RADIOACTIVE GRANITE IN THE MILLER HOUSE-CIRCLE HOT SPRINGS AREA, EAST-CENTRAL ALASKA

Trace Elements Investigations Report 194

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

IN REPLY REFER TO:

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

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AEC-581/2

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

Dear Phil:

Transmitted herewith for your information and distribution are 6 copies of Trace Elements Investigations Report 194, "Radioactive granite in the Miller House-Circle Hot Springs area, east-central Alaska", by Max G. White and Gene E. Tolbert, February 1952.

Although most of the radioactivity of granite in the Miller House-Circle Hot Springs area is probably due to uraniferous primary accessory minerals of the rock, the presence of metallic sulfides, cassiterite, and uraniferous fluorite and malachite either in the granite or associated placers suggests a possible hydrothermal source for at least part of the uranium. During the 1952 field season we are planning the reconnaissance of two known fluorite occurrences in the Circle quadrangle. One of these is the occurrence mentioned in this report; the other consists of fluorite-pyrite-quartz veins cutting schist adjacent to a fluorite-bearing tourmaline granite near the head of Hope Creek, approximately 35 miles southwest of Miller House. The reconnaissance in the Miller House-Circle Hot Springs area will consist primarily of radiometric traversing in the headwaters of Deadwood, Boulder, and Bedrock Creeks; first to determine the location of the granite-schist contact, and second to search for concentrations of uranium minerals in vein or related deposits in the general vicinity of that contact. A small area of granite, not adequately covered in the hasty reconnaissance of 1949, on Deadwood Creek below Switch Creek will also be traversed.

We plan to publish this report as a Survey circular, and are asking Mr. Hosted, by a copy of this letter, whether the Commission has any objection to such publication.

Sincerely yours,

O. E. McKelvey

for W. H. Bradley
Chief Geologist

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Geology - Mineralogy

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Series A

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

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By

Max G. White and Gene E. Tolbert

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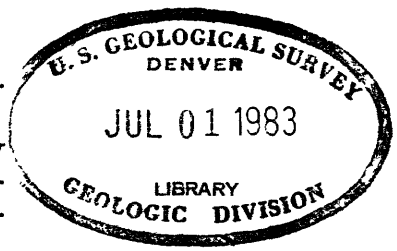

_/This report concerns work done on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission

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	55

CONTENTS

TABLES

ILLUSTRATION

RADIOACTIVE GRANITE IN THE MILLER HOUSE-CIRCLE HOT SPRINGS AREA, EAST-CENTRAL ALASKA

By

Max G. White and Gene E. Tolbert

ABSTRACT

Mesozoic(?) granite in the Miller House-Circle Hot Springs area, east-central Alaska, contains 0.005 to 0.007 percent equivalent uranium. The radioactivity is largely caused by uranium in such primary accessory minerals of the granite as allanite, garnet, scheelite, sphene, and zircon. However, the presence of metallic sulfides, cassiterite, and uraniferous fluorite, malachite, and topaz in the granite or associated placers suggests a post-emplacement or late-stage mineralization of the granite, presumably of hydrothermal origin, as a source for at least part of the uranium. Additional reconnaissance in the area to determine the presence or absence of hydrothermal uraniferous deposits of commercial grade appears warranted.

INTRODUCTION

The Miller House-Circle Hot Springs area is located in east-central Alaska about 100 miles east-northeast of Fairbanks (fig. 1). The area lies in the highlands along the south edge of the Yukon Flats. It is easily accessible from Fairbanks via the Steese Highway or by plane to small airfields in the area (fig. 1).

Radiometric analysis of 33 placer concentrates, obtained prior to 1949 from mining operations on Porcupine, Bonanza, Miller, Mastodon, Independence, Deadwood, Ketchum, Holdem, Switch, Portage, Half Dollar, and Harrison Creeks in the Miller House-Circle Hot Springs area (fig. 1), showed radioactive

material in the range of 0.0X percent equivalent uranium only in concentrates from Ketchum and Portage Creeks. Preliminary mineralogic study of these samples indicated that the radioactive mineral may be monazite, although too little material was available for thorough examination.

In September 1949 a Geological Survey party consisting of Max G. White and Gene E. Tolbert, geologists, and Egil Salveson, camp assistant, conducted a reconnaissance in the Miller House-Circle Hot Springs area in an attempt to locate the source of the radioactive material found in the placers and to obtain more material for mineralogic study. The party was in the area for about one week at the close of the field season after having completed previously assigned projects elsewhere in interior Alaska.

GEOLOGY

The geology, mineral deposits, and mining activities of the Miller House-Circle Hot Springs area have been described by Prindle (1913) and Mertie (1938). The bedrock of the area includes the pre-Cambrian Birch Creek schist, which is mostly a quartz-mica variety. This schist has been intruded by Mesozoic(?) granitic rocks.

Johnson (1910) reports the occurrence of wolframite, cassiterite, arsenopyrite, pyrite, galena, limonite, and tourmaline, in addition to gold, in placer concentrates from Deadwood and Switch Creeks, arsenopyrite in quartz-feldspar veins on Switch Creek, and pyrite, galena, and quartz in mineralized fracture zones on the upper part of Deadwood Creek.

RADIOACTIVITY INVESTIGATIONS

Radiometric traverses in the Miller House-Circle Hot Springs area were made with El-tronics Model SGM-18A and Beckman Model MX-5 portable survey

meters equipped with probes of six 1- by 14-inch gamma tubes or four 1- by 18-inch gamma tubes which were interchangeable with the standard 6-inch beta-gamma probes.

As many localities as the limited time permitted were traversed radiometrically. The courses of these traverses are shown on figure 1. The results of the radiometric traversing indicate that the granite and the wash from disintegrated granite are more radioactive than the adjacent schist and alluvium and were probably the source of the radioactive minerals found in the placer concentrates taken prior to this reconnaissance. Selected samples of the granite on Portage and Deadwood Creeks and at Miller House were taken for radiometric analysis and mineralogic study. In addition, concentrates were taken from various placer workings, other stream gravels, and areas of granite wash in the area to supplement the data on the granite samples. The radiometric analyses of these samples were made by personnel of the Alaskan Trace Elements Unit. Most of the mineralogic determinations were made by Miss Kiyoko Onoda of the Trace Elements Section Washington Laboratory.

Granite

The data on the granite samples obtained in the Miller House-Circle Hot Springs area are summarized in table 1.

Mineralogic study of the heavy-mineral fraction of sample 49AWe177L from Portage Creek shows the presence of minor amounts of allanite, zircon, and apatite, and traces of magnetite and sphene. The allanite, apatite, and sphene are uraniferous. The heavy-mineral fraction of the granite on Deadwood Creek (sample 49AWe199L) contains chlorite, uraniferous fluorite, and magnetite. The minerals of the heavy fraction of the granite near

Table 1.--Data on granite samples from the Miller House-Circle Hot Springs area, east-central Alaska

Sample no. Field	Sample no. File	Location Description	Percent eU[1] Unconcentrated	Percent eU[1] Fraction >2.8 Sp.G.	Concentration ratio
49AWe168L	3649	Portage Creek Granite from bedrock in placer mine	0.005	0.020	15:1
177L	3655	Portage Creek Disintegrated granite from bedrock in placer mine	n.d.[2]	0.056	15,400:1
198L	3669	Deadwood Creek, just below mouth of Switch Creek Granite bedrock in placer cut	0.005	0.023	400:1
199L	3670	Deadwood Creek Granite bedrock	0.006	0.041	550:1
200L	3671	do	0.006	0.035	325:1
203L	3674	Miller House Granite bedrock	0.007	0.053	150:1
204L	3675	do	0.007	0.065	325:1

1/ eU - equivalent uranium

2/ n.d. - not determined

Miller House are as follows:

Minerals	Estimated volume (percent)
Altered rock fragments with hematite and limonite*	60
Magnetite	20
Common rock-forming minerals	10
Malachite*	5
Zircon*	2
Anatase	1
Galena	1
Ilmenite	1
Pyrite	tr
Rutile	tr

* indicates mineral is uranium-bearing

The mineralogic study indicates that the radioactivity of the granite is apparently due mostly to uranium rather than thorium although this is not conclusive as no quantitative analyses were made. The locality distribution of the uranium-bearing minerals in the granite is shown in table 2.

Placers

The radioactivity of the concentrates from stream gravels and granite wash in the Circle Hot Springs area (fig. 1) is comparative to that of the several samples available prior to 1949, that is, it is in the 0.0X range of percent equivalent uranium. The radioactivity, as in the granite, is more than likely due to uranium, rather than thorium.

The mineralogy of the placer concentrates is similar to that of the heavy-mineral fractions of the granite samples. Many other heavy minerals, though, are also present. Of significance are cassiterite and traces of chalcopyrite and fluorite on Portage Creek, scheelite on Hot Springs and Ketchum Creeks, cassiterite on Ketchum and Deadwood Creeks, and topaz on Ketchum Creek. The locality distribution of the uranium-bearing minerals in the placers is shown by creek in table 2.

Table 2.--Locality distribution of uranium-bearing minerals in the Miller House-Circle Hot Springs area, east-central Alaska

Locality: Source	Allanite	Apatite	Fluorite	Garnet	Limonite	Malachite	Scheelite	Sphene	Topaz	Zircon
Portage Creek:										
Granite	X	X	-	-	-	-	-	X	-	-
Placer	X	-	-	X	-	-	X	X	-	X
Hot Springs Creek:										
Placer	X	-	-	-	-	-	-	X	-	-
Ketchum Creek:										
Placer	X	-	-	X	-	-	X	X	X	-
Deadwood Creek:										
Granite	-	-	X	-	-	-	-	-	-	-
Placer	-	-	-	-	-	-	X	-	-	-
Miller House:										
Granite	-	-	-	-	X	X	-	-	-	X

The presence of monazite was not verified in any of the samples collected in 1949.

CONCLUSIONS

Although many of the uranium-bearing minerals in the granite and placer concentrates of the Miller House-Circle Hot Springs area are probably primary accessory minerals of the granite, the presence of fluorite, topaz, several of the metallic sulfides, cassiterite, and malachite indicates that hydrothermal alteration of the granite after its emplacement or in the late stages of its emplacement may in part be the source of the uranium. It is possible that concentrations of primary uranium minerals may occur in association with the granitic rocks in the Miller House-Circle Hot Springs area, particularly in the headwaters of Deadwood, Boulder, and Bedrock Creeks (fig. 1) in the vicinity of the granite-schist contact. The possibility, however, that such concentrations may occur within the granite should not be overlooked.

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