

GEOLOGICAL SURVEY CIRCULAR 239



URANIUM DEPOSITS OF THE
BULLOCH GROUP OF CLAIMS
KANE COUNTY, UTAH

By E. P. Beroni, F. A. McKeown, F. Stugard, Jr., and G. B. Gott

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W. E. Wrather, Director

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URANIUM DEPOSITS OF THE BULLOCH GROUP OF CLAIMS

KANE COUNTY, UTAH

ABSTRACT

The Bulloch group of uranium claims is in T. 40 S., R. 9 W., Kane County, Utah. In June 1950, 8.5 tons of submarginal ore was shipped to the Marysvale purchasing depot of the Atomic Energy Commission; this shipment assayed 0.16 percent U_3O_8 .

Uranium compounds are finely disseminated in clay, carbonized wood fragments, iron oxide concretion, petrified logs, sandstone, and conglomerate of the lower part of the Dakota sandstone and upper part of the Summerville formation. Small quantities of the uranium minerals carnotite, tyuyamunite, and autunite were recognized in the conglomerate and sandstone on Lynn Nos. 2 and 3 claims.

Exposures of three uraniferous lenses, each less than 75 feet long, contain as much as 0.1 percent uranium. The presence of uranium in ground water and in plants indicates that the uranium is being redistributed by ground water and may suggest the presence of concealed ore deposits nearby.

INTRODUCTION

The Bulloch group of claims, owned by Henry Bulloch of 399 East Center Street, Cedar City, Utah, is on both sides of Orderville Gulch, in secs. 8, 9, 15, 16, 17, 20, and 21, T. 40 S., R. 9 W., Salt Lake principal meridian, Kane County, Utah (fig. 1). The claims can be reached by an unsurfaced county road that connects State Highway 14 at Navajo Lake with State Highway 15 at a point 2 miles east of the entrance to Zion National Park (fig. 2). Poorly maintained access roads lead from the county road to some of the claims, but four-wheel drive vehicles are required to climb the steep grades.

The Bulloch group includes 36 claims, covering most of the Dakota sandstone cliffs on the north and south sides of Orderville Gulch. Development work has been done at Lynn No. 3 claim, to which an access road has been built. The development work on this claim consists of one prospect cut in the cliff face (pl. 1), about 14 feet wide, 7 feet high, and 7 feet deep.

In June 1950, 8.5 tons of ore containing 0.16 percent U_3O_8 was shipped to the Marysvale purchasing depot of the Atomic Energy Commission. This shipment was below the minimum requirement of 0.2 percent U_3O_8 and, therefore, was rejected.

Samples from the Lynn No. 3 and the Bulloch No. 17 claims, submitted by Mr. Bulloch, were assayed for uranium in 1949; additional samples were collected by the U. S. Atomic Energy Commission and the U. S. Geological Survey from the Lynn No. 3, Jeannie No. 3, and Bulloch No. 2 claims in the spring and summer of 1950.

The Bulloch group of claims was examined briefly in the summer of 1950 as part of the U. S. Geological Survey's program for evaluating the uranium resources in the Marysvale region¹. As a result of this prelim-

inary investigation, the most uraniferous parts of the area were mapped at a scale of 1:480 (pl. 1). A systematic radiometric reconnaissance of the Dakota sandstone outcrops on the other claims was made in late October and early November, 1950.

GEOLOGY

The uranium deposits on the Bulloch group of claims are chiefly in the lower part of the Dakota sandstone of Cretaceous age and upper part of the Summerville formation of Jurassic age. Some uranium also occurs in the upper part of the Dakota sandstone. The Dakota sandstone in this area is unconformably underlain by the Summerville formation and Entrada sandstone of Jurassic age and is conformably overlain by the Tropic formation of Cretaceous age.

Stratigraphy

Jurassic rocks

Summerville formation and Entrada sandstone, undivided.—The Jurassic rocks² on the Bulloch claims have not been differentiated on plates 1, 2, and 3. Rocks mapped as Jurassic are the Summerville formation and the Entrada sandstone, whose combined thickness is about 350 feet. The formations are composed of gypsum, red and gray sandstone, and sandy clays. Sandstone predominates in the upper 10 to 20 feet. In strong contrast to the red and gray sandstone and clays, the gypsum crops out as a conspicuous white band, 25 to 30 feet wide, about 185 feet below the Dakota sandstone along the base of the cliffs.

Cretaceous rocks

Dakota sandstone.—The Dakota sandstone is 50 to 75 feet thick on the Bulloch group of claims. It is composed of fluvialite yellow-to-buff conglomerates, and some interbedded sandstones and clay. The conglomerates are composed principally of pebbles of quartz, quartzite, and chert, which range from an eighth of an inch to 3 inches in diameter; the average pebble near the base of the formation is about 1 inch in diameter, and the average pebble in the upper part is about half an inch in diameter. The sandstone is yellow, medium-grained, and slightly micaceous. It contains many carbonized wood fragments, petrified logs, and a few iron oxide concretions. In many places both the sandstone lenses and the conglomerate are cross-bedded and channelled. Most of the cross-bedding indicates deposition from streams that flowed north or northeast.

The conglomerates in the lower part of the Dakota sandstone commonly contain carbonized wood fragments

¹Wyant, D. G., Stugard, Frederick, Jr., and Kaiser, E. P., 1950, *Uranium resources of the Marysvale region, Utah*: U. S. Geological Survey Trace Elements Memo. Rept. 169. [Unpublished report.]

²Gregory, H. E., *Geology and geography of the Zion Park Region*: U. S. Geol. Survey Prof. Paper 220.

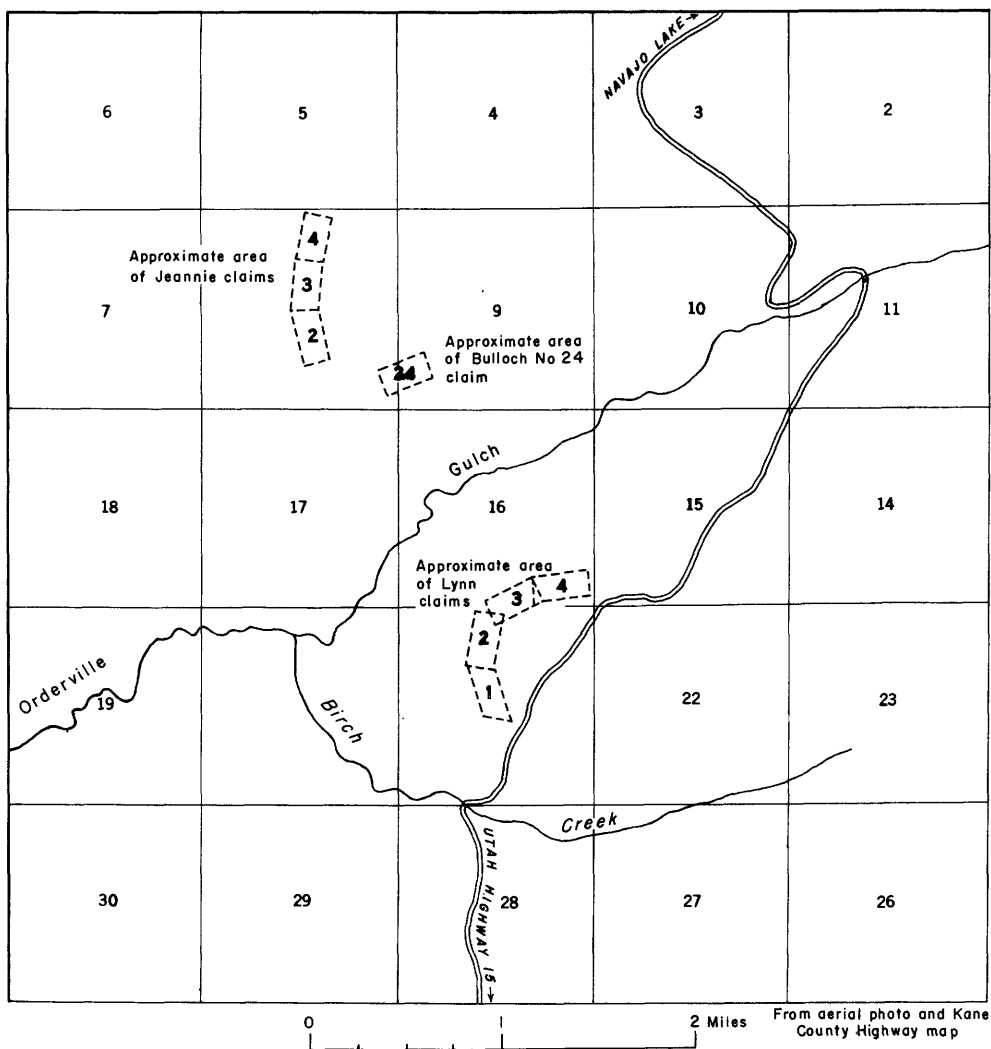


Figure 1. --Map showing approximate location of several claims of the Bulloch group of claims in T. 40 S., R. 9 W., Kane County, Utah.

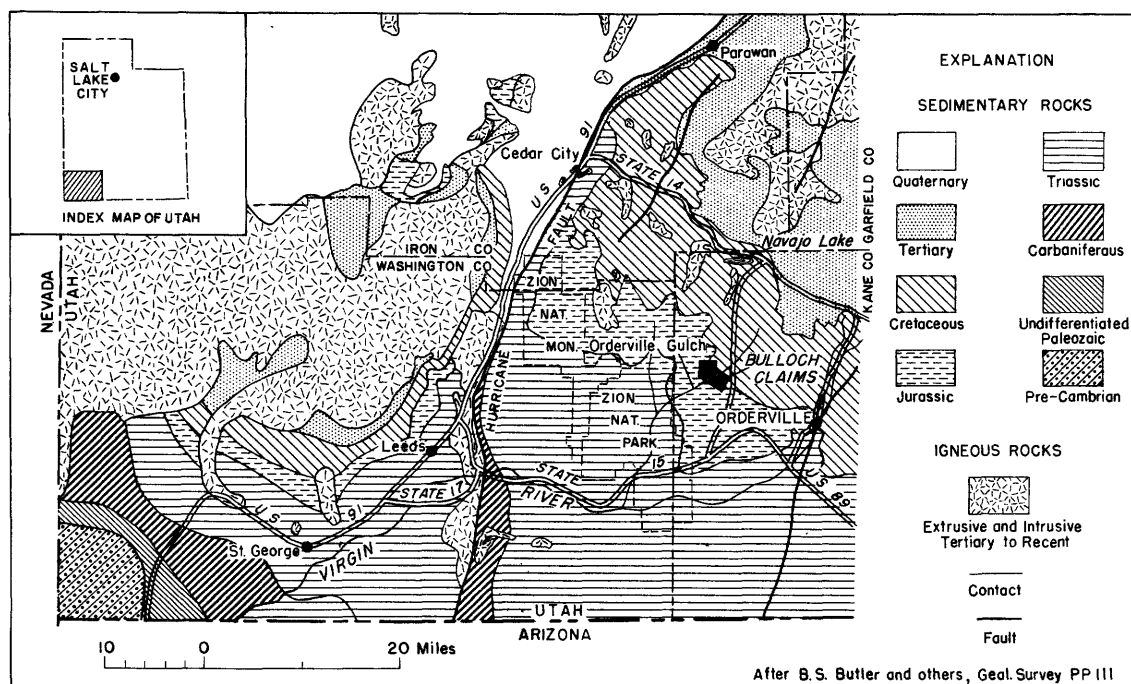


Figure 2. --Index map of southwestern Utah.

encased by a shell of iron oxide. In some places iron oxide forms a prominent reddish-brown halo around nodular and disseminated clay. Small clay lenses, ranging from 1 to 20 feet in length and from 0.5 to 5 feet in thickness, are interbedded with the conglomerate. The clay and carbonized wood fragments apparently have controlled the precipitation of uranium compounds.

Tropic formation.—The Tropic formation conformably overlies the Dakota sandstone, and in the vicinity of the uranium deposits is composed chiefly of carbonaceous shales, clays, sandy clays, sandstones, and lignites. It is estimated to be more than 200 feet thick.

Structure

The Orderville Gulch area is part of the Markagunt Plateau, a fault block, bounded on the east by the Sevier fault, and on the west by the Hurricane fault. These faults are about 15 and 20 miles, respectively, from the Orderville Gulch area. The sedimentary rocks in the Markagunt fault block have a regional dip to the northeast of about 5 degrees.

URANIUM DEPOSITS

General statement

Abnormal radioactivity has been detected along 4,000 feet of outcrop on the Bulloch claims. This abnormal radioactivity is caused by low-grade uraniferous deposits, chiefly in the base of a cliff of Dakota sandstone and in the upper few feet of the Summerville formation. Small amounts of carnotite, tyuyamunite, and autunite occur on the Lynn Nos. 2 and 3 claims, but most of the uranium in the surface rocks is in an unknown form finely disseminated through gray clay, carbonaceous clay, carbonized wood fragments, iron oxide concretions, sandstone, conglomerate, and petrified logs. Spectrographic analyses of the carbonaceous clay, carbonized wood fragments, and iron oxide concretions show that at least 24 elements are present in small quantities (table 1).

The three richest deposits are: (1) a deposit 75 feet long and 2 feet thick on the Lynn No. 1 claim; (2) a deposit 14 feet long and 7 feet thick at the prospect cut on the Lynn No. 3 claim; and (3) a deposit 35 feet long and 1 foot thick on the Jeannie No. 3 claim. They contain a weighted average of 0.058, 0.13, and 0.15 percent uranium, respectively.

Lower-grade uraniferous deposits have been found on the Lynn Nos. 2, 3, and 4, the Bulloch Nos. 2 and 24, and the Jeannie Nos. 2, 3, and 4 claims. Assays of samples taken from these claims range from 0.005 to 0.02 percent uranium.

Although the tonnage of ore exposed on these claims is small, the abnormal radioactivity of the surface rocks may be an indication of more concentrated uranium in the covered rocks. This interpretation is based on the premise that uranium has been redistributed from concealed deposits by ground water and carried to the rock surfaces now exposed to weathering. Because of leaching, the uranium content

of such exposures probably is less than that of buried uraniferous rocks. It is believed that the abnormal radioactivity detected over a comparatively wide area on the Bulloch claims is due to the relatively small amount of uranium remaining in the weathered outcrops.

Radioactivity

Most of the accessible exposures of the Dakota sandstone on the Bulloch claims were radiometrically examined. Because the Dakota sandstone is exposed along nearly vertical sandstone and conglomerate cliffs, in most places the rocks between the top and the bottom of the cliffs were not examined.

Radiometric examination of these claims was made with a Geiger-Mueller counter. The average background reading of the instrument, which was neither calibrated nor standardized, was 3 on the 0.2 milliroentgen per hour scale. In order that rate-meter readings could be compared with each other, all readings taken in the field were converted to the 0.2 scale sensitivity. Measurement of the same source of radiation on different scales showed that the sensitivity ratio between scales was 8 to 1 on the instrument used. Hence, a reading of 5 divisions on the 2.0 scale is equal to 40 divisions on the 0.2 scale.

The highest radioactivity detected was on Lynn Nos. 1 and 3, and Jeannie No. 3 claims (pls. 2 and 3). The rate-meter readings at the prospect cut on Lynn No. 3 (pl. 1) averaged 80 divisions on the 0.2 scale. Readings between 18 and 48 divisions were noted at 2 small exposures of tyuyamunite near the center and at the top of the cliff on Lynn Nos. 2 and 3 claims (pls. 1 and 2). Readings that ranged between 8 and 12 divisions were common near the unconformity separating the Dakota sandstone from the underlying undifferentiated Summerville formation and Entrada sandstone on the Lynn Nos. 1, 2, 3, and 4, the Bulloch No. 24, and the Jeannie Nos. 2, 3, and 4 claims.

An empirical correlation between the rate-meter readings made on outcrops and the uranium content of samples (fig. 3) can be used as a guide to interpret the rate-meter readings shown on plates 1, 2, and 3. The curve in figure 3 was fitted to the points by inspection. As rate-meter readings at some places sampled were not recorded or were uncertain because of configuration of outcrops or because of other factors, only those data that were valid were used in plotting the points on figure 3.

Four samples—clay, sandstone, and concretions of iron oxide—from Lynn No. 1 (sample nos. 47586, 47589, 47591, 47592, table 2) are notably out of radioactive equilibrium. These anomalies suggest that the uranium was leached more readily from clay and from iron oxide concretions than from carbonized wood fragments (sample no. 47583, table 2).

Description of claims

Lynn No. 1 claim.—On the Lynn No. 1 claim, a 2- to 3-foot thick, radioactive zone of gray carbonaceous clay, highly carbonized wood fragments, and iron oxide concretions (pl. 3) occurs 4 feet below the

Table 1.--Radiometric and spectrographic analyses of clays, carbonized wood fragments, and iron oxide concretions from Lynn Nos. 1 and 3 claims, Kane County, Utah

Rock type	Radiometric Equivalent uranium (percent)	More than 1.0 (percent)	0.1 to 1.0 (percent)	0.01 to 0.1 (percent)	Spectrographic 0.001 to 0.01 (percent)	0.0001 to 0.001 (percent)	Less than 0.0001 (percent)	Looked for but not found
Concretion-----	0.50	V-----	U-----	As, Zn, Y, Zr, Ca.	Cu, Mo, Pb, Co, Ni, Cr, Ti, Ba.	Mn, Sc-----	Be, Bi-----	Au, Pt, W, Sn, Cd, Ti, Nb, Ta, La, Hf, Th, Ag, Ge, Ga, Sr, Na.
Carbonaceous clay-----	.055	----	Ti, Ca-----	Zr, U, Sr, Ba.	Cu, Mo, Mn, Ni, Cr, V, Y, Na.	Be, Pb, Co, Ga, Sc.	----	Au, Pt, W, Sn, Cd, Ti, Nb, Ta, La, Hf, Th, Ag, Ge, As, Bi, Zn.
Do-----	----	----	Ti-----	Mo, Zr, Ca, Ba.	Cr, V, Sr-----	Cu, Pb, Mn, Y.	Co, Ni, Ga, Sc, Na.	Au, Pt, W, Sn, Cd, Ti, Nb, Ta, La, Hf, Th, Be, Ag, Ge, As, Bi, Zn, U.
Carbonized wood fragments--	1.2	U, Na-----	Mo, Ti-----	Pb, As, V, Y, Ca.	Cu, Ge, Co, Ni, Cr, Ba.	Be, Mn, Sc-----	Ag, Bi, Sr-----	Au, Pt, W, Sn, Cd, Ti, Nb, Ta, La, Hf, Th, Zn, Ga.
Do-----	.023	Na-----	----	Ge, As, V, Ti, Zr, U, Ca.	Cu, Mo, Pb, Mn, Co, Ni, Cr, Y, Ba.	-----	Be, Sc-----	Au, Pt, W, Sn, Cd, Ti, Nb, Ta, La, Hg, Th, Ag, Bi, Zn, Ga, Sr.

Table 2.--Analyses of samples from Lynn Nos. 1 and 4, Jeannie No. 3, and Bulloch Nos. 2 and 24 claims, Kane County, Utah

Sample no.	Claim	Material	Type of sample	eU (percent)	U (percent)	V ₂ O ₅ (percent)	CaCO ₃ ¹ (percent)	Mn (percent)	Fe (percent)	Cu (percent)	Remarks
47585	Lynn No. 1-----	Iron oxide concretion and clay.	Grab-----	0.10	0.098	3.58	0.22	0.011	3.76	0.13	(²)
47586	---do-----	---do-----	---do-----	.036	.021	.34	.05	.005	1.54	.02	(²)
47587	---do-----	Conglomerate, clay, and iron oxide concretion.	2-foot channel-----	.054	.063	1.37	.05	---	---	---	(²)
47588	---do-----	Iron oxide concretion-----	Grab-----	.091	.10	4.99	.03	.011	3.43	.09	(²)
47589	---do-----	Sandstone and clay-----	4-foot channel-----	.022	.006	.38	.03	---	---	---	(²)
47590	---do-----	Sandstone, clay, and iron oxide concretion.	2-foot channel-----	.052	.043	3.22	.29	---	---	---	(²)
47591	---do-----	Clay-----	2-foot channel-----	.086	.015	.39	.06	---	---	---	(²)
47592	---do-----	Sandstone, clay, and iron oxide concretion.	1-foot channel-----	.150	.098	1.98	1.00	---	---	---	(²)
47583	---do-----	Carbonized wood fragments.	Grab-----	.63	.63	.67	.05	---	---	---	19.51 percent ash, 2.86 percent U in ash. ²
47571	Lynn No. 4-----	Sandstone-----	4-foot channel-----	.022	.036	.03	.13	---	---	---	---
47569	Jeannie No. 3-----	Clay-----	1-foot channel-----	.048	.031	.35	.01	---	---	---	(²)
47570	---do-----	Conglomerate-----	2-foot channel-----	.010	.009	.07	.06	---	---	---	(²)
43269	---do-----	Clay-----	1-foot channel-----	.170	.150	.07	---	---	---	---	Sample taken by U. S. Geological Survey, preliminary investigation, August 1950.
47593	Bulloch No. 2-----	Clay-----	1-foot channel-----	.014	.019	.24	.10	---	---	---	---
47573	Bulloch No. 24-----	Conglomerate with clay balls.	1-foot channel-----	.010	.009	.03	.07	---	---	---	(²)
47578	---do-----	Conglomerate-----	3-foot channel-----	.011	.009	.11	1.17	---	---	---	(²)
47579	---do-----	Conglomerate with clay balls.	3.5-foot channel-----	.022	.017	.42	.94	---	---	---	(²)
47581	---do-----	---do-----	3-foot channel-----	.020	.017	.80	1.31	---	---	---	(²)
47582	---do-----	Conglomerate with efflorescent incrustations.	Grab-----	.021	.017	.11	3.53	---	---	---	(²)
47580	---do-----	Water-----	---do-----	---	³ .16	³ .01	³ .68.12	---	---	---	10 ⁻⁸ ppm Ra. ³
47584	Lynn No. 1-----	Carbonized wood fragments.	Grab-----	.019	.021	.28	.13	---	---	---	27.09 percent ash, 0.07 percent U in ash. ²

¹ Calcium soluble in diluted acetic acid, calculated as carbonate.² See plate 3.³ Parts per million.

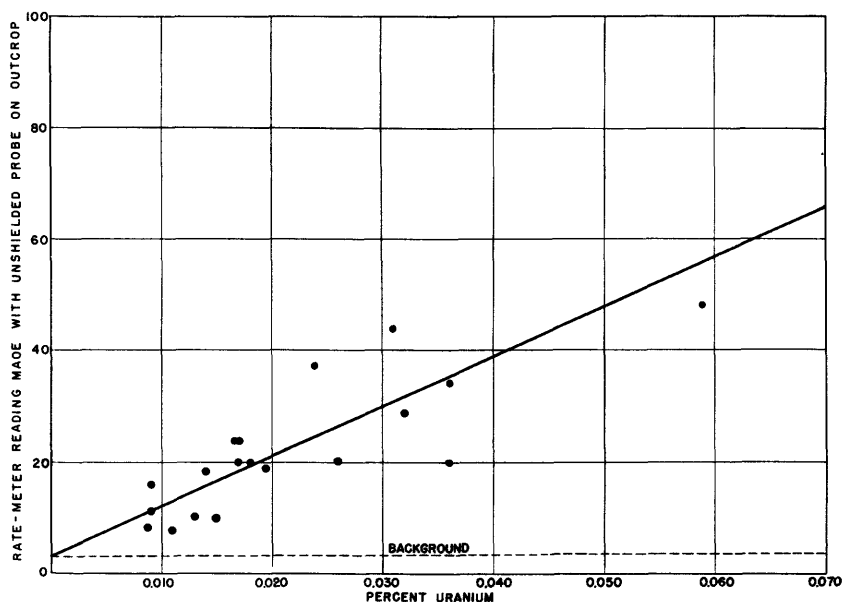


Figure 3. --Relationship between rate-meter readings at sampled outcrops and percent uranium of the sample.

base of the Dakota sandstone. This zone is exposed for 75 feet along the base of the cliff and is abnormally radioactive throughout its length. Clay is the principal constituent of the zone, but small pods and irregular patches of carbonized wood fragments and iron oxide concretions are present. The iron oxide concretions and carbonized wood fragments have a higher uranium content than the clay. Although no uranium minerals were identified, the uranium content ranges from 0.01 to 0.02 percent in the clay, from 0.02 to 0.1 percent in the iron oxide concretions, and from 0.021 to 0.63 percent in the carbonized wood fragments (table 2).

Lynn No. 2 claim. --Two exposures of carnotite and tyuyamunite were observed at the claim monument (pls. 1 and 2) on the Lynn No. 2 claim. These minerals are about 75 feet above the base of the Dakota sandstone cliff and are finely disseminated through a lens of friable medium-grained sandstone that is enclosed by conglomerate. The mineralized part is from 3 to 5 feet in length and half a foot in thickness. The uranium content of samples from these deposits ranges from 0.02 to 0.059 percent. Samples nos. 47562 and 47563 are representative of the grade of this deposit (table 3).

Lynn No. 3 claim. --The Lynn No. 3 claim contains the largest deposit of uraniferous rock exposed on any of the claims that were examined. The uranium is concentrated in autunite-bearing clay, carbonaceous clay, and carnotite-bearing sandstone and conglomerate. Noncarbonaceous clay, conglomerate, petrified logs, and sandstone commonly are weakly radioactive.

The best exposure of this uraniferous deposit is at the prospect cut (pls. 1 and 2) on the west side of the claim, where autunite and a green mineral resembling torbernite are in clay balls, about 1 foot in diameter, several feet above and immediately below the unconformity at the base of the Dakota sandstone. Uranium minerals are visible on the outcrop only, in

an area 25 feet long and 3.5 feet wide; uraniferous rock can be traced for an additional 30 feet. Many of the clay balls above the unconformity contain carbonized wood fragments. The clay is bleached around the autunite-bearing parts of the clay balls. A representative sample (no. 47567, table 3) of autunite-bearing clay ball contained 0.69 percent uranium.

Carnotite and tyuyamunite in the iron-stained conglomerate at the prospect cut occur as coatings on pebbles, linings of vugs, and fillings in small fractures. A 3-foot channel sample (no. 43264, table 3) of the carnotite-bearing conglomerate contained 0.028 percent uranium. In the conglomerate many carbonized wood fragments are immediately above the carnotite-bearing zone. A 1.5 foot channel sample (no. 47566, table 3) from this zone contained 0.019 percent uranium. Carnotite and tyuyamunite are disseminated in sandstone near the claim marker between the Lynn Nos. 2 and 3 claims and on top of the cliff, about 350 feet west of the prospect cut (pls. 1 and 2). Sample nos. 47557 and 47563 (table 3) from these places contained 0.036 and 0.059 percent uranium, respectively. The carnotite and tyuyamunite are in irregular patches less than 3 feet in greatest dimension.

Petrified logs were found to be slightly radioactive; one contained as much as 0.015 percent uranium.

On the northeast side of the Lynn No. 3 claim (east of the prospect cut) uraniferous clay balls as much as 1 foot in diameter occur at two places, about 500 feet apart, along the eastward-facing Dakota sandstone exposures. The maximum uranium content, estimated from outcrop rate-meter readings, is about 0.015 percent. At both places the clay balls are randomly distributed along an outcrop length of about 25 feet and across a thickness of about 10 feet. The northernmost of these occurrences, 470 feet northeast of the prospect cut (pl. 1), is about 15 feet above the unconformity at the base of the Dakota sandstone.

The southernmost occurrence of the uraniferous clay balls, 620 feet east of the prospect cut (pl. 1), is similar to the deposit exposed at the cut. Carbonaceous clay balls in the Dakota sandstone and noncarbonaceous clay immediately below the unconformity are uraniferous; however, no uranium minerals were found. The clay balls are fewer in number and less uraniferous than those at the prospect cut on the west side of the claim.

On the basis of field observations, sample data, and field radiometry, approximately 1,000 linear feet of the uraniferous rock exposed near the base of the Dakota sandstone is estimated to contain between 0.005 and 0.01 percent uranium.

Lynn No. 4 claim.—At the Lynn No. 4 claim five radioactive clay, sandstone, and conglomerate zones, each 4 feet or less in thickness, were detected in the upper part of the Summerville formation. The largest and most radioactive of these zones is about 20 feet long, 4 feet thick, and contains 0.036 percent uranium.

Jeannie No. 2 claim.—On the basis of field observations and radiometry it is estimated that the uraniferous rock exposed for about 1,500 linear feet near the base of the Dakota sandstone contains between 0.005 and 0.01 percent uranium. Meter readings ranging from 6 to 12 on the 0.2 scale were common near the unconformable surface between the Cretaceous Dakota sandstone and the undifferentiated Jurassic sediments.

Jeannie No. 3 claim.—The highest-grade uraniferous deposits observed on the Jeannie No. 3 claim occur in two lenticular zones of carbonaceous clay 30 to 35 feet long and 1 foot thick. These clay zones are separated by about 5 feet of weakly radioactive sandstone, and occur from 10 to 17 feet above the unconformity at the base of the Dakota sandstone (pl. 3). The highest grade of these lenticular clay bodies is represented by samples nos. 47569 and 43269 that contained 0.031 and 0.15 percent uranium, respectively (table 2).

On the basis of field observation, sample data, and field radiometry it is estimated that the uraniferous rock exposed for about 500 linear feet along the unconformity at the base of the Dakota sandstone contains between 0.005 and 0.01 percent uranium. Plate 3 shows the geology of the low-grade uraniferous rock on this claim.

Jeannie No. 4 claim.—On the basis of field observation and radiometry it is estimated that the uraniferous rock exposed for about 200 linear feet near

the unconformity at the base of the Dakota sandstone contains between 0.005 and 0.01 percent uranium. The deposit is similar to the Jeannie No. 3 deposit (pl. 3).

Bulloch No. 24 claim.—On the Bulloch No. 24 claim a radioactive zone, 50 feet long and from 3 to 7 feet thick, is exposed on the face of a cliff conglomerate containing small clay lenses (pl. 3). Water seeping from the base of the conglomerate contains 0.16 ppm uranium. This suggests that the uranium in the conglomerate and clay was deposited from circulating ground water. Uranium in samples of the conglomerate and clay balls ranged from 0.017 to 0.009 percent (table 2).

On the basis of field observation, sample data, and field radiometry it is estimated that uraniferous rock near the base of the Dakota sandstone exposed for about 800 linear feet contains from 0.005 to 0.01 percent uranium.

CONCLUSIONS

Although only a small quantity of the uraniferous material exposed on the Bulloch group of claims is commercial grade, geologic evidence suggests the presence of concealed deposits. Abnormally radioactive rock along 4,000 feet of outcrop indicates that uranium is widely distributed in the lower part of the Dakota sandstone. The presence of uranium in ground water and in plants, as shown by samples nos. 47580 and 47595 (tables 2 and 3) suggests that the uranium in these deposits has been redistributed by ground water and that the uranium content of the exposed deposits may have been decreased by leaching at or near the surface. Therefore, it appears possible that richer uranium deposits may be concealed behind the present weathered surface.

SUGGESTIONS FOR PROSPECTING

As uranium minerals and high radioactivity are found mainly in the rocks near the top of the talus slope and in a zone near the Cretaceous-Jurassic unconformity, prospecting should be concentrated along these zones. The consistent association of uranium with carbonized wood fragments and carbonaceous clay suggests that this type of material should be radiometrically examined wherever it is present. Wherever abnormally radioactive rocks or recognizable uranium minerals are found, fresh exposures should be made to determine if the size and grade of the deposits increase inward from the cliff face.

Table 3.--Analyses of samples from Lynn Nos. 2 and 3 claims, Kane County, Utah

Sample no.	Material	Type of sample	eU (percent)	U (percent)	V ₂ O ₅ (percent)	CaCO ₃ ¹ (percent)	Cu (percent)	P ₂ O ₅ (percent)	Remarks
47552	Clay-----	Grab-----	0.023	0.018	0.38	0.42	----	----	(²)
47553	Sandstone and clay-----	5-foot channel-----	0.13	0.009	.29	.11	----	----	(²)
47554	Conglomerate, sandstone, and clay-----	1-foot channel-----	0.10	0.008	.24	.05	----	----	(²)
47555	Iron-stained log-----	Grab-----	0.09	0.037	.04	.01	----	----	(²)
47556	Sandstone, clay, and conglomerate-----	3-foot channel-----	0.16	0.019	.03	.03	----	----	(²)
47557	Sandstone with carnotite and tyuyamunite-----	0.5-foot channel-----	0.04	0.036	.30	.34	----	----	(²)
47558	Petrified log-----	Grab-----	0.14	0.015	.36	.15	----	----	(²)
47559	Conglomerate-----	3-foot channel-----	0.13	0.013	.27	.05	----	----	(²)
47560	Sandstone-----	4-foot channel-----	0.030	0.029	.09	.03	----	----	(²)
47561	Sandstone and clay-----	4.5-foot channel-----	0.048	0.056	.11	.07	None	.215	(²)
47562	Sandstone-----	3-foot channel-----	0.19	0.020	.32	.05	----	----	Near claim monument. ²
47563	Sandstone with carnotite and tyuyamunite-----	1-foot channel-----	0.07	0.059	.24	.05	----	----	Do.
47564	Sandstone with carbonized wood fragments-----	1-foot channel-----	0.03	0.003	.03	.76	----	----	(²)
47565	Conglomerate with clay pellets-----	2-foot channel-----	0.08	0.006	.47	.06	Tr.	.145	(²)
47566	Carbonized wood fragments-----	1.5-foot channel-----	0.020	0.019	.07	.03	----	----	(²)
47567	Clay with autunite-----	0.5-foot channel-----	.560	.690	.19	.13	.02	.660	(²)
47568	Sandy clay-----	0.5-foot channel-----	0.15	0.018	.40	.03	----	----	(²)
47574	Conglomerate and sandstone-----	5-foot channel-----	0.007	0.005	.35	.08	----	----	Near claim monument. ²
47575	Conglomerate-----	3-foot channel-----	0.007	0.004	.05	.06	----	----	Do.
47576	Conglomerate and sandstone with autunite-bearing clay.	3.5-foot channel-----	0.084	0.095	.24	.03	----	----	Do.
47594	Sandstone-----	3-foot channel-----	0.025	0.026	.11	.01	----	----	Do.
47572	Carbonaceous clay-----	Grab-----	0.007	0.009	.03	.67	----	----	Summerville formation. 93.70 percent ash, 0.010 percent U in ash.
47577	Carbonaceous clay-----	3-foot channel-----	0.001	0.001	.27	.20	----	----	Tropic formation. 92.33 percent ash, 0.002 percent U in ash.
47595	Manzanita plant-----	----	----	----	.04	25.57	----	----	Plant growing in uraniferous soil, base of Dakota sandstone cliff. 3.59 percent ash, 0.09 percent U in ash.
43263	Sandstone-----	Grab-----	0.04	0.026	.10	----	----	----	Sample taken by U. S. Geological Survey, preliminary investigation, August 1950.
43264	Conglomerate-----	Grab-----	0.07	0.028	.08	----	----	----	Do.
43265	Clay with autunite-----	Grab-----	0.088	0.120	.08	----	----	----	Do.
43266	Uranium-bearing clay and conglomerate-----	Selected grab-----	.750	.970	.15	----	----	----	Do.

43267	Conglomerate with carbonized wood fragments.	1.5-foot channel--	0.074	0.088	0.13	----	----	Sample taken by U. S. Geological Survey, preliminary investigation, August 1950.
43268	Sandstone	Grab-----	.005	.002	.10	----	----	Do.
F-9012	Torbernite in shale	----	.43	----	----	----	----	Sample taken by U. S. Atomic Energy Commission, July 1950.
F-9013	Carnotite in sandstone	----	.08	----	----	----	----	Do.
F-9014	Torbernite and autunite in shale	----	.19	----	----	----	----	Do.
F-9037	Conglomerate	----	.03	----	----	----	----	Do.
F-9038	Sandstone	----	.03	----	----	----	----	Do.
F-9039	Uranium-bearing clay	----	.20	----	----	----	----	Do.
F-9040	Sandstone	----	.03	----	----	----	----	Do.
----	----	----	----	.30	----	----	----	Sample taken by U. S. Bureau of Mines, Salt Lake City, Utah.
----	----	----	----	.62	----	----	----	Do.
----	----	----	----	.72	----	----	----	Sample taken by the U. S. Atomic Energy Commission, August 1949.
----	----	----	----	.72	----	----	----	Do.
----	Clay	----	----	.43	----	----	----	Do.

¹Calcium soluble in diluted acetic acid, calculated as carbonate.

²See plates 1 and 2.