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INVESTIGATIONS IN THE FALL CREEK AREA, BONNEVILLE COUNTY, IDAHO, DURING THE 1952 FIELD SEASON - A PRELIMINARY REPORT

By James D. Vine

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Trace Elements Memorandum Report 555

UNITED STATES DEPARTMENT OF THE INTERIOR

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INVESTIGATIONS IN THE FALL CREEK AREA, BONNEVILLE COUNTY, IDAHO, DURING THE 1952 FIELD SEASON - A PRELIMINARY REPORT*

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James D. Vine

November 1952

Trace Elements Memorandum Report 555

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INVESTIGATIONS IN THE FALL CREEK AREA, BONNEVILLE COUNTY, IDAHO, DURING THE 1952 FIELD SEASON - A PRELIMINARY REPORT

By James D. Vine

ABSTRACT

Additional field work was done in 1952 in the vicinity of the abandoned Fall Creek coal prospect, Bonneville County, Idaho, where uraniferous carbonaceous rocks in the Bear River formation of Cretaceous age were found in 1951 (Vine and Moore, 1952). Geologic mapping on a scale of 1/20,000 has shown that the uraniferous carbonaceous rocks are continuous over a much greater area than originally detected in reconnaissance work. The rocks are folded into overturned anticlines and synclines and have been faulted. The uranium appears to be secondary in the carbonaceous rocks, having been deposited there by groundwater. It is possible that carbonaceous rocks containing 0.1 percent uranium may be found by drilling along the axes of basin-like or synclinal structures which may have concentrated the flow of uranium-bearing groundwater.

INTRODUCTION

Purpose and scope of the report

Field work during the 1952 field season has supplied new data on the areal extent, composition, and estimated reserves of uranium-bearing carbonaceous rocks in the Fall Creek area, Bonneville County, Idaho. The following is a preliminary report of progress to describe these new data which supplement the information contained in Trace Elements Memorandum Report 340 (Vine and Moore, 1952). This work was done on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

Acknowledgments

The field investigations were greatly facilitated by an advanced copy of a geologic map of the Caribou Mountains prepared by Louis S. Gardner (U. S. Geological Survey unpublished manuscript map).

GEOGRAPHY

Location and accessibility

The uranium-bearing strata of the Fall Creek area are located on the west flank of the Caribou Mountains in Bonneville County, Idaho, chiefly in Tps. 1 N., and 1 S., R. 42 E. The principal exposure is in the NE 1/4 sec. 4, T. 1 S., R. 42 E., at an abandoned, inclined shaft dug for coal, adjacent to the Fall Creek road in the Caribou National Forest. The area is easily accessible in good weather from the town of Swan Valley, Idaho, a distance of about 16 miles. However, the road is not kept open during the period of heavy snow which may come any time between November and April.

Topography and water supply

Elevations in the area mapped range from about 5,800 feet near the Fall Creek Ranger Station to 7,600 feet in the hills near the Fall Creek prospect. Discontinuous stands of conifers and aspen cover about one third of the area and the remainder is covered with grass and low shrubs. Fall Creek and several of its tributaries are permanent streams that normally carry sufficient water for use in a drilling program, but which may run low in late summer.

Land ownership

The Fall Creek area lies within the boundary of the Caribou National Forest, but there are several small tracts of privately owned land within the National Forest. The areas of government and privately owned land shown on figure 1 were adapted from a U. S. Department of Agriculture Caribou National Forest map, dated 1949.

GENERAL GEOLOGIC FEATURES

Structural setting

The Caribou Mountains in southeastern Idaho are at the northern end of a system of parallel mountain ranges that form an arcuate belt along the Idaho-Wyoming border. The Caribou Mountains are characterized by complex structural features that trend northwest and ultimately plunge beneath the lavas which constitute the Snake River Plain, that surrounds the northern end of the range. Closely spaced, parallel folds, overturned at many places, and broken by faults, are the principal structural features of the range. In the northeastern part of the area mapped the principal folds are overturned toward the southwest while in the southwestern part of the area the principal overturning is toward the northeast.

Sedimentary rocks

Both Mesozoic and Paleozoic strata are folded and faulted in the Caribou Mountains. Since only sedimentary rocks of the Cretaceous and Jurassic systems are exposed in the area mapped, the following descriptions concern only that portion of the stratigraphic section.

The stratigraphy of the Fall Creek area is described by Kirkham (1924), and the following descriptions of formations older than the Tygee formation are adapted from his sections. The descriptions of the younger formations are from the author's observations and those of Louis S. Gardner (U. S. Geological Survey unpublished manuscript map).

Sedimentary rocks exposed in the Fall Creek area

Age	Group	Formation	Thickness	Description
UPPER CRETACEOUS		Wayan formation	3,000 to 4,000 ft. (estimate)	Shale, red and purple, and sandstone, gray, medium- to coarse-grained, cross-bedded, friable. Sandstone beds form prominent ledges in the softer shales.
LOWER CRETACEOUS		Bear River formation	300 feet	Siltstone, carbonaceous, ferruginous, and brown thin-bedded sandstone in lower two-thirds, overlain in upper third by brown to gray medium-grained quartzite or sandstone that is very resistant to weathering. Uraniferous carbonaceous shale, carbonaceous limestone, and coaly shale also occur in the upper third of the formation.
LOWER CRETACEOUS	Gannet group	Tygee formation	215 feet	Shale, red, interbedded with sandstone, gray to brown, fine-grained; some sandstone is gray, medium-grained, cross-bedded and friable. The sandstone beds form ledges in the softer shales.
LOWER CRETACEOUS	Gannet group	Draney limestone	175 feet	Limestone, gray, fine- to coarse-grained, weathers dirty white; fossiliferous at top
LOWER CRETACEOUS	Gannet group	Bechler formation	225 feet	Shale, red, weathers into a red soil
LOWER CRETACEOUS	Gannet group	Peterson limestone	50 feet	Limestone, fine-grained, dark gray, weathers dirty white
LOWER CRETACEOUS	Gannet group	Ephraim formation	360 feet	Conglomerate and sandstone, reddish-gray, coarse-grained, gritty with some reddish-gray shale and purplish-gray limestone
JURASSIC		Stump formation	220 feet	Sandstone, gray to greenish-gray, fine-grained and shaly; some sandstone is massive and coarse-grained
JURASSIC		Preuss formation	425 feet	Shale, red and green with green "salt and pepper" sandstone and thin beds of limestone

Igneous rocks

Tertiary volcanic flows and tuffs lie unconformably on the steeply tilted Mesozoic and Paleozoic strata at many places in the Caribou Mountains. Within the area mapped, only one of the high hills is capped by a remnant of volcanic rock although several erosional remnants similar to the one mapped are present in the areas adjacent to the Fall Creek prospect. Ross and Forester (1947) assign these volcanic rocks to the oldest of a series of three volcanic groups which they recognize in southeastern Idaho. This oldest group is classed as Miocene and Pliocene silicic volcanic rocks associated with the Snake River basalt (welded tuffs and flows of rhyolitic appearance). In the Fall Creek area these older volcanic rocks are hard, dense, gray and tan to red, felsite-porphyries containing small feldspar phenocrysts. Black and gray obsidian with microlites and spherulites are also present.

URANIUM-BEARING STRATA

Introduction

A detailed description of the uranium-bearing strata exposed in the abandoned coal prospect on Fall Creek (NE 1/4 sec. 4, T. 1 S., R. 42 E.) was given in the original report on this area (Vine and Moore, 1952, pp. 10-23). This is the only place where the uranium-bearing strata can be examined and sampled in detail. Uranium-bearing coaly shale, carbonaceous shale, and carbonaceous limestone in the Bear River formation are exposed in an inclined shaft which extends 83 feet down the dip of the beds. The strata dip about 33 degrees to the northeast, forming the northeast limb of a faulted anticline. The coaly shale and associated carbonaceous beds are characterized by drag folds and represent a zone of incompetent strata which have been sheared by differential movement between the overlying and underlying more competent beds. Mineralization is most intense at the top of the coaly shale, the upper foot of which contains as much as 0.13 percent uranium in the fresh rock and 0.3 percent uranium in the ash. The average content for the top foot of coaly shale is 0.045 percent uranium in the fresh rock and 0.082 percent in the ash, but the amount of uranium in the upper part of the bed increased with depth below the surface of the ground so that in the lower 20 feet of the incline the average uranium content of the top foot of coaly shale is 0.11 percent in the fresh rock and 0.22 percent in the ash.

Distribution

At the end of the 1951 field season the only known occurrence of uranium-bearing strata in this area was at the abandoned coal prospect and along the strike to the northwest of the prospect for about half a mile. Geologic mapping during the 1952 field season has shown that the uranium-bearing strata in the Bear River formation are continuous over a much greater area than originally suspected, and they are now known to be present in the flanks of faulted anticlines and synclines adjacent to the prospect. (See figure 1.) However, two factors make prospecting very difficult and structural interpretations rather uncertain. First, the exposures of the uranium-bearing zone are invariably very poor. Generally, the only evidence for its presence is a line of radioactive, carbonaceous limestone boulders on soil covered slopes. Second, on the flanks of the severely deformed overturned anticlines and synclines, some of the less competent beds are missing at a few places, which may be due to faulting or squeezing out as a result of regional deformation. Attempts to uncover the uranium-bearing strata by trenching failed at most places because of the thick mantle of soil and colluvium. Three trenches as much as 6 feet deep were dug in sec. 4, T. 1 S., R. 42 E., along the northeast flank of the anticline between the abandoned coal prospect and the northwest limit of the outcrop. However, these trenches were not deep enough to reach fresh uranium-bearing strata. A soil auger was used at several places to supplement the data obtained by trenching and its use was partly successful. Samples recovered with the soil auger (See tables 1 and 2) were dark colored radioactive soils that were probably derived from the weathering of the uranium-bearing carbonaceous strata.

Three areas are considered especially worthy of further investigation. These are as follows (See figure 1): (Block one) the northeast flank of the anticline in sec. 4, T. 1 S., R. 42 E.; (Block two) the southwest flank of the same anticline described above, and (Block three) the southwest flank of a similar and parallel anticlinal structure approximately a mile southwest of the coal prospect, chiefly in sections 8, 9, and 16, T. 1 S., R. 42 E. In all three of these blocks, the strata have relatively gentle dips of less than 35 degrees which should provide the best opportunity for underground development.

Mineralization

No additional data were obtained during the 1952 field season which would shed light on the time of mineralization, the nature of mineralizing solutions, or the identity of any uranium minerals. No uranium minerals have been recognized in the uranium-bearing strata, and the uranium probably is present as a constituent of the carbonaceous material.

Uranium content of the rocks exposed in the Fall Creek prospect is highest at the top of the bed of coaly shale, near joints, and along sheared zones that would provide access for uranium-bearing groundwater. It is believed that the uranium is secondarily emplaced in the carbonaceous rocks by circulating groundwater. The source of the uranium-bearing solutions is not known although the writer suggests that radioactive Tertiary volcanic rocks that once extended across the area possibly may have been a source from which the uranium was leached prior to the removal of most of the volcanic materials by erosion. Regardless of the source of the uranium, radioactivity occurs over many square miles in the carbonaceous beds of the Bear River formation in the Fall Creek area.

The highest grade uraniferous rocks known so far are from the Fall Creek coal prospect, the only place where the rocks could be sampled in detail. Rocks containing as much as 0.1 percent uranium may also be present in the carbonaceous beds at many places throughout the area mapped. However, the uranium content probably is influenced by the location of channels of most effective groundwater movement which is believed to occur primarily along the axes of synclines or basin-like structures and secondarily along joints and shear zones. Along the flanks and near the axes of synclines would seem, therefore, to present the most favorable areas in which to search for ore-grade uranium deposits.

TABLE 1. SAMPLES COLLECTED IN THE FALL CREEK AREA DURING THE 1952 FIELD SEASON

A. Coal, black limestone and radioactive soil samples from the Bear River formation

Field No.	Rock type	Thickness sampled	Location Sec., T., R.	Equivalent uranium (percent)	Ash (percent)	Uranium in ash (percent)	Uranium in sample (percent)
VI-1036	Black limestone	18 inches	4-1S-42E	0.013	61.5	0.017	0.010
VI-1033	Coal and soil	9 inches	"	0.008	70.2	0.009	0.006
VI-1034	"	9 inches	"	0.011	75.1	0.014	0.011
VI-1035	"	17 inches	"	0.010	71.2	0.011	0.008
VI-1047	Black limestone	Grab	9-1S-42E	0.003	61.9		
VI-1048	Radioactive soil	Grab	"				
VI-1049	"	7 inches	"				
VI-1050	"	14 inches	"				
VI-1051	"	28 inches	"				
VI-1052	Black soil	Grab	"				
VI-1053	Black limestone	Grab	16-1S-42E				
VI-1055	Radioactive soil	17 inches	"				
VI-1056	"	17 inches	"				
VI-1057	"	17 inches	"				
VI-1074	Black limestone	Grab	33-1N-42E				
VI-1071	Radioactive soil	10 inches	"				
VI-1072	"	16 inches	"				
VI-1073	"	16 inches	"				
VI-1088	Black limestone	Grab	16-1S-42E				
VI-1120	"	Grab	4-1S-42E				
VI-1121	Gray shale	10 inches	"				
VI-1122	Coaly shale	12 inches	"				
VI-1123	Carb. shale	6 inches	"				
VI-1124	Black limestone	2 inches	"				
VI-1125	Sandstone	4 inches	"				
VI-1126	Black limestone	12 inches	"				
VI-1127	"	8 inches	"				

A. Coal, black limestone and radioactive soil samples from the Bear River formation (Cont.)

Field No.	Rock type	Thickness sampled	Location Sec., T., R.	Equivalent uranium (percent)	Ash (percent)	Uranium in ash (percent)	Uranium in sample (percent)
VI-1128	Black shale	Grab	4-1S-42E				
VI-1129	Radioactive soil	Grab	"				
VI-1130	Black limestone	Grab	"				
VI-1131	"	Grab	"				
VI-1132	Coal	Grab	"				
VI-1133	Black limestone	Grab	"				
VI-1134	Coal	6 inches	"				
VI-1135	Coal	6 inches	"				
VI-1136	Coal	6 inches	"				
VI-1137	Coal	6 inches	"				
VI-1138	Black limestone	Grab	"				

B. Miscellaneous rock samples from various formations

VI-1031	Bone from Wayan fm.	Grab	3-1S-42E
VI-1037	Rhyolite tuff	Grab	30-1N-42E

C. Water samples

Field No.	Location Sec., T., R.	U (ppm)
VI-1101	Cattle Spring, 32-1N-42E	0.003
VI-1102	Spring, Fall Creek Ranger Sta.	0.008

TABLE 2. SAMPLES COLLECTED IN THE CARIBOU MOUNTAINS ADJACENT TO THE FALL CREEK AREA DURING THE 1952 FIELD SEASON

A. Coal, black limestone and radioactive soil samples from the Bear River formation

Field No.	Rock type	Thickness sampled	Location Sec., T., R.	Equivalent uranium (percent)	Ash (percent)	Uranium in ash (percent)	Uranium in sample (percent)
VI-1032	Black limestone	Grab	34-1N-42E	0.006	61.1	0.007	0.004
VI-1038	Soil	6 inches	2-1S-42E	0.007	86.4	0.005	0.004
VI-1039	Soil	6 inches	2-1S-42E	0.007	86.6	0.007	0.006
VI-1040	Soil	12 inches	34-1N-42E	0.001	92.3		
VI-1041	Soil	12 inches	"	0.004	85.3		
VI-1042	Black limestone	Grab	24-1N-42E	0.004	59.4		
VI-1043	Black soil	Grab	15-1N-42E	0.004	84.4		
VI-1044	Black limestone	Grab	13-1N-41E	0.003	61.7		
VI-1045	"	Grab	2-1N-41E	0.006	59.6	0.008	0.005
VI-1046	Black soil	Grab	"	0.002	81.6		
VI-1054	Black limestone	Grab	25-1S-42E				
VI-1058	Black soil	Grab	1-2S-42E				
VI-1060	Black limestone	Grab	6-2S-43E				
VI-1059	Black soil	18 inches	"				
VI-1061	Radioactive soil	8 inches	"				
VI-1062	"	8 inches	"				
VI-1063	"	8 inches	"				
VI-1064	"	8 inches	"				
VI-1066	Impure coal	9 inches	23-3S-43E				
VI-1068	Impure clay	9 inches	"				
VI-1068	Clay and impure coal	9 inches	"				
VI-1069	"	9 inches	"				
VI-1070	Impure coal	12 inches	24-3S-44E				
VI-1075	Black limestone	Grab	33-1S-42E				
VI-1080	"	Grab	36-1N-41E				

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A. Coal, black limestone and radioactive soil samples from the Bear River formation (Cont.)

Field No.	Rock type	Thickness sampled	Location Sec., T., R.	Equivalent uranium (percent)	Ash (percent)	Uranium in ash (percent)	Uranium in sample (percent)
VI-1087	Black limestone	Grab	7-1S-42E				
VI-1089	"	Grab	27-1S-42E				
VI-1090	"	Grab	25-1S-42E				
VI-1091	Radioactive soil	Grab	"				
VI-1092	Black limestone	Grab	"				
VI-1098	"	Grab	7-1S-43E				
VI-1099	"	Grab	12-1S-42E				
VI-1140	Coal	Grab	27-1S-41E				
VI-1141	Coal	Grab	"				
VI-1142	Radioactive soil	9 inches	"				
VI-1143	"	9 inches	"				
VI-1144	"	9 inches	"				
VI-1145	"	9 inches	"				
VI-1146	"	9 inches	"				
VI-1147	"	9 inches	"				
VI-1166	"	8 inches	16-1N-42E				
VI-1167	"	8 inches	"				
VI-1168	"	4 inches	"				
VI-1169	Black limestone	Grab	"				
VI-1170	Coal	Grab	34-2N-40E				
VI-1171	Coal	Grab	"				
VI-1172	Limestone	Grab	"				
VI-1173	Coal	12 inches	18-2N-45E				
VI-1174	Limestone	24 inches	"				
VW-1190	Coal	Grab	5-32N-119W				

B. Miscellaneous rock samples from various formations

Field No.	Rock type	Thickness sampled	Location Sec., T., R.	Equivalent uranium (percent)	Ash (percent)	Uranium in ash (percent)	Uranium in sample (percent)
VI-1030	Obsidian	Grab	21-1N-42E				
VI-1065	Black limestone Draney fm.	Grab	17-2S-43E				
VI-1081	Rhyolite	Grab	8-1S-42E				
VI-1139	"	Grab	29-1S-42E				

C. Water Samples

Field No.	Location Sec., T., R.	U (ppm)
VW-1100	Snake River	0.002
VI-1103	Spring, 33-1N-41E	0.002
VI-1104	Spring, 31-2N-41E	0.005
VI-1105	Spring, 32-2N-41E	0.002
VI-1106	Mineral spring, 8-1N-43E	0.002

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PART II

ABSTRACT

Inferred reserves are tentatively estimated to be about 1,500 tons of uranium in about seven million tons of coaly shale, carbonaceous shale, and carbonaceous limestone. This estimate is based on data from the abandoned coal prospect, the only place where the uranium-bearing strata can be sampled. About 2,000 feet of core drilling is planned to search for uranium ore deposits along favorable structural features to obtain information on the distribution of uranium in the carbonaceous rocks from which reserves can be estimated with greater reliability. Plans for further work will be based on evaluation of data from this preliminary drilling.

INFERRED RESERVES

Some idea of potential reserves in the Fall Creek area can be obtained by extending through the area the data from the abandoned Fall Creek coal prospect, the only place where good samples can be collected. The uranium-bearing strata are known to underlie the three blocks outlined on the geologic map. Analyses and field counter readings of soil samples and float pieces of the carbonaceous limestone that overlies the coaly shale suggest that the uranium content of the carbonaceous strata in the area is comparable to the range of uranium content of the strata in the prospect (Vine and Moore, 1952). Lacking sample data that can be obtained only by physical exploration, no more reliable conclusions can be reached concerning inferred reserves.

The number of acres underlain by uranium-bearing strata for each of the three blocks for which inferred reserves are shown in Table 3 is determined by the length of outcrop and the assumption that the strata are continuous in their observed or assumed thickness and grade for a minimum distance of 1,000 feet down the dip of the beds from their outcrop.

On the basis of these assumptions, about 1,500 tons of uranium may be present in the Fall Creek area.

PLANS

Use of $13,000 from the fiscal 1953 contingent fund for exploratory drilling for about 2,000 feet of core-drilling has been authorized by the Division of Raw Materials of the Atomic Energy Commission. The drilling program will take place during the 1953 field season and is designed to determine the factors controlling the distribution and concentration of uranium in carbonaceous strata. The holes are to be located so that the most favorable structural areas for uranium mineralization will be tested. Additional exploration may be proposed after the results of the first drilling have been evaluated.

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TABLE 3. INFERRED RESERVES OF URANIUM IN THE FALL CREEK AREA

Rock type	Tons/acre foot	Size of area	Thickness of rock unit	Uranium (percent)*	Tons of rock	Tons of uranium
Block one						
Limestone	3,600	57 acres	1.5 feet	0.02	308,000	61
Carb. sh.	2,600	57 acres	1.5 feet	0.024	222,000	53
Coaly sh. (top)	1,750	57 acres	1.0 feet	0.045	99,800	44
Coaly sh. (base)	1,750	57 acres	3.0 feet	0.011	299,000	32
				Sub-totals	928,800	190
Block two						
Limestone	3,600	54 acres	1.5 feet	0.02	292,000	58
Carb. sh.	2,600	54 acres	1.5 feet	0.024	211,000	50
Coaly sh. (top)	1,750	54 acres	1.0 feet	0.045	94,500	42
Coaly sh. (base)	1,750	54 acres	3.0 feet	0.011	284,000	30
				Sub-totals	881,500	180
Block three						
Limestone	3,600	356 acres	1.5 feet	0.02	1,920,000	382
Carb. sh.	2,600	356 acres	1.5 feet	0.024	1,390,000	333
Coaly sh. (top)	1,750	356 acres	1.0 feet	0.045	623,000	280
Coaly sh. (base)	1,750	356 acres	3.0 feet	0.011	1,870,000	205
				Sub-totals	5,803,000	1,200
				GRAND TOTALS	7,613,300	1,570

*Grade from TEMR 340.

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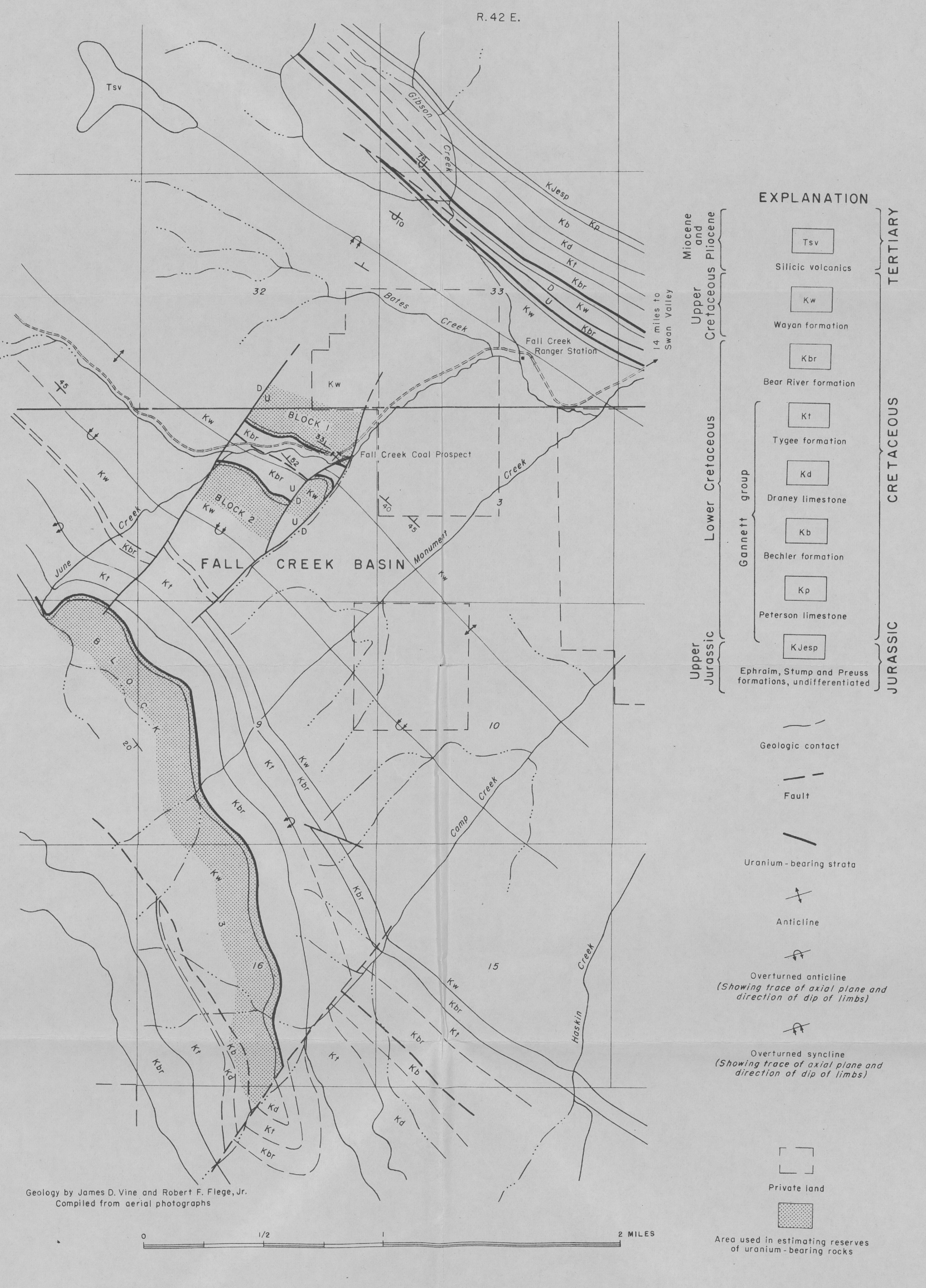

PRELIMINARY GEOLOGIC SKETCH MAP OF FALL CREEK BASIN SHOWING FAVORABLE AREAS FOR EXPLORATORY CORE DRILLING FOR URANIUM-BEARING CARBONACEOUS ROCKS, CARIBOU NATIONAL FOREST, BONNEVILLE COUNTY, IDAHO

FIGURE 1