with the $\pm(1 \text{ to } 2)\%$ precision of uranium measurements for the Atlantic and Pacific data. At the 95% confidence level: (1) the uranium/salinity ratio is $(9.34 \pm 0.56) \times 10^{-8} \text{ g/g}$ for the seawater analyzed with salinity ranging from 30.3 to 36.2‰; the uranium concentration of seawater of 35‰ salinity is $3.35 \pm 0.2 \mu\text{g l}^{-1}$; (2) the U-234/U-238 activity ratio is 1.14 ± 0.03 . Uranium isotopes in interstitial waters of the Pacific surface sediments analyzed do not show large concentration differences across the sediment-water interface as suggested by previous measurements. Current estimations of the average world river uranium concentration ($0.3 \text{ to } 0.6 \mu\text{g l}^{-1}$) and U-234/U-238 ratio (1.2 to 1.3) and of the diffusional U-234 influx from sediments ($0.3 \text{ dpm cm}^{-2} 10^{-3} \text{ yr}^{-1}$) are essentially consistent with a model which depicts a steady state distribution of uranium in the ocean. However, the 0.3 to $0.6 \mu\text{g l}^{-1}$ value for river uranium may be an upper limit estimate.
- KEY analysis, concentration, interstitial water, uranium, river, water, seawater
- 223 AUTH Kunzendorf, H.; Friedrich, G.H.
 DATE 1976
 TITL The distribution of U and Th in growth zones of manganese nodules.
 CITA Geochimica et Cosmochimica Acta 40: 849-852 (1976).
 COUN Denmark
 ABST Growth zones and individual sublayers from one manganese nodule and three manganese crusts from an area south of Hawaii were analyzed for U and Th. The concentrations for U in the nodule ranged from 6.3-8.3 ppm at the surface last in contact with seawater to 3.4 ppm at the surface last exposed to the sediment. The crusts

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- contained up to 9 ppm U at the outermost surfaces.
KEY uranium, concentration, sediments
- 224 AUTH Kunzendorf, H.; Friedrich, G.H.
DATE 1976
TITL Uranium and thorium in deep sea manganese nodules from the Central Pacific.
CITA Institute of Mining and Metallurgy, Transactions 85: B284-288 (1976)
COUN Denmark
ABST Analytical data on U and Th from 119 ferromanganese nodules, collected during the 1973 and 1974 expeditions of the German research vessel Valdivia in the Central Pacific, are presented here. The average U content of the 119 samples was 4.9 ± 1.6 ppm.
KEY uranium, concentration, sediments
- 225 AUTH Kunzendorf, H.; Friedrich, G.H.W.
DATE 1976
TITL Uranium and thorium in deep-sea manganese nodules from the central Pacific.
CITA Inst. Min. Metall., Trans., Sect. B. 85: B284-B288 (1976).
COUN Denmark
AREA Central Pacific
ABST Analytical data on uranium and thorium from 119 nodules are presented. A small number of samples were collected in the vicinity of some seamounts. Correlation figures between uranium, thorium, manganese and iron are included. Uranium enrichment generally occurred in samples with relatively high iron contents. Correlation between iron and thorium was a factor less than that between iron and uranium. It is therefore possible that thorium enrichment follows different and probably more complex paths during precipitation from sea water.
KEY uranium, seawater, analysis
- 226 AUTH Kuznetsov, Yu.V.
DATE 1971
TITL The question of possible variations in the past concentrations of uranium in the ocean.
CITA Radiokhimiya 13(1): 118-125 (1971).
COUN USSR
ABST Inasmuch as the theory and practice of geochronology of ocean formations by dating with ionium and uranium is based on the constancy of uranium concentration with time, experiments were carried out to verify whether ionium found in sediments is the value that would have been deposited assuming that the annual production of ionium from uranium dissolved in the water was constant in the past. An undeniable excess of ionium (average value of $A = 2.7$) was found. Three possible hypotheses were offered.

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- KEY uranium, concentration, sediments, chemistry, seawater
- 227 AUTH Laevastu, T.; Harding, J.; Rabe, K.; Larson, S.
 DATE 1976
 TITL Ocean--atmosphere interactions off the northeast coast of North America.
 CITA Middle Atlantic Continental Shelf and the New York Bight, American Society of Limnology and Oceanography, Proceedings of Symposium American Museum of Natural History, 3, 4 and 5 November, 1975, p.35 (1976).
 COUN USA
 AREA New York Bight, Middle Atlantic
 ABST The New York Bight-Middle Atlantic continental shelf region is typical of midlatitude continental east coast areas in the intense sea-air interaction occurring during late autumn and winter. During these seasons dry but cool air moving over warm coastal water takes up a considerable amount of heat and moisture (latent heat). The daily uptake near the coast can exceed 0.5 g of water per cm² on a monthly mean basis.
 KEY climate, offshore, seawater, mid atlantic
- 228 AUTH Lalou, C.; Lambert, G.; Le Roulley, J.C.; Nguyen, H.V.; Sanak, J.
 DATE 1970
 TITL Use of low level α -spectrometry for the determination of trace elements in natural inorganic substances.
 CITA Dosage Elem. Etat Traces Roches Autres Subst. Miner. Natur., Actes Colloq. 1968: 395-409 (1970). (French).
 COUN France
 AREA Atlantic Ocean, Mediterranean Sea, Antarctica
 ABST Low level α -spectrometry was used to study the U balance on the earth. The concns. of U-238 and the U-234/U-238 ratios were detd. in the Atlantic Ocean at depths of 0-4800 m, in the Mediterranean Sea at 22-2400 m, and in several rivers. The method was used to det. the age of a stalagmite ($93,000 \pm 2000$ yr) from the Drgnac Chasm and of marine carbonates by Th-230/U-234 dating. The method was also used to measure the accumulation rate of snow in Antarctica by studying Pb-Po²¹⁰ ratios. The semiconductor detector used is described.
 KEY analysis, trace metals, concentration, river
- 229 AUTH Larionov, E. G.; Nikolaeva, N. M.; Pirozhkov, A. V.
 DATE 1977
 TITL Forms of uranium and Fe existence in natural water and leaching solutions.
 CITA Geol. Geofiz. (2): 162-165 (1977). (Russian).
 COUN USSR
 ABST The measurement of pH, Eh and temperature in a number of pumped out and non-acidified wells in deposits and sampling of the solution from these wells for analysis and comparative evaluation of pH and Eh under laboratory

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conditions have been carried out in order to calculate experimentally the forms of U and Fe presentation in the leaching solution. For the sulphate solution with the minimum oxidizing potential $E_0 = 0.404$, ionic strength 0.05–2.75 and temperature 25°C, the ratio $(\text{UO}_2^{2+})/(\text{U}^{4+})$ is estimated to be 2.5×10^{18} and the ratio $(\text{UO}_2\text{SO}_4)/(\text{UO}_2^{2+})$ approximately 80, and hence in leaching solutions the concentration of U(4) in the form of sulphate complexes is higher than in the form of uranyl ions by 80 times. In the natural water with $E_h = 0.2478$, $\text{pH} = 7.58$ and $E = 404$ the ratio $(\text{UO}_2^{2+})/(\text{U}^{4+}) = 10^{25}$ and hence uranium is in the oxidized condition. When pH of the natural water equals 7 and the concentration of bicarbonate ions approximately 10^{-3} M the constant of the formation of carbonate complexes of uranyl is equal to 10^{22} which is higher than the constant of sulphate complexes by 18 points, and consequently it is the most probable that U is present in such waters in the form of carbonate complexes. Forms of the Fe present have been calculated in the same way.

KEY uranium, chemistry, temperature, analysis, water, chemical species, trace metals, concentration

230 AUTH Lawton, F.L.
DATE 1972
TITL Tidal power in the Bay of Fundy.
CITA Tidal Power, by Gray and Gashus, Plenum Press, New York, p. 1–104 (1972).
COUN Canada
AREA Bay of Fundy
ABST Here is discussed the many engineering and economic aspects involved in the utilization of tidal power, as exemplified by the Bay of Fundy investigations.
KEY tidal systems, tide

231 AUTH Lawton, F.L.
DATE 1972
TITL Economics of tidal power.
CITA Tidal Power, by Gray and Gashus, Plenum Press, New York, p. 105–129 (1972).
COUN Canada
ABST Tidal power plants are characterized by the influence of the tidal cycle dictated by the astronomical forces controlling the tides. The output, entirely predictable many years in advance, follows the lunar cycle and hence gradually moves out of and then back into phase with the solar cycle. The solar cycle shapes the energy requirements of the community.
KEY tidal system, tide

32 AUTH Laxen, P.A.
DATE 1971
TITL The dissolution of UO_2 as an electron transfer reaction.

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- CITA The Recovery of Uranium, Proceedings of a Symposium on the Recovery of Uranium from its Ores and other Sources, IAEA, Sao Paulo, 17-21 August 1970, p. 321-330 (1971).
- COUN South Africa
- ABST In the course of a study of the fundamental aspects of the dissolution of UO_2 in acid solutions containing Fe^{3+} , the strong similarity was observed between factors affecting the dissolution of UO_2 and factors affecting many electron transfer reactions occurring in solution - particularly the $Fe^{3+} - Fe^{2+}$ exchange.
- KEY concentration, uranium
- 233 AUTH Lee, T.N.
- DATE 1975
- TITL Florida current spin-off eddies.
- CITA Deep-Sea Research 22: 753-765 (1975).
- COUN USA
- AREA Florida
- ABST Analysis of one year of near-surface current meter records from the narrow coastal zone inside the Florida Current off Boca Raton and Pompano, Florida, shows the occurrence of a large number of cyclonic current reversals that are not wind or tide induced. The reversals are accompanied by an advection of heat and salt into the coastal region and are interpreted as cyclonic eddies which spin off the western edge of the Florida Current and become entrained northward through the coastal waters. A kinematic model is used.
- KEY current, temperature, salinity, seawater, nearshore, gulf of mexico
- 234 AUTH Lee, T.N.; Munier, R.S.C.; Chiu, S.
- DATE 1978
- TITL Water mass structure and variability north of St. Croix, U.S. Virgin Islands, as observed during the summer of 1977 for DTEC assessment.
- CITA University of Miami, Rosentiel School of Marine and Atmospheric Science, Technical Report UM-RSMAS No. 78004 (1978).
- COUN USA
- AREA Puerto Rico
- ABST Variability of the water mass structure north of St. Croix in the Virgin Islands Basin was observed during a 2.5 month study of corrosion and biofouling on DTEC heat exchanger performance in the summer of 1977. The largest temporal fluctuation in water properties occurred in the Tropical Surface Waters of the upper 100m due primarily to advection of this spatially inhomogeneous water mass past the moor. Currents in the upper layer were also highly variable with speeds ranging from 0 to 50 cm/sec and numerous direction reversals.
- KEY temperature, current, climate, salinity, seawater,

(CONT.)

caribbean

- 235 AUTH Legin, V.K.; Kuznetsov, Yu.V.; Lazarev, K.F.
DATE 1966
TITL Forms of uranium occurrence in marine sediments.
CITA Geokhimiya 5: 606-608 (1966).
COUN USSR
ABST Leaching with 0.7N NaHCO_3 solutions extracted nearly all the 5.0 ppm U in H_2S -containing sediments from the Black Sea but only 4-10% of the 1-2 ppm U in the H_2S -poor sediments of the Black and Azov Seas. The results permit the inference that the U of the U-rich sediments is precipitated by reduction from sea water, but the possibility that the U is precipitated with organic matter is open (Kochenov et al., Geokhimiya 1965, No. 3).
KEY uranium, sediments, extraction, organics, concentration
- 236 AUTH Leipper, D.F.
DATE 1970
TITL A sequence of current patterns in the Gulf of Mexico.
CITA Journal of Geophysical Research 75(3): 637-657 (1970).
COUN USA
AREA Gulf of Mexico
ABST The primary current in the Gulf of Mexico is in the form of a loop entering through the Yucatan Channel and eventually leaving through the Florida Straits. It usually transports more than 25 million m^3/sec of water at 50 to 200 cm/sec. Although it retains its basic characteristics along the line of flow, it is known to be highly variable in position. Little information on the exact nature of the variations is published. The flow is well represented year-around by the topographies of the 22°C isothermal surfaces. This permits a simplified analysis and allows conclusions about the current systems to be drawn from cruises on which only limited data were collected. From July 1965 through December an eastward flow along the coast of Cuba strengthened and became the start of a 'spring intrusion' into the gulf. By August 1966 the intrusion had reached 760 km across the gulf, and a 'fall spreading' into the west gulf had begun. In July and August 1965 the northern end of the loop became a separate eddy, a detached exterior flow.
KEY current, offshore, temperature, gulf of Mexico, seawater
- 237 AUTH Leung, G.; Kim, Y.S.; Zeitlin, H.
DATE 1972
TITL An improved separation and determination of uranium in sea water.
CITA Anal. Chim. Acta 60(1): 229-232 (1972).
COUN USA
ABST An adsorbing colloid flotation technique (K. and Z. (CA

(CONT.)

75:9738c, 112756f)) using colloidal $\text{Th}(\text{OH})_4$ and $\text{C}_{11}\text{H}_{23}\text{CO}_2\text{Na}$ (I) as surfactant is used for separation of U from sea water. To 500-ml samples of filtered sea water contg. 0-6 μg of U^{6+} , 2 ml 0.1M $\text{Th}(\text{NO}_3)_4$ was added and the pH was adjusted to 5.7 ± 0.1 with M HCl. The flow of air in the cell was 10 ± 2 ml/min. Three ml of 0.05% I soln. (in 95% EtOH) was added; after 2-3 min, the froth was collected in a small conical flask. The froth was treated as previously described, except that the vol. of $\text{Ca}(\text{NO}_3)_2$ -EDTA salting soln. was 15 ml. The fluorescence intensity of the pink U-rhodamine B complex soln. was measured at the 575 nm max. The calibration curve of fluorescence intensity vs. U^{6+} concn. in spiked samples is linear for 0-8 μg U. The recoveries of 2-6 μg U^{6+} , added to 500-ml samples of sea water originally contg. 3.1 μg U/l., were 89.2- 93.5, av. 90.0%.

KEY extraction, uranium, seawater, analysis, concentration, chemistry, capacity

- 238 AUTH Lewis, D.M.
 DATE 1976
 TITL The geochemistry of manganese, iron, uranium, lead-210 and major ions in the Susquehanna River.
 CITA PhD Thesis (Abstracted in Geochemistry) (1976).
 COUN USA
 ABST The precipitation of manganese, iron and lead in the Susquehanna River was found to be first order for each. The U-238 was related to the amount of rock weathered, while the U-234 in solution was dependent on the residence time of the stream water as ground water. The U-234/U-238 activity ratio was due to a combination of the above phenomena. The data showed that uranium is removed from solution onto the suspended sediment in the Susquehanna.
 KEY river, uranium, concentration, biological productivity, trace metals, sediment

- 239 AUTH Lieberman, M.A.
 DATE 1976
 TITL United States uranium resources - an analysis of historical data.
 CITA Science 192(4238): 431-436 (1976).
 COUN USA
 AREA USA
 ABST Using historical data, a study of U.S. uranium resources was performed with emphasis on discovery and drilling rates for the time interval from 1948 until the present. The ultimate recoverable resource up to a forward cost category of \$30 or less per pound is estimated to be 1,134,000 short tons - about one third the estimate offered by ERDA. A serious shortfall in uranium supply is predicted for the late 1980's if nuclear power proceeds as planned; and courses of action are

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KEY recommended for uranium resource management.
uranium, economics

- 240 AUTH Lin, Y.M.
DATE 1973
TITL Determination of uranium content in sea water by a fluorimetric method with dinonyl naphthalene sulfonic acid as a extractant.
CITA Ho Tzu K'o Hsueh 10(3-4): 38-42 (1973). (Chinese).
COUN Taiwan
AREA Taiwan
ABST The seawater is added to 1% HCl right after sampling to prevent the loss of U [7440-61-1] through ppt. and adsorption on the sample vessel. Seawater 2 ml is mixed with 8 ml conc. HClO_4 and 10 ml of 8×10^{-9} F dinonyl naphthalene sulfonic acid [25322-17-2] in n-hexane was added and the mixt. shaken at $25 \pm 1^\circ$ for several min. After phase sepn., 0.2 ml was placed in a Pt dish and dried under an ir lamp. Then 0.4 g 98% NaF and 2% LiF were placed in the dish and fused at $850-900^\circ$ for 3 min so that the reagent completely fused in the 1st min and then the temp. was reduced slightly in the next 2 min. The dish was cooled and dried in an amberlite desiccator, and fluorescence detd. in 30 min. The calib. curve of U_3O_8 is linear at $0-20 \times 10^{-9}$ g. The efficiency of U extraction in HClO_4 is in proportion to the concn. of dinonyl naphthalene sulfonic acid. The optimum concn. is 8×10^{-3} F. The extraction yield reached 85% even after a few min of shaking and settling. The U content in sea water around the coast of Taiwan was 9.37-13.3 mg/l.
KEY analysis, extraction, temperature, capacity, concentration, seawater, uranium
- 241 AUTH Lin, Y.M.; Weng, P.S.; Ma, I.
DATE 1974
TITL Use of dinonylnaphthalenesulfonic acid for the determination of environmental uranium in air, sea, and soil.
CITA Hoken Butsuri 9(3): 157-158 (1974).
COUN Taiwan
ABST The U in soil, seawater, and air (dusty filter paper from a low-vol. air sampler) was detd. The sample was dissolved in 9.4N HClO_4 . The resulting soln. was dild. to an acidity of $<2\text{N}$ and U was extd. with dinonylnaphthalenesulfonic acid in n-hexane. The U in the org. phase was detd. by fluorometry after fusing with NaF and LiF at $850-900^\circ$ for 2.5 min. The detn. range was 4.43×10^{-14} to 3.37×10^{-4} g U/l. for air samples. The overall extn. of U was $\sim 80\%$.
KEY analysis, uranium, concentration, seawater, extraction, temperature, capacity

- 242 AUTH Llewelyn, G.I.W.
 DATE 1976
 TITL Extraction of uranium from seawater.
 CITA Atom (London) (238): 214-219 (1976).
 COUN UK
 AREA Straits of Dover, Irish Sea
 ABST This paper is based on the conclusions of a working party set up by the United Kingdom Atomic Energy Authority some years ago to assess the problems involved in the extraction of U from sea water. Headings include the following: the sea as a source of U - an examination of possible extraction schemes; energy balance analysis for extraction of U from sea water; environmental aspects; possible extractive plant sites; and sites of process development. Amongst conclusions reached are (i) there are a number of uncertainties associated with the process and extensive further research would be necessary to appreciably reduce the level of these uncertainties; (ii) the most promising extraction system is that based on pumped sea water flow; (iii) it seems unlikely that there are sites around the UK where U extraction from sea water could appreciably help UK requirements; (iv) a large scale U extraction plant could involve a major biological management effort both within the process and the environment, although the biological problems could probably be overcome; (v) in view of the uncertainties associated with such a project, it is at present unrealistic to attempt to give even approximate cost estimates; (vi) it would be unwise to expect U from sea water to contribute significant amount to world U demands for thermal reactors on an acceptable time scale.
- KEY extraction, uranium, seawater, environmental impact, pumped system, marine organisms, economics, adsorbent, current, temperature, particulate, elution, existing system
- 243 AUTH Llewelyn, G.I.W.
 DATE 1976
 TITL Recovery of uranium from sea-water.
 CITA Uranium ore processing, Proceedings of an advisory group meeting organized by the IAEA and held in Washington, D.C., 24-26 November 1975. ISBN 92-0-041176-2. IAEA, Vienna: 205-212 (1976).
 COUN UK
 ABST The possibility of extraction of uranium from sea-water on a sufficiently large scale to contribute significantly to national UK requirements is placed in perspective. It seems unlikely that there are sites around the UK coast where this could be achieved, and insufficient work has been done to be confident that sites exist anywhere to enable uranium extraction to be carried out on a large scale. Process techniques have been developed on a small scale, but extensive further

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research work would be necessary to reduce appreciably the present uncertainties. It would be unwise to expect uranium from sea-water to contribute significant amounts to the world's uranium demand for thermal reactors on an acceptable timescale.

KEY extraction, uranium, seawater, economics

- 244 AUTH Mahdavi, A.
DATE 1976
TITL Study on the behaviour of radionuclides in seawater in the Persian Gulf and Caspian Sea area. Part of a coordinated programme on marine radioactivity studies.
CITA International Atomic Energy Agency, Vienna (Austria). Final report for the period 1 Nov. 1973 - 31 Oct. 1974. IAEA-R-1405-F: 5p (1976).
COUN Iran
AREA Persian Gulf, Caspian Sea
ABST Results of the analysis of coastal waters from the Persian Gulf and the Caspian Sea are reported. Certain radionuclides, trace elements and salts (U, Ra226, Cu, Mn, Zn, Pb, Fe, Cd, Hg, Na, K, Ca, Cl, SO_4) were determined in samples from the two different areas. The measured concentrations are given (table) and compared with reported values for open sea water in the areas studied. The results indicate an obvious difference between the two water bodies compared with open sea water.
KEY analysis, uranium, seawater, trace metals, concentration
- 245 AUTH Malik, W.U.; Sharma, T.C.
DATE 1972
TITL Spectrophotometric determination of micro-amounts of uranium(VI) and thorium(IV) with dithizone.
CITA Indian J. Appl. Chem. 35(4): 147-148 (1972).
COUN India
ABST Uranyl complexes and thorium complexes with dithizone were prepared and studied spectrophotometrically with a view to assess suitability of dithizone as a reagent for colorimetric estimation of uranium and thorium. The complexes obey Beer's law. Uranium and thorium in quantities as low as 1 ppm can be determined. The molar composition of the complexes shows that it contains metal and dithizone in the molar ratio 1:2. Interferences by a large number of added foreign ions have been studied and tolerance limit determined.
KEY uranium, analysis,
- 246 AUTH Maloney, N.; Chan, K.M.
DATE 1974
TITL Physical oceanography
CITA Reprinted from: A Summary of Knowledge of the Southern California Coastal Zone and Offshore Areas, p. 3-1--3-65 (1974).

(CONT.)

- COUN USA
AREA Southern California
ABST This is a detailed summary of the physical oceanography off Southern California.
KEY temperature, salinity, current, chemistry, nearshore, offshore, pacific southwest, climate
- 247 AUTH Manheim, F.T.
DATE 1961
TITL A geochemical profile in the Baltic Sea.
CITA Geochimica et Cosmochimica Acta 25: 52-70 (1961).
COUN Sweden
AREA Baltic Sea
ABST An investigation has been made of the relationship between depositional environment and element distribution in sediments from the Baltic Sea. A prominent feature of the Baltic is its salinity stratification, which gives rise to changes in bottom character from oxygenation to stagnation as greater depths are approached. Maximum heavy metal concentrations were not found in the central, most stagnant and organic-rich parts of the basins, but in the transition zone to stagnant conditions. Manganese-iron nodules were found in a peripheral area characterized by aerated bottom water but moderately reducing sediment environment, as measured by redox potential determinations. In two of the Baltic deeps manganese was found enriched in sapropelic sediments, in one case reaching 5.2 per cent MnO. The mineral responsible for the enrichment is regarded as a mixed manganese-calcium carbonate.
KEY chemistry, estuary, seawater
- 248 AUTH Manheim, F.T.; Meade, R.H.
DATE 1970
TITL Suspended matter in surface waters of the Atlantic Continental Margin from Cape Cod to the Florida Keys.
CITA Science 167(3917): 371-376 (1970).
COUN USA East Coast
AREA U.S. East Coast
ABST Appreciable amounts of suspended matter (>1.0 milligram per liter) in surface waters are restricted to within a few kilometers of the Atlantic coast. Particles that escape estuaries or are discharged by rivers into the shelf region tend to travel longshoreward rather than seaward. Suspended matter farther offshore, chiefly amorphous organic particles, totals 0.1 milligram per liter or less. Soot, fly ash, processed cellulose, and other pollutants are widespread.
KEY particulate, n atlantic, mid atlantic, s atlantic, seawater
- 249 AUTH Marhol, M.; Chmelicek, J.; Pekarek, V.;

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Vesely, V.

DATE 1969
TITL Uranium sorption from natural water or phosphorylated sawdust.
CITA Ustav Jad. Vyzk. (Ref.) 2218-Ch: 41 pp. (1969)
COUN Czechoslovakia.
ABST The uranium sorption from natural water on phosphorylated sawdust was studied and the dependence of U sorption on HCO_3^- examined. The sorption maximum for U occurred at a HCO_3^- concentration of 250-300 mg/l. Elution was found to be most effective with a 1% solution of $(\text{NH}_4)_2\text{CO}_3$.
KEY uranium, sorption, water, elution,

250 AUTH Martinec, M.
DATE 1973
TITL Influence of uranium extraction upon radium-226 content in surface water, reed, and freshwater fish.
CITA Cesk. Hyg. 18(10): 475-478 (1973). (Czech).
COUN Czechoslovakia
ABST Ra-226 concn. in the Horka pond was 3 pCi/l. before mining began and rose to 5-20 pCi/l. during mining. The Ra-226 concn. in reeds and fish also increased. Ra-226 levels in scales and bones were 334-365 and 286-327 pCi/1000g, resp.; levels in flesh were 0.1-12 pCi/1000g which is within the natural range.
KEY uranium, extraction, water, marine organisms,

251 AUTH Mathews, T.D.; Pashuk, O.
DATE 1977
TITL A description of oceanographic conditions off the southeastern United States during 1973.
CITA South Carolina Marine Resources Center, Technical Report Number 19; Charleston, 105 p. (1977).
COUN USA
AREA South Carolina, Georgia
ABST Distribution of oxygen, temperature, density & salinity are presented on horizontal and vertical surfaces for regions from South Carolina to Georgia. These figures are for various months.
KEY temperature, salinity, chemistry, nearshore, offshore, seawater, s atlantic

252 AUTH Mathews, T.D.; Shealy, M.H. Jr.
DATE 1978
TITL Hydrography of South Carolina estuaries, with emphasis on the north and south Edisto and Cooper rivers.
CITA South Carolina Marine Resources Center, Technical Report Number 30, Charleston 148 p. (1978).
COUN USA
AREA South Carolina
ABST Measurements and results are given for estuaries along

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KEY the coast of S. Carolina. All seasons are represented.
temperature, salinity, chemistry, estuary, nearshore,
seawater, river, water, particulate, s atlantic

- 253 AUTH Mathieson, A.R.
DATE 1949
TITL Stability of complexes of uranyl nitrate with ketones
and ethers
CITA Journal of the Chemical Society, Supplement No. 2:
294-299.
COUN USA
ABST New complexes of uranyl nitrate with ketones have been
prepared by dissolving $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ in the ketones,
and subsequent crystallisation. 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
vapour-pressure curves of evaporating solutions of the
complexes in their own ketone as solvent, determined at
different temperatures, enabled the energies of rupture
of the ketone-uranyl nitrate bonds to be estimated. The
formation by diethyl ether 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 compounds 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 organic solutions of the complexes
were compared with that of $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ in water. The
bearing of these results on the solubility of uranyl
nitrate in the solvents under consideration is
discussed.
KEY uranium, chemical species, organics
- 254 AUTH Matsumoto, T.; Satake, M.; Hirata, Y.
DATE 1964
TITL On the macro constituent elements in marine
invertebrates.
CITA The Journal of the Oceanographic Society of Japan 20(3):
8-14 (1964).
COUN Japan
ABST The contents of macro constituent elements in marine
invertebrates such as Octopus, Sepia, Ostrea, Horothuria
and Aurelia which live in the eastern area of Seto
Inland Sea have been investigated. The amounts of
sodium, magnesium, chlorine and sulfur contained in
those invertebrates are smaller than those in the
seawater, except potassium content in animals other than
Ostrea and Aurelia, which is larger than that in the
seawater. The atomic ratios K/Na, Ca/Mg and S/P in
these animals are generally smaller than 1, except that
the value S/P in Holothuria is 2 and in Aurelia 3. The
atomic ratio S/Cl is about 0.1~0.3 and Si/Cl about 0.1
or less.
KEY marine organisms, trace metals, seawater, concentration
- 255 AUTH Matsumoto, T.; Satake, M.; Yamamoto, J.; Haruna, S.

(CONT.)

- DATE 1964
TITL On the micro constituent elements in marine invertebrates
CITA The Journal of the Oceanographic Society of Japan 20(3): 15-19 (1964).
COUN Japan
ABST The contents of micro constituent elements in marine invertebrates such as Octopus, Sepia, Holothuria and Aurelia have been investigated. Octopus and Sepia generally contain appreciable amounts of these micro constituents, and especially in their livers the quantity of copper, zinc and iron amounts to a few percent. Holothuria contains aluminum, iron and lead in considerable quantity. The animal of lower order like Aurelia contains very small amount of all the metals determined. The atomic ratio Cu/Zn in these invertebrates is generally 0.2-0.5, but the value Fe/Al is variable and extremely larger than that in the seawater.
KEY marine organisms, trace metals, concentration, analysis, extraction, seawater
- 256 AUTH Matthews, J.B.; Mungall, J.C.H.
DATE 1978
TITL A numerical tidal model and its application to Cook Inlet, Alaska.
CITA Journal of Marine Research 30(1): 27-38 (1978).
COUN USA
AREA Cook Inlet
ABST A numerical scheme for predicting tides and tidal currents has been designed for rapid application to new situations with a minimum of effort. The model is two-dimensional and includes Coriolis and frictional terms. An application to Cook Inlet, Alaska, is described for a tide having a period of 12.42 hours and an amplitude of one half the mean tidal range. Currents and ranges predicted by the model show good agreement with the few available observations. The maximum error in the model was 8% for the tidal range predicted for Kenai.
KEY current, tide, estuary, seawater, nearshore, alaska
- 257 AUTH Maul, G.A.
DATE 1977
TITL The annual cycle of the Gulf Loop Current, Part I: observations during a one-year time series.
CITA Journal of Marine Research 35(1): 29-47 (1977).
COUN USA
AREA Gulf of Mexico
ABST The Gulf Loop Current is that portion of the Gulf Stream System which connects the Yucatan Current and the Florida Current in the eastern Gulf of Mexico. An experiment to test the annual cycle proposed by Leipper

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(1970) was conducted from August, 1972, through September, 1973. Twelve pathlines of the 22°C isotherm at 100 meters depth were made from Yucatan to the Florida Keys at 36-day intervals in conjunction with a satellite oceanography project. The sequence of pathlines shows an annual cycle of penetration into the eastern Gulf that is in phase with the historical annual cycle of current speeds and transports of the Gulf Stream, and is also reflected in tide gage sea-level records taken between Key West, Havana, and Progreso.

KEY current, seawater, offshore, temperature, gulf of Mexico

- 258 AUTH McClaine, L.S.; Bullwinkel, E.P.; Huggins, J.C.
 DATE 1955
 TITL The carbonate chemistry of uranium: theory and applications
 CITA The International Conference on Peaceful Uses of Atomic Energy. 8:26-37.
 COUN USA
 ABST This is a review of uranium technology and the applications of carbonate systems to uranium extractive metallurgy. It provides a thorough examination of the speciation of uranium in carbonate systems.
 KEY uranium, chemical species, chemistry, extraction
- 259 AUTH McGinley, F.E.; Facer, J.F.
 DATE 1976
 TITL Uranium as a by-product and by-products of uranium production
 CITA In Uranium Ore Processing, Proceedings of an Advisory Group Meeting, Wash. D.C., 24-26 Nov. 1975, Iata, Venice, 1976, pp. 181 - 190.
 ABST With increasing demand and correspondingly higher prices for uranium there is a renewed interest in uranium recovery from phosphates. The possible recovery of uranium from porphyry copper waste dump leach liquors is also being re-examined. Because of the concern about the adequacy of uranium resources in conventional-type deposits, other low-grade sources of uranium such as the Chattanooga shale (60 ppm U) are being re-evaluated. Most uranium recovered in the USA comes from sandstone-type ores with little or no other metals of commercial interest. Some ores, however, contain sufficient vanadium to warrant recovery. Nearly all ores contain traces of other metals, many of which either have been recovered on a small scale at one time or another or the possibilities of recovery have been investigated. They include molybdenum, rhenium, selenium, copper, silver, scandium, arsenic, mercury, thorium, ionium, protactinium and radium. Uranium ore processors should be alert to the possibility of recovering these and other metals which may occur in uranium ores.

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- KEY uranium, economics, multi-purpose process, trace metals, vanadium.
- 260 AUTH McKay, H.A.C.
DATE 1972
TITL By-products of nuclear power.
CITA Chem. Ind. (London) (7): 275-280 (1972).
COUN UK
ABST A review with 25 refs. The by-products of nuclear power (i.e., waste heat, fission products, various radiations, and depleted U) and their possible applications are discussed.
KEY multi-purpose process, uranium, economics, concentration, chemical species, adsorbent, titanium, elution, marine organisms, particulate, tidal system, existing plants
- 261 AUTH McLain, D.R.
DATE 1968
TITL Oceanographic surveys of Traitors Cove Revillagigedo Island, Alaska.
CITA U.S. Fish & Wildlife Service Special Scientific Report-Fisheries No.576, U.S. Department of Interior, Washington D.C. December 1968.
COUN USA
AREA Alaska
ABST This small report gives several cross sections of temperature and salinity and discusses the seasonal effects on stratification and currents.
KEY current, estuary, river, seawater, climate, temperature, salinity, nearshore, alaska,
- 262 AUTH Means, J.L.; Crerar, D.A.
DATE 1978
TITL Migration of radioactive wastes: radionuclide mobilization by complexing agents.
CITA Science 200: 1477-1481 (1978)
COUN USA
ABST Ion exchange, gel filtration chromatography, and gas chromatography-mass spectrometry analyses have demonstrated that ethylenediaminetetraacetic acid (EDTA), an extremely strong complexing agent commonly used in decontamination operations at nuclear facilities is causing the low-level migration of cobalt-60 from intermediate-level liquid waste disposal pits and trenches in the Oak Ridge National Laboratory burial grounds.
KEY ion exchange, analysis, concentration, adsorption, sediments, trace metals, capacity, adsorbent
- 263 AUTH Metcalf, W.G.
DATE 1968
TITL Shallow currents along the northeastern coast of South

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- America.
CITA Journal of Marine Research 26(3): 232-243 (1968).
COUN USA
AREA Western Tropical Atlantic
ABST It has generally been considered that the Guiana Current carries South Atlantic Central water in an uninterrupted flow along the northeastern coast of South America and then into the Caribbean Sea. Certain phenomena observed in the western tropical Atlantic and in the Caribbean indicate that the picture is not that simple. The formation of the Equatorial Undercurrent, the pattern of the subsurface-salinity maximum along the Brazilian Coast, the distribution of lenses of the Amazon River outflow, and the relative lack of South Atlantic Central water in the Caribbean Sea all suggest that the Guiana Current undergoes major changes somewhere along the Brazilian Coast. Recent data indicate that a major interruption in this Current occurs in the area off the mouth of the Amazon River.
KEY current, temperature, salinity, offshore, seawater, caribbean, river
- 264 AUTH Metcalf, W.G.
DATE 1976
TITL Caribbean-Atlantic water exchange through the Anegada-Jungfern Passage.
CITA Journal of Geophysical Research 81(36): 6401-6409 (1976).
COUN USA
AREA Caribbean, Atlantic
ABST Measurements of the salinity, oxity, and silicate from hydrographic stations occupied at opposite ends of the Anegada-Jungfern Passage have been plotted graphically against potential temperature. The water column has been divided into six layers on the basis of distinctive features in the θ -S, θ - O_2 , and θ -silicate relationships. The differences and similarities between these features at opposite ends of the passage are correlated with geostrophic current computations to describe the current pattern through this passage. At about the 700-m level the predominant current changes from a shallow flow into the Caribbean to a deeper outflow. In a layer 200 m thick immediately above sill depth (1815 m) the current alternates between inflow and outflow. The net transport through the passage is an inflow of roughly 1.4 Sv ($1 \text{ Sv} = 10^6 \text{ m}^3/\text{s}$), mostly in the upper 400-500 m of the water column.
KEY current, temperature, salinity, seawater, offshore, chemistry, caribbean
- 265 AUTH Mihalik, B.
DATE 1974
TITL Contribution to the determination of microquantities of

BIBLIOGRAPHY OF URANIUM RESOURCES

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uranium in water.

CITA Chem. Listy 68(12): 1278-1281 (1974). (Czech).

CDUN Hungary

ABST A procedure is described for the isolation of uranium salts from superficial waters using a sorption on activated charcoal and spectrophotometric determination of uranium with arsenazo III in acid medium (pH = 2). The method permits microdetermination of uranium in various superficial waters.

KEY water, uranium, adsorbent, analysis, chemistry, extraction

266 AUTH Milner, G.W.C.; Wilson, J.D.; Barnett, G.A.; Smales, A.A.

DATE 1961

TITL The determination of uranium in sea water by pulse polarography.

CITA Journal of Electroanalytical Chemistry 2: 25-38 (1961).

CDUN UK

ABST A procedure is described for the determination of uranium content in sea water. Uranium-237 is employed as a radioactive tracer to measure the percentage recovery of uranium in the chemical separation processes. The value obtained for English Channel water is $3.37 \pm 0.08 \mu\text{g}$ of uranium per liter.

KEY analysis, uranium, seawater, concentration, extraction, organics

267 AUTH Mita, K.

DATE 1961

TITL Chemical studies on the green seaweed-III. On the inorganic components of *Enteromorpha compressa*, *Ulva pertusa* and their mucilages.

CITA Bulletin of the Japanese Society of Scientific Fisheries 27(3): 239-242 (1961).

CDUN Japan

AREA Hiroshima Bay

ABST Succeding to the previous paper, in which the elemental composition of ashes of a red seaweed, *Gloiopeltis furcata*, and its mucilage was given, the present report deals with that of green seaweeds. The specimens were two kinds of green seaweed, *Enteromorpha compressa*, and *Ulva pertusa*, collected from Hiroshima Bay in January and May and mucilages extracted with hot water.

KEY marine organisms, chemistry, analysis, trace metals, extraction, seawater, concentration

268 AUTH Miyake, Y.; Sugimura, Y.

DATE 1964

TITL Uranium and radium in the western North Pacific waters.

CITA Studies on Oceanography, Prof. K. Hidaka, Sixtieth Birthday Commemorative Volume, Univ. of Tokyo Press, Tokyo. p 274-278. Reprinted in: Geochemical Study of the Ocean and the Atmosphere, Geochemical Laboratory,

(CONT.)

- Meteorological Research Institute, Tokyo, Japan, p. 293-297.
- COUN Japan
 AREA Western North Pacific
 ABST The vertical profile of radium and uranium in sea waters, collected along 38°N extending from 143°E to 148°E in the western North Pacific was studied. Radium content in sea water ranged from 0.4 to 0.6×10^{-13} g/l at the surface and from 0.9 to 1.3×10^{-13} g/l at the bottom. The mean value was 7.3×10^{-14} g/l. The analytical result of uranium showed that its content in sea water varied considerably on both horizontal and vertical directions ranging from 1.9 to 4.7×10^{-6} g/l. Average content of uranium was 3.4×10^{-6} g/l given for the Pacific and the Atlantic which is in good agreement with the mean value of 3.3×10^{-6} g/l by RONA et al. (1956). It is to be noted that the uranium content also increases with the depth.
- KEY trace metals, uranium, seawater, analysis, ion exchange, concentration, north pacific ocean
- 269 AUTH Miyake, Y.; Saruhashi, K.; Sugimura, Y.
 DATE 1968
 TITL Biogeochemical balance of natural radioactive elements in the oceans.
 CITA Records of Oceanographic Works in Japan 9(2):179-187 (1968).
 COUN Japan
 ABST An equation (Eq. 1) is presented which expresses the biogeochemical cycle of radioactive elements in the ocean. Among radioactive elements, discussions about the contents of ionium, thorium and radium in sea water are done. The results indicate that the concentrations of thorium and ionium may range respectively from 5×10^{-10} to 5×10^{-8} g/l for thorium and 6×10^{-14} to 6×10^{-12} g/l for ionium. With respect to radium, a most part of this element seems to be supplied from the sea floor, but the vertical variation in concentration may be resulted by the radioactive generation from ionium remaining in sea water.
- KEY trace metals, seawater, concentration, sediments, uranium, organics, biological productivity
- 270 AUTH Miyake, Y.; Saruhashi, K.; Katsuragi, Y.; Kanazawa, T.; Sugimura, Y.
 DATE 1964
 TITL Uranium, radium, thorium, ionium, strontium 90 and cesium 137 in coastal waters of Japan.
 CITA Recent Researches in the Fields of Hydrosphere, Atmosphere and Nuclear Geochemistry, publ. by Editorial Committee of Sugawara Festival Volume, Maruzen Co. Ltd., Tokyo, Japan, p 127-141. Reprinted in Geochemical Study of the Ocean and the Atmosphere, Geochemical Laboratory, Meteorological Research Institute, Tokyo, Japan, p 298-312.

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COUN Japan
AREA Suruga Bay
ABST The determination was made with respect to uranium, radium, thorium, ionium, Sr-90 and Cs-137 in coastal waters collected in Suruga Bay, Honshu Is., Japan in 1960 and 1961. Suruga Bay is located near the central parts of Honshu, facing the Pacific Ocean.
KEY uranium, trace metals, concentration, analysis, north pacific, kuroshio, river, estuary, seawater, marine organisms

- 271 AUTH Miyake, Y.; Sugimura, Y.; Mayeda, M.
DATE 1970
TITL The uranium content and the activity ratio U-234/U-238 in marine organisms and sea water in the Western North Pacific.
CITA J. Oceanogr. Soc. Japan 26:123-129. Reprinted in: Geochemical Study of the Ocean and the Atmosphere, ed. by Geochemical Laboratory, Meteorological Research Institute, Tokyo, Japan, p. 265-271.
COUN Japan
AREA Western North Pacific
ABST The uranium content and activity ratio AU-234/AU-238 were determined in open ocean water, marine plankton, marine algae and sea water in the environment in which plankton and algae live. The average uranium content of $3.34 \pm 0.28 \times 10^{-6}$ g/l and the average activity ratio of 1.13 ± 0.04 were obtained in open ocean water. The uranium contents in plankton and algae were respectively from 1.7 to 7.8×10^{-7} g/g and 0.4 to 23.5×10^{-7} g/g on dry basis with the respective concentration factors of 48 to 260 and 10 to 733. The activity ratio in plankton and algae ranged from 1.07 to 1.18 which coincided well with those in the environmental sea water.
KEY uranium, concentration seawater, marine organisms, analysis, organics
- 272 AUTH Miyake, Y.; Sugimura, Y.; Uchida, T.
DATE 1966
TITL Ratio U-234/U-238 and the uranium concentration in seawater in the Western North Pacific.
CITA J. Geophys. Res. 71(12): 3083-3087. Geochemical Study of the Ocean and the Atmosphere, ed. by Geochemical Laboratory, Meteorological Research Institute, Tokyo, Japan, p. 288-292.
COUN Japan
AREA Western North Pacific
ABST The concentration of uranium and the activity ratio of seawater collected in the Kuroshio region and in the area of the mixing of Oyashio and Kuroshio waters in the western North Pacific were determined. Uranium was analyzed by the absorption spectrophotometric method with Arsenazo-III after separating it with a chelating resin.

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The activity ratio was determined by α -spectrometry after electroplating concentrated samples on a silver disk. The average content of uranium of 3.31×10^{-6} g/l and the average activity ratio AU-234/AU-238 of 1.09 ± 0.05 were obtained.

KEY concentration, uranium, seawater, analysis, current, north pacific ocean

- 273 AUTH Miyake, Y.; Sugimura, Y.; Uchida, T.
 DATE 1972
 TITL A new method of spectrophotometric determination of uranium in sea water and uranium content with U-234/U-238 ratio in the Pacific water.
 CITA Rec. Oceanogr. Works Japan 11:53-63. Reprinted in: Geochemical Study of the Ocean and the Atmosphere, ed. by Geochemical Laboratory, Meteorological Research Institute, Tokyo, Japan, p.254-264.
 COUN Japan
 AREA Western North Pacific
 ABST A new method of determination of uranium in sea water is devised. The average recovery of uranium in sea water $99.7 \pm 0.5\%$. By using the above method and alpha-ray spectrometry, the content of uranium of 3.31×10^{-6} g/l and the activity ratio U-234/U-238 of 1.13 were obtained on the average in sea water in the western North Pacific off Japan and the Japan Sea.
 KEY analysis, uranium, seawater, adsorbent, elution, chemistry, capacity, concentration
- 274 AUTH Mo, T.; O'Brien, B.C.; Suttle, A.D. Jr.
 DATE 1971
 TITL Uranium: Further investigation of uranium content of Caribbean cores P6304-8 and P6304-9.
 CITA Earth Planet. Sci. Lett. 10(2): 175-178 (1971).
 COUN USA
 AREA Caribbean
 ABST U content in P6304-8 and P6304-9 Caribbean cores is detd. by thermal neutron activation followed by (1) delayed neutron counting, and (2) Te-132 -fission product radiochemistry. The av. value obtained by these two methods is 34% higher than that obtained previously by α -spectrometry.
 KEY uranium, analysis, caribbean, concentration
- 275 AUTH Mo, T.; Suttle, A.D.; Sackett, W.M.
 DATE 1973
 TITL Uranium concentrations in marine sediments.
 CITA Geochim. Cosmochim. Acta 37: 35-51 (1973).
 COUN USA
 AREA Pettaquamscutt River (Rhode Island), Gulf of Mexico, Pacific
 ABST Uranium concentrations in a large number of marine sediment samples of different types with world-wide spatial

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distribution have been determined using the rapid, precise and nondestructive technique of counting the delayed neutrons emitted during U-235 fission induced with thermal neutrons. Several interesting relationships were apparent. (1) A direct proportionality was observed between percentage of organic carbon and uranium in sediments deposited in an anoxic environment in the Pettaquamscutt River in Rhode Island with concentrations ranging from 7 per cent organic carbon and 7 ppm uranium to 14 per cent organic carbon and 30 ppm uranium. A similar relationship was found in cores of sediments deposited on the Sigsbee Knolls in the Gulf of Mexico. (2) For manganese nodules a direct relationship can be seen between uranium and calcium concentrations and both decrease with depth of deposition. For nodules from 4500 m in the Pacific, concentrations are 3 ppm uranium and 0.3 per cent calcium compared with 14 ppm uranium and 1.5 per cent calcium at 1000 ppm. (3) Relatively high uranium concentrations were observed in carbonates deposited in the deepest parts of the Gulf of Mexico, with the >88 μ carbonate fraction in Sigsbee Knoll cores having as much as 1.20 ppm. A model to explain the observed variations must include uranium enrichment in near shore environments via an anoxic pathway, followed by redeposition in a deep ocean environment with dilution either by low-uranium-bearing foraminiferal or siliceous oozes or, along the continental margins, dilution with high-uranium-bearing carbonate sands.

KEY uranium, concentration, organics, gulf of mexico, sediments, analysis, river, nearshore

- 276 AUTH Moore, W.S.
 DATE 1967
 TITL Amazon and Mississippi River concentrations of uranium, thorium and radium isotopes.
 CITA Earth and Planetary Science Letters 2:231-234 (1967).
 COUN USA
 ABST Concentrations of uranium and thorium series isotopes were measured in two large samples of river water and associated sediment. From these data an oceanic residence time for uranium of 4 m.y. is calculated. The concentration of Th-232 in these rivers is an order of magnitude greater than in surface Atlantic waters. The amounts of Th-230 and Ra-226 being supplied to the ocean directly from rivers are less than 4% of that coming from other sources.
- KEY concentration, uranium, trace metals, analysis, river, sediments, chemistry

- 277 AUTH Moore, W.S.; Sackett, W.M.
 DATE 1964
 TITL Uranium and thorium series inequilibrium in sea water.

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- CITA Journal of Geophysical Research 69(24): 5401-5405
(1964).
- COUN USA
- ABST Sea water samples of 130 to 190 liters were collected to measure the concentration of thorium and protactinium in the ocean. After concentration at sea and chemical isolation of the elements in the laboratory, the various isotopes were resolved with an α -particle spectrometer. The precipitation of Th-230 and Pa-231 as they are formed from uranium was found to be essentially quantitative, less than 0.05% of the Th-230 and less than 0.2% of the Pa-231 remaining in solution. All thorium isotopes seem to be more concentrated in the one sample of North Atlantic Bottom Water than in several samples of surface or intermediate waters.
- KEY sea water, concentration, trace metals, chemistry, extraction, analysis, uranium, north atlantic, sediments, river water
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- 278 AUTH Morris, A.W.
DATE 1968
TITL The simultaneous determination of vanadium, chromium, manganese, iron, cobalt, nickel, copper and zinc in sea water by x-ray fluorescence spectrometry.
CITA Analytica Chimica Acta 42: 397-406 (1968).
COUN UK
ABST Continuous solvent extraction is described to separate and concentrate the elements, vanadium, chromium, manganese, iron, cobalt, nickel, copper, and zinc in seawater. This is to prevent matrix interferences in the subsequent X-Ray fluorescence spectrometric method of analysis. Sensitivity of 0.14 μ g or better were obtained with a 600 sec counting period in the X-Ray fluorescence.
- KEY extraction, concentration, vanadium, trace metals, analysis, chemistry, seawater
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- 279 AUTH Mrost, M.; Lloyd, P.J.
DATE 1971
TITL Bacterial oxidation of Witwatersrand slimes.
CITA The Recovery of Uranium, Proceedings of a Symposium on the Recovery of Uranium from its Ores and Other Sources, IDED, Sao Paulo, 17-21 August 1970, p. 223-239.
COUN S. Africa
AREA Witwatersrand Gold Mines
ABST Bacterial oxidation of iron pyrites occurs naturally on residue dams of Witwatersrand gold mines, yielding ferric sulphate and sulphuric acid which react with uranium-bearing minerals to produce soluble uranium sulphate. Examination of the various factors governing the bacterially assisted pyrite oxidation reaction has established that, in the practical context, access to air is rate-limiting. Methods are discussed for

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introducing air into slimes material so as to increase the rate of pyrite oxidation, and therefore of uranium solubilization, to a level sufficient to permit the development of methods for the recovery of such uranium at an acceptable rate.

KEY chemistry, uranium, extraction, economics

- 280 AUTH Mukai, S.; Koyanaka, Y.
DATE 1974
TITL Extracting uranium from sea water and uranium-containing aqueous solutions by galena.
CITA Japan. 74 14,443 (Cl. C 22b. B 01d), Appl. 69 95,789, 28 Nov 1969: 2p (1974).
COUN Japan
ABST Galena of grain size 0.2-1.0 mm is used to adsorb U from sea water or aq. solns. contg. 1.0-100 ppm U. The U is adsorbed by the galena grains at the rate of 4-250 mg U/1 g of galena. The recovery is 95% and the adsorbed U may be removed as the nitrate by washing with 0.01 N HNO₃. The galena may be washed with water and reused.
KEY uranium, seawater, water, concentration, extraction, capacity, elution, adsorbent
- 281 AUTH Murakami, T.; Ishihara, Y.; Uesugi, K.
DATE 1965
TITL Inorganic constituents in marine organisms.
Quantitative determination of vanadium in shell fish.
CITA Himeji Kogyo Daigaku Kenkyu Hokoku 18A: 99-103 (1965).
ABST Vanadium was determined colorimetrically in certain shellfish and found to be more concentrated in the shell than in the flesh. Seawater at Himeji Japan contained .0033ppm vanadium.
KEY vanadium, marine organisms, seawater, concentration
- 282 AUTH Nath, J.H.; Ambler, J.W.; Hansen, R.M.
DATE 1977
TITL Screens of DTEC plants.
CITA Program Report for 15 September 1976-14 September 1977, Corvallis, Oregon State University, 14 p. (1977).
COUN USA
ABST This progress report describes the work to date for the contract time period of 15 September 1976 to 14 September 1977. An overview of screens for onshore plants is in progress while an overview of micronekton abundance has been completed. A tentative schematic design for a screening system for completely enclosed conduit flow is presented. In addition, a tentative proposed design for sampling micronekton in a manner similar to an DTEC plant is presented. It is concluded that possibly large volumes of micronekton will need to be filtered from the warm and cold water flows at times in order to protect the heat exchangers and other items. Most of the screened fish will die and will need to be

- disposed of in such a manner so as to not attract large numbers of predators.
- KEY environmental impact, filtration, marine organisms, multi-purpose process, plant design, pumped system
- 283 AUTH Nelson, J.L.; Perkins, R.W.; Nielsen, J.M.; Hanshild, W.L.
 DATE 1966
 TITL Reactions of radionuclides from the Hanford reactors with Columbia River sediments.
 CITA Symposium on the Disposal of Radioactive Wastes into seas, oceans and surface waters, Proceedings, IAEA (1966) .
 COUN USA
 ABST On disposal to the Columbia River, effluent water from the nuclear reactors at Hanford contains many different radionuclides. These radionuclides provide numerous tracers for studying river phenomena. Among the radionuclides are activation products produced by n, γ reactions on water salts and smaller amounts of fission products resulting from fission of the trace quantities of uranium in the water. Although most of these radionuclides have such short half-lives or low abundances that they are not useful in studying river processes, Cr-51, Zn-65, Sc-46, Mn-54, Co-58, Fe-59, Co-60, Zr-95, Nb-95, Ru-106, Sb-124 and Ba-140 are present in sufficient amounts to serve as useful tracers. These findings have provided an understanding of many important processes in the Columbia River and can be extrapolated to provide predictions of radionuclide behaviour in other river systems.
 KEY chemistry, river, uranium, trace metals, concentration, extraction, organics, sediments, pacific northwest, adsorption
- 284 AUTH Niiler, P.P.; Richardson, W.S.
 DATE 1973
 TITL Seasonal variability of the Florida Current.
 CITA Journal of Marine Research 31(3): 144-167 (1973).
 COUN USA
 AREA Florida Straits
 ABST The seasonal variability of the directly measured transport and horizontal currents in the Florida Strait has been determined from 90 transects of the Florida Current at the latitude of Miami, Florida. It is estimated that the seasonal variability accounts for 45% of the total variability in the total transport; the early summertime maximum value of the transport is $33.6 \times 10^6 \text{ m}^3/\text{sec}$, and the early winter low is $25.4 \times 10^6 \text{ m}^3/\text{sec}$. The details of the temperature distribution with depth at the season of maximum and minimum flow also have been determined. The seasonal changes of the transport in the Florida Strait penetrate to the ocean bottom.
 KEY s atlantic, gulf of mexico, current, nearshore, temperature, salinity, seawater

- 285 AUTH Nininger, R. D.
DATE 1978
TITL Remarks by Robert D. Nininger, Assistant Director for Raw Materials Division of Uranium Resources and Enrichment, U.S. Department of Energy.
CITA Paper presented at Atomic Industrial Forum "Fuel Cycle '78" New York, New York, March 7, 1978
ABST This presentation includes an economic breakdown of the estimated land-based uranium reserves in the United States as of January 1, 1978. Besides evaluating the resource potential for uranium at its current price the paper includes brief summaries of the industrial production capability, current exploration activities and foreign developments. The conclusion drawn is that enough resource potential exists to justify a growing uranium industry.
KEY uranium, economics
- 286 AUTH Nissenbaum, A.
DATE 1977
TITL Minor and trace elements in Dead Sea water.
CITA Chemical Geology 19: 99-111 (1977).
COUN Israel
ABST The average concentration of several metals in six water profiles taken from the Dead Sea are: Sr = 308-330 mg/l; Li = 17-21 mg/l; Mn = 3.1-8.0 mg/l; Cu = 300-500 μ g/l; Zn = 500 μ g/l; Fe = 10-15 μ g/l; Ni = 20-25 μ g/l; Co = 8 μ g/l; Cd = 8-10 μ g/l; Pb = 120-300 μ g/l; I = 80-120 μ g/l and U = 1.5-2.5 μ g/l. The mechanisms which govern the behavior of metals in the Dead Sea are: (a): incorporation into authigenic carbonates and sulfides in the sediment (Sr, Zn, Cd, Fe); (b) formation of soluble salts or soluble chloridic complexes (Li, Mn, Pb); and (c) removal due to reduction and formation of sparingly soluble compounds (U).
KEY concentration, trace metals, sediments, interstitial water, seawater
- 287 AUTH Nitani, H.; Shoji, D.
DATE 1970
TITL On the variability of the velocity of the Kuroshio--II.
CITA The Kuroshio: A Symposium on the Japan Current, ed. by John C. Morr, East-West Center Press, Honolulu, p. 107-116 (1970).
COUN Japan
AREA North West Pacific
ABST Investigations of the variability of the Kuroshio, using two or three vessels simultaneously, were carried out in October of 1964, 1965, and 1966, respectively. The relationship between the velocity and the position of the center of the Kuroshio is discussed. Also discussed are dynamic height anomaly and semidiurnal to several days of fluctuations.
KEY current, seawater, offshore

- 288 AUTH Noakes, J.E.; Kim, S.M.; Supernaw, I.R.
DATE 1967
TITL Uranium content of Gulf of Mexico seawater.
CITA Transactions American Geophysical Union Vol. 48(1),
March 1967: p. 237.
COUN USA
AREA Gulf of Mexico
ABST The uranium content of Gulf of Mexico seawater collected
by 31 hydrographic stations between 1965 and 1966 was
measured. Uranium measurements were made by
radiochemical techniques and α spectroscopy. Total
uranium content for surface water samples was found to
range between 3 and 4 micro g/l for coastal and shelf
water, and between 2 and 3 micro g/l for open seawater.
Vertical profiling showed uranium distribution to be
almost uniform with depth. Measurement of the amount of
soluble and particulate organic linked uranium was made
for a limited number of water samples. U-234/U-238
activity ratios for coastal and open seawater samples
were measured and compared.
KEY uranium, seawater, gulf of mexico
- 289 AUTH Noddack, I.; Noddack, W.
DATE 1939
TITL Schwermetalle in meeres tieren.
CITA Arkiv For Zoologi 32A 4: pp 32 & 33 only (1939)(German).
COUN Germany
ABST This is a study on heavy metals in marine organisms.
KEY vanadium, marine organisms, trace metals
- 290 AUTH Nowlin, W.D.Jr.; Hubertz, J.M.
DATE 1972
TITL Contrasting summer circulation patterns for the Eastern
Gulf.
CITA Contributions on the Physical Oceanography of the Gulf
of Mexico, Vol. 2, ed. by Capurro and Reid, Texas A&M
University, Oceanographic Studies, p.119 (1972)
COUN USA
AREA Gulf of Mexico
ABST The results of two oceanographic surveys of the eastern
Gulf of Mexico illustrate two contrasting summer
circulation patterns of the area and provide the first
detailed description of an anticyclonic ring detached
from the Loop Current. The transport in the upper 1350
m of the principal ring, as well as the Loop in 1966 and
1967, is at least $30 \times 10^6 \text{ m}^3/\text{sec}$.
KEY current, temperature, salinity, offshore, seawater, gulf
of mexico
- 291 AUTH Nowlin, W.D.Jr.
DATE 1971
TITL Water masses and general circulation of the Gulf of
Mexico.
CITA Oceanology International—February 1971
COUN USA

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AREA Gulf of Mexico

ABST This article examines water masses and circulation within the Gulf of Mexico. Firstly, it is possible to distinguish and identify the likely origins of vertically layered waters within the Gulf. Secondly, interpretation of results from surveys predating 1962 and of my surveys since shows a general circulation pattern consisting of a clockwise Loop Current flowing from the Yucatan to the Florida Strait in the eastern Gulf, but no strong, semi-permanent currents in the western Gulf. Finally, indications of the degree of variability of these circulation patterns come from recent cruises.

KEY temperature, salinity, current, seawater, offshore, gulf of mexico

292 AUTH Nowlin, W.D. Jr.

TITL Winter circulation patterns and property distributions.

CITA Contributions on the Physical Oceanography of the Gulf of Mexico, Vol. 2, ed. by Capurro and Reid, Texas A.&M. University, Oceanographic Studies. p.3

COUN USA

AREA Louisiana, Texas, Gulf of Mexico

ABST Based on their characteristic properties, the water masses of the Gulf of Mexico and their vertical stratification are discussed. The T-S relationships specific to the region are presented. For the basin waters, below a sill depth of about 2000 m, the potential temperature, salinity, and dissolved-oxygen concentrations show no measurable horizontal variation, although weak vertical density gradients evidence slight positive stability. For the winter season, the property distributions in the mixed surface layers are described. The general winter circulation patterns within the Gulf are examined. The mode most often observed in the eastern Gulf is one dominated by the Loop Current; water enters through Yucatan Strait as the Yucatan Current and flows in a clockwise loop which extends well into the Gulf and exits via Florida Strait. The extent of penetration and location of this loop is quite variable. The winter circulation in the western Gulf seems more predictable; it consists primarily of a clockwise cell centered over the western central Gulf, having broad westward flow for its southern limb, a narrow east northeastward flow for its northern limb and flanked to the north by a west-southwestward current along the outer Texas-Louisiana shelf.

KEY current, temperature, salinity, chemistry, seawater, offshore, gulf of mexico

293 AUTH Nowlin, W.D. Jr.; McLellan, H.J.

DATE 1967

TITL A characterization of the Gulf of Mexico waters in

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- winter.
CITA Journal of Marine Research 25(1): 20-59 (1967).
COUN USA
AREA Gulf of Mexico
ABST The results of a rapid survey of the Gulf of Mexico in the winter of 1962 are presented. Variations in the characteristics of the water in several core layers are described. Circulation has been examined on the basis of dynamic computations and G.E.K. measurements. In the eastern Gulf, water enters through Yucatan Strait and leaves through Florida Strait, flowing in an anticyclonic loop that extends well into the Gulf. In the western Gulf, circulation is anticyclonic around an elongated cell oriented NE-SW over the Gulf Basin.
KEY current, temperature, salinity, offshore, gulf of mexico, seawater
- 294 AUTH NTIS
DATE 1978
TITL Marine fouling - a literature search.
CITA NTIS/ps-78/0740 (1978).
COUN USA
ABST Fouling of ships, docks, and underwater structures by marine organisms is reviewed in these Federally-funded research reports. Remedial treatments and coatings are investigated. Barnacle cements are analyzed. (This updated bibliography contains 255 abstracts, 38 of which are new entries to the previous edition.)
KEY seawater, fouling, marine organisms
- 295 AUTH Ogata, N.
DATE 1968
TITL Extraction of uranium from seawater. I. Coprecipitation of uranium in seawater with metal hydroxides.
CITA Nippon Genshiryoku Gakkaishi 10(12): 672-678 (1968).
COUN Japan
ABST With the view to studying the possibility of separating uranium from seawater by coprecipitation, the carrier properties of ferric, aluminum, and titanium hydroxides were examined, with the following results: (1) The values of pH at which uranium started to coprecipitate with the carriers were 8 to 9 for aluminum and ferric hydroxides, and 4.5 for ferric hydroxide, 5.0 for aluminum hydroxide, and 2.8 for titanium hydroxide. (2) Optimum pH values for decarbonated seawater to obtain maximum recovery of uranium were 4.5 to 9 for titanium hydroxide with natural seawater; the values were appreciably lower for ferric and aluminum hydroxides; but unchanged for titanium hydroxide. (3) In the case of ferric and aluminum hydroxides, the coprecipitation ratios of uranium were much smaller in natural than in decarbonated seawater. With titanium hydroxide, however, uranium coprecipitated with equal ease in natural seawater and decarbonated seawater. (4) Uranium was effectively separated from the carriers by carbonate salt extraction but not by acid extraction.

- 296 AUTH Ogata, N.
DATE 1978
TITL The industrial feasibility of extracting uranium from seawater.
CITA Nuclear Engineering (Japan) 24(1): 27-31 (1978).
COUN Japan
ABST This is a review of the situation in which Japan expects to find itself with regard to the availability of uranium by the year 1990. The steps taken to develop a seawater extraction scheme in Japan and in various countries are briefly described. A brief review of the various facets of chemical and biological extraction is also presented.
KEY uranium, seawater, extraction, adsorption, marine organisms, pumped system, tidal system, titanium, plant design, plant productivity, economics, current
- 297 AUTH Ogata, N.
DATE 1970
TITL Recovery of uranium from sea water.
CITA Genshiryoku Kyoyo 16(12), 19-22 (1970). (Japanese).
COUN Japan
ABST The status of investigation of uranium recovery from seawater is reviewed. Recent values of uranium content in seawater are from 0.0030 to 0.0035 ppm, and the total amount of uranium in the world's seawater is estimated as 4,500 million tons. English investigators recently obtained 550 μ g of uranium per 1g of titanium, using titanitic acid adsorbent. Inoue and Kakihana reported 1550 μ g of adsorbed uranium per 1g of titanium, using titanitic acid by a thermal dissociation process. This method is explained together with the method that uses titanitic acid prepared from a neutralization process. Factors that have great effects on the adsorption of uranium in seawater, such as temperature and amount of contacting seawater, are discussed.
KEY uranium, seawater, temperature, concentration, adsorbent, titanium, capacity, extraction
- 298 AUTH Ogata, N.
DATE 1971
TITL Collection of uranium in sea-water. VI. Adsorption of uranium in sea-water with titanitic acid.
CITA Nippon Genshiryoku Gakkaishi 13(3): 121-127 (1971). (Japanese).
COUN Japan
ABST The adsorbing capacity for uranium shown by titanitic acid prepared in homogeneous and acidic solution was found larger than titanitic acid prepared in nonhomogeneous and neutral solution. The uranium adsorbed on titanitic acid increased with rising temperature of seawater. The adsorption reached equilibrium within 2 days. The

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concentration of uranium in the titanitic acid was found experimentally to have a maximum value of $U/Ti=1,500 \mu g/g$. The concentration of uranium adsorbed on the titanitic acid at a given temperature was determined by the amount of seawater and the concentration of uranium in seawater on the same titanitic acid. An empirical formula was obtained for this relationship; the adsorption was applied to Freundlich's isotherm, and the distribution coefficients were found nearly constant within the range of seawater volume covered by the present experiment. The adsorption capacity was estimated from the term of multiplication of the distribution coefficient and the concentration of uranium in seawater. The maximum value evaluated was $U/Ti=4,200 \mu g/g$, with the titanitic acid prepared by hydrolysis. The uranium adsorbed on the titanitic acid increased with rising temperature of the seawater, the empirical relationship being $c=k \exp(\alpha t^2)$, (c : concn. of U., t : temp., k and α : const.).

KEY capacity, uranium, concentration, temperature, titanium, chemistry, adsorbent

- 299 AUTH Ogata, N.
 DATE 1971
 TITL Fundamental study on the recovery of uranium in seawater.
 CITA Nippon Kaisui Gakkai-Shi 24(121): 197-212 (1971). (Japanese).
 COUN Japan
 ABST Through the course of a fundamental study on the collection of uranium in seawater, an extensive improvement was made in the separating and determining methods of uranium. Various studies were made on the collecting methods of uranium in seawater, the adsorption method with titanitic acid being the most effective. Chemical species of uranium in seawater were researched by the stability constants of such components as Na^+ , K^+ , Ca^{2+} , Mg^{2+} , Cl^- , SO_4^{2-} , F^- , PO_4^{3-} , HPO_4^{2-} , CO_3^{2-} , OH^- , and UO_2^{2+} . As consequence, most of the dissolved uranium species were found to be $UO_2(CO_3)_3^{4-}$. The adsorption mechanism of uranyl carbonate complex ion on titanitic acid was presumed an anion exchange reaction. The adsorption of uranium was governed by the kind of titanitic acid, the temperature of seawater, the contacted volume of seawater, and the concentration of uranium in seawater.
- KEY uranium, seawater, chemical species, temperature, concentration, extraction, adsorbent, titanium, ion exchange, trace metals

- 300 AUTH Ogata, N.
DATE 1971
TITL Collection of uranium in sea-water. VII. Desorption of uranium adsorbed on titanitic acid.
CITA Nippon Genshiryoku Gakkaishi 13(5): 253-259 (1971). (Japanese).
COUN Japan
ABST A basic study was carried out on the desorption of uranium adsorbed on titanitic acid, using alternatively, a mixed solution of $(\text{NH}_4)_2\text{CO}_3$ and NH_4OH , a mixed solution of Na_2CO_3 and NaHCO_3 , dilute H_2SO_4 , or dilute HCl . The titanitic acid used was prepared by homogeneous precipitation, in which urea was added to $\text{Ti}(\text{SO}_4)_2$ solution and then the solution was heated to produce titanitic acid precipitate. Uranium was adsorbed by dipping the titanitic acid in natural seawater. In the case of uranium desorption with carbonate solution, there was little dissolution of the titanitic acid and of impurities in the solution after desorption, but the drawback of this agent is its expensiveness and it is further liable to be gradually consumed upon repeated use. Desorption with acid, which it was believed to have the disadvantage of dissolving titanitic acid in much greater quantity, proved on experiment not to be any worse than with carbonate. The cost of acid, moreover, is lower, and there is little deterioration of the adsorption ability of titanitic acid because of the small amount of impurities remaining in it. It was concluded that desorption with acid could be used in practice with good chances of rivaling the carbonate method. For the desorption, it is recommended to heat above 90°C the titanitic acid carrying the uranium in HCl (0.5N) or in a mixed solution of $\text{Na}_2\text{CO}_3/\text{NaHCO}_3$ (8/2 to 0/10) containing over 6% CO_3^{2-} .
KEY uranium, seawater, titanium, adsorbent, elution, temperature, economics
- 301 AUTH Ogata, N.
DATE 1974
TITL Production of uranium from sea water.
CITA Genshiryoku Kogyo 20(12): 51-56 (1974). (Japanese).
COUN Japan
ABST A review with 15 refs. is given on the engineering problems assocd. with large-scale extn. of U from sea water by adsorption methods, with emphasis on the method utilizing the natural movement of sea water, such as tides and current.
KEY uranium, seawater, tide, current, extraction, economics, adsorbent, plant design

- 302 AUTH Ogata,N.
DATE 1976
TITL Extaction of uranium from sea water: current statuses of researches and considerations for the future.
CITA Bulletin of the Society of Seawater Science 30: 1, 3-13 (1976).
COUN Japan
ABST A brief review is presented of research and industrial developments involving any process for uranium extraction from seawater. Short descriptions of governmental policies are presented for several western nations as well as a brief examination of the current research status in these countries. The work and policies of West Germany, England, France, U.S.A. and two communist block countries are summarized and the entire scope of Japanese research is outlined. A brief review of the various facets of chemical extraction is also presented.
KEY uranium, extraction, seawater
- 303 AUTH Ogata,N.
DATE 1977
TITL Extraction of uranium from sea water (II).
CITA Bulletin of the Society of Seawater Science 31: 3, 97-109 (1977).
COUN Japan
ABST This is a review of the situation Japan expects to find itself in regards to a source of uranium and of steps taken to develop a seawater extraction scheme. The situations in various countries are outlined with brief discussions of specific methods under development around the world. Aspects such as adsorption, desorption, seawater mobilization, plant situation and plant cost are summarized and some effort is made to estimate a few parameters. .
KEY uranium, seawater, extraction, adsorption
- 304 AUTH Ogata,N.; Inoue,N.
DATE 1970
TITL Separation and determination of uranium in sea water.
CITA Nippon Kaisui Gakkaishi 23: 148-153 (1970). (Japanese).
COUN Japan
AREA Odawara Coast
ABST A study was made to improve the separation method and fluorophotometric method for the determination of U in seawater without using the isotope dilution method. Uranium in the sample was adsorbed into titanitic acid which was prepared by a homogeneous precipitation method using urea. The uranium adsorbed into titanitic acid was extracted with mixture of sodium carbonate and sodium hydrogen carbonate at 100°C. The extracted solution was passed through an anion exchange resin of carbonate type, and the U adsorbed into the resin was eluted with HCl solution. The recovery of U by this method represented 90%, which was higher than the conventional methods but was still incomplete.

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Therefore, the condition of adsorption must be kept stable to obtain the recovery with small variation, and the determined value was corrected with the recovery. A given amount of this pretreated solution was pipetted into a Pt dish, dried, and melted at 665°C with carbonate - sodium fluoride flux, and the fluorescence strength of the dish was measured. The error caused by the variation of melting condition could be decreased by using a furnace with a fan and correction by simultaneous operation with the U standard solution. The unevenness of the fluorescence strength in the dish could be decreased by using the temporary standard and rotating the fused dish during the measurement, and the measuring error was below 2%. Uranium content in seawater collected along the coast of Odawara showed 3.34 μ g/l by this method.

KEY uranium, seawater, analysis, adsorbent, titanium, elution, temperature, ion exchange, chemistry, concentration

- 305 AUTH Ogata,N.; Kakihana,H.
DATE 1969
TITL Extraction of uranium from sea water. II. Adsorbents for extraction of uranium from sea water.
CITA Nippon Kaisui Gakkai-Shi 11(2): 82-87 (1969).
(Japanese).
COUN Japan
ABST About fifty insoluble compounds of titanium, aluminum, magnesium, calcium, silicon, zinc, chromium, lead and tin were examined in search for suitable adsorbents of uranium in sea water. The only materials that exhibited an effective uptake were titanium hydroxide, lead sulfide and chromium hydroxide, the uptake capacities of which were 196, 134 and 68 μ g/g respectively. While their uptake capacity was small, manganese dioxide, zinc hydroxide and lead hydroxide also adsorbed uranium in the pH range of sea water. Ferric hydroxide, ferrous sulfide, ferric phosphate, tin sulfide, titanium hydroxide and manganese oxide were found to be good adsorbents in acidified sea water, though acidification of sea water would not be practical in industrial scale operations. Tannic acid salts of manganese, calcium and titanium adsorbed uranium in sea water, but had the drawback of relatively large solubility.
KEY adsorbent, uranium, seawater, chemistry, temperature, analysis, titanium, concentration
- 306 AUTH Ogata,N.; Inoue,N.; Kakihana,H.
DATE 1970
TITL Adsorption of uranium in artificial sea water with titanate acid.

- CITA Bulletin of the Societies of Seawater Science, Japan, 68-72 (Japan)
COUN Japan
ABST The authors carried out a study on the adsorption of uranium in sea water using titanitic acid as an adsorbent. The results indicated that the amount of uranium adsorption was effected by conditions of titanitic acid preparation such as homogeneity and acidity. The study also found increased uranium absorption with increased temperature and uranium concentration; decreased absorption with increased salinity and co-existence of phosphate, fluoride and copper; and greater absorption (by 20%) in artificial seawater than that in natural seawater.
KEY uranium, titanium, adsorbent, adsorption, capacity
- 307 AUTH Ogata, N.; Inoue, N.; Kakihana, H.
DATE 1971
TITL Collection of uranium in sea-water. X. Chemical state of uranium dissolved in sea-water and adsorption mechanism of titanitic acid.
CITA Nippon Genshiryoku Gakkaishi 13(10): 560-565 (1971). (Japanese).
COUN Japan
ABST The chemical state of uranium in seawater was sought from stability constants. It was estimated that uranium in seawater existed as U(VI) and that the distribution of the chemical species in standard seawater was: $\text{UO}_2(\text{CO}_3)_3^{4-}$ 97.9%, $\text{UO}_2(\text{OH})_3^-$ 1.73%, and $\text{UO}_2(\text{CO}_3)_2^{2-}$ 0.4%. The cation-exchange ability of titanitic acid was demonstrated from the fact that the pH value of NaCl solution shifted toward the acidic side by the addition of titanitic acid. But, despite this cation-exchange ability, it is thought that the form in which titanitic acid adsorbed uranium is probably $\text{UO}_2(\text{CO}_3)_3^{4-}$, because it was found to adsorb HCO_3^- in quantities proportional to uranium. From the results of the present and previous studies, it is presumed that uranium is adsorbed by the coordinate bond.
KEY uranium, chemical species, chemistry, ion exchange, absorption
- 308 AUTH Ohnishi, K.; Hori, Y.; Tomari, Y.
DATE 1977
TITL Rapid spectrophotometric determination of trace amounts of uranium in sea water.
CITA Bunseki Kagaku 26(1): 74-77 (1977). (Japanese).
COUN Japan
ABST Published in summary form only.
KEY uranium, seawater, analysis, concentration, chemistry
- 309 AUTH Omura, A.
DATE 1977
TITL On the apparent distribution coefficient of uranyl between sea water and skeletal calcium carbonates.
CITA Sci. Rep. Kanazawa Univ. 22(1): 106-116 (1977).

COUN Japan
 AREA Malay Peninsula, Ryukyu Islands
 ABST Some hermatypic corals, molluscs, and their inhabiting sea water were collected from the tropical (Malay Peninsula) and subtropical (Ryukyu Islands) localities, and the $M_{UO_2^{2+}}/M_{Ca^{2+}}$ of them were determined in order to evaluate the apparent distribution coefficient of uranyl between biogenic carbonate and seawater, which can be an aid to understand the factors controlling uranium concentration in skeletal calcium carbonates. The result suggests that the compositional factor such as mineral phases and organic matrices and the physiological factor such as chemistry of the body fluid and extrapallial fluid become major causes to control uranium concentration in skeletal carbonates. Moreover, a little difference in distribution coefficient of uranyl in coralline aragonite between Malay Peninsula and Ryukyu Islands may be attributed to the difference in water temperature. The difference in uranium concentration between two shell layers of an individual specimen of Tridacnid may be interpreted as the result of a subtle control over physiological process during shell formation, rather than compositional and environmental causes.

KEY seawater, uranium, concentration, chemistry, temperature

310 AUTH Ouchi, S.; Ogawa, I.; Masuda, S.; Kurabayashi, M.
 DATE 1970
 TITL Uranium contamination of the Shinkawa River.
 CITA Tokai Jigyosho, Doryoku-do, Kaku-nenryo Kaihatsu Jigyo-dan, Report N831-70-02: 91-98 (1970).
 COUN Japan
 AREA Shinkawa River
 ABST A ten year (1959-69) discharge of low-level liq. wastes, contg. $(1-2) \times 10^{-7}$ $\mu\text{Ci U/cm}^3$ caused <100 fold increase in the background radioactivity of the Shinkawa River muds; over 90% of all the U activity was adsorbed on <1 mm mud particles. Using fluorometric anals. Carassius auratus (goldfish), cambaroides clarkii (crayfish), and reed in Shinkawa showed U concns. of 2×10^{-3} , $(7 \text{ and } 8) \times 10^{-2}$ in the middle and downstream, and $(4, 5, 12) \times 10^{-2}$ $\mu\text{g/g wet wt.}$ upstream, in the middle, and downstream, resp.
 KEY uranium, environmental impact, analysis, concentration, river

311 AUTH Pakholkov, V.S.
 DATE 1967
 TITL The problem of the uranium sorption mechanism on anion-exchange resins from uranyl fluoride solutions.
 CITA Coprecipitation and Adsorption of Radioactive Elements, Akademiia Nauk USSR, Trans. from Russian by Israel Program for Sci. Trans., Ltd. p. 183-187.
 COUN USSR
 ABST From determinations of the molar ratio of the amount of

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chlorine displaced from the anion-exchange resin to the amount of uranium sorbed on it, and the molar ratios $F^-:UO_2^{2+}$ in the resin and filtrate, it was established that uranium is sorbed from stoichiometrically neutral uranyl fluoride solutions in the form of monovalent complex anions, $UO_2F_3^-$. At a certain stage of the sorption process, when the uranium concentration in the resin phase is high, the sorbed ions become complex as a result of hydrolysis and subsequent complex formation. The low degree of dissociation of UO_2F_2 in aqueous solutions and the breakthrough of uranium into the filtrate in the form of the most stable complex ions UO_2F^+ confirm the validity of the sorption mechanism derived from an analysis of the effluent curves. The neutral uranyl fluoride molecules attach themselves to the fluoride ions in the resin to form complex anions.

KEY ion exchange, uranium, adsorption, concentration, analysis, filtration, chemistry, capacity

- 312 AUTH Pakholkov, V.S.
 DATE 1967
 TITL The sorption of uranium (VI) from HCl-HF solutions on anion exchange resins
 CITA In: Coprecipitation and Adsorption of Radioactive Elements, Akademiia Nauk, USSR. Trans. from Russian by Israel Program in Sci. Trans., Ltd. 203-209.
 COUN USSR
 ABST The sorption of uranium (VI) from HCl-HF solutions on the AV-17, AV-16G, EDE-10P, and AN-2f anion-exchange resins was studied under dynamic conditions. It was found that the addition of hydrofluoric acid to uranyl solutions in HCl causes a sharp increase in the sorbability of uranium, which is due to the appearance of $UO_2F_3^-$ complex monovalent ions in the solutions. These anions are readily sorbed on the anion-exchange resins. It was found that uranium is not eluted from the anion-exchange resins by dilute HCl containing HF. Nitric acid and acidified ammonium nitrate solutions, however, readily eluted the sorbed uranium. The anion-exchange resins studied can be arranged in the following order according to their regeneration capacity: AV-17>AV-16G>EDE-10P>AN-2f.
- KEY adsorption, uranium, adsorbent, ion exchange, elution, analysis, concentration, capacity, chemistry
- 313 AUTH Pakholkov, V.S.
 DATE 1967
 TITL The sorption of uranium (VI) on anion exchange resins from H_2SO_4 -HF solutions.
 CITA Coprecipitation and Adsorption of Radioactive elements, Akademiia Nauk USSR, Trans. from Russian by Israel Program for Sci. Trans, Ltd., p. 198-202.
 COUN USSR

(CONT.)

- ABST A study of the sorption of uranium (VI) from H_2SO_4 -HF solutions on the AV-17, EDE-10P and AN-2f anion-exchange resins was carried out under dynamic conditions. It was found that when hydrofluoric acid was added the sorbability of uranium increased to 2-3 times that from pure sulfuric acid. The increase in sorbability with the increase in the HF concentration may be due to the preferential sorption of uranium in the form of complex monovalent fluoride anions, $UO_2F_3^-$.
- KEY adsorbent, uranium, ion exchange, extraction, concentration, analysis, capacity
- 314 AUTH Panfilova, S.G.; Stepanov, V.N.
DATE 1975
TITL Variability of the physico chemical properties of the american region of the Caribbean Ocean.
CITA Dokl Akad. Nauk. SSSR 222(2): 459-61 (1975). (Russian).
COUN USSR
AREA Caribbean Sea
ABST The physical chemical properties in the Caribbean are described.
KEY temperature, salinity, offshore, seawater, caribbean
- 315 AUTH Paquette, R.G.; Bourke, R.H.
DATE 1974
TITL Observations on the coastal current of Arctic Alaska.
CITA Journal of Marine Research 32(2): 195-207 (1974).
COUN USA
AREA Chukchi Sea, Beaufort Sea, Bering Sea, Point Barrow
ABST This paper describes characteristics of the warm coastal current in the vicinity of the ice margin in the Chukchi and Beaufort seas. The warm current originates in Bering Strait and is traced around Pt. Barrow to longitude 152° W in the Beaufort Sea. In the Chukchi Sea it is concentrated near the surface, overlying dense relict bottom water trapped by the shallow depths. Eastward, as the bottom deepens, the warm water descends to mid-depth, eventually becoming warmest near bottom in depths of 30 to 50 m. Mechanisms for cooling and dilution of the warm water are discussed.
KEY current, temperature, nearshore, seawater, salinity, climate, river, alaska
- 316 AUTH Pequegnat, J.E.
DATE 1975
TITL Trace metals in phytoplankton from an area of coastal upwelling.
CITA Oregon State University, Corvallis, Or.: 108 pp (1975).
COUN USA
AREA Oregon coast
ABST This is a study of the surface distribution of phytoplankton associated trace metals (Fe, Mn, Cu, Cr, Co, Ni, Zn) in the waters of an area of coastal upwelling. The distributions are correlated to local

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- hydrography.
KEY trace metals, marine organisms
- 317 AUTH Pytkowicz, R.M.; Atlas, E.; Culberson, C.H.
DATE 1975
TITL Chemical equilibrium in seawater.
CITA Marine Chemistry in the Coastal Environment, ed. by Thomas M. Church, A.C.S. Symposium Series, No. 18.
COUN USA
ABST Concurrent chemical, biological and geological processes, in addition to the presence of the gravitational potential and of temperature and pressure gradients must be taken into consideration in the study of chemical equilibria in the oceans. A simplifying feature occurs because the approximately constant ratios of the concentrations of the major ions mean that seawater is an ionic medium of relatively constant composition. Estuarine waters differ from normal seawater because of the time and spacial variations in composition due to the input of river water. The equilibrium chemistry of estuarine waters has not been studied to any significant extent but it will be shown that equilibrium data for open ocean waters are often applicable to estuaries.
KEY chemistry, biological productivity, temperature, seawater, concentration, estuary, river marine organisms
- 318 AUTH Reed, R.K.; Halpern, D.
DATE 1976
TITL Observations of the California Undercurrent off Washington and Vancouver Island.
CITA Limnology and Oceanography 21(3): 389-398 (1976).
COUN USA
AREA Washington, Vancouver Island
ABST the presence of semidiurnal internal tidal waves seaward of the continental shelf. The resulting disturbances to the geopotential anomalies, however, had little effect on the derived patterns of geostrophic flow. During this survey, the surface flow relative to 1,000 db was generally southward, but a northward flow was present at intermediate depths along the continental slope. This northward flow appears to be an extension of the California Undercurrent, which remains an identifiable feature to at least 49° N but weakens along its path by mixing with adjacent water.
KEY current, offshore, seawater, temperature, salinity, pacific northwest
- 319 AUTH Reid, J.L. Jr.
DATE 1965
TITL Intermediate waters of the Pacific Ocean.
CITA Johns Hopkins Press: Baltimore, 85 p. (1965).
COUN USA

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- AREA Pacific Ocean
ABST The characteristics and spread of the Pacific Intermediate water is investigated. This water is characterized by a low salinity signal at low and mid latitudes. Both of the polar regions contribute intermediate waters.
KEY offshore, seawater, temperature, salinity, current, nutrients, chemistry
- 320 AUTH Richard, C.F.; Gustafson, R.L.; Martell, A.E.
DATE 1959
TITL Stability of metal chelates of 8-quinolinol-5-sulfonate.
CITA J. American Chemical Society 81(2): 1033-1040 (1959).
ABST The interaction of Mn(II), Co(II), Ni(II), Cu(II), Zn(II), Mg(II), Fe(III), $UO_2(VI)$, and Th(IV) ions with 8-hydroxy-quinoline-5-sulfonate has been investigated by potentiometric and spectrophotometric methods. Formation constants have been calculated for chelates containing 1:1, 2:1 and in some cases 3:1 and 4:1 ratios of ligand to metal ion. Comparison of these stability constants with those obtained for 8-quinolinol itself shows that the observed differences are essentially the result of the lower basicity of the sulfonated ligand. The hydrolytic behavior of Fe(III), $UO_2(VI)$ and Th(IV) chelates containing two unfilled coordination positions has been investigated quantitatively. The hydrolysis and olation tendencies of the 3:1 thorium and 2:1 uranyl and ferric chelates were found to follow the order $Fe(III) > Th(IV) > UO_2(VI)$.
KEY trace metals, analysis, concentration, chemistry
- 321 AUTH Richards, A.F.
DATE 1976
TITL Extracting energy from the oceans: a review.
CITA Marine Technology Society Journal 10(2): 5-24 (1976).
COUN USA
ABST Renewable energy resources are expected to minimize environmental impact and present none of the security and waste disposal problems associated with nuclear power plants. Eight methods, and a number of variants, of obtaining energy from the oceans are presented: ocean thermal, kelp bioconversion, ocean waves, tides and tidal currents, ocean winds, ocean currents, salinity gradients, and ocean geothermal. Each method is discussed in terms of concepts, geographic areas applicable, and development schedule and costs insofar as information is available. None of these methods produce "excess" heat into the environment, as do fossil-fuel and nuclear-power generating plants. Most of the methods represent relatively new technologies. farming systems, platform systems, plant design, pumped systems, climate, current, seawater, tidal system
KEY

- 322 AUTH Richards, F.A.
 DATE 1958
 TITL Dissolved silicate and related properties of some western North Atlantic and Caribbean waters.
 CITA Journal of Marine Research 17(T.G.Thompson 70th Anniversary): 449-465 (1958).
 COUN USA
 AREA Western North Atlantic, Caribbean
 ABST Dissolved silicate, phosphate, nitrate, and oxygen as well as salinity and temperature were observed in several regions around the Antilles Arc and in the Woods Hole-Bermuda area. It is shown that silicate is generally in low concentration in surface waters, where its ratio to phosphate, nitrate and oxygen consumption is variable.
 KEY biological productivity, chemistry, seawater, offshore, caribbean
- 323 AUTH Riedel, H.J.
 DATE 1970
 TITL Adsorption behavior of uranium dissolved in sea water on synthetic ultramarine.
 CITA Kerntechnik 12(1): 16-19 (1970).
 COUN West Germany
 ABST Uranium dissolved in seawater as the tricarbonat complex is found in the oceans in a concentration of 3.3 $\mu\text{g/l}$, remarkably constant down to depths of at least 400 m. The total reserve is estimated at 4.16 Gt. The suitability of synthetic ultramarine as an ion exchanger for the extraction of this uranium was studied. A capacity for UO_2^{2+} ions of 0.1 mval/g was found. The ion exchange with Na^+ ions freely mobile in the ultramarine lattice follows the law of mass action. The uptake of UO_2^{2+} ions from the tricarbonat was found to be 0.03 mval/g after the pH of the seawater was adjusted to 5.
 KEY uranium, seawater, concentration, extraction, capacity, chemical species, ion exchange, chemistry, adsorbent, titanium, elution
- 324 AUTH Riedel, H.J.
 DATE 1970
 TITL Separation of uranium from sea water.
 CITA Ger. Offen. 1,928,864 (Cl. C 01g), Appl. 06 Jun 1969: 7p (1970).
 COUN West Germany
 ABST U occurring in sea water as tricarbonat complex was sepd. in a UO_2^{2+} ion exchange process with ultramarine blue at $\text{pH} \sim 5$. Thus, 10 g synthetic ultramarine blue of <0.2 mm grain size was added to 100 ml M NaCl and dried at 111° . Sea water (1 l.) enriched to 81.6 mg U content as tricarbonat complex and acidified with HNO_3 to pH 5 was added and stirred 2 hr to adsorb 52.6% of the U. The ultramarine was filtered and mixed with 1 l. M Na_2CO_3 to elute 97 and 99.6% of the adsorbed U after 2 and 4

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hr, resp.

KEY uranium, seawater, ion exchange, adsorbent, chemical species, chemistry, temperature, elution, extraction

325 AUTH Riedel, H.J.

DATE 1973

TITL Method of extracting uranium from sea-water.

CITA U.S. Patent 3,721,533. Priority date 6 Jun 1969: 4p (1973).

COUN West Germany

ABST A method is presented for extracting uranium in the form of tricarbonat complexes of UO_2^{2+} from seawater or other liquids rich in metal ions. The seawater is acidified to a pH of approximately 5 (e.g. with hydrochloric acid or HNO_3), and then is treated with ultramarine blue in an ion-exchange relationship until equilibrium is reached in the distribution of uranium between the ultramarine blue and the seawater. Elution of the uranium is carried out with an alkali carbonate solution.

KEY uranium, seawater, ion-exchange, chemical species, chemistry, extraction, elution

326 AUTH Riedel, H.J.

DATE 1976

TITL Method of obtaining uranium from uranium compounds dissolved in sea water.

CITA German (F.R) patent 1928864/C/. Int. Cl. C01G 43/02: 3p (1976). (German).

COUN West Germany

ABST The patent deals with an ion exchange separation process for uranium compounds dissolved in sea water. The uranium is generally present here as tri-carbonato complex. Synthetic ultramarine blue is used for the exchange of the uranyl ions, which, compared to other ion exchange materials, has the advantage of favourable exchange kinetics and is also cheaper. The loading takes place at pH 5 with a ratio exchanger to seawater of 1:100. Alkali carbonate solution is used for the elution.

KEY ion exchange, uranium, seawater, chemical species, chemistry, elution, extraction

327 AUTH Riley, J.P.; Chester, R.

DATE 1971

TITL Introduction to marine chemistry.

CITA Academic Press Inc.: 465 pp. (1971).

COUN USA

ABST A basic introduction is presented here to chemical oceanography. Chapters are devoted to the physical properties and chemistry of seawater and marine sediments, the physical processes occurring in the oceans and the sediments and to basic biological production in

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- the oceans.
- KEY uranium, concentration, seawater, chemical species, chemistry, biological productivity
- 328 AUTH Riley, J.P.; Taylor, D.
DATE 1972
TITL The concentrations of cadmium, copper, iron, manganese, molybdenum, nickel, vanadium and zinc in part of the tropical north-east Atlantic Ocean.
CITA Deep Sea Research 19(4): 307-317 (1972).
COUN UK
ABST Determinations of cadmium, copper, iron, manganese, molybdenum, nickel, vanadium and zinc have been carried out on water samples from the tropical north-east Atlantic Ocean using a chelating ion-exchange concentration method followed by atomic absorption spectrophotometry, or for molybdenum and vanadium by colorimetry. The results indicate that cadmium, iron, manganese and nickel are relatively uniformly distributed in this area, whereas molybdenum, vanadium, zinc and to some extent copper show larger variations of a random nature.
KEY analysis, trace metals, seawater, n atlantic, ion-exchange, concentration, vanadium
- 329 AUTH Robertson, D.E.; Carpenter, R.
DATE 1974
TITL Neutron activation techniques for the measurement of trace metals in environmental samples.
CITA National Academy of Sciences - National Research Council Report NAS-NS-3114: 84p (1974).
COUN USA
ABST Neutron activation techniques for measuring trace metals in fresh waters, seawater, marine organisms, sediments, and atmospheric particulates are discussed. Principles of neutron activation analysis, neutron irradiation facilities and procedures, and sample preparation including preconcentration and postirradiation separations are outlined.
KEY seawater, trace metals, marine organisms, analysis, water, particulate, sediments, extraction
- 330 AUTH Robertson, D.E.; Young, J.A.; Abel, K.H.; Crecelius, E.A.; Wilkerson, C.L.; Weimer, W.C.; Langford, J.C.; Vaughan, B.E.
DATE 1977
TITL Geochemical ocean sections study (GEOSECS). Chemistry of ocean solutions.
CITA Pacific Northwest Laboratory annual report for 1976 to the ERDA Assistant Administrator for Environment and Safety. Part 2. Ecological sciences. BNWL-2100(Pt.2): 7.10-7.25 (1977).
COUN USA
AREA US Coastlines, Pacific Northwest

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- ABST The GEOTSECS project is a multi-institutional investigation of the geochemistry and mixing dynamics of the oceans. The objective of this study is to utilize the oceans' chemical and radionuclide constituents to characterize the biogeochemical and physiodynamic processes occurring in the oceans. Results are reported from the characterization of a large group of trace elements in the oceans, and the measurement and utilization of cosmic-ray and fallout radionuclides as tracers of aerosol deposition and ocean mixing processes. The radionuclide studies have now been completed and the program has been directed towards measurement of the distributions of trace metals of geochemical and environmental interest in the oceans utilizing the valuable inventory of well documented GEOTSECS samples. The analyses of sea water from open ocean GEOTSECS tracks are being supplemented by trace metal measurements of seawater samples collected on cruises extending from the coastlines of the U.S. to open ocean areas. These data will help define the natural and anthropogenic processes which create concentration gradients between the coastal and open ocean waters. The air-to-sea transfer of airborne trace metals to the coastal marine environment, the chemical species after dissolution, and subsequent chemical reactions which will affect bioavailability were also studied. The validity of $Be-7$ as a tracer for air-sea transfer of trace metals is being investigated presently. The distribution chemical/physical forms of plutonium in the Pacific Northwest coastal waters and sediments is also being studied to predict the future consequences of plutonium inputs to the coastal ecosystem.
- KEY trace metals, seawater, chemical species, analysis, environmental impact, concentration, marine organisms, biological productivity, sediments, pacific northwest, geology

- 331 AUTH Robinson, T.M.; Anders, R.B.
DATE 1973
TITL Electrical analog model study of the alluvial aquifer in the Yabucoa valley, Puerto Rico, phase 2--the planning, construction, and use of the model.
CITA U.S.G.S. with Commonwealth of Puerto Rico and other Agencies.
COUN USA
AREA Puerto Rico
ABST The detailed freshwater sources and characteristics for the Yabucoa valley site are given.
KEY water, geology, climate, river, caribbean
- 332 AUTH Roelofs, E.W.; Bumpus, D.F.
DATE 1953

(CONT.)

- TITL The hydrography of Pamlico Sound.
CITA Bulletin of Marine Science of the Gulf and Caribbean
3(3): 181-205 (1953).
COUN USA
AREA North Caribbean
ABST The horizontal distribution of salinity in Pamlico Sound is influenced by wind and long-term runoff. Vertical salinity gradients are minimal ($<0.7\text{‰}/20$ feet) in the main body of the sound, intermediate ($>12\text{‰}/20$ feet) in the river mouths and maximal ($>14\text{‰}/9$ feet) in the northern part of Core Sound. Water temperature closely follows air temperature with practically no stratification. Currents in the sound resulting from wind friction reach velocities of 69 cm/sec. Currents resulting from runoff are calculated to be of the order of 0.5 cm/sec. Tidal exchange in the inlets amounts to about 220×10^6 cubic meters per tide. This amount, equivalent to 8 times the average river flow, would produce a rise and fall over the whole sound of 5 cm.
KEY estuary, river, tide, temperature, salinity, current, climate, s atlantic
- 333 AUTH Rogers, C.L.
DATE 1977
TITL Geologic map of the Punta Guayane's quadrangle, southeastern Puerto Rico.
CITA U.S.G.S. Miscellaneous Investigation Series, Map I-99 (1977).
COUN USA
AREA Puerto Rico
ABST This is a detailed geologic map.
KEY geology, caribbean
- 334 AUTH Rona, Elizabeth.
DATE 1943
TITL Radioactivity of sea water.
CITA Grant No. 619. Yearbook American Philosophical Society, p 136.
ABST The uranium content of ocean water samples of the Northern Atlantic, taken off George's Bank, were determined, and the method presented. Uranium concentration varied from 0.75 to 1.00 micro grams/liter, and radium concentration varied from .014 pg/liter to .058 pg/liter.
KEY uranium, water, extraction, analysis, concentration.
- 335 AUTH Rona, E.; Urry, W.D.
DATE 1952
TITL Radioactivity of ocean sediments VIII. Radium and uranium content of ocean and river waters.
CITA American Journal of Science 250: 241-262 (1952).
COUN USA
ABST Some new determinations of the radium and uranium

(CONT.)

content of ocean and river waters are reported here and it appears possible to draw some tentative general conclusions concerning the distribution of the radioelements of the uranium-238 series in the hydrosphere from these measurements and the few reliable determinations reported in the literature. Open ocean waters contain only about 16 per cent of the amount of radium that would be in radioactive equilibrium with the uranium content. Ocean waters lack also the ionium content required for equilibrium with the uranium content. A few measurements of the radium and uranium contents of river waters show that the departures from radioactive equilibrium are in the opposite direction from similar departures in ocean waters.

KEY seawater, river, uranium, trace metals, concentration, analysis, sediments

336 AUTH Rona, E.; Joensuu, O.
DATE 1974
TITL Uranium geochemistry in Black Sea.
CITA O. American Association Petroleum Geological Mem. 20: 570-572 (1974).
COUN USA
AREA Black Sea
ABST Three deep-basin cores from the Black Sea taken along a 400-km profile, have been analyzed for uranium and thorium isotopes and some major and minor elements. Three distinct sedimentary units can be recognized in all cores, and the uranium concentrations and isotopic compositions can be correlated with the sedimentary history of these units.

KEY sediments, uranium, trace metals, concentration, analysis, salinity, organics, marine organisms

337 AUTH Rosenbaum, J.B.
DATE 1976
TITL Minerals extraction and processing: new developments.
CITA Science 191 (4228): 723 (1976).
COUN USA
ABST In southern Texas, loosely consolidated uranium bearing sand stone occurs at depths of 300 to 700 feet. Development of a successful in-place leaching technique could mean low capital and operating costs, minimum land-surface disruption and avoidance of disposal or storage of mill tailings. The clue to in-place leaching of the Texas uranium deposits without excessive reagent use and without plugging the ore formation appears in the use of extremely dilute alkaline leach solution with a low uranium-loading and a high circulation rate. For meeting the uranium requirements of nuclear power generation, 125 tons of U_3O_8 is roughly equivalent to the annual requirement of a 500-mega watt reactor.

KEY uranium, environmental impact, extraction, ion exchange,

(CONT.)

concentration, plant design, plant productivity

- 338 AUTH Rosenbaum, J.B.
DATE 1976
TITL Outlook for uranium demand and production capacity.
CITA Uranium Ore Processing, Proceedings of an Advisory Group Meeting, Wash. D.C., 24-26 Nov. 1975, IAEA, Vienna 1976, pp.3-9.
COUN USA
AREA Texas
ABST Despite appreciable errors in recent forecasts of nuclear power growth rate, the amended estimates still show the required amount of uranium raw material for 1985 to be three to four times larger than the world's existing uranium production capacity, both operating and on standby. By expanding the existing production units and adding new units based on known ore reserves, the uranium demands of 1980 might be met. The number of production units in the world (except by China, the Soviet Union and the Eastern European countries) might increase from the current 45 to about 70. Substantial additional capacity based mostly on newly discovered ore resources would be necessary to meet the uranium demands of 1985.
KEY uranium, economics, plant productivity, environmental impact
- 339 AUTH Rosenberg, D.H., ed.
DATE 1972
TITL A review of the oceanography and renewable resources of the northern Gulf of Alaska.
CITA Institute of Marine Science, University of Alaska, Fairbanks, Alaska, IMS Rpt. R72-23 Sea Grant Rpt. 73-3, February 1972.
COUN USA
AREA Alaska
ABST This publication is a collection of papers treating many oceanographic conditions in the Gulf of Alaska and nearshore waters. Biological, chemical, physical and geological oceanography is considered.
KEY biological productivity, climate, chemistry, current, geology, marine organisms, nearshore, offshore, seawater, temperature, salinity, gulf of Alaska
- 340 AUTH Rosholt, J.N.
DATE 1963
TITL Uranium in sediments.
CITA Thesis, University of Miami, January 1963.
COUN USA
ABST An oceanographic approach is used to study the distribution of abnormal occurrences of uranium in sediments. These occurrences predominate in marine phosphorites, black marine shales, and deposits in

(CONT.)

terrestrial-fluvial sandstones and ancient conglomerates. In early Paleozoic times, marine shales accounted for the majority of uranium deposition. By the beginning of Tertiary time, the balance had shifted to predominant deposition in marine phosphorites which continued to the present. Much smaller total quantities of uranium are associated with terrestrial sandstones and ancient conglomerates, although its concentration is greater and its economic recovery is more feasible. All the abnormal occurrences fit into their unique niche in the hydrologic cycle, and their emplacement was largely controlled by cycles of organic substances in water. Radiochemical data on the abundance of Pa-231 and Th-230 in comparison to uranium, in terrestrial sandstone type deposits of controversial origin, indicate that much of the uranium in terrestrial sediments is presently in a slow, continual state of migration toward the ocean.

KEY uranium, sediments

- 341 AUTH Ross, C.K.; Mann, C.R.
DATE 1971
TITL Oceanographic observations in the Jungfern Passage and over the sill into the Venezuela Basin, February 1968.
CITA Symposium on Investigations and Resources of the Caribbean Sea and Adjacent Regions, Organized Jointly by UNESCO and FAO, Willemstad, Curacao, Netherlands, Antilles, 18-26 November, 1968 (1971).
COUN USA
AREA Caribbean
ABST The current and water mass structure is investigated for the region between the Virgin Islands and Puerto Rico. Deep water movement into the Caribbean ocean is discussed.
KEY current, temperature, salinity, nutrients, caribbean, seawater, offshore
- 342 AUTH Rotschi, H.
DATE 1970
TITL Variations of equatorial currents.
CITA Scientific Exploration of the South Pacific, Proceedings of Symposium during Ninth General Meeting of Scientific Committee of Oceanographic Research, June 18-20, 1968, ed. by Warren S. Wooster, Scripps Institute of Oceanography, La Jolla, National Academy of Sciences, Washington D.C., p.75-83 (1970).
COUN New Caledonia
AREA Equatorial Pacific
ABST From October 1965 to May 1968 the research vessel CORIOLIS of the Centre O.R.S.T.O.M. of Noumea, New Caledonia, made 10 cruises along 170°E, from 20°S to 4°N. On seven of these cruises, direct measurements were made of the equatorial current system. Some of the most

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significant preliminary results of these cruises are presented in this paper.

KEY current, seawater, offshore

- 343 AUTH Rowe, G.T.; Menzies, R.J.
DATE 1968
TITL Deep bottom currents off the coast of North Carolina.
CITA Deep-Sea Research 15: 711-719 (1968).
COUN USA
AREA North Carolina
ABST The direction of bottom currents and their extent from the seaward margin of the continental shelf (300 m) to the Hatteras Abyssal Plain (5335 m) off North Carolina have been determined on the basis of 150 multishot bottom camera lowerings representing approximately 3000 compass-oriented photographs and correlated with hydrographic and other observations. There are three major currents on the deep-sea floor: the Gulf Stream with a marked seasonal variation in location, the Western Boundary Undercurrent which may split into sections, and one derived from Antarctic Bottom Water.
KEY current, offshore, seawater, geology, salinity, temperature, mid atlantic, s atlantic
- 344 AUTH Ryabochikov, D.I.; Seniavin, M.M.
DATE 1955
TITL Chromatographic determination of uranium in various materials.
CITA Proc. UN Intern. Conf. Peaceful Uses At. Energy (Geneva) 8: 278-284 (1955).
COUN USSR
ABST The methods of preliminary isolation of pure uranium are very important (equally to selective methods of direct determination) for the quantitative analysis of materials, containing uranium. This report is devoted to the application of ion exchange and distribution chromatography for isolating uranium from various solutions.
KEY extraction, uranium, adsorbent, trace metals, ion exchange, chemistry, capacity, elution, water, analysis
- 345 AUTH Rydell, H.; Kraemer, T.; Bostrom, K.; Joensuu, O.
DATE 1974
TITL Postdepositional injections of uranium-rich solutions into East Pacific rise sediments.
CITA Marine Geology 17: 151-164 (1974)
ABST An 8.5m long core has been taken from calcareous sediments on the crest of the East Pacific rise. It has an average uranium content of 44.8 ppm and at one point a high value of 150 ppm. Anomalous Th values lead to the supposition that a postdepositional injection of uranium rich solutions took place 90,000-110,000 years ago.

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KEY uranium, concentration, sediments

- 346 AUTH Sackett, W.
DATE 1966
TITL Manganese nodules: thorium-230: protactinium-231 ratios.
CITA Science 154: 646-647 (1966).
COUN USA
ABST The Th-230:Pa-231 activity ratio in 7 of 11 manganese nodules is less than 10.8, the theoretical production ratio of activities in the ocean. This finding indicates differential accumulation of these nuclides in authigenic deposits of manganese-iron oxide.
KEY trace metals, uranium, seawater, analysis, concentration, extraction
- 347 AUTH Sackett, W.M.; Cook, G.
DATE 1969
TITL Uranium geochemistry of the Gulf of Mexico.
CITA Trans. Gulf Coast Association Geol. Studies, 19: 233-238 (1969).
COUN USA
ABST The economic importance, the dissimilarity in chemical behavior of its two oxidation states and the unique usefulness of its radioactive daughter products make uranium and its geochemistry extremely interesting to earth scientists. The Gulf of Mexico (GOM) has the attractive feature of being a semi-closed system that offers the possibility of a complete monitoring of all inputs and removal processes for trace elements such as uranium. Experimental values obtained in this study of the geochemical cycle of uranium in the GOM are as follows: Uranium concentration for GOM profiles of surface to 3600 m was 3.4 to 3.6 pg/ml. In estuaries and bays along the Gulf Coast the concentration was 2.1 to 17.3 pg/ml and 0.6 to 3.0 pg/ml for midwest rivers. High uranium concentrations in midwest U.S.A. rivers relative to other rivers of the world can be explained by solubilization of the uranium in phosphate fertilizers applied to the land surface. Estimated pre-fertilizer uranium input to the GOM is nearly balanced by uranium co-deposition with carbonates on the Yucatan shelf. .
KEY economics, uranium, gulf of mexico, trace metals, concentration, estuary, river, extraction, analysis
- 348 AUTH Sackett, W.M.; Mo, T.; Spalding, R.F.; Exner, M.E.
DATE 1973
TITL A revaluation of the marine geochemistry of uranium.
CITA From symposium on the interaction of radioactive contaminants with the constituents of the marine environment; Seattle, Washington, USA (10 Jul 1972). See STI/PUB-313; CONF-720708-: 757-769 (1973).
COUN USA

(CONT.)

- ABST Approximately 10^{15} $\mu\text{g/yr}$ of dissolved uranium are being removed from the ocean by each of the generally accepted significant sinks for uranium-carbonate deposits and deep anoxic basin sediments. However, these sinks account for only 10% of the estimated present-day input of uranium. Possible explanations for this discrepancy are: contemporary input values are too high owing to a significant contribution from man's effects, such as uranium input via phosphate fertilizers or world-wide cultivation leading to premature leaching of uranium from soils; or there are other important uranium sinks such as the abundant siliceous oozes or continental shelf anoxic sediments.
- KEY uranium, seawater, environmental impact, marine organisms
- 349 AUTH Sakou, T.; Neshyba, S.
DATE 1972
TITL The temporal structure of oceanic motion off the Oregon coast, Northeastern Pacific, 1969.
CITA Journal of Marine Research 30(1): 1-14 (1972).
COUN USA
AREA Oregon, North East Pacific
ABST Current measurements collected from an array of moored buoy stations off the coast of Oregon from April through November 1969 have been used to study the spatial and temporal structure of oceanic currents over the continental slope in the northeastern part of the Pacific.
KEY current, offshore, seawater, pacific northwest
- 350 AUTH Sani, A.R.
DATE 1966
TITL Uranium from seawater.
CITA Nucleus (Lahore) 3(4): 102-104 (1966).
COUN Pakistan
ABST Work done on the use of seawater as a source of uranium is reviewed. Two of the major obstacles are: the uranium is in a strongly complexed form at an extreme dilution in the presence of relatively high concentration of other ions, and any extractant that could be used must be brought into contact with a very large volume of water and must function efficiently at the pH of the seawater. The use of various organic and inorganic absorbants is discussed, specifically titanium hydroxide. The ion-flotation method is also considered. The use of activated charcoal for the recovery of uranium from seawater is currently being investigated.
KEY seawater, uranium, titanium, chemical species, concentration, chemistry, adsorbent, extraction
- 351 AUTH Sarma, T.P.; Krishnamoorthy, T.M.
DATE 1968

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TITL Uranium disequilibrium in Arabian Sea.
CITA Current Science 15: 422-424 (1968).
COUN India
AREA Arabian Sea
ABST The purpose of this work was to investigate the uranium isotope ratio in waters near the west coast of India and to determine whether any difference existed between these values and values found by others for open ocean and coastal waters. The values found were in agreement with other work and suggest that land drainage input into coastal waters is not significant enough to affect isotopic differences between coastal and open ocean waters.
KEY uranium, seawater, water

352 AUTH Schempf, F.J.
DATE 1976
TITL Giant platforms scheduled for deep water, (platform report).
CITA Ocean Industry 11(5): 70-74 (1976).
COUN USA
AREA California
ABST Exxon will install its 945-ft platform in 850-ft water off Santa Barbara soon; Shell will install a 1220-ft platform in 1,000-ft water two years hence.
KEY offshore, platform, system

353 AUTH Schmidt-Mende, P.
DATE 1974
TITL Possibilities of uranium production from North Sea water. .
CITA Meerestech./Mar. Technol. 5(2): 61-63 (1974). (German).
COUN West Germany
AREA German North Sea
ABST Water samples from the areas of the German North Sea coast were analyzed to investigate possibilities of uranium production from the water of these areas. The uranium contents found were: Bay of Heligoland 3.6 μg U/l, river Elbe up to 8.2 μg U/l, river Weser approximately 3.3 μg U/l, and river Ems less than 1 μg U/l. The use of inorganic sorption material for the uranium enrichment appears to have the greatest chances of success. The production from sea water, however, cannot be carried out economically with the means known today.
KEY uranium, river, seawater, concentration, adsorbent, economics, analysis

354 AUTH Schmitz, W.J. Jr.; Richardson, W.S.
DATE 1968
TITL On the transport of the Florida Current.
CITA Deep-Sea Research 15: 679-693 (1968).
COUN USA

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- AREA Gulf of Mexico
 ABST This paper contains results from the first series of transport measurements made with free instrument techniques. The series consists of the equivalent of 50-60 transects across four sections of the current made over a period of about 3 years. Based on averages of our data, and a comparison of these averages with previous data, we submit $32 \pm 3 \times 10^6 \text{ m}^3/\text{sec}$ as the steady-state volume transport of the Florida Current. Monthly or bi-monthly averages lie within this bound and are reproducible. The total fluctuation bound is $\pm 12 \times 10^6 \text{ m}^3/\text{sec}$. We estimate tidal amplitudes of $3.5 \pm 1 \times 10^6 \text{ m}^3/\text{sec}$ for each of M_2 , K_1 , O_1 and $1.5 \pm 1 \times 10^6 \text{ m}^3/\text{sec}$ for S_2 , in excellent agreement with past analysis of potential measurements across the Key West-Havana cable. However, in contrast with some previous investigations, in particular with the past analysis of cable data, there is no evidence in our data for total transport fluctuations at non-tidal periods of amplitudes LARGER than 10% of the mean.
 KEY current, gulf of mexico, seawater
- 355 AUTH Schott, W.
 DATE 1976
 TITL Mineral (inorganic) resources of the oceans and ocean floors: a general review.
 CITA Handb. Strata-Bound Stratiform Ore Deposits 3: 245-294 (1976).
 COUN West Germany
 ABST A review with 206 refs. is presented.
 KEY uranium, sediments
- 356 AUTH Schwartz, F.J.; Chestnut, A.F.
 DATE 1973
 TITL Hydrographic atlas of North Carolina estuarine and sound waters, 1972.
 CITA University of North Carolina Sea Grant Publication, UNC-SG-73-12, 132 p. (1973).
 COUN USA
 AREA North Carolina
 ABST This is a detailed composite of the hydrographic characteristics of the nearshore ocean waters along the North Carolina coast.
 KEY current, temperature, salinity, chemistry, m atlantic, s atlantic, seawater, nearshore
- 357 AUTH Schwochau, K.; Astheimer, L.; Schenk, H.J.; Schmitz, J.
 DATE 1977
 TITL Method for recovering uranium from sea water.
 CITA Ber. Kernforschungsanlage Juelich, Juel-1415: 71p (1977). (German).
 COUN West Germany
 ABST In view of the augmenting uranium demand for energy

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supply and of the anticipated depletion of the actually assured and economic uranium resources the possibility of recovering uranium from sea water receives increasing attention. It is the purpose of the present report to give a detailed discussion of fundamental problems involved and a critical survey of hitherto proposed processes of recovery and to recommend some general directives for further work.

KEY uranium, economics, seawater, extraction

358 AUTH Sekine, K.
DATE 1975
TITL Determination of traces of uranium in sea water after separation by froth flotation.
CITA Mikrochim. Acta 4: 313-319 (1975).
COUN Japan
AREA Pacific Coast
ABST Uranium in sea water is separated by froth flotation of the uranium(VI)-Arsenazo III-Zephiramine ion-adduct and then determined by neutron activation or spectrophotometric method using the uranium(VI)-Arsenazo III complex. Results of the analysis of Pacific coastal samples by the two methods are in good agreement; an average value of $3.0 \mu\text{g U}$ per liter was obtained.

KEY uranium, seawater, analysis, extraction, concentration

359 AUTH Sekine, K.
DATE 1976
TITL Separation and spectrophotometric determination of uranium(VI) by extraction with arsenazo III and zephiramine.
CITA Mikrochim. Acta (5-6): 559-568 (1976).
COUN Japan
ABST Microgram quantities of uranium(VI) can be determined at 655 nm after separation by chloroform extraction of its Arsenazo III complex with Zephiramine. The extracted uranium can be back-extracted with an aqueous solution of ammonium carbonate. Uranium can be separated from aluminium, iron(II), and some other elements. Probably the same species, i.e., the ion association compounds between the uranium(VI)-Arsenazo III complex and Zephiramine are involved during the extraction and the froth flotation.

KEY uranium, extraction, analysis, trace metals

360 AUTH Shokes, R.F.; Trabant, P.K.; Presley, B.J.
DATE 1977
TITL Anoxic, hypersaline basin in the Northern Gulf of Mexico.
CITA Science 196: 1443-1446 (1977).
COUN USA
ABST A 400-square-kilometer depression in the continental slope of the northern Gulf of Mexico (approximately 27°

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N, 91°W) has been found to contain anoxic, hypersaline (~ 250 grams per kilogram) water in the bottom 200 meters. The interface between the brine and overlying seawater acts as a midwater seismic reflector similar to those seen in the Red Sea. The bulk chemical composition of the brine is similar to that from the Red Sea, but differences between the two in both heat content and geomorphological setting indicate different modes of origin.

KEY gulf of mexico, salinity, seawater, geology,

- 361 AUTH Sillen, L.G.; Martell, A.E. Eds.
DATE 1964
TITL Stability constants of metal ion complexes.
CITA The Chemical Society of London, Burlington House: 754 pp. (1964).
ABST This is a compilation of stability constants for metal ion complexes.
KEY chemical species, uranium, trace metals
- 362 AUTH Silvey, W.D.
DATE 1967
TITL Water supply paper.
CITA U.S.G.S. 1535-L: L22-L23 (1967).
COUN USA
ABST Concentrations of titanium, vanadium and fifteen other trace metals were measured in seawater and a common brown alga (Fucus). Vanadium shows a concentration factor of 790 in Fucus.
KEY seawater, vanadium, concentration
- 363 AUTH Smith, N.P.
DATE 1975
TITL Seasonal variations in nearshore circulation in the northwestern Gulf of Mexico.
CITA Contributions in Marine Science. The University of Texas Marine Science Institute 19: 49-65 (1975).
COUN USA
AREA Gulf of Mexico
ABST Sub-surface current data from a late winter and a midsummer period are used to describe the nearshore circulation in the northwestern Gulf of Mexico. The winter currents are generally west-southwesterly and average approximately 21.5 cm/sec. The summer currents alternate between a south-southwesterly and a north-northwesterly direction with little net transport. Comparison of simultaneously collected wind and current data suggests that many features of the nearshore current patterns can be explained as a response to surface windstress.
KEY current, gulf of mexico, seawater, nearshore
- 364 AUTH Smith, N.P.

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DATE 1978
TITL Low-frequency reversals of nearshore currents in the northwestern Gulf of Mexico.
CITA Contributions in Marine Science, 21:(1978).
COUN USA
AREA Gulf of Mexico
ABST Sub-surface current time series from a midwinter and a midsummer period are used to describe features of the near shore circulation in the northwestern Gulf of Mexico occurring over time scales of a few hours to a few weeks. Both time series show small tidal or inertial motions superimposed onto longer-period reversals in the nearshore flow, especially in the slower summer currents. At periods greater than about 45 hours, the coherence between the longshore component of the current and the longshore component of the computed wind-stress is significant at the 99% confidence limit for both study periods.
KEY current, nearshore, gulf of mexico, seawater

365 AUTH Smith, R.L.
DATE 1974
TITL A description of current, wind, and sea level variations during coastal upwelling off the Oregon Coast, July-August 1972.
CITA Journal of Geophysical Research 79(3): 435-443(1974).
COUN USA
AREA Pacific Northwest
ABST The major low-frequency fluctuations in the current (at 20 m and deeper) are barotropic, experienced equally at all depths, and highly correlated with sea level variations. Spectral analysis shows very high mutual coherence between wind, sea level, and clockwise currents only in a narrow band at 0.15 cpd.
KEY current, nearshore, pacific northwest, seawater

366 AUTH Sonu, C.J.
DATE 1972
TITL Field observation of nearshore circulation and meandering currents.
CITA Journal of Geophysical Research 77(13): 3232-3247 (1972).
COUN USA
AREA Gulf of Mexico
ABST Field observations were made of wave-induced nearshore circulations and meandering longshore currents on an undulatory surf-zone bed, under the action of uniform incident waves. Circulations were associated with normal-wave incidence; meandering currents were associated with oblique-wave incidence.
KEY current, nearshore, gulf of mexico, seawater

367 AUTH Spalding, R.F.; Sackett, W.M.

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DATE 1972
TITL Uranium in runoff from the Gulf of Mexico distributive province: anomalous concentrations.
CITA Science 175: 629-631 (1972).
COUN USA
ABST Uranium concentrations in North American rivers are higher than those reported 20 years ago. The increase is attributed to applications to agricultural land of larger amounts of phosphate fertilizer containing appreciable concentrations of uranium. Experiments showing a constant phosphorous-uranium ratio for various types of fertilizers and for the easily solubilized fraction of 0-46-0 fertilizers support this view. .
KEY gulf of mexico, uranium, concentration, river, environmental impact

- 368 AUTH Spence, R.
DATE 1968
TITL The uranium content of seawater.
CITA Talenta 15: 1307-1309 (1968).
COUN Ireland
ABST This report is a review of the literature on the uranium content of seawater. The author reviews past methods and results of analytical experiments, and points out that modern experiments have strongly indicated that the uranium content of normal seawater is constant, within the limits of experimental error, irrespective of location and depth.
KEY uranium, concentration, seawater, analysis
- 369 AUTH Spencer, D.W.; Robertson, D.E.; Turekian, K.K.; Folsom, T.R.
DATE 1970
TITL Trace element calibrations and profiles at the Geosecs test station in the northeast Pacific Ocean.
CITA Journal of Geophysical Research, Vol. 75(36), December 20, 1970, pp. 7688-7696.
COUN USA
AREA North Pacific Ocean
ABST Four laboratories collaborated on the trace element analysis of sea water samples obtained on the 1969 Geosecs test cruise in the northeast Pacific Ocean. The elements determined were Sr, Cs, Rb, Co, Ni, Sc, Cu, Sb, Zn, Fe, and U. Two or more laboratories reported on Sr, Cs, Zn, Fe, and U. The general agreement was good. Depth variations were noted for some elements. Acidified samples were higher in Fe, Zn, and Co than the unacidified samples. Except for surface iron values, filtering had no effect on concentration.
KEY seawater, uranium, trace metals

- 370 AUTH Stalcup, M.C.; Metcalf, W.G.
DATE 1972

(CONT.)

- TITL Current measurements in the passages of the Lesser Antilles.
CITA Journal of Geophysical Research 77(6): 1032-1049(1972).
COUN USA
AREA Caribbean
ABST Direct-current measurements during March and April 1970, in the four major passages through the Lesser Antilles show a westward transport of about $26 \times 10^6 \text{ m}^3/\text{sec}$. This transport is divided between the Grenada, St. Vincent, and St. Lucia passages with, respectively, 10, 10, and $6 \times 10^6 \text{ m}^3/\text{sec}$ flowing to the west. The transport through the Dominica passage was less than $2 \times 10^6 \text{ m}^3/\text{sec}$ during these measurements. This flow pattern is consistent with the distribution of variables as shown by data from hydrographic stations to the east and west of each passage. On the basis of the temperature-oxygen relationship, water that enters the Caribbean with a temperature between $16^\circ\text{--}23^\circ\text{C}$ comes from a broad band of water found east of the area.
KEY current, caribbean, seawater, temperature, salinity
- 371 AUTH Starik, I. Ye., Nikolayev, D.S., Kuznetsov, Yu.V. Legin, V.K.
DATE 1961
TITL The Radioactivity of Black Sea Sediments.
CITA Doklady Acad Nauk USSR (English) 139(6):704-707.
ABST As a result of an investigation into the distribution of radioelements in sediments of the Black Sea, the authors established that it differs markedly from the distribution of radioelements in typical ocean sediments, and that the character of sediment formation in the Black Sea is clearly shown by the distribution of radioelements in the sediments. The range of concentrations of radium in the Black Sea sediments is 0.5-0.9 $\mu\text{g/g}$, much less than the 4-50 $\mu\text{g/g}$ of ocean sediments.
KEY Black Sea, trace metals, sediments, seawater, concentration.
- 372 AUTH Starik, I.E., Kuznetsov, Yu.V., Grashchenko, S.M., Frenkikh, M.S.
DATE 1958
TITL The ionium method of determination of marine sediments.
CITA Geochemistry 1958(1): 1-15 (1958).
COUN USSR
ABST Results of an investigation of the vertical distribution of uranium, radium, ionium and thorium as well as iron, manganese and calcium in 7 cores of marine sediments raised from the bottom of the Indian and Pacific oceans are given in the article.
KEY sediments, uranium, trace metals
- 373 AUTH Starik, I.E.; Kolyadin, L.B.

(CONT.)

- DATE 1957
TITL The occurrence of uranium in ocean water.
CITA Geochemistry (3): 245-256 (1957).
COUN USSR
ABST The adsorption on glass, cationite or anionite, the ultrafiltration and electrophoresis of hexavalent uranium in oceanic water and solutions containing $2-50 \times 10^{-6}$ g U/l and 0.1 g U/l have been studied. The investigation has been carried out in the interval of pH 2-10. Conclusions on the forms of uranium occurrence in oceanic water at different pH values are drawn from the data obtained.
KEY uranium, seawater, adsorbent, chemistry, chemical species, extraction
- 374 AUTH Stefánsson, U.; Atkinson, L.P.; Bumpus, D.F.
DATE 1971
TITL Hydrographic properties and circulation of the North Carolina shelf and slope waters.
CITA Deep-Sea Research 18: 383-420 (1971).
COUN Iceland
AREA Mid Atlantic
ABST Processes affecting the renewal of the North Carolina Shelf Waters are discussed on the basis of temperature, salinity, dissolved oxygen, nutrients, runoff and wind data collected during 1965-1967. These consist of horizontal advection near the coast from the north, meanders of the Gulf Stream, subsurface intrusion, cascading and runoff.
KEY current, temperature, salinity, river, nutrients, nearshore, mid atlantic, seawater
- 375 AUTH Stephens, C.F.; Oppenheimer, C.H.
DATE 1972
TITL Silica contents in the northwestern Florida Gulf coast.
CITA Contributions in Marine Science 16: 99-108 (1972).
COUN USA
AREA Gulf of Mexico
ABST Analyses of the river and bay waters of the Northwestern Florida Gulf Coast indicate that weathering of silica is active and that the fresh waters and runoff are significant sources of silica for the estuarine waters. An eighteen month study of the distribution of silica in the St. Marks River and Apalachee Bay indicates that active inorganic processes contribute to the loss of silica as dilution is not entirely responsible for the change. Silicate content of the surface waters ranged from 240 ug-at/l in fresh water at 10 miles from the open Apalachee Bay to less than 1 ug-at/l in the Bay where salinity is 34‰. The St. Marks River has an average discharge of 1000 cfs which, if containing 200 ug Si/l would have an average discharge of ~15.5 metric tons of silica per day. Other areas of the shore estuarine environment show similarly high silica values and are

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relative to salinity.
KEY nutrients, nearshore, estuary, river, seawater, gulf of
mexico salinity

- 376 AUTH Strom, K.M.
DATE 1948
TITL A concentration of uranium in black muds.
CITA Nature 162:922 (1948).
COUN Norway
AREA Norwegian fjords
ABST Concentrations of uranium are provided for several
Norwegian fjords as well as some chemical data on the
reducing environment of the sample locations.
KEY uranium, concentration, sediments
- 377 AUTH Sturges, W.
DATE 1965
TITL Water characteristics of the Caribbean Sea.
CITA Journal of Marine Research 23(2): 147-164 (1965).
COUN USA
AREA Caribbean
ABST The volume of Caribbean Sea water in bivariate classes
of potential temperature vs. salinity has been estimated
from 76 hydrographic stations. The resulting statistics
are presented on a pair of characteristic diagrams. The
outstanding feature of the diagrams is the strong mode;
nearly half of all Caribbean water lies within 0.1°C
and 0.02 per mil of the mode, at 3.9°C, 34.98 per mil.
An envelope of all samples has been determined. The
waters below 2000 m in each of the four large basins are
compared by using only data from a single CRAWFORD
cruise. In each basin the deep water is remarkably
homogeneous, but the deep waters are different in the
eastern (Yucatan and Cayman) and western (Colombia and
Venezuela) basins. There appears to be no inflow of
deep water through Jungfern Passage, the deepest
connection with the Atlantic Ocean, but there may be
sporadic inflow through Windward Passage into the
western basins. There appears to be no inflow of water
at mid-depth above either sill.
KEY current, salinity, temperature, caribbean, seawater
- 378 AUTH Sturges, W.
DATE 1970
TITL Observations of deep-water renewal in the Caribbean Sea.
CITA Journal of Geophysical Research 75(36): 7601-02(1970).
COUN USA
AREA Caribbean
ABST Observations with bottom-moored current meters in the
Jungfern passage show that, contrary to previous
conclusions, deep water in the Venezuela basin is being
renewed. During a 5-day record, the flow was mainly
oscillatory at tidal frequency, with a net inflow by the

(CONT.)

tidal mechanism of only $6 \times 10^3 \text{ m}^3/\text{sec}$. During a single 11-hour surge the inflow rate was 50 to $200 \times 10^3 \text{ m}^3/\text{sec}$. Steady-state heat-budget and oxygen-budget calculations require a renewal rate of about $100 \times 10^3 \text{ m}^3/\text{sec}$. The sill depth is 1860 meters. STD observations near the sill reveal a sharp interface between Caribbean water above and oceanic water below sill depth. The north-south hydrographic sections of IGY data show an abrupt change in vertical temperature gradient near 2600 to 2800 meters. This feature, also found in other basins, is interpreted to result from differences in renewal between tidal inflow and stronger sporadic surges, with the earth's rotation being an important controlling parameter.

KEY current, caribbean, seawater, temperature

- 379 AUTH Sugawara, K.; Okabe, S.
 DATE 1966
 TITL Molybdenum and vanadium determinations of Umitaka-Maru samples from her 1962-63 and 1963-64 cruises of the International Indian Ocean Expedition.
 CITA Journal of Tokyo University Fisheries Special Edition 8(2): 165-71.
 CDUN Japan
 AREA Indian Ocean
 ABST The Mo content in these ocean waters ranges from 0.113 to 0.127 micro g. atoms/kg. (Cl 19 per mil) with an av. at 0.119 micro g. atoms/kg. In comparing the av. value with the data from the other parts of the oceans which have been reported by K. Sugawara and S. Okabe, it is pointed out that this part of the ocean has been enriched with Mo. In the middle part of the Indian Ocean the V value varies from 0.033 to 0.048 micro g. atoms/kg. (Cl 19 per mil) with an av. at 0.040 micro g. atoms/kg. Some geochem. consideration is given on the distribution of both metals in the ocean waters.
 KEY trace metals, seawater
- 380 AUTH Sugimura, Y.; Torii, T.; Murata, S.
 DATE 1964
 TITL Uranium distribution in Drake Passage waters.
 CITA Nature 204:464-465. Reprinted in : Geochemical Study of the Ocean and the Atmosphere, Geochemical Laboratory, Meteorological Research Institute, Tokyo, Japan, p. 313-315.
 CDUN Japan
 ABST Water samples were collected along the transect of Drake Passage and the uranium content determined fluorometrically. An average value of 3.1 plus/minus 0.2 ppb is obtained for the uranium content of surface water. In the vertical distribution, uranium tends to show a minimum concentration about the depth of 300-400 m, increasing at greater depths.

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KEY uranium, seawater, analysis

- 381 AUTH Sugiura, Y.; Saruhashi, K.; Miyake, Y.
DATE 1976
TITL Evaluation on the disposal of radioactive wastes into the North Pacific.
CITA Pap. Met. Geophys. 27:81-87. Reprinted in: Geochemical Study of the Ocean and the Atmosphere, ed. by Geochemical Laboratory, Meteorological Research Institute, Tokyo, Japan, p. 329-335.
COUN Japan
ABST Evaluation on deep sea disposal of radioactive waste into the North Pacific on the basis of diffusion process is done using a simplified model. The results of calculation by employing different sets of diffusion coefficients on the horizontal and vertical directions show that for the smaller diffusion coefficients discrepancies between relative concentration of nuclides and the law of radioactive disintegration are greater. For larger coefficients, concentration above the site of release approaches mean, homogeneous concentration which satisfies the rule of radioactivity. From oceanographic and radiological view points, it is concluded that $100 \text{ cm}^2/\text{s}$ and $10^8 \text{ cm}^2/\text{s}$ respectively of diffusion coefficient of the vertical and horizontal directions are appropriate and reasonable in the North Pacific for the purpose of dose evaluation. A new definition of the high-level radioactive waste and other matter is given as follows: (a) 10 Ci/t for beta/gamma emitter (except tritium), 1 Ci/t for Sr-90 plus Cs-137, (b) 10^4 Ci/t for tritium, (c) NO long-lived alpha emitter may be dumped.
KEY environmental impact, seawater
- 382 AUTH Sutton, J.
DATE 1949
TITL The hydrolysis of the uranyl ion. Part 1.
CITA Journal of Chemical Society Supply No. 2: 275-286 (1949).
COUN UK
ABST Cryoscopic measurements prove conclusively that the hydrolysis of uranyl salts leads to the formation of the ions $\text{U}_2\text{O}_5^{++}$ and $\text{U}_3\text{O}_8^{++}$, and not $\text{UO}_2(\text{OH})^+$ and $\text{UO}_2(\text{OH})_2$. Measurements of pH of solutions of UO_3 in solutions of uranyl salts, pH titrations of uranyl perchlorate with sodium hydroxide, and the conductivity and absorption spectra of these solutions, point to the formation of further ions $\text{U}_3\text{O}_8(\text{OH})^+$, $\text{U}_3\text{O}_8(\text{OH})_2$, and $\text{U}_3\text{O}_8(\text{OH})_3^-$. More highly charged anions may be formed but the evidence is still inconclusive. The equilibrium constants for the formation of some of these ions have been determined.
KEY chemistry, absorption, ion exchange, analysis
- 383 AUTH Szekielda, K.H.

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- DATE 1975
TITL General chemistry of the coastal waters of the
Mid-Atlantic coast.
CITA Mar. Environ. Implic. Offshore Oil Gas Dev. Baltimore
Canyon Reg. Mid-Atl. Coast, Proc. Estuarine Res. Fed.
Outer Cont. Shelf Conf. Workshop 1974: 153-163 (1975).
COUN USA
AREA Mid-Atlantic Coast
ABST The character and circulation of the waters were detd.
KEY chemistry, seawater, concentration, m atlantic
- 384 AUTH Taft, B.A.
DATE 1970
TITL Path and transport of the Kuroshio South of Japan.
CITA The Kuroshio: A Symposium on the Japan Current, ed. by
John C. Marr, East-West Centre Press, Honolulu, p.
185-196 (1970). 1
COUN USA
AREA Japan
ABST Geomagnetic electrokinetograph and hydrographic data
from quarterly surveys from 1956 to 1964 have been
analyzed. Maximum current speed of the Kuroshio
increases downstream from long. 132° to 137°E. Current
speed decreases as the current goes from the deep water
of the Shikoku Basin into the shallow water overlying
the Izu Ridge.
KEY current, seawater, offshore
- 385 AUTH Taft, B.A.; Jones, J.H.
DATE 1973
TITL Measurements of the equatorial undercurrent in the
Eastern Pacific.
CITA Progress in Oceanography, Vol. 6, ed. by B. A. Warren,
Pergamon Press, New York, p. 47-110 (1973).
COUN USA
AREA Equatorial Pacific
ABST During the PIQUERO Expedition (June 26-August 4, 1969)
direct measurements of the Pacific Equatorial
Undercurrent were made at four longitudes between 115.5°
and 93.5° W. Eastward volume transports of the
Undercurrent were $19 \times 10^6 \text{ m}^3/\text{sec}$ at 115.5° W and $8 \times$
 $10^6 \text{ m}^3/\text{sec}$ at 93.5° W.
KEY current, offshore, seawater, salinity, temperature
- 386 AUTH Takebayashi, T.; Matsuda, H.; Umemoto, S.
DATE 1973
TITL Application of the fission-track technique to the
determination of uranium in natural waters.
CITA Talanta 20(9): 892-895 (1973).
COUN Japan
AREA Fukuoka City Rivers
ABST A procedure for the detn. of the U content of natural
waters is presented. To 100 ml of natural waters, 200

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ml concd. HCl is added and this soln. is passed through a 6-ml column of Dowex 1-X8. The U is eluted with 60 ml of 0.1M HCl, and the eluate is evapd. to dryness. The residue is subjected to the fission-track technique. The U content of the river waters in Fukuoka City was determined.

KEY uranium, water, analysis, ion exchange, elution

387 AUTH Takenouti, A.Y.; Ohtani, K.

DATE 1972

TITL Currents and water masses in the Bering Sea: A review of Japanese work.

CITA Oceanography of the Bering Sea; Proceedings of International Symposium for Bering Sea Study, 1972 p. 39-57. .

COUN Japan

AREA Bering Sea

ABST About half of the volume transport of the Alaskan Stream enters the Bering Sea through Aleutian island passes and the rest from west of Attu Island. The highly stratified Alaskan stream water loses its characteristic structure upon entering the Bering Sea during its first step of transformation from Eastern to Western Subarctic water. A general counterclockwise circulation and small eddies prevail in the Bering Sea. The continental shelf of the eastern Bering Sea is characterized by various types of vertical temperature and salinity structures. Freshwater dilution of the surface layer, the intrusion of warm saline water near the bottom, and strong vertical mixing associated with winter cooling cause formation of dichothermal water. In regions where a conspicuous halocline is present as a barrier to winter convection activity, cold bottom water is absent.

KEY current, seawater, offshore, temperature, salinity, alaska

388 AUTH Tatsumoto, Mitsunobu; Goldberg, E.D.

DATE 1959

TITL Some Aspects of the Marine Geochemistry of Uranium.

CITA Geochimica et Cosmochimica Acta, 17 : 201-208.

ABST The uranium concentrations marine calcareous material of a biological origin varied between 0.0X and 0.X p.p.m. with the exception of corals which had concentrations of several p.p.m. The aragonitic oolites and aragonite precipitated from sea water had values similar to those of the corals. A geochronology based on the growth of ionium (thorium-230) from uranium is applicable not only to corals, as previous investigators have pointed out, but also to oolites. Several examples of "oolite ages" are given. The uranium content of ferromanganese minerals from pelagic deposits is of the order of from 4 to 5 p.p.m.

KEY uranium, concentration, sediments, trace metals, sea water, geology, analysis.

- 389 AUTH Thurber, D.L.
DATE 1964
TITL The uranium content of sea water.
CITA Transactions American Geophysical Union 45: 119 (1964).
COUN USA
AREA Arctic, Atlantic, Caribbean
ABST The uranium concentration of sea water samples from the Arctic Ocean, the South Pacific, the Atlantic, and the Caribbean has been determined using a tracer technique. The values range from 1.5 to 3.3 $\mu\text{g/l}$. These variations confirm the findings of Miyake who reported a similar range of values. The activity ratio of U-234/U-238 does not appear to vary within the limits of measurement from a value of 1.15.
KEY uranium, seawater, concentration
- 390 AUTH Titaeva, N.A.
DATE 1967
TITL Association of radium and uranium with peat.
CITA Geochem. Int. 4: 1168-1174 (1967).
COUN USSR
ABST U is considerably more mobile than radium in surface waters containing small amounts of calcium bicarbonate. Radium is readily solved by clays as well as by peat. In peat, uranium is bound to the humic and fulvic acids soluble in alkali, whereas the radium is associated with the insoluble residue. Under oxidizing conditions, the elements appear to be retained by ion exchange, but in the presence of high concentrations of calcium in the water, the radium in the peat and in the insoluble residue becomes nearly unexchangeable. The exchangeability of that radium bound to the humic acid is, however, retained.
KEY uranium, ion exchange, water, adsorbent
- 391 AUTH Torii, T.; Murata, S.
DATE 1964
TITL Distribution of uranium in the Indian and the Southern ocean waters.
CITA Ken Sugawara Festival Volume : 321-334 (1964).
COUN Japan
ABST The content of uranium in sea waters collected respectively on the route from Japan to Antarctica was determined. Uranium was analyzed by the fluorometric method using transmission type fluorometer after separation with solvent extraction and fusion with sodium fluoride. The analytical results showed that uranium content in surface water respectively ranged from 2.7 to 3.2×10^{-6} g/l in the Indian Ocean Basin in the Antarctic Ocean, 2.7 to 3.5×10^{-6} g/l in the Drake Passage, 2.5 to 3.5×10^{-6} g/l in the Indian Ocean and 2.5 to 3.3×10^{-6} g/l in the South China Sea. Judging from the mean value of 0.5×10^{-13} g/l for radium in the

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- Indian Ocean, the ratio of radium to uranium may be 4 to 6 per cent of the secular equilibrium amount.
- KEY concentration, uranium, seawater, japan, antarctica, analysis, extraction, trace metals
- 392 AUTH Tsytsugina, V.G.; Risik, N.S.; Lazorenko, Q.E.
DATE 1975
TITL Artificial and natural radionuclides in marine life.
CITA United States-Israel Binational Science Foundation, Rept. No. TT-75-50010, ISBN-0-7065-1509-9.: 123p.
COUN USSR
AREA Mediterranean
ABST The book presents the results of research into the Karyology and radiation cytogenics of marine fish, the accumulation and distribution of uranium in marine organisms and the mechanisms by which the radio nuclides are taken up by algae.
KEY uranium, marine organisms
- 393 AUTH Turekian, K.K.
DATE 1969
TITL The oceans, streams, and atmosphere.
CITA Handbook of Geochemistry, Vol. 1, K.H. Wedepohl, editor, Springer Verlag, pp. 297-323 (1969).
COUN USA
ABST In this chapter an attempt is made to bring together the most recent data on the chemical properties of the ocean, streams and the atmosphere. In addition to the chemical data, estimates of the physical properties of the systems are included, such as the dimensions of the ocean basins and the mean annual runoff of the world, since most geochemical calculations involving the cycles of the elements require flux rates and reservoir dimensions for meaningful material balances.
KEY river, seawater, water, uranium, geology
- 394 AUTH Turekian, K.K.; Chan, L.H.
DATE 1971
TITL The marine geochemistry of the uranium isotopes, Th-230 and Pa-231.
CITA Activation Analysis in Geochemistry and Cosmochemistry, ed. by Brunfelt and Steinnes, Proceedings of the Nute Advanced Study Institute, Kjeller, Norway, 7-12 Sept. 1970, p. 311-320 (1971).
COUN USA
ABST The supply rate of U-234 and U-238 by streams and the diffusion rate of U-234 from deep-sea sediments are shown to form a self-consistent pattern when the following values of the critical quantities are used: average stream concentration of U = $0.3 \mu\text{g/l}$; average U-234/U-238 activity ratio of streams = 1.19; average U-234 diffusion rate from deep-sea sediments = $0.3 \text{ dpm/cm}^2/1000 \text{ y}$. Other values of these parameters are

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also self-consistent, but some suggested regional values are found not to be. The uranium-to-salinity ratio of the oceans is constant within 4% at a 9.21×10^{-8} g U/salinity corresponding to 3.2 μ g U/l for sea water of 35‰ salinity.

KEY uranium, river, sediments, geology, concentration, geography, salinity, seawater, chemistry

- 395 AUTH Turner, H.J. Jr.
DATE 1967
TITL A practical approach to...marine fouling.
CITA Geomarine Technology 3(3): 28-32 (1967).
COUN USA
ABST Marine fouling is defined as the assemblage of living organisms which attach and grow on surfaces introduced into the marine or estuarine environment by man. The same organisms inhabit surfaces naturally occurring in the sea but that is of little importance to this discussion except that they form the parent stocks from which fouling communities develop. Fouling is costly and sometimes dangerous to a variety of marine enterprises.
KEY fouling, seawater
- 396 AUTH U.S. Congress Senate, 1961. Select Committee on National Water Resources.
DATE 1961
TITL Water resource activity in the United States.
CITA 86th Congress, 2nd session, January 1960. Committee Print No. 3. (1961).
COUN USA
AREA US and Territories
ABST National water resources and problems.
KEY geography, river, climate
- 397 AUTH U.S. Congress Senate, 1961. Select Committee on National Water Resources.
DATE 1961
TITL Water resources activities in the United States.
CITA 86th Congress, 2nd session, December 1960, Committee Print No. 6 (1961).
COUN USA
AREA US and Territories
ABST Views and comments of the States about their water resources.
KEY geography, river, climate
- 398 AUTH Van Der Sloot, H.A.
DATE 1976
TITL Neutron activation analysis of trace elements in water samples after preconcentration on activated carbon.
CITA Vrije Universiteit (Amsterdam): (1976).
COUN The Netherlands

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- ABST In this thesis, the use of activated carbon for the determination of trace elements in sea and fresh water is studied. Activated carbon, if pure, appears very usable for the preconcentration of trace elements in water. Because of its simplicity, the analysis can be performed at the sampling site itself. The absorbed elements are then determined through neutron activation analysis. The scope of this study is limited to: V, Cr, Co, Cu, Zn, Se, Mo, Cd, W, Hg and U.
- KEY seawater, water, adsorbent, analysis, trace metals, uranium
- 399 AUTH Van Der Sloot, H.A.; Masee, R.; Das, H.A.
DATE 1975
TITL Determination of uranium in sea and surface waters by neutron activation analysis after adsorption on charcoal.
CITA J. Radioanal. Chem. 25(1): 99-105 (1975).
COUN The Netherlands
ABST The determination of uranium in sea and surface water samples after a preconcentration with activated charcoal by neutron activation analysis is described.
KEY uranium, seawater, water, analysis, concentration
- 400 AUTH Veeh, H.H.
DATE 1967
TITL Deposition of uranium from the ocean.
CITA Earth and Planetary Science Letters 3: 145-150(1967).
COUN USA
ABST Anaerobic sediments from the upper continental slope in the eastern Pacific, the Gulf of California, and a Norwegian Fjord have been analyzed for their total uranium content and U-234/U-238 ratios by alpha-spectrometry. The uranium concentrations range from 4.8 to 39 ppm and are thus significantly higher than the average uranium content of 3 ppm in deep sea clays, stream sediments and soils. The U-234/U-238 ratios approach the sea water value of 1.15 in samples with high uranium content. These results indicate that uranium is being removed from seawater in nearshore areas under certain conditions. If such conditions prevail in only 0.4% of the total area covered by the ocean, an amount of uranium equal to that supplied by streams (assuming $0.04 \mu\text{g/l}$) can be removed from the ocean, on the basis of measured accumulation rates in the Gulf of California, off southern California, and in other areas. The effect of Pleistocene sea level fluctuations as a controlling factor in determining the concentration of uranium in sea water is diminished by the occurrence of extensive areas of uranium deposition below 200 m and by the very long residence time of uranium in the ocean.
- KEY uranium, sediments, concentration

- 401 AUTH Veeh,H.H.; Burnet,W.C. .
DATE 1973
TITL Contemporary phosphorites on the continental margin of Peru.
CITA Science 181: 844-845 (1973).
COUN USA
ABST Phosphorite nodules occurring along the biologically productive continental margin of Peru have been dated by uranium-series methods. The radiometric ages range from late Pleistocene to Recent, indicating that phosphorites are currently forming in this area.
KEY uranium, sediments, concentration
- 402 AUTH Veeh,H.H.; Turekian,K.K.
DATE 1968
TITL Cobalt, silver, and uranium concentrations of reef-building corals in the Pacific Ocean.
CITA Limnology and Oceanography 13(2): 304-308 (1968).
COUN USA
ABST A study was made of the concentration of silver, cobalt, and uranium in the calcium carbonate skeletons of reef-building corals, using neutron activation analysis. The silver, cobalt, and uranium concentrations in the corals vary considerably, with mean values of 0.041 ppm Ag, 0.005 ppm Co, and 2.2 ppm U. The Ag : Ca and Co : Ca ratios in the corals are much lower than those reported for open ocean water from the same general area, showing that corals discriminate against these trace elements during the deposition of their aragonite skeletons. The U : Ca ratios in the corals on the average appear to approach that of seawater with a slight discrimination against uranium. Variations among species from the same locale, beyond the limits of analytical error, further suggest biochemical control by the corals in the incorporation of uranium in the skeleton.
KEY uranium, concentration, sediments, trace metals
- 403 AUTH Vernon,F.; Kyffin,T.W.; Nyo,K.M.
DATE 1976
TITL The spectrophotometric determination of uranium with 8-hydroxyquinoline.
CITA Anal. Chim. Acta. 87(2): 491-493 (1976).
COUN UK
ABST To an aliquot contg. 250 μ g U, 50 ml deionized water was added, the pH was adjusted to 0.85 with H_2SO_4 , the mixt. was extd. 2 25-ml portions of 0.1M trioctylamine in petroleum ether contg. 2 vol.% 2-octanol, the U was back-extd. with 0.2M HNO_3 , the mixt. was neutralized with NH_4OH , and the pH was adjusted to 8.8. Then 5ml 0.02M EDTA di-Na salt was added, and the soln. was extd. with 1% (w/v) 8-hydroxyquinoline soln. in CCl_4 . The absorbance was detd. in a 1-cm cell at 400 nm against a reagent blank.

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KEY uranium, water, chemistry, analysis, extraction

- 404 AUTH Wald, M.; Wiegand, G.
DATE 1973
TITL Determination of nanogram uranium content in solutions by the fission track method.
CITA Radiochim. Acta 19(1): 37-40 (1973).
COUN West Germany
ABST A fission track method was adapted for the determination of uranium in nanogram quantities in solutions, without any preliminary chemical treatment of the solution. Polycarbonate foil was used as a fission track detector. Experimental conditions were worked out to accommodate the method for as small volumes of uranium solutions as 1 ml. The uranium solution was either directly contacted with the detector foil, or after being fixed on Bio-Gel matrix. A proper arrangement of the foils for the sparking process leads to very small spark holes, considerably improving the detection. The fraction of the tracks that may be rendered visible due to etching and sparking was found to be of a constant value for given irradiation conditions and matrix. The intensity of gamma radiation existing in the irradiation position of the reactor influences significantly the value of this fraction.
- KEY uranium, analysis

- 405 AUTH Walford, L.A.
DATE 1958
TITL Seaweeds.
CITA Living Resources of the Sea. Ronald Press Co., New York, p. 273-295 (1958).
COUN USA
ABST Seaweeds vary tremendously in form and elaborateness of organization, ranging from one-celled, microscopic flagellates to giant kelp which grow to be five or six hundred feet long. Marine algae have some human nutritional value, but this is not their most interesting use. Some of the chemicals derived from them have peculiar properties which give them special values for industrial or medical purposes. It is these that put algae among the important resources of the sea.
- KEY farming system, nutrients, marine organisms

- 406 AUTH Wamser, C.A.
DATE 1972
TITL Recovery of uranium from hydrochloric acid-digested phosphate rock solution.
CITA U.S. 3,880,980 (Cl. 423-7; Colg) April 29, 1975, Appl. 311,012, Nov 30, 1972. (Abstracted in Chemical Abstracts 83:46229y, 1975)
COUN USA
ABST In the manuf. of fertilizers from phosphate rock, a

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slurry of the pulverized rock is treated with HCl to form H_3PO_4 in an aq. soln. that commonly contains 5-30 wt.% each of $CaCl_2$ and H_3PO_4 with 100-1000 ppm U by wt., and useful compds. of U can be recovered from it. Any U^{6+} present is reduced to U^{4+} , preferably by H_2S or $Na_2S_2O_4$ at 40-100° with a $CuSO_4$ catalyst, followed by solvent extn. of H_3PO_4 with a butanol or pentanol compd. in kerosene or heptane. U^{4+} remains in the aq. brine raffinate during the extn., and must afterwards be re-oxidized to the hexavalent state, preferably with Cl or $NaClO_3$ at 40-100°.

KEY uranium

- 407 AUTH Warren, B.A.
 DATE 1970
 TITL General circulation of the South Pacific.
 CITA Scientific Exploration of the South Pacific, Proceedings of Symposium during Ninth General Meeting of Scientific Committee of Oceanic Research, June 18-20, 1968, ed. by Warren S. Wooster, Scripps Institute of Oceanography, La Jolla, National Academy of Sciences, Washington D.C., p. 33-49 (1970).
 COUN USA
 AREA South Pacific
 ABST This paper reviews some of the principle things that have been learned about the general circulation of the South Pacific, with emphasis on ambiguities requiring investigation, and with reference to circulation theory.
 KEY current, temperature, salinity, offshore, seawater
- 408 AUTH Warsh, K.L.; Stakhiv, E.Z.; Garstang, M.
 DATE 1970
 TITL On the relation between the surface temperatures of the Gulf of Mexico and its circulation.
 CITA Bulletin of Marine Science 20(4):803-812 (1970).
 COUN USA
 AREA Gulf of Mexico
 ABST The circulation of the Gulf of Mexico is compared to the distribution of sea-surface temperatures. For temperature gradients greater than $0.02^\circ C/km$, a correlation exists between surface-temperature gradients and current speeds in winter, which could be used to monitor surface-current intensity by satellite.
 KEY current, gulf of mexico, temperature, seawater, offshore,
- 409 AUTH Wastler, T.A.; de Guerrero, L.C.
 DATE 1970
 TITL Estuarine and coastal pollution in the United States.
 CITA FAO Technical Conference on marine pollution and its effects on living resources and fishing. Rome, Italy. 9-18 Dec 1970. FIR:MP/70/R-11: 42p (1970).
 COUN USA

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AREA Atlantic Ocean, Pacific Ocean, Gulf of Mexico, Caribbean, Alaska, Pacific Islands

ABST In 1966 the U.S. Congress directed that a comprehensive study of coastal pollution be undertaken and that recommendations be made to them for a national coastal zone management program to preserve and use these areas for the continuing benefit of the entire Nation. The Federal Water Quality Administration of the Dept. of Interior submitted to the Congress in November 1969 the definitive report of the National Estuarine Pollution Study, which was the first comprehensive appraisal of coastal pollution in the U.S. This review of estuarine and control pollution in the U.S. is based on these three years of intensive investigation and presents not only the pollution problems themselves, but also some of the concepts and techniques developed during the study.

KEY n atlantic, mid-atlantic, s atlantic, northwest pacific, southwest pacific, gulf of mexico, alaska, pacific islands, caribbean, estuary, current, river, sediments, climate, tide, offshore, marine organisms, nearshore, organics, temperature, environmental impact

410 AUTH Weaver, J.N.
DATE 1974
TITL Rapid, instrumental neutron activation analysis for the determination of uranium in environmental matrices.
CITA Anal. Chem. 46(9): 1292-1294 (1974).
COUN USA
ABST To det. >25 ppb U in environmental materials, samples were irradiated 4-8 hr in a flux of 3×10^{13} neutrons/cm²/sec, and after 48 hr decay, the I-133 activity was measured with a low-energy photon detector coupled to a multichannel analyzer. The photopeaks at 14.4, 18.32, 106.80, and 109.32 keV were used; the ratios between the peaks were used to eliminate interference by other isotopes. The technique was demonstrated by analyses of orchard leaves, beef liver, coal, sea water, Cu ore, and mud samples. The precision was approx. 10 and approx. 5% for detns. of 100 ppb and 1 ppm U, resp., in the leaves.

KEY uranium, seawater, analysis

411 AUTH Weissbuch, H.; Botezatu, E.; Gradinaru, M.
DATE 1978
TITL Spectrophotometric method for the simultaneous determination of uranium and thorium in natural water.
CITA J. Radioanal. Chem. 42(2): 385-391 (1978).
COUN Romania
ABST The method is based on the separation of uranium from thorium and on their subsequent purification on strong basic anion exchange resin. Increased chemical yield, precision and selectivity can be achieved. The assay is performed spectrophotometrically in the form Arsenazo

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III complexes. By this way the difficulties of the fluorimetric method can be easily avoided. The sensitivity is claimed to be $0.02 \mu\text{g}/\text{cm}^3$; the accuracy is 10%, the chemical yield is 75-80% and the time requirement is 30 hours for 5 simultaneous samples. No proposal is made on the application of the method on sea-water.

KEY uranium, analysis, water, extraction, ion exchange

- 412 AUTH Wennekens, M.P.
DATE 1959
TITL Water mass properties of the Straits of Florida and related waters.
CITA Bulletin of Marine Science of the Gulf and Caribbean 9(1): 1- (1959).
COUN USA
AREA Gulf of Mexico, Caribbean
ABST The hydrography of the Straits of Florida is greatly influenced by a flow of water originating in the Caribbean-Gulf of Mexico region and to a lesser extent by waters of the Western Atlantic. The Continental Edge Water is found along the continental margin of the Florida Current throughout the length of the Straits.
KEY current, temperature, salinity, caribbean, gulf of mexico, nutrients, offshore
- 413 AUTH Wesolowski, K.; Ryczek, M.
DATE 1965
TITL Heavy metal concentrates from dilute waste solutions.
CITA Pol. 50,128 (Cl. C01g), Appl. Feb 12, 1964: 3p (1965).
COUN Poland
ABST The concentrates are obtained by adsorption on humins of heavy metals whose high-valence ions have acid properties. The ions are absorbed from dil. solns. obtained during purification of industrial gases and mine waters. For this purpose, humins were heated to 250° in a neutral or reducing atm., and the moisture was 2-5% by wt. Next, the humins were treated with alk. earth hydroxides and used as absorber. Absorption of each metal should be performed at appropriate pH: V(V) at pH 1.5-2, V(IV) 3, U(IV) 4, U(VI) 2.5, Ge(II) 4.5, Ge(IV) 1.5-2.0, Ga(III) 5-5.5, Mn(II) 4, and Mn(VII) 1.8-2.2.
KEY trace metals, adsorbent, temperature, chemistry, uranium
- 414 AUTH Wickham, J.B.
DATE 1975
TITL Observations of the California Countercurrent.
CITA Journal of Marine Research 33(3): 325-340 (1975).
COUN USA
AREA US West Coast
ABST Spatially dense observations in consecutive years in a region within about 50 km of the continental shelf show

(CONT.)

a complex structure of southern water undergoing dilution by mixing as it flows northward. Marked differences are seen in structure and flow between the two years.

KEY current, temperature, salinity, offshore, seawater, pacific northwest, pacific southwest

- 415 AUTH Wilson, A.; Iseri, K.T.
DATE 1969
TITL River discharges to the sea from the shores of the conterminous United States. (reprinted 1978).
CITA U.S. Dept. of the Interior, Geological Survey, Hydrologic Investigations Atlas No. HA-282 (1969).
COUN USA
AREA USA
ABST The river discharge into the oceans from United States runoff is tabled and mapped.
KEY river, water
- 416 AUTH Wilson, B.W.
DATE 1964
TITL Generation and dispersion characteristics of tsunamis.
CITA Studies on Oceanography, ed. by Kozo Yoshida, University of Washington Press, p. 413-444 (1964).
COUN USA
ABST This presentation attempts to discuss the modes of generation of tsunami waves, the nature of the waves as to their type and dispersive characteristics, their great destructive power and some of the features of their run-up on coastlines. The Pacific Ocean accounts for about 60 to 70% of all occurrences of tsunamis in the world's ocean in which 4 notable tsunamis occur every 3 years.
KEY geology, tide
- 417 AUTH Wilson, E.M.; Swales, M.C.
DATE 1972
TITL Tidal power from Cook Inlet, Alaska.
CITA Tidal Power, by Gray and Gashus, Plenum Press, New York, p.239-256 (1972).
COUN Canada
AREA Cook Inlet
ABST One barrage site, however, across Knik Arm in the upper reaches of Cook Inlet, has a multipurpose potential which, the authors believe, might well justify further study. This paper describes a general assessment of the practical possibilities of several sites in the inlet and presents the results of an investigation into the development of the most promising site across Knik Arm.
KEY tide, tidal system, alaska
- 418 AUTH Wilson, J.D.; Webster, R.K.; Milner, G.W.C.; Barnett, G.A.; Smales, A.A.

(CONT.)

- DATE 1960
TITL A comparison of three methods of determining the concentration of uranium in sea water.
CITA Anal. Chim. Acta 23: 505-514 (1960).
COUN UK
AREA English Channel, Bay of Biscay
ABST A stable isotopic dilution method and a fluorimetric method for the measurement of the concentration of uranium in sea water are described. In both methods the uranium is extracted from the sea water into chloroform using 8-hydroxyquinoline. U-237 is used as a tracer in the fluorimetric method. The results obtained by these two methods and by a pulse polarographic method are compared, and give a mean value of $3.3_3 \pm 0.08 \mu\text{g}$ per l for the uranium content of samples of English Channel and Bay of Biscay water. The precision of the methods improves in the order fluorimetry, pulse polarography, isotopic dilution. .
KEY concentration, uranium, seawater, analysis, extraction
- 419 AUTH Wodkiewicz, L.; Dybczynski, R.
DATE 1974
TITL Anion-exchange behavior of some elements on a weakly basic anion exchanger in hydrobromic acid medium.
CITA J. Chromatogr. 102: 277-285 (1974). (French).
COUN Poland
ABST The adsorbability of several elements was studied in the system: weakly basic anion exchange resin Amberlite IRA-68 (Br⁻)-HBr+ Br⁻. Distribution coefficients of more than 30 elements were determined by batch equilibration in HBr concentration range 0.01 to 12M. In most instances the distribution coefficients increase with increase in acid concentration. Some elements, such as Cu, Co, Fe, Mn, In, Ga, and U, are adsorbed only at acid concentrations greater than 4 M. Pt, Hg, Ag, and, to a somewhat smaller extent, Au, Tl and Re, show high distribution coefficients in dilute HBr solution. In general, the adsorabilities of elements on Amberlite IRA-68 in the bromide system are lower than the adsorabilities in analogous system with strongly basic Dowex 1 resin. The observed differences in distribution coefficients are high enough for some interesting separations to be obtained. The possibility of column separations of several mixtures, such as Eu-U, Zn-Cd-Hg and Cu-Ag-Au, was demonstrated. The influence of temperature on the separation of the latter mixture was studied, and the most important chromatographic parameters (distribution coefficients, separation factors, resolutions, and plate heights) were calculated.
KEY ion exchange, concentration, uranium, temperature, trace metals, adsorbent, extraction

- 420 AUTH Woodroof, J.G.; Young, C.T.
DATE 1967
TITL Ocean raw materials.
CITA Kirk-Othmer Encyclopedia of Chemical Technology, Second Edition, 14: 150-157 (1967).
COUN USA
ABST The oceans of the world cover nearly three-quarters of the surface of the earth to an average depth of over 12,000 ft. The presence of this vast quantity of water gives our planet a special position in the solar system. No other is believed to have substantial quantities of liquid water. The economic uses of the ocean are even now, quite impressive. It has been estimated that the annual value of oceanic activities (not including transportation, conventional recreation, most naval operations) is more than \$7.6 billion and that the growth rate of ocean-connected market is close to 15% each year. In addition to being a source of raw materials, the oceans serve as a major heat sink, as an artery of commerce, as a source of fresh water, and as a repository for the waste products of mankind. The present annual value of the production of raw materials and products from the ocean is given, excluding fish or marine mammal products. These materials are produced from seawater, beach sands, the surface and beneath the surface of the continental shelf. The water of the oceans is quite probably the most complex solution that will ever be encountered. More than 77 elements have been found dissolved in seawater. The technical chemistry of seawater, despite the complexity of the solution is determined by the nine major components and it is from these nine that industrial products are now recovered. Cations include sodium, magnesium, calcium, potassium, and strontium. Anions include chloride, sulfate, bicarbonate, and bromide. All other constituents of seawater total less than 1% of the weight of the dissolved materials.
KEY water, economics, marine organisms, seawater, trace metals, adsorber, extraction, uranium, ion exchange
- 421 AUTH Wooster, W.S.
DATE 1970
TITL Eastern boundary currents in the South Pacific.
CITA Scientific Exploration of the South Pacific, Proceedings of Symposium during Ninth General Meeting of Scientific Committee of Oceanic Research, June 18-20, 1968, ed. by Warren S. Wooster, Scripps Institute of Oceanography, La Jolla, National Academy of Sciences, Washington DC, p. 60-68 (1970).
COUN USA
ABST The differences in the oceanography of the eastern and western sides of the oceans are by now well known. The intensification of horizontal flow in the west is matched by an intensification of oceanographic research

(CONT.)

activity in the Gulf Stream and the Kuroshio. On the eastern side, where oceanographic conditions are somewhat less dramatic, only the California Current has been studied with comparable vigor, and the North Atlantic analog, the Canary Current, remains little known to this day.

KEY current, seawater, temperature, salinity

- 422 AUTH Wooten, M.J.; Hirayama, C.; Panson, A.J.; Patton, J.T.
DATE 1976
TITL Uranium recovery from seawater. Final report.
CITA Electric Power Research Institute Report EPRI NP-132, Project 450-1 Gov. Rep. Announce. Index (U.S.) 76(17): 90 (1976).
COUN USA
ABST The objective of this study was to assess the feasibility of an electrochemical method of extracting uranium from seawater by laboratory experiments and analysis. The study also was directed at defining prospects for acquiring uranium by methods that result in very low environmental insult. The report describes in Section 1 the results of the experimental evaluation of electrolytic methods for obtaining uranium from seawater and in Section 2, the results of an assessment of alternative low environmental insult methods for acquiring uranium.
KEY uranium, seawater, analysis, environmental impact, extraction, concentration, chemical species, titanium, adsorbent, tidal system, multi-purpose process, economics, plant productivity
- 423 AUTH Worthington, L.V.
DATE 1976
TITL On the North Atlantic circulation.
CITA Johns Hopkins University Press, Baltimore, 110 p. (1976).
COUN USA
AREA North Atlantic
ABST This publication gives a detailed treatment of the circulation and characteristics of the North Atlantic Ocean. Abyssal and mid depth circulation is treated as well as surface circulation. Nearshore detail is minimal.
KEY current, temperature, salinity, climate, chemistry, w atlantic, mid atlantic, s atlantic
- 424 AUTH Wright, W.R.
DATE 1976
TITL The limits of shelf water south of Cape Cod, 1941-1972.
CITA Journal of Marine Research 34(1): 1-14 (1976).
COUN USA
AREA Cape Cod
ABST Some 19,000 bathythermograms and 1,600 oceanographic

(CONT.)

stations in the region 39° to 41° N, 69° to 72° W have been examined for evidence of changes in the character and position of the shelf water/slope water boundary. At the edge of the Middle Atlantic Bight between Cape Cod and Cape Hatteras the warm and saline waters of the North Atlantic Ocean meet the cooler and fresher waters of the continental shelf. The boundary between them is a complex region of interacting water masses, strong temperature and salinity gradients and continual change.

KEY current, climate, temperature, salinity, offshore, seawater, mid atlantic

425 AUTH Wright, W.R.; Parker, C.E.
DATE 1976
TITL A volumetric temperature/salinity census for the Middle Atlantic Bight.
CITA Limnology and Oceanography 21(4): 563-571 (1976).
COUN USA
AREA Nantucket, Cape Hatteras
ABST Two seasonal volumetric temperature/salinity diagrams have been prepared for the waters of the Middle Atlantic Bight from Nantucket Shoals to Cape Hatteras, to a depth of 200 m and extending as much as 130 km beyond the edge of the continental shelf. Total volume included is 23,145.6 km³, of which about half is slope water, more saline than 35‰.

KEY temperature, salinity, n atlantic, mid atlantic, offshore, seawater

426 AUTH Wyatt, B.; Burt, W.V.; Pattullo, J.G.
DATE 1972
TITL Surface currents off Oregon as determined from drift bottle returns.
CITA Journal of Physical Oceanography 2:286-293 (1972).
COUN USA
AREA Oregon
ABST It is generally known that surface currents off Oregon flow equatorward in summer when winds are from the northwest and poleward in the winter when winds are from the south. The annual cycle of surface currents indicated from these returns was as follows:
Northward--October through February Southward--May through August Variable--March, April and September. The Davidson current or (northward) winter current was considered to be any northward prevalence of surface flow. The Davidson current commonly reached 48-50° N. Mean surface currents in both summer and winter were 0.2 kt (150 n mi per month).

KEY current, pacific northwest, climate, offshore, seawater

427 AUTH Yamabe, M.; Kojima, M.; Umezawa, K.
DATE 1974
TITL Uranium from sea water.

(CONT.)

CITA Japan Kokai 76 67,216 (Cl. C22B60/02). 10 Jun 1976,
Appl. 74/141,724, 09 Dec 1974 (1974).

COUN Japan

ABST Sea water is passed through sheets of Uranium adsorbent with tubular or columnar projections between as a current disturber. Thus, TiO_2 of mean diam. 250 micron obtained by heating $Ti(SO_4)_2$ was coated on both sides of a stainless steel plate, 50 sheets were fixed with 60 glass beads of 5 mm diam. between each 2 sheets, and sea water contg. 3.2 ppb uranium was passed through at 102 cm/sec. for 2 days to adsorb 8.3 g uranium, vs 4.9 without the glass beads. Polyamidoxime on polyacrylonitrile filament taffeta and galena on polypropylene sheet were also used as adsorbents. (Abstracted in Chemical Abstracts 85: 111241d. 1976).

KEY seawater, uranium, adsorbent

428 AUTH Yemel'yanov, Ye.M.; Shimkus, K.M.
DATE 1976
TITL Concentrations of iron, aluminum, manganese and titanium in suspended matter in the Mediterranean Sea.

CITA Oceanology 15(4): 462-468 (1976).

COUN USSR

ABST On the basis of colorimetric and kinetic studies of 78 samples of suspended matter, we have discussed the concentrations and principal features of distribution of the suspended forms of Fe, Mn, Al, and Ti in the sea. The quantitative distribution of Al and Ti is controlled by the inflow and distribution of fluvial and eolian material, and increased amounts of these elements are concentrated towards the geosynclinal areas of the basin. The distribution of Fe and Mn is more complex. It is controlled by the inflow and distribution of terrigenous and biogenic materials and by the structure of the water masses. Large amounts of Fe have been found in the nearshore zones and in the centers of cyclonic gyres. The amount of Mn increases somewhat with depth.

KEY trace metals, seawater, titanium, analysis, concentration

429 AUTH Yemel'yanov, Ye.M.; Blazhis, I.K.; Yuryavichyus, R.Yu.;
Payeda, R.I.; Valyukyavichyus, Ch.A.; Yankauskas, I.I.
DATE 1972
TITL Determination of traces of iron, cobalt, and titanium in sea water and suspended matter (in samples from the Baltic Sea and Atlantic Ocean).

CITA Oceanology 11(6): 924-933 (1972).

COUN USSR

ABST Iron, cobalt, and titanium were determined in 250 samples of suspended matter on biological filters with pores 0.5μ to 0.7μ in diameter. The samples (1 to 3 mg) were prepared by "wet combustion". Iron was

(CONT.)

determined colorimetrically with violet pyrocatechol, titanium colorimetrically with tiron, and cobalt by the extraction-kinetic method. In the Baltic and North Seas and in the Northeast Atlantic, 5.7 to 2595.4 $\mu\text{g/liter}$ of Fe and 2.6×10^{-4} to 3.07×10^{-2} $\mu\text{g/liter}$ of Co were determined. In per cent of dry weight, the amounts are 0.29 to 24.81 and 1×10^{-5} to 1.38×10^{-3} %, respectively. In the Baltic Sea, 0.00 to 17.88 $\mu\text{g/liter}$ or 0.00 to 0.53% of Ti was determined.

KEY concentration, determination, iron, cobalt, titanium, baltic, north seas, atlantic

- 430 AUTH Yemel'yanov, Ye.M.; Yuryavichyus, R.Yu.; Blazhis, I.K.; Payeda, R.I.; Valyukavichyus, Ch.A.; Yankauskas, I.I.; Vlasenko, N.B.
DATE 1972
TITL Determination of traces of iron, cobalt, and titanium in plankton and foraminiferal tests.
CITA Oceanology 12(2): 294-301 (1972).
COUN USSR
AREA Atlantic, Baltic
ABST It was found possible to determine traces of iron, cobalt, and titanium in small plankton samples and calcareous tests by kinetic and colorimetric methods. These elements were found in plankton and foraminiferal tests from the Baltic Sea and the Atlantic Ocean (16 samples) in approximately the same concentrations as those determined by earlier investigators who used other methods.
KEY trace metals, analysis, marine organisms

- 431 AUTH Young, D.R.; McDermott, D.J.; Heesen, T.C.; Jan, T.K.
DATE 1975
TITL Pollution inputs and distributions off Southern California.
CITA Proceedings of the 169th National Meeting of the American Chemical Society, Marine Chemistry in the Coastal Environment, 8-10 April 1975.
COUN USA
AREA Southern California
ABST This paper deals with the pollution from such sources as industrial and municipal waste. Some preliminary discussion of the background setting is given.
KEY water, particulate, pacific southwest, environmental impact

- 432 AUTH Zlobin, V.S.
DATE 1966
TITL Accumulation of Uranium and Plutonium by Marine Algae
CITA Radiobiology 6(4): 219-27
COUN USSR
ABST A study was made of the accumulation of plutonium and uranium by marine algae in aquarium water following

(CONT.)

introduction of soluble salts. There was a possibility of formation of pseudocolloids on the suspended particles in the sea water. The northern marine algae *Chorda filum*, *Monostroma fuscum*, and *Laminaria saccharina* were found to accumulate plutonium-239 and natural uranium in their tissues to different degrees. The magnitude of the concentration factors was dependent both on the individual characteristics of the algae and on the physicochemical state of the plutonium-239 and uranium. A similar pattern of accumulation was observed for *Chorda filum* and *Monostroma fuscum* in the accumulation of plutonium-239; the most intensive concentration occurred up to the third day, followed by a slowdown without reaching equilibrium. The coefficients of accumulation of plutonium and uranium decreased in the series *Chorda filum* > *Monostroma fuscum* > *Laminaria saccharina*. A consideration of the natural alpha-radioactivity of the algae revealed that the main alpha-radioactivity is due to uranium. The processes of accumulation of uranium and plutonium by the algae were found to be relative independent.

KEY   uranium, plutonium, algae, extraction, biological.

2.2 Supplementary Listing

Several literature citations were either obtained or discovered missing from the FAMULUS data base after the latter had been prepared for final printing and indexed. Because incorporation of these citations into the data base would have delayed publication of this bibliography we chose to compile them into a supplementary data base. They are but few in number and we therefore hope that this decision will not cause excessive confusion or inconvenience to the reader. We apologise for any which does occur.

The supplementary citations will be referenced in the companion report with the prefix, "s", for example, [s8].

(CONT.)

- 1 AUTH Altschuler, Z.S.; Clarke Jr., R.S.; and Young, E.J.
DATE 1958
TITL Geochemistry of uranium in apatite and phosphorite.
CITA U.S. Geological Survey Professional Paper 314-D: 45-90 (1958).
ABST A very detailed examination is made of the geochemistry of uranium in primarily land based formations of apatite and phosphorite. Some attention is given to marine samples from the continental shelf off California.
KEY uranium, concentration, sediments

- 2 AUTH Anonymous
DATE 1962
TITL Special report on intake works at demonstration plant no. 2, San Diego.
CITA Appendix B of PB 181684, First Annual Report Subline Water Conversion Demonstration Plant; Progress Report #102, Office of Saline Water: B1-B15 (1962).
COUN USA
AREA California
ABST This report deals with systems.
KEY existing system, fouling

- 3 AUTH Baturin, G.N.
DATE 1973
TITL Uranium in the modern marine sedimentary cycle.
CITA Geochemistry International 10(5): 1031-1041 (1973).
ABST The concentrations and cycling of uranium in the earth's crusts, streams, oceans and marine sediments is discussed. Factors favoring enrichment in marine sediments include high amounts of organic matter and phosphorus, high uranium content in water, reducing conditions, slow sedimentation and renewal of bottom waters.
KEY uranium, concentration, sediments

- 4 AUTH Baturin, G.N.; and Kochenov, A.K.
DATE 1974
TITL Uranium content of oceanic phosphorites.
CITA Lithology and Mineral Resources Jan/Feb No. 1: 99-103 (1974).
ABST The results of determinations of uranium and P_2O_5 in 55 specimens of phosphorites obtained by Soviet expeditions in various regions of the oceans and the corresponding data of foreign authors. These are compared with samples of phosphate rocks and phosphorites of a Russian platform.
KEY uranium, concentration, sediments

- 5 AUTH Baturin, G.N.; Kochenov, A.V.; Kovaleva, S.D.
DATE 1966
TITL Certain peculiar features of uranium distribution in the waters of the Black Sea.
CITA Akademiia Nauk. SSSR. Doklady 156(3): 698-700 (in Russian) (1966).

(CONT.)

- COUN USSR
AREA Black Sea
ABST A field and laboratory study of processes involved in the incorporation of uranium into Black Sea sediments.
KEY chemistry, interstitial water, particulate, seawater, sediments, uranium
- 6 AUTH Binney, Stephen E.
DATE 1978
TITL Extraction of Uranium from Seawater. Phase I.
CITA Progress Report, July 7, 1978. Department of Nuclear Engineering, O.S.U.
ABST In continuing the work described in two previous reports, the adsorption qualities of silica gel were further examined. The silica gel adsorbed $21.5 \mu\text{g/g}$ in 2 days under the conditions of a low specific gravity sodium silicate solution (sp. gr. = 1.15), a three-day syneresis period and being freeze-dried as opposed to oven-dried. The previously reported high had been $5 \mu\text{g/g}$ in 15 days. Also, experiments were done with topo-adsorbent silica gel with a pore size of $12\text{\AA}$, to see if the larger pore size would increase the gel's loading capacity. No improvement was indicated, however. Present sensitivity of the delayed fission neutron (DFN) uranium counting system at 1 MW is 2000 counts per μg natural uranium. With a background of 32 counts, this represents a minimum level detection of 8.5 ppb. A study of potential sources of error showed no major problems. Future plans include the optimization of silica gel and the search for other resins and adsorbents, the construction of a new reactor made for long-term exposure of adsorbent to seawater, and a comparison of the He neutron detector with the BF neutron detector. Also, the DFN technique is being tested for measurement of U-235 , U-238 , and Th-232 .
KEY uranium, seawater, concentration, extraction, capacity, adsorption, adsorbent, analysis, economics
- 7 AUTH Calvert, S.E.
DATE 1976
TITL The Minerology and Geochemistry of Near-shore Sediments
CITA Chemical Oceanography, J.P. Riley and R. Chester eds. Vol. 6 Chapter 33: 187-280.
COUN U.K.
ABST This is part of an extensive work on chemical oceanography.
KEY uranium, sediment
- 8 AUTH Cinneide, S.O.; Scanlon, J.P.; Hynes, M.J.
DATE 1975
TITL Equilibria in uranyl carbonate systems--I; The overall stability constant of $\text{UO}_2(\text{CO}_3)_3^{4-}$.
CITA Journal of Inorganic Nuclear Chemistry 37: 1013-1018 (1975).
COUN UK

(CONT.)

- ABST Solutions of 8-hydroxyquinoline in chloroform have been shown to extract the uranyl(VI) ion from aqueous carbonate media and from aqueous solutions of two phenylarsonic acid derivatives, as the species $UO_2(OX)_2$ HOX. A method for calculation the overall stability constant, $\beta_{3(c)}$ of $UO_2(CO_3)_3^{4-}$ from the resultant distribution data is outlined. The value obtained is $\log \beta_{3(c)} = 21.54 \pm 0.03$ at an ionic strength of 0.1 M.
- KEY uranium, chemical species
- 9 AUTH Committee on Commerce, United States Senate
DATE 1974
TITL The Economic Value of Ocean Resources to the United States
CITA Committee on Commerce, Pursuant to S. Res. 222 National Ocean Policy Study
COUN USA
ABST This study takes into consideration the mineral resources of the ocean, the living resources and the non-extractive uses.
KEY seawater, multi-purpose process
- 10 AUTH Gundersen, K.R.; Corbin, J.S.; Hanson, C.L.; Hanson, M.L.; Hanson, R.B.; Russell, D.J.; Stollar, A.; Yamada, O.
DATE 1976
TITL Structure and biological dynamics of the oligotrophic ocean photic zone off the Hawaiian Islands
CITA Pacific Science 30(1): 45-68 (1976)
COUN USA
AREA Hawaii
ABST The base of the photic zone, as defined by the 1-percent light depth and discontinuance of photosynthetic carbon fixation, was determined to be at 130-140 meters on stations off the Hawaiian Islands. Measurements, including radiant energy transmission, plant nutrients, and chlorophylls, were made in the depth interval 0-250 meters. The numerical vertical abundance, biomass, and the identity of phytoplankton, microzooplankton, bacteria, and fungi were determined. A discussion of the biological dynamics within this photic zone is based on these observations and on measurements of photosynthetic production, nitrogen fixation, and other microbial activities.
KEY biological productivity, marine organisms, chemistry, nutrients, temperature, salinity, seawater, pacific islands
- 11 AUTH Inman, D.L.; Brush, B.M.
DATE 1973
TITL The coastal challenge.
CITA Science 181: 20-32 (July 1973).
COUN USA
ABST Fragile ribbons which border our land require more understanding, new technology, and resolute planning.

(CONT.)

- KEY nearshore, seawater, sediments, current
- 12 AUTH Klygin, A.E.; Smirnova, I.D.
DATE 1959
TITL The dissociation constant of the $\text{UO}_2(\text{CO}_3)_3^{4-}$ ion.
CITA Russian Journal of Inorganic Chemistry 4(1): 16-18 (1959).
COUN USSR
ABST The overall dissociation constant of uranyl tricarbonat ion was determined from solubility measurements of uranyl hydroxyquinolate.
KEY uranium, chemical species
- 13 AUTH Laevastu, T.; Avery, D.E.; Cox, D.C.
DATE 1964
TITL Coastal currents and sewage disposal in the Hawaiian Islands
CITA Hawaii Institute of Geophysics HIG-64-1 97 p. (1964)
COUN USA
AREA Hawaii
ABST IN this report the current components are first discussed separately. The actual resultant coastal current systems around each of the islands are then described systematically in as much detail as present information allows.
KEY current, seawater, pacific islands
- 14 AUTH Lal, D.
DATE 1977
TITL The oceanic microcosm of particles.
CITA Science 198(4321): 997-1009 (9 Dec 1977).
COUN India
ABST This is an analysis of the suspended matter larger than 1 micrometer in the ocean.
KEY particulate, water, seawater
- 15 AUTH Langmuir, D.
DATE 1977
TITL Uranium solution--mineral equilibria at low temperatures with applications to sedimentary ore deposits.
CITA U.S.D.O.E. GJB X 54(78): 39 (1977).
COUN USA
ABST A critical evaluation of the thermodynamic properties of 42 dissolved uranium species and 30 uranium-bearing solid phases at 25°C has been made. Applications of this data are used in determining species under varying chemical conditions in fresh water. In oxidized waters, uranyl fluoride complexes and uranyl ion predominate below pH 5; from about pH 4-7.5, $\text{UO}_2(\text{HPO}_4)_2^{3-}$ is the principal species, while at higher pH's, UO_2CO_3 and the di- and tri-carbonate complexes predominate.
KEY uranium, water, chemical species, chemistry, adsorption
- 16 AUTH Lee, T.N.; Brooks, D.A.
DATE In Press

(CONT.)

- TITL Initial observations of current, temperature and coastal sea level response to atmospheric and Gulf Stream forcing on the Georgia Shelf.
CITA In Press
COUN USA
AREA Georgia, South Carolina
ABST Winter observations of winds, coastal sea level and currents in the outer region of the Georgia Shelf indicate considerable differences in the dynamics governing shelf water motions between inner and outer shelf regions.
KEY current, temperature, salinity, climate, nearshore, offshore, seawater, s atlantic
- 17 AUTH Lee, T.N.; Mayer, D.A.
DATE 1977
TITL Low-frequency current variability and spin-off eddies along the shelf off Southeast Florida.
CITA Journal of Marine Research 35(1): 193-220 (1977).
COUN USA
AREA Florida
ABST Time series analyses of current meter records from a 6-element box array installed on the narrow shelf (<5 km) off Miami, Florida revealed two distinct current regimes. Current oscillations at the shelf break (30m isobath) appeared to be primarily produced by Florida Current spawned events, such as low frequency (periods of 2 days to 2 weeks) wave-like meanders of the Florida Current and the transient occurrence of small diameter spin-off eddies, both of which may be indirectly related to wind forcing.
KEY current, temperature, nearshore, offshore, seawater, s atlantic
- 18 AUTH Lisitzin, A.P.
DATE 1972
TITL Sedimentation in the world ocean.
CITA Society of Economic Paleontologists and Mineralogists, special publication no. 17, Tulsa, Oklahoma: 218 pp. (1972).
COUN USSR
ABST This book emphasizes the nature, distribution and behavior of marine suspensions.
KEY particulate, seawater, geology
- 19 AUTH Menard, H.W.; Smith, S.M.
DATE 1966
TITL Hypsometry of ocean basin provinces.
CITA Journal of Geophysical Research 71(18): 4305-4325 (1966).
COUN USA
ABST This reference provides a breakdown of ocean volumes at different depth levels.
KEY seawater

(CONT.)

- 20 AUTH Meyers, G.
DATE 1975
TITL Seasonal variation in transport of the Pacific North
Equatorial Current system relative to the wind field
CITA Journal of Physical Oceanography 5(3) 442-449 (1975)
COUN USA
AREA Hawaii
ABST Geostrophic transport in the upper 300 m ranged from 11×10^6 m³/s to 23×10^6 m³/s. Observed vertical
displacements of the thermocline and variations in the
strength of the current agreed with the predictions of a
model. According to the model, the divergence of Ekman
transport causes variation in the meridional slope of
the thermocline and in the geostrophic current speed.
KEY current, seawater, pacific islands
- 21 AUTH Millas, J.
DATE 1965
TITL The hurricanes of the Caribbean Sea and adjacent regions
during the eighteenth century.
CITA U. of Miami Final Report; U.S. Weather Bureau, Contract
No. CWB-10938 (1965).
COUN USA
AREA Caribbean, Equatorial Atlantic
ABST An estimate of frequencies is given.
KEY climate, caribbean
- 22 AUTH The MODE Group
DATE 1978
TITL The mid-ocean dynamic experiment.
CITA Deep Sea Research 25: 859-910 (1978).
COUN USA
AREA North Atlantic
ABST The Mid-Ocean Dynamic Experiment was an extensive
program to investigate mid-ocean mesoscale eddies by
numerous techniques and equipment. These experiments
found conclusive evidence for the existence of these
eddies. For the North Atlantic there is a band of
variability around 100 day period and 70 km scale.
KEY current, seawater, water, offshore
- 23 AUTH Muench, R.D.; Mofield, H.O.; and Charnell, R.L.
DATE 1978
TITL Oceanographic conditions in lower Cook Inlet: spring and
summer 1973.
CITA Journal of Geophysical Research 83(C10): 5090-5098
(1978).
COUN USA
AREA Alaska
ABST Current, salinity, and temperature data obtained from
lower Cook Inlet during May-September 1973 have been
analyzed. These data define a regional mean circulation
whose main features are (1) a concentrated southward
flow along the western shore of lower Cook Inlet of
water from upper Cook Inlet which has been diluted by

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river input, (2) an intense westerly flow across the lower inlet which originates from Kennedy Entrance, exits via Shelikof Strait, and is bathymetrically steered in a cyclonic sense during its transit across the inlet, and (3) a slow northward drift in eastern lower Cook Inlet. The southward flow is an estuarine mode due to freshwater input to upper Cook Inlet.

KEY current, temperature, salinity, estuary, seawater, river, water, nutrients, climate, tide, chemistry, alaska

- 24 AUTH NOAA
DATE 1977
TITL Tide Tables 1978; Vol. 2, Atlantic Coast of North & South America
CITA U.S. Department of Commerce; Washington D.C. (1977)
COUN USA
ABST Predictions of tidal heights are given daily for various localities. Also means for extrapolation to adjacent regions is included.
KEY tide
- 25 AUTH NOAA
DATE 1977
TITL Tide tables 1978; Vol. 3, Pacific Coast of North and South America
CITA U.S. Department of Commerce; Washington D.C. (1977)
COUN USA
ABST Predictions of tidal heights are given daily for various localities. Also means for extrapolation to adjacent regions is included.
KEY tide
- 26 AUTH Patzert, W.
DATE 1969
TITL Eddies in Hawaiian waters
CITA Hawaii Institute of Geophysics HIG-69-8 122 p. (1969)
COUN USA
AREA Hawaii
ABST Oceanographic observations near the Hawaiian Islands demonstrate that ocean circulation is extremely variable and is dominated by eddies with diameters ranging from 50 to 150 kilometers. The data from 20 cruises have been analyzed. Most of the eddies are cyclonic, and have been observed during all seasons. Observations show that the flow in them is nearly geostrophic and volume transports can be as large as 8 million m^3/sec . Although surface flow around them can be in excess of 100 cm/sec, the eddies are relatively shallow in depth and most of the horizontal flow is concentrated in the upper 150 m, above the 20°C isothermal surface.
KEY current, seawater, pacific islands
- 27 AUTH Patzert, W.; Wyrteki, K.
DATE 1974

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- TITL Anticyclonic flow around the Hawaiian Islands indicated by current meter data
CITA Journal of Physical Oceanography 4(4): 573-575 (1974).
COUN USA
AREA Hawaii
ABST The resultant flow calculated from 42 current meter measurements near the Hawaiian Islands for different periods of from two to six weeks between October 1964 and May 1969 indicate nearshore anticyclonic circulation around the islands. Two possible mechanisms generating this flow are considered: steady currents induced by oscillations around the islands and the cyclonic shear imposed on the local trade winds by the islands.
KEY current, seawater, pacific islands
- 28 AUTH Robinson, A.R.
DATE 1975
TITL The variability of ocean currents.
CITA Reviews of Geophysics and Space Physics 13: 593-601 (1975).
COUN USA
ABST This is a short review article giving numerous references.
KEY current, water, seawater
- 29 AUTH Scanlon, J.P.
DATE 1977
TITL Equilibria in uranyl carbonate systems--II; The overall stability constant of $\text{UO}_2(\text{CO}_3)_2^{2-}$ and the third formation constant of $\text{UO}_2(\text{CO}_3)_3^{4-}$.
CITA Journal of Inorganic and Nuclear Chemistry 39: 635-639 (1977).
COUN USA
ABST The equilibrium in solution between the tricarbonates and dicarbonate complexes of the uranyl ion has been investigated. It has been shown that these species are the only species of the uranyl ion existing in solutions of sodium bicarbonate in the concentration range 0.03 M-0.15 M. It has also been concluded that it is not feasible to isolate the dicarbonate complex as the only form of UO_2^{2+} in carbonate media. A spectrophotometric determination of the third formation constant of $\text{UO}_2(\text{CO}_3)_3^{4-}$ gave a value for $k_3 = 3.01 \times 10^5$ ($t = 20^\circ$, $\mu = 0.1$). An extension of the solvent extraction method previously applied to the determination of the overall stability constant of $\text{UO}_2(\text{CO}_3)_2^{2-}$ gave a value of $\beta_{(2c)} = 1.57 \times 10^{16}$ ($t = 20^\circ$, $\mu = 0.1$). The absorption spectrum of $\text{UO}_2(\text{CO}_3)_2^{2-}$ has been calculated from equilibrium and optical density measurement.
KEY uranium, chemical species
- 30 AUTH Sergeyeva, E.I., Nikitin, A.A., Khodakovskiy, I.L.; Naumov, G.B.
DATE 1972
TITL Experimental investigation of equilibria in the system

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- $\text{UO}_3\text{-CO}_2\text{-H}_2\text{O}$ in 25-200°C temperature interval.
 CITA Geochemistry International 9: 900-910 (1972).
 COUN USSR
 ABST Solubility of uranyl carbonate in aqueous solutions of carbon dioxide was determined in the 25-200°C temperature interval and the data were used to calculate stability constants of uranyl carbonate complexes: UO_2CO_3^0 and $\text{UO}_2(\text{CO}_3)_2^{2-}$ and the activity products of $\text{UO}_2\text{CO}_3(\text{cr})$. Equilibrium constants of reaction $\text{UO}_2\text{CO}_3(\text{cr}) + \text{H}_2\text{O}(\text{liq}) = \text{UO}_2(\text{OH})_2(\text{cr}) + \text{CO}_2(\text{g})$ were determined at temperatures of 100, 150, and 200°C. The thermodynamic parameters (ΔH_f^0 , ΔG_f^0 , and S_f^0) of the phases formed in the system $\text{UO}_3\text{-CO}_2\text{-H}_2\text{O}$ were calculated, and the results were used to analyze various factors (T, pH, P_{CO_2}) influencing formation of uranyl carbonate complexes in hydrothermal solutions, and of the natural uranyl carbonate, rutherfordite.—Author's Abstract
 KEY uranium, chemical species, chemistry
- 31 AUTH Stommel, H.
 DATE 1956
 TITL The Gulf Stream.
 CITA University of California Press, Los Angeles: 248 pp. (1956).
 COUN USA
 AREA North Atlantic
 ABST This is a classic text which presents many of the methods used by oceanographers. It gives an historical introduction to the Gulf Stream and develops and discusses many of the theories and observations of this current.
 KEY current, offshore, seawater, temperature, salinity
- 32 AUTH Stone, R.S.
 DATE 1942
 TITL Meteorology of the Virgin Islands.
 CITA Scientific Survey of Puerto Rico and the Virgin Islands, vol. XIX, New York Academy of Sciences: 138 pp. (1942).
 COUN USA
 AREA Puerto Rico, Virgin Islands
 ABST This is a long and detailed study using records as far back as the 1700's.
 KEY caribbean, climate
- 33 AUTH Sverdrup, H.U.; Johnson, M.W.; and Fleming, R.H.
 DATE 1942
 TITL The oceans: their physics, chemistry and general biology.
 CITA Prentice Hall, Inc.: 1037 p. (1942).
 COUN USA
 ABST This is a classic oceanographic text covering most aspects of oceanography.
 KEY biological activities, chemistry, current, estuary, marine organisms, nearshore, nutrients, offshore, particulate, salinity, seawater, sediments, temperature,

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tide

- 34 AUTH Umemoto, S.
DATE 1955
TITL U-234/U-238 in seawater from the Kuroshio region.
CITA Journal of Geophysical Research 70: 5326-5327 (1965).
ABST The U-234/U-238 ratio in natural water was determined and it seems to be greater than unity. U-234 leaches preferentially from natural minerals because of the recoiled atoms caused by alpha decay. The U-234/U-238 ratio in seawater, therefore, is expected to be greater than unity. Sample preparation was described, having concentrations of 3.2 and 2.9 micrograms/liter.
KEY uranium, concentration, seawater, analysis, extraction, elution
- 35 AUTH United States Department of Interior Fish & Wildlife Service
DATE 1970
TITL Nation Estuary Study; Vol. 2, appendix A - staff report: 303p (1970)
CITA United States Department of the Interior Fish & Wildlife Service, Bureau of Sport Fisheries & Wildlife, and Bureau of Commercial Fisheries; Washington D.C.
COUN USA
ABST This is a staff report summarizing background information and problems of the nations estuaries and the Great Lakes. It draws from published material of federal agencies, institutions and organizations.
KEY estuary, environmental impact, geography
- 36 AUTH Sturges, W.
DATE 1975
TITL On the general ocean circulation.
CITA Reviews of Geophysics and Space Physics 13:603-607 (1975).
COUN USA
ABST This is a short review article giving numerous references.
KEY current, water, seawater
- 37 AUTH Wust, G.
DATE 1964
TITL Stratification and circulation in the Antillean-Caribbean Basins.
CITA Columbia University Press, (1964)
COUN Germany
AREA Caribbean Sea
ABST The core method is used to investigate the circulation of the Caribbean. Temperature, salinity, and oxygen are used as tracers. Surface currents are given for the different seasons. An atlas of the waters of the Caribbean is included.
KEY current, offshore, salinity, temperature, caribbean, gulf of mexico, seawater

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- 38 AUTH Wyrтки, K.
DATE 1974
TITL Sea level and the seasonal fluctuations of the equatorial currents in the Western Pacific Ocean.
CITA Journal of Physical Oceanography 4(1): 91-99 (1974).
COUN USA
AREA Hawaii
ABST The seasonal variations of the dynamic topography relative to 500 decibars in the western equatorial Pacific, using data from 6900 hydrographic stations, are compared with the seasonal fluctuations of sea level observed at eleven islands. It is shown that the changes in the meridional profile of sea level correlate with changes in the strength of the major ocean currents measured by their speed or by geostrophic transports. The strength of the North Equatorial Current and that of the Countercurrent vary synchronously, both being strong in fall and weak in spring. The South Equatorial Current varies exactly out of phase with the two Northern Hemisphere currents, but is apparently in phase with the Undercurrent.
KEY current, seawater, pacific islands
- 39 AUTH Wyrтки, K.; Graefe, V.; Patzert, W.
DATE 1969
TITL Current observations in the Hawaiian Archipelago.
CITA Hawaii Institute of Geophysics HIG-69-15 101 p. (1969)
COUN USA
AREA Hawaii
ABST From 1965 to 1969 current measurements with moored current meters were made in the Hawaiian Archipelago for periods of from two to six weeks. A discussion of the results shows that hardly any consistent resulting flow takes place through the Archipelago. The semidiurnal tide governs most of the current pattern. The flow associated with the semidiurnal tide wave represents a progressive wave approaching the Archipelago from the northeast. Typical amplitudes of the tidal current are 20 to 30 cm/sec.
KEY current, seawater, pacific islands

CHAPTER 3

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3.1 Author Index

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5 Solvent extraction of uranium (VI) by N-m-tolyl-o-methoxybenzohydroxamic acid.

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7 Studies on the hydrolysis of metal ions: X. the hydrolysis of the uranyl ion, UO_2^{2+} .

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- 282 Screens of OTEC plants.

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- 142 New York Bight water stratification--October 1974.

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- 331 Electrical analog model study of the alluvial aquifer in the Yabucoa valley, Puerto Rico, phase 2--the planning, construction, and use of the model.

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- 10 Rapid radiometric assay for radium and application to uranium ore process solutions.

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- 29 Water resources data for Puerto Rico, part 1, surface water records.
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- 32 The Preconcentration of various trace elements in seawater by solvent extraction and ring oven.

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- 52 Uranium determinations in deep-sea sediments and natural waters using fission tracks.

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