UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

INVESTIGATIONS OF DOMESTIC RADIOACTIVE RAW MATERIALS, BERYLLIUM, AND OTHER TRACE ELEMENTS

PREPARED FOR U. S. ATOMIC ENERGY COMMISSION

MONTHLY REPORT--NOVEMBER 1951

TRACE ELEMENTS OFFICE

Contents

	Page
Summary	7
Reconnaissance investigations, domestic	9
Property examinations	9
Copper-uranium deposits in sandstones	9
Relation of volcanism of uranium deposits	11
Central Mineral Belt, Colorado	11
Uraniferous granitic rocks	11
Colorado Front Range	13
Central City district, Gilpin County	13
Lawson-Dumont district, Clear Creek County	13
Caribou mine, Boulder County	14
Prairie Divide district, Larimer County	14
Ralston Creek district, Jefferson County	15
Leyden coal mine, Jefferson County	15
Silver Reef, Washington County, Utah	15
Bulloch claims, Kane County, Utah	16
Thomas Range fluorite district, Juab County, Utah	17
White Signal-Black Hawk districts, Grant County, New Mexico	17
Boulder batholith, Montana	18
Lost Creek schroeckingerite deposit, Sweetwater County, Wyoming	18
Yellow Canary claims, Daggett County, Utah	19
Craven Canyon area, Fall River County, South Dakota	19
Clinton group of Pennsylvania and New York	20
Radon in natural gas	21
Airborne detection	22
Reports	23
Reconnaissance investigations, Alaska	25
General information	25
Colorado Plateau, exploration	26
Introduction and summary	26
Field work in progress	26
East Gateway district, Mesa County, Colorado	26
Uravan district, Montrose County, Colorado	29
Slick Rock district, San Miguel County, Colorado	31
Thompsons district, Grand County, Utah	32
Field work recessed or completed	32
Radiometric logging of drill holes	33
Resistivity studies	34
Radiometric scanning of core	35
Claim inventory and appraisal	35
Information to claim owners and lessees	36
Colorado Plateau, geologic studies	37
Field work in progress	37
Resource appraisal	37

Page

Field work recessed..... 37
Stratigraphic studies..... 37
Resource appraisal..... 37
Regional mapping..... 38
Ground-water studies..... 38
Geochemical prospecting..... 38
Pre-Morrison studies (Colorado Plateau)..... 39
Field work recessed..... 39
Monument Valley, Apache and Navajo Counties, Ariz..... 39
White Canyon, San Juan County, Utah..... 39
Capitol Reef, Wayne County, Utah..... 40
Northwest phosphate..... 41
Geologic mapping..... 41
Stratigraphic and paleontologic studies..... 41
Southeast phosphate..... 43
Lignite and coal investigations and black-shale reconnaissance..... 46
Silver Peak Range, Esmeralda County, Nevada..... 46
Powder River Basin, Campbell and Johnson Counties, Wyoming..... 46
Slim Buttes, Harding County, South Dakota..... 47
Red Desert, Sweetwater County, Wyoming..... 47
Goose Creek district, Cassia County, Idaho..... 48
La Ventana Mesa, Sandoval County, New Mexico..... 48
General information..... 49
Thorium and monazite investigations..... 51
Wet Mountains-Haputa Ranch, Custer County, Colorado..... 51
Mountain Pass, San Bernardino County, California.....
Southeastern monazite 52
General information..... 53
Uranium in natural water..... 54
Laboratory investigations..... 57
Research..... 57
Chemical..... 58
Mineralogic..... 58
Spectrographic..... 59
Radiometric..... 59
Reports forwarded..... 60
Trace Elements Investigations reports..... 60
Trace Elements Memorandum Reports..... 60
Beryllium-bearing rocks..... 61
Financial and personnel statement..... 61
Geographic index..... 62

ILLUSTRATIONS

		Page
Figure 1.	Location of Trace Elements field projects in the United States.....	24
2.	Map of part of the Colorado Plateau, showing the areas of drilling.....	28
3.	Colorado Plateau project, location of drill holes, Outlaw Mesa, East Gateway district, Mesa County, November 1951.....	In envelope
4	Colorado Plateau project, location of drill holes, Horse Mesa, Uravan district, Mesa and Montrose Counties, November 1951.....	In envelope
5.	Colorado Plateau project, location of drill holes, Atkinson Mesa, Uravan district, Montrose County, November 1951.....	In envelope
6.	Colorado Plateau project, location of drill holes, Spring Creek Mesa, Uravan district, Montrose County, November 1951.....	In envelope
7.	Colorado Plateau project, location of drill holes, Club Mesa, Uravan district, Montrose County, November 1951.....	In envelope
8.	Colorado Plateau project, location of drill holes, Long Park district, Montrose County, November 1951.....	In envelope
9.	Colorado Plateau project, location of drill holes, Spud Patch area, Slick Rock district, San Miguel County, November 1951.....	In envelope
10.	Colorado Plateau project, location of drill holes, Yellow Cat area, Thompsons district, Grand County, Utah, November 1951.....	In envelope
11.	Florida phosphate project, location of company tracts examined and TVA drill holes, November 1951..... (Seven sheets: A, B, C, D, E, F, and G.)	In envelope

TABLES

		Page
Table 1.	Domestic reconnaissance drilling data, November 1951	9
2.	Summary of reserves of radioactive material of current Reconnaissance field projects, November 1951	10
3.	Summary of exploration, Colorado Plateau project, November 1951	27
4.	Mapping and sampling data, Northwest phosphate project	41
5.	Sampling and drilling data, Southeast phosphate project	43
6.	Sources of water containing greater than 10 ppb of uranium	55-56
7.	Analytical work and sample inventory	57
8.	Summary of personnel by projects	

INVESTIGATIONS OF DOMESTIC RADIOACTIVE RAW MATERIALS AND OTHER TRACE ELEMENTS

MONTHLY REPORT--November 1951

SUMMARY

Significant data reported in November for projects in the U. S. Geological Survey's Trace Elements program are summarized below:

Reconnaissance investigations, domestic.--Carnotite, discovered in August 1951 in the Craven Canyon area, sec. 24 and 25, T. 7 S., R. 2 E., and secs. 19 and 30, T. 7 S., R. 3 E., Fall River County, S. Dak., was examined during November. Reconnaissance mapping in the region indicates that the known carnotite occurrences are restricted to the lower 100 to 150 feet of the Lower Cretaceous Lakota formation. From surface exposures on the claims it is estimated that there are at least 150 tons of indicated reserves containing 0.16 to 0.25 percent uranium and 200 tons containing 0.08 percent uranium. The inferred reserves in known deposits are estimated as 90 tons containing 0.15 to 0.25 percent uranium and 2030 tons containing 0.02 to 0.08 percent uranium.

Auger drilling for schroeckingerite on the northeast side of the Cyclone Rim fault zone that marks the northeast limit of the deposit heretofore explored, has disclosed a new deposit that has a length of more than 3,400 feet and is of unknown width. This new discovery represents a marked increase in the economic potentialities of the region.

Seventy tons of 0.1 percent uranium (in addition to previously estimated reserves) are reported from the Caribou mine, Boulder County, Colo.

The total indicated reserves on the Bulloch property were estimated during November to be 3,780 tons of material containing 0.1 percent uranium; this includes 100 tons reported last month.

A joint aeromagnetic-radioactivity survey was in progress in Lake, Cook, Beltrami, and Lake of the Woods Counties, Minn. and a brief survey was made in Nye County, Nev. Examination of the records disclosed no radioactivity anomalies of interest.

Colorado Plateau, exploration.--A total of 12,100 tons of ore was found by 43,820 feet of drilling in Colorado on Outlaw Mesa, Mesa County; on Horse Mesa, Atkinson Mesa, Dolores Bench, Spring Creek Mesa, San Miguel Bench, Club Mesa, Long Park, Montrose County; and in Utah in the Yellow Cat area, Thompson's district, Grand County.

Northwest phosphate.--A formerly unexposed part of one stratigraphic section of the Phosphoria formation was measured, described, and sampled east of Georgetown, Bear Lake County, Idaho.

Southeast phosphate.--Drilling was continued by the International Minerals and Chemical Corp. on its French tract, Polk County, Fla., under contract with the U. S. Atomic Energy Commission. Virginia-Carolina Chemical Corporation's drilling program on its Homeland and Clear Springs tracts, Polk County, also under contract with the Atomic Energy Commission, has been completed.

Coal and lignite investigations and black-shale reconnaissance.--Ten carnotite deposits, in addition to the one described last month, were found during November in Johnson and Campbell Counties, the Powder River Basin, Wyo. These deposits, together with about eight low-grade carnotite deposits, occur in an area of 220 square miles; additional field work may show that this area is even larger.

The high grade of some of these deposits, the easy accessibility throughout the area, and the fact that strip mining methods can be applied to all the deposits found to date, makes this area favorable for commercially exploitable deposits.

Thorium and monazite investigations.--Seven holes, totaling about 70 feet in depth, have been churn drilled at Area 1 on Knob Creek, Cleveland County, N. C. by the U. S. Bureau of Mines. The area also is being mapped in detail by the Geological Survey.

Uranium in natural water.--Of 48 samples collected by the Geological Survey during the past several months to test the uranium content of natural waters, the sample that most closely approaches the minimum requirements stipulated is from Cimarron Creek, in the SE¼ sec. 16, T. 48 N., R. 16 W., Montrose County, Colo.

Reports forwarded.--In November, three Trace Elements Investigations Reports and four Trace Elements Memorandum Reports were transmitted to the Atomic Energy Commission.

Other projects.--In November, work similar to that previously in progress was continued on the following projects, and no outstanding results pertaining to these projects were reported.

Reconnaissance investigations, Alaska
Colorado Plateau, geologic studies
Pre-Morrison studies (Colorado Plateau)
Laboratory investigations

RECONNAISSANCE INVESTIGATIONS, DOMESTIC

During November, field work was conducted mainly in California, Colorado, Minnesota, Montana, Nevada, New Mexico, Oregon, South Dakota, Utah, and Wyoming. Drilling data are given in table 1; a summary of reserves of radioactive material for current field projects is given in table 2.

Table 1.--Domestic reconnaissance drilling data, November 1951.

Project	Number of holes		Feet	
	This month	Total	This month	Total
Leyden coal mine	2	6	655	3,147
Lost Creek schroeckingerite	37	128	549	2,776
White Signal district	1?	2?	350?	580?
Thomas Range	1	1	214	502
Haputa ranch area	1	1	178	178

Property examinations

No private property examinations were made during November and no examinations are scheduled definitely for December.

Copper-uranium deposits in sandstones

No reconnaissance field work was done in the study of copper-uranium deposits in sandstones. A mineralogic and petrographic study of samples from the various deposits examined during the 1951 field season is in progress. Preliminary studies of polished sections of samples taken from the Shinarump conglomerate on the west side of the San Rafael Swell show

Table 2.--Summary of reserves of radioactive material of current Reconnaissance field projects, November 1951.

State County Area	Material	Short tons (inferred)	Uranium (percent)
Colorado			
Boulder County			
Caribou mine	---	10	0.15
	Pitchblende-bearing veins.	70	0.10[1]
Jefferson County			
Leyden mine	Silicified carbonaceous silt.	9,200	0.19
Larimer County			
Copper King mine	Pitchblende, pyrite, and sphalerite veins.	200	1.0
South Dakota			
Fall River County			
Craven Canyon area	Carnotite in Lakota fm.	150[2]	0.16-0.25
		210[2]	008
		90	0.15-0.25
		2030	0.02-0.08
Utah			
Daggett County			
Yellow Canary claims	Tyuyamunite coating fracture surfaces.	500	0.04
Kane County			
Bulloch claims	Carnotite-bearing sandstone.	3780	0.1
Wyoming			
Sweetwater County			
Red Desert	Schroeckingerite-bearing beds. [3]	11,700[4]	0.1
	do.	55,000[5]	0.1
	Uraniferous lignite beds.	255,000,000[4]	0.005
	do.	2,000,000,000[5]	0.005

1/ Equivalent uranium.
2/ Indicated reserves.
3/ Does not include reserves for the extensions of the deposit found during the 1951 field season.
4/ Calculated ore (revised April 1951), Trace Elements Investigations Report 122 (in preparation).
5/ Potential ore (revised April 1951), Trace Elements Investigations Report 122 (in preparation).

that appreciable amounts of sulfides, chiefly chalcopyrite and bornite, occur within hydrocarbon pellets found in the formation. One experimental autoradiograph, using an alpha particle plate, showed uniform distribution of radioactivity throughout the pellet; in addition, concentrations of radioactivity, which may be caused by pitchblende, were noted.

A preliminary report is in preparation that summarizes the results of the 1951 investigations in New Mexico, Colorado, Utah, Idaho, and Wyoming.

Relation of volcanism to uranium deposits

Field study was made of carnotite deposits near the Carrizo Mountains, Apache County, Ariz. Office and laboratory study was continued of the relation of clay minerals and carbonaceous materials in sediments to uranium and vanadium minerals.

Central Mineral Belt, Colorado

Field work in the Central Mineral Belt was recessed during November.

Uraniferous granitic rocks

Granitic rocks were studied and sampled in California, Oregon, and Nevada.

Near Waldport, Lincoln County, Ore., an elongate stock of nepheline syenite at Blodgett Peak contains rather uniformly low radioactivity, probably about 0.002 percent equivalent uranium.

Near Eureka, Humboldt County, Calif., a small stock of anorthoclase trachyte, similar to those in the Blue Lake quadrangle to the east, contains comparatively low radioactivity, probably about 0.003 percent equivalent urani

At Downieville, Sierra County, Calif., several small granitic stocks related to the Sierra Nevada batholithic intrusions were examined, but none were sampled, as the radioactivity appeared uniformly low. Those examined include a biotite granite, a diorite porphyry, and an aplitic granite containing many quartz veins. The last has a radioactivity ranging from 0.001 to 0.002 percent equivalent uranium; the other two have even lower radioactivity.

The radioactivity of the soda-granite at the Dayton iron deposit, Wabuska, Lyon County, Nev. is not significantly above background. No samples were taken.

Several bodies of syenitic rock were examined in the Mocassin quadrangle, Tuolumne County, Calif., along the trend of the Mother Lode and generally near serpentine intrusions. None of these bodies contained radioactivity significantly above background. It is believed that the extremely low radioactivity found in these rocks reflects their relationship to the serpentine, which, in many places both in the Coast Ranges and the Sierra Nevada, is associated closely with sodic igneous rocks or sodic emanations.

In the Dunlap quadrangle, Fresno County, Calif., hornblende, biotite and granodiorite, fairly typical of Sierra Nevada batholith, contain about 0.001 percent equivalent uranium.

Sodic granite in the New Idria quadrangle, Fresno County, Calif., occurs as a thin sill, probably not over thirty feet thick. It's radioactivity is quite low, probably about 0.001 percent equivalent uranium, and may reflect a genetic association with the serpentine into which the sill was intruded.

A series of stocks, dikes, and batholithic masses, related to the other granitic intrusives of the Peninsular Range were examined in the Cuyamaca Peak and adjacent quadrangles, San Diego County, Calif. The composition of those examined ranges from quartz diorite to aplite. In general, the more silicic

and felsic rocks were highest in radioactivity, but none were very high. A muscovite granite contains about 0.002 percent equivalent uranium, an alaskitic dike contains about 0.004 percent, and granitic pegmatites contain from about 0.002 to 0.004 percent.

The Carmel granite, a porphyritic biotite granite, at Paint Lobos State Park, Monterey County, Calif., contains an estimated 0.001 percent equivalent uranium.

This field work on this project was recessed November 16. Reports, describing the results of this season's work, are in preparation.

Colorado Front Range

Central City district, Gilpin County

The surface mapping planned for the 1951 field season in the Quartz Hill area, Central City district was completed during October; compilation of the maps is in progress. Radiometric traverses were made along all veins shown on the maps, but no radioactivity, other than that already known, was found.

A topographic map of the Pewabic-Iron mine area was completed during the month, but due to the paucity of outcrops, a surface geologic map of this area will not be made.

Mapping of the Justice Hill area was nearly completed. The pitchblende-bearing vein, which strikes N. 70°E. appears to lie between the Justice vein, which strikes N. 50° E., and a parallel vein to the northwest.

Lawson-Dumont district, Clear Creek County

The accessible parts of the Elida tunnel and of the Bellevue-Rochester tunnel were mapped during the month. Mine workings in the Annamosa and Prince

Albert areas were radiometrically reconnoitered; some mapping was done in the Annamosa area.

Office work during the month consisted of map compilation and report writing. Maps of the Jo Reynolds mine area show that the main Jo Reynolds vein passes 1800 feet north of the torbernite-bearing Robineau claims.

Caribou mine, Boulder County

Field work on the Caribou project has been completed. No new uranium-bearing deposits were discovered in the Caribou mine during November, although one previously exposed uranium-bearing deposit was explored by an 80-foot raise. Pitchblende occurs in a streak up to 1 inch wide on one side of this raise to the present top.

Development work in ground favorable for uranium is currently being done on the 740-foot level in the Caribou mine. On this level, the No Name vein workings are being rehabilitated and exploration for the Radium vein (the uranium-bearing vein) is planned. This is 180 feet above the highest known occurence of the uranium in the mine. Examination and sampling of the Radium vein at the 740-foot level will be done when it is exposed.

In addition to the reserves for the Caribou mine area listed in the October Monthly Report, 70 tons of material were estimated during November to contain about 0.1 percent equivalent uranium. (See table 2.)

Prairie Divide district, Larimer County

No field work was done at the Copper King mine during November. See September (p. 14) and October (p. 15) 1951 Monthly Reports.

Reserves for the Copper King mine are listed in table 2; revision of

these reserves is pending completion of field and laboratory work.

Ralston Creek district, Jefferson County

Field investigations of the Nigger Shaft area in northernmost Jefferson County were recessed during November. The purpose of this study, which was begun in October (see October 1951 Monthly Report, pp. 15-16), is to delineate the limits of the uranium-bearing deposit exposed in the prospect shaft. Reserves of uraniferous rock in the Nigger Shaft area have not been estimated.

Leyden coal mine, Jefferson County

Six diamond-drill holes have been completed in the Leyden coal mine area (table 1). Holes No. 5 and No. 6, completed by November 9, were bottomed at 401 feet and 254 feet, respectively. H ole No. 6 contained about one foot of radioactive material estimated from gamma-ray logs to contain 0.008 percent equivalent uranium.

A report on this season's investigations is in preparation. Inferred reserves at the Leyden coal mine are listed in table 2.

Silver Reef, Washington County, Utah

Numerous small showings of uranium minerals in the Chinle formation of the Silver Reef district led to prospecting of similar ledge-forming rocks east of the Hurricane fault. Radiometric reconnaissance of the Chinle formation in secs. 21, 27, and 28, T. 38 S., R. 12 W., disclosed no abnormal radioactivity. No further reconnaissance east of the Hurricane fault is planned.

A geologic sketch section through Paulmar Hill and tentative drill hole sites indicate that the Silver Reef sandstone east of Tecumseh Hill could only be reached at a depth greater than 500 feet. This is considered a greater depth than that warranted by the value of geologic information that could be obtained.

Further physical exploration in the district seems unwarranted at this time, in view of the negative results at Rough Rider No. 2, Maud claim, and Tecumseh Hill, and the small size of the deposit at Hot Rock No. 1 claim. Further diamond-drilling probably will not be undertaken in these areas. Two previously planned holes at the Vanderbilt mine, to total about 400 feet, may be drilled when a rig is available in the region. An attempt will be made to complete mapping and sampling in the district by December.

Reserves have not been calculated for the Silver Reef area.

Bulloch claims, Kane County, Utah

At the Lynn No. 3 claim, the Salina Mining and Smelting Co. has exposed over 200 feet of Summerville formation (much of it disseminated with autunite) of Upper Jurassic age to a depth of 10 feet in places. The uniformity of the fine-grained white Summerville sandstone and the autunite content suggests that the uranium deposit may extend through much of the Summerville formation at this place, instead of being confined to a thin layer immediately beneath the unconformable contact with the overlying Dakota sandstone of Upper Cretaceous age.

The ore at the Lynn No. 3 claim contains about 0.1 percent uranium and occurs in a deposit 3.5 feet thick and 180 feet long. Assuming that the deposit extends 90 feet into the hill and averages 15 cubic feet to a ton, indicated reserves of 3,780 tons of ore are present. Of this amount, 100 tons was reported in the October Monthly Report (p. 17). The grade of 0.1

percent uranium is based on the mill assay of 0.13 percent uranium of the one commercial shipment of this rock.

In view of the continued successful operations of the Salina Mining and Smelting Co., no government exploration is planned; however, continued observation of the mining developments will be made.

Thomas Range fluorite district, Juab County, Utah

Geologic mapping on the southern part of Spor's Mountain has been completed except for local checking.

Mapping (scale 1 inch equals 500 feet) was begun on the east side of Spor's Mountain. (See Trace Elements Memorandum Rept. 167 for a description of the properties and geology involved). Drilling on the Bell Hill property, begun in late September, was continued; a total of 500 feet has been drilled. No ore has been noted in the core; the hole will be abandoned at 550 feet if no ore is pentrated before that depth and a shallow hole, located to intersect the ore about 100 feet below the drill level, will be drilled. If, however, ore is pentrated in the first hole in the interval between 500 and 550 feet, the drilling will be stopped on this property and begun on the Harrisite property.

Calculation of reserves of uraniferous fluorite in the Thomas Range district pend completion of the geologic and exploration work.

White Signal-Black Hawk districts, Grant County, N. Mex.

Geologic mapping was begun in the Black Hawk district (about 20 miles west of Silver City), secs. 20, 21, 28, and 29, T. 18 S., R. 16 W., New Mexico principal meridian to determine the distribution and geologic setting

of possible radioactive material, indications of which were noted in 1950. (See Trace Elements Memorandum Rept. 118.)

Drilling on claims adjacent to the Merry Widow mine in the White Signal district has disclosed no abnormal radioactivity. See Trace Elements Investigations Report 157 for a description of the geology involved.

Boulder batholith, Montana

Geologic mapping (scale 1:12,000) in T. 6 and 7 N., R. 4 and 5 W., and radiometric reconnaissance near Boulder, Jefferson County, was recessed on November 3. This study is part of a general program to find new deposits similar to those near Clancey and at the Free Enterprise mine, Jefferson County. The detailed study of the Comstock mine in sec. 15, T. 6 N., R. 5 W., begun in October, probably will be completed during the 1952 field season.

Mineralogic study of samples taken from the Haynes Homestead adit near Clancey, Jefferson County has shown that pyrite, chalcopyrite, and arsenopyrite are the only sulfides present. Much of the mineral identified as metatorbernite in the field has the optical properties of metazeunerite. Fluorescent hyalite, coated with crystalline aragonite, is present in samples from low-angle fractures that are normal to the nearly vertical main vein system.

Lost Creek schroeckingerite deposit, Sweetwater County, Wyoming

Auger drilling for schroeckingerite on the northeast side of the Cyclone Rim fault zone, which marks the northeast limit of the deposit heretofore known, has disclosed a new deposit that has a length of more than 3,400 feet

and an unknown width. Of the 36 holes drilled north of the fault zone, seven cut schroeckingerite-bearing material. This new discovery represents a marked increase in the economic potentialities of the region.

The exploratory programs for trenching and 8-inch auger drilling were begun in early November, but progress has been slow. An attempt is being made to devise a method for obtaining representative samples from the 8-inch auger cuttings.

Reserves of schroeckingerite-bearing material and uraniferous lignite are given in table 2; the reserves of schroeckingerite-bearing material will be revised upon the completion of the current exploration.

Yellow Canary claims, Daggett County, Utah

Office work on the Yellow Canary claims sub-project consisted of preparing a report on the recent investigations of the area. (See October 1951 Monthly Report, p. 20.)

Craven Canyon area, Fall River County, South Dakota

Carnotite was discovered during August 1951 in the Craven Canyon area, secs. 24 and 25, T. 7 S., R. 2 E. and secs. 19 and 30 of unsectioned T. 7 S., R. 3 E., Fall River County, South Dakota. Over 28 claims have been staked in the area, but almost no prospecting had been carried out prior to November 18, 1951.

The known carnotite occurrences are restricted to the lower 100 to 150 feet of the Lower Cretaceous Lakota formation; most are within 50 feet of a distinctive, papery weathering, non-radioactive, carbonaceous, black shale that is 100 to 125 feet above the top of the underlying Morrison formation of

Upper Jurassic age. Three favorable zones have been recognized: (1) a zone 20 to 30 feet above the carbonaceous shale horizon; (2) a zone 20 to 30 feet below the carbonaceous shale horizon; and (3) a zone about 25 feet below zone (2). Possibly a fourth zone may occur 20 feet below zone (3). The deposits are in general parallel to bedding, but in detail they cross the bedding. Widespread carnotite staining coats fractures in and adjacent to the deposits. These stains are commonly associated with an unknown green mineral stain that contains uranium and vanadium.

The only exploitable ore bodies discovered to date are of small size, but the presence of widespread and numerous low-grade deposits suggests that additional commercial deposits may be found by further prospecting.

Indicated reserves are estimated to be 150 tons of rock containing 0.16 to 0.25 percent uranium and 210 tons containing 0.08 percent uranium. Inferred reserves are estimated to be 90 tons of rock containing 0.15 to 0.25 percent uranium and 2,030 tons containing 0.02 to 0.08 percent uranium.

Additional reconnaissance examination and sampling of these occurrences are in progress. A report is in preparation on the reconnaissance work in this area to date.

Clinton group of Pennsylvania and New York

Reconnaissance examination was made of about 40 outcrops of the Clinton group (of Silurian age) in Pennsylvania and New York to determine, in general, the radioactivity present. Of particular interest, were the hematite beds in the group.

In Pennsylvania, no abnormal radioactivity was noted in ferruginous beds at any of the outcrops examined, nor at Mount Union, Huntingdon County

and at Delaware Water Gap, Monroe County, where complete sections of the Clinton group are exposed. Outcrops of hematite beds of the Clinton group were examined at three places: about eight miles south of State College, Centre County; ten miles north of Lewisburg, Union County; and at Swatara Gap, Lebanon County. As these hematite beds are concealed by talus and mantle rock at the other localities visited, radioactivity measurements were made of only old mine dumps and float on the hillsides. The maximum reading obtained at any of the localities visited was 0.03 mR. per hour, indicating an equivalent uranium content of less than 0.002 percent.

In New York, the reconnaissance was hampered by a fall-out of radioactive snow and dust on November 1 that gave counter readings as high as 1.5 mR. per hour (normal background was 0.03 to 0.04 mR. per hour). Samples of oolitic and fossil (fossiliferous limestone replaced partly or completely by hematite) iron ore were collected for uranium analysis at: the Niagara River gorge, Niagara County; the Genesee River gorge, near Rochester, Monroe County; the Fruitland iron ore pits, Wayne County; and the Clinton Metallic Paint Company's iron ore mine at Clinton, Oneida County. No abnormal radioactivity was noted in the mine at Clinton--the only locality at which a reliable reading could be obtained.

Radon in natural gas

Reduction of the additional pitot-tube data obtained in September, and graphic plotting of the productive capacity of the individual gas zones were continued.

Radiometric analysis of samples from 6 additional wells in the Panhandle gas field, Moore and Potter Counties, Tex. was completed; a few samples contained as high as 0.004 percent equivalent uranium.

The insoluble residues of dolomite samples from 3 wells were analyzed to test the possibility of establishing stratigraphic correlation by this means. A total of 208 samples, representing 1,540 feet of sediments, were analyzed for this purpose.

Compilation and reduction of the radon data obtained during last summer's field season was continued.

Airborne detection

During November, the joint aeromagnetic-radioactivity survey in Minnesota was continued. Examination of the records disclosed no radioactivity anomalies of interest. Scintillation radiation equipment was used throughout. A special survey of the Frenchman Flat-Yucca Valley area, Nye County, Nevada was made for the Los Alamos National Laboratory. The surveys are as follows:

State	County	Flight miles	Terrane
Minnesota	Lake, Cook	2,000	General Pre-Cambrian
	Beltrami, Lake of Woods	1,000	General Pre-Cambrian
Nevada	Nye	400	Test area

Arrangements for the proposed airborne radioactivity survey in Liberia have been delayed as permission was not obtainable from the Defense Department to take the Shoran equipment out of the United States. Discussion between the

Liberian government, the State Department, and the U. S. Coast and Geodetic Survey concerning the alternative use of astronomic ground control is now in progress.

Reports

Reports, in addition to those noted above, are being prepared on the completed phases of the following reconnaissance investigations:

(1) Uraniferous lignites in North Dakota, South Dakota, Montana, and Wyoming.

(2) Radiometric surveys of northeastern states.

(3) Uranium occurrences on the Merry Widow claim, White Signal district, Grant County, N. Mex.

(4) Uranophane at the Silver Cliff mine near Lusk, Niobrara County, Wyo.

(5) Uranium and thorium investigations during 1950, east-central Idaho and southwestern Montana.

(6) The tin, copper, and uranium deposits at Majuba Hill, Pershing County, Nev.

(7) Reconnaissance investigations for uranium in the Colorado Front Range.

(8) Uraniferous deposits in the Red Desert area, Sweetwater County, Wyo.

(9) Geology of the area adjacent to the Free Enterprise uranium-silver mine, Jefferson County, Mont.

(10) Carnotite deposits at the Yellow Canary claims, Daggett County, Utah.

(11) Reconnaissance survey of the Sheeprock Mountains, Tooele County, Utah.

(12) Rare-earth and fluorite deposits of the Bear Lodge Mountains, Crook County, Wyo.

(13) Radiometric reconnaissance of parts of the northwestern San Juan Mountains, Gunnison, Ouray, and San Juan Counties, Colo.

(14) Reconnaissance of sandstone-type copper-uranium deposits in parts of New Mexico, Colorado, Utah, Idaho, and Wyoming.

(15) The Hines and Langford autunite-fluorite deposits, Grant County, N. Mex.

NUMBER PROJECT OR AREA

Reconnaissance Investigations

1. Alma-St. Kevin districts, Colo.
2. Carrizo Mountains, Ariz.
3. Lincoln County, Oreg.
4. Humboldt County, Calif.
5. Sierra County, Calif.
6. Dayton iron deposit, Nev.
7. Moccasin quadrangle, Calif.
8. Dunlap quadrangle, Calif.
9. New Idria quadrangle, Calif.
10. Cuyamaca quadrangle, Calif.
11. Paint Lobos State Park, Calif.
12. West Panhandle field, Tex.
13. Central City district, Colo.
14. Lawson Dumont district, Colo.
15. Caribou mine, Colo.
16. Prairie Divide district, Colo.
17. Ralston Creek district, Colo.
18. Leyden coal mine, Colo.
19. Silver Reef, Utah
20. Bulloch claims, Utah
21. Thomas Range, Utah
22. White Signal, N. Mex.
23. Boulder Batholith, Mont.
24. Lost Creek schroeckingerite, Wyo.
25. Marysvale area, Utah
26. Yellow Canary claims, Utah
27. Lake and Cook Counties, Minn.
28. Beltrami and Lake of the Woods Counties, Minn.
29. Nye County, Nev.
30. Craven Canyon area, S. Dak.

Colorado Plateau (See also fig. 2)

31. Monument Valley, Ariz.
32. White Canyon, Utah
33. Capitol Reef, Utah
34. Yellow Cat area, Utah
35. Outlaw, Horse, Atkinson, Spring Creek, Club and Long Park Mesa areas, Colo.
36. Spud Patch and Legin groups, Colo.

Northwest Phosphate

37. Dry Valley and Johnson Creek quadrangles, Idaho.
38. Willis quadrangle, Mont.
39. Georgetown, Idaho

Southeast Phosphate

40. Land-pebble district, Fla.

Lignite, Coal, and Black Shale

41. Slim Buttes, S. Dak.
42. Red Desert, Wyo.
43. Goose Creek district, Idaho
44. La Ventana Mesa, N. Mex.
5. Silver Peak, Nev.
46. Powder River Basin, Wyo.
47. Beautiful Mountain, N. Mex.
48. Tintic mining district, Utah

Thorium and monazite

49. Mountain Pass, Calif.
50. Wet Mountains, Colo.
51. Southeast monazite

Figure 1.--LOCATION OF TRACE ELEMENTS FIELD PROJECTS IN THE UNITED STATES

RECONNAISSANCE INVESTIGATIONS, ALASKA

Field work in Alaska was recessed for the winter at the close of the 1951 season in September; it will be resumed sometime in the late spring of 1952.

Preparation of reports on 25 Alaskan reconnaissance projects, initiated prior to 1951 (see fig. 2, October 1951 Monthly Report), was in progress during November. Preliminary information on these projects is available in the following monthly reports:

November 1949, pp. 19-29
December 1949, pp. 13-15
January 1950, pp. 16-18
February 1950, pp. 21-23
July 1950, pp. 18-19
October 1950, pp. 13-15

Preparation of preliminary summary reports on projects initiated in the 1951 field season was continued during November. (See June, July, August, and September 1951 Monthly Reports.)

Trace Elements Memorandum Report 323 "Adaptation of portable survey meters for airborne reconnaissance with light planes" by Helmuth Wedow, Jr. was transmitted to the Atomic Energy Commission on November 1, 1951.

General information

Two samples, one collected in 1950, the other in 1951, from the Canyon vein, Fish Creek No. 5 claim, Mountain View property in Hyder district of southeastern Alaska are reported by the Territorial Department of Mines to contain a black uranium mineral. The sample collected in 1950 was determined by the Atomic Energy Commission to contain 0.7 percent equivalent uranium oxide. The black uranium mineral was identified as pitchblende (?). Other data on the Mountain View property is being assembled prior to planning reconnaissance in the Hyder district during 1952 to determine the significance of the pitchblende (?) occurrence.

COLORADO PLATEAU, EXPLORATION

Introduction and summary

Exploration of the carnotite deposits of the Colorado Plateau continued in the areas listed under "Drilling continuing" in table 3. Figures 2 to 10, inclusive, show the areas of exploration. The estimated reserves given in table 3 include all material in layers 1 foot or more thick containing at least 0.10 percent U_3O_8 or 1.00 percent V_2O_5. For completed projects, the tonnages are taken from listings in final reports. Where projects are incomplete, tonnage figures are preliminary and are largely based on experience and visual estimates of the uranium and vanadium content of the cores.

During November, a total of 43,820 feet was drilled, which is a 19 percent decrease from October. This decrease resulted from the completion of drilling contracts at Outlaw Mesa and Long Park before the end of the month. This total includes 3,986 feet of dry-hole, non-core drilling in the Yellow Cat area.

Brief interpretive comments for individual phases of the project follow.

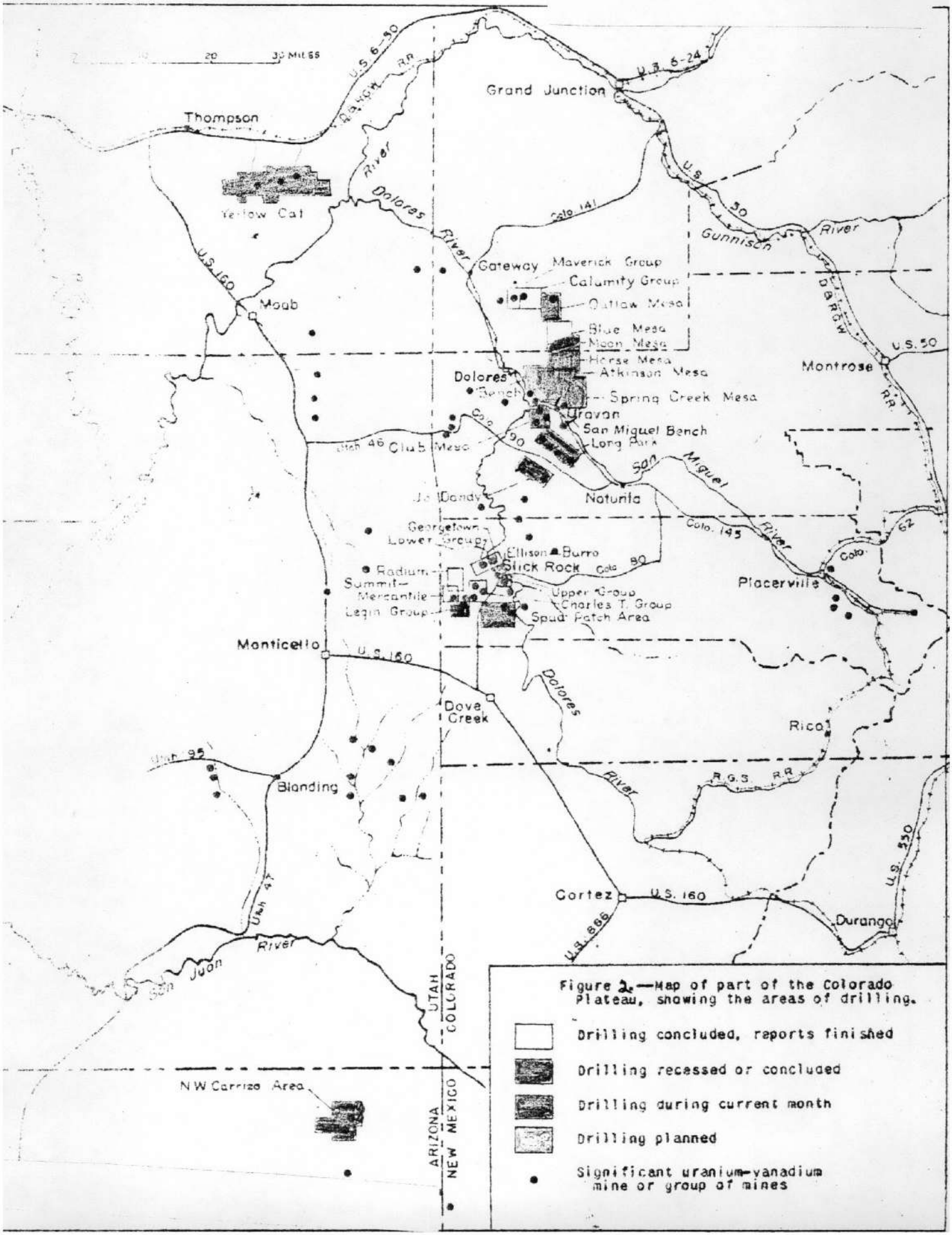
Field work in progress

East Gateway district, Mesa County, Colorado

Outlaw Mesa.--Drilling on Outlaw Mesa was concluded on November 4. Of the four holes completed during November, one (No. 1300) is in ore (fig. 3). Trace Elements Memorandum Report 295, covering the results of drilling on Outlaw Mesa during 1951, is in preparation.

Table 3 --Summary of exploration, Colorado Plateau project, November 1951

Project or activity	Drilling, radiometric scanning, and sampling						Indicated and inferred reserves found by drilling (short tons)			Remarks
	Holes			Feet or samples (s)						
	Last month	This month	Total	Last month	This month	Total	Last month	This month	Total	
EXPLORATION										
Drilling concluded, reports finished, combined totals			2,238			151,589			111,615	
Drilling recessed or concluded										
Carrizo Mtns., Apache Co., Ariz.	0	0	24	0	0	3,032	0	0	100	
Outlaw Mesa, Mesa Co., Colo.	43	4	1,302	9,744	561	222,151	200	0	210,000	Tonnage from TEIR 295
Blue Mesa, Mesa Co., Colo.	0	0	284	0	0	31,374	0	0	5,000	Tonnage from TEIR 154
Moon Mesa, Mesa Co., Colo.	0	0	141	0	0	16,871	0	0	1,000	
Long Park, Montrose Co., Colo.	13	8	485	5,325	2,979	143,550	0	0	135,000	
Jo Dandy area, Montrose Co.,Colo.	0	0	46	0	0	8,947	0	0	50,000	
Legin group area, San Miguel Co.,Colo.	0	0	427	0	0	55,917	0	0	45,000	
Spud Patch area,San Miguel Co.,Colo.	87	47	356	13,283	9,558	52,197	500	8,100	9,000	Tonnage from TEMR 294
Subtotal	143	59	3,065	28,352	13,098	534,039	700	8,100	455,100	
Drilling continuing										
Horse Mesa, Montrose Co., Colo.	5	12	72	1,521	3,645	15,973	0	0	0	
Atkinson Mesa, Montrose Co., Colo.	5	5	20	3,295	3,606	13,574	0	0	500	
Spring Creek Mesa, Montrose Co.,Colo.	11	11	31	7,043	7,305	20,464	0	0	0	
Club Mesa, Montrose Co., Colo.	25	20	630	7,041	7,785	153,684	0	3,000	151,200	
Yellow Cat area, Grand Co., Utah	84	98	182	7,097	8,381	15,478	300	1,000	1,300	
Subtotal	130	146	935	25,997	30,722	219,173	300	4,000	153,000	
Total drilling	273	205	6,238	54,349	43,820	904,811	1,000	12,100	719,915	
Gamma-ray hole scanning	129	292	5,295	15,759	36,637	777,923				
Radiometric core scanning	75	78	5,259	1,905 325s	2,489 131s	343,997 8,947s				


20
30 Miles
U.S. 6-50
D&RGW RR
U.S. 6-24
Grand Junction
Thompson
Colorado River
Dolores River
Yellow Cat
U.S. 160
Moab
Colo. 141
Gateway Maverick Group
Calumity Group
Outlaw Mesa
Blue Mesa
Moon Mesa
Horse Mesa
Atkinson Mesa
Spring Creek Mesa
Dolores
Bench
Uravan
San Miguel Bench
Long Park
Colo. 90
Utah 46
Club Mesa
San Miguel River
Gunnison River
U.S. 50
Montrose
Narrows
Naturita
Jo Dandy
Georgetown Lower Group
Ellison
Burro
Slick Rock
Colo. 145
Colo. 62
Placerville
Radium
Summit-Mercantile-Legin Group
Upper Group
Charles T. Group
Spud Patch Area
Monticello
U.S. 160
Dove Creek
Dolores River
Rico
Utah 95
Blanding
D.G.S. RR
U.S. 550
Cortez
U.S. 160
Durango
U.S. 666
Utah 47
San Juan River
UTAH
COLORADO
NW Carrizo Area
ARIZONA
NEW MEXICO
Figure 2.—Map of part of the Colorado Plateau, showing the areas of drilling.
Drilling concluded, reports finished
Drilling recessed or concluded
Drilling during current month
Drilling planned
Significant uranium-vanadium mine or group of mines

Uravan district, Montrose County, Colorado

Horse Mesa.--Drilling continued in the Horse Mesa area during November with two diamond-drill rigs in operation at the start of the month. Three rigs were added on November 4, one on November 5, and one on November 7, making a total of seven rigs in operation through the rest of the month. On November 5, drilling on the Blue, Moon and Horse Mesa contracts, the maximum was attained. From November 4 to 30, drilling was done on the Outlaw Mesa contract with footage remaining from the drilling on Outlaw Mesa. Of the 12 holes completed during the month, two (Nos. 68A and 73) are in mineralized material that is below the cut-offs for ore (fig. 4). Each of these two holes is a new discovery. All of the holes were drilled on wide-spaced intervals for geologic information.

During December, drilling will continue on a wide spacing to obtain geologic information. A few close-spaced holes will be drilled near weakly mineralized ground to search for ore deposits.

Atkinson Mesa.--Drilling continued on Atkinson Mesa with ten diamond-drill rigs and a churn drill in operation at the beginning of the month. Five more diamond drills were put into operation during the latter half of the month when they were transferred from Long Park (see below). Five holes were completed during the month, all of which are in barren material (fig. 5). Operations continue to be slow, due primarily to the exceedingly low footage drilled per shift worked. This continues to be so despite a considerable drop in lost time. Discussions with the contractor are planned for mid-December to determine how the operations may be speeded up. The drilling will continue to be wide-spaced in order to obtain geologic information.

Dolores Bench.--The contract with Minerals Engineering Co. of Grand Junction, Colo. for 30,000 to 45,000 feet of diamond drilling on the Dolores Bench (fig. 2) has been approved. Drilling will start the first week of December.

Spring Creek Mesa.--Eight to ten drill rigs continued to operate on Spring Creek Mesa during November. All of the 11 holes completed during the month are in barren material (fig. 6). All drilling is wide-spaced to obtain geologic information.

San Miguel Bench.--Drilling started with three diamond drills on November 27 on the San Miguel Bench (fig. 2). There were no holes completed by the end of the month. All drilling is wide-spaced to obtain geologic information.

Club Mesa.--Drilling continued on Club Mesa during November with six rigs in operation on a double shift basis. Of the 20 holes completed, three (Nos. 606, 621, and 625) are in ore, and three (Nos. 588, 612, and 624) are in mineralized rock that is below the cut-offs for ore (fig. 7). The drilling resulted in the discovery of three deposits and extended the known limits of deposits discovered earlier.

Drilling during November was planned to complete the outlining of known deposits in the east part of the mesa and to appraise the inferred favorable belt beneath the Burro Canyon outcrop. The shallow drilling in the east part of the mesa was completed.

Since the maximum footage for the present Long Park-Club Mesa contract will be reached early in December, drilling thereafter will be continued with four drills on Club Mesa on a 7,500 foot extension of the

present contract. This drilling will be used, mainly, to block out the two discoveries in the favorable belt under the Burro Canyon caprock.

Long Park.--Drilling in the vicinity of Long Park continued during the first half of November with four drills in operation. Of the eight holes completed, two (Nos. 480 and 485) are in mineralized material that is below the cut-offs for ore and may represent two new deposits (fig. 8). All holes were wide spaced in the central part of the area.

On November 15 drilling was recessed and footage remaining on the contract will be used on Club Mesa in order to complete the drilling exploration in that area.

Trace Element Memorandum Report 297, covering the results of drilling in the Long Park area during 1951, is in preparation.

Slick Rock district, San Miguel County, Colorado

Spud Patch area.--Eight rigs operated in the Spud Patch area until the 28th of November when the drilling contract maximum footage was reached. Drilling has been recessed until the spring of 1952. Of the 47 holes completed during the month, seven (Nos. 315, 336, 337, 341, 352, 353, and 356) are in ore and ten (Nos. 308, 333, 334, 339, 343, 346, 349, 351, 354, and 355) are in mineralized material that is below the cut-offs for ore (fig. 9). Two deposits were discovered as a result of this drilling. Most of the drilling was planned to define deposits discovered by previous drilling and some drilling was planned to test favorable ground for ore deposits with moderately spaced drilling. Trace Element Memorandum Report 294, covering the results of drilling in the Spud Patch area during 1951, is in preparation.

Some additional drilling may be done in the Spud Patch area during calendar 1952, perhaps in the spring.

Thompsons district, Grand County, Utah

Yellow Cat area.--Diamond drilling and non-core, dry-hole experimental drilling continued in the Yellow Cat area during November with six diamond-drill rigs and one wagon drill. Of the 30 diamond-drill holes completed during the month, nine (Nos. 44, 53, 54, 56, 58, 61, 67, 68, and 70) are in mineralized material that is below the cut-offs for ore (fig. 10). Of the 68 wagon-drill holes completed during the month, two (Nos. W-86 and W-87) are in ore and 21 (Nos. W-40, W-41A, W-42, W-45, W-67, W-69, W-70, W-74, W-76, W-78, W-79, W-80, W-81, W-83, W-84, W-88, W-96, W-99, W-101, W-103, and W-104) are in mineralized material that is below the cut-offs for ore (fig. 10). Eighteen deposits were discovered as a result of the drilling during November. Most of the diamond-drill holes were drilled on a wide-spaced pattern for geologic information, and most of the wagon-drill holes were drilled on a close-spaced pattern to search for deposits in favorable areas as determined by previous Survey drilling. Sixteen holes were drilled to test geobotanical data and nine of these cut mineralized sandstone. Drilling during December will follow the same plan.

Field work recessed or completed

Areas in which exploration of the carnotite deposits of the Colorado Plateau was recessed or completed prior to November 1951, and for which final reports are not completed, are listed in table 3.

Radiometric logging of drill holes

During November four gamma-ray logging units were used on the Colorado Plateau. Drilling projects at eight areas were serviced. The distribution of drilling activities necessitates an excessive amount of travel on the part of the gamma-ray logging units and the operators. One gamma-ray logging unit is being used on a full time basis for the logging of drill holes in Florida.

Compilation of calibration data by which gamma-ray logs can be interpreted in terms of equivalent uranium is progressing very slowly. Uncorrected calibration curves for all grades and thicknesses of ore have been determined and experiments are being set up to determine the effects of hole diameter and other variable factors. The results of the experiments will be used to determine correction factors to be applied to the calibration curves.

Four holes drilled by the Concho Petroleum Company were logged at the request of the Colorado Exploration Branch, Atomic Energy Commission. Three of these holes are located in Disappointment Valley, San Miguel and Dolores Counties, Colo., and the fourth hole is located about six miles northwest of Dove Creek, Dolores County, Colo. These holes were logged with a 2 x 20-inch probe so as to obtain stratigraphic information. A complete log of the hole located northwest of Dove Creek was obtained. This hole is collared in the Dakota sandstone and is bottomed in mudstone several feet below the base of the Salt Wash. It has a total depth of 718 feet. The three holes located in Disappointment Valley were found to be either caved or closed by swelling of mudstone at some point in the Brushy Basin. It was not possible to obtain logs of the Salt Wash. The total footage logged amounts to 2,404 feet.

One hole drilled at the site of the abandoned Leyden coal mine north of Golden, Colorado was logged on November 9. A depth of 251.7 feet was logged.

Resistivity studies

Vertical resistivity measurements were made between drill holes in the Broad Valley area on Long Park, Montrose County, to delineate favorable ground for close-spaced exploratory drilling. The measurements were made at depth intervals of 10 feet to total depths ranging from 300 to 400 feet at 79 stations spaced approximately 200 feet apart.

The resistivity-depth curves over favorable ground at these greater depths do not differ very much from curves over unfavorable ground. Apparently high conductivity in near surface materials tends to mask small anomalies at depth caused by changes in thickness of the ore-bearing sandstone.

Natural potential measurements were made at stations 50 feet apart along three 1600-foot traverses crossing the southern part of the Broad Valley area. This work was done to determine if small changes in potential may be associated with changes in subsurface conditions as was noted in measurements made over part of the Spud Patch area. Sufficient work has not been done to determine if this method is applicable over deeper ground.

The results of wide-spaced measurements made in the Spud Patch area indicate that other techniques should be used in conjunction with depth measurements in order to delineate the more favorable parts of the sandstone. A few natural potential measurements made in this area showed positive anomalies

overlying thicker and weakly mineralized parts of the sandstone. This method may be helpful in certain areas but more work must be done to determine its general application.

Radiometric scanning of core

The data on radiometric scanning of core are given in table 3 at the back of this report. Since March 19, a cut-off of 0.035 percent equivalent U_3O_8 has been used as a lower limit for the selection of samples for uranium assay. Since August 8, a cut-off of 0.020 percent equivalent U_3O_8 has also been used as a lower limit for the reporting of equivalent U_3O_8 values, but these samples (between 0.020 and 0.035) are not submitted for chemical assay. Only core from holes that could not be probed by a gamma-ray field counter has been scanned completely.

Claim inventory and appraisal

Searching of public records for the recording and status of claims continued in November. The search turned up 366 newly recorded claims, 23 amended claim locations, and 668 instruments--lesses, deeds, and affidavits of labor.

About 300 claims were found in the field. More than half these claims have been plotted on quadrangle maps.

Compilation of claim data for 12 topographic base claim maps was continued.

Information to claim owners and lessees

The number of requests received from claim owners and lessees, or the Commission, for information on U. S. Geological Survey drilling on private ground or Commission-controlled ground, and the number of replies transmitted are summarized in the following table:

	October 1951	November 1951	Total to date
Number of requests	1	6	75
Number of replies	1	6	73

COLORADO PLATEAU, GEOLOCIC STUDIES

Field work in progress

Resource appraisal

Northeastern Arizona.--The appraisal of the total uranium resources and geologic studies of carnotite deposits and the Salt Wash member of the Morrison formation in the Carrizo Mountains area, Apache County, Ariz., continued during November. Deposits on the east flanks of the mountains were examined. Field work will be recessed early in December and a preliminary resource appraisal report will be prepared for transmittal sometime during the winter.

Field work recessed

Stratigraphic studies

Stratigraphic studies of the ore-bearing Morrison formation were continued through November. Field work was completed. The preparation of a final report on the Morrison formation was begun and will be continued through the winter and spring months.

Resource appraisal

Slick Rock area.--A report on the resource appraisal work in the Slick Rock area, San Miguel County, Colo., has been completed and is being reviewed. (The results of this work were summarized in the October 1951 Monthly Report, p. 37.).

Regional mapping

Southwestern Colorado.--Regional mapping compilation and preparation of reports for publication in the Quadrangle Map Series continued during November. The approximate status of various phases of this work on the eighteen 7½-minute quadrangles in southwestern Colorado is shown below:

Compilation on topographic base maps from air photos	85%
Preparation of structure contour maps	78%
Preparation of structural sections	75%
Writing of texts to accompany geologic quadrangle maps	5%
Editorial review and criticism	0%

Northeastern Arizona.--Geologic mapping in the Carrizo Mountains area, Apache County, Ariz., was recessed at the end of August. Of the total area, less than 10% (175 square miles) remains to be mapped. This part comprises the igneous-sedimentary complex in the Carrizo Mountains. As this part of the area has little economic interest from the standpoint of uranium production, completion of the mapping may be delayed indefinitely. A preliminary map of the rest of the area, however, will be completed some time during calendar year 1952.

Ground-water studies

Field and laboratory work on ground-water studies were completed in mid-September, and the report on this work is being prepared. The results of this work were summarized in the October 1951 Monthly Report, p. 38.)

Geochemical prospecting

Geochemical prospecting work was recessed in November.

PRE-MORRISON STUDIES (COLORADO PLATEAU)

Field work recessed

Regional mapping and detailed studies of the pre-Morrison ore-bearing formations (mainly Triassic) are being conducted by the Geological Survey's Pre-Morrison project. The principal objectives are to determine the distribution and character of the ore-bearing strata, and to study geologic relations that may be useful in guiding exploration and appraising the total resources. The progress and results of the work during November are reported below.

Monument Valley, Arizona

Field work in the Monument Valley area, Apache and Navajo Counties, Ariz., was recessed in September and will be resumed next spring. During November map compilation was completed and progress was made on a detailed report. Detailed laboratory studies on rock specimens and samples were begun.

White Canyon, Utah

Field work in the White Canyon area, San Juan County, Utah, was recessed in October and will be resumed next spring. Report preparation and map compilation were nearly completed during November. A study of rock specimens and samples was begun.

Preliminary plans for exploration during calendar year 1952 at two localities--on Deer Flats and in the vicinity of the Scenic claim--were made during discussions with the Colorado Plateau project early in November.

Capitol Reef, Utah

Field work in the Capitol Reef area, Wayne County, Utah was recessed in September and will be resumed next spring. Report writing and map compilation is in progress and will be completed in the near future.

NORTHWEST PHOSPHATE

Geologic Mapping

Preparation of texts and compilation, including structure sections, of the Dry Valley quadrangle, Caribou County, Idaho, were in progress during November. Upon completion, this map and text will be released in open file. Compilation was also begun on data for the Johnson Creek quadrangle, Caribou County, Idaho, but much more work will be necessary before this map is released in open file.

Field review of critical areas in the NW¼ of the Willis quadrangle was continued in the north part of the quadrangle near a tungsten-bearing area.

Stratigraphic and paleontologic studies

A formerly unexposed part of one section of the Phosphoria formation was sampled, measured, and described east of Georgetown, Bear Lake County, Idaho. (See table 4.) No stratigraphic or paleontologic studies were made in Montana.

Table 4.--Mapping and sampling data, Northwest phosphate project.

Location	Area mapped (square miles)		Localities sampled		Samples taken	
	This Month	Total	This Month	Total	This Month	Total
Whole project	0	510	1	51	10	1143
Idaho, Utah, and Wyoming						
Bear River region	0	193	1	35	10	935
Montana						
Lyon quadrangle	0	290	0	0	0	0
Willis quadrangle	0	20	0	0	0	0
Other areas	0	7	0	16	0	208

Stratigraphic and sample data collected during the summer are being assembled for future use in preparation of columnar sections and other studies after receipt of analytical reports on the samples.

SOUTHEAST PHOSPHATE

In November, investigation of the Florida phosphate deposits (fig. 1) consisted principally of: (1) recording data from drilling programs on the French tract (Polk County) of the International Minerals and Chemical Corp., the Homeland and Clear Springs tracts (Polk County) of the Virginia-Carolina Corp., and on property of the Royster Guano Co. (Polk County); (2) sampling and gamma-ray logging of current company prospect holes; (3) stratigraphic studies; (4) preparing isopach maps of the matrix, overburden, and leached zone, and contour maps of the basement rock surface; and (5) preparing reports. Tabular data pertaining to the sampling, drilling, and gamma-ray logging activities are given in table 5. Tracts of land on which records have been furnished by each company are listed in figure 11, sheet B. Progress in compiling company data and preparing isopach and contour maps is shown in figure 12, sheets C, D, E, F, and G.

Table 5.--Sampling and drilling data, Southeast phosphate project.

Activity	Samples taken		Drilling			
			Number of holes		Footage	
	This Month	Total	This Month	Total	This Month	Total
Whole project 1/	2,756	96,118	153	942	5,732	51,269
TVA drilling	60	1,808	46	510	2,518	34,766
AEC drilling 2/	0	5,146	0	145	0	6,067
IMCC 3/	163	350	33	68	1,081	2,094
VC 4/	468	468	11	43	265	1,473
Mine sampling	9	3,744	---	---	---	---
Company drilling	2,006	65,881	---	---	---	---
Royster tract	50	198	54	146	1,641	6,295
Gamma-ray logging	0	0	93	1,289	2,830	43,853
Miscellaneous	0	18,523	9	40 5/	227	704 5/

1/ Excludes gamma-ray logging.
2/ Fiscal year 1951.
3/ International Minerals and Chemical Corp.
4/ Virginia-Carolina Chemical Corp.; drilling completed.
5/ Drilling by U.S.G.S.

The International Minerals and Chemical Corp. continued drilling on its French tract, Polk County under contract with the Atomic Energy Commission. From the drilling to date, it has been found that the leached zone ranges in thickness in this tract from 1.0 to 18.0 feet and averages 5.5 feet thick. Analyses are available for 12 holes. The minus 200-mesh fraction of the samples contain from 0.006 to 0.039 percent uranium and average 0.018 percent. Chemical analyses for Al_2O_3 and P_2O_5 and tonnage calculations will be made and reported by the company.

The Virginia-Carolina Chemical Corp. completed drilling on its Homeland and Clear Springs tracts, Polk County, (table 5) under contract with the Atomic Energy Commission. The leached zone on these tracts ranged from two to nine feet in thickness, and averaged five feet.

Drilling was continued in November by Wayne Thomas, independent consultant, on land owned by the Royster Guano Co., in secs. 11, 14, and 23, T. 30 S., R. 25 E., Polk County. About 400 drill holes in all are planned 54, of which were sampled and logged by the Survey in November, making a total of 146 holes. The thickness of the leached zone ranges from one foot in the southwestern corner of the property (sec. 23, T. 30 S., R. 25 E.) to 60 feet in the northeastern corner (sec. 11, T. 30 S., R. 25 E.). (See October 1951 Monthly Report, p. 42.)

Further study of the content of leached zone material in overburden dumps in the land-pebble phosphate district will consist of mapping, and drilling about 20 holes at both the International Minerals and Chemical Corporation's Peace Valley mine and at the Swift and Company's Varn mine, Polk County to aid in calculating the tonnage of the leached-zone material.

Reports are being prepared on: (1) a statistical study of drilling at the Bonny Lake mine, Polk County; (2) the use of local mining terminology; (3) the Virginia-Carolina Chemical Corp. drilling program on the Homeland and Clear Springs tracts, Polk County; (4) the origin and distribution of phosphate--for presentation at the AIME-SEG meeting in New York in February 1952; (5) the reconnaissance of overburden dumps in the land-pebble phosphate district; and (6) an investigation of a reported occurrence of uraniferous material in Citrus County, Fla.

LIGNITE AND COAL INVESTIGATIONS AND BLACK SHALE RECONNAISSANCE

The objectives of the present investigations of lignite, coal, and black shale in the Rocky Mountains region are (1) to search for new uraniferous deposits; (2) to map, sample, and appraise, in a preliminary manner, the more promising of the known uraniferous deposits; and (3) to determine the possible sources of uranium found in lignite, coal, and black shale in order to guide future investigations. Detailed mapping and sampling were in progress during November in the Red Desert, Sweetwater County, Wyo.; in the Goose Creek district, Cassia County, Idaho; on La Ventana Mesa, Sandoval County, N. Mex.; and on Slim Buttes, Harding County, S. Dak.

Most of the field investigations in the Rocky Mountain region were recessed for the winter during late November.

Silver Peak Range, Esmeralda County, Nevada

A report on a small deposit of uranium-bearing rhyolitic tuff at the north end of the Silver Peak Range is being prepared. (See October Monthly Report, pp. 43-44.) The uraniferous part of the tuff consists of a few tens of tons of rock containing more than 0.1 percent uranium and a larger tonnage of lower-grade rock containing 0.005 to 0.05 percent uranium.

Powder River Basin, Campbell and Johnson Counties, Wyoming

During November, investigations in the Powder River Basin were continued. Ten additional carnotite ore bodies were found and sampled. No analyses are yet available, but, on the basis of similarity with the deposit described in the October Monthly Report (pp.44-45), all ten contain high-grade material.

In addition to the total of 11 of these relatively high-grade carnotite deposits, eight lower-grade ore deposits, of which two were mapped in detail, were found and sampled.

These known high- and low-grade deposits occur in a minimum area of 220 square miles, and it is believed that additional field work may show that the area is even larger.

A detailed report on these investigations to date is being prepared.

Slim Buttes, Harding County, South Dakota

Core drilling in South Dakota was recessed during November; the two 300-foot holes that were planned to be drilled in the Bar-H area (October 1951 Monthly Report, p. 47) may be completed when contract difficulties are resolved. One hole, 412 feet deep was completed on top of Slim Buttes (Trace Elements Memorandum Report 175, fig. 6) in the Custer National Forest about 5 miles south of Reva Gap, Harding County, and 11 feet of lignite core was submitted for uranium analysis and laboratory study. Nineteen holes, totaling 2,486 feet have been completed; 229 samples of 170 feet of lignite core have been submitted to the Survey's Trace Elements laboratory in Washington for uranium analysis.

Red Desert, Sweetwater County, Wyoming

Detailed sampling and mapping of the radioactive Red Desert lignites underlying an area of about eight townships south of the Cyclone Rim fault in Sweetwater County, Wyo. have been completed.

Sampling and radiometric examinations were made of three radioactive

coal beds in the Red Desert that occur in what appears to be the stratigraphically high Cathredral Bluffs tongue of the Wasatch formation of Eocene age. The beds, 4.5 feet, 1 foot, and 2.2 feet thick, were traced for eight miles along their strike.

Radiometric reconnaissance was made of about 400 square miles between Chain Lakes and Bison Basin in the northern Red Desert area to locate possible uranium source beds and to gather information to aid in determining the mode of distribution and concentration of uranium in the lignites.

Goose Creek district, Cassia County, Idaho

Sampling and radiometric examination in the Goose Creek district were continued during November. Due to the relative inaccessibility and ruggedness of this area only a general approximation of the extent and quality of the uranium-bearing carbonaceous shales and lignites will be obtained this field season. If the analyses of the samples show notably high concentrations of uranium, detailed mapping will be undertaken next year.

La Ventana Mesa, Sandoval County, New Mexico

Detailed investigations were continued of a radioactive zone in coal and carbonaceous shale at the base of the La Ventana sandstone that caps La Ventana Mesa. (See October Monthly Report, pp. 49-50.) Detailed geologic mapping of about 18 square miles of the area has been completed. Three radioactive deposits have been found on the south butte and three on the north butte.

General information

Analyses of Paleozoic black-shale samples from six localities in Utah and Nevada range from 0.002 to 0.006 percent uranium. A black-shale zone in the upper part of the Gardner formation of Mississippian age in the Tintic mining district, Juab County, Utah, contained 0.003 to 0.006 percent uranium and up to 1.22 percent V_2O_5 and 23 percent P_2O_5. The samples were taken from drill core from the depth interval of 1713 to 1770 feet in ground adjacent to the Consolidated mine workings; this interval represents 25 to 30 feet of strata in a steeply folded section.

Samples of two thin beds (1 and 1.5 feet thick) of a basal black-shale zone in the Deseret limestone of Mississippian age in Ogden Canyon, Weber County, Utah contained 0.005 percent uranium. A sample of a two-foot interval of the black-shale beds of Pennsylvanian (?) age in the northern part of Elko County, Nev., contained 0.005 percent uranium. Samples, representing a zone about 12 feet thick, of Lower Paleozoic (Silurian or Ordovician) black shales exposed at the mouth of Ikes Canyon, Nye County, Nev., contained 0.003 to 0.004 percent uranium. Samples of a zone, about 9 feet thick, of black shale in the Manning Canyon shale of Mississippian and Pennsylvanian age, near Provo, Utah County, Utah, contained 0.003 percent uranium. A bed, 1½ feet thick, in the Oquirrh formation of Pennsylvanian age, also near Provo, contained 0.003 percent uranium.

Radioactive carbonaceous shale and coal in the Tocito sandstone of Upper Cretaceous age on Beautiful Mountain, San Juan County, N. Mex. is estimated to contain 0.006 to 0.01 equivalent uranium. Some radioactivity was noted in the iron stain along joint surfaces within the Tocito. This occurrence is

topographically quite near the same erosional unconformity that overlies the Morrison formation of Jurassic age on Lukachukai Point and Cove Mesa where carnotite is being mined.

THORIUM AND MONAZITE INVESTIGATIONS

Wet Mountains-Haputa Ranch, Custer County, Colorado

In addition to the reserves previously reported (see October 1951 Monthly Report, p. 50) for the Haputa ranch extension and the Tuttle ranch and Greenwood property, reserves of 100,000 tons of material containing 0.053 percent equivalent uranium, 5,950 tons containing 0.019 percent, and 1,700 tons containing 2.94 percent are estimated to be present in Shear zones 1, 3, and 4, respectively, in the Haputa Ranch area.

Drilling at the Haputa ranch was begun on November 16.

A preliminary memorandum report concerning the Wet Mountains area is in preparation. Trace Elements Memorandum Report 285, "Radioactive deposits on the Haputa ranch, Custer County, Colorado" will be transmitted to the Atomic Energy Commission in early December.

Mountain Pass, San Bernardino County, California

Detailed geologic mapping was continued at the calcite-barite-bastnaesite (a fluo-carbonate of thorium and rare earths) deposit on the Sulphide Queen claims in the Mountain Pass district and in the area between the Sulphide Queen claims and the Birthday claims. (See Trace Elements Memorandum Report 35). Structural features and the distribution of rock types in the Sulphide Queen deposit suggest that bastnaesite was deposited after the carbonates and barite.

The mapping to date between the Sulphide Queen deposit and the Birthday claims suggests that the igneous dikes and carbonate veins, as well as the main carbonate mass, may have been emplaced along zones of dilation developed during a period of regional stress. Alteration in the gneiss--consisting of

a reddening of the feldspar and the development of crocidolite in fractures--around the periphery of the main carbonate body, seems to be a feature characteristic of the gneiss-carbonate contact. The extension of this alteration zone westward from the southwest corner of the bastnaesite deposit, and the structural features of the deposit itself, suggest that the carbonate body may be close to the surface for several hundred feet west of the mapped contact. This possible extension of the deposit from the southwest corner is important because the southwest corner contains the highest concentration of rare earths.

Southeastern monazite

The search for and reconnaissance appraisal of economically minable monazite placer deposits in the western Piedmont of the southeastern states was continued during November.

Reconnaissance examination and sampling of the placer deposits was recessed on November 1 for the winter. Field work during the month consisted of locating spots for churn-drill holes in Area 1 on Knob Creek, Cleveland County, N. C., and surveying that area at 1:6,000 scale. Associated with personnel in selecting locations for drill holes were members of the U. S. Bureau of Mines, Special Minerals Investigating Branch. Churn drilling at site 1 began on Knob Creek November 26. Seven holes, totaling about 70 feet in depth, were drilled by the contractor and samples were processed by the Bureau of Mines. Maps (scale 1:20,000) were drafted of Sandy Run, Beaverdam, Big Branch, Puzzle, Webbs, Robinson, Hunting, and Heaveners Creeks and Poween River. These streams are in Cleveland and Rutherford Counties, N. C., and Cherokee County, S. C.;

they were examined and sampled during the summer of 1951.

A progress report for the period July 16 to November 1, 1951 is in preparation.

During the winter months the results of the previous season's work will be compiled, areas outlined for drilling by the U. S. Bureau of Mines will be surveyed, and preparations made for the field season of 1952.

General Information

Interest in the central part of the western monazite belt in Cleveland, Rutherford, and Burke counties, N. C. has been shown by F. R. Hunter and Thomas Garner, geologists of International Mimerals and Chemical Corporation, Mulberry, Polk County, Fla. Garner spent about three months in reconnaissance during the summer and has recommended exploration of placer areas in those counties during the winter.

URANIUM IN NATURAL WATERS

A total of 48 samples has been collected from 33 localities by the Geological Survey during the past several months in an attempt to find non-saline waters from which uranium might be concentrated enough (10 ppb in a flow containing several hundred pounds per year) to be recovered by means of a process developed by Bruce and Ferguson of Oak Ridge National Laboratory. All of the samples have now been analyzed for uranium by the Oak Ridge National Laboratory and for other constituents by the Quality of Water Branch of the Geological Survey. In addition, 17 of the samples have been analyzed for uranium by the Survey's Trace Elements laboratory to compare results obtained by a newly developed analytical technique.

Of the 48 samples, 13 contained 10 ppb or more uranium (table 7). The water from Cimarron Creek, above its junction with Little Cimarron Creek, in the SE¼, sec. 16, T. 48 N., R. 16 W., Montrose County, Colo. approaches the minimum requirements in that its flow of about 15.5 cfs contains 77 ppb. It drains a terrane consisting mainly of Tertiary San Juan tuffs, except at the headwaters where the tuffs are intruded by monzonite and quartz monzonite.

In connection with testing analytical techniques, the Trace Elements laboratory has analyzed some seawater from the Gulf of Mexico and has found it to contain about 3.5 ppb. Results confirming these have just been published by a Japanese investigator.

Arrangements have been made to continue the search for uraniferous non-saline waters in the Spring under the auspices of the Division of Research. A report summarizing these results is in preparation.

Table 6.--Sources of water containing greater than 10 parts per billion of uranium.

Sample Number	Source of Sample	Terrane	Location	Uranium (ppb)	Flow
4	Stream	San Juan tuffs. (Tertiary)	Cimarron Creek, SE¼ sec. 16, T. 48 N., R. 16 W., Montrose County, Colo.	77	15.5 cfs.
6-1	Spring	White River formation. (Oligocene) Contains lignite.	West Spring, NW¼NW¼SW¼ sec. 25, T. 19 N., R. 7 E., Harding County, S. Dak.	30	Piped into cattle trough.
6-2	Spring	do.	Colonel Spring, NW¼SE¼SE¼ sec. 1, T. 17 N., R. 7 E., Harding County, S. Dak.	36	do.
7-1	Stream	Schroeckingerite-bearing sediments and uraniferous lignite.	Lost Creek, 200 feet south of bridge, NE¼NW¼NW¼ sec. 31, T. 26 N., R. 94 W. (6th Principal Meridian), Sweetwater County, Wyo.	60	Intermittent
7-2	Spring	do.	Spring near bridge, SE¼SW¼SW¼ sec. 30, T. 26 N., R. 94 W., Sweetwater County, Wyo.	195	do.
8	Spring	White River formation. (Oligocene)	Cameron Spring, NE¼NE¼ sec. 11, T. 32 N., R. 90 W., Fremont County, Wyo.	10	One-inch pipe flows full, yielding about 7 gallons per minute.
9	Well	Barstow formation. (Miocene) Contains volcanics.	Well 19 miles northeast of Yermo, San Bernardino County, Calif.	64	Twenty-five gallons per day seepage.
16-1	Mine sump	Carnotite-bearing sandstone.	Cactus Rat mine, Yellow Cat, Grand County, Utah	165	No visible flow.
16-2	Spring	do.	Maverick Mesa Spring, SW¼ sec. 9, T. 40 N., R. 18 W., Mesa County, Colo.	45	No visible flow.
16-3	Spring	do.	Calamity Mesa Spring, SW¼ sec. 11, T. 50 N., R. 18 W., Mesa County, Colo.	300	One-half gallon per minute.
16-4	Mine sump	do.	Cougar Mine, Lower Group, SE¼ sec. 23, T. 44 N., R. 19 W., San Miguel County, Colo.	490	100 gallon per day.

Table 6.--Sources of water containing greater than 10 parts per billion of uranium. (Cont'd.)

Sample Number	Source of Sample	Terrane	Location	Uranium (ppb)	Flow
16-5	Spring	Carnotite-bearing sandstone.	Long Park Spring, NW¼ sec. 15, T. 47 N., R. 17 W., Montrose County, Colo.	440	1/50 gallon per minute.
20-1	Springs in mine face.	Uraniferous phosphate.	Bonny Lake mine, NW¼SE¼ sec. 32, T. 29 S., R. 24 E., Polk County, Fla.	16	Pumped 1500-2000 gallons per minute daily.

LABORATORY INVESTIGATIONS

Tabular data pertaining to routine analytical work completed during November are listed in table 6. A total of 66 samples was received by the Geological Survey from the public, including 22 public samples forwarded by the Atomic Energy Commission.

Table 7.--Analytical work and sample inventory.

Project or material	Chemical determinations		Spectrographic determinations	Radiometric determinations	Samples received	Samples on hand at end of month
	Uranium	Other				
Washington Laboratory						
Florida phosphates	555	0	0	1132	2619	3200
Lignites	15	21	2342	94	206	206
Monazites	0	0	0	0	217	217
Miscellaneous	85	20	5490	7	165	0
Total	665	41	7832	1233	3207	3623
Denver Laboratory						
Colorado Plateau carnotites	145	381	0	222	181	26
Colorado Plateau plants	0	50	0	0	20	36
Oil-well drillings	0	0	0	376	111	420
Florida phosphates	1	0	0	1	0	546
Northwest phosphates	0	10	0	0	121	193
Miscellaneous	371	553	1758	393	517	276
Total	517	894	1758	992	850	1497
Grand total	1172	935	9590	2225	4057	5120

Research

Detailed reports of progress in laboratory research projects are given in quarterly, semiannual, and annual reports. A report for the third quarter of calendar year 1951 will be transmitted to the Atomic Energy Commission in December.

Chemical

Chemical research projects in progress are: (1) Determination of micro amounts of lead in minerals, rocks and ores as an aid in determining geologic age (no work was done during the month). (2) Study of immersion liquids of high refractive index and liquids of high specific gravity, (this is also a mineralogic study). This study is being continued on a part-time basis; no work was done this month. (3) Continuing studies of methods for the determination of many different elements and compounds in radioactive rocks, minerals, and ores. (4) Statistical interpretation of chemical and radiometric analyses.

The project for the determination of a short procedure for estimation of oil content of shale and phosphate rock has been completed and a report is in preparation.

Mineralogic

Mineralogic research studies in progress are : (1) the Carnotite project, including lead and uranium isotope studies, studies of the minerals of the carnotite deposits, and study of the clays associated with the ore deposits; (2) the Phosphate project, including a study of the mineralogy and petrology of the Florida and northwest phosphate deposits and synthesis of apatite (no work was done during the month on this phase of the project); (3) properties of uranium minerals; (4) Colorado Front Range project, including the mineralogy and petrology of the veins and dikes in the Central City district, Gilpin County, the mineralogy and petrology of the fluorite deposits at, and the cerite deposits near, Jamestown, Boulder County, and the mineralogy and

petrology of the Copper King mine, Larimer County; and (5) mineralogy and petrology of lignites and shales.

Spectrographic

Spectrographic research projects in progress are: (1) detection of thorium in amounts as small as 0.001 percent; (2) detection of lead in amounts of less than one part per million to aid in geologic-age studies; (3) continuing studies in methods of analysis; and (4) studies of germanium in lignite. Current experimental work on project (4) is being done to determine if germanium volatilizes during ashing of lignites at 800°C in preparation for chemical analysis.

Radiometric

Radiometric research projects in progress are: (1) establishment of a control chart for the performance of the Tracerlab automatic scaler (no work was done during the month); (2) continuting studies to improve the counting methods; and (3) development of a radiochemical method for the determination of uranium and thorium in monazite (no work was done during the month.)

REPORTS FORWARDED

Technical and other reports and memoranda prepared by the Trace Elements Office for transmittal to the Atomic Energy Commission include: (1) Trace Elements Investigations reports on specific areas, types of material, or laboratory and field techniques; (2) Trace Elements Memorandum reports on results of property examinations or preliminary appraisals of results of field projects, and on miscellaneous subjects; and (3) financial and administrative reports.

The reports listed below were transmitted to the Atomic Energy Commission in November on the dates given after the report titles.

Trace Elements Investigations Reports

180--"Preliminary report on the stratigraphy of the Morrison and related formations of the Colorado Plateau," by L. C. Craig, C. N. Holmes, R. A. Cadigan, V. L. Freeman, T. E. Mullens, and G. W. Weir; November 26, 1951.

200--"Bibliography of U. S. Geological Survey Trace Elements Reports," compiled by R. C. Vickers; November 20, 1951.

201--"List of current and planned projects of the Trace Elements program, U. S. Geological Survey," compiled by R. C. Vickers; November 23, 1951.

Trace Elements Memorandum Reports

247--"Preliminary report on geologic studies in the Capitol Reef area, Wayne County, Utah," by J. F. Smith; November 17, 1951.

272--"Geobotanical reconnaissance near Grants, New Mexico," by H. L. Cannon; November 14, 1951.

323--"Adaptation of portable survey meters for airborne reconnaissance with light planes in Alaska," by Helmuth Wedow, Jr. November 1, 1951.

256--"Preliminary reserve statement 18, reserve Block 6, Club Mesa, Montrose County, Colorado," by Leonid Bryner and M. A. Cramer; November 7, 1951.

BERYLLIUM-BEARING ROCKS

All field work related to the investigation of beryllium-bearing rocks and supported by the Atomic Energy Commission was discontinued on June 30, 1950. Preparation of reports was continued on the sub-projects listed on pages 35 and 36 of the June 1951 Monthly Report.

FINANCIAL AND PERSONNEL STATEMENT

The monthly statement of projects costs is being discontinued temporarily because the project costs are not received from the Accounting Section in time to include them; they will be reported separately in the future until some arrangement can be made for their inclusion.

The number of persons employed by each project are listed in table 8.

Table 8.--Summary of personnel by projects

Project	Number	
	Last month	This month
Reconnaissance, domestic	51	49
Airborne detection	0	1
Reconnaissance, Alaska	12	9
Colorado Plateau, exploration	92	92
Colorado Plateau, geologic studies	16	16
Colorado P;ateau, Pre-Morrison studies	11	11
Northwest phosphate	9	11
Southeast phosphate	15	15
Lignite and coal investigations and black-shale reconnaissance	12	12
Thorium and monazite	3	6
Laboratory Investigations	105	105
Total	326	327

GEOGRAPHIC INDEX

Alaska: 25, 60, 61
  Southeastern Alaska region: 25

Arizona: 11, 37, 38, 39
  Apache County: 11, 37, 38, 39
    Carrizo Mountains area: 11, 37, 38
  Navajo County: 39
    Monument Valley area: 39

Boulder Bathlolith area: 18

California: 11, 12, 51
  Fresno County: 12
    Dunlap quadrangle: 12
    New Idria quadrangle: 12
  Humboldt County: 11
    Eureka: 11
  Monterey County: 13
    Paint Lobos State Park: 13
  San Bernardino County: 51
    Mountain Pass: 51
  San Diego County: 12
    Cuyamaca Peak quadrangle: 12
  Sierra County: 12
    Downieville: 12
  Tuolumne County: 12
    Mocassin quadrangle: 12

Colorado: 7, 8, 10, 13, 26-40, 51, 54, 58,60
  Boulder County: 7, 10, 14, 58
    Caribou district: 7, 10, 14
    Jamestown: 58
  Clear Creek County: 13
    Jo Reynolds mine: 14
    Lawson district: 13
      Annamosa area: 13
      Bellevue-Rochester tunnel: 13
      Elida tunnel: 13
      Prince Albert: 13
  Custer County: 51
    Huputa Ranch-Wet Mountains: 15
  Dolores County: 33
    Disappointment Valley: 33
  Gilpin County: 13, 58
    Central City district: 13, 58
      Pewabic-Iron mine area: 13
      Justice Hill area: 13
      Quartz Hill area: 13
  Jefferson County: 10, 15
    Old Leyden mine: 10, 15
    Ralston district: 15
  Larimer County: 10, 14, 59
    Copper King mine: 10, 14, 59
  Mesa County: 7, 26
    East Gateway district: 26
      Outlaw Mesa: 7, 26
  Montrose County: 7, 8, 29, 34, 54, 60
    Cimarron Creek: 54
    Little Cimarron Creek: 54
    Uravan district: 7, 29, 60
      Atkinson Mesa: 7, 29
      Dolores Bench: 7, 30
      Horse Mesa: 7, 29
      Long Park: 7, 31, 34
      San Miguel Bench: 7, 30
      Spring Creek Mesa: 7, 30
  San Miguel County: 31, 33, 37
    Slick Rock district: 31, 37
      Disappointment Valley: 33
      Spud Patch area: 31

Colorado Front Range: 7, 13-15, 5

Colorado Plateau: 7, 26-40, 57, 6 61

Florida: 7, 43-45, 57, 58
  Polk County: 7, 43, 44, 45
    Clear Spring tract: 7, 43, 44
    Homeland tract: 7, 43, 44
    French tract: 7, 43, 44

Idaho: 7, 41, 46, 48
  Bear Lake County: 7, 41
    Georgetown: 7, 41
  Caribou County: 41
    Dry Valley quadrangle: 41
    Johnson Creek quadrangle: 41
  Cassia County: 46, 48
    Goose Creek district: 46, 48

Minnesota: 7, 22

Montana: 18
  Jefferson County: 18
    Boulder district: 18
      Free Enterprise mine: 18

Nevada: 7, 12, 46, 49
Elko County: 49
Esmeralda County: 46
Silver Peak Range: 46
Lyon County: 12
Nye County: 7, 49

New Mexico: 17, 46, 48, 49, 60
Grant County: 17
Blackhawk district: 17
White Signal district: 18
Merry Widow claim: 18
San Juan County: 49
Beautiful Mountain: 49
Sandoval County: 46, 48
La Ventana Mesa: 46, 48
Valencia County: 60
Grants district: 60

New York: 20

North Carolina: 8, 52
Burke County: 53
Cleveland County: 8, 52
Knob Creek: 8, 52

Northwest phosphate: 7, 41-42, 57, 58, 61

Oregon: 11
Lincoln County: 11
Walport: 11

Pennsylvania: 20
Centre County: 21
State College: 21
Lebanon County: 21
Swatara Gap: 21
Huntingdon County: 20
Mount Union: 20
Monroe County: 20
Delaware Water Gap: 20
Union County: 21
Lewisburg: 21

South Carolina: 52

South Dakota: 1, 7, 10, 19, 46, 47
Fall River County: 7, 10, 19
Craven Canyon area: 7, 10, 19
Harding County: 46, 47
Slim Buttes area: 46, 47
Southeastern monazite: 8, 52, 57
Southeast phosphate: 7, 43-45, 57 58, 61

Texas: 22
Moore County: 22
Potter County: 22
West Panhandle gas field: 22

Utah: 7, 9, 10, 15-17, 19, 32, 39, 40, 41, 49, 60
Daggett County: 10, 19
Yellow Canary claims: 10, 19
Emery County: 9
San Rafael swell: 9
Grand County: 7, 32
Thompsons area: 7, 32
Juab County: 17, 49
Thomas Range: 17
Fluorite district: 17
Kane County: 7, 10, 16
Bulloch claims: 7, 10, 16
Lynn No. 3 claim: 16
San Juan County: 39
White Canyon area: 39
Washington County: 15
Silver Reef: 15
Hot Rock No. 1 claim: 16
Maud claim: 16
Paulmar Hill: 16
Tecumseh: 16
Vanderbilt mine: 16
Wayne County: 40-60
Capitol Reef area: 40-60
Weber County: 49
Odgen canyon: 49

Wyoming: 7, 8, 10, 18, 41, 46, 47
Campbell County: 8, 46
Johnson County: 8, 46
Sweetwater County: 7, 10, 18, 46, 47
Red Desert area: 10, 46, 47
Lost Creek schroeckingerite deposit 7, 10, 18, 46

U. S. Department of the Interior
Geological Survey

Colorado Plateau project
Monthly report Nov. 1951

APPROXIMATE BASE OF THE ORE-BEARING SANDSTONE

PRMP-3
7152

B.M.6991

B.M.6963

POTATOE

B.M.6664

B.M.6402

B.M.6199

B.M.5981

Calamity Creek

Approximate base of ore-bearing sandstone

Blue Creek

N

EXPLANATION

Diamond-drill holes, U.S.G.S. (classification of holes is by visual estimates, modified by gamma-ray logs, radiometric counts, or chemical assays, when available).

- Barren
- Weakly mineralized (less than 0.1% U_3O_8 and 1.0% V_2O_5, or less than 1 foot thick regardless of grade).
- Ore-bearing (0.1% or more U_3O_8 or 1.0% or more V_2O_5 and 1 foot or more thick).
- Current month drill hole.
- Ground underlain by carnotite-bearing rock found by U.S.G.S. drilling.

OUTLAW MESA, MESA COUNTY, COLORADO

1000 0 3000 FEET

CONTOUR INTERVAL 100 FEET
DATUM IS MEAN SEA LEVEL

Figure 3

U. S. Department of the Interior
Geological Survey

Colorado Plateau project
Monthly report, Nov. 1951

EXPLANATION

Diamond-drill holes, U.S.G.S. (Classification of holes is by visual estimates, modified by gamma-ray logs, radiometric counts, or chemical assays, when available).

○ Barren

Weakly mineralized (less than 0.1% U_3O_8 and 1.0% V_2O_5, or less than 1 foot thick regardless of grade).

◎ Current month drill hole.

Ground underlain by carnotite-bearing rock found by U.S.G.S. drilling.

MESA COUNTY
MONTROSE COUNTY
Approximate boundary
Creek
Fork
South
Mesa

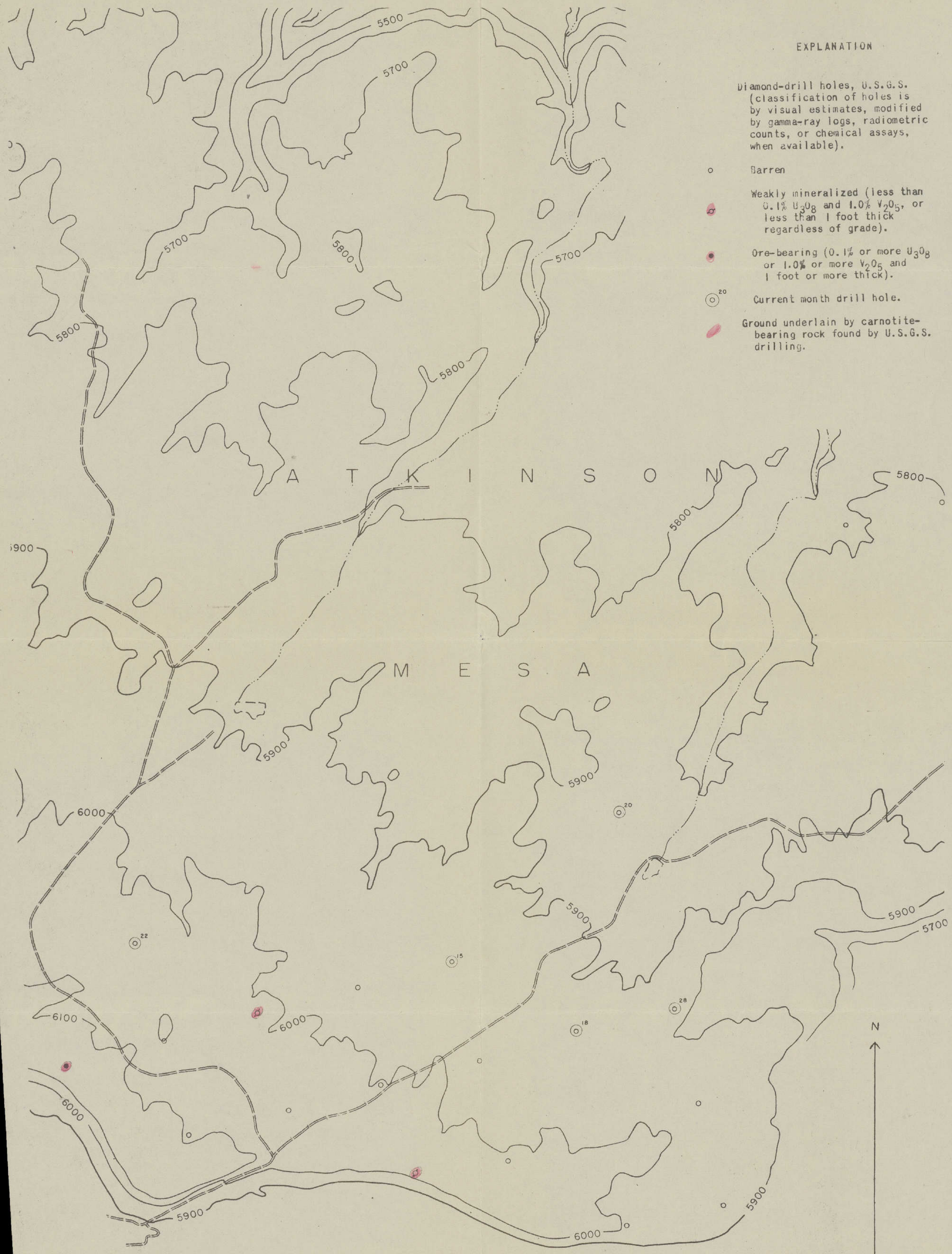
N

HORSE MESA AREA, MESA AND MONTROSE COUNTIES, COLORADO

1000 0 3000 FEET

Contour interval 100 feet. Datum is mean sea level.

Figure 4



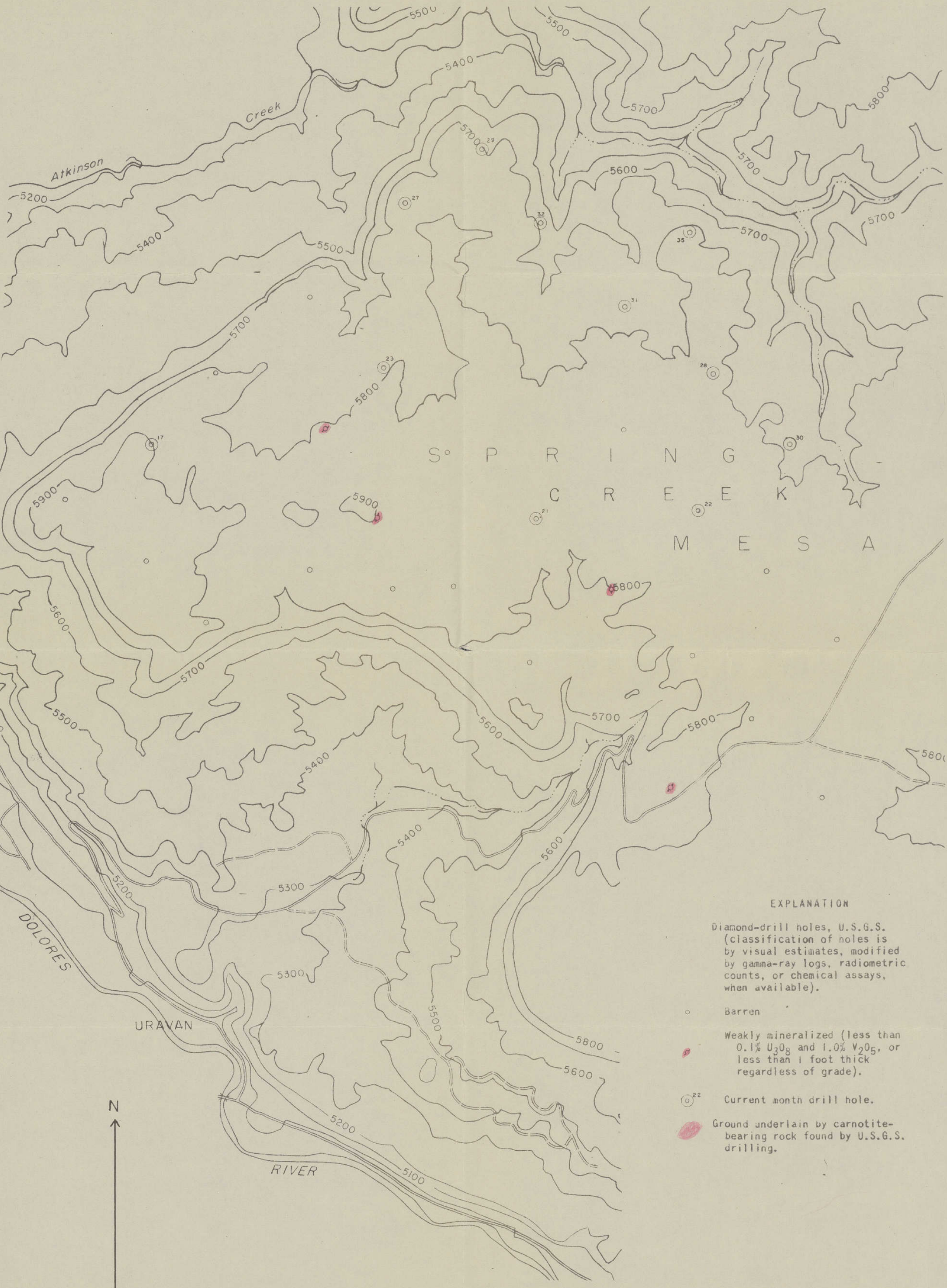
PART OF ATKINSON MESA, MONTROSE COUNTY, COLORADO

1000 0 3000 FEET

Contour interval 100 feet. Datum is mean sea level.

Figure 5

[redacted]



PART OF SPRING CREEK MESA, MONTROSE COUNTY, COLORADO [redacted]

1000 0 3000 FE[redacted]

CONTOUR INTERVAL 100 FEET. DATUM IS MEAN SEA LEVEL [redacted]

Figure 6

U. S. Department of the Interior
Geological Survey

Colorado Plateau project
Monthly report Nov. 1951

CLUB MESA, Montrose County, Colorado

CLAIM INDEX

1	LUCKY STRIKE	16	RAINY DAY	31	R.A.M.	46	BIG SHOT
2	MARY	17	B & M	32	BETA WONDER	47	
3	VIRGINIA	18	COMMODORE	33	BETA	48	TRAMP NO. 1
4	HUNTER	19	YELLOW JACKET	34	SURPRISE	49	TRAMP NO. 2
5	IRENE	20	KAISER	35	SURPRISE NO.1	50	TRAMP NO. 3
6	SHAMROCK	21	J. M.	36	TELLURIDE	51	TRAMP NO. 4
7	OLD SALT LICK	22	RAMBLER	37	CHEMIST	52	OLD TAYLOR
8	LOST HORSE	23	BEAVER	38	CHEMIST NO.2	53	OLD HICKORY
9	TRUSCOTT	24	ELK	39	LOLA	54	U. S. GRANT
10	RANCH VIEW	25	MILL NO.1	40	RAVEN-20472	55	WILLIAM McKINLEY
11	RAYMOND	26	MILL NO.2	41	CRACK SHOT		
12	LITTLE JOHNNY	27	MILL NO 3	42	BIRD SHOT	56	JOHN ADAMS
13	SALT LAKE EXT.	28	MILL NO.4	43	BUCK SHOT	57	JACK RABBIT
14	ANTELOPE	29	MILL NO.5	44	HALF SHOT	58	PEARL WALKER
15	RAVEN-20271	30	JOE JUNIOR	45	SURE SHOT		

EXPLANATION

Diamond-drill holes, U.S.G.S. (classification of holes is by visual estimates, modified by gamma-ray logs, radiometric counts, or chemical assays, when available).

- Barren
- Weakly mineralized (less than 0.1% U_3O_8 and 1.0% V_2O_5, or less than 1 foot thick regardless of grade).
- Ore-bearing (0.1% or more U_3O_8 or 1.0% or more V_2O_5 and 1 foot or more thick).
- Current month drill hole.
- Ground underlain by carnotite-bearing rock found by U.S.G.S. drilling.
- Mine workings (approximate outline).
- Area tested by other drilling (individual holes not shown).

Figure 7

U. S. Department of the Interior
Geological Survey

Colorado Plateau project
Monthly report, Nov. 1951

EXPLANATION

Diamond-drill holes, U.S.G.S. (classification of holes is by visual estimates, modified by gamma-ray logs, radiometric counts, or chemical assays, when available).

- Barren
- Weakly mineralized (less than 0.1% U_3O_8 and 1.0% V_2O_5, or less than 1 foot thick regardless of grade).
- Ore-bearing (0.1% or more U_3O_8 or 1.0% or more V_2O_5 and 1 foot or more thick).
- Current month drill hole.

Ground underlain by carnotite-bearing rock found by U.S.G.S. drilling.

Mineralized area found by mine development and other drilling.

Area tested by other drilling (individual holes not shown).

1000 0 3000 FEET

Contour interval 100 feet
Datum is mean sea level

APPROXIMATE TOP OF THE ORE-BEARING SANDSTONE

APPROXIMATE TOP OF THE ORE-BEARING SANDSTONE

LONG PARK

N

LONG PARK AND VICINITY, MONTROSE COUNTY, COLORADO

Figure 8

EXPLANATION

Diamond-drill holes, U.S.G.S. (classification of holes is by visual estimstes, modified by gamma-ray logs, radiometric counts, or chemical assays, when available).

- Barren
- Weakly mineralized (less than 0.1% U_3O_8 and 1.0% V_2O_5, or less than 1 foot thick regardless of grade)
- Ore-bearing (0.1% or more U_3O_8 or 1.0% or more V_2O_5 and 1 foot or more thick)
- Current month drill hole
- Ground underlain by carnotite-bearing rock found by U.S.G.S. drilling
- Area tested by other drilling (individual holes not shown)
- Mine workings, underground (approximate outline)
- Mine workings, open cut (approximate outline)
- X Prospect, or small open cut

N

Bush canyon

Bell Canyon

PT-2

Bessie Mines

Norma Jean Mines

Moqui Jug Mine

Paystreak Mine

Mayday Mine

Approximate base of ore-bearing sandstone

B.M.7462

Bell Canyon reservoirs

19 20 30 29

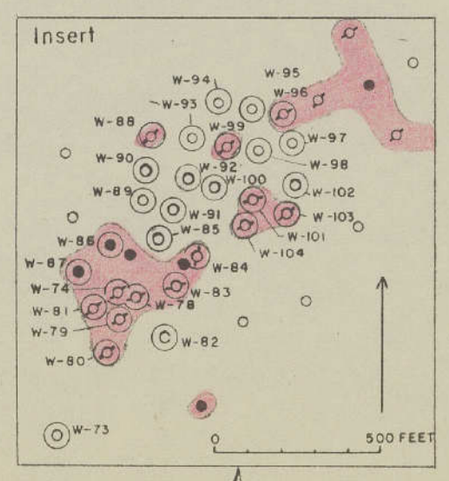
29 28 32 33

SPUD PATCH AREA, SAN MIGUEL COUNTY, COLORADO

1000 0 3000 FEET

Contour interval is 100 feet. Datum is mean sea level

Figure 9



PART OF THE YELLOW CAT AREA, GRAND COUNTY, UTAH

1000 0 3000 FEET

Contour interval 50 feet Datum is assumed.

Fig. 10

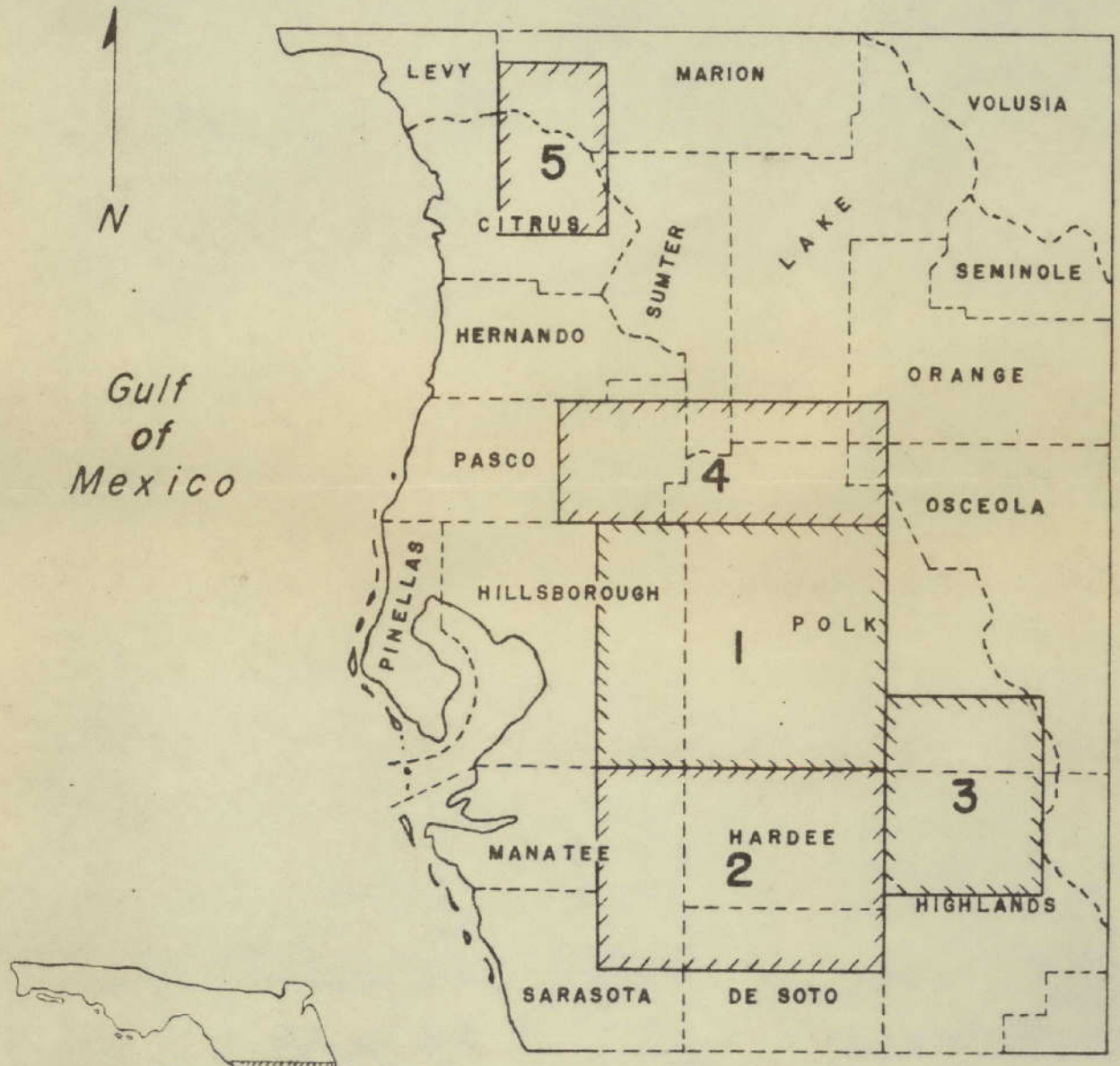
U. S. GEOLOGICAL SURVEY

FLORIDA PHOSPHATE PROJECT

Figure 11
Sheet A

INDEX TO PROGRESS MAPS

NOV 1951

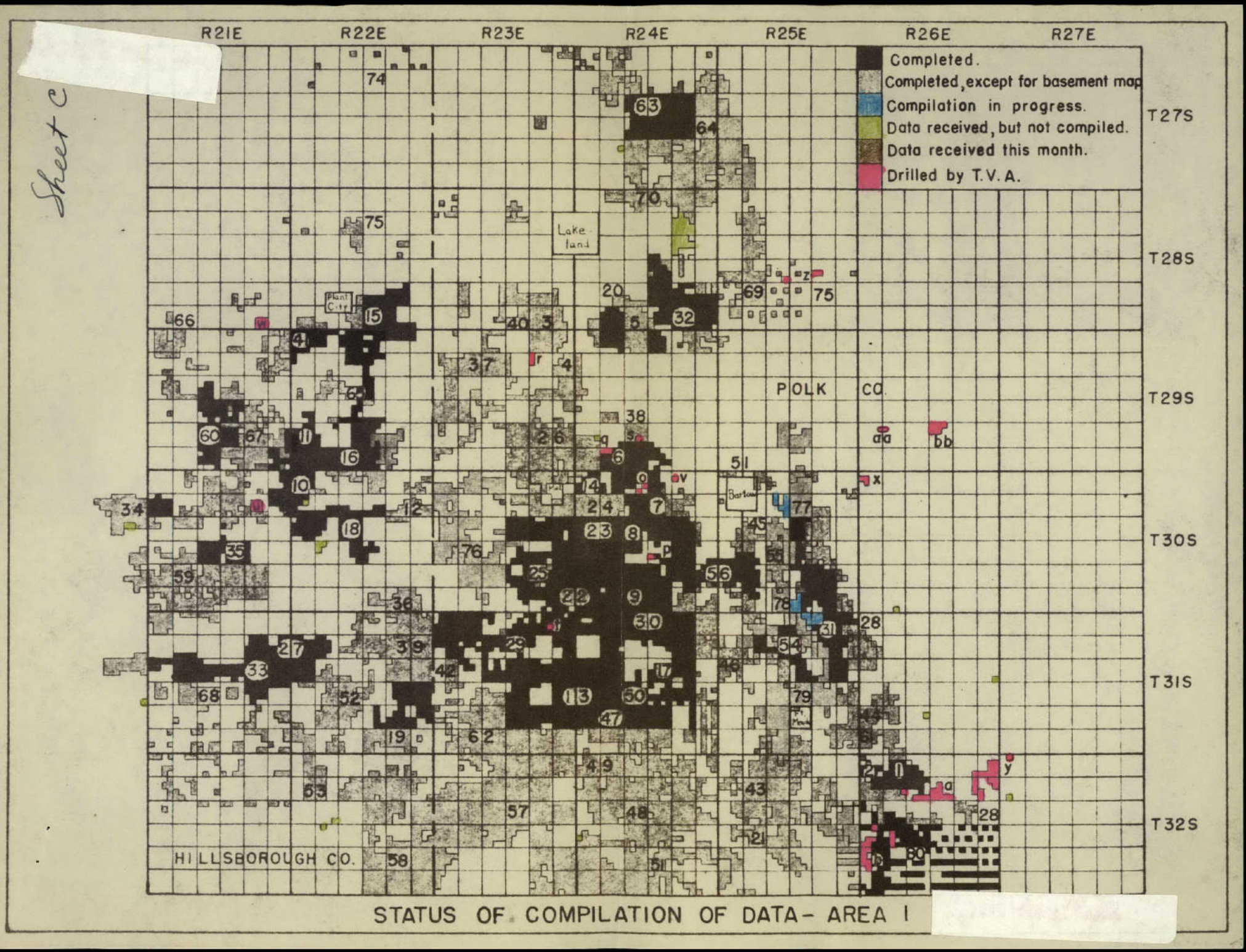


Sheet B

STATUS OF COMPILATION OF DATA FURNISHED BY COMPANIES ON INDIVIDUAL TRACTS

Sites drilled by TVA: a,b,c,etc.
80% indicates data compiled except for basement contour map.

1.	OLD COLONY, AM. CY. CO.	100%
2.	B. HART ESTATE, AM. CY. CO.	100%
3.	SANGULLY, DAVISON	80%
4.	STANDARD, DAVISON	80%
5.	PAUWAY NO. 4, DAVISON	90%
6.	BONNEY LAKE, DAVISON	100%
7.	RIDGEWOOD, DAVISON	100%
8.	OAK RIDGE, AM. CY. CO.	100%
9.	GREEN BAY, AM. CY. CO.	100%
10.	CARMICHAEL, A.A.C.	100%
11.	HOPEWELL, A.A.C.	100%
12.	KEYSVILLE, A.A.C.	80%
13.	BREWSTER, AM. CY. CO.	100%
14.	MARY LEE, CORONET	100%
15.	CORONET (UPPER) CORONET	100%
16.	HOPEWELL (LOWER) CORONET	90%
17.	GREEN HEAD, AM. CY. CO.	100%
18.	ELEANOR, CORONET	100%
19.	BIG FOUR, CORONET	80%
20.	CLEVELAND HEIGHTS, AM. CY.	80%
21.	POLK PHOS. CO. LANDS	80%
22.	PEBBLEDALE-PIERCE, A. A. C.	100%
23.	NO. 122 WASHER, IMCC	90%
24.	NO. 12 WASHER, IMCC	80%
25.	No. 6 WASHER, IMCC	100%
26.	PRAIRIE, IMCC	80%
27.	WAYNE THOMAS	80%
28.	A.C.L. R.R.	80%
29.	BRADLEY, IMCC	100%
30.	EAST BRADLEY, IMCC	90%
31.	EAST PEACE VALLEY, IMCC	100%
32.	SADDLE CREEK, AM. CY. CO.	100%
33.	BOYETTE, A.A.C.	80%
34.	BLOOMINGDALE, A.A.C.	80%
35.	LITHIA, A.A.C.	100%
36.	WELCOME, AM. CY. CO.	80%
37.	MEDULLA, IMCC	80%
38.	HIGHLAND, IMCC	80%
39.	HILLSBOROUGH, IMCC	80%
40.	BRANE, IMCC	80%
41.	COONS, SWIFT & CO.	80%
42.	WEST BRADLEY, SWIFT & CO.	80%
43.	WARREN, SWIFT & CO.	80%
44.	VARN, SWIFT & CO.	80%
45.	PHARR, PEMBROKE CO.	80%
46.	TIGER BAY, A.A.C.	80%
47.	NO. 12 WASHER, A.A.C.	90%
48.	SOUTH PIERCE, A.A.C.	80%
49.	BRADLEY LANDS (T32S,R24E)	80%
50.	BRADLEY LANDS (T31S,R24E)	90%
51.	INDEPENDENT CHEM. CO.	80%
52.	CARTER, W. THOMAS	80%
53.	BAKER, W. THOMAS	80%
54.	WEST PEACE VALLEY, IMCC	100%
55.	N. PEACE VALLEY, IMCC	100%
56.	NORALYN, IMCC	100%
57.	CONSOLIDATED, A.A.C.	80%
58.	ALDERMAN'S CREEK, A.A.C.	80%
59.	FISHHAWK, A.A.C.	80%
60.	SIDNEY, AM. CY. CO.	100%
61.	SOUTH VARN, W. THOMAS	80%
62.	SWEARINGEN, W. THOMAS	80%
63.	ORANGE, AM. CY. CO.	90%
64.	SADDLE CREEK, A.A.C.	80%
65.	MOCCASIN POND, W. THOMAS	80%
66.	DOVER, W. THOMAS	80%
67.	DURANT, W. THOMAS	80%
68.	PETROVICH, W. THOMAS	80%
69.	EBERSPACH, W. THOMAS	80%
70.	GRIMES GOLDEN, W. THOMAS	80%
71.	MANATEE, AM. CY. CO.	80%
72.	WILDCAT T25S, AM. CY. CO.	80%
73.	WILDCAT T26S, AM. CY. CO.	80%
74.	WILDCAT T27S, AM. CY. CO.	80%
75.	WILDCAT T28S, AM. CY. CO.	80%
76.	NICHOLS, V-C	80%
77.	CLEAR SPRINGS, V-C	80%
78.	HOMELAND, V-C	80%
79.	FT. MEADE, V-C	80%
80.	SOUTH FT. MEADE, V-C	90%

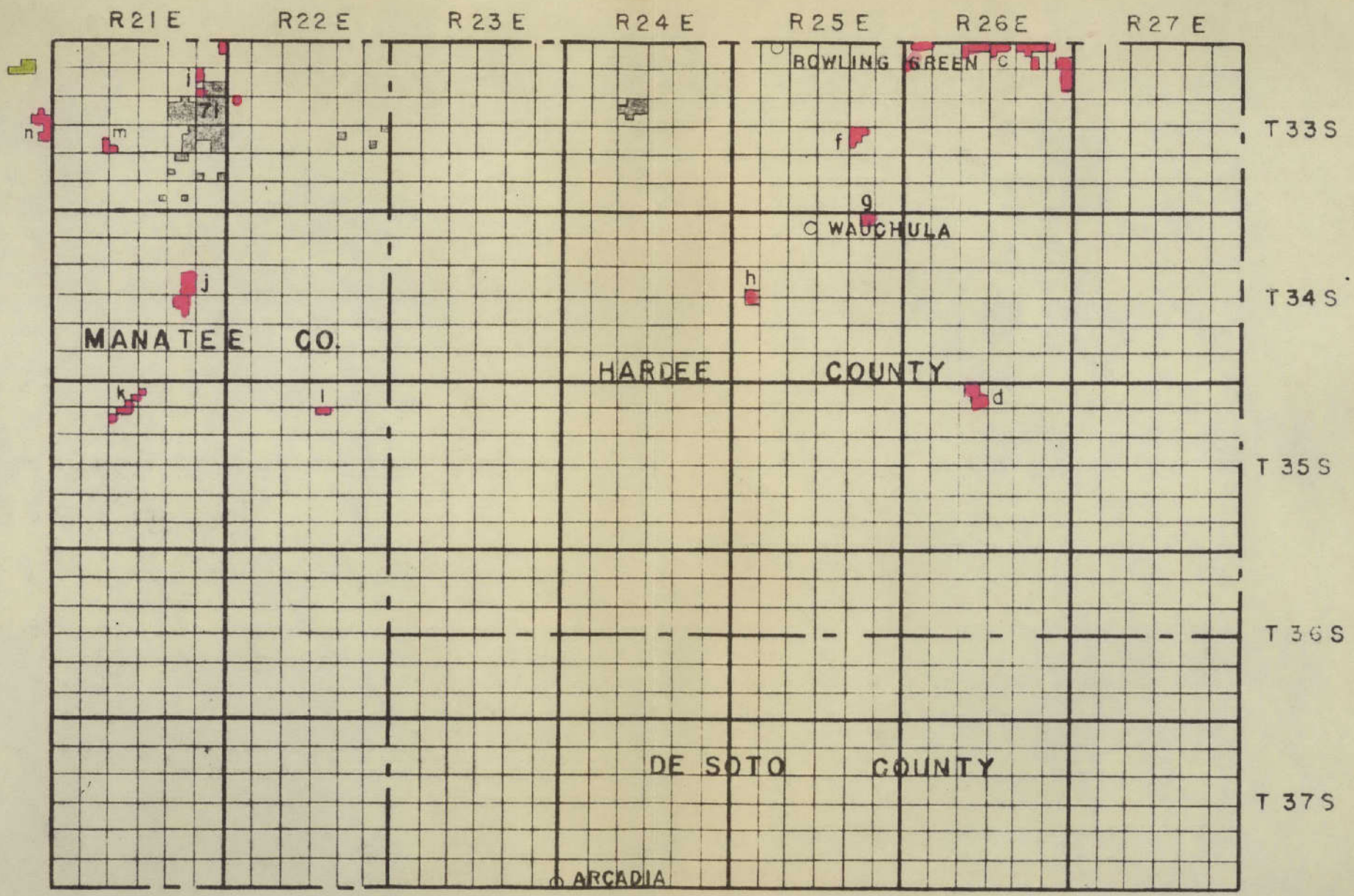


STATUS OF COMPILATION OF DATA - AREA I

U S GEOLOGICAL SURVEY

Sheet 2

For explanation see map of Area 1.

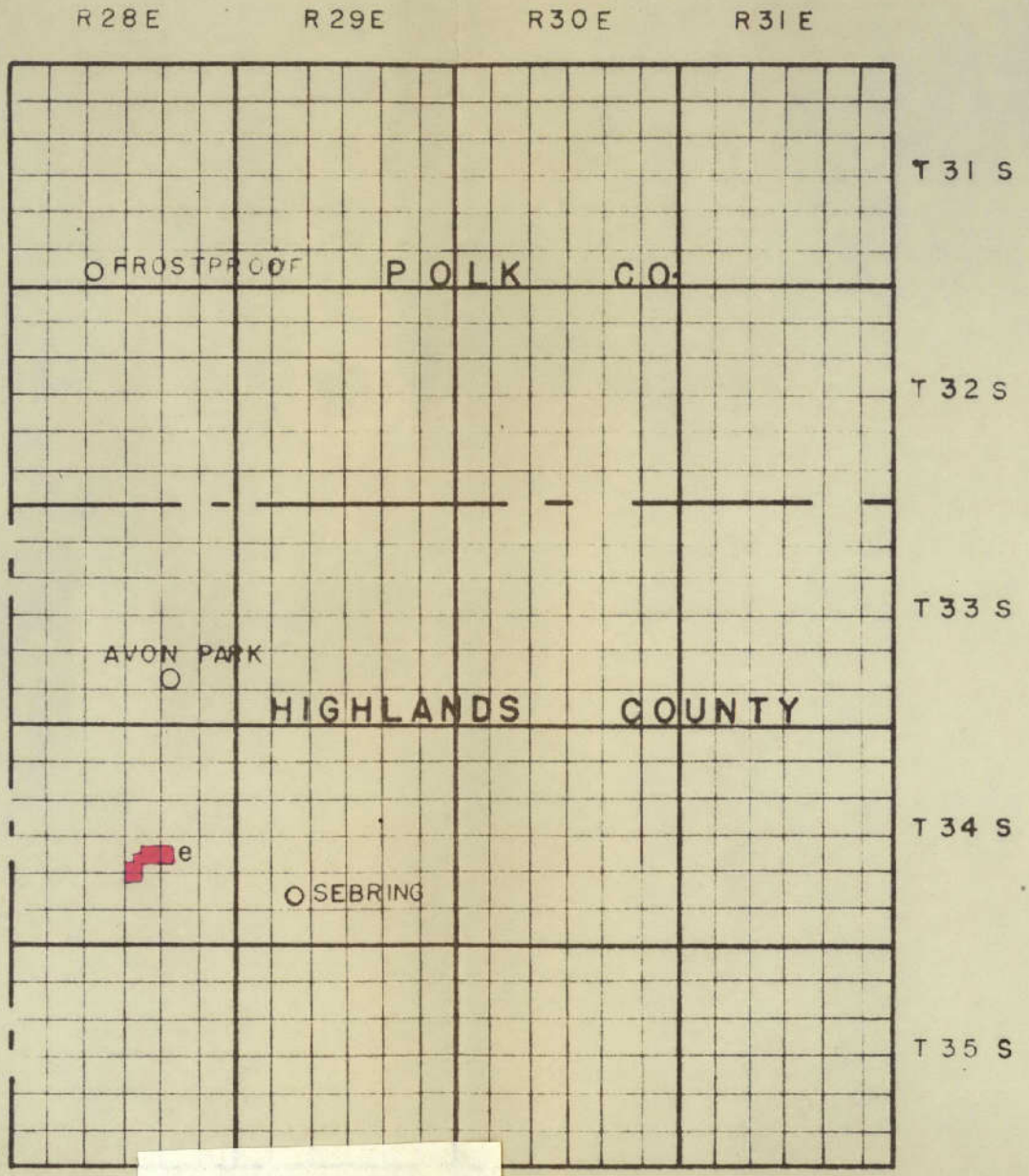


STATUS OF COMPILATION OF DATA - AREA 2

U. S. GEOLOGICAL SURVEY

For explanation see map of Area 1.

Sheet E

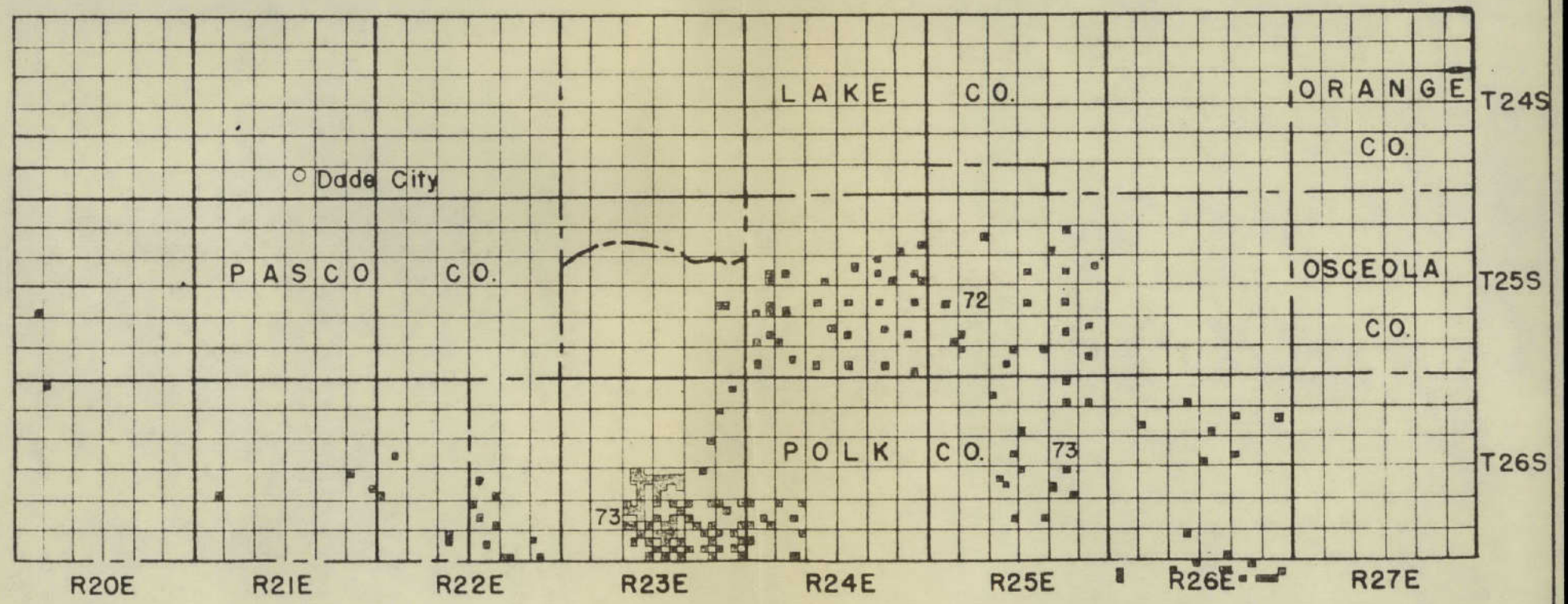


STATUS OF COMPILATION OF DATA - AREA 3

U. S. GEOLOGICAL SURVEY

Sheet F

For explanation see map of Area 1.



STATUS OF COMPILATION OF DATA - AREA 4

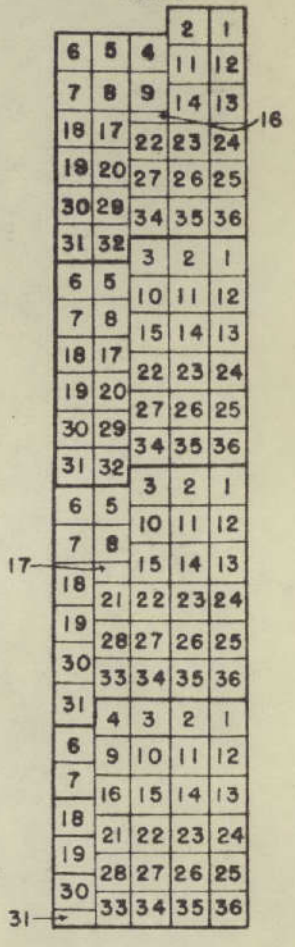
U. S. GEOLOGICAL SURVEY

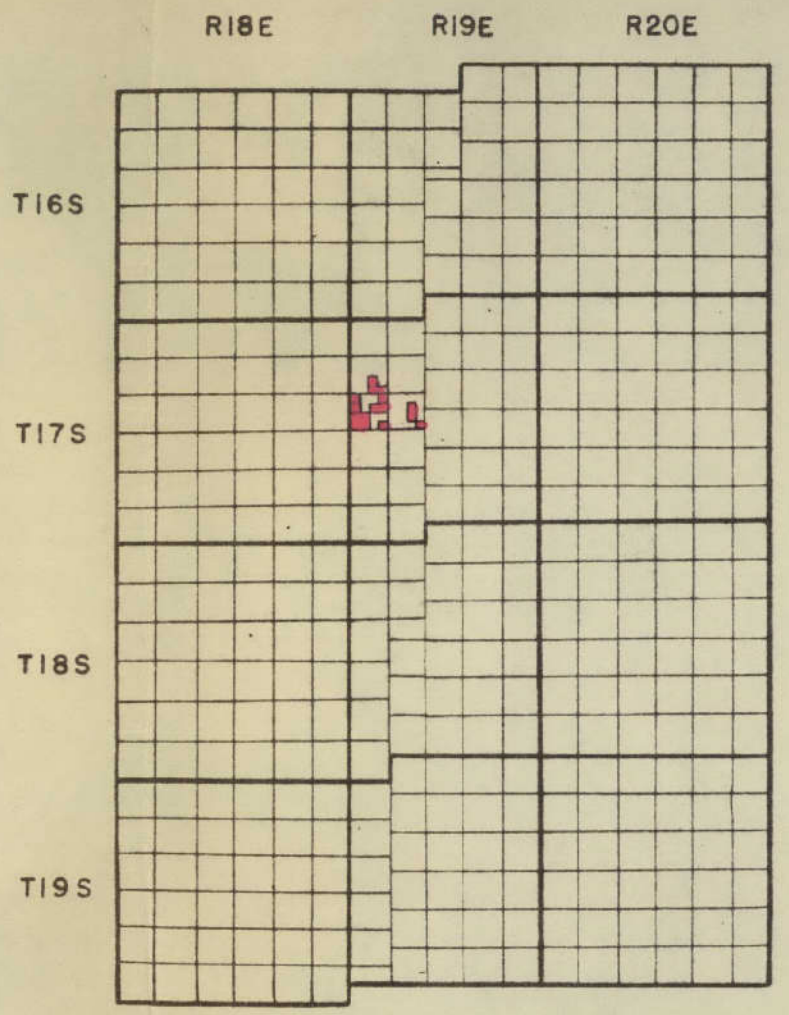
Sheet G

For explanation see map of Area I.

KEY TO SECTION NUMBERS

R19E





STATUS OF COMPILATION OF DATA - AREA 5