UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON 25, D. C.

JUL 19 1950

AEC-618/0

Dr. P. L. Merritt, Assistant Manager
Raw Materials Operations
U. S. Atomic Energy Commission
P. O. Box 30, Ansonia Station
New York 23, New York

Dear Phil:

Enclosed are five copies of an errata sheet to be inserted in the front of Trace Elements Investigations Report 42, Part 2, "Trace elements reconnaissance on the South Fork of Quartz Creek, northeastern Seward Peninsula, Alaska." Will you please see that a copy of the errata sheet is inserted in each of the five copies of the report that were sent to you on June 7, 1950.

Sincerely yours,

/s/ H. M. Bannerman

for W. H. Bradley
Chief Geologist

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U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Trace Elements Investigations Report 42, Part 2

May 1950

TRACE ELEMENTS RECONNAISSANCE ON THE SOUTH FORK OF QUARTZ CREEK, NORTHEASTERN SEWARD PENINSULA, ALASKA

by

P. L. Killeen and M. G. White

ERRATA

Table 1, pages 15-20

Heading of fifth column, "Pounds concentration per cubic yard" should read "Pounds of concentrate per cubic yard."

Heading of seventh column, "Percent equivalent uranium in gravels or rocks in place" should read "Calculated percent equivalent uranium in gravels or rocks in place."

UNITED STATES
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JUN 7 1950

AEC-452/0

Dr. P. L. Merritt, Assistant Manager
Raw Materials Operations
U. S. Atomic Energy Commission
P. O. Box 30, Ansonia Station
New York 23, New York

Dear Phil:

Transmitted herewith are five copies of Trace Elements Investigations Report 42, Part 2, "Trace elements reconnaissance on the South Fork of Quartz Creek, northeastern Seward Peninsula, Alaska", by P. L. Killeen and M. G. White, May 1950.

Other copies of this report are being distributed as shown on the attached distribution sheet.

We are not classifying this report, as we believe that it will be suitable for publication after review in accordance with standard Geological Survey procedures. We would appreciate being informed whether or not you have any objections to its release on grounds of security before we prepare it for publication.

Sincerely yours,

/s/ Esper S. Larsen, 3rd

for W. H. Bradley
Chief Geologist

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

SHORTER CONTRIBUTIONS TO ALASKAN TRACE ELEMENTS STUDIES FOR 1946

1950

Trace Elements Investigations Report 42

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

TRACE ELEMENTS RECONNAISSANCE ON THE SOUTH FORK OF QUARTZ CREEK, NORTHEASTERN SEWARD PENINSULA, ALASKA

By

P. L. Killeen and M. G. White

May 1950

Trace Elements Investigations Report 42 - Part 2

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TRACE ELEMENTS RECONNAISSANCE ON THE SOUTH FORK OF QUARTZ CREEK, NORTHEASTERN SEWARD PENINSULA, ALASKA

By P. L. Killeen and M. G. White

ABSTRACT

Two uranium-bearing minerals, uranothorianite and thorite(?), were found in the stream gravels of the main branch of the South Fork of Quartz Creek, a tributary of the Kiwalik River. Although the bedrock source of the minerals was not located, the radioactive material was traced in slope wash well above the stream gravel. A detailed investigation of the area with more sensitive counters might reveal the source of the minerals and localities where the minerals are sufficiently concentrated to be minable.

INTRODUCTION

Purpose and scope of investigation

In January 1945, the United States Geological Survey made a rapid survey (Harder and Reed, 1945) of some placer samples to determine areas for preliminary radioactivity investigations in Alaska. The most radioactive sample was no. 342, a heavy-mineral concentrate from the Circle claim on Sweepstakes Creek, a tributary of the Peace River, south of Granite Mountain in the northeastern Seward Peninsula. (See insert on fig. 1.) Chemical analysis of this sample indicated the presence of approximately 42 percent uranium and 43 percent thorium. In the summer of 1945 a Geological Survey party (Gault, et al, 1946) visited the Sweepstakes Creek area to study the extent and possible source of the radioactive elements. The party failed to find a major deposit of the principal radioactive mineral in question, which they tentatively called uranothorite, or discover any conclusive evidence of its source. However, tests on all of the bedrock types in the area showed that the radioactive material was confined to the syenite of Granite Mountain.

Upon completion of the 1945 work in the Sweepstakes Creek area, it was decided to conduct a reconnaissance investigation on the north side of Granite Mountain in the headwaters of the South Fork of Quartz Creek, a tributary of the Kiwalik River, to determine the possible northward extension of the radioactive mineralization. Results of such an investigation by P. L. Killeen and M. G. White in July 1946 are given in this report. The area to the north of Granite Mountain has even more uranothorianite (uranothorite? of Gault, et al) (Frondel and Fleischer, 1950, p. 7) than the Sweepstakes Creek area and in addition carries uranium-bearing thorite(?). During the 1947 season, investigations (West and Matzko, in preparation) were extended to the syenite masses north of the Granite Mountain mass to determine the possible northward extent of these radioactive minerals.

Location of area

The locality examined is on the headwaters of the main branch of the South Fork of Quartz Creek, a westward-flowing tributary of the Kiwalik River, in the northeastern part of the Seward Peninsula. The headwaters of the branch are in the syenite mass of Granite Mountain. The creek gravels were formerly mined for placer gold. There is a short airstrip on the creek, and the area is most easily accessible by plane from Haycock, 25 miles to the south, and from Nome, 160 miles to the southwest.

GEOLOGY

The geology of the area has been described briefly by Moffit (1905, p. 29) in connection with his reconnaissance of the northeastern part of the Seward Peninsula and by Harrington (1919, pp. 371, 372, 374) in connection with studies of the gold and platinum placer deposits in the nearby Sweepstakes Creek area.

The bedrock of the headwaters area of the South Fork of Quartz Creek consists of syenite, the Granite Mountain stock, intruded into a complex of andesitic flows and intrusives. (See fig. 1.) The syenite is generally light in color, and its texture ranges from even and fine-grained to porphyritic and coarse-grained. The porphyritic facies contains feldspar crystals almost an inch long with a roughly parallel orientation. The darker and coarser syenite forms the border facies of the stock. Veins and dikes are rare in the syenite. Fragments of narrow quartz veins and pegmatite dikes were found in the float, but none of them is highly mineralized. One boulder of pegmatite found at the top of the north peak of Granite Mountain contains the heavy minerals magnetite, biotite, sphene, zircon, fluorite, and allanite (sample no. 46AWe90).

The andesite is green to dark green on fresh surfaces and weathers yellow to dark brown. No mineralized zones were found in this rock, and there is virtually no quartz. At the outset of field investigations, the andesite was discovered to be non-radioactive, so work was restricted to the syenite mass, the apparent source of radioactivity in the area.

Except for a few scattered pinnacles, no outcrops of bedrock were found, but large masses of talus cover the hill slopes. The syenite shatters into rather large boulders, many of them 2 or 3 feet in diameter. The andesite usually breaks into relatively small angular pieces.

RADIOACTIVITY INVESTIGATIONS

Field investigations

Bedrock

A portable gamma-ray counter was used for radioactivity determinations in the field. On all traverses, readings were taken at every opportunity on talus, isolated boulders, or outcrops of bedrock; the tube lying on and covered by fresh surfaces of rock. No bedrock was crushed and tested in the field because it was decided that covering the tube with bedrock fragments was sufficient test of the rock's radioactivity. For these field readings, rocks were chosen that appeared to be representative of the type or types of rock in a talus or outcrop of a particular locality. Different types of rock at any locality were tested separately.

Readings on the syenite mass are consistently higher than those on any of the surrounding rocks. Within the syenite the background count is from two to four times greater than the background count on any of the surrounding rocks. This indicates that the radioactive minerals may be disseminated in the syenite rock, possibly in facies of small extent or in inclusions in the syenite. A more detailed study might reveal that the highly radioactive minerals occur in pegmatite dikes or in veins cutting the syenite. However, dikes and veins are uncommon on the north side of Granite Mountain (none were found in place), and those fragments that were tested in the field were not generally as radioactive as the syenite itself. Zircon and sphene, common accessory minerals, are radioactive but do not seem to account for the amount of radioactivity of the syenite.

Stream gravels

The stream gravels and gravels in placer cuts were panned to recover semi-concentrates of the heavy minerals for testing. A rock mixture of known radioactivity, in a sealed container, was used in the field as a standard to estimate relative amounts of radioactivity in the semi-concentrates. The counter indicated 8 to 10 counts per minute for average background.

Stream gravels that originate entirely in the andesitic rocks are essentially non-radioactive. Only the gravels of that part of the South Fork of Quartz Creek that heads in the syenite mass of Granite Mountain showed any appreciable radioactive content. Therefore activity was directed toward locating the source of the radioactive gravels of this stream with the field counter. Radioactivity was traced into Syenite Gulch, so named for convenience of this report, a southern headwaters fork of the South Fork of Quartz Creek. (See fig. 1.) About half a mile from the mouth of the creek both uranothorianite and thorite(?) occur in the surface wash on the east bank of the gulch. The minerals are more concentrated at the surface and decrease markedly in abundance with depth into the gravels. Two localities about 50 feet apart have a relatively high concentration of the two radioactive minerals. Two samples, nos. 57 and 80, collected from prospect pits at these locations, represent approximately the top foot of material. The heavy-mineral fraction of sample 57 contains 0.06 percent equivalent uranium, hereafter referred to as eU, and that of sample 80, 0.088 percent eU.

Two other samples were collected from the same pits at greater depth. Sample 66, a concentrate taken at the site of sample 57 at a 3½-foot depth, contains 0.049 percent eU in the heavy-mineral fraction. Sample 78, from a 2-foot depth at the site of sample 80, contains only 0.002 percent eU in the heavy-mineral fraction. Search for the source of the radioactive minerals on all hill slopes above the sides and head of Syenite Gulch revealed a few patches of slope wash where readings on the counter were higher than average but none that approached the intensity of that in samples 57 and 80.

Laboratory investigations

In table 1 at the end of this report are listed all pertinent data on samples.

No attempt is made herein to calculate reserves of uranium for the area on the north side of Granite Mountain. The purpose of the reconnaissance was to determine whether there were radioactive minerals north of Granite Mountain, and if so, whether any localities with significantly high concentration could be found. Data are insufficient to warrant an estimate of reserves.

Concentrates of crushed bedrock

Four bedrock samples that gave fairly high counts in field readings were crushed and brought back for laboratory study. The highest eU value obtained by laboratory test is 0.064 percent, which was from sample 90, a pegmatite from the top of Granite Mountain. The radioactivity is probably in the zircon and allanite with which the pegmatite is rich. The three other samples, nos. 58, 59, and 87, are of syenite. Sample 87 has the greatest beta-count and contains a large amount of zircon. Samples 58 and 59 have low beta-counts and contain only small amounts of zircon. All three samples are very rich in sphene, which forms as much as 50 percent of the heavy-mineral fraction. Possibly fragments of the uranium minerals are present in these concentrates. No significantly radioactive vein material was found.

Stream concentrates

Twenty-one semi-concentrate samples were collected from the stream gravels of the South Fork of Quartz Creek. The concentrates include heavy minerals which originate in both the syenite mass and the andesite; and they are indicative of the amounts of those heavy minerals present in about the upper 2 feet of the stream and placer gravels of the creek. (See table 1.) The samples were fractionated in bromoform or methylene iodide, and all computations and determinations were made on the heavy fractions of the concentration. The average concentration ratio of the samples from the South Fork of Quartz Creek is 192:1; the average recovery of heavy minerals of less than 20-mesh grain size per cubic yard of gravel is 35 pounds; the average percentage of eU in the heavy-mineral fraction is 0.026 percent; and the average grade of eU in the gravels in place is 0.00014 percent.

Zircon and sphene which are major constituents of the heavy-mineral fractions are the source of some, but as yet undetermined amount, of the radioactivity. Most of the activity of the gravels, however, is due to uranothorianite and thorite(?), although very minor amounts of these minerals are present in all heavy-mineral fractions examined. The thorite(?) is apparently somewhat more common than the uranothorianite. More detailed studies may, however, prove the reverse to be true, as the uranothorianite has a tendency to shatter into fine silt-size particles that are easily detected only after magnetic concentration.

None of the samples taken during this reconnaissance from the gravels of the Kiwalik River tributaries heading in the syenite (sample localities 67, 68, and 69, fig. 1) contain a significant amount of radioactive material. On the other hand, a sample from the headwater fork of Cub Creek heading in the syenite (sample locality 70, fig. 1) contains 0.022 percent eU, a value of significance in determining possible variation in the distribution of radioactive material in this acid intrusive.

MINERALOGY

The semi-concentrates from stream gravels were treated with bromoform to separate the minerals with specific gravity greater than 2.8. The relative order of abundance of the minerals with a specific gravity greater than 2.8 in the two principal types of source rock is listed below:

Syenite	Andesite
sphene 1/	hornblende
melanite	light green
magnetite	magnetite
hornblende	ilmenite
dark green,	spinel
black	hematite
zircon 1/	
apatite	
thorite(?) 1/	
uranothorianite 1/	

1/ Mineral contains radioactive material as determined by radiometric and chemical tests.

The black cubic uranium-bearing mineral listed above as uranothorianite is so named (Frondel and Fleischer, 1950, p. 7) until more information is available as to whether there is variability in the uranium-thorium content of the mineral not only in the Quartz Creek gravels but in other localities where the mineral has been found in the eastern Seward Peninsula. (West and Matzko, in preparation.)

No trace was discovered of the mineral found by Gault (1946, p. 20) in the Sweepstakes Creek area and tentatively identified by him as hydrothorite.

CONCLUSIONS

The reconnaissance in 1946 extended the area known to contain uranothorianite to the north side of Granite Mountain, where the mineral was found in stream gravels and slope wash derived from syenite, but did not define the mode of occurrence.

The irregularity of the concentration of the uranothorianite in slope wash and gravel appears to indicate that this mineral may be concentrated in facies or veins in the syenite, although no facies or veins of this type could be found because of the heavy cover of talus and tundra. On the other hand, the uranothorianite may be rather evenly disseminated in the syenite, and the vagaries of surficial concentration may account for the irregular distribution of the uranothorianite in slope wash and gravel derived from the syenite.

A detailed examination of the Granite Mountain syénite by traversing with more sensitive counters and by trenching with a bulldozer would be necessary to find the facies or veins in the syenite with concentrations of uranothorianite as postulated above and to determine if sufficient radioactive material is present to be of interest as a primary source of uranium.

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Table 1

Data on placer and rock samples from the area of South Fork of Quartz Creek

Field no. 46AWe	Alaska placer file no.	Location	Concentration ratio	Pounds of concentrates per cubic yard	Percent equivalent uranium in a bromoform or iodide (I) separation	Calculated Percent equivalent uranium in gravels or rocks in place
49	1633	South Fk. Quartz Cr., just above Jack cabin	210:1	14	0.011	0.000052
50	1634	South Fk. Quartz Cr., gravel from sluice box, Jack mine	111:1	27	0.020	0.00018
51	1635	South Fk. Quartz Cr., 4000 feet S. of Jack mine	58:1	52	0.020	0.00034
52	1636	South Fk. Quartz Cr., at head of placer workings on creek	65:1	46	0.013	0.0002
53	1637	South Fk. Quartz Cr., 800 feet below mouth of Syenite Gulch	93:1	32	0.005	0.000053
54	1632	Airfield Cr., 1 mile above junction with South Fork Quartz Cr.	694:1	4.3	0.001	<0.0000014

Table 1 (continued)

Data on placer and rock samples from the area of South Fork of Quartz Creek

Field no. 46AWe	Alaska placer file no.	Location	Concentration ratio	Pounds of concentration per cubic yard	Percent equivalent uranium in a bromoform or iodide (I) separation	Calculated Percent equivalent uranium in gravels or rocks in place
55	1656	North Fk. Quartz Cr., S. headwaters fork	254:1	11	<0.001	<0.000004
56	1657	North Fk. Quartz Cr., N. headwaters fork	222:1	13	<0.001	0.0000057
57	1640	Syenite Gulch, Cairn no. 1, 400 feet vertically above mouth	50:1	59	0.06 0.115 (I)	0.0012
58	1642-L	Syenite Gulch, dark syenite from talus	3:1	1008	0.015	0.005
59	1643-L	Syenite Gulch, syenite with dark bands from talus	2:1	1512	0.006	0.003
60	1639	Syenite Gulch, 200 feet vertically above mouth of gulch	94:1	32	0.015	0.00015
61	1638	Syenite Gulch, gravel bar at foot of gulch	51:1	59	0.011	0.0002
62	1624	South Fk. Quartz Cr., base of tailings 2500 feet below Jack cabin	137:1	22	0.010	0.00007

Table 1 (continued)

Data on placer and rock samples from the area of South Fork of Quartz Creek

Field no. 46AWe	Alaska placer file no.	Location	Concentration ratio	Pounds of concentration per cubic yard	Percent equivalent uranium in a bromoform or iodide (I) separation	Calculated Percent equivalent uranium in gravels or rocks in place
63	1623	South Fk. Quartz Cr., 3400 feet below tent frame	153:1	19	0.005	0.000032
64	1622	South Fork Quartz Cr., 4000 feet below tent frame	90:1	33	0.007	0.000077
65	1625	South Fk. Quartz Cr., at tent frame	-	-	0.039	-
66	1641	Syenite Gulch, Cairn no. 1 at 3½-foot depth	92:1	32	0.049	0.00053
67	1650	Headwaters tributary Kiwalik River	50:1	60	0.006	0.00012
68	1651	Headwaters tributary Kiwalik River	58:1	52	0.007	0.00012
69	1652	Headwaters tributary Kiwalik River	48:1	63	0.004	0.000083
70	1653	Cub Cr., middle headwaters fork at head	131:1	23	0.022	0.00017

Table 1 (continued)

Data on placer and rock samples from the area of South Fork of Quartz Creek

Field no. 46AWe	Alaska placer file no.	Location	Concentration ratio	Pounds of concentrate per cubic yard	Percent equivalent uranium in a bromoform or iodide (I) separation	Calculated Percent equivalent uranium in gravels or rocks in place
71	1654	Cub Cr., N. headwaters fork	109:1	27	0.002	0.000018
72	1629	South Fk. Quartz Cr., Jack mine	1884:1	1.6	0.019 (I) 0.024	0.000013
73	1630	South Fk. Quartz Cr., Jack mine, probably blowings	very large	-	too high for determination	-
74	1658	North Fk. Quartz Cr., 1¼ miles above junction with South Fk.	173:1	17	0.001	0.0000057
75	1620	Quartz Cr., 400 feet below junction of North and South Forks	143:1	21	0.019	0.00013
76	1621	South Fk. Quartz Cr., 4000 feet above junction with North Fork	145:1	20	0.005	0.000034
77	1628	South Fk. Quartz Cr., Jack mine	371:1	8.2	0.010	0.000026

Table 1 (continued)

Data on placer and rock samples from the area of South Fork of Quartz Creek

Field no. 46AWe	Alaska placer file no.	Location	Concentration ratio	Pounds of concentration per cubic yard	Percent equivalent uranium in a bromoform or iodide (I) separation	Calculated Percent equivalent uranium in gravels or rocks in place
78	1645	Syenite Gulch, Cairn no. 2 at 2-foot depth	31:1	97	0.002	0.000064
79	1646	Syenite Gulch, at top of grassy bank above Cairn no. 2	83:1	36	0.071	0.00085
80	1644	Syenite Gulch, Cairn no. 2, 15 feet vertically above Cairn no. 1 at surface	51:1	59	0.088 0.27 (I)	0.0017 -
81	1647	Syenite Gulch, 20 feet above Cairn no. 2	72:1	42	0.068	0.00094
84	1648	Syenite Gulch, 200 feet E. of head of Gulch	50:1	60	0.046	0.00092
86	1631	South Fk. Quartz Cr., Jack mine, probably blowings	very large	-	too high for determination	-
87	1649-L	Syenite Gulch, dark syenite from talus	not known	-	0.058 (estimate)	-

Table 1 (continued)

Data on placer and rock samples from the area of South Fork of Quartz Creek

Field no. 46AWe	Alaska placer file no.	Location	Concentration ratio	Pounds of concentration per cubic yard	Percent equivalent uranium in a bromoform or iodide (I) separation	Calculated Percent equivalent uranium in gravels or rocks in place.
88	1626	South Fork Quartz Cr., just S. of Jack mine	Not known	-	0.113 (estimate)	-
89	1627	South Fork Quartz Cr., Jack mine	Not known	-	0.045	-
90	1655-L	Granite Mtn., pegmatite from syenite at cairn, N. peak	55:1	54	0.064	0.0011