A MINERALOGICAL STUDY OF THE ORE ON NICKEL PLATE MOUNTAIN

Robert Johnson

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HISTORY

The Hedley Gold Mining Company commenced development of the Nickel Plate Mine in 1904. This property was worked until 1930 when the mine was closed down, permanently as was then believed. In 1932, J.W. Mercer of New York acquired the Hedley Company's holdings, and in July, 1933, the Kelowna Exploration Company Limited was formed to operate the property. Since reopening, the Nickel Plate Mine has operated continuously and most successfully.

LOCATION

The Nickel Plate Mine is in Nickel Plate Mountain, which is near the town of Hedley. It is in the Osoyoos mining division and lies about 28 miles north of the international boundary and 1½ miles west of the 120th meridian. The

Hedley district is situated in the Okanagan range of southern British Columbia, where the rather gentle uplift is deeply dissected by the canyons of the Similkameen and its tributaries.

Hedley, on a spur of the Great Northern Railway, is 25 miles to the southwest of Princeton, which lies on the Kettle Valley line of the Canadian Pacific Railway. The Trans-Canada highway connects Hedley with Princeton and the Okanagan Valley.

GENERAL GEOLOGY

The ore deposits so far discovered lie in the upper portion of the Nickel Plate Mountain where a series of westward dipping Triassic sedimentary rocks have been intruded by large bodies of igneous rock of later Mesozoic or possibly Tertiary age. The ore, of the contact metamorphic type, consists of gold-bearing arsenopyrite in a gangue of metamorphic silicates. Replacement has played an important part in determining the position and size of the many ore shoots. The ore deposition has been controlled mainly by structural features such as minor folding.

MINERALOGY OF NICKEL PLATE ORE

The specimens examined were part of a suite of samples obtained by the Geology department from the Kelowna Exploration Company-operators of Nickel Plate Mountain. Samples of the top and middle of the Red Ore body, the top, middle, and bottom of the Orange Ore body, and the middle and bottom of the Yellow Ore body were hand-polished and examined. Unfortunately, since the cobalt minerals, gold, and sphalerite occur in particles generally less than 15 microns in their maximum dimensions, microscopic examination of the hand-polished sections revealed very little of the mineralogy of the ore. Samples of the top red and the middle yellow ore bodies were superpolished; these particular specimens were chosen since previous assays indicated high gold and cobalt values, and the lack of polishing facilities did not permit the superpolishing of more than two sections.

In the few samples that were examined, the following metallic lustred minerals, in order of particle size, have been identified:

Arsenopyrite
Pyrrhotite
Pyrite
Chalcopyrite
Loellingite-Safflorite
Gold
Sphalerite

Arsenopyrite

Arsenopyrite was seen in every specimen under straight microscopic examination and is the most important mineral in the ore. The section of middle yellow ore contained about 70% arsenopyrite, and 20% siliceous gangue; although only 5% arsenopyrite was visible in the top red specimen it was again the most abundant metallic lustred mineral.

The arsenopyrite is generally massive, but where the particles are small in relation to the gangue around, it is frequently seen in its crystal form; this is especially evident in the top red specimen. Small fractures and inclusions exist in fair quantity throughout the arsenopyrite. A carbonate, probably calcite, is the gangue mineral in the fractures; effervescence usually occurred when acids, from the etching of the metallic lustred minerals in the inclusions, touched the gangue material.

Pyrrhotite

Pyrrhotite is quite scattered throughout the ore. While not occurring in any amount in one place, it is the most abundant mineral after arsenopyrite. Pyrrhotite occurs as blebs in the arsenopyrite and epidote and also as well-defined veins in the arsenopyrite. The only mineral in intimate association with pyrrhotite is sphalerite.

Pyrite

Pyrite was observed in most of the specimens but in very small amounts. In only one specimen - the middle red ore - was there an appreciable quantity present.

Chalcopyrite

Chalcopyrite was found only in the superpolished specimens and is fairly rare. When present, it is usually found next to pyrrhotite in arsenopyrite.

Loellingite-Safflorite

The loellingite-safflorite was found as minute inclusions, and occasionally as very short veins, in the arsenopyrite. The inclusions are very fine, the largest around 25 microns with the average below 15 microns. These particles were difficult to identify because of the slight difference in hardness and colour between arsenopyrite and loellingite-safflorite. Etch and microchemical tests were used to distinguish between the two. Where the two minerals were close together, the slight differences in colour and hardness were readily apparent.

The loellingite-safflorite inclusions were not uniformly distributed throughout the arsenopyrite but tended to occur in scattered groups. These groups were not tested individually but any small inclusions of a hard grey mineral, generally associated with gold, observed in the arsenopyrite were assumed to be loellingite-safflorite. Because the physical properties and the etch reactions of loellingite and safflorite are very similar, no attempt was made to distinguish between the two.

Gold

Gold could not be seen in the hand-polished specimens; only upon examination of superpolished sections could the occurrence of gold in the ore be detected. The gold is fine-grained - the average particle being of the order of 10 microns in size. Most of the gold was observed in fractures in the arsenopyrite although several gold particles appeared in the massive arsenopyrite.

The gold in the inclusions is often intimately associated with the loellingite-safflorite and calcite. The calcite was probably responsible for the deposition of the gold and loellingite-safflorite in the fractures.

Sphalerite

Sphalerite is the rarest metallic lustred mineral in the ore specimens. It was detectable only by its brown internal reflection under the carbon arc. Under the carbon arc, several small blebs of pyrrhotite exhibited a brown mottled appearance - indicating grains of sphalerite, which were invisible in ordinary light under quite high magnification.

PARAGENESIS

From a study of the different polished sections, it is apparent that the siliceous gangue was formed first. The arsenopyrite was probably the first metallic lustred mineral to be introduced. It is predominantly massive, acting as the matrix for most of the valuable minerals. The pyrite might possibly have crystallized contemporaneously with the arsenopyrite since the pyrite shows a tendency to occur in euhedral grains.

The next minerals to be deposited were pyrrhotite, chalcopyrite, and sphalerite - all crystallizing out about the same time. Blebs and veins of pyrrhotite in the silicates and arsenopyrite are quite common. Chalcopyrite and pyrrhotite were found together with mutually rounded boundaries. Very small grains of sphalerite were seen in the pyrrhotite.

The presence of gold and loellingite-safflorite in the calcite stringers indicates that these minerals were probably the last to be deposited. However, since gold particles were observed in the massive arsenopyrite, some of the gold must have been deposited contemporaneously with the arsenopyrite.

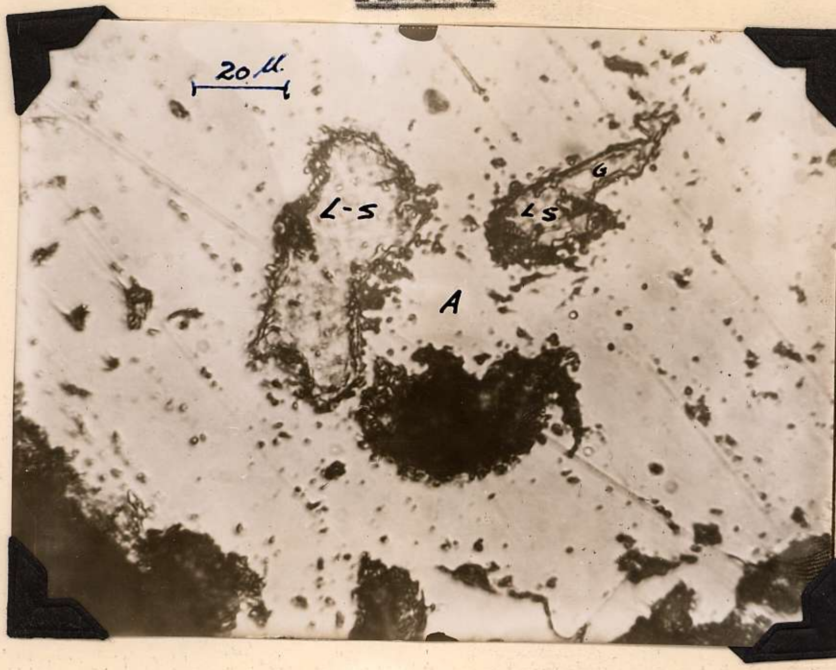
COMMENTS

It is quite understandable why high gold recoveries by cyanidation are difficult to obtain. The gold is extremely fine-grained and can be satisfactorily separated from the gangue only by very fine grinding. Also the gold, in certain instances, was found directly associated with the arsenopyrite.

The cobalt content of the ore is quite low, and the cobalt minerals are found as minute inclusions in the arsenopyrite . A sufficiently rich cobalt concentrate could not be made, although cobalt could be recovered, as is sometimes done, as a by-product.

Since chalcopyrite and sphalerite are uncommon in the ore, zinc and copper could not be profitably recovered.

Plate 1



Mag. 648

Loellingite-safflorite and gold in arsenopyrite.

Top of red ore body.

The loellingite-safflorite inclusions show the boundaries of calcite. The dark blobs of material are siliceous gangue.

Plate II - Mag. 648
Chalcopyrite in arsenopyrite
surrounded by siliceous gangue.
Top of red ore body.

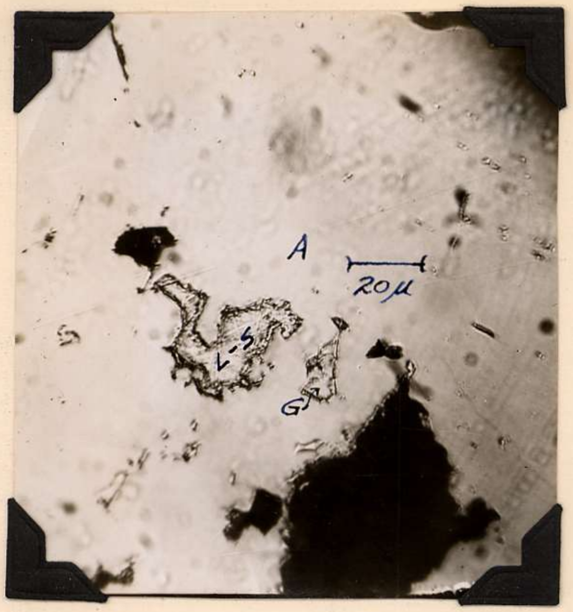


Plate III - Mag. 485
Loellingite-safflorite and gold in arsenopyrite.
Top of red ore body.

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