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TIN IN PANNED CONCENTRATES, SERPENTINE RIVER, SEWARD PENINSULA, ALASKA

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INTRODUCTION

The area discussed lies on the Seward Peninsula, Alaska, about 70 miles north of Nome (fig. 1). Placer and lode tin occurs at numerous localities on the Seward Peninsula. These deposits constitute the largest known reserves of tin in the United States (Sainsbury, 1970, p. 10). Continuing work by the U.S. Geological Survey has resulted in periodic discoveries of tin minerals in new areas (Sainsbury and Hamilton, 1967; Sainsbury and others, 1970), as well as of large deposits of fluorite that contain beryllium and minor amounts of tin (Sainsbury, 1963, 1969a, 1970). Hence, one can infer that new deposits remain to be found, some of which may be of economic importance.

This note discusses the results of a short field study completed in 1971 to test for placer tin in gravels of the headwaters of the Serpentine River. The study was prompted by the fact that a few pebbles of cassiterite-bearing quartz-tourmaline rock were found on bars of the river in 1970. This find tended to corroborate a statement by J. J. Mulligan, U.S. Bureau of Mines, that an Eskimo hunter had found a fist-sized piece of cassiterite in this area in the 1950's (Mulligan, oral commun., 1966).

GENERAL GEOLOGY AND STRUCTURE

The bedrock of the area consists of thrust sheets of Precambrian and Paleozoic rocks which are intruded by a few diabase dikes and which locally display thermal metamorphism that may be related to an unroofed granitic rock at depth. The regional geology has been described by Sainsbury (1970).

The older rocks consist of the "Slate of the York Region" and chloritic-graphitic schists which may be either metamorphosed impure slates with intercalated volcaniclastic rocks or metamorphosed mafic intrusions of much younger age. The slate consists of silt-sized quartz grains with abundant graphite or carbonaceous dust, phengitic mica, and calcareous cement. In the area of figure 1, the slate is so intimately admixed with chloritic schist that a hybrid rock forms much of the bedrock. This hybrid rock consists of quartz-chlorite-graphite-mica schist that shows intense dragfolding, lineation, and segregation of folded and attenuated quartz veinlets. This highly deformed schist forms a thrust plate that overrides a thick sequence of steeply dipping limestones and marbles which probably are of Ordovician age but which are undated by fossils. In the west part of the mapped area, thick carbonite rocks which form a thrust plate over chloritic schists are faulted off by a normal fault trending north-northwest.

The thrust plates are intruded by altered diabasic dikes of late Cretaceous or Tertiary age. Copper minerals occur along some of these dikes west of the Serpentine River.

Copper minerals consisting of malachite, azurite, chalcopyrite, and unidentified gray copper-bearing sulfides are present in a small thrust sheet of limestone east of the Serpentine River (fig. 1). Known as the Ward Mountain copper prospect, this deposit contains copper sulfide minerals in several pits and trenches at scattered localities for almost a mile. The dump from a short adit at the base of the carbonate contains silicified limestone with abundant malachite and azurite. Spectrographic analyses of ores disclose that tin, silver, bismuth, lead, and zinc occur in addition to copper in some of the ores. The fact that the veinlets containing the varied suite of sulfide minerals are undeformed suggests that the sulfide minerals were introduced hydrothermally after the general dynamic deformation of the area. Such an interpretation is supported by the fact that the Tertiary dikes that are mineralized are undeformed.

The scattered gravity data support the conclusion that a granitic mass underlies the entire area and may extend eastward to the exposed granite at Serpentine Hot Springs, some 25 miles northeast (oral commun., D. F. Barnes, 1967). Tin and base-metal elements have been found recently near the granite at Serpentine Hot Springs (Sainsbury and others, 1970). Rich and extensive placer gold deposits extend for miles down Washington Creek, which heads against the east margin of the area and flows eastward. Bits of cassiterite, as well as base-metal sulfide minerals, are found in placer gold deposits of this stream, again suggesting that epigenetic mineralized material is rather common.

Analyses of panned concentrates

Marsh and Ewing spent 2 days in 1971 in securing panned concentrates from the Serpentine River, beginning below the Ward Mountain copper prospect and continuing to the headwaters of the main stream. To delimit the drainages that contain tin, pans were taken above the junction of each stream entering the Serpentine River. Concentrates were analyzed by J. C. Hamilton, U.S. Geological Survey, by semiquantitative spectrographic analyses. The results are shown in table 1.

DISCUSSION

Clearly, the tin-bearing concentrates all come from the main stream or streams entering from the east. On the other hand, lanthanum and cerium, with very little tin, occur in concentrates from streams entering the Serpentine River from the west. In one concentrate, europium was detected (200 ppm). This suggests that a europium-bearing monazite may occur in the chloritic schists, as such a monazite has been reported elsewhere in similar rocks (Guigues and Devismes, 1969). Obviously, the east drainages should be searched for the lode sources of tin, the west drainages for those of euorpium monazite.

OTHER ECONOMIC CONSIDERATIONS

Inasmuch as the thrust sheet of schist overlies limestone, a contact between limestone and schist must exist somewhere beneath the surface east of the Serpentine River. The thermal metamorphic effects noticeable in the schists suggest that this area is underlain by granite at a depth not exceeding a few hundred feet. The placer tin, the epigenetic copper deposits containing tin at the Ward Mountain copper prospect, and the intensely silicifed schists north of the Ward Mountain copper prospect may be interpreted as being related and as indicating hydrothermal processes. Taken together, the facts suggest that the buried limestone beneath the schist east of the Serpentine River should be tested by a drill hole after the source of the placer tin is located. Too, the chance of larger deposits at depth beneath the Ward Mountain copper prospect should be kept in mind.

In future prospecting of the general area, it cannot be overemphasized that panned concentrates are more dependable in searching for buried lodes than are total stream sediments. This was clearly proved by the work in 1968 around the granite of Serpentine Hot Springs (Sainsbury and others, 1970).

References cited

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Table 1.--Metal content, in parts per million, of panned concentrates, Serpentine River, Seward Peninsula, Alaska

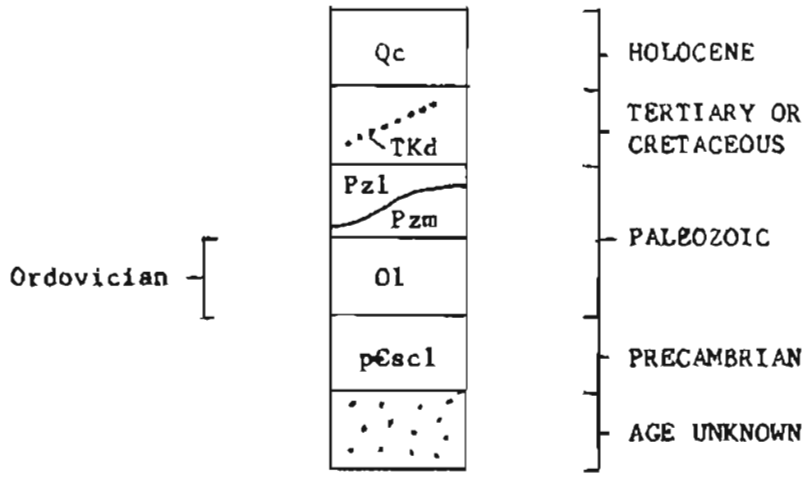
[Semiquantitative spectrographic analyses by J. C. Hamilton, U. S. Geological Survey. N, below detection limit. L, detected, but below level of dependable qunatitative reading]

Field No.---	71-Asn-167A	167C	167D	167F	167G	167H	167I	167J	167K	167L
Lab No.---	D155003	D155005	D155004	D155006	D155007	D155008	D155009	D155010	D155011	D155012
Map No.---	1	2	3	4	5	6	7	8	9	10
Ag	N	N	N	N	N	N	N	N	N	N
B	100	70	50	1000	300	700	150	150	500	50
Bi	N	N	N	N	N	N	N	N	N	N
Cu	20	50	100	100	20	15	30	70	150	20
La	150	500	300	1500	100	500	500	500	300	150
Nb	L	L	L	10	10	10	L	10	L	L
Pb	15	20	10	30	20	20	20	70	200	15
Sb	N	N	N	N	N	N	N	300	N	N
Sn	500	500	1500	20,000	1000	2000	700	200	10,000	50
Ce	300	1000	1000	2000	200	1000	1000	1000	700	300
Th	N	200	N	500	N	N	N	N	N	N
Pr	N	150	100	200	N	100	100	100	N	N
Nd	100	500	300	1500	100	500	500	500	300	200
Sm	N	100	100	200	N	150	100	100	N	N
Eu	N	N	N	N	N	N	N	N	N	N
Gd	N	70	50	150	N	50	50	50	N	N

Table 1.--Metal content, in parts per million, of panned concentrates, Serpentine River, Seward Peninsula, Alaska--continued

Field No.---	71-Asn-167M	1670	167P	167R	167T	167U	167V	167W	167Y	167Z
Lab No.---	D155013	D155014	D155016	D155017	D155018	D155019	D155020	D155021	D155022	D155023
Map No.---	11	12	13	14	15	16	17	18	19	20
Ag	N	N	N	N	N	N	N	N	N	N
B	30	300	100	50	1000	200	50	70	200	150
Bi	N	N	N	N	N	N	N	N	N	N
Cu	15	150	15	1000	20	20	15	20	20	20
La	100	700	500	10,000	150	70	100	150	70	150
Nb	L	L	L	10	L	10	L	L	L	L
Pb	N	200	50	70	30	50	30	30	50	200
Sb	N	N	N	N	N	N	N	N	N	N
Sn	N	7000	700	30	1000	20	N	N	150	700
Ce	300	1500	700	10,000	300	N	200	300	200	500
Th	N	N	N	3000	N	N	N	N	N	N
Pr	N	N	150	2000	N	N	N	N	N	N
Nd	150	700	300	7000	200	100	150	150	70	200
Sm	N	200	100	2000	N	N	N	N	N	N
Eu	N	N	N	200	N	N	N	N	N	N
Gd	N	N	70	500	N	N	N	N	N	N

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Qc	COVER - Tundra, brush
TKd	DIKES - Diabase and altered diabase
	LIMESTONE AND MARBLE
Pzl	Principally limestone with minor marble
Pzm	Principally marble
Ol	LIMESTONE - Medium-bedded limestone and marble with bedding clearly visible
p€scl	SCHIST - Graphitic and chloritic schist, in part with quartz veinlets; highly crinkled, lineated, and dragfolded on small scale. Probably represents tectonic mixture of graphitic and chloritic schist
	SILICIFIED ROCKS

Contact. Dashed where inferred; dotted where concealed

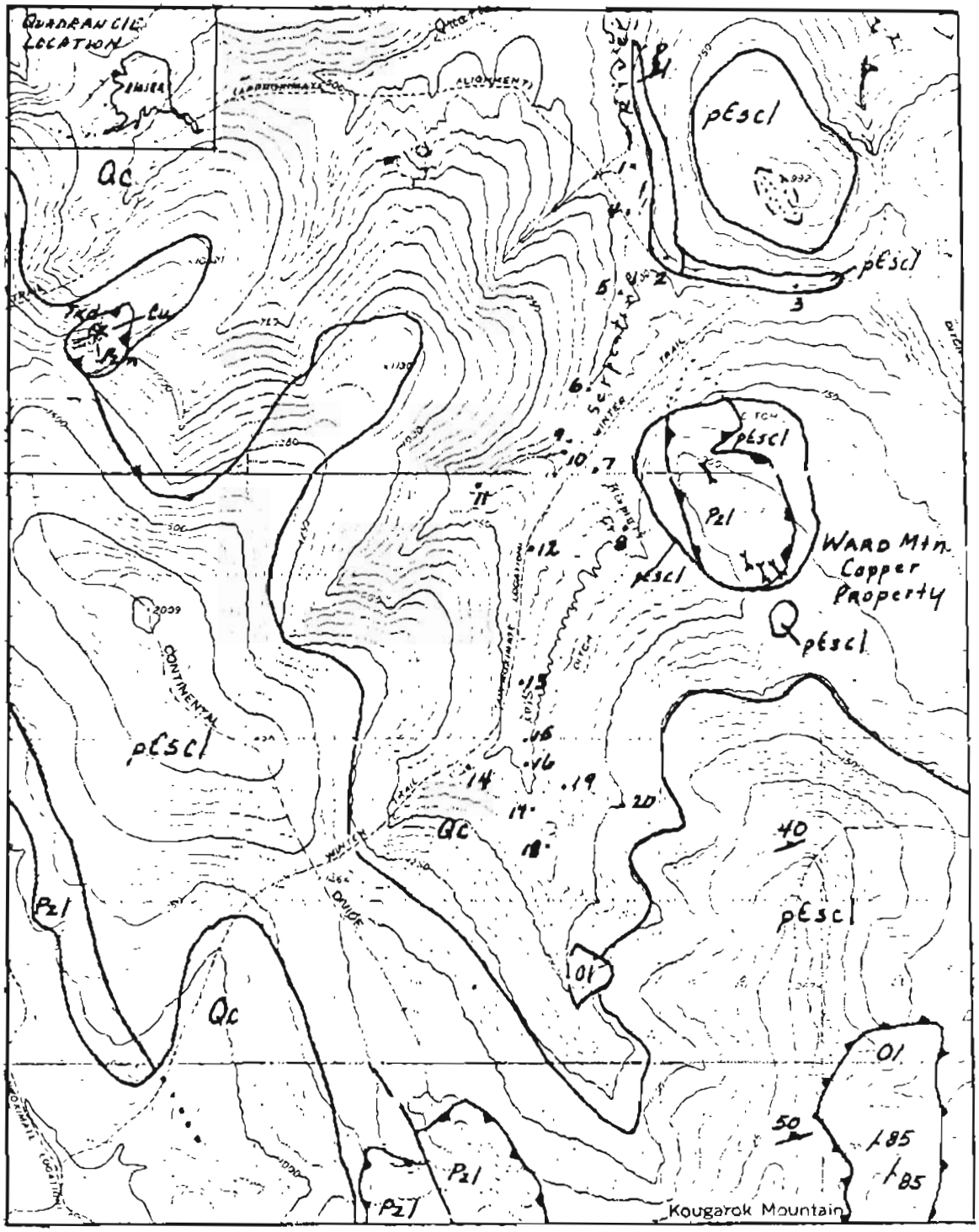
Trench

85 Strike and dip of foliation or cleavage

Thrust fault. Sawteeth on upper plate

Normal fault. Dashed where inferred

Old prospect pit or trench



Base from U.S. Geol Survey
Teller C-1 and C-2, 1950

Geology by C.L. Sainsbury,
1967-68

0 1 2 MILES

Figure 1.- Index map of Alaska and generalized geologic map of the Serpentine River area