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OCCURRENCE OF URANIUM-BEARING COAL, CARBONACEOUS SHALE, AND CARBONACEOUS LIMESTONE IN THE FALL CREEK AREA, BONNEVILLE COUNTY, IDAHO

Classification changed from Res. Sec. Inf. To OUO
By authority of Memo fm Date 2/7/57
Johnson & Merritt dtd 1/6/54

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Trace Elements Memorandum Report 340

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

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AEC - 718/2

Dr. Phillip L. Merritt, Assistant Director
Division of Raw Materials
U. S. Atomic Energy Commission
P. O. Box 30, Ansonia Station
New York 23, New York

Classification changed from Res. Sec. Inf. To OUO
By authority of Memo fm. Date 2/2/57
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Dear Phil:

Transmitted herewith for your information and distribution are 6 copies of Trace Elements Memorandum Report 340, "Occurrence of uranium-bearing coal, carbonaceous shale, and carbonaceous limestone in the Fall Creek area, Bonneville County, Idaho," by James D. Vine and George W. Moore, March 1952.

It is estimated that reserves at the Fall Creek prospect are about 490,000 tons of limestone, carbonaceous shale, and coal containing about 100 tons of uranium. Physical exploration proposed for this area to be done by the Survey consists of a minimum of four holes, each about 100 feet deep, and one hole, 800 to 1,000 feet deep. This drilling would show the extent and quantity of uranium in the coal at depth and along strike. A second outcrop strip northeast of the Fall Creek prospect, which has yet to be examined, may warrant physical exploration.

Other occurrences of coal associated with volcanic rocks in southeastern Idaho will be examined during the 1952 field season.

We plan to publish Part I as a Survey circular. We are asking Mr. Hosted, by a copy of this letter, whether the Commission has any objection, on grounds of security, to such publication.

Sincerely yours,

W. H. Bradley

W. H. Bradley
Chief Geologist

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Geology - Mineralogy

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Series A

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

OCCURRENCE OF URANIUM-BEARING COAL, CARBONACEOUS SHALE, AND CARBONACEOUS LIMESTONE IN THE FALL CREEK AREA, BONNEVILLE COUNTY, IDAHO*

By

James D. Vine and George W. Moore

March 1952

Trace Elements Memorandum Report 340

This preliminary report is distributed without editorial and technical review for conformity with official standards and nomenclature. It is not for public inspection or quotation.

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

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OCCURRENCE OF URANIUM-BEARING COAL, CARBONACEOUS SHALE, AND CARBONACEOUS LIMESTONE IN THE FALL CREEK AREA, BONNEVILLE COUNTY, IDAHO

By James D. Vine and George W. Moore

ABSTRACT

Uraniferous coal, carbonaceous shale, and carbonaceous limestone occur in the Bear River formation of Upper Cretaceous age at the Fall Creek prospect, in the Fall Creek area, Bonneville County, Idaho. The uranium compounds are believed to have been derived from mildly radioactive silicic volcanic rocks of Tertiary age that rest unconformably on all older rocks and once overlay the Bear River formation and its coal. Meteoric water, percolating downward through the silicic volcanic rocks and into the older rocks along joints and faults, is believed to have brought the uranium compounds into contact with the coal and carbonaceous rocks in which the uranium was absorbed.

INTRODUCTION

Uraniferous coal, lignite, and associated carbonaceous rocks were searched for in the summer of 1951 as part of the Geological Survey's program for the investigation of carbonaceous sediments in the western states that might be potential sources of uranium. This work was done on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission. The occurrence of small quantities of uranium with lignite had been reported previously from other areas by Slaughter, et al. (1946), Staatz, et al. (1951), Wyant, et al. (1950), and Wyant, et al. (1951). The uraniferous coal at the Fall Creek prospect was found as the result of routine radiometric examination of coals in Colorado, Wyoming, and Idaho closely associated with volcanic rocks, an association believed to be favorable for the occurrence of uranium in carbonaceous rocks (Denson, Bachman, and Zeller, 1950).

Radiometric examination was made chiefly with a Nuclear Instrument and Chemical Corporation counter, Model 2610A. A Halross gamma scintillometer was available for a short time and it was used in the radiometric examination of the silicic volcanic rocks because this instrument permits the recognition of lower radioactivity anomalies than the counter used. All radioactive coals and associated carbonaceous rocks found were sampled for analysis and lithologic study. Mildly radioactive igneous rocks, considered to be possible source rocks for uranium, were sampled for mineralogic and petrographic study.

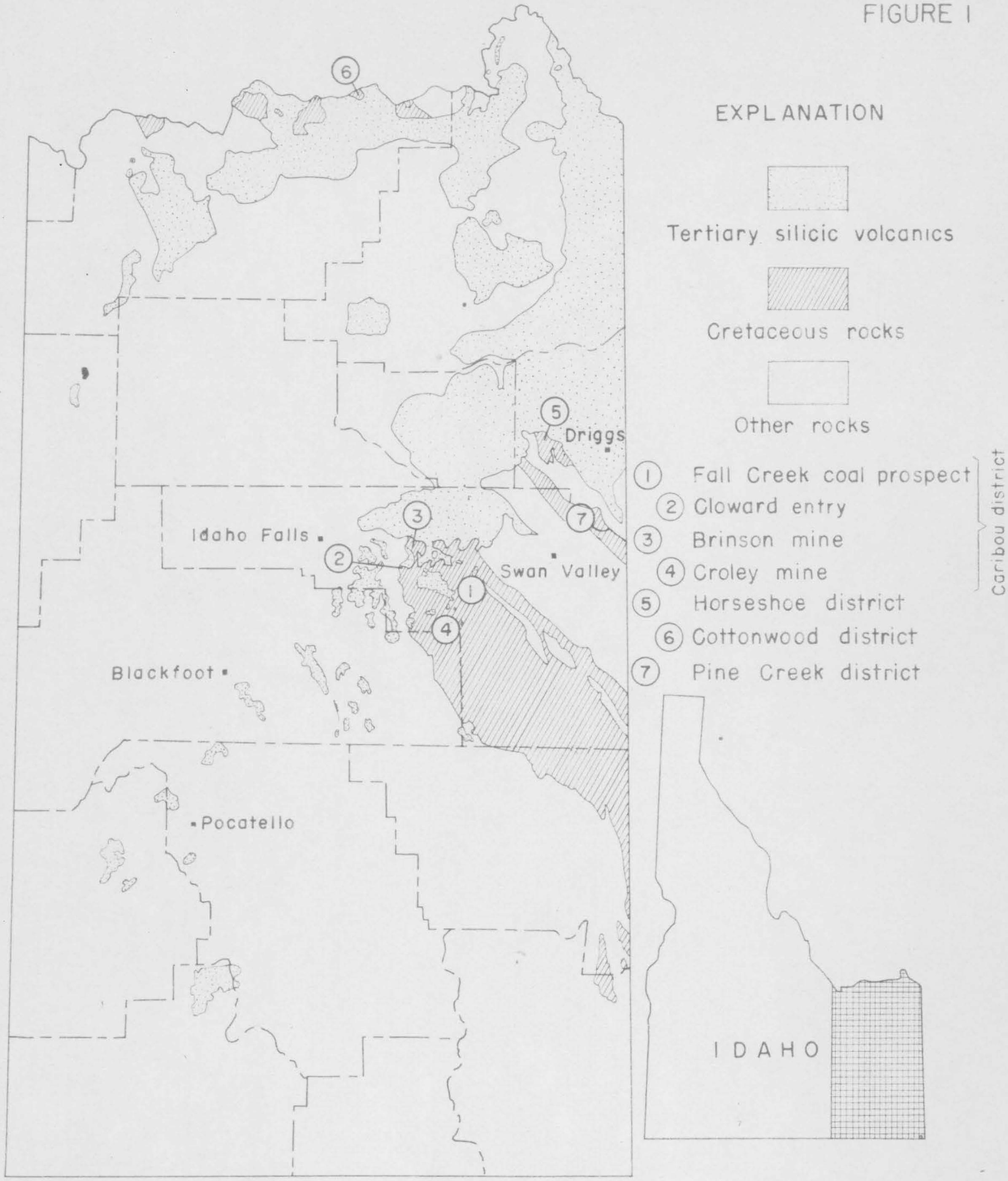
Louis S. Gardner visited the area and assisted with the interpretation of the structural and stratigraphic relations; he also made available his manuscript maps of the area. Norman M. Denson also visited the area and aided in the interpretation of factors contributing to the localization of the uranium compounds.

GEOGRAPHY

Location

The Fall Creek prospect is in the NE$\frac{1}{4}$ sec. 4, T. 1 S., R. 42 E., in the Caribou Mountains of southeastern Idaho (fig. 1). The adit is adjacent to the Fall Creek road in the Caribou National Forest and may be reached as follows: Take State Highway 29 west from the town of Swan Valley about 3 miles. Turn left onto a graveled road at the west side of the bridge which crosses the Snake River. Proceed along this road for about 1 mile then turn right at the junction with the Fall Creek road and continue along this road

FIGURE I



INDEX MAP OF SOUTHEASTERN IDAHO SHOWING THE AREAL DISTRIBUTION OF COAL-BEARING CRETACEOUS ROCKS AND RADIOACTIVE SILICIC VOLCANICS

about 12 miles. The adit is marked by a small wooden structure about 1 mile beyond the Fall Creek Guard station, on the south side of the road at a sharp curve in the road. The total driving distance from Swan Valley is about 16 miles.

Topography

The topography as shown on the Hell Creek quadrangle sheet ranges in elevation from about 5,800 to 7,600 feet above sea level, a relief of 1,800 feet. The grassy, soil-covered slopes in the vicinity of the prospect opening are known as Fall Creek Basin and form the headwaters of Fall Creek which flows northeast to join the Snake River opposite the town of Swan Valley. Except for a few rock ledges the area is covered with a dense growth of grass and stands of aspen and conifers.

Accessibility

The nearest town is Swan Valley, 16 miles distant, 13 miles of which is a graded dirt road and 3 miles of which is paved. A railroad station is located on the Union Pacific Railroad at Victor, Idaho, a distance of about $21\frac{1}{2}$ miles beyond Swan Valley to the northeast. It is about 37 miles, mostly on graded dirt road, from the Fall Creek prospect to the railroad at Victor. The railroad at Idaho Falls, to the northwest might be nearer, but the distance was not measured, and the condition of the road is not known.

GENERAL GEOLOGY

Structure

The Caribou Mountains are part of the system of parallel mountains which form an arcuate belt along the Idaho-Wyoming border. The Caribou

Range lies at the northern end of the arc where the prominent structural features trend northwest to plunge beneath the lavas of the Snake River Plain. Tight folds and overthrust sheets characterize the complex structure of the Caribou Mountains. The Snake River flows along a strike valley which separates the Caribou Range from the Snake River Range to the northeast. To the southwest lie other ridges belonging to the same system of parallel mountains; eventually they give way to the block faulted type of mountains which characterizes the Great Basin.

Sedimentary rocks

Mesozoic and Paleozoic strata are exposed in the Caribou Range. The following tabular description of the sedimentary rocks exposed in the vicinity of the Fall Creek prospect is taken chiefly from Kirkham (1924, pp. 23-29). The Bear River formation is described from the authors' observations in the field following the usage of Louis S. Gardner.

Sedimentary strata exposed in the vicinity of the Fall Creek prospect

C R E T A C E O U S	Upper Cretaceous		Wayan formation	8,800 ft.	Sandstones, grits, conglomerates, shales, limestones and ash beds of freshwater and continental origin
	Lower Cretaceous		Bear River formation	At least 150 ft.	Black shale of brackish and fresh-water origin, quartzite, and thin beds of coal and carbonaceous limestone
		G A N N E T T G R O U P	Tygee formation	1,020 ft.	Sandstone, reddish, yellowish and gray and carbonaceous shale
			Draney limestone	175 ft.	Limestone, very fine grained, light gray, also 25 feet of dark-colored coarse-grained limestone at the top
			Bechler formation	225 ft.	Red shale, soft, weathers into a red soil
			Peterson limestone	50 ft.	Limestone, massive, fine grained, dark gray; contains calcite seams and dark chert nodules
			Ephraim formation	360 ft.	Conglomerate, massive; sandstone, reddish; shale, reddish; and limestone

Kirkham (1924, p. 26) states that the Tygee formation unconformably underlies the Wayan formation and makes no mention of the Bear River formation which Gardner (personal communication) recognizes between the Tygee and Wayan formations. It seems probable that Kirkham has included the Bear River formation in the Tygee formation.

Igneous rocks

Tertiary volcanic rocks of several types and ages lie unconformably on the steeply tilted Mesozoic and Paleozoic strata. Ross and Forrester (1947), showed three classes of volcanic rocks in this area:

Pleistocene and Recent--Snake River basalt (chiefly basaltic flows)

Pliocene and Pleistocene--Salt Lake formation and associated strata (rather poorly consolidated sand, silt, and gravel of lacustrine and fluviatile origin, including fan deposits. Minor quantities of rhyolitic flows and welded tuffs and of basalts are included. Some of the sediments are tuffaceous, and fresh water limestone is locally present).

Miocene and Pliocene--Silicic volcanic rocks associated with the Snake River basalt (welded tuffs and flows of rhyolitic appearance).

Small remnants of the silicic volcanic rocks cap many of the hills in the vicinity of the Fall Creek area. Radiometric tests with a scintillometer indicate that these volcanic rocks are mildly radioactive.

FALL CREEK COAL PROSPECT

Introduction

The Fall Creek coal prospect is an adit which extends about 83 feet down the dip of a coal bed in the Bear River formation (fig. 5A). The prospect was dug about 30 years ago by J. H. Smith of Rigby, Idaho. He reports that he went down about 98 feet and ceased operations when he reached water. Good timbering and a solid roof have helped to preserve the opening, though the floor of the mine and the lower 15 feet of the opening are covered with rubble. Figure 2 is a diagrammatic longitudinal section of the adit.

Structure

The adit was driven in the coal bed where it is on the northeast limb of a faulted anticline (fig. 3). The beds dip about 33° NE., and the axes of the major structural features trend northwest. The anticline is faulted along the axis dropping the Wayan formation down on the southwest against the Bear River formation. Erratic dips in the surrounding area may indicate that the structure is more complex than suggested here. The coal forms a thin zone of incompetent strata which has been sheared by differential movement between the overlying and underlying competent beds, and is characterized by drag folds as shown in figure 2. Clay and shale pods have been dragged into the coal so that the quality of the coal was too poor to make a commercial coal mine.

Sedimentary rocks

A stratigraphic section was measured beginning in the creek bottom below the adit and extending northeastward in the direction of dip through the coal horizon. This section is shown graphically in figure 4 and corresponds to the following description:

Stratigraphic section of the upper part of the Bear River formation and the lower part of the Wayan formation measured at the Fall Creek Entry about 16 miles southwest of Swan Valley in Bonneville County, Idaho.

		Thickness Ft.	In.
Wayan formation:			
Unit 1.	Sandstone, light gray, medium-grained, thin-bedded to thick-bedded, cross-bedded, forms prominent ledge	23	
Unit 2.	Covered, probably contains red shale, forms slope	106	
Unit 3.	Sandstone, bluish-gray, fine- to medium-grained	2	
Unit 4.	Covered, probably contains red shale, forms slope	34	

EXPLANATION

Shear planes in the coal

Coal and carbonaceous shale in the sheared zone

Coal lenses not in main sheared zone

Carbonaceous limestone

Carbonaceous shale and coaly gouge

Clay gouge

Joint

50 — Slope distance from portal indicated every 5 feet

39 / .007 — The top figure indicates the number of sample collected for analysis
The lower figure indicates the percent of uranium in the sample
The bracket indicates the thickness of the sample

Rubble

DIAGRAMMATIC LONGITUDINAL SECTION OF FALL CREEK COAL PROSPECT, BONNEVILLE COUNTY, IDAHO

James D. Vine and George W. Moore

0 1 2 3 4 FEET

Horizontal and vertical scale

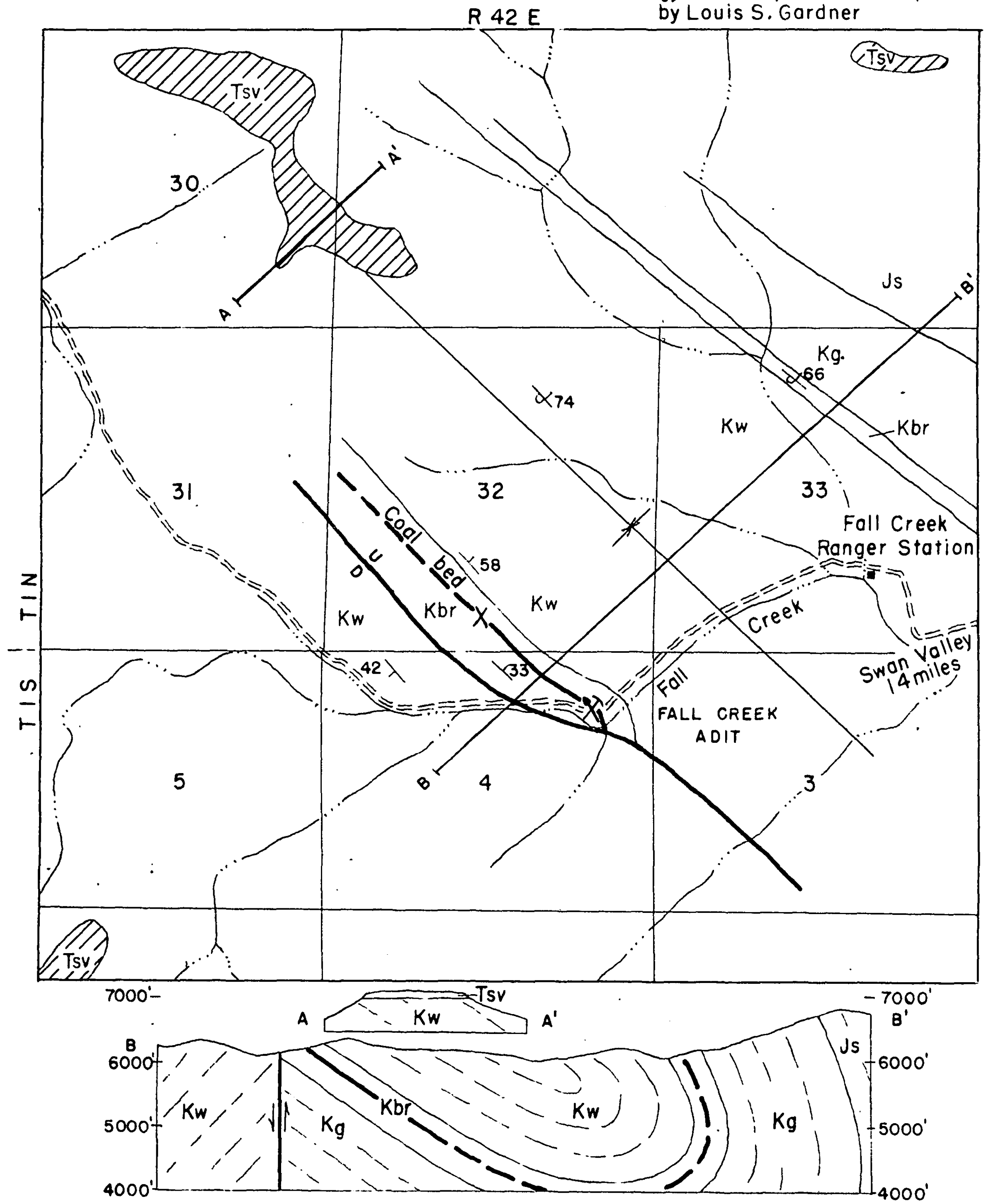
1952

FIGURE 3

EXPLANATION

Tsv Silicic volcanics
Kw Wayan formation
Kbr Bear River formation
Mine adit
Kg Gannett group
Js Stump formation
X Prospect trench

Geology after unpublished map by Louis S. Gardner



GEOLOGIC SKETCH MAP OF THE FALL CREEK AREA
BONNEVILLE COUNTY, IDAHO

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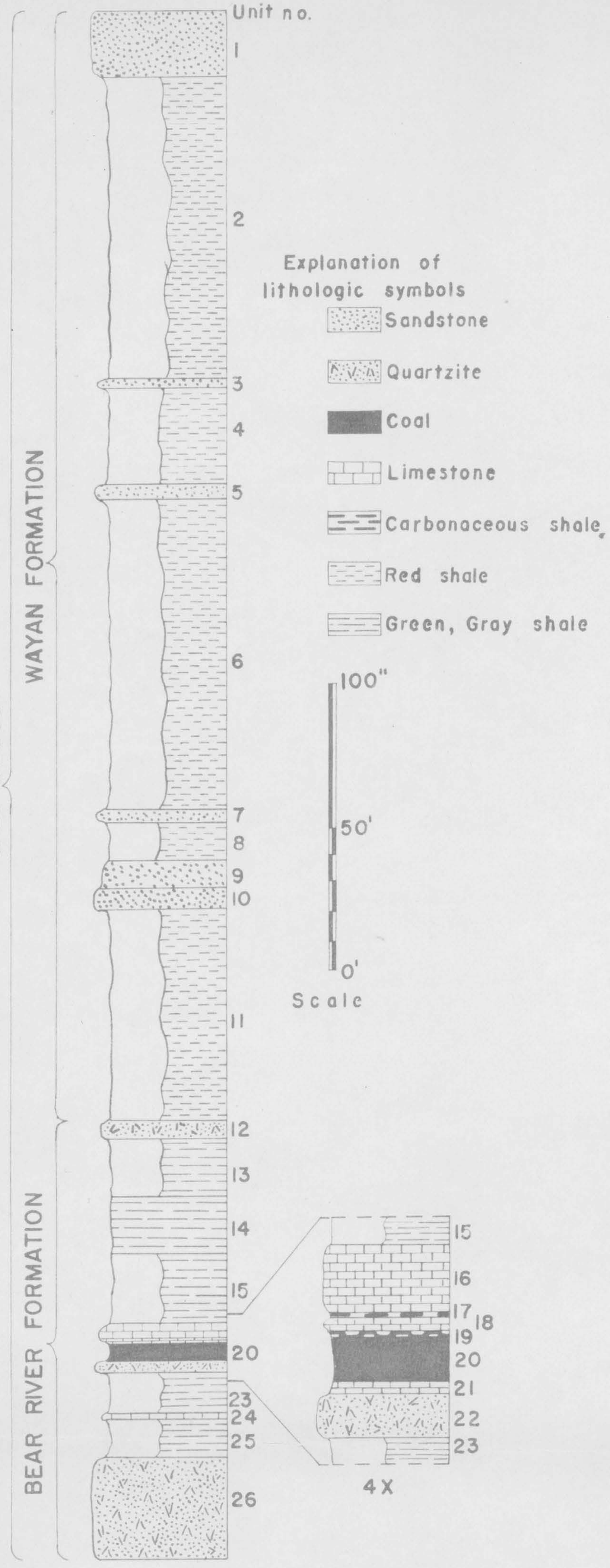
FIGURE 4



STRATIGRAPHIC SECTION OF THE UPPER PART OF THE BEAR RIVER FORMATION AND THE LOWER PART OF THE WAYAN FORMATION MEASURED AT FALL CREEK ADIT

Wayan formation		Thickness Ft.	In.
Unit 5.	Sandstone, bluish-gray, fine-grained	5	
Unit 6.	Covered, probably contains red shale, forms slope	108	
Unit 7.	Sandstone, greenish-gray, fine-grained	4	
Unit 8.	Covered, probably contains red shale, forms slope	13	
Unit 9.	Sandstone, light gray, fine- to medium-grained, friable, forms ledge locally	10	
Unit 10.	Sandstone, light gray, fine- to medium-grained, cross-bedded, thin-bedded, slightly friable, forms ledge; the lower 6" to 8" contains a siltstone pebble conglomerate	6	
Unit 11.	Covered with reddish soil, probably red shale, forms slope	75	
	Total Wayan formation (measured)	386	

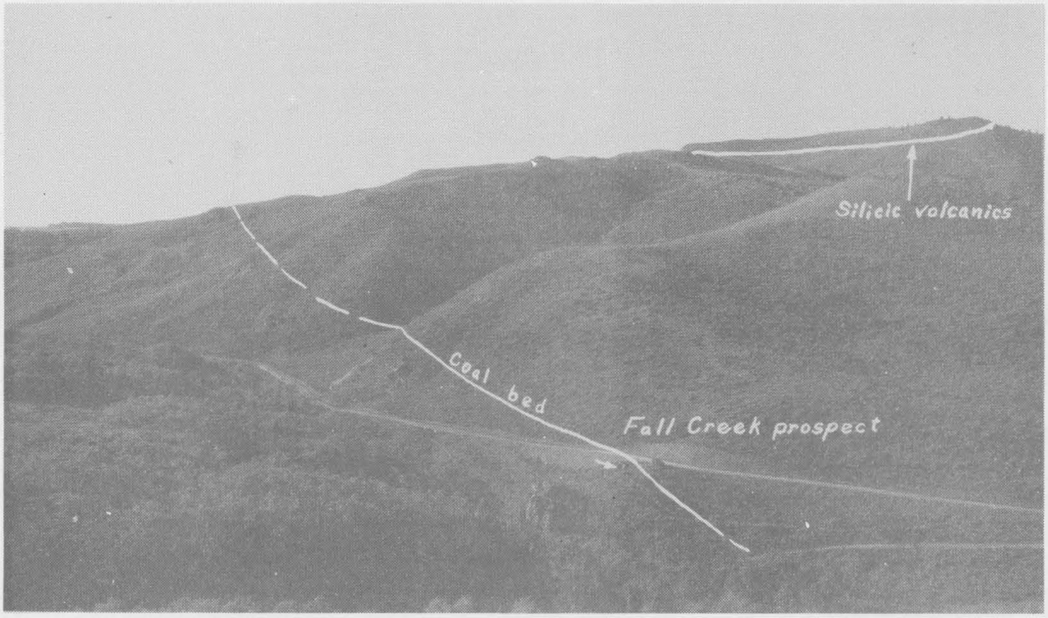
Bear River formation		Ft.	In.
Unit 12.	Quartzite, greenish-gray to gray, fine-grained to dense	6	
Unit 13.	Covered, probably shale, green, not fissile	20	
Unit 14.	Shale, greenish- to purplish-gray, not fissile, forms slope	20	
Unit 15.	Covered, road fill, probably shale, green, not fissile	25	
Unit 16.	Limestone, carbonaceous, black, weathers gray, dense to finely crystalline, radioactive; contains fossil fragments including smooth gastropod shells	4	6
Unit 17.	Shale, carbonaceous, dark greenish-gray	0	4
Unit 18.	Limestone, carbonaceous, fossiliferous, fresh fragments give off fetid odor, radioactive	1	3
Unit 19.	Clay gouge, radioactive	0	6
Unit 20.	Coal, clay and thin limestone lenses, sheared, highly radioactive	4	
Unit 21.	Limestone, carbonaceous and shale, carbonaceous, radioactive	1	
Unit 22.	Quartzite, greenish-gray to brown, fine-grained, forms ledge	4	
Unit 23.	Covered slope-forming unit, probably gray, fissile shale	15	
Unit 24.	Limestone, impure, dark brown, weathers brown, dense to finely crystalline, fresh fragments give off a fetid odor; contains fossil fragments including smooth gastropod shells	0	8
Unit 25.	Covered, slope-forming unit, probably gray, fissile shale	15	
Unit 26.	Quartzite, greenish-gray to brown, fine-grained, forms massive ledge, cross-bedded in part	35	
	The lower part of the Bear River formation not exposed.		
	Total Bear River formation exposed	152	5

Carbonaceous beds in the upper part of the Bear River formation contain uranium (fig. 5B). Units 16, 17, and 18 may be considered together as a limestone unit with a thin shale parting which overlies the coal and forms the roof of the entry. The limestone is black and carbonaceous, contains fossil fragments including smooth gastropod shells, and gives off a fetid odor when crushed. Cavernous joints are visible in the roof of the entry indicating solution by circulating ground water. Unit 19, immediately below the limestone and separating it from the underlying coal, is a unit of varying thickness and lithology. It consists of clay gouge, carbonaceous shale, lenses of carbonaceous limestone and thin lenses of dense black brittle coal with a bright luster. The shear planes in this unit are parallel or nearly parallel to the bedding of the overlying limestone. The thickness of this unit ranges from about 4 inches to 2 feet. Directly underlying Unit 19 is the coal bed, Unit 20. The coal is highly distorted and is characterized by shear planes rather than bedding planes. As a result of this distortion the coal contains a considerable quantity of yellow and gray clay and carbonaceous limestone which has been dragged into the coal bed to form lenses and pods parallel to the shear planes. Directly below the coal horizon, is Unit 21 which is similar to Unit 19 above the coal. Exposures of this unit were poor because of the quantity of rubble on the floor of the opening. It consists of carbonaceous shale, lenses of clay, lenses of dense black brittle coal and, at the bottom, an impure bed of carbonaceous limestone. The shear planes in this unit are wavy but tend to parallel the bedding.

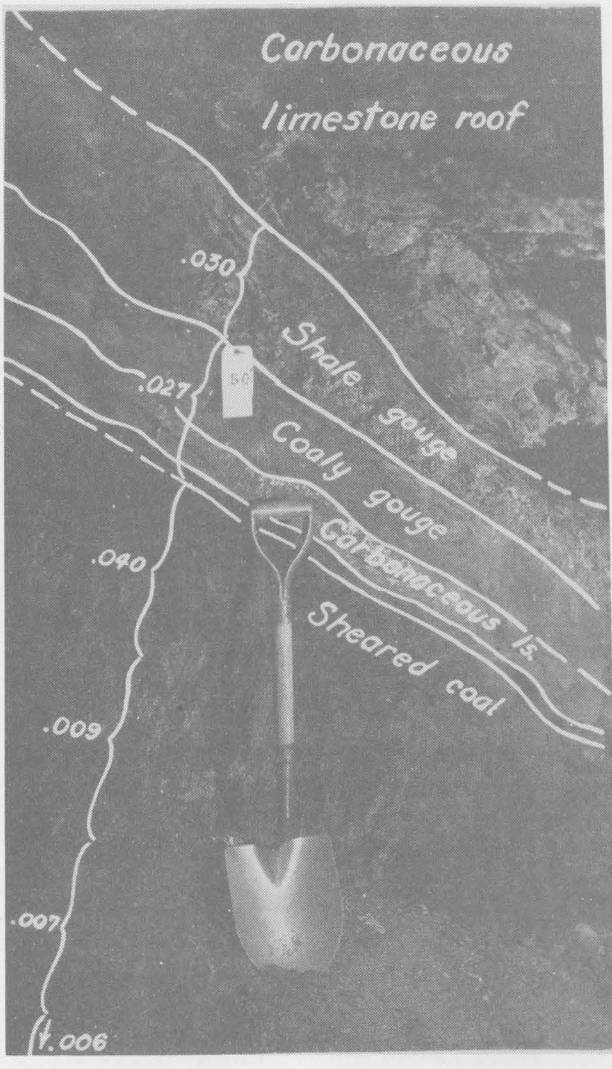
Uranium-bearing coal, carbonaceous shale, and carbonaceous limestone

Radioactivity was detected first at the mouth of the Fall Creek prospect. Further investigation showed that all the carbonaceous beds, Units 16, 17, 18, 19, 20 and 21 were radioactive. Three preliminary samples, Nos.

FIGURE 5



A. Photograph of Fall Creek coal prospect showing position of entry and trace of coal bed with relation to road and surrounding hills.



B. Interior view of Fall Creek coal prospect. Photograph taken 50 feet from portal showing stratigraphic sequence of mineralized beds and percent uranium in the samples.

1, 2, and 3 were collected for quick analysis. Other samples for analysis were collected from a section normal to the dip of the strata at the mouth of the entry and from similar sections at 10-foot intervals along the length of the opening. Forty-eight samples were collected from eight sections in order to obtain data representative of the mine. This information is summarized in table 1, which shows the variation in uranium content for samples collected from different places in the opening. The same information is shown graphically on figure 2 and on the graphs in figure 6.

In general mineralization is greatest at or near the top of the coal bed, Unit 20. Mineralization diminishes downward through the coal and the carbonaceous shale below the coal. It also diminishes upward through the overlying carbonaceous shale and limestone. A relatively high concentration of uranium, 0.053 percent uranium in the coal and 0.31 percent uranium in the ash in sample No. 2, was found in one of the lenses of dense black brittle coal in the zone of gouge immediately above the main coal horizon. Unfortunately there is only a small quantity of such material available in the prospect. The average uranium content in the top 1 foot of coal is about 0.045 percent in the coal and 0.082 percent in the ash. It is interesting to note that the grade increases toward the lower portion of the opening, and that the average for the top of the coal in the last two sections is 0.110 percent uranium in the coal and 0.222 percent uranium in the ash.

No other exposures of the coal bed were found along its strike. The hills in this area are covered by thick soil and colluvium, and only the most resistant beds crop out (fig. 5A). Fragments of radioactive, carbonaceous limestone were found within half a mile northwest of the adit. A trench 3-5 feet deep and 20 feet long was dug adjacent to a caved and abandoned coal prospect about half a mile northwest of the adit in an attempt to

Table 1.--Analyses of samples collected from the Fall Creek coal prospect

Sample number	Lab. No.	eU */ (percent)	Ash (percent)	U in Ash (percent)	U in sample (percent)	Sample description
Preliminary samples, Nos. 1 to 3, collected about 35 feet from portal, Sept. 13, 1951						
1.	52040	0.064	43.9	0.090	0.040	Grab sample sheared coal
2.	52041	0.10	17.3	0.31	0.053	Grab sample vitreous coal
3.	52042	0.020	77.5	0.013	0.010	Channel sample 4' sheared coal
Comprehensive suite of samples, Nos. 4 to 51, collected from vertical sections stationed at 10 foot intervals from portal on Sept. 24, 1951.						
Samples collected from station at portal						
4.	66874	0.002	----	----	0.001	3" shale above limestone
5.	66873	0.027	----	----	0.024, 0.021	15" carbonaceous limestone above coal
6.	66861	0.019	84.8	0.018	0.015, 0.014	2" carbonaceous shale, limestone and coal
7.	66862	0.011	78.8	0.014	0.011	Top $1\frac{1}{4}$' sheared coal
8.	66863	0.013	74.6	0.025	0.019, 0.023	Next $1\frac{1}{4}$' sheared coal
9.	66864	0.009	77.5	0.016	0.012, 0.013	Bottom $1\frac{1}{4}$' sheared coal
10.	66865	0.007	----	----	0.007	6" carbonaceous limestone
11.	66866	0.004	----	----	0.003	6" carbonaceous shale and clay
Samples collected from station 10 feet from portal						
12.	66867	0.021	77.5	0.029	0.022	4" carbonaceous shale
13.	66868	0.011	69.4	0.018	0.012	Top 1' sheared coal
14.	66869	0.017	71.5	0.027	0.019, 0.020	Next 1' sheared coal
15.	66870	0.009	73.0	0.022	0.016	Next 1' sheared coal
16.	66871	0.005	72.6	0.006	0.004	Bottom 1' sheared coal
17.	66872	0.004	72.8	0.007	0.005	Carbonaceous shale and clay

*/ eU = equivalent uranium

Table 1.--Analyses of samples collected from the Fall Creek coal prospect--Continued

Sample number	Lab. No.	eU */ (percent)	Ash (percent)	U in Ash (percent)	U in sample (percent)	Sample description
Samples collected from station 20 feet from portal						
18.	66875	0.012	----	----	0.013	Carbonaceous limestone and shale
19.	66876	0.035	61.3	0.066	0.040	Top 1' sheared coal
20.	66877	0.006	71.8	0.011	0.008	Next 1' sheared coal
21.	66878	0.009	73.4	0.015	0.011	Next 1' sheared coal
22.	66879	0.005	77.9	0.007	0.005	1' clay and carbonaceous shale
23.	66880	0.004	69.3	0.008	0.006	1' clay, carbonaceous shale and limestone
Samples collected from station 30 feet from portal						
24.	66881	0.024	----	----	0.025, 0.028	1' carbonaceous shale and clay
25.	66882	0.008	72.0	0.014	0.010	Top 1 1/3' sheared coal
26.	66883	0.006	68.3	0.011	0.008	Next 1 1/3' sheared coal
27.	66884	0.007	69.7	0.014	0.010	1 1/3' sheared coal
28.	66885	0.007	74.4	0.009	0.007	15" sheared coal, shale, and limestone
Samples collected from station 40 feet from portal						
29.	66886	0.026	----	----	0.029, 0.032	6" carbonaceous shale and clay
30.	66887	0.028	70.8	0.044	0.031	10" carbonaceous limestone and vitreous coal
31.	66888	0.021	72.3	0.033	0.024	Top 1 1/3' sheared coal
32.	66889	0.006	74.6	0.010	0.007	Next 1 1/3' sheared coal
33.	66890	0.018	71.4	0.030	0.021	Next 1 1/3' sheared coal
34.	66891	0.005	78.2	0.009	0.007	1 1/3' coal, carbonaceous shale and limestone

*/ eU = equivalent uranium

Table 1.--Analyses of samples collected from the Fall Creek coal prospect--Continued

Sample number	Lab. No.	eU */ (percent)	Ash (percent)	U in Ash (percent)	U in sample (percent)	Sample description
	Samples collected from station 50 feet from portal					
35.	66892	0.026	----	----	0.028, 0.030	1' carbonaceous shale and limestone
36.	66893	0.025	----	----	0.027	8" carbonaceous limestone, shale and vitreous coal
37.	66894	0.033	60.4	0.066	0.040	Top $1\frac{1}{4}$' sheared coal
38.	66895	0.007	66.0	0.013	0.009	Next $1\frac{1}{4}$' sheared coal
39.	66896	0.005	70.8	0.010	0.007	Next $1\frac{1}{4}$' sheared coal
40.	67239	0.006	70.8	0.008	0.006	1' coal and clay
	Samples collected from station 60 feet from portal					
41.	67240	0.016	----	----	0.018, 0.020	8" carbonaceous shale
42.	67241	0.018	----	----	0.022	15" carbonaceous limestone
43.	67242	0.096	43.7	0.30	0.131	Top $1\frac{1}{4}$' sheared coal
44.	67243	0.025	66.2	0.044	0.029	Next $1\frac{1}{4}$' sheared coal
45.	67244	0.006	75.9	0.010	0.008	Next $1\frac{1}{4}$' sheared coal
46.	67245	0.007	77.4	0.009	0.007	Bottom $1\frac{1}{4}$' sheared coal
	Samples collected from station 75 feet from portal					
47.	67246	0.003	----	----	0.003	4" carbonaceous shale
48.	67247	0.010	----	----	0.011	17" carbonaceous limestone
49.	67248	0.064	58.4	0.145	0.085, 0.089	Top 1.1' sheared coal
50.	67249	0.007	64.9	0.009	0.006	Next 1.1' sheared coal
51.	67250	0.008	72.4	0.012	0.009	Next 1.1' sheared coal
	Sample from dump of abandoned prospect half a mile northwest of portal					
52.	66858	0.066	37.0	0.22	0.08	Coal fragments

*/ eU = equivalent uranium

GRAPH SHOWING PERCENT URANIUM AND ASH IN SAMPLES FROM THE FALL CREEK COAL PROSPECT, BONNEVILLE COUNTY, IDAHO uncover an exposure of the coal but bedrock was not found. Enough small chunks of coal, however, were gathered from the dump of the abandoned coal prospect to fill a quart container. These fragments analyzed 0.08 percent uranium in the sample, 37 percent ash, and 0.22 percent uranium in the ash. This substantiates the belief that the uranium-bearing coal bed extends for at least half a mile along the strike northwest of the main adit.

Mineralogy

No uranium minerals have been identified by this field study of the coal, carbonaceous shale or carbonaceous limestone even though the analyses indicate a comparatively large quantity of uranium. Tolmachev (1943) has shown in his experiments on the adsorption of uranyl nitrate by activated carbon and carbonaceous shales that after the adsorption had taken place the amount of nitrate in the solution remained the same, but the amount of uranyl ion diminished. This suggested to him that the uranyl ion was adsorbed between the graphitic layers of carbonaceous material. A similar mechanism may explain why the uranium-bearing coal in the Fall Creek area contains no megascopically detectable uranium minerals. That is, the uranium may be present in the ionic state, adsorbed by carbonaceous material.

Origin

It seems fairly evident that the carbonaceous material is in some way responsible for the localization of the ore whether it be due to ionic adsorption or some other mechanism such as chemical reduction, because the uranium is associated with beds of several different lithologies which have but one common factor, a high content of carbon. Carbonaceous beds near the top of the carbonaceous zone are the most intensely mineralized and below the top foot of coal the uranium content diminishes rapidly downward. This is interpreted as meaning that the mineralization was effected by downward percolation of solutions bearing uranium ions and that the ions were held by adsorption by the first carbonaceous material which they encountered. The diminishing amount of uranium in the lower part of the coal bed, therefore, could indicate that few ions were able to penetrate that far before being adsorbed.

Silicic volcanic rocks cap several of the hills in the vicinity of the Fall Creek coal prospect and are mildly radioactive. Analysis of a sample of the volcanic rock gave 0.004 percent equivalent uranium but less than 0.001 percent uranium. The areal pattern formed by the exposures of the silicic volcanics suggests that they once blanketed the entire surrounding area. Such a large mass of mildly radioactive rock can readily be imagined as the source for the uranium in the coal. Meteoric waters percolating through the source rock could take small quantities of uranium in solution and later deposit it under the proper physical and chemical environment such as was provided by the coal and carbonaceous material. A similar mechanism has been suggested for the source of the uranium in certain lignites in the Dakotas (Denson, et. al., 1950).

In trying to reconstruct the sequence of events which lead to the mineralization of the coal in the Fall Creek area the fact that at least 650 feet of sediments separate the coal from the overlying silicic volcanics, must be explained. These intervening sediments contain red and green shales, sandstones and quartzites which are relatively impervious for the circulation of ground water. However, the fault which offsets the axis of the anticline and passes no more than several hundred feet south of the Fall Creek prospect may have provided a conduit which facilitated the circulation of ground water. Ground water solutions may have left the fault to continue down the dip of the cavernous limestone which overlies the coal and thus enter the coal horizon from above. The average of the analyses of samples from the various sections indicates higher uranium content for some sections than for adjacent sections. This more intense mineralization may be due to the solutions being introduced through an open joint in the limestone above that section.

Geologic features believed to be significant in the localization of uranium in the Fall Creek area are: (1) the mildly radioactive silicic volcanics, which could have been a source of mineralizing meteoric waters; and (2) the coal, carbonaceous limestone, and carbonaceous shale below the volcanics, which now hold the uranium that was introduced by percolating meteoric water.

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