PRELIMINARY REPORT OF RECONNAISSANCE FOR URANIFEROUS GRANITIC ROCKS IN MONTANA, IDAHO, OREGON, WASHINGTON, AND CALIFORNIA

Trace Elements Memorandum Report 343

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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AEC - 880/2

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 six copies of Trace Elements Memorandum Report 343, "Preliminary report of reconnaissance for uraniferous granitic rocks in Montana, Idaho, Oregon, Washington, and California," by Robert R. Coats, April 1952.

The paucity of our knowledge of the granitic rocks that are most likely to contain significant quantities of uranium has prevented all but a very general isolation of areas or types of granitic rocks for reconnaissance examination. Most of the areas examined thus far were chosen on the basis of chemical and petrographic data and known common associations of igneous rock types that indicated characteristics similar to those of the uraniferous Nigerian granites and the radioactive rocks of the White Mountain magma series of New England.

Although much additional study is necessary before more detailed positive or negative limiting characteristics of likely uraniferous granitic rock types can be determined with certainty, the work done thus far suggested two types of rocks that generally are not highly uraniferous. The larger batholithic bodies including the highly differentiated sodic phases, and bodies that have been enriched hydrothermally in sodic feldspar, are both types that do not seem to be favorable for containing significant quantities of uranium.

This reconnaissance study will be continued during the remainder of fiscal year 1952 but there are no plans for its continuation in fiscal year 1953.

We do not plan to publish this report or to send it to Technical Information Service for further distribution.

Sincerely yours,

V.E. McKelvey

for W. H. Bradley
Chief Geologist

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Geology - Mineralogy

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UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

PRELIMINARY REPORT OF RECONNAISSANCE FOR URANIFEROUS GRANITIC ROCKS IN MONTANA, IDAHO, OREGON, WASHINGTON, AND CALIFORNIA*

By

Robert R. Coats

April 1952

Trace Elements Memorandum Report 343

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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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By Robert R. Coats

ABSTRACT

A reconnaissance to determine the uranium content of granitic rocks in the western states was made during parts of October and November 1951.

The paucity of our knowledge of the granitic rocks that are most likely to contain significant quantities of uranium has prevented all but a very general isolation of areas or types of granitic rocks for reconnaissance examination. Most of the areas examined thus far were chosen on the basis of chemical and petrographic data and known common associations of igneous rock types that indicated characteristics similar to those of the uraniferous Nigerian granites and the radioactive rocks of the White Mountain magma series of New England.

Although much additional study is necessary before more detailed positive or negative limiting characteristics of likely uraniferous granitic rock types can be determined with certainty, the work done thus far has suggested two types of rocks that generally are not highly uraniferous. The larger batholithic bodies including the highly differentiated sodic phases, and bodies that have been enriched hydrothermally in sodic feldspar, are both types that do not seem to be favorable for containing significant quantities of uranium.

INTRODUCTION

A reconnaissance to determine the uranium content of granitic rocks in the western states was begun in October and temporarily suspended in November 1951. Granular igneous rocks in about 12 localities (fig. 1) were tested with a field counter, and sampled; a number of others were tested with the counter but were not sampled because the level of radioactivity was low, and they did not appear significantly different from other bodies of igneous rocks that had been examined. This work was done on behalf of the Division of Raw Materials of the Atomic Energy Commission.

This reconnaissance was not intended as a complete examination of all western granitic rocks. The stimulus for this work was the discovery in Nigeria of granitic rocks containing relatively high percentages of uranium, and the desire to investigate the possibility that rocks of comparable richness might be found in the United States. This approach was suggested by close resemblances between some of the Nigerian granites and some rocks of the White Mountain magma series in New England (Greenwood, 1951), and the knowledge that the White Mountain magma series was relatively high in radioactivity (Billings and Keevil, 1946). It was known that the igneous rocks of both areas have a number of characteristics in common; among these are post-tectonic age, richness in alkalis, commonly expressed by high content of sodic ferromagnesian minerals, abundance of fluorite, and iron-rich biotite. In both areas, ring-dikes are common and are believed to be a reflection of the tectonic conditions at the time of intrusion. Evidence is insufficient to show how many of these common characteristics are genetically associated with richness in uranium and hence may be used as a guide to the location

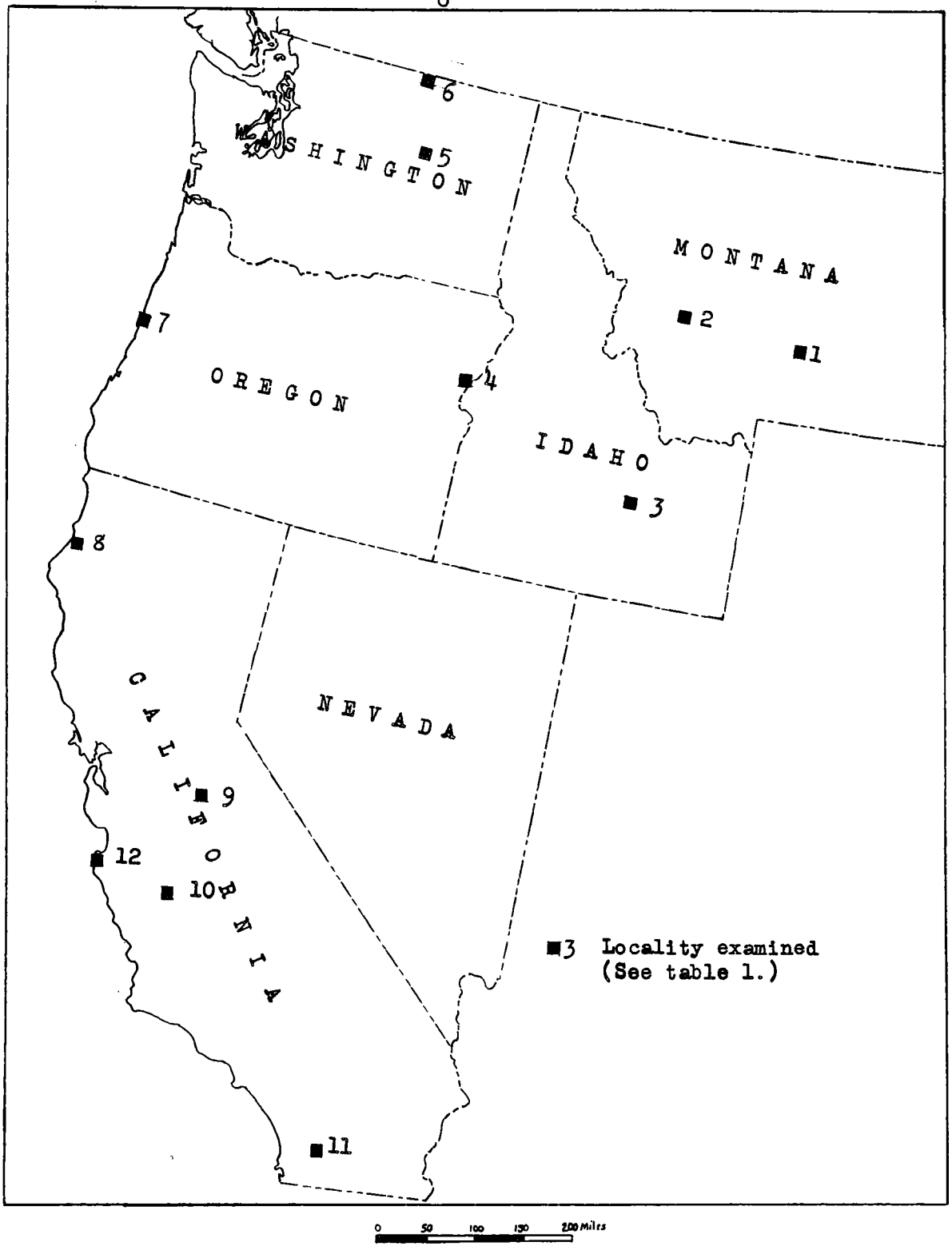

Figure 1.--Some localities examined in a reconnaissance in the western states for uraniferous granitic rocks

of similarly uranium-rich igneous rocks in other regions. The extent to which original variation in the uranium content of different parts of the earth's crust may affect the possibility of the development of highly uraniferous igneous rocks is not known.

Existing data regarding the syntectonic or post-tectonic age of igneous rock bodies are sufficiently detailed in but few areas in the western states to permit without examination the elimination of some intrusive bodies as being not worthy of study. Map-pattern, in areas of careful mapping, may be indicative, but such areas are relatively few. Existing chemical and petrographic data, and known common associations of igneous rock types, suggested areas for preliminary investigation.

RESULTS

The results of the reconnaissance are shown in table 1. The column headed "Type" refers to the classification below.

1. Alkali-rich phases of relatively large plutons
    a. Silicic and mediosilicic
    b. Subsilicic
2. Minor (hypabyssal) pluton sills, and dikes
    a. Silicic
    b. Mediosilicic
    c. Subsilicic
3. Albitized phases of major intrusives

Most of the radioactivity found apparently is due to thorium, rather than uranium. In the two bodies in which uranium was reported by chemical analysis, the radioactivity appeared to be concentrated in allanite and zircon; this does not exclude the possibility that a part of it may be present in other minerals but means merely that petrographic study of thin sections showed radioactive halos about grains that could be identified as allanite and zircon.

Table 1.--Some abnormally radioactive intrusive rocks in the western states

No. (See map)	Rock name	State	County	Quadrangle	Type*	Radioactive minerals	Age	Uranium (percent)	Equivalent uranium (percent) lab.	field	Rock type
1	Crazy Mts.	Mont.	Meagher	Little Belt Mts.	2ab	Allanite	Laramide	-	0.002-0.004	0-0.003	Syenite, granite, minette
2	Philipsburg	Mont.	Powell and Deer Lodge	Philipsburg	1a	Allanite, zircon	Laramide	-	0.002-0.004	0-0.008	Granite
3	Lava Creek	Idaho	Butte	Craters of the Moon	1a	Allanite, zircon	Tertiary	-	0.004	0.001	Granite
4	Pine	Ore.	Baker	Pine	3	None	Mesozoic	-	-	-	Albite granite
5		Wash.	Douglas	Steamboat Rock	1a	Allanite, zircon	Mesozoic	0-0.001	0.002-0.006	0.002-0.013	Granite-granodiorite
6	Okanogan	Wash.	Okanogan	Chopaka and Osoyoos	1b	Zircon, allanite (?)	Mesozoic	-	0.003	0.00-0.001	syenite
7	Waldport	Ore.	Lincoln	Waldport	2c	(?)	Oligocene or Miocene	-	0.004	0.002	Nepheline syenite porphyry
8		Calif.	Humboldt	Eureka	2b	Zircon, allanite (?)	Miocene (?)	0.008	0.008	0.002	Anorthoclase trachyte porphyry
9		Calif.	Tuolumne	Moccasin	2b	(?)	Late Jurassic	-	0.001	0.001	Albite syenite
10		Calif.	Fresno	New Idria	2b	Zircon (?)	?	-	0.002	0.001	Soda-syenite
11		Calif.	San Diego	Cuyamaca Pk.	1a	Zircon, allanite	Late Jurassic	-	0.002-0.004	0.001-0.004	Granodiorite, granite, aplite
12	Point Lobos	Calif.	Monterey	Monterey	1a	Allanite	Paleozoic	-	0.002	0.001	Granite

* See page 7

One of these uraniferous rock bodies is one of several small schlieren, rich in biotite, forming one phase of a granite exposed in the floor of Grand Coulee, just southeast of Steamboat Rock, Washington. This appears to be quantitatively unimportant, and the uranium content is also very low; the thorium content is relatively high (estimated 0.015 percent) and is reflected in the large amount of allanite visible in a thin section of the rock.

The other body that was found to have an appreciable uranium content is a small mass of anorthoclase trachyte porphyry in the Eureka quadrangle, California. Field measurements on this body were relatively low; hence it was examined at but one place. Similar rocks are apparently exposed in the Blue Lake quadrangle, to the east (Manning and Ogle). The age relationships in the Blue Lake quadrangle are indeterminable; Manning and Ogle suggest that the rock is a Tertiary intrusive. Further work on this body and other bodies of related rock may result in the discovery of material of higher uranium content.

More extensive work will be necessary before any negative conclusions could be adopted with any degree of confidence, but the work done thus far, including that in areas where only field measurements were made, suggests that two types of rocks are rather unlikely to have any occurrences of highly uraniferous rock. One of these is the larger batholithic bodies, including the highly differentiated sodic phases. The work done on the albite granite in the Pine Quadrangle, Oregon (Gulluly, 1933) as well as that on other bodies of rock that have been enriched in sodic feldspar by hydrothermal

processes, suggests that such bodies are also poor in uranium. It is possible that the solutions that produced this type of alteration may originally have been somewhat more uraniferous, but that the uranium was removed at an earlier and higher-temperature stage.

REFERENCES

Billings, M. P., and Keevil, N. B., 1946, Petrography and radioactivity of four Paleozoic magma series in New Hampshire: Geol. Soc. America Bull. vol. 57, pp. 797-828.

Gilluly, James, 1933, Replacement origin of the albite granite near Sparta, Oregon: U. S. Geol. Survey, Prof. Paper 175-C.

Greenwood, Robert, 1951, Younger intrusive rocks of Plateau Province, Nigeria, compared with alkalic rocks of New England: Geol. Soc. America Bull. vol. 62, no. 10, pp. 1151-1178.

Manning, G. A., and Ogle, B. A., 1950, Geology of the Blue Lake quadrangle: Calif. State Div. Mines Bull. 148, p. 26.