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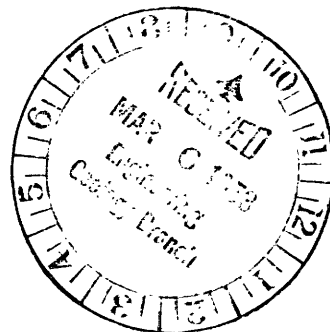
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RECONNAISSANCE FOR URANIUM-BEARING
CARBONACEOUS ROCKS IN NORTHWESTERN
COLORADO, SOUTHWESTERN WYOMING, AND
ADJACENT PARTS OF UTAH AND IDAHO

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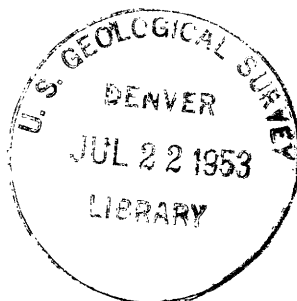
This preliminary report is released without editorial and technical review for conformity with official standards and nomenclature, to make the information available to interested organizations and to stimulate the search for uranium deposits.

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ABSTRACT

During parts of July, August, and September 1951, a reconnaissance was conducted in parts of Colorado, Wyoming, Utah, and Idaho in search of new deposits of uranium-bearing carbonaceous rocks.

One significant uranium occurrence was found, the Fall Creek deposit, Bonneville County, Idaho. Several additional localities were discovered that contain uranium in concentrations many times that normally found in carbonaceous rocks.

GEOLOGY AND MINERALOGY

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RECONNAISSANCE FOR URANIUM-BEARING CARBONACEOUS ROCKS IN NORTHWESTERN COLORADO, SOUTHWESTERN WYOMING, AND ADJACENT PARTS OF UTAH AND IDAHO*

INTRODUCTION

The search for uranium-bearing carbonaceous rocks in northwestern Colorado, southwestern Wyoming, and adjacent parts of Utah and Idaho was undertaken as part of a program of reconnaissance in the western United States on behalf of the Atomic Energy Commission. Special attention was given to carbonaceous rocks associated with or overlain by tuffaceous sandstone and volcanic tuff. The most significant deposit of uranium-bearing coal is in the Fall Creek area, Idaho (Vine, and Moore 1952). Other localities visited are shown on figure 1.

The occurrence of uranium in carbonaceous rocks has been reported from North and South Dakota, Nevada, and Wyoming by Slaughter and Nelson (1946), Staatz and Bauer (1951), and Wyant, et al. (1951). Denson, Bachman, and Zeller (1950) studied the uranium-bearing lignites in the Dakotas and accumulated much evidence that the uranium had been derived from the tuffaceous, slightly radioactive White River formation that unconformably overlies the uranium-bearing lignites of Paleocene age, or older. Meteoric water is believed to carry the uranium from these tuffaceous rocks down into the carbonaceous formations. Reconnaissance in northeastern Wyoming (Denson, 1950) indicated that the occurrence of carbonaceous rocks in association with tuffaceous or volcanic rocks might be an effective prospecting guide for uranium-bearing carbonaceous material.

Approximately 350 samples of coal, carbonaceous shale, asphaltite, and related carbonaceous materials were collected for uranium analysis. In addition, 20 samples of spring water from potential source beds and from mineral springs were submitted for uranium determination. Approximately 30 rock samples of tuffaceous sandstones and volcanic rocks were also collected for uranium analysis. Many localities were visited in addition to those where samples were collected. Samples were not collected in these localities because the rocks were not radioactive when tested with a field counter.

Acknowledgments

J. Q. Berta, Planning Engineer of the Union Pacific Coal Company, spent several days conducting the writers through the mines operated by that company near Rock Springs, Wyo. Numerous other mine operators aided the work by permitting the writers to sample coal in their mines.

* This report concerns work done on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

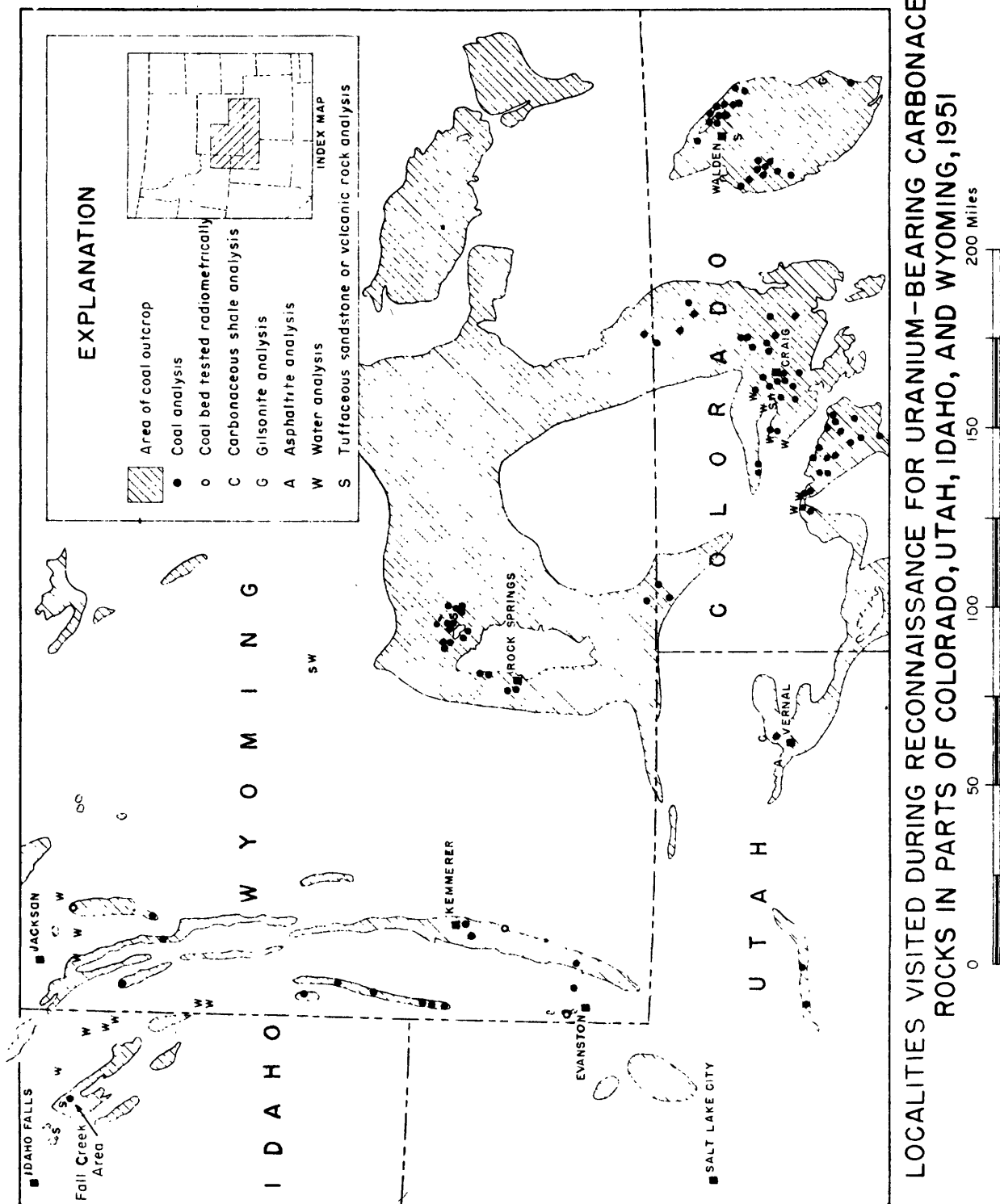


FIG. 1—LOCALITIES VISITED DURING RECONNAISSANCE FOR URANIUM-BEARING CARBONACEOUS ROCKS IN PARTS OF COLORADO, UTAH, IDAHO, AND WYOMING, 1951

AREAS EXAMINED

North Park and Middle Park areas, north-central Colorado

Reconnaissance for uranium-bearing coal was made in the North Park and Middle Park areas of Grand and Jackson Counties, north-central Colo. Coal occurs in the Middle Park formation of Paleocene (?) age in this region of north-central Colorado. Unconformably overlying the Middle Park formation is the North Park formation of Miocene (?) age which contains tuffaceous sandstones, ash beds, and conglomerate. A grab sample of tuffaceous sandstone from the North Park formation contains 0.003 percent equivalent uranium and 0.001 percent uranium. All the important outcrops of coal as shown on the "Geologic map and sections of North Park, Colorado," by Beekly (1915, plate 12) were visited and numerous samples were collected. Some samples of coal contain as much as 0.003 percent uranium and as much as 0.010 percent uranium in the ash. Clinker from a burning coal bed at Coalmont, Colo., contains 0.011 percent uranium in the ash. Carbonaceous shale overlying the coal at the Winscom Mine, sec. 14, T. 8 N., R. 87 W., contains 0.004 percent equivalent uranium. The samples mentioned above are too low grade to be of economic interest now, although they contain more uranium than normally occurs in coal.

A vein of gilsonite as much as 3 feet thick was examined in an abandoned mine near the Continental Divide between North Park and Middle Park. The gilsonite contains 0.0013 percent uranium and 8 percent ash. The ash of the gilsonite contains 0.016 percent uranium. Deposits of uranium-bearing carbonaceous materials worthy of detailed investigation were not found in the North Park and Middle Park areas. Additional reconnaissance may be done, however, after more promising areas elsewhere are examined. Such additional work should be directed to finding carbonaceous material as high topographically and stratigraphically as possible so as to test material that may have received uranium from the potential source beds in the North Park formation. Carbonaceous material also should be sought in synclines or other structural features that may tend to concentrate the flow of groundwater.

Table 1. --Analyses of samples from the North and Middle Park areas, Colorado

Coal samples

Lab. No.	Field No.	Thickness of unit	eU (percent)	U (percent)	U in ash (percent)	Ash (percent)	Location Sec., Twp., Range
62511	VC-82	1 ft.	a			11.2	29, 9N., 78 W.
62512	VC-83	1 ft.	0.002			12.5	"
62513	VC-84	2 ft.	a, a			15.8	"
62514	VC-85	2 ft.	.002			70.4	"
62515	VC-86	1 ft.	.001			90.0	7, 9N., 78 W.
62516	VC-87	2 ft.	.002			87.6	"
62517	VC-88	2 ft.	a			14.0	"
62518	VC-89	1 ft.	a	a	a	8.8	"
62519	VC-90	1 ft.	a			19.6	"
62520	VC-91	1 ft.	a			9.9	"
62521	VC-92	1 ft.	a	a	0.001	6.1	"
62522	VC-93	1 ft.	a			10.8	"
62523	VC-94	1 ft.	a			23.3	19, 10N., 79 W.
62524	VC-95	1 ft.	a			9.5	"
62525	VC-96	1/2 ft.	.002			62.7	31, 8N., 81 W.
62526	VC-97	2 ft.	a			9.6	"
62527	VC-98	2 ft.	a	a	.010	6.6	"
62528	VC-99	1 ft.	a			8.0	24, 8N., 82 W.
62529	VC-160	1 ft.	a	a	a	7.2	19, 9N., 78 W.
62530	VC-161	1 ft.	a			10.1	21, 9N., 78 W.
62531	VC-162	1 ft.	.002			89.7	15, 9N., 78 W.
62532	VC-163	1 ft.	a			54.9	"
62533	VC-164	1 ft.	a	a	a	4.1	"
62534	VC-165	1 ft.	a	a	.001	4.0	"
62535	VC-166	1 ft.	a	a	.001	6.1	"
62536	VC-167	1 ft.	a	a	.001	3.2	"
62537	VC-168	1 ft.	a			9.3	"
62538	VC-169	1 ft.	a			8.7	"
62539	VC-170	1 ft.	.001			24.2	"
62540	VC-171	1 ft.	a			8.4	13, 9N., 79 W.
62541	VC-172	1 ft.	a	a	.001	6.5	"
62542	VC-200	1 ft.	a	a	.002	4.8	26, 7N., 81 W.
62543	VC-201	1 ft.	a			11.6	"
62544	VC-202	1 ft.	a			9.1	"
62545	VC-203	1 ft.	a	a	.003	5.0	"
62546	VC-204	1 ft.	a	a	.003	4.9	"
62547	VC-205	1 ft.	.002			89.1	"
62548	VC-206	1 ft.	a			6.4	"
62549	VC-207	1 ft.	a			14.7	"
62550	VC-208	1 ft.	.010	.008	.011	71.5	24, 7N., 81 W.
62551	VC-209	1 ft.	.002			67.6	"
62552	VC-210	1 ft.	.001			25.1	"
62553	VC-211		a			17.1	"
62554	VC-212	1 ft.	a			17.0	36, 7N., 81 W.
62556	VC-214	1 ft.	a			16.4	35, 9N., 78 W.
62557	VC-215	1 ft.	a	a	.001	1.8	"
62558	VC-216	1 ft.	a	a	.001	3.6	"

Table 1. --Analyses of samples from the North and Middle Park areas, Colorado
(Continued)

<u>Coal samples</u>							Location Sec., Twp., Range
Lab. No.	Field No.	Thickness of unit	eU (percent)	U (percent)	U in ash (percent)	Ash (percent)	
62559	VC-217	1 ft.	a	a	0.003	5.3	2, 8N., 78 W.
62560	VC-218	1 ft.	0.004			84.6	14, 8N., 78 W.
62561	VC-219	1 ft.	.003			90.0	"
62562	VC-220	1 ft.	.002		.005	37.9	"
62563	VC-221	1/2 ft.	.002			52.2	14, 7N., 81 W.
62564	VC-222	1 ft.	a			13.8	21, 7N., 81 W.
62565	VC-223	2 ft.	.001	0.001	.002	35.9	"
62566	VC-224		a			27.0	32, 6N., 81 W.
62567	VC-225	2 ft.	a			31.8	"
62568	VC-226	3 ft.	.001	.001	.003	44.5	"
62569	VC-227	1/2 ft.	.001	.001	.003	36.1	9, 6N., 81 W.
62570	VC-228	14 in.	a			16.3	29, 8N., 77 W.
62571	VC-229	1/2 ft.	a			17.4	14, 8N., 77 W.
62572	VC-230	1 ft.	a			27.9	"
62992	VC-231	1 ft.	.005	.003			33, 3N., 77 W.
62993	VC-232	1 ft.	.001	.001	.004	35.1	"

Gilsonite sample

62555 & 65639	VC-213	--	a	.0013	.016	8.2	15, 4N., 77 W.
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Rock sample

58066	VC-507	--	.003	.001			35, 8N., 80 W. North Park fm.
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Northwestern Colorado

Coal beds were tested for radioactivity in the Mesaverde group of Upper Cretaceous age and in the Fort Union and Wasatch formations of Paleocene and Eocene ages (Sears, 1924) in the southern part of the Green River coal region and in the northern part of the Uinta coal region in Moffat, Routt, and Rio Blanco Counties, Colo. Tuffaceous sandstone occurs in the Browns Park formation of Miocene (?) age that unconformably overlaps all the older strata. A grab sample of tuffaceous sandstone from the Browns Park formation near U. S. Highway 40, 10.7 miles west of Craig, Colo., contained 0.001 percent equivalent uranium. No significant deposits of uranium were discovered. At the abandoned coal workings just south of Lay, Colo., the Browns Park formation overlies coal of Cretaceous age with no more than 10 feet of intervening sandstone and shale. The upper 6 inches of the coal contains 0.007 percent uranium with concentrations of 0.015 percent in the ash, which is a higher percentage than that of the average coal in the region but not of commercial importance. Elsewhere the coal sampled analyzed 0.002 percent uranium or less.

No further work in northwestern Colorado is planned until more promising areas elsewhere have been examined.

Table 2. -- Analyses of samples from northwestern Colorado

<u>Coal samples</u>							
Lab. No.	Field No.	Thickness of unit	eU (percent)	U (percent)	U in ash (percent)	Ash (percent)	Location: Sec., Twp., Range
61370	VC-1	1 ft.	a			49.52	21, 7N., 91 W.
61371	VC-2	1 ft.	a	a	0.003	8.58	"
61372	VC-3	1 ft.	a	a	.002	16.15	11, 5 N., 91 W.
61373	VC-4	2 in.	a	a	.002	11.23	"
61374	VC-5	2 ft.	a	a	.002	12.64	"
61375	VC-6	1' 7"	a			26.77	"
61376	VC-7	2' 6"	0.001			86.52	"
61377	VC-8	2 ft.	a			36.30	"
61378	VC-9	2 ft.	a	a	.001	11.22	"
61379	VC-10	2 ft.	a	a	.001	8.50	"
61380	VC-11	2 ft.	a	a	.001	5.88	"
61381	VC-12	2 ft.	a	a	.001	6.98	"
61382	VC-14	1 ft.	.001			92.67	31, 7 N., 93 W.

"a" indicates equivalent uranium or uranium content of less than 0.001 percent

Table 2. -- Analyses of samples from northwestern Colorado--Continued

<u>Coal samples</u>							
Lab. No.	Field No.	Thickness of unit	eU (percent)	U (percent)	U in ash (percent)	Ash (percent)	Location Sec., Twp., Range
61383	VC-15	2 ft.	0.002			91.78	31, 7 N., 93 W.
61384	VC-16	1 ft.	.002			90.76	"
61385	VC-17	6 in.	.005	0.007	0.015	43.89	"
61386	VC-18	6 in.	.001	.001	.014	9.15	"
61387	VC-19	2 ft.	a	a	.004	5.40	"
61388	VC-20	2 ft.	a	a	.003	7.35	"
61389	VC-21	1 ft.	a			45.73	1, 7 N., 92 W.
61390	VC-22	1' 6"	a			21.04	30, 7 N., 91 W.
61391	VC-23	2' 6"	.001			86.21	16, 6 N., 91 W.
61392	VC-24	2' 6"	.002	.002	.002	87.49	16, 6 N., 91 W.
61393	VC-25	2' 6"	.002			84.14	"
61394	VC-26	1 ft.	a	a	.002	15.40	"
61395	VC-27	2' 6"	.002	.001	.001	84.28	"
61396	VC-28	1' 8"	a	a	.002	8.76	31, 6 N., 91 W.
61397	VC-29	2 ft.	a			23.55	"
61398	VC-30	8 in.	.001			56.65	"
61399	VC-31	2' 6"	a	a	.002	3.47	"
61400	VC-32	2' 6"	a	a	.005	4.53	"
61401	VC-33	2 ft.	a	a	.001	18.38	33, 6 N., 92 W.
61402	VC-34	2' 6"	a	a	.002	17.33	"
61403	VC-35	1' 4"	a	a	.002	9.10	9, 6 N., 91 W.
61404	VC-36	2 ft.	a	a	.002	4.86	"
61405	VC-37	2 ft.	a	a	.004	14.23	15, 6 N., 91 W.
61406	VC-38	2 ft.	a	a	.005	11.30	"
61407	VC-39	2 ft.	a			31.74	"
61408	VC-40	1 ft.	a	a	.002	15.05	20, 8 N., 89 W.
61409	VC-41	2 ft.	a	a	.002	8.36	"
61410	VC-42	3 ft.	a	a	.001	6.95	"
61411	VC-43	10 ft.	a	a	.001	3.65	"
61412	VC-44	1 ft.	a			22.08	28, 8 N., 89 W.
61413	VC-45	2 ft.	a	a	.001	12.96	"
61414	VC-46	3 ft.	a	a	.001	18.09	"
61415	VC-47	2 ft.	.001			89.50	12, 4 N., 96 W.
61416	VC-48	1 ft.	a	a	.001	11.43	28, 3 N., 94 W.
61417	VC-49	1 ft.	.002			82.02	27, 3 N., 94 W.
61418	VC-50	1/2 ft.	.003	.002	.002	91.80	23, 4 N., 95 W.
61419	VC-51	1 ft.	.002			66.00	"
61420	VC-52	1 ft.	a	a	.002	17.80	"
61483	VC-53	2 ft.	.001			24.93	17, 5 N., 96 W.
61484	VC-54	1 ft.	.001			75.88	"
61485	VC-55	2 ft.	a			31.15	8, 5 N., 96 W.
61486	VC-56	2 ft.	a	a	.002	9.06	"
61487	VC-57	1 ft.	a	a	.004	19.46	"
61488	VC-58	1 ft.	a			42.67	9, 5 N., 97 W.
61489	VC-59	2 ft.	a			34.72	"
61490	VC-60	2 ft.	a			23.26	"

Table 2. -- Analyses of samples from northwestern Colorado--Continued

<u>Coal samples</u>							Location Sec., Twp., Range
Lab. No.	Field No.	Thickness of unit	eU (percent)	U (percent)	U in ash (percent)	Ash (percent)	
61491	VC-61	2 ft.	a			22.00	20, 5 N., 97 W.
61492	VC-62	1 ft.	a			33.87	16, 12 N., 89 W.
61493	VC-63	1 ft.	a	a	0.001	14.89	"
61494	VC-64	1 ft.	0.001			45.16	25, 11 N., 89 W.
61495	VC-65	1 ft.	.001			54.69	10, 10 N., 88 W.
61496	VC-66	8 in.	.001			57.49	6, 10 N., 87 W.
61497	VC-67	1 1/2 ft.	a	a	.002	6.30	"
61498	VC-73	1 ft.	.003			77.35	8, 11 N., 101 W.
61499	VC-74	1 1/2 ft.	.002			79.20	"
61500	VC-75	1 1/2 ft.	.002			61.92	"
61501	VC-76	1/2 ft.	.001	a	.003	20.99	"
61502	VC-77	1/2 ft.	a			24.81	20, 12 N., 101 W.
61505	VC-80	1 ft.	a	a	.002	7.42	8, 12 N., 89 W.
61506	VC-81	2 ft.	a	a	.002	4.85	"
61421	VC-100	1 ft.	.002			85.43	30, 7 N., 93 W.
61422	VC-101	1 ft.	.001	0.002	.009	20.71	"
61423	VC-102	1 ft.	.001			61.50	"
61424	VC-103	1 ft.	a	a	.002	6.14	"
61425	VC-104	2 ft.	a	a	.004	4.34	"
61426	VC-105	2 ft.	a	a	.004	4.10	30, 7 N., 93 W.
61427	VC-106	2 ft.	a	a	.003	6.67	"
61428	VC-107	1 ft.	.002			88.58	1, 7 N., 90 W.
61429	VC-108	2 ft.	a			37.11	"
61430	VC-109	2 ft.	a	a	.002	11.76	"
61431	VC-110	1 ft.	.002			34.71	30, 7 N., 89 W.
61432	VC-111	1' 2"	.001			57.42	"
61433	VC-112	1' 4"	a			32.10	26, 7 N., 90 W.
61434	VC-113	1' 6"	.002			58.71	"
61435	VC-114	2 ft.	a			25.45	"
61436	VC-115	2 ft.	a			36.42	"
61437	VC-116	1' 7"	a	a	.002	19.13	"
61438	VC-117	2 ft.	a	a	.001	19.60	4, 6 N., 89 W.
61439	VC-118	2 ft.	a	a	.001	5.50	"
61440	VC-119	2 ft.	a	a	.001	4.80	"
61441	VC-120	2 ft.	a	a	.001	4.03	"
61442	VC-121	2 ft.	a	a	.002	5.22	4, 5 N., 88 W.
61443	VC-122	2 ft.	a	a	.001	3.51	"
61444	VC-123	2 ft.	a	a	.005	5.75	"
61445	VC-124	2 ft.	a	a	.001	11.14	"
61446	VC-125	1 ft.	a			33.11	10, 6 N., 92 W.
61447	VC-126	2 ft.	a	a	.002	10.52	"
61448	VC-127	1 ft.	.001			92.19	11, 1 N., 94 W.
61449	VC-128	1 ft.	.002			58.53	"
61450	VC-129	6 in.	a	a	.003	12.98	"
61451	VC-130	1 ft.	a	a	.006	9.29	33, 3 N., 93 W.
61452	VC-131	7 ft.	a	a	.003	9.67	"

Table 2. -- Analyses of samples from northwestern Colorado--Continued

<u>Coal samples</u>							
Lab. No.	Field No.	Thickness of unit	eU (percent)	U (percent)	U in ash (percent)	Ash (percent)	Location Sec., Twp., Range
61453	VC-132	1 ft.	a	a	0.001	20.94	12, 3 N., 94 W.
61454	VC-133	1' 6"	a	a	.003	14.95	"
61455	VC-134	1 ft.	0.002	a	.002	51.09	10, 2 N., 94 W.
61456	VC-135	1 ft.	a	a	.003	15.65	8, 7 N., 95 W.
61457	VC-136	1 ft.	a	a		28.71	9, 7 N., 95 W.
61458	VC-137	8 in.	a			72.87	"
61507	VC-138	13 in.	a	a	.002	15.46	21, 4 N., 93 W.
61508	VC-139	1 ft.	a	a	.002	9.30	"
61509	VC-140	15 in.	a	a	.005	13.10	"
61510	VC-141	10 in.	a			32.63	20, 4 N., 93 W.
61511	VC-142	1 1/2 ft.	a	a	.001	13.57	18, 4 N., 93 W.
61512	VC-143	14 in.	a	a	.002	16.04	32, 5 N., 94 W.
61513	VC-144	3 ft.	a	a	.002	4.07	25, 5 N., 95 W.
61514	VC-145	8 in.	.002			85.37	17, 12 N., 91 W.
61515	VC-146	12 in.	.002	a	.007	13.35	33, 7 N., 88 W.
61517	VC-148	8 in.	a			80.90	"
61518	VC-149	1 ft.	a	a	.002	14.36	"
61520	VC-156	2 ft.	a	a	.001	12.25	34, 7 N., 90 W.
61521	VC-157	2 ft.	a	a	.001	8.61	"
61522	VC-158	3 ft.	a	a	.002	4.98	"
64560	VC-300	22 in.	.002	0.002	.010	15.6	25, 12 N., 101 W.
64561	VC-301	3 ft.	a			11.9	"

Rock sample

58065	VC-506	--	.001	.0004			32, 7 N., 92 W. Browns Park fm.
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Rock Springs area, Wyoming

Much coal is mined from the Mesaverde group of Upper Cretaceous age and from formations of early Tertiary age in the vicinity of the Rock Springs Uplift in the Wyoming part of the Green River coal region. The Browns Park formation is present to the south of this area, and the tuffaceous rocks of possible Oligocene age are present to the north so it is likely that at some time in geologic history the entire area was covered by one or perhaps both of these formations that are considered to be possible source beds for uranium. Coal was sampled in detail in a number of the Union Pacific coal mines in the Stansbury, Reliance, and Superior districts. Most of the samples contained less than

0.001 percent equivalent uranium, though a few with low ash contained as much as 0.003 percent uranium in the ash.

At the northeastern end of the Rock Springs Uplift coal of Upper Cretaceous age is overlain by highly alkalic volcanic rocks, erosional remnants of which compose the Leucite Hills (Schultz and Cross, 1912). A sample of pumice from Zirkel Mesa (fig. 2) contained 0.007 percent equivalent uranium and 0.0018 percent uranium. Several beds underlying the radioactive volcanic rock were sampled, one of which contained 0.004 percent uranium in the coal and 0.017 percent uranium in the ash. It was not feasible to obtain samples of coal directly overlain by the volcanic rock because of the broad apron of talus which surrounds outcrops of the volcanic rocks and conceals the contact with the sedimentary strata. The samples which contained the highest percentage of uranium were those that were relatively near the base of the volcanic sequence (fig. 2). The geologic conditions here are favorable for the occurrence of a deposit of uranium-bearing coal in the gently dipping beds that are overlain unconformably by the volcanic cap of the Leucite Hills. Trenching or core drilling will be necessary to evaluate the potentialities of this area after areas are investigated that now seem more promising.

Table 3. -- Analyses of samples from the Rock Springs area, Wyoming

<u>Coal samples</u>							
Lab. No.	Field No.	Thickness of unit	eU (percent)	U (percent)	U in ash (percent)	Ash (percent)	Location Sec., Twp., Range
62969	VW-173	1 ft.	a			16.5	19, 21 N., 101 W.
62970	VW-174	1 ft.	0.001		0.003	16.8	"
62971	VW-175	1 ft.	a			45.4	"
62972	VW-176	1 ft.	a			16.6	"
62973	VW-177	1 ft.	a			19.7	"
62974	VW-178	1 ft.	a			27.0	"
62975	VW-179	1 ft.	a			18.0	"
62976	VW-180	1 ft.	a			12.9	"
62977	VW-181	1 ft.	a			30.9	"
62978	VW-182	1 ft.	a			16.3	"
62979	VW-185	15 in.	a			24.3	12, 21 N., 102 W.
62980	VW-186	15 in.	a			43.9	"
62981	VW-187	2 ft.	.001	0.001	.002	31.8	"
62982	VW-188	1 ft.	.004	.004	.017	26.0	10, 21 N., 102 W.

"a" indicates equivalent uranium or uranium content of less than 0.001 percent

Table 3. -- Analyses of samples from the Rock Springs area, Wyoming--Continued

<u>Coal samples</u>							
Lab. No.	Field No.	Thickness of unit	eU (percent)	U (percent)	U in ash (percent)	Ash (percent)	Location Sec., Twp., Range
62983	VW-189	2 1/2 ft.	0.003	0.002	0.008	30.6	10, 21 N., 102 W.
62984	VW-190	1 ft.	a			7.96	"
62985	VW-191	3 ft.	a			5.35	"
62986	VW-192	1 ft.	.002			30.9	"
62987	VW-193	1 ft.	a			9.5	"
62988	VW-194	2 ft.	a			46.1	4, 21 N., 101 W.
62989	VW-195	3 ft.	a			18.8	"
62990	VW-196	1 ft.	a			20.8	15, 22 N., 102 W.
62991	VW-197	1 ft.	a			25.6	"
62994	VW-233	2 ft.	a			13.3	Roosevelt School Rock Springs, Wyo.
62995	VW-234	16 in.	a			23.2	Union Pacific Coal Co., Stansbury Mine
62996	VW-235	21 in.	a			9.5	"
62997	VW-236	22 in.	a			10.1	"
62998	VW-237	3 ft.	a			3.41	"
62999	VW-238	3 ft.	a			3.27	"
63000	VW-239	2 ft.	a			6.50	"
63001	VW-240	2 ft.	a			2.34	"
63002	VW-241	2 ft.	a			2.32	"
63003	VW-242	2 1/2 ft.	a			4.19	"
63004	VW-243	2 1/2 ft.	a	a	.002	2.54	"
63005	VW-244	2 1/2 ft.	a	a	.003	2.10	"
63006	VW-245	15 ft.	a			11.1	"
63007	VW-246	9 in.	a			34.9	"
63008	VW-247	17 in.	a			5.45	Union Pacific Coal Co., Reliance Mine
63009	VW-248	2 1/2 ft.	a			2.79	"
63010	VW-249	2 1/2 ft.	a	a	.002	2.02	"
63011	VW-250	18 in.	a			15.3	"
63012	VW-251	2 ft.	a			3.57	"
63013	VW-252	2 ft.	a			3.94	"
63014	VW-253	3 ft.	a			2.61	"
63015	VW-254	18 in.	.001	a	.002	10.5	22, 19 N., 105 W.
63016	VW-255	2 ft.	a			20.7	"
63017	VW-256	2 ft.	a			8.97	"
63018	VW-257	2 1/2 ft.	a			10.5	"
63019	VW-258	2 ft.	a			8.23	Union Pacific Coal Co., Superior District
63020	VW-259	3 ft.	a			8.78	"
63021	VW-260	6 in.	.001	a	.001	35.7	"
63022	VW-261	2 1/2 ft.	a			2.24	"
63023	VW-262	3 ft.	a			8.87	"
63024	VW-263	18 in.	a			18.3	"
63025	VW-264	2 1/2 ft.	a			2.49	"
63026	VW-265	2 ft.	a	a	.003	1.32	"

Table 3. -- Analyses of samples from the Rock Springs area, Wyoming--Continued

Coal samples							
Lab. No.	Field No.	Thickness of unit	eU (percent)	U (percent)	U in ash (percent)	Ash (percent)	Location Sec., Twp., Range
63027	VW-266	3 1/2 ft.	a			3.09	Union Pacific Coal Co., Superior District
63028	VW-267	4 ft.	a			3.50	"
63029	VW-268	2 ft.	a			7.12	20, 21 N., 102 W.
63030	VW-269	18 in.	a			18.1	Union Pacific Coal Co., Superior District
63031	VW-270	2 1/2 ft.	a	a	0.006	2.59	"
63032	VW-271	2 ft.	a			4.99	"
63033	VW-272	8 in.	a			10.6	"
63034	VW-273	6 in.	0.001			57.0	"
63035	VW-274	10 in.	a	a	.005	2.94	"
63036	VW-275	3 ft.	a	a	.003	3.01	"
63039	VW-278	8 in.	.001	a	.002	13.1	26, 18 N., 105 W.
63040	VW-279	2 1/2 ft.	a			5.95	"
63041	VW-280	2 1/2 ft.	a	a	.002	2.78	"
63042	VW-281	2 ft.	a			9.44	26, 20 N., 101 W.
63043	VW-282	16 in.	a			4.94	"
63044	VW-283	26 in.	a			3.32	"
63045	VW-284	10 in.	a			30.0	20, 21 N., 101 W.
63046	VW-285	1 ft.	a			28.8	19, 21 N., 101 W.
63047	VW-286	1 ft.	a			6.13	19, 21 N., 102 W.
63048	VW-287	1 ft.	.002			78.9	"
63050	VW-289		a			52.3	35, 22 N., 103 W.
63051	VW-290	1 ft.	a			56.4	2, 21 N., 103 W.
63052	VW-291	1 ft.	a			30.9	34, 22 N., 103 W.
63053	VW-292	2 ft.	a			9.91	"
63054	VW-293	1 ft.	.003			93.8	4, 21 N., 102 W.
63055	VW-294	1 ft.	a			13.1	"
63056	VW-295	6 in.	.002	0.001	.003	21.7	3, 21 N., 102 W.

Rock sample

58810	G-3	--	.007	.0018			13, 21 N., 102 W. Leucite Hills, Wyomingite
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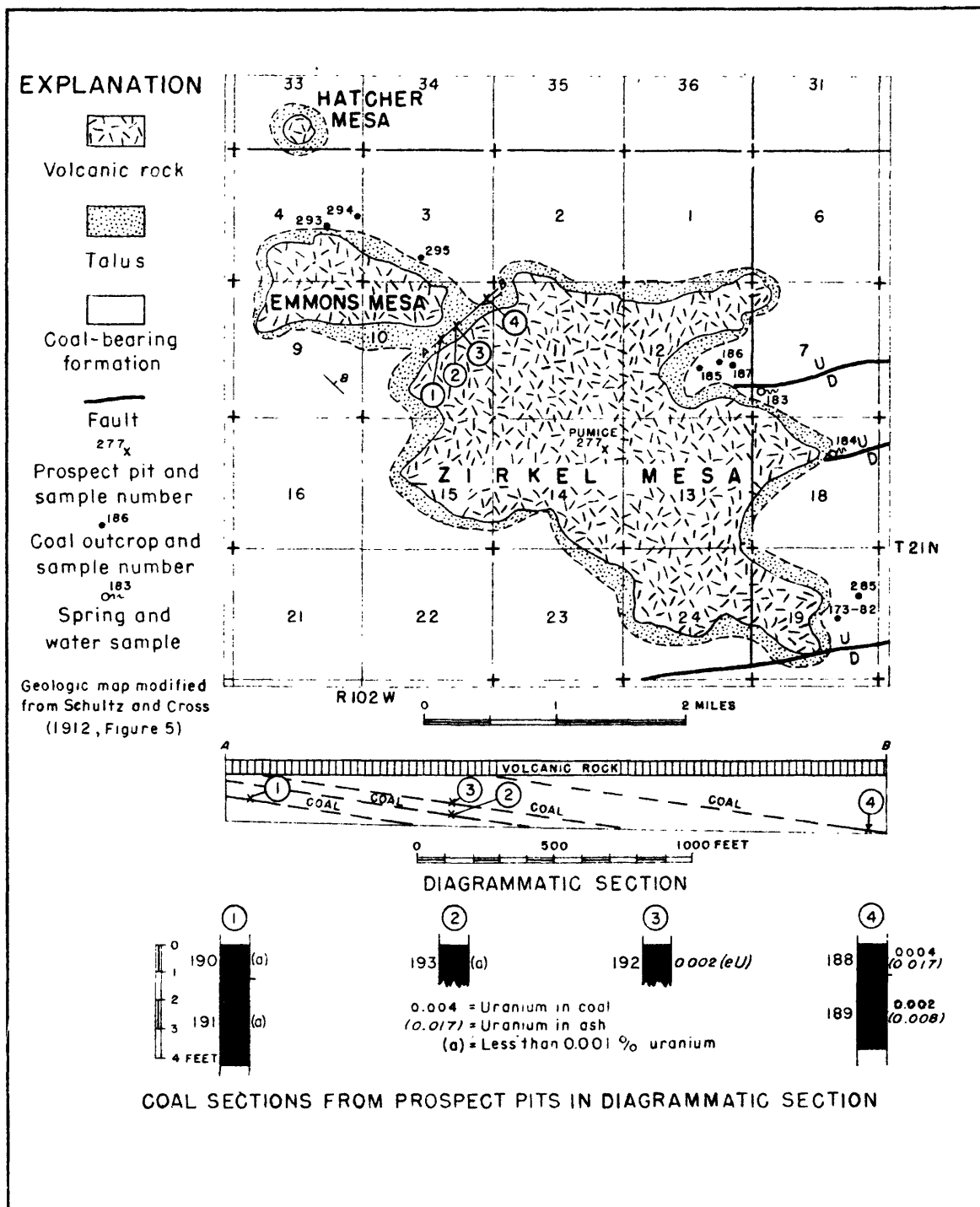


FIG. 2—GEOLOGIC MAP AND SECTION OF A PART OF THE LEUCITE HILLS, SWEETWATER COUNTY, WYOMING.

Northeastern Utah

Coal beds in the Mesaverde and Frontier formations were tested for radioactivity at a few localities in northeastern Utah. Significant radioactivity was not detected.

A grab sample of dark brown shale in the Morrison formation (NE 1/4 sec. 13, T. 3 S., R. 21 E., Uintah County, Utah) contained 0.50 percent uranium. The uranium occurs in the shale only at this place; radioactivity was not detected elsewhere in the shale. The area has been mapped by Kinney and Rominger (1947).

A sample of bitumen from a bituminous sandstone quarry just west of Vernal contained 0.003 percent uranium, 11.8 percent ash, and 0.028 percent uranium in the ash. Spieker (1930) estimates that 1,970,000,000 tons of bituminous sandstone on Asphalt Ridge, west of Vernal, contains 1,150,000,000 barrels of bitumen. Additional samples will be collected to determine if uranium occurs throughout the area for which Spieker calculated reserves of bitumen. If small amounts of uranium are present in the bitumen, a considerable quantity of uranium might be recoverable if the bitumen is ever used as a raw material for a petroleum refinery or a chemical industry.

Table 4. -- Analyses of samples from northeastern Utah

<u>Coal samples</u>							
Lab. No.	Field No.	Thickness of unit	eU (percent)	U (percent)	U in ash (percent)	Ash (percent)	Location Sec., Twp., Range
64563	VU-320	1 ft.	a			29.7	36, 3 S., 21 E.
64564	VU-327	1 ft.	a			28.3	12, 1 S., 9 W.
64565	VU-328		a			15.7	23, 1 S., 9 W.
<u>Carbonaceous shale sample</u>							
64965	VU-315	--	0.34	0.50	--	--	13, 3 S., 21 E.
<u>Bitumen sample</u>							
64968	VU-318	--	.002	.003	0.028	11.8	3, 4 S., 20 E.

"a" indicates equivalent uranium content of less than 0.001 percent

Western Wyoming

Coal beds of Cretaceous age containing as much as 0.002 percent uranium have been reported from an abandoned mine at Sage in the Hams Fork Coal Region, Lincoln County, Wyo. (Beroni, oral communication, 1951). The uranium-bearing coal is directly overlain by a 15-foot tuff bed in continuous stratigraphic sequence. The uranium in the coal may have come from this tuff which contains 0.001 percent uranium. Additional deposits of uranium-bearing coal were found at several localities north of the Sage deposit. One of these contains as much as 0.003 percent uranium with 0.008 percent uranium in the ash, but these deposits were not associated with interbedded tuffs. However, tuffaceous beds in the vicinity of Sage are similar to the Browns Park and White River formations and probably once unconformably overlapped all of the coal-bearing rocks at Sage. These tuffaceous beds were mapped by Veatch (1907) as the Fowkes formation but their nature and distribution suggest that they are not part of the Fowkes formation as it was defined.

Coal beds were examined elsewhere in the Hams Fork region of western Wyoming but none contained significant amounts of uranium. The coal occurs chiefly in the Bear River formation of Lower Cretaceous age and the Frontier and Adaville formations of Upper Cretaceous age in a belt of complexly folded and faulted rocks. The coal has been described by Veatch (1907) and Schultz (1914).

Table 5. -- Analyses of samples from western Wyoming

<u>Coal samples</u>							
Lab. No.	Field No.	Thickness of unit	eU (percent)	U (percent)	U in ash (percent)	Ash (percent)	Location Sec., Twp., Range
61503	VW-78	1/2 ft.	a			21.83	7, 12 N., 101 W.
61504	VW-79	1/2 ft.	a			22.14	"
64558	VW-198	1 ft.	a			12.0	8, 15 N., 118 W.
64559	VW-199	1 ft.	a			14.6	5, 15 N., 119 W.
64562	VW-305	1 ft.	a			9.02	11, 20 N., 117 W.
63765	VW-306	6 in.	0.001			93.0	6, 21 N., 119 E.
63766	VW-307	6 in.	.002			53.6	"
63767	VW-308	18 in.	a			20.0	"
63768	VW-309	18 in.	.001	0.001	0.004	17.3	"
63769	VW-310	20 in.	.002	.002	.007	25.2	"
63770	VW-311	1 ft.	.003	.001			"

"a" indicates equivalent uranium content of less than 0.001 percent

Table 5. -- Analyses of samples from western Wyoming-- Continued

<u>Coal samples</u>							Location Sec., Twp., Range
Lab No.	Field No.	Thickness of unit	eU (percent)	U (percent)	U in ash (percent)	Ash (percent)	
63771	VW-312	1 ft.	a			32.3	6, 21 N., 119 E.
63773	VW-314	2 ft.	0.005	0.002			"
66846	VW-347		a			4.5	23, 35 N., 115 W.
66847	VW-348	2 ft.	.003	.002	0.004	41.5	12, 36 N., 118 W.
66848	VW-349	2 ft.	a			5.1	1, 34 N., 116 W.
66850	VW-357	1 ft.	.003	.003	.008	37.9	24, 28 N., 119 W.

Southeastern Idaho

Coal beds in the Bear River, Frontier, and unnamed other formations of Cretaceous age in the northern part of the Hams Fork Coal Region in southeastern Idaho were sampled at several localities.

The presence of silicic volcanic rocks overlapping the coal-bearing formations in this area

(Mansfield, 1920, and Ross and Forrester, 1947) made it seem a likely area for reconnaissance prospecting.

A significant deposit of uranium was found on Fall Creek in Bonneville County, Idaho. This deposit is located in sec. 4, T. 1 S., R. 42 E. (Vine and Moore, 1952). The coal is exposed in an abandoned prospecting incline. Samples contain as much as 0.13 percent uranium in the coal, and as much as 0.31 percent uranium in the ash. The silicic volcanic rocks of Tertiary age that cap the higher hills in the area are slightly radioactive, and are thought to have blanketed the area at one time.

Insufficient time was available during the 1951 field season to visit many other localities in southeastern Idaho. Of the areas described in this report southern Idaho is probably the most promising area for future work, as the Tertiary silicic volcanics, that are potential source rocks for uranium, cover much of this region. Further reconnaissance work is planned for fiscal year 1953.

Table 6. -- Analyses of samples from southeastern Idaho

<u>Rock samples</u>							Location Sec., Twp., Range
Lab. No.	Field No.	Thickness of unit	eU (percent)	U (percent)	U in ash (percent)	Ash (percent)	
66853	VI-366		0.003		--	--	10, 1 N., 40 E.
66854	VI-367		.004		--	--	25, 5 N., 44 E.
66855	VI-368		.004		--	--	"
66856	VI-369		.004		--	--	16, 1 S., 45 E.
66857	VI-370		.004		--	--	29, 1 N., 42 E.

ANALYSES OF WATER AND SPRING DEPOSITS

Samples of water from springs and wells and of the deposits formed by hot springs were collected to obtain comparative data on the possibility that the formations from which they issue are source beds for uranium.

Table 7 shows the analyses and locations of 20 water samples from springs and wells issuing from possible source rocks and from mineral springs in western Wyoming and eastern Idaho. Nine samples were collected from springs and wells in the Browns Park formation in northwestern Colorado. Of these, six samples contained less than 1 part uranium per billion, one sample contained 7 parts per billion, and two samples, both near the town of Lay, Colo., contained 10 to 14 parts per billion of uranium respectively.

In Wyoming, two samples of water were collected at springs that issued from the base of the lava of the Leucite Hills. These contained 1.9 and 0.4 parts of uranium per billion respectively. A sample of water from a spring in the White River formation of Oligocene age northeast of Farson, Wyo., contained 42 parts per billion--more than any other sample including those from hot springs where radioactivity could be detected with a field counter. By contrast, the average uranium content of the ocean is given by Koczy (1951) to be 1.1 parts per billion. However, sea water from near Ocean City, Md., contained 2.3 parts of uranium per billion (Pietsch and Grimaldi, 1952).

In western Wyoming and southeastern Idaho, a suite of samples was collected from hot springs, sulfur springs, and the travertine deposits associated with the springs. Radioactivity was detected in the travertine, algae, or water from springs on Sulphur Bar Creek, Idaho, at Auburn, Wyo., and on

Granite Creek, Wyo., but the samples did not contain more than 2 parts per billion of uranium. However, samples from a sulfur spring at the mouth of Hoback Canyon, Wyo., and a hot sulfur spring 6 miles northwest of Alpine, Idaho, where no radioactivity was detected with a field counter, contained 3 parts per billion of uranium. Travertine and sulfur deposited by the hot springs near Auburn, Wyo., contained as much as 0.008 percent equivalent uranium but only 0.001 percent uranium.

No specific conclusions can be reached, but the following points are of interest:

1. The three water samples with the highest content of uranium are from springs issuing from tuffaceous sandstone.
2. The hot springs at which radioactivity was detected with a Geiger counter contained relatively small amounts of uranium, whereas, no radioactivity was detected at the springs that contained relatively large amounts of uranium.

Table 7. -- Analyses of samples of water and spring deposits

<u>Water samples</u>				
Lab. No.	Field No.	eU (percent)	U (percent)	Location Sec., Twp., Range
65026	VW-183		1.9×10^{-7}	18, 21 N., 101 W.
65027	VW-184		0.4 "	7, 21 N., 101 W.
65028	VW-296		42 "	24, 28 N., 104 W.
53780	VW-343		1 "	Snake River Hot Spring near Hoback, Wyo., 32, 39 N., 116 W.
53781	VI-345		1 "	Alpine Hot Springs, Idaho, 19, 38 N., 46 E.
53782	VI-346		3 "	"
53783	VI-353		1 "	Hot springs north of Auburn, Wyo.
53784	VW-355		2 "	Hot springs sulfur mine, Auburn, Wyo.
53785	VW-358		3 "	Sulfur spring at Hoback Canyon, Wyo., 3, 38 N., 115 W.
53786	VW-359		2 "	Granite hot spring, Wyoming, 6, 39 N., 113 W.
53787	VI-362		2 "	Fall Creek Hot Spring 8, 1 N., 43 E.
61523	VC-68		7 "	Cedar Spring, 12, 6 N., 97 W.
61524	VC-69		1 "	"

Table 7. -- Analyses of samples of water and spring deposits--Continued

<u>Water samples</u>				
Lab. No.	Field No.	eU (percent)	U (percent)	Location Twp., Range
61525	VC-70		1 $\times 10^{-7}$	Cross Mt., filling station, Colorado
61526	VC-71		1 "	Conoco Station, Maybell, Colo.
61527	VC-150		1 "	Sand spring, 34, 7 N., 92 W.
61528	VC-151		1 "	Big Gulch Spring, 19, 7 N., 92 W.
61529	VC-152		10 "	Wet Gulch Spring, 26, 7 N., 94 W.
61530	VC-153		1 "	Juniper spring, 15, 6 N., 94 W.
61531	VC-154		14 "	Lay Creek tributary, 28, 7 N., 94 W.

Spring deposit samples

53788	VW-351	0.002	0.001	Hot springs near Auburn, Wyo.
53789	VW-352	.002	.001	"
53790	VW-354	.008	.001	Hot springs sulfur mine, Wyoming
53791	VW-356	.004	.001	Milled sulfur from Auburn mine,
63772	VW-313	.002	.001	6, 21 N., 119 E.

CONCLUSIONS

During the reconnaissance for uranium-bearing coal in parts of Colorado, Wyoming, Utah, and Idaho, one possible commercial deposit was discovered: the Fall Creek deposit, Bonneville County, Idaho (Vine and Moore, 1952). In addition, three localities were found in which coal beds contains more than 0.010 percent uranium in the ash. They are located near Lay, Colo.; Walden, Colo.; and the Leucite Hills, Wyo. Coal beds north of Sage, Wyo. contains 0.008 percent uranium in the ash; gilsonite south of Rand, Colo. contains 0.016 percent uranium in the ash; and bitumen west of Vernal, Utah contains 0.028 percent uranium in the ash.

Plans

Further reconnaissance work is planned, based on the guides for occurrence indicated by work in other areas, in three regions: (1) Southeastern Idaho where the Tertiary silicic volcanic rocks overlap coal or other possible receptor beds; (2) the Leucite Hills in the Rock Springs area, Wyo., where alkalic volcanic rocks overlie Upper Cretaceous coals; and (3) near Vernal, Utah.

Additional study of the Fall Creek occurrence, as discussed in TEM-340, is in progress this field season. No further study of the other Utah, Wyoming, or Colorado occurrences mentioned above is planned at this time.

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