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UNITED STATES
DEPARTMENT OF THE INTERIOR
Geological Survey
Washington

IRON-COPPER DEPOSITS OF THE RICH HILL AREA, KASAAN PENINSULA, PRINCE OF WALES ISLAND, SOUTHEASTERN ALASKA

By

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INTRODUCTION

The Rich Hill area of Kasaan Peninsula is about 2½ miles southeast of Kasaan village and 35 miles northwest of Ketchikan, the nearest port (see fig. 1). The deposit is at the top of a small hill at an altitude of 500 feet and about a quarter of a mile from tidewater.

The Rich Hill deposit and several prospects south and west of it (see fig. 2) were examined by the Geological Survey during the summer of 1943. Magnetic surveys were made of the Rich Hill deposit and the surrounding area. Geologic and topographic maps also were prepared.

DEVELOPMENT

Surface workings at the Rich Hill mine include numerous trenches, open cuts, and a small glory hole about 20 feet deep (see fig. 3). Two adits explore the ore body underground (see figs. 3 and 4). Adit 2 intersects the bottom of the main chalcopyrite lens 45 feet below the rim of the glory hole. Adit 1, 125 feet below the rim of the glory hole, exposes only small amounts of disseminated chalcopyrite and pyrite in greenstone. Two inclined raises were driven from near the end of adit 1 (see fig. 4). Raise 1 terminates 50 feet above the level of adit 1; raise 2 terminates 46 feet above the level of adit 1. Twenty-five feet from the face of the west drift of adit 2 a 10-foot shaft connects with a sub-level.

An aerial tramway, still in good condition, connects the mine workings and a loading shed near the beach. Several small buildings are on the property including a small mill and equipment in good condition.

The mineralized zone (see fig. 2) west of the Rich Hill mine has been prospected by four short adits in addition to surface cuts and trenches. The zone near the beach south of the mine has been prospected only by a few open cuts and trenches (see fig. 6).

HISTORY AND PRODUCTION

The Rich Hill mine was worked during 1917-1918 and a small tonnage of ore was mined. The production figures available to the Geological Survey for the years 1917 and 1918 are as follows:

	Tons of material sold or treated	Gold		Silver		Copper	
		Fine oz.	Value	Fine oz.	Value	Pounds	Value
1917	160	28.00	$578.	220.00	$181.	31,412	$8,575
1918	350	33.50	$672.	191.00	$191.	59,931	$14,803
Total	510	61.50	$1,270.00	411.00	$372.	91,343	$23,378

The Granby Consolidated Mining, Smelting, and Power Company is reported to have mined a considerable tonnage of high-grade chalcopyrite ore in 1928 but the Geological Survey has no record of the production from this operation.

GENERAL GEOLOGY

The Kasaan greenstone, the principal rock on Kasaan Peninsula, is the country rock in the Rich Hill area. It consists largely of metamorphosed and altered volcanic materials. In general, the formations strike northwesterly.

Numerous dikes, ranging from porphyritic bostonite through diorite, diabase, and gabbro, to lamprophyre have intruded the greenstone (see figs. 2 and 3). The dikes dominantly trend to the north or northwest. The largest igneous body in the area is a northerly-trending hornblende-diorite dike which attains a maximum width of 50 feet and has been traced a quarter of a mile.

Both the dikes and greenstone are cut by numerous faults which do not appear to conform to any definite pattern.

ORE DEPOSITS

Most of the ore in the Rich Hill area consists of disseminated chalcopyrite, pyrite, and magnetite in greenstone, but numerous irregular pods and veinlets of magnetite and sulfide minerals are present. The main ore body at the Rich Hill mine consisted of a

mass of rich chalcopyrite ore, with little or no associated magnetite, in a fault zone that strikes N. 77° E. and dips from 80° north to vertical. Most of the high-grade ore has been mined but a considerable amount of low-grade material remains.

The fault zone is exposed in the glory hole (see fig. 3) and also in adit 2 (see fig. 4) where the rich chalcopyrite lens pinches out. Low-grade ore is exposed in the north and west drifts of adit 2 (see fig. 4). Some rich chalcopyrite veinlets are present in the low-grade ore but the typical ore is disseminated chalcopyrite and pyrite in greenstone. The fault zone is also exposed on the sub-level of adit 2 and contains disseminated chalcopyrite and pyrite in greenstone.

The west drift of adit 1 was designed to explore the ore body 80 feet below the level of adit 2 but the drift may have been placed too far north (see fig. 4). The upper ends of the two raises from adit 1, however, expose ore which may be the downward extension of that found in the glory hole and in adit 2. A small amount of ore is exposed in the west drift of adit 1 east of the large hornblende-diorite dike; it appears to be localized in a small fault and to be separate from the main ore body.

Disseminated chalcopyrite and pyrite are present at places in a pronounced northerly-trending fault along which adit 1 has been driven for 290 feet. The copper content of this material is probably less than 0.5 percent and the mineralization is thought to have been confined to the immediate vicinity of the fault. A well-defined fault, 110 feet from the portal of adit 2, trends N. 70° W. A drift 65 feet along this fault has exposed no ore.

A short prospect adit (adit 3) 75 feet northwest of the portal of adit 1 extends 22 feet into slightly-mineralized greenstone that contains magnetite and chalcopyrite in joints and fractures.

Mineralized zones

Detailed studies of the Rich Hill area indicate that mineralization took place along certain definite zones (see fig. 2). Three and possibly four mineralized belts have been recognized. All of these zones trend northwesterly and include low-grade deposits of disseminated chalcopyrite, pyrite, and magnetite in greenstone. However, within these mineralized zones may be areas of high-grade magnetite and chalcopyrite. The rich chalcopyrite ore body at the Rich Hill mine was a high-grade mass in zone 3. The mineralized area which includes the mine workings may represent only a part of zone 3, which has not yet been completely traced. Zones 1 and 2 are well established but zone 4 is questionable. These zones contain much unmineralized greenstone and probably not all of the mineralized material is minable under present conditions. However, the zones definitely are areas in which further prospecting seems warranted.

Factors influencing ore deposition

Most of the deposits in the Rich Hill area are in zones which contain disseminated magnetite and sulfide minerals in greenstone. In these zones are scattered masses of high-grade magnetite, pyrite, and chalcopyrite. Magnetite appears to replace fractured greenstone whereas the sulfide minerals for the most part fill a network of fractures in the greenstone and magnetite. The fact that mineralized material is confined mainly to northwesterly-trending belts suggests that some structural control was operative during ore deposition. The mineralized zones in general trend parallel to the strike of the greenstone on Kasaan Peninsula. Whether the ore-bearing zones are localized by certain beds of greenstone or are localized by northwesterly-trending faults is not known.

At the Rich Hill deposit and at other places in the area northeasterly-trending faults have provided local openings in which sulfide minerals and minor amounts of magnetite have been concentrated. This appears to be true of the main chalcopyrite ore body at the Rich Hill mine. There is less indication that faults were an important factor in localizing the deposition of the larger masses of magnetite.

The composition of the country rock also may have been a factor in localizing deposition. In the northwestern part of zone 1 disseminated magnetite, with little or no associated chalcopyrite or pyrite, is the principal ore mineral and the country rock is the typical greenstone composed of feldspar, pyroxene, and epidote. In the southeastern part of zone 1, however, the country rock is a garnet-epidote rock and chalcopyrite and pyrite are the dominant ore minerals; magnetite is much less abundant.

GEOLOGIC INTERPRETATION OF MAGNETIC SURVEYS

In general, vertical magnetic anomalies in the vicinity of the Rich Hill mine are small (see fig. 5). The amount of magnetite associated with the chalcopyrite is not sufficient to affect the dip needle appreciably. However, large deflections were recorded locally where masses of magnetite are known to be present. The largest magnetic anomalies were recorded over a covered area 300 feet south of the glory hole. A maximum dip-needle deflection of 85° N. was noted and within a radius of 75 feet of this magnetic high, horizontal magnetic anomalies of as much as 20 degrees were recorded. It is inferred that a body of magnetite is beneath this covered area. The size of this body of magnetite is not known, nor is it known whether the body is solid magnetite or is disseminated magnetite in greenstone similar to the material found in zone 1 to the south.

Magnetic data from a survey of the prospected area near the beach (see fig. 6) confirms the presence of a northwesterly-trending mineralized zone (zone 1, see fig. 2) as inferred from geologic evidence. The occurrence of large dip-needle deflections over barren greenstone just northeast of the exposed mineralized zone suggests that the zone dips northeast and that the magnetite content of the zone may increase with depth or that the zone persists downward for a distance much greater than its known width.

The large dip-needle deflections in the Rich Hill area might at first suggest that large bodies of magnetite occur in the area, but repeated observations with the Pollard type dip-needle used here indicate that small amounts of magnetite have a considerable effect on the needle. Therefore, the results of the magnetic surveys, though of considerable qualitative value, have but little quantitative significance.

RESERVES

Reserve estimates have been made for zones 1 and 2 and part of zone 3. Only the area adjacent to the glory hole has been considered in the reserve figure for zone 3. The ore exposed in the glory hole, adit 2, and raises 1 and 2 (see fig. 4) is considered as forming a block 100 feet by 35 feet by 80 feet. In the underground workings disseminated chalcopyrite is found to a depth of 80 feet below the rim of the glory hole. Assuming a factor of 10.5 cubic feet to a ton about 27,000 tons of ore are indicated in the Rich Hill mine. No estimate for the inferred tonnage is made, although the body may be considerably larger than is indicated by the exposures.

A chip sample collected by the Geological Survey from the north drift of adit 2 contained 1.40 percent of copper. Another sample from near the top of raise 1 contained 2.00 percent of copper.

Zone 1 is known to be at least 500 feet long, and assuming that it averages 140 feet wide and extends to a depth of 100 feet, the total volume of this block is 7,000,000 cubic feet of which about two-thirds is estimated by inspection to be unmineralized. Assuming a factor of 10 cubic feet to a ton there are 230,000 tons of mineralized material. About 105,000 tons are estimated to carry slightly less than 1 percent of copper and 125,000 tons are estimated to contain 15 percent of iron.

Zone 2 is about 1200 feet long. It averages about 100 feet wide and is estimated to extend to a depth of at least 200 feet. Thus a total of approximately 24,000,000 cubic feet of partially-mineralized greenstone is indicated. Probably two-thirds of this material is waste rock or very sparsely-mineralized greenstone. The remaining

8,000,000 cubic feet comprise about 760,000 tons of sulfide-bearing material, assuming a factor of 10.5 cubic feet to a ton. No samples of this material were taken but it is estimated to be of similar grade to the low-grade ore at the Rich Hill mine and possibly averages 1 percent of copper. It is possible that high-grade bodies similar to the one mined at the Rich Hill glory hole are present in this zone.

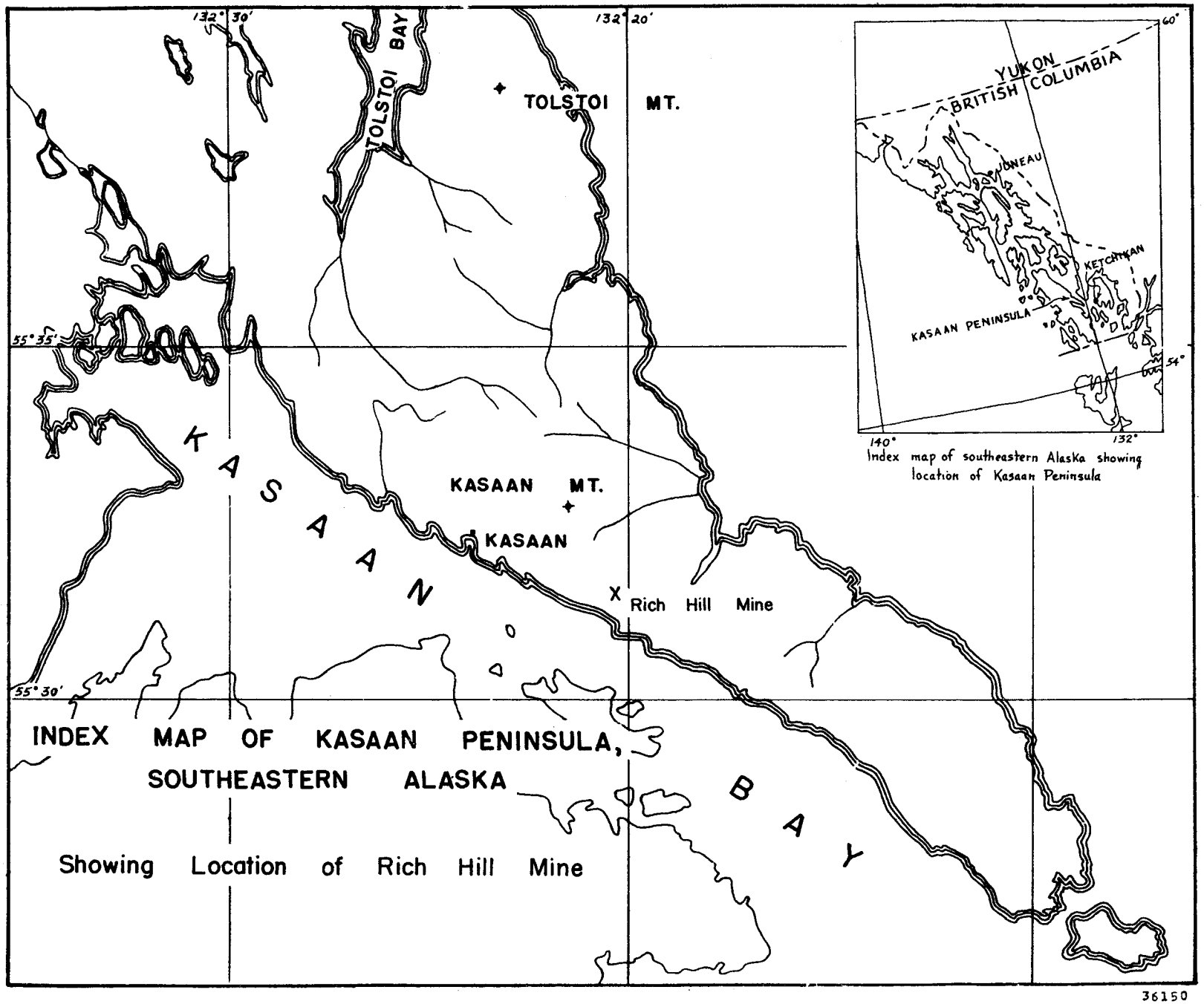
SUGGESTIONS FOR FURTHER EXPLORATION

If further exploration of the Rich Hill area is undertaken, it is recommended that studies be made to determine any possible extension of the mineralized zones and the presence or absence of other zones parallel to those already known. Geologic studies should be supplemented by magnetic surveys. Magnetic studies of zone 2 were not made by the Geological Survey because of time limitations and it is recommended that such studies be made.

Trenching and sampling in zones 1 and 2 is recommended to determine the tenor of the material in these zones.

Under present conditions, the estimated tonnage and grade of ore in the glory hole area at the Rich Hill mine do not appear to warrant diamond drilling. However, should diamond drilling be justified at some future time, the glory hole ore body could be explored by flat holes bearing southerly and westerly from near the end of adit 1.

Magnetic data indicate that a body of magnetite is beneath the covered area 300 feet south of the glory hole. This body could be prospected by drilling vertical holes or sinking a shaft from near the center of the magnetic high, or by driving a short adit from the base of the cliff south of the magnetic high.


132° 30'
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TOLSTOI BAY
TOLSTOI MT.
55° 35'
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KASAAN PENINSULA
KASAAN MT.
KASAAN
X Rich Hill Mine
BAY
INDEX MAP OF KASAAN PENINSULA,
SOUTHEASTERN ALASKA
Showing Location of Rich Hill Mine
YUKON
BRITISH COLUMBIA
JUNEAU
KETCHIKAN
KASAAN PENINSULA
60°
54°
140°
132°
Index map of southeastern Alaska showing location of Kasaan Peninsula
36150

Figure 1