UNITED STATES DEPARTMENT OF THE INTERIOR
Oscar L. Chapman, Secretary

GEOLOGICAL SURVEY
W. E. Wrather, Director

GEOLOGICAL SURVEY CIRCULAR 185

RECONNAISSANCE FOR RADIOACTIVE DEPOSITS ALONG THE UPPER PORCUPINE AND LOWER COLEEN RIVERS, NORTHEASTERN ALASKA

By Max G. White

This report concerns work done on behalf of the U. S. Atomic Energy Commission and is published with the permission of the Commission.

Washington, D. C., 1952

Free on application to the Geological Survey, Washington 25, D. C.

CONTENTS

ILLUSTRATIONS

TABLES

RECONNAISSANCE FOR RADIOACTIVE DEPOSITS ALONG THE UPPER PORCUPINE AND LOWER COLEEN RIVERS, NORTHEASTERN ALASKA

PART 1. --RECONNAISSANCE ALONG THE UPPER PORCUPINE RIVER

ABSTRACT

The highest equivalent-uranium content found in the sedimentary rocks on the upper Porcupine River, northeastern Alaska, is 0.005 percent. Rhyolitic dikes associated with a granitic intrusive a few miles north of the Porcupine, along the international boundary, contain about 0.006 percent equivalent uranium, which is attributed to small amounts of disseminated radioactive accessory minerals. The granite also is slightly radioactive.

INTRODUCTION

LOCATION OF AREA

The Porcupine River, a major tributary of the Yukon River, is located in northeastern Alaska (fig. 1). It enters the Yukon from the northeast, near the town of Fort Yukon, a short distance north of the Arctic Circle. The upper two-thirds of the Porcupine River is in Yukon Territory, Canada. The river waters are navigable by medium-sized river boats and scows for 280 miles above its mouth. The river distance from the mouth of the Porcupine to Rampart House on the Alaska-Yukon boundary is about 215 miles. Only the area along the upper 80 miles of the Alaskan part of the river, from Burnt Paw to Rampart House (fig. 1), was examined in detail in the course of this investigation.

PURPOSE AND SCOPE OF INVESTIGATION

In 1948 a Geological Survey field party carried on a radioactivity reconnaissance in the Porcupine River valley to obtain the following:

1) General information on possible radioactive deposits.

2) Specific information on the content of radioactive material in black shale and other sedimentary rocks of pre-Cambrian and Paleozoic age.

3) Radiometric and geologic information on a granitic intrusive north of the Porcupine River valley along the international boundary.

No information on the occurrence of radioactive materials in the valley of the Porcupine River was available prior to the 1948 investigation. The period of field work extended from late in June to late in August and was carried on by a party consisting of Max G. White, geologist; Arthur Wahl and Glenn E. Fellows, camp assistants; and Egil Salveson and Charlie Strom, boatmen.

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

GENERAL GEOGRAPHIC INFORMATION

The lower 100 miles of the Porcupine River crosses a broad flat alluvium-filled basin called the Yukon Flats. Many meanders and sloughs make the channel very tortuous and in places difficult to follow. The lowest exposure of bedrock, a bluff called Graphite Point, is 100 miles above the river's mouth.

Between Graphite Point and the mouth of the Coleen River (fig. 1), about 30 miles farther upstream, the Porcupine has cut its course through rocks that are principally limestone. The cliffs along this part of the river are 60 to 75 ft high and are known locally as the "Lower Ramparts". From the mouth of the Coleen River to Red Gate (fig. 1) the Porcupine occupies a wide meander loop across a small basin. This basin is filled partly with Quaternary alluvium and partly with gravels of Tertiary age. Red Gate is a high, dark-reddish cliff, which rises abruptly above the river to a height of 300 ft and marks the entrance to the "Upper Ramparts", where, for 52 miles, from Red Gate to 12 miles east of the international boundary, the Porcupine has cut a nearly continuous canyon 250 to 300 ft deep; locally the cliffs rise 500 ft above the valley floor.

For further information on this region, both geographic and historic, the reader is directed to Fitzgerald's report (1944)[1] on a general topographic reconnaissance of the Porcupine River valley.

PREVIOUS GEOLOGIC INVESTIGATIONS

Four geologic investigations (Kindle, 1908; Maddren, 1912a, 1912b; Cairnes, 1914; and Mertie, 1941) have been made of the rocks along the Porcupine River and along the international boundary in northeastern Alaska.

Kindle's observations were made in 1906 during a three weeks' round trip by canoe from Fort Yukon to Rampart House. His paper includes a geologic map of the rocks adjacent to the Porcupine River from the Lower Rampart to the international boundary.

[1] See reference cited.

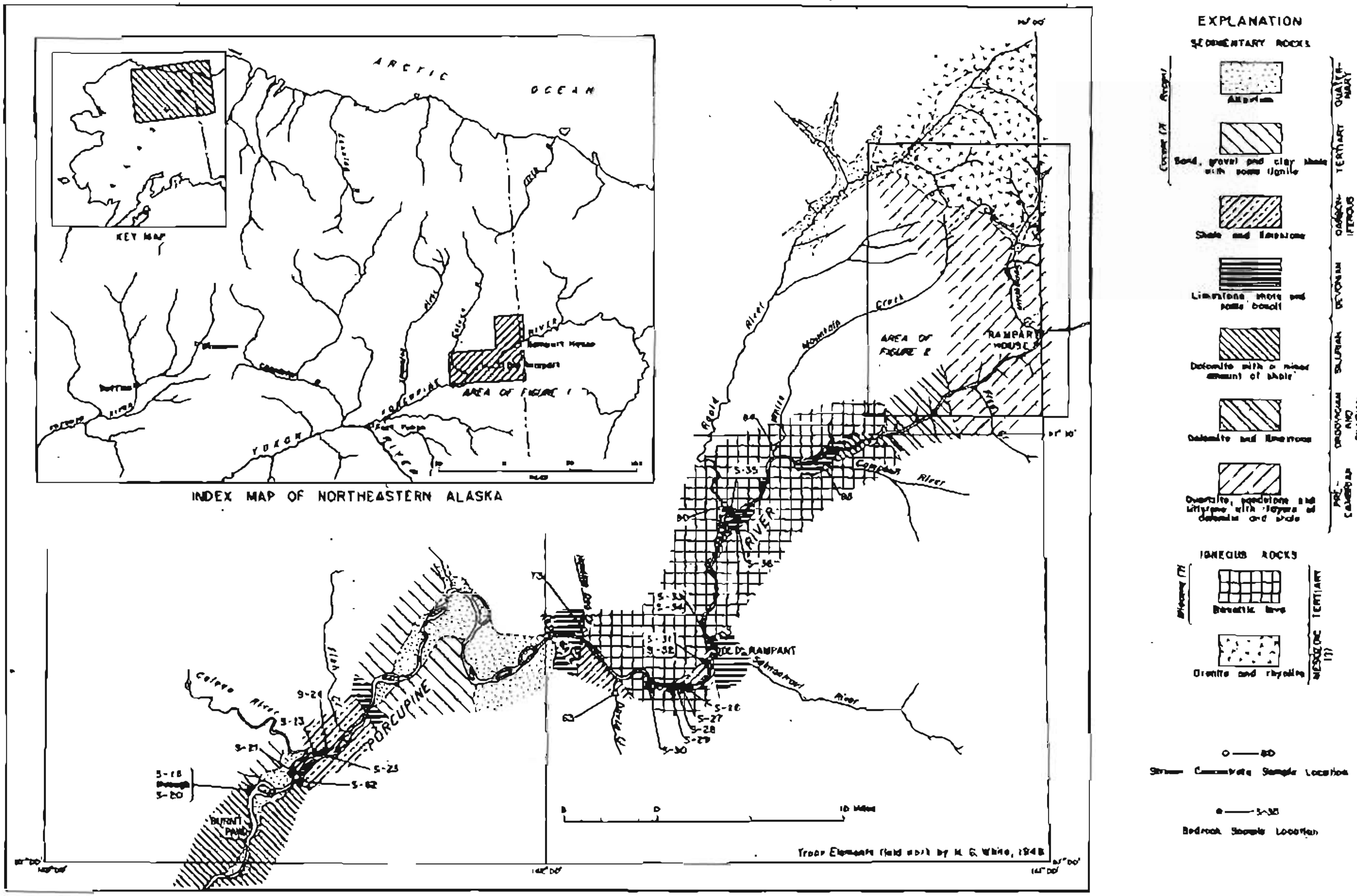

Figure 1. --Geologic sketch map of the upper Porcupine River, northeastern Alaska, showing location of samples collected in 1948.

In 1911 and 1912 Maddren accompanied the International Boundary Survey, mapping the geology of a strip 4 miles wide straddling the boundary from the Porcupine River north to the Arctic Coast. The results of his 1911 field work (Maddren, 1912a), the study of the Porcupine-Firth River sector, were published without a map. Notes and maps for the area north of the Firth remain unpublished in the Geological Survey files (Maddren, 1912b).

Cairnes' studies along the international boundary south of the Porcupine River paralleled the work of Maddren. The final published report includes geologic strip maps of the boundary from the Porcupine south to the Yukon River (Cairnes, 1914).

Mertie (1941, unpublished) conducted a geologic investigation on the Porcupine River in 1941 (manuscript notes and maps in files of U. S. Geological Survey).

RADIOACTIVITY RECONNAISSANCE IN 1948

Geologic data and maps from the investigations described above served as the basis for the radioactivity reconnaissance in 1948. Much of this reconnaissance consisted in radiometric tests on outcrops of Silurian, Devonian, and Carboniferous black shale. All the pre-Cambrian rocks were also examined in some detail. Concentrates were taken from the gravels of most of the streams entering the Porcupine, as a check on the possible presence of radioactive materials in the areas drained by these streams. A granite mass along the international boundary 6 to 23 miles north of the Porcupine was investigated both radiometrically and geologically. Very little previous information was available about this intrusive.

The geologic maps in this report are modifications and expansions of maps already in existence. Figure 1 is modified from a map by Kindle (1908, p. 321), and figure 2 from one by Maddren (1912b).

Portable survey meters with conventional low-count beta-gamma tubes were used for field radioactivity measurements. Continuous radiometric traverses were made on foot along most of the outcrops of the various rock types. Where counting rates seemed appreciably higher than background, stationary counts were taken on the outcrops and significant samples were taken. These samples were crushed and tested in the field with either a standard portable survey meter or a modified counter designed by U. S. Geological Survey. Representative samples from outcrops that showed the presence of radioactive material were examined in the laboratory for a final check on the field results.

GEOLOGY AND RADIOACTIVITY INVESTIGATIONS

Brief descriptions of the rocks of the geologic systems present in the upper Porcupine area are given below. Radioactivity studies, where made, are included with the separate descriptions.

SEDIMENTARY ROCKS

Pre-Cambrian rocks

The oldest rocks on the Porcupine River are those on the upper 6 miles of the river in Alaska, near the international boundary. Cairnes (1914, pp. 44-58) assigned them to the pre-Cambrian (actually pre-Middle Cambrian) and correlates them with the Tindir group farther south along the boundary. Mertie (1932, pp. 369-392) presents an excellent description of the Tindir group in the area of its type locality.

The Tindir group on the Porcupine River consists of quartzite, usually light gray, some sandstone and siltstone, and bedded dolomite and shale. Most of this shale is black, but some red and yellow beds also are present. The quartzite is apparently more abundant in the upper and lower parts of the sequence than in the middle. The quartzite forms the cliffs 300 to 500 ft high in the vicinity of Rampart House. Weathering of the exposed surfaces of the quartzite gives this rock the appearance of massive chalky limestone. The more protected surfaces, however, are usually covered with a light-yellow film of sulfur that has accumulated from the oxidation of pyrite disseminated in the quartzite.

The sandstone and siltstone, interbedded in the quartzite, commonly are highly ferruginous, deep chocolate to yellow, and have brown spots due to weathering of enclosed iron sulfide. The dolomite and black shale each account for approximately 25 percent of the total sequence. The dolomite is cream to white and very dense; the black shale in places is highly contorted between the more competent beds of quartzite and dolomite and locally exhibits a slaty cleavage.

No evidence of significant faulting or folding was observed in the rocks of the Tindir group, which have a prevailing westerly dip of about 40°. A conservative estimate of the stratigraphic thickness of this group along the upper Porcupine River is 18,000 ft.

Radioactivity studies

Radiometric readings were taken on outcrops in all traverses of the pre-Cambrian

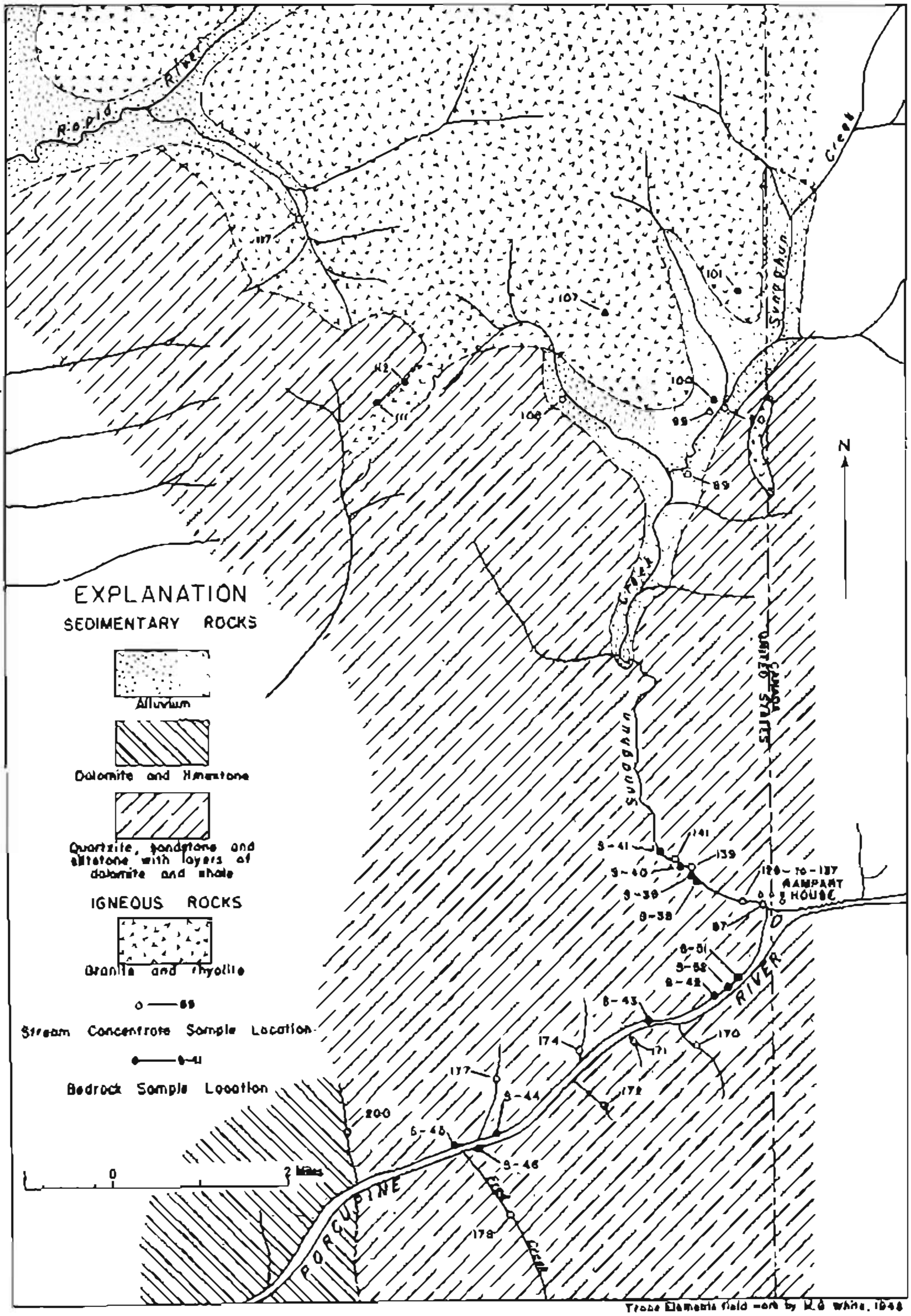

Figure 2.--Sketch map of the Sunaghun Creek-upper Rapid River area, northeastern Alaska.

sedimentary rocks. Data on samples collected from locations with relatively high field readings are listed below. The sample localities are shown on figure 2.

Sample no.	Rock type and location	eU[1] content (percent)
S-38	Black slate, Sunaghun Creek -------------	0.004
S-39	----------------- do -----------------	.002
S-40	----------------- do -----------------	.002
S-41	----------------- do -----------------	.002
S-42	Black shale, Porcupine River below Rampart House.	.003
S-43	----------------- do -----------------	.003
S-44	Black shale, Porcupine River in vicinity of Fred Creek.	.003
S-45	----------------- do -----------------	.002
S-46	----------------- do -----------------	.001
S-51	Red shale, Porcupine River below Rampart House.	.004
S-52	Yellowish Shale, Porcupine River below Rampart House.	.005

[1]eU, equivalent uranium

In 1947 the Geological Survey received some samples of radioactive calcareous siltstone or argillite of pre-Cambrian age from Great Slave Lake, Northwest Territories, Canada. Chemical analyses of the rock (Rabbitt, 1947) show the presence of 0.17 percent thorium oxide and 0.006 percent uranium. According to Lang (1950, p. 9) monazite and pitchblende or uraninite have been identified in these rocks. He also adds that these minerals are probably original constituents of the rocks. The lithologic similarity of the pre-Cambrian sedimentary rocks at Great Slave Lake (Stockwell, 1936) to the pre-Cambrian Tindir group on the international boundary (Cairnes, 1914; Mertie, 1932) led to the search for similar thorium-bearing strata in the course of this reconnaissance of radioactive materials. The search, however, disclosed no significantly radioactive rock of any type in the pre-Cambrian sequence.

Ordovician and Silurian strata

Kindle (1908, p. 332) states that the section of rocks immediately overlying the pre-Cambrian 6 to 10 miles downstream from Rampart House probably contain rocks of both Ordovician and Silurian age, but he was unable to separate the two systems. Cairnes (1914, pp. 55, 59) found Middle Cambrian fossils in rocks, believed to be no older than Ordovician, that overlie the Tindir group in its type area. He also states that the strata overlying the pre-Cambrian range in age from Cambrian to Silurian. As Kindle's geologic map was used as a base in this reconnaissance, his designation of these strata as Ordovician and Silurian is used in this report. These Ordovician and Silurian rocks, at least several thousand feet thick, are buff and bluish-gray dolomite and limestone.

Radioactivity studies

The Ordovician and Silurian carbonate rocks were tested only hastily with a standard portable survey meter traverse on the way downstream at the end of the field season. These rocks appear to be essentially nonradioactive.

Silurian limestone and shale

The Silurian strata along the Porcupine River comprise about 3,000 ft of magnesian limestone or dolomite, mostly on the lower part of the river, and were not examined in this reconnaissance. At the top of the Silurian, within the area of the upper part of the river, is a small amount of black shale which was examined at two places, one 3 miles above Burnt Paw and the other about 1 mile above Old Rampart (fig. 1).

Radioactivity studies

Above Burnt Paw (fig. 1) black- and chocolate-colored fissile shale is interbedded with thin layers of dolomitic limestone and a few thin layers of sandstone. The highest radiometric readings recorded in the field were obtained on outcrops of this shale. About 1 mile above Old Rampart (fig. 1) approximately 300 ft of black graptolitic fissile shale with a few thin beds of black limestone were also tested for radioactivity. The equivalent-uranium content of Silurian black shale samples collected above Burnt Paw and near Old Rampart is as follows:

Sample no.	Rock type and location	eU content (percent)
S-15	Black shale interbedded with limestone, about 3 miles upstream from Burnt Paw.	0.005
S-16	----------------- do -----------------	.005
S-17	----------------- do -----------------	.000
S-18	----------------- do -----------------	.002
S-19	----------------- do -----------------	.001
S-20	----------------- do -----------------	.002
S-33	Black graptolitic shale, about 1 mile up stream from Old Rampart.	.003
S-34	----------------- do -----------------	.003

Devonian rocks

The Devonian rocks along the upper Porcupine River (fig. 1) consist of siliceous limestone; black, brown, gray and red shale; and a small amount of interbedded basalt.

Radioactivity studies

The Devonian shale at the mouth of the Rapid River (fig. 1) was traversed radiometrically but proved barren of significantly radioactive beds. Samples of black shale (nos. S-35 and S-36, fig. 1) from two beds with the highest field readings contain only 0.002 percent equivalent uranium. The basalt and siliceous limestone are nonradioactive.

Carboniferous limestone and shale

The Carboniferous strata exposed on the upper Porcupine River (fig. 1) are interbedded limestone and shale. Some of the limestone beds are gray- to cream-colored, somewhat massive, and contain some chert; some are bluish-black to gray, and, locally, fissile or slaty, calcareous or sandy, or graphitic. Although no estimate of the thickness of the Carboniferous rocks has been made because these beds usually have been highly disturbed, the Carboniferous section doubtless includes many hundreds of feet of sedimentary beds.

Radioactivity studies

Radiometric traverses on foot along all exposures of Carboniferous rocks on the upper Porcupine disclosed no beds of shale or other rock that contained more than 0.003 percent equivalent uranium. The equivalent-uranium values of samples taken from Carboniferous strata showing the greatest radioactivity on the outcrop are listed below.

Sample no.	Rock type and location	eU content (percent)
S-21	Black shale, at east side of mouth of Coleen River.	0.003
S-23	Black shale, north side of Porcupine River upstream from Coleen River.	.003
S-24	------------------ do ------------------	.001
S-25	------------------ do ------------------	.001
S-26	Black shale, south side of Porcupine River downstream from Salmontrout River.	.002
S-27	------------------ do ------------------	.002
S-28	------------------ do ------------------	.002
S-29	------------------ do ------------------	.002
S-30	------------------ do ------------------	.002
S-31	Black shale, north side of Porcupine River opposite mouth of Salmontrout River.	.003
S-32	------------------ do ------------------	.003
S-62	Black shale, north side of Porcupine River opposite mouth of Coleen River.	.003

Tertiary sediments

A wide belt of Tertiary sediments between Fish Creek and Red Gate (fig. 1) is comprised of about 40 ft of sand, gravel, and drab clay with 6- to 10-in. beds of low-grade lignite; underlain by 50 ft of soft, finely laminated, drab-colored clay. Similar beds occur on the north bank of the Porcupine River below the Coleen River.

Radioactivity studies

Several of the lignite beds, cropping out between Fish Creek and Red Gate and below the mouth of the Coleen River, were tested radiometrically in the field and found to be nonradioactive.

Quaternary alluvium

Concentrates were taken from gravels (Quaternary alluvium) of streams draining into the Porcupine River in an attempt to determine whether heavy radioactive minerals were being eroded from rocks in the watersheds of those streams. The locations of such concentrates are plotted on figures 1 and 2. Between 40 and 100 lb of stream gravels at each location were panned to semiconcentrates in the field. Such semiconcentrates were further concentrated in the laboratory by the use of bromoform (sp gr 2.8).

Radioactivity studies

The equivalent-uranium content of the heavier-than-bromoform mineral fractions of the semiconcentrates of the stream gravels was determined radiometrically in the laboratory. No significant amounts of radioactive material were detected in any of these heavy-mineral fractions. Data on these samples are shown in table 1.

IGNEOUS ROCKS

Two main types of igneous rock are found in the Porcupine River area. One type is a granitic intrusive of Mesozoic(?) age, which occurs along the International boundary 6 to 23 miles north of the Porcupine (figs. 1 and 2); the other type consists of lava flows of Tertiary age which form the bulk of the Upper Ramparts of the Porcupine River from Howling Dog Creek northeastward to a point 10 miles west of the international boundary (fig. 1).

Mesozoic(?) granitic rocks

The Mesozoic(?) granitic body north of the Porcupine River was first located by the International Boundary Survey in 1911 (Maddren, 1912a). This body is the westward extension of a large granite mass in the Old Crow Mountains of Canada, and intrudes pre-Cambrian sedimentary rocks consisting mainly of quartzite and black shale.

Table 1.--Data on heavier-than-bromoform fractions of concentrates from gravels of streams tributary to the upper Porcupine River, northeastern Alaska

Field no. (see fig. 1 and 2)	ATE file no.	Location	eU content (percent)	Concentration ratio
48AWe63	3178	David Creek.	0.000	2,300:1
73	3177	Howling Dog Creek.	.000	1,600:1
80	3179	Rapid River.	.000	3,400:1
84	3180	White Mountain Creek.	.000	1,200:1
85	3181	Campbell River.	.000	1,000:1
87	3182	Sunaghun Creek, near mouth.	.003	600:1
129	3183	Sunaghun Creek, lower part.	.002	1,300:1
130	3184	do	.002	3,000:1
131	3185	do	.002	800:1
132	3186	do	.000	650:1
133	3187	do	.000	300:1
134	3188	do	(1)	?
135	3189	Sunaghun Creek, lower part.	(1)	?
136	3190	do	.001	7,600:1
137	3191	do	(1)	?
139	3192	Sunaghun Creek, middle part.	.001	700:1
141	3193	do	.005	800:1
170	3205	First south tributary of Porcupine River below Rampart House.	.006	1,100:1
171	3204	Second south tributary of Porcupine River below Rampart House.	.005	2,400:1
172	3203	Third south tributary of Porcupine River below Rampart House.	.000	500:1
174	3202	First north tributary of Porcupine River above third south tributary (sample 172) below Rampart House.	.001	3,800:1
177	3201	North tributary of Porcupine River opposite mouth of Fred Creek.	.003	1,100:1
178	3200	Fred Creek.	.000	1,300:1
200	3199	North tributary of Porcupine River about $1\frac{1}{4}$ miles below Fred Creek.	.006	850:1

[1] Sample too small for determination of eU content.

Within the area examined (fig. 2), the granite is medium- to coarse-grained, and contains small amounts of biotite and hornblende and very small amounts of the accessories apatite, zircon, and magnetite. Most of the orthoclase feldspar and much of the biotite in the granite have been partly replaced by minute sericitic aggregates.

Rhyolitic dikes, locally aplitic in texture, appear on the borders of the granite, cutting into the pre-Cambrian sedimentary rocks. The largest of these dikes observed is at the head of White Mountain Creek (fig. 2).

Field evidence indicates that the granite mass underlies the thick covering of Tertiary lava flows that appears a few miles to the west. The granite contact probably veers gradually to the north and then northeast, to cross the international boundary at a point approximately 23 miles north of the Porcupine River.

The age of the granite is not yet known, but it is thought to be younger than Carboniferous and older than Tertiary, and therefore Mesozoic(?).

Radioactivity studies

Although the granitic rocks in the upper Porcupine area contain minor amounts of radioactive materials, no zones of high concentrations were found. The rhyolitic rocks are slightly more radioactive than the coarser-grained phases of the granite. Consequently, the field studies were extended to all borders of the granite where the rhyolitic dikes are located. The equivalent uranium content and other data of all samples collected by the author in the area of the granite are shown in table 2.

Table 2.--Data on samples related to the granitic intrusive on the international boundary north of the Porcupine River, northeastern Alaska

Field no. (see fig.2)	ATE file no.	Description and location	eU content (percent)		Concentration ratio
			Crushed rock	Heavy-mineral fraction [1]	
48AWe89	3194	Concentrate from stream gravels in northeast headwaters fork of Sunaghun Creek.	-	0.045	3,500:1
90	3195	Concentrate from stream gravels in Sunaghun Creek about ½ mile west of international boundary.	-	.016	8,200:1
99	3196	Concentrate from disintegrated rhyolitic dike near Sunaghun Creek about ½ mile west of the international boundary.	-	.060	2,000:1
100	3217-L	Crushed fragments of fresh rock from same locality as sample 48AWe99.	0.006	.030	450:1
101	3218-L	Crushed granite from ridge west of Sunaghun Creek about ¼ mile west of international boundary.	.003	.004	6:1
107	3219-L	Crushed granite from highest point on ridge about 2 miles west of international boundary.	.003	.009	6:1
108	3197	Concentrate from stream gravels in northwest headwater fork of Sunaghun Creek.	-	.010	1,000:1
111	3220-L	Crushed rhyolitic rock from saddle between Sunaghun and White Mountain Creeks.	.006	.002	10:1
112	3221-L	---------------- do ----------------	.006	.035	85:1
117	3198	Concentrate from stream gravels in a southeast tributary of the Rapid River.	-	.052	2,700:1

[1]Fraction heavier than bromoform (sp gr 2.8).

Radioactive minerals

Z. S. Altschuler and T. W. Stern of the Geological Survey's Trace Elements Laboratory examined six moderately radioactive samples (nos. 48AWe89, 90, 99, 100, 108 and 117, fig. 2 and table 2) from the granitic rock area on the international boundary in an attempt to determine which mineral cause the radioactivity. Subsequently the author examined a seventh sample (48AWe112, fig. 2 and table 2) for the same purpose. The radioactive minerals found in these samples are as follows:

Biotite.--The radioactivity of sample 48AWe112 is restricted to the biotite part of the heavy-mineral fraction. The sample is from a large rhyolitic dike at the head of White Mountain Creek (fig. 2).

Clarkeite(?).--Reddish-brown uraniferous grains, tentatively identified as clarkeite ($UO_3 . nH_2O$) by its optical properties, appears to be the only radioactive mineral in sample 48AWe89.

Hematite.--The hematite in sample 48AWe99 is reported to contain some uranium as an impurity.

Pyrite.--Fluoresence tests of the heavy minerals in sample 48AWe100 indicate that pyrite grains, which are oxidized and altered although euhedral, are radioactive, mostly on the surfaces and in minute fractures within the grains. Crushed fragments show minute amounts of quartz and another material within the fractures. Fluorimetric analysis shows the presence of 0.027 percent uranium. Whole grains of pyrite were used in this analysis. A second fluoresence test made on crushed grains disclosed no uranium, bearing out the hypothesis that the uranium is only in the surficial, weathered part of the pyrite.

Rutile(?).--Fluoresence tests indicate that material tentatively identified as altered rutile(?) is probably the only uranium-bearing mineral in sample 48AWe117. This mineral, however, is too altered and heterogeneous to yield a good X-ray pattern. It is called altered rutile(?) on the basis of an incomplete spectrographic determination. Optically, however, it resembles eschynite.

Unknown mineral no. 1.--A mineral, herein designated "Unknown mineral no. 1", contains most of the radioactive material in the heavy-mineral fraction of sample 48AWe99. Identification of this mineral by optical or X-ray methods appears to be impossible. It is probably hexagonal, although pseudo-orthorhombic in appearance, and is orange and translucent with a dull luster. In addition to uranium, this mineral contains calcium and phosphorus.

Unknown mineral no. 2.--The only radioactive mineral in sample 48AWe90 has not yet been identified. For the purpose of this report it is called "Unknown mineral no. 2". This altered mineral contains iron, titanium, aluminum, and silicon as determined by spectrographic analysis, and uranium by fluoresence test.

Unknown mineral no. 3.--Unknown mineral no. 3 apparently is the only uranium-bearing mineral in sample 48AWe108. It is black and opaque, and spectrographic analysis indicates that its major constituents are iron, manganese, aluminum, and silicon.

Tertiary lava flows

Tertiary lava flows, which form the bulk of the Upper Rampart, extend from 10 miles west of the international boundary westward to Howling Dog Creek. The flows are over 300 ft thick and are exposed in the steep cliffs that rise abruptly from river level. At one place above Old Rampart there are at least 15 different flows distinguishable in the canyon wall. The lava rests on a very irregular surface of Paleozoic rocks. Exposures of Paleozoic rocks such as those at the mouths of Rapid and Campbell Rivers represent localities on the pre-lava erosion surface that were of sufficient relief to be only thinly covered, if at all, by the flows. Tests of the Tertiary lava flows showed them to be nonradioactive.

SUMMARY OF MATERIALS TESTED

Shale, granitic rock, and concentrates from gravels of streams draining areas of granitic rocks are the only materials tested in the reconnaissance of the Porcupine River area that contained at least minor amounts of radioactive material. The search did not reveal any deposit that would be considered a commercial source of uranium ore. A summary of the results for the material tested is shown in the table on page 10.

CONCLUSIONS

Although this reconnaissance disclosed the presence of minor amounts of radioactive materials associated with shale beds of pre-Cambrian and Paleozoic age, and Mesozoic(?) granitic rocks, the equivalent-uranium contents are not of sufficient significance to warrant additional study. It is probable that the Porcupine River area described in this report does not contain deposits that can be considered as a commercial source of uranium.

REFERENCES CITED

Cairnes, D. D., 1914, The Yukon-Alaska international boundary, between Porcupine and Yukon Rivers: Canada Geol. Survey Mem. 67, 161 pp.

Fitzgerald, Gerald, 1944, Reconnaissance of Porcupine Valley, Alaska: U. S. Geol. Survey Bull. 933-D, pp. 219-243.

Kindle, E. M., 1908, Geologic reconnaissance of the Porcupine Valley, Alaska: Geol. Soc. America Bull. vol. 19, pp. 315-338.

Lang, A. N., 1950, Summary account of Canadian uranium deposits: Canada Geol. Survey mimeographed report.

Maddren, A. G., 1912a, Geologic investigations along the Canada-Alaska boundary: U. S. Geol. Survey Bull. 520-K, pp. 297-314.

________________ 1912b,. (Unpublished notes and maps of surveys along the international boundary north of the Porcupine River, in files of U. S. Geol. Survey).

Mertie, J. B., Jr., 1932, The Tatonduk-Nation district (Alaska): U. S. Geol. Survey Bull. 836-E, pp. 347-443.

________________ 1941, (Unpublished notes and maps of surveys along the Porcupine River, Alaska, in files of U. S. Geol. Survey).

Rabbitt, J. C., 1947, Interim report on thorium-bearing limestone from Great Slave Lake, Canada: U. S. Geol. Survey Trace Elements Memorandum Rept. 50 (unpublished).

Stockwell, C. H., 1936, Preliminary geological map of Great Slave Lake, east arm (east and west sheets), Northwest Territories: Canada Geol. Survey Paper 36-16.

Summary of results for materials tested

Rock types and age of material tested	Radioactivity (values given are in percent eU)
Sedimentary and other bedded rocks:	
Pre-Cambrian (Tindir group)	
Quartzite	(1)
Dolomite	(1)
Black shale	0.001-0.004
Red shale	.004
Yellow shale	.005
Ordovician and Silurian	
Dolomite and limestone	(1)
Silurian	
Magnesian limestone (dolomite)	(1)
Black shale (above Burnt Paw)	.000-0.005
Black shale (above Old Rampart)	.003
Devonian	
Black shale	.002
Basalt	(1)
Siliceous limestone	(1)
Carboniferous	
Black shale	.001-0.003
Limestone	(1)
Tertiary	
Lignite	(1)
Igneous rocks:	
Mesozoic(?)	
Medium- to coarse-grained granite	
Unconcentrated	.003
Heavy-mineral fractions	.004-0.009
Rhyolite dike rock	
Unconcentrated	.006
Heavy-mineral fractions	.002-0.060
Tertiary	
Lava	(1)
Heavy-mineral concentrates from stream gravels:	
From gravels of Porcupine River tributaries which drain areas underlain mostly by sedimentary strata and basaltic rocks	0.000-0.006
From gravels of streams draining area of granitic rocks along the international boundary	.010-0.052

[1]Nonradioactive.

PART 2.--RECONNAISSANCE ALONG THE LOWER COLEEN RIVER

ABSTRACT

The highest radioactivity value obtained in a traverse of shales in the middle Paleozoic strata of the lower Coleen River is 0.003 percent equivalent uranium. Traverses on pre-Cambrian schists at Rabbit Mountain were made with negative results.

INTRODUCTION

LOCATION OF AREA

The Coleen River, a northern tributary of the Porcupine River, heads in the Brooks Range of northern Alaska and enters the Porcupine River about 50 miles in an airline west of the Alaska-Yukon boundary. (See inset, fig. 3.)

PURPOSE AND SCOPE OF INVESTIGATION

During the Porcupine River investigation in 1948 (see part 1) a 10-day side trip was made up the Coleen River to investigate reported outcrops of sedimentary rocks. A party of four men ascended the river to a point 75 miles above its mouth, where J. E. Owens, the only inhabitant of the valley, maintains a permanent residence. This area had never before been explored by the Geological Survey.

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

AREA INVESTIGATED

All exposures along the river from J. E. Owens' camp to the mouth of the Coleen River were tested for radioactivity, and most of them were sampled. In addition, measurements of radioactivity were made on the slopes of Rabbit Mountain, 15 miles east of Owens' camp. Radioactivity values of all samples collected during this investigation are recorded in table 3.

GEOLOGY

This investigation should be considered a geological exploration-reconnaissance of the lower Coleen River, as no geological information was available from the area prior to this investigation.

LOWER COLEEN RIVER

No attempt was made to measure any stratigraphic sections or to make any detailed geological studies or maps---all effort was directed solely to the detection of possible radioactive deposits.

The rocks on the lower Coleen River consist of a series of gray, black, and red shales, slate with some limestone and siltstone, and an abundance of light-gray chert in beds up to 20 ft thick. Dikes and sills of basic igneous rock are found throughout the series. There is a distinct similarity between the rocks on the Coleen River and those to the west in the Sheenjek River valley, which Mertie (1929, p. 119) tentatively classified as "Devonian or Carboniferous".

As no attempt was made at geologic mapping, figure 3 merely shows the locations of most of the outcrops that were tested and from which samples were collected.

RABBIT MOUNTAIN

Two and a half days were spent investigating Rabbit Mountain, about 15 miles east of Owens' camp. This mountain had been locally reported to be a mass of granite, but traverses along most of its northwest side showed it is composed of schist and slate, similar to the pre-Cambrian rocks along the international boundary, about 30 miles east of Rabbit Mountain. No mineralization was found associated with two granite dikes that intrude the schist.

RADIOACTIVITY INVESTIGATIONS

Foot traverses with portable survey meters were made along all accessible exposures of bedrock and talus on the Coleen River and at Rabbit Mountain. No significant radioactivity was detected anywhere.

The samples listed in table 3 are those brought back to the laboratory for a final, conclusive check.

Table 3.--Radioactivity values for samples collected in Coleen River valley in 1948.

File no.	Field no. (48AWe)	Location and description	Percent equivalent uranium in crushed rock
S-1	1	Black shale cut by basic dikes in section below Owens' camp.	0.002
S-2	2(1)	Black shale in section on Coleen River below Owens' camp.	.002
S-3	2(2)	------------ do ------------	.002
S-4	2(3)	------------ do ------------	.002
S-5	2(4)	------------ do ------------	.002
S-6	3	------------ do ------------	.000
S-7	16	Black shale from section on Coleen 3 miles airline below Owens' camp.	.002
S-8	17	------------ do ------------	.003
S-9	18	------------ do ------------	.002
S-10	19	------------ do ------------	.002
S-11	20	------------ do ------------	.002
S-12	23	------------ do ------------	.002
S-13	29	Black shale 3½ miles airline above Porcupine River.	.003
S-14	31	------------ do ------------	.003
S-22	44	Black shale, Coleen River, donated by J. E. Owens.	.000
3176	43	Stream concentrate from Rabbit Mountain.	*.001

*Heavier-than-bromoform mineral fraction.

According to J. E. Owens, the Aluminum Company of America reports the presence of more than trace amounts of gallium in material from the Coleen River area, which he had submitted for spectrographic analysis.

REFERENCE CITED

Mertie, J. B., Jr., 1929, The Chandalar-Sheenjek district (Alaska): U. S. Geol. Survey Bull. 810-B, pp. 87-139.

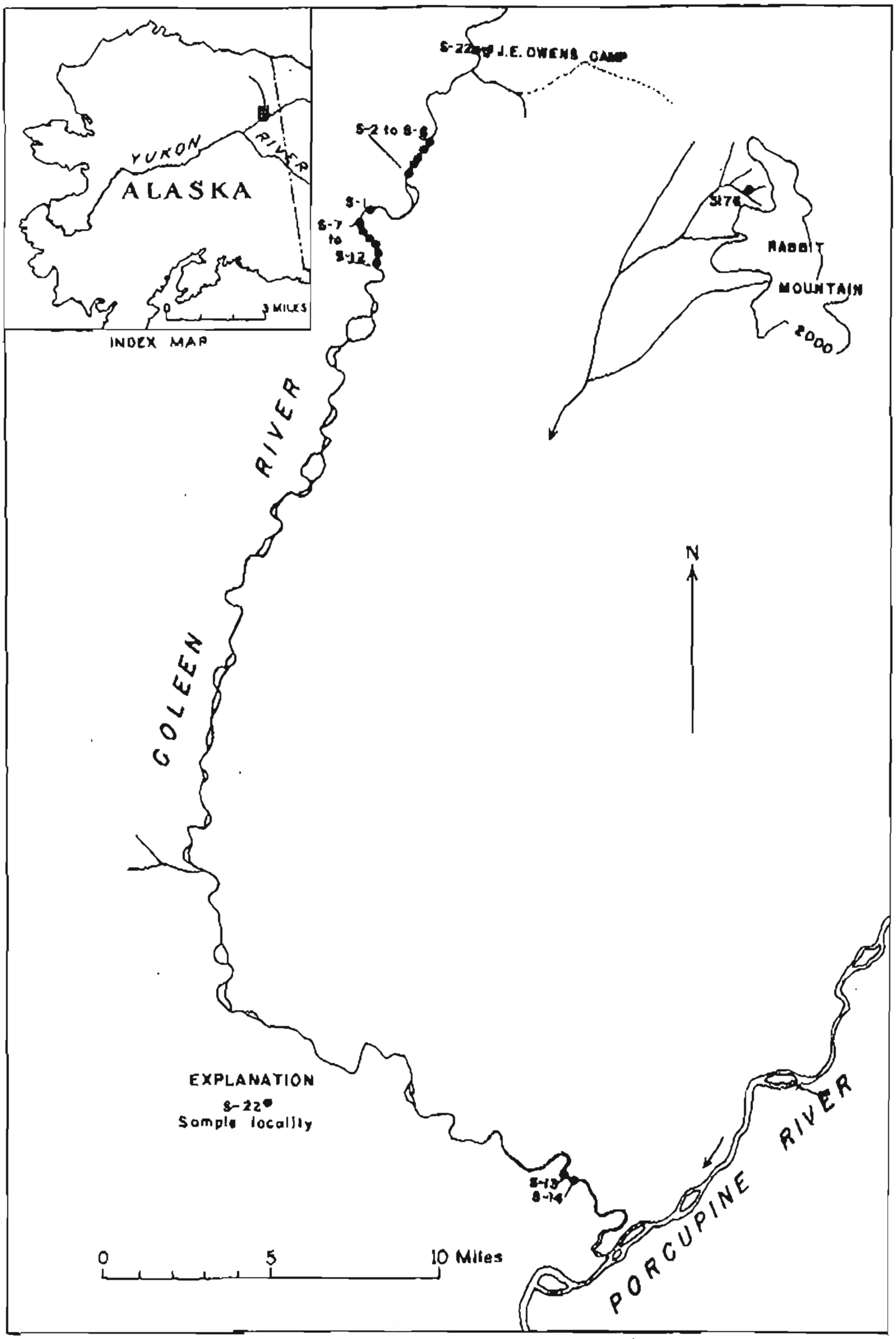

Figure 3.--Geologic sketch map of the lower Coleen River, Alaska.

INT.-DUP. SEC., WASH., D.C. 22132