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THE OCCURRENCE OF ZEUNERITE IN THE RUSSIAN MOUNTAINS, ALASKA
Interim Report

Part 4
Trace Elements Investigations Report 57
SHORTER CONTRIBUTIONS TO ALASKAN TRACE ELEMENTS STUDIES FOR 1948

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INTERIM REPORT

By

R. M. Moxham

February 1950

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ABSTRACT

Seven rock samples collected by a U. S. Geological Survey geologist in the Russian Mountains in 1944 proved to be somewhat radioactive. The most active sample, a concentrate of vein material from the Konechney copper prospect, contains 0.017 percent equivalent uranium. Zeunerite, a copper uranite, is the source of the radioactivity of the sample. Insufficient data are available to permit an estimation of reserves. Field investigation of the area appears to be warranted.

INTRODUCTION

The Russian Mountains area was visited by R. E. Wallace and E. J. Webber of the Geological Survey in 1944 in connection with mineral resources investigations of the central Kuskokwim region. In the spring of 1947, a group of Webber's samples was scanned and seven proved to be slightly radioactive. Postponement of further study until 1948 was necessitated by the press of more urgent work. The present writing is an interim report on the data obtained from laboratory work on the samples. A field investigation and a more detailed report on this area are contemplated.

Location of area

The Russian Mountains, part of the Kuskokwim Mountains, are north of the Kuskokwim River, a short distance east of the village of Aniak. (See fig. 1.) The drainage basins of the Owhat and Kolmakof Rivers nearly surround the mountain mass, forming a roughly oval-shaped area of rugged peaks bounded on all sides by lowlands.

Travel in the area is chiefly by air; Aniak airfield, maintained by the C. A. A., is suitable for multi-engine aircraft, and a smaller airstrip is located on a bar in the Kuskokwim River at Napaimiut. The westward-flowing Kuskokwim River is navigable for shallow-draft vessels, and most heavy freight is brought in by barge from Bethel, 100 miles southwest of Aniak, near the mouth of the river.

GEOLOGY AND MINING

Cady (Cady, et al, in preparation) has given a detailed description of the geology and mineral resources of the Russian Mountains area. His work is summarized below.

The Russian Mountains have been formed from an igneous complex consisting of an acidic stock bordered by basic extrusives. Porphyritic quartz monzonite and granite are the chief components of the stock, with more basic material occurring as a border phase in the peripheral areas. Both basic and silicic dikes are common throughout the stock and immediately adjacent rocks and probably represent a complimentary suite of late differentiates of the parent magma. The igneous complex probably was intruded in either Oligocene or early Miocene time, but the age and structural relationship of the adjacent basic extrusives are not clear. Metamorphosed graywacke and slate of Cretaceous age adjoin the igneous mass on the south and east. A mantle of glacial deposits and outwash has been deposited in the lowlands north and west of the mountains.

Zones of sulfide mineralization are rather common within the confines of the stock and may be genetically related to its formation. The ore occurs in fissure veins and breccia filling, localized along major joints and shear zones that strike northwesterly across the stock and dip steeply southwest. Evidently the ore-forming fluids were introduced very late in, or after, the time of consolidation of the stock, inasmuch as the exposed part of the intrusive had been crystallized and the joints intruded by dikes in advance of ore mineralization.

A mixture of arsenopyrite, chalcopyrite, and pyrite comprise the metallic sulfides. In addition to copper, assays have indicated small amounts of gold, silver, and tin, whose occurrence is not commonly apparent from field examination alone. Quartz is practically the only non-sulfide gangue mineral. Ore exposed to surface weathering is altered to limonite, malachite, chrysocolla, and to various greenish arsenic compounds, which may be confused with copper stain formed by malachite.

There are two prospects and several other indications of mineralization in the Russian Mountains. The Konechney prospect is at the extreme head of Mission Creek in the southeastern part of the Russian Mountains, at an altitude of about 2,000 to 2,350 feet above sea level, and 7 miles northeast of the village of Russian Mission on the Kuskokwim River. The openings consist of two adits that total about 900 feet and several surface trenches. The prospect was discovered in 1920 by Joe Konechney, and he has explored it almost continuously since that time. The country rock is quartz monzonite intruded by nearly vertical basaltic dikes that strike N 25° W. A mineralized area about 200 feet wide consisting of quartz veins and thin zones of breccia and gouge occursin both the dikes and quartz monzonite. Their orientation is the same as that of the dikes. The mineralized zone has been explored for about 1,000 feet along the surface trace. Assays of the ore are said to indicate an average of 1.0 percent copper, 0.1 ounce of gold, and 1.0 ounce of silver per ton.

Another prospect is near the head of Cobalt Creek between elevations of 1,550 and 1,750 feet and a little more than a mile north-northeast of the Konechney prospect. The openings consist of several surface trenches and three shallow shafts. This prospect was discovered about 1900 and was examined by A. G. Maddren of the U. S. Geological Survey in 1914 (Maddren, 1915, pp. 359-360). The country rock is a porphyritic phase of the quartz monzonite. A fissure vein about 3 feet wide and associated breccia zones, chiefly in the hanging wall of the vein, strike N 25° W and dip 80° SW. The mineralized zone had been explored for about 800 feet along the strike. A specimen selected from the dump of one of the shafts is reported to have assayed 11 percent copper, less than 0.25 ounces per ton of gold, and traces of silver. Two samples from a short shaft about 1,000 feet west of the vein described above are reported to have assayed 1.40 and 1.22 percent tin.

Another mineralized zone trends northwesterly across the crest of the ridge about half way between the Konechney and Cobalt Creek prospects.

RADIOACTIVITY INVESTIGATIONS

Four of the samples examined were from the Konechney copper prospect at the head of Mission Creek (fig. 1, sample localities 43, 44, 67, 72), two from a prospect at the head of Cobalt Creek (50, 51), and one, float rock, from lower Mission Creek (38).

All the samples except 67, a panned concentrate, were crushed to about 20-mesh, and the equivalent uranium (abbreviated E. U.) content of the material determined by beta count. Methylene iodide was used to remove the heavy minerals (greater than 3.3 specific gravity) from each sample; the E. U. content of this fraction was also determined. Results of these studies are shown in table 1.

Sample 67 is composed of material of 20-mesh size and smaller. It was processed in the same manner as the other samples, except that it was not crushed. No data are available concerning the degree of concentration of the sample at the time of collection.

The heavy minerals of each sample were separated into six fractions of decreasing magnetic susceptibility. The radiation from the non-magnetic fraction of sample 67 indicated the presence of a very active mineral, which has been identified as zeunerite, $Cu(UO_2)_2As_2O_8 \cdot 8H_2O$, a member of the uranite group. The mineral is green, orthorhombic in form, and has a perfect cleavage parallel to (001).

Sample 67 was described by Webber (1944) as "concentrate panned from ore at junction of upper tunnel with arsenic-copper vein". Sample 72, described as vein material from the upper tunnel dump, did not contain zeunerite, nor was any found in the other samples, including specimens of the wall rock in the upper tunnel. The slight radioactivity of these rocks is attributed to minor amounts of common accessory minerals.

CONCLUSIONS

Zeunerite is a relatively rare secondary uranium mineral, and it is of interest in this instance only in that it may be indicative of the presence of primary uranium minerals. Both favorable and unfavorable indications may be inferred from the results of the laboratory tests and a study of Cady's work. The discouraging aspect is that a relatively small amount of radioactive material was obtained from only one of six samples of the two more prominent mineralized zones in the Russian Mountains. Six samples, however, certainly do not present adequate data upon which to base a rejection of the possibilities of this area. It is noteworthy that Cady has stated that "ore exposed to surface weathering is altered to limonite, malachite, chrysocolla, and to various greenish arsenic compounds...." It seems possible, therefore, that the occurrence of zeunerite or other secondary minerals may be more widespread than the present data indicate. Moreover, zeunerite is a secondary uranium mineral associated with primary deposits in other parts of the world.

The number of samples available is inadequate to permit an estimation of the reserves at the Konechney prospect. An investigation of the mineralization in the Russian Mountains is recommended.

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Table 1

Radiometric data on samples from the Russian Mountains, Alaska

Sample number		Percent equivalent uranium			
Field	ATE file	Unconcentrated	Heavy-mineral fraction	Concentration ratio	Location and description
44AWb67	1734-L	Unknown	.017	Unknown	Konechney prospect --- panned concentrate of ore from upper tunnel
44AWb38	3266-L	.005	.006	132:1	Mission Creek --- granodiorite float
44AWb43	3267-L	.002	.008	847:1	Konechney prospect --- lower tunnel dump, basalt lamprophyres
44AWb44	3268-L	.005	.008	147:1	Konechney prospect --- lower tunnel dump, blue granite
44AWb50	3269-L	.004	.004	161:1	Cobalt Creek --- trench no. 3 on footwall, monzonite
44AWb51	3270-L	.006	.009	134:1	Cobalt Creek --- McDonald shaft, hanging wall
44AWb72	3271-L	.004	.011	143:1	Konechney prospect --- upper tunnel dump, vein material