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DISSEMINATED TIN OCCURRENCE NEAR COAL CREEK, TALKEETNA MOUNTAINS D-6 QUADRANGLE, ALASKA

by

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This report is preliminary and has not been edited or reviewed for conformity with Geological Survey standards and nomenclature.

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Introduction.-- In June 1977 a brief stop was made at a tourmaline-bearing granite locality reported by C. C. Hawley to the U.S. Bureau of Mines. In the present investigation 9 grab samples of altered and apparently fresh rock, and a stream sediment and pan concentrate sample were collected and analyzed.

This brief examination and subsequent semiquantitative spectrographic analyses and examination of thin sections of the samples indicate that the granite is greisenized and can be classified as a disseminated tin occurrence. Most of the samples collected show pervasive alteration (addition of boron and fluorine). Although they come from a dissimilar geologic environment, they possess many of the physical characteristics of the Bolivian "porphyry tin" deposits described by Sillitoe and others (1975). Briefly, the Bolivian deposits are high-level felsic porphyry stocks that contain low-grade stockwork, disseminated and breccia-filling cassiterite mineralization, and possess many of the characteristics of porphyry ore deposits as defined by Lowell and Gilbert (1970). A notable difference from porphyry copper deposits is that, owing to the chemical immobility of tin (once precipitated as cassiterite), tin deposits lack supergene enrichment. For a description of porphyry tin deposits and a detailed comparison with porphyry copper deposits the reader is referred to Sillitoe and others (1975) and subsequent discussion by Taylor (1976) and Sillitoe and others (1976).

The occurrence near Coal Creek lies on the south flank of the Alaska Range on the northwest side of the Chulitna River valley at an altitude of about 885 m (2,900 ft) in the Talkeetna Mountains D-6 quadrangle (Sec. 21, T. 22 S., R. 12 W.), about 200 km north of Anchorage (fig. 1). There are no roads in the immediate area of the occurrence although the Alaska Railroad and the recently completed Parks Highway lie on the opposite side of the Chulitna River 11 km to the southeast (fig. 1). The Chulitna valley has been glaciated, and topography consists of rounded hills with low relief. Rock exposures along this part of the valley are generally sparse.

Description of occurrence.-- Tin mineralization occurs in a small (about 4,000 m^2) area of greisenized granite. The granite cuts graywacke hornfels which is part of the Chulitna sequence (Jones and others, 1976; Clark and others, 1972). Biotite is developed in sample 9 collected about 6 m from the granite contact, but the extent of the thermal metamorphic aureole is not known.

At least two granitic rock types, alaskite and muscovite granite, are present, but due to overburden the relation of the two is unknown. They are presumably genetically related and part of the McKinley sequence, a group of biotite and/or muscovite granite plutons that was emplaced about 55 m.y. ago (Reed and Lanphere, 1973) in this part of the Alaska Range.

Alaskite (sample 1) is fine grained and consists of quartz, orthoclase, sodic plagioclase, muscovite, and less than 1 percent biotite

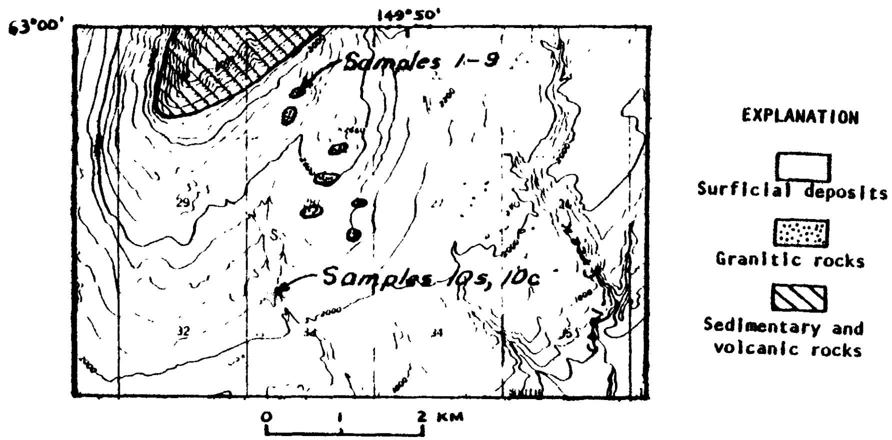

Fig. 1A

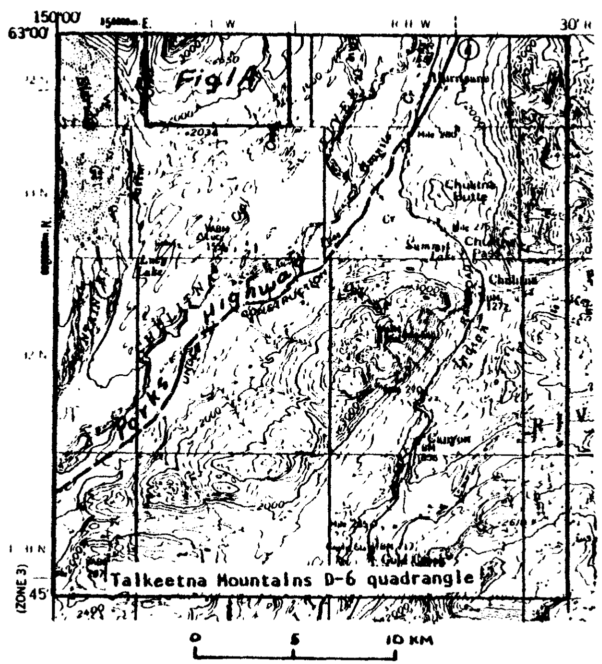

Fig. 1B

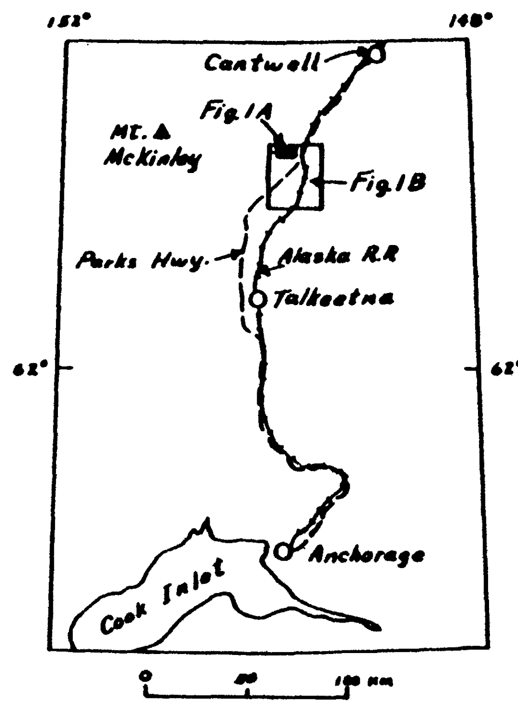

FIGURE 1.-- MAPS SHOWING LOCATION OF AREA DISCUSSED IN THIS REPORT. LOCATION OF GRANITIC ROCKS IN FIGURE 1A FROM C. C. HAWLEY (WRITTEN COMMUN., 1977).

and topaz. Minor sericitic alteration is present. Seriate to porphyritic muscovite granite, with phenocrysts of quartz and orthoclase 2 to 5 mm in maximum dimension in a groundmass of quartz, sodic plagioclase, orthoclase and muscovite, is the most pervasive granitic rock in the area examined. Plagioclase and, to a lesser extent, orthoclase are sericitized. In most of the samples, alteration (greisenization) has transformed the feldspar and groundmass minerals to a fine aggregate of quartz, tourmaline, sericite, topaz and minor fluorite, and only quartz phenocrysts of the original igneous rock are recognizable in hand specimen.

Conspicuous features of the granite are irregular patches of black tourmaline up to 3 cm in maximum dimension and stockworks of irregular greisen veinlets which consists chiefly of black tourmaline and/or quartz. (The pleochroic formula for tourmaline is: O(Z)=various shades of blue, E(X)=gray to very pale blue.) The width of individual greisen veinlets ranges from a few millimeters up to 10 cm. It was not possible in the time available to obtain details on the distribution and density of the veinlet-stockwork zones.

Granite adjacent to the veinlets is pervasively altered to quartz, tourmaline, topaz, sericite and minor fluorite. Locally, parts of the granite have been altered to a porous, light-gray, aphanitic mass of quartz and topaz. Examination of thin sections indicates that the veinlet/stockwork zone has undergone several pulses of hydrothermal brecciation, hydraulic fracturing and alteration. The latest phase, in what was probably a more-or-less continuous series of magmatic events, was the development of quartz, topaz, cassiterite, and sulfide veinlets. Identified sulfide minerals are arsenopyrite, pyrite, pyrrhotite, sphalerite, and although analysis of samples 4 and 7 (table 1) which contain 2.9 and 4.3 ounces per ton silver, respectively, indicate that other sulfide or sulfosalt minerals are present.

The recognized tin mineral is cassiterite which occurs as (1) sporadic grains with locally high concentrations in greisen veinlets, (2) minor disseminations in adjacent greisenized granite and (3), as mentioned above, in thin (1-3 mm wide) quartz-topaz-sulfide veinlets which postdate the alteration and stockwork veinlets. In thin section cassiterite occurs as small (0.3-0.8 mm) crystals or crystal aggregates, often with pyramidal terminations. It is moderately pleochroic with zones or patches that display pale-pink to pale-brown pleochroism.

From this brief examination it is believed that this disseminated tin occurrence is genetically related to the granitic host, and formed through a series of magmatic events that included intrusion, brecciation, alteration (greisenization), and stockwork and vein mineralization.

Description of samples and analytical data.-- The following descriptions are of the 9 (grab) rock samples collected at the locality examined. Analytical data for these samples are given in table 1. Samples 10s and 10c are a stream sediment and pan concentrate sample, respectively, collected about 2.5 km from the occurrence (fig. 1).

Table 1.-- Semiquantitative spectrographic analyses of 9 bedrock, 1 stream sediment and 1 pan concentrate sample from the Talkeetna Mountains D-6 quadrangle.

Sample No.	Field No.	Fe	Mg	Ca	Ti	Ag	As	B	Ba	Be	Bi	Cd	Co	Cr	Cu	Le	Mn	Mo	Nb	Ni	Pb	Sb	Sc	Sn	Sr	V	W	Y	Zn	Zr
		percent				ppm																								
		Bedrock samples																												
1	77AR29B	1	.03	.2	.007	5	N	10	50	3	L	N	L	N	15	L	150	N	L	L	20	N	15	50	N	L	N	10	N	50
2	77AR29C	3	.07	.3	.007	7	7000	2000	100	5	200	N	L	N	150	30	700	10	L	L	20	N	5	500	N	L	N	15	L	70
3	77AR29D	3	.02	.1	.005	7	700	2000	50	5	100	N	L	N	200	50	5000	5	L	L	30	N	5	200	N	L	N	10	L	70
4	77AR29E	5	.03	.1	.002	100	3000	2000	100	2	50	N	L	N	1500	30	1000	5	L	L	200	N	5	15000 1/	N	L	100	L	L	100
5	77AR29F	1.5	.05	.2	.007	5	N	500	50	7	70	N	L	N	20	L	200	N	L	L	30	N	5	150	N	L	N	10	L	70
6	77AR29G	2	.03	.1	.005	5	N	1500	100	30	150	N	L	N	10	L	700	15	L	L	30	N	5	70	N	L	N	10	N	50
7	77AR29J	2	.07	.2	.02	150	>10,000	1000	50	100	200	N	10	N	2000	30	300	N	L	L	N	N	30	1500 1/	N	L	500	10	2000	70
8	77AR29K	1	.02	.15	.01	2	200	300	20	5	300	N	L	N	15	30	150	N	L	L	200	N	5	20	N	L	N	10	N	70
9	77AR29H	5	1	.3	.7	N	300	2000	1000	20	30	N	L	150	15	50	500	L	L	50	100	N	5	100	N	100	N	20	200	300
		Stream sediment and pan concentrate samples																												
10s	77TL41S	10	2	1.5	.7	N	N	100	1000	1	N	N	30	1000	100	70	1000	N	L	200	50	N	50	200	100	200	N	20	500	200
10c	77TL41C	>20	5	5	.7	N	N	1500	1000	2	L	N	50	5000	300	50	>5000	N	L	150	20	N	50	2000 1/	200	500	N	150	500	>1000

1/ approximate value

Sample No.	Field No.	
1.	77AR29B	Alaskite; fine-grained equigranular quartz, potassium feldspar, sodic plagioclase and muscovite; minor topaz and biotite; weakly sericitized.
2	77AR29C	Greisenized granite; quartz phenocrysts in a matrix of quartz (45 percent), tourmaline (30 percent), topaz (10 percent), and sericite, fluorite, cassiterite and sulfide minerals (15 percent); tourmaline occurs in irregular patches 2 to 5 mm in maximum dimension.
3	77AR29D	Greisenized granite (quartz, sericite, tourmaline and topaz) cut by 2-mm-wide quartz-topaz veinlet.
4	77AR29E	Greisenized granite; quartz phenocrysts (25 percent) in a medium to fine matrix of quartz, tourmaline, topaz and sericite (70 percent), and fluorite and cassiterite (5 percent); cut by veinlets of topaz, quartz tourmaline and fluorite.
5	77AR29F	Muscovite granite porphyry; phenocrysts of orthoclase and quartz (3 to 6 mm in maximum dimension) in a fine-grained seriate matrix of sodic plagioclase, quartz, orthoclase and muscovite. Plagioclase intensely sericitized; rock is locally greisenized to a fine-grained aggregate of quartz, sericite, tourmaline, topaz, and minor fluorite. Phenocrysts of quartz contain microveinlets of quartz, topaz and tourmaline.
6	77AR29G	Greisenized granite; quartz phenocrysts 2 to 5 mm in maximum dimension in a seriate matrix of quartz, sericite, tourmaline and topaz. Sample is cut by a 1.5-cm-wide, vuggy quartz-topaz vein.

7	77AR29J	Greisen vein; light-gray, porous aphanitic mass of quartz (60 percent), topaz (35 percent), tourmaline and fluorite (5 percent); cut by minor veinlets of tourmaline and topaz, and later veinlets of quartz, topaz, sulfide minerals, tourmaline and cassiterite.
8	77AR29K	Sericitized muscovite granite porphyry; irregular patches of quartz, tourmaline and topaz greisen; cut by microveinlets of tourmaline, quartz and topaz.
9	77AR29H	Graywacke biotite hornfels; cut by multistage quartz veins and later veinlets of quartz, topaz and fluorite.
10s	77TL40S	Minus-80-mesh stream sediment sample.
10c	77TL40C	Minus-20-mesh pan concentrate sample; hand-magnetic minerals removed; specific gravity greater than 2.86.

Significance.-- This disseminated tin occurrence may be similar to parts of the tin mineralization in the Lost River area about which Sainsbury (1968, p. 1562) wrote of a buried biotite granite that "has been greisenized or cut by numerous small veinlets that formed along joints in the outer shell of the granite". At Lost River a stockwork of low-grade tin ore is developed in carbonate rocks above the granite. The tin occurrence near Coal Creek is genetically related to a stock of muscovite granite thought to be part of the McKinley sequence of granites. Geologic work has documented the close association of tin metallization with this granite sequence (Reed and others, in press). An example is the recently described tin deposit at Boulder Creek, a stockwork deposit in which tin mineralization is restricted to intensely fractured meta-sedimentary rocks that overlie a granite cusp of the McKinley sequence. At Boulder Creek, however, drill hole intersections of the granite suggest that it is not greisenized. Tin values of the granite cusp range between 20 and 100 ppm.

Several small outcrops of granitic rock suggest that the ridge in sections 21 and 28, T. 22 S., R. 12 W. may be underlain by a granitic stock. A stream sediment and a pan concentrate sample collected 2.5 km south of the above occurrence (sample 10s, 10c, fig. 1, table 1) contain 200 and 2,000 ppm tin respectively and may reflect additional tin mineralization within the stream drainage area. Additional work is warranted to examine the other granitic rocks in the immediate area and to determine the extent and grade of tin mineralization.

Although data are not available to provide information on the extent, distribution and average grade of this disseminated mineralization, the analyses given in table 1 range from .002 to 1.5 percent tin. These values should not be considered representative of anything more than the sample collected nor is their mean value in any way indicative of an average grade. However, in comparison, underground lode tin mines in Bolivia average about 0.9 percent tin and development is underway on open-pit porphyry tin deposits which have an average grade of 0.3 percent.

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