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DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
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Sincerely yours,

/s/ Esper S. Larsen, 3rd

for W. H. Bradley
Chief Geologist

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

TRACE ELEMENTS RECONNAISSANCE OF THE SOUTHERN HIGHWAY BELT, SOUTH-CENTRAL ALASKA

By

R. M. Moxham

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CONTENTS

ILLUSTRATIONS
(in pocket at back of report)

TRACE ELEMENTS RECONNAISSANCE OF THE SOUTHERN HIGHWAY BELT SOUTH-CENTRAL ALASKA

By R. M. Moxham

ABSTRACT

A radiometric reconnaissance of the areas adjacent to the principal highways and secondary roads of south-central Alaska was carried out during the summer of 1947. The investigation included the examination of nine gold-placer workings, five gold lodes, a gypsum mine, and a copper prospect. Nearly all of the lithologic types outcropping in the highway belt were tested. No significant amounts of radioactive material were found.

INTRODUCTION

The highway system of south-central Alaska offers ready access to a mineralized region of considerable size from which little trace elements information had been obtained prior to 1947. The objective of the 1947 field work was to make a radiometric reconnaissance of the area. This entailed testing various rock types for radioactivity, investigating lode and placer-mining operations, and collecting placer concentrates from as many streams as possible to determine whether radioactive minerals were being liberated from bedrock in the various drainage basins by erosion.

Reconnaissance of the areas bordering the principal highways in Alaska was begun in 1946 (Wedow and Matzko, 1947). The present report gives the results of a continuation of the previous year's work. The 1947 field party, consisting of Robert M. Moxham, geologist, and Donald R. Olson, camphand, began work in June and terminated in September.

GEOGRAPHY

Mountainous areas separated by broad lowlands make up that portion of south-central Alaska with which this report is concerned. The Wrangell Mountains, situated between the Chugach Mountains to the south and the Alaska Range of the interior, are partly volcanic in origin and include some of the highest peaks in Alaska. In the Coast Range, or Chugach Mountains, rugged peaks 4,000 to 7,000 feet high border the coast of the Gulf of Alaska from the Canadian border to Cook Inlet. To the north, the broad lowland of the Copper and Chitina Rivers lies between the Coast Range and the Wrangell Mountains. The northwestern border of the region is marked by the Talkeetna Mountains, an isolated mass separated from the Chugach Mountains by the Matanuska Valley and from the interior by the Copper and Susitna River lowlands. The latter drainage basins include a vast area of glacial moraine and outwash extending from north of the Talkeetna Mountains southeast to the Wrangell Mountains.

As referred to in this report, the southern highway belt comprises the areas bordering the following highways and secondary roads in south-central Alaska: the Edgerton Cutoff, locally referred to as the Chitina Road; the Richardson Highway from Gulkana to Valdez; the Glenn Highway from Anchorage to Glenn Allen; and the secondary roads in the Willow Creek mining region northwest of Palmer. The Nizina and Bremner mining areas were included in the reconnaissance, although they are some distance east of the highway belt described above. (See fig. 1.)

MEASUREMENTS OF RADIOACTIVITY

A Victoreen counter, model 263, equipped with a single six-inch beta tube, was employed in the field. Investigations included spot outcrop tests of the various rock types; panning stream gravel to obtain heavy-mineral concentrates; investigating mines, prospects, and mineralized zones; and testing and collecting mine concentrates. Standard methods were followed in making semi-quantitative measurements and spot checks. The procedures have been discussed in detail by Stead (1945) and Wedow and Matzko (1947, pp. 5-7). In the laboratory the rock samples were crushed, and the equivalent uranium (hereafter referred to as eU) content of the unconcentrated material measured on the basis of the beta count. Placer concentrates were treated with bromoform to remove the minerals with a specific gravity greater than 2.9, and the eU content of the heavy-mineral fraction was determined on the basis of the beta count.

AREAS INVESTIGATED

Wrangell Mountains

Geology

Only the southeastern part of the Wrangell Mountains was visited in the course of the examinations described in this report. The Nikolai greenstone of Triassic age is the oldest formation in this area. The unit consists of approximately 4,000 feet of dark altered lava flows, many of them coarse-textured and amygdaloidal. The greenstone is overlain conformably by the Upper Triassic Chitistone limestone, whose thickness is approximately 3,000 feet. The limestone in the lower part of the formation is gray and massive-bedded; that in the upper part of the formation is increasingly thin-bedded upwards and passes by transition to a black shale with a few intercalated limestone beds. The Chitistone formation is overlain by the McCarthy shale, of Triassic age, and the McCarthy by the shales and sandstones of the Kennecott formation of Upper Jurassic age. The Triassic and Jurassic rocks have been intruded by dikes, sills, and laccoliths of light-colored quartz diorite of post-Jurassic age. In most places these intrusives have had little effect on the country rock, though local silicification of the limestone and shale and recrystallization of the limestone have taken place. A detailed description of the geology of the area is given by Moffit (1938, pp. 42-43).

Nizina district

Mineral deposits and mining: The Nizina district, in the southeastern part of the Wrangell Mountains, is noted for the production of copper, principally from mines of the Kennecott Copper Corporation. It is estimated that more than a billion pounds of the metal were produced in this area between 1911 and 1938. Since 1938 the region has produced only a few tons of native copper. Gold has been produced from placer deposits on Dan and Rex Creeks for many years, but the total value of the gold is relatively small.

Radioactivity studies: The materials tested and the results of the tests are listed below.

Sample no.	Type of material	Location	Radioactivity (in percent eU)
10	Shale, Kennecott formation	Dan Creek	0.002
11	Panned concentrate	Dan Creek tributary	0.000
12	Shale, Kennecott formation	Rex Creek	0.002
13	Panned concentrate	Young Creek	0.001
14	Shale, McCarthy formation	North of McCarthy	0.000
15	Greenstone, Nikolai formation	North of McCarthy	0.002
16	Granite	Near Kennecott	0.001
25	Sluice-box concentrate	O'Neill Mine, Dan Creek	0.000
86	Sluice-box concentrate	Chititu Mines,Inc., Rex Creek	0.000
Spot checks	Shale, Kennecott formation	Several localities	insignificant

The extensive copper deposits at Kennecott could not be examined, as the property has been closed since 1938.

Chugach Mountains

Geology

The Chugach Mountains consist mainly of a thick series of dark metamorphosed argillites and graywackes, probably of Mesozoic age. These units are interbedded with altered extrusive rocks in the western part of this range. Carboniferous argillite, conglomerate, quartzite, and lava intruded by quartz diorite crop out in a relatively small area near Tonsina. The geology of the Chugach Mountains has been discussed in detail by Moffit (1935, pp. 16-26) and Capps (1940, pp. 53-64).

Bremner district

Mineral deposits and mining: A small amount of gold has been produced from lode and placer mines in the vicinity of the Bremner River, southwest of the Nizina district. Most of the metal has been taken from placer deposits on Golconda Creek and adjacent streams and from lode mines in the valley of Golconda Creek. The district has been inactive since about 1941.

Radioactivity studies: Time limited the work in the Bremner area to the collection of one placer sample from surface gravel in the vicinity of former mining operations on Golconda Creek. The heavy-mineral fraction contained 0.004 percent eU. A small percentage of zircon and sphene is responsible for the slight radioactivity.

Klutina district

Mineral deposits and mining: The Klutina district includes the area drained by the west tributaries of the Copper River between the Tiekel and Gulkana Rivers. There are many placer and lode-gold prospects in the district, and mining has been carried on sporadically for many years. Fall, Boulder, and Hurtle Creeks, in the vicinity of Tiekel, and the headwater tributaries of the Little Nelchina River were the principal sources of placer gold. A number of gold-lode prospects are in the vicinity of Tiekel. At the present time, however, mining is confined to one placer operation on Albert Creek, a headwater tributary of the Little Nelchina River.

Radioactivity studies: The material tested and the results of the tests are listed below:

Sample no.	Type of material	Location	Radioactivity (in percent eU)
1	Carboniferous extrusives	North of Rock Creek	0.001
2	Diorite	Pippin Lake	0.000
4	Diorite	Mt. Du Relle	0.001
5	Panned concentrate	Squirrel Creek	0.000
6	Diorite	Bernard Creek	0.000
7	Panned concentrate	Bernard Creek	0.000
8	Panned concentrate	Rock Creek	0.000
9	Panned concentrate	Little Tonsina River tributary	0.001
17	Panned concentrate	Tiekel River	0.003
18	Panned concentrate	Abandoned placer mine, Fall Creek	0.003
19	Panned concentrate	Tiekel River tributary	0.002
20	Panned concentrate	Abandoned placer mine, Boulder Creek	0.002
21	Panned concentrate	Stuart Creek	0.002
22	Schist	Mile 38, Richardson Highway	0.002
23	Graywacke	Mile 64, Richardson Highway	0.000
32	Panned concentrate	Little Tonsina River tributary	0.001
33	Panned concentrate	Bernard Creek	0.000
34	Panned concentrate	Tonsina River	0.001
35	Panned concentrate	Tonsina River	0.000
36	Panned concentrate	Copper River tributary	0.000
38	Panned concentrate	Tazlina River tributary	0.000
39	Panned concentrate	Little Nelchina River	0.000
56	Panned concentrate	Crooked Creek tributary	0.000
57	Panned concentrate	Crooked Creek tributary	0.000
58	Panned concentrate	Albert Creek	0.000
59	Panned concentrate	Crooked Creek	0.000
87	Sluice concentrate	McMahon Mine, Albert Creek	0.000
Spot check	Mesozoic graywacke and argillite	Along Richardson Highway	insignificant
Spot check	Gold lode, dump material	Holland-Townsend prospect, 11 miles south of Tiekel	insignificant

Valdez district

Mineral deposits and mining: The Valdez district comprises the coastal flank of the Chugach Mountains and the northeastern part of Prince William Sound in the general vicinity of the town of Valdez. Most of the mines in this area have been idle in recent years. Previous production was chiefly gold and copper. Numerous gold lodes have been prospected in the valley of Mineral Creek, a short distance from Valdez, and in earlier years gold was mined from placer deposits on Mineral and Gold Creeks.

Radioactivity studies: The materials tested and the results of the tests are listed below:

Sample no.	Type of material	Location	Radioactivity (in percent eU)
24	Panned concentrate	Tonsina River	0.003
26	Panned concentrate	Ptarmigan Drop	0.003
27	Panned concentrate	Lowe River tributary	0.003
28	Panned concentrate	Lowe River	0.000
29	Panned concentrate	Mineral Creek	0.003
30	Panned concentrate	Abandoned placer mine, Mineral Creek	0.005
31	Panned concentrate	Abandoned placer mine, Gold Creek	0.003
50	Panned concentrate, outwash	Valdez glacier	0.002
Spot check	Mesozoic argillite	Along Richardson Highway	insignificant
Spot check	Gold-bearing quartz veins	Little Giant Mine, Mineral Creek	insignificant

Anchorage district

Mineral deposits and mining: The Anchorage district includes the areas between Knik Arm and Turnagain Arm at the head of Cook Inlet, extending in an easterly direction to the crest of the Coast Range. Little mining has been done in this district. At the present time one placer-gold operation is working on a north tributary of the Knik River. The property was not accessible by road at the time of this investigation.

Radioactivity studies: The material tested and the results of the tests are listed below:

Sample no.	Type of material	Location	Radioactivity (in percent eU)
72	Panned concentrate	Eklutna Creek	0.000
73	Panned concentrate	Ship Creek	0.001
76	Panned concentrate	Peters Creek	0.000
77	Panned concentrate	Eagle River	0.001
78	Panned concentrate	Knik River	0.002
Spot check	Rhyolite	Eklutna Creek	insignificant

Talkeetna Mountains

Geology

The Talkeetna Mountains are chiefly granitic rocks of the Talkeetna batholith, but lavas and tuffs, schists, and sedimentary rocks occur as subordinate units in the peripheral area of the intrusive.

The oldest rock is the pre-Cambrian Birch Creek schist which crops out in the southern part of the mountains. The Birch Creek consists of highly contorted, fissile mica schists and phyllites cut by numerous quartz veins. The structure is highly complex; all traces of the original bedding are obscured by the secondary schistosity. Along the southern boundary of the mountains, a group of volcanic rocks are interbedded with Lower Jurassic sedimentary rocks. The volcanic rocks are largely stratified breccias composed of angular fragments in a chloritic matrix. Several thousand feet of Middle and Upper Jurassic sedimentary rocks crop out in the headwaters of the Little Nelchina River. The principal intrusive rock forming the Talkeetna batholith is a medium- to coarse-grained quartz diorite of Jurassic age. Capps (1940, pp. 65-93) has given a detailed description of the geology of the area.

Wasilla district

Mineral deposits and mining: The Wasilla district comprises the southwestern part of the Talkeetna Mountains and a part of the lower Susitna Valley. Mining at the present time is confined to the Willow Creek area a short distance north of the town of Palmer. Gold production from lode mines in this district accounted for a large part of the prewar Alaskan output. In earlier years a small amount of placer gold was taken from streams in this area, particularly from Grubstake Gulch. Several writers have reported pegmatite dikes in the Willow Creek region, but the only one described in the literature (Ray, 1933, p. 184) is an intrusive at the head of Purches Creek, with which copper mineralization is associated.

Subsequent to the 1947 trace elements field studies, R. G. Ray, of the Geological Survey, discovered pegmatite float at two localities east of the road in the valley of Fishhook Creek. The rocks are slightly radioactive. During the 1949 field season the pegmatites in the Fishhook Creek area were examined. The results will be presented in a separate report (Moxham, in preparation).

Radioactivity studies: The materials tested and the results of the tests are listed below:

Sample no.	Type of material	Location	Radioactivity (in percent eU)
64	Panned concentrate	Fishhook Creek	0.000
65	Diorite	Independence Mine, Fishhook Creek	0.003
66	Panned concentrate	Willow Creek	0.004
67	Panned concentrate	Willow Creek	0.001
68	Panned concentrate	Little Susitna River	0.000
69	Panned concentrate	Archangel Creek	0.001
70	Panned concentrate	Abandoned placer mine, Grubstake Creek	0.000
74	Birch Creek schist	Grubstake Gulch	0.001
75	Panned concentrate	Little Susitna River	0.001
79	Panned concentrate	Fish Creek	0.000
88	Mill headings	Independence Mine	0.000
89	Mill headings	Independence Mine	0.000
Spot check	Quartz diorite	Numerous localities	insignificant
Spot check	Birch Creek schist	Numerous localities	insignificant
Spot check	Gold-bearing quartz veins	Independence Mine	insignificant
Spot check	Gold-bearing quartz veins	Gold Cord Mine, Fishhook Creek	insignificant
Spot check	Gold-bearing quartz veins	Fern Mine, Archangel Creek	insignificant
Spot check	Copper-bearing pegmatite	Holland prospect, Purches Creek	insignificant

Matanuska Valley

Geology

The valley of the Matanuska River separates the Talkeetna and Chugach Mountains. The oldest rocks in the valley belong to the Matanuska formation, comprising Upper Cretaceous shale and sandstone and subordinate amounts of conglomerate. The thickness of the Matanuska formation is approximately 4,000 feet. The beds are strongly folded in the southwestern part of the valley and are progressively less disturbed to the northeast. Overlying the Matanuska formation are Eocene shale, sandstone, arkose, coal, and conglomerate which have been tilted and folded. The sedimentary rocks of the Matanuska Valley have been intruded by a large number of small, irregularly shaped dikes of various types, including diorite, trachyte, diabase, gabbro, and basalt, probably of late Tertiary age. A detailed description of the geology of the Matanuska Valley is given by Landes (1927).

Matanuska district

Mineral deposits and mining: The Matanuska district includes the valley of the Matanuska River and adjacent areas. It is noted primarily for the Matanuska coal field, one of the two most important coal-producing regions in Alaska. Five miles northeast of Glacier Point in the extreme eastern part of the Matanuska district, a recently discovered deposit of gypsum is being developed.

Radioactivity studies: The materials tested and the results of the tests are listed below:

Sample no.	Type of material	Location	Radioactivity (in percent eU)
40	Panned concentrate	Matanuska River tributary	0.000
41	Panned concentrate	Matanuska River tributary	0.001
42	Panned concentrate	Caribou Creek	0.000
43	Panned concentrate	Hicks Creek	0.000
44	Panned concentrate	Matanuska River tributary	0.001
45	Panned concentrate	Matanuska River	0.002
46	Panned concentrate	Matanuska River tributary	0.001
47	Basic intrusive	East of Chickaloon	0.000
48	Panned concentrate	Chickaloon River	0.000
49	Shale, Matanuska formation	Near Hicks Creek	0.000
51	Panned concentrate	Matanuska River	0.000
52	Panned concentrate	Kings River	0.001
53	Anthracite coal	4 miles west of Hicks Creek	0.000
54	Panned concentrate	Matanuska River tributary	0.000
55	Panned concentrate	Granite Creek	0.002
60	Panned concentrate	Gravel Creek	0.002
61	Panned concentrate	Eska Creek	0.000
Spot check	Bituminous coal	Numerous localities	insignificant
Spot check	Gypsum	Northeast of Glacier Point	insignificant
Spot check	Basic dikes	Numerous localities	insignificant

CONCLUSIONS

None of the rocks examined in the southern highway belt are significantly radioactive, and no further work appears warranted. Radioactive pegmatite float discovered in the Willow Creek area of the Wasilla district subsequent to the work on which this report is based is probably of significance only in suggesting the possibility of larger concentrations of radioactive materials elsewhere in the vastly more extensive area of the Talkeetna batholith.

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