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MINERALOGICAL INVESTIGATION OF A COPPER-NICKEL ORE FROM THE E-L MINE, ISKUT RIVER AREA, NORTHERN BRITISH COLUMBIA

by

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MINERAL SCIENCES DIVISION

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SUMMARY OF RESULTS

A mineralogical study of lump samples from a surface trench of a copper-nickel deposit in the Iskut River area of British Columbia shows that the ore minerals of economic interest are principally chalcopyrite and a secondary nickel sulphide, with lesser amounts of covellite and pentlandite. The proportion of supergene to hypogene minerals varies from sample to sample, and there are also variations in size of grains within individual samples.

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INTRODUCTION

Oxidized samples from a surface trench from the E-L mine, Iskut River area, northern British Columbia, were received from A. Stemerowicz of the Mineral Processing Division of the Mines Branch on February 9, 1966. Mr. Stemerowicz stated that the samples had been submitted by W. Dunn, superintendent of exploration, Silver Standard Mines Ltd. (N.P.L.), 808-602 West Hastings Street, Vancouver, B. C. The samples consisted of oxidized lump ore from a surface trench, as well as a crushed head sample. Mr. Stemerowicz's accompanying statement indicated that "average grades calculated for the known ore are 0.7% Ni and 0.6% Cu."

METHOD OF INVESTIGATION

The crushed head sample was screened and the -65+100 mesh portion was separated into two density fractions by means of a heavy liquid with a specific gravity of 3.33. Six polished sections and one thin section were prepared from the lump samples, and several polished sections were prepared from the separated mineral fractions. The minerals were identified by microscopic and X-ray diffraction studies, and the textural relationships of the minerals were determined microscopically.

RESULTS OF THE INVESTIGATION

The lump ore samples consist largely of disseminated ore minerals* in gangue. The ore minerals consist chiefly of masses and disseminations of pyrrhotite and chalcopyrite, with minor amounts of a secondary nickel sulphide, pentlandite, covellite, pyrite, sphalerite (?), bornite, ilmenite, lepidocrocite, and goethite. The gangue consists of coarse-grained, altered feldspars, pyroxenes, and amphiboles. There are alteration rims of chlorite and talc (?) around the amphibole grains, and amphibole and chlorite rims around the pyroxene grains. There is also a little quartz present.

Detailed Mineralogy

The principal ore mineral is pyrrhotite. It occurs as disseminations and irregular grains, varying considerably in size from less than about 5 microns to over 3000 microns. The grains contain inclusions of nearly all the ore minerals reported above (see Figures 1 and 2). Most of the pyrrhotite appears to be of the monoclinic variety, but there may also be some of the hexagonal variety present.

The chalcopyrite is the next most abundant ore mineral and varies in size from less than one micron to over 3000 microns. It is intimately associated with pentlandite, pyrite, pyrrhotite, and secondary nickel sulphide (Figures 3 and 4). Rims of supergene copper sulphides (such as covellite

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* The term "ore mineral" as used in this report does not necessarily have an economic connotation.

occur, and in some cases the chalcopyrite has been completely converted to covellite. However, primary chalcopyrite was by far the principal copper sulphide in the sections examined.

The primary nickel mineral (pentlandite), on the other hand, has been mostly altered to a secondary nickel sulphide. The cell-edge lies between that of siegenite $(Co, Ni)_3S_4$ and violarite $(Ni, Fe)_3S_4$. The pentlandite varies from about less than one micron to about 350 microns in size. The secondary nickel sulphide typically occurs as octagonal-shaped grains with an irregular cubic or octagonal fracture pattern (Figure 3). It also varies considerably in size, from less than one micron to over 350 microns (Figures 2 and 5).

The pyrite grains vary in shape from cubes (Figures 1 and 4), irregular masses, and veins cutting across pyrrhotite (Figure 5). These veins contain small inclusions of chalcopyrite. Pyrite was also observed forming encrustations in cavities.

The other minerals reported above are present in much smaller quantities.

<u>Mineralogy of the Head Sample</u>

Estimates of the proportions of ore and gangue minerals, and of the liberation characteristics of the ore minerals in the -65+100 mesh fraction, were made by means of microscopic examination of polished sections prepared from the products of heavy-liquid separations. The ore minerals constituted only about 5% of the fraction with a specific gravity less than 3.33, and occurred as attached grains. Approximately 15 to 18% of the fraction with a specific gravity greater than 3.33 consisted of ore minerals, over 50% of which were pyrrhotite grains. Approximately 50% of the chalcopyrite and secondary nickel sulphide plus pentlandite present in the heavier than 3.33 fraction was free of gangue and other inclusions.

CONCLUSIONS

Both primary and supergene copper and nickel sulphides constitute the ore minerals of economic interest. The proportion of primary to secondary sulphides varies markedly from hand sample to hand sample and probably indicates a shallow depth of supergene alteration, or samples taken in the border zone between primary and supergene mineralization.

Some of the factors that would be expected to adversely affect the beneficiation of the ore are:

1. The friable nature of the secondary nickel sulphide.
2. Some of the chalcopyrite is coated by covellite.
3. Some of the chalcopyrite is intimately intergrown with pyrite.
4. The presence of numerous fine-grained gangue inclusions in the ore.

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(Figures 1-5 follow,)
(on pages 5 to 7.)

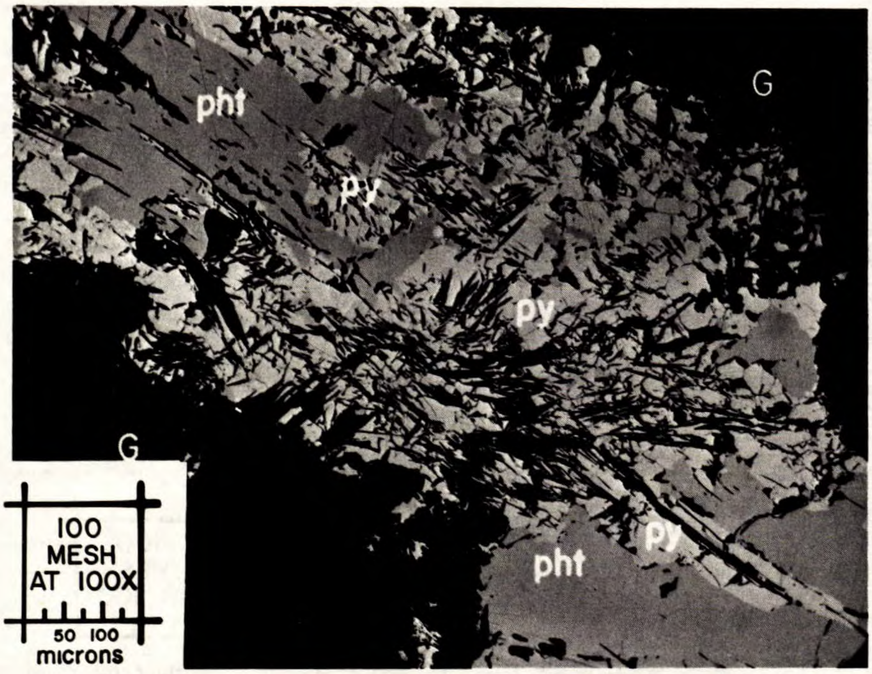

Figure 1. Photomicrograph of polished section showing large pyrrhotite (pht) grains containing smaller grains of pyrite (py) and gangue (G).

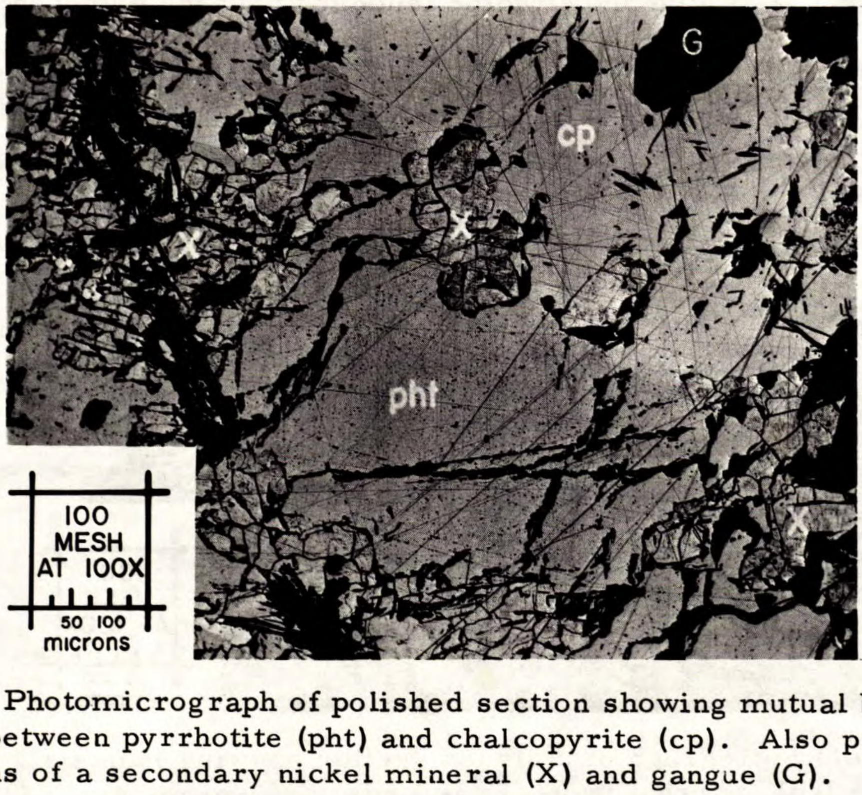

Figure 2. Photomicrograph of polished section showing mutual boundary texture between pyrrhotite (pht) and chalcopyrite (cp). Also present are inclusions of a secondary nickel mineral (X) and gangue (G).

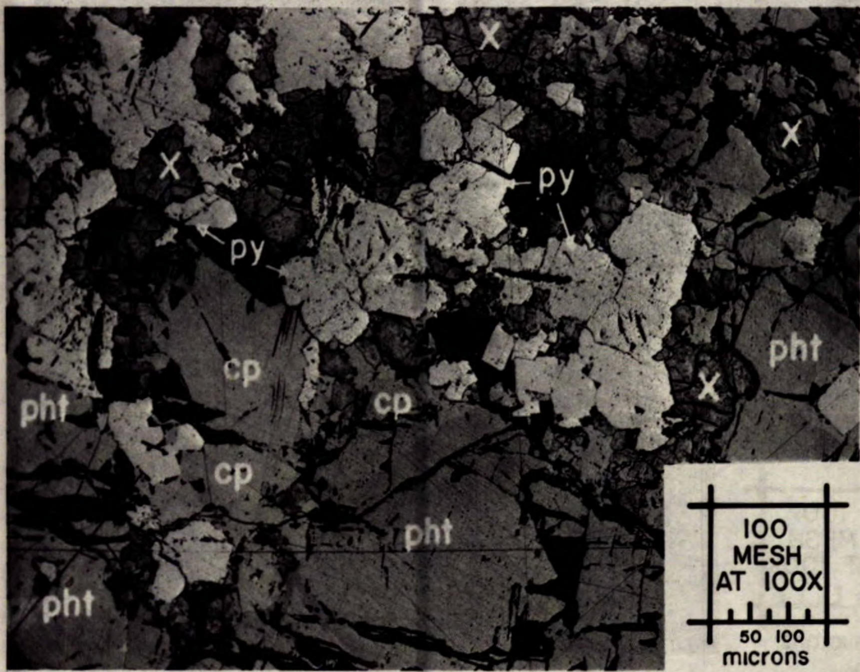

Figure 3. Photomicrograph of polished section showing a typical assemblage of pyrrhotite (pht), pyrite (py), chalcopyrite (cp), and the secondary nickel mineral (X) which shows some tendency towards octagonal cleavage.

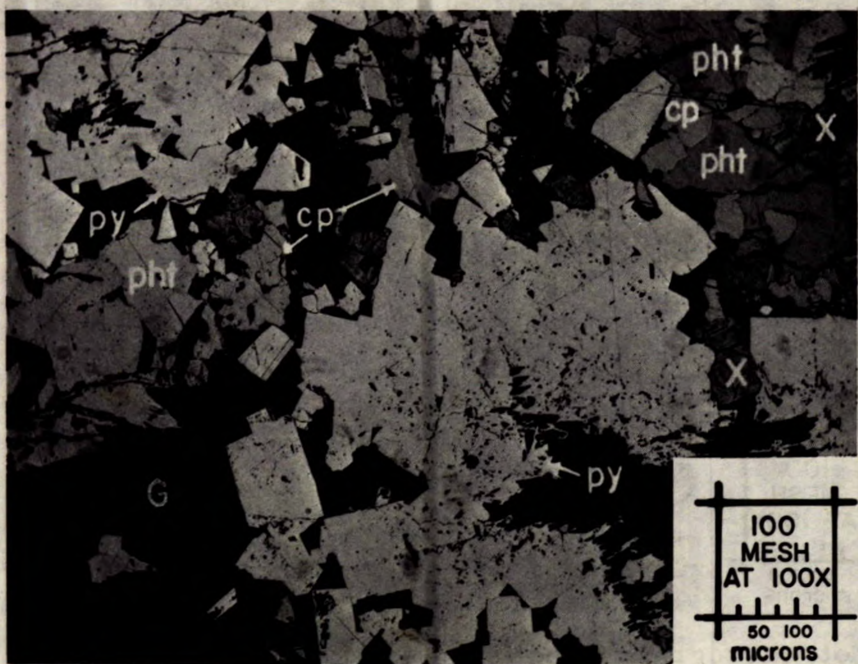

Figure 4. Photomicrograph of polished section showing isometric pyrite (py), chalcopyrite (cp), pyrrhotite (pht), secondary nickel mineral (X), and gangue (G).

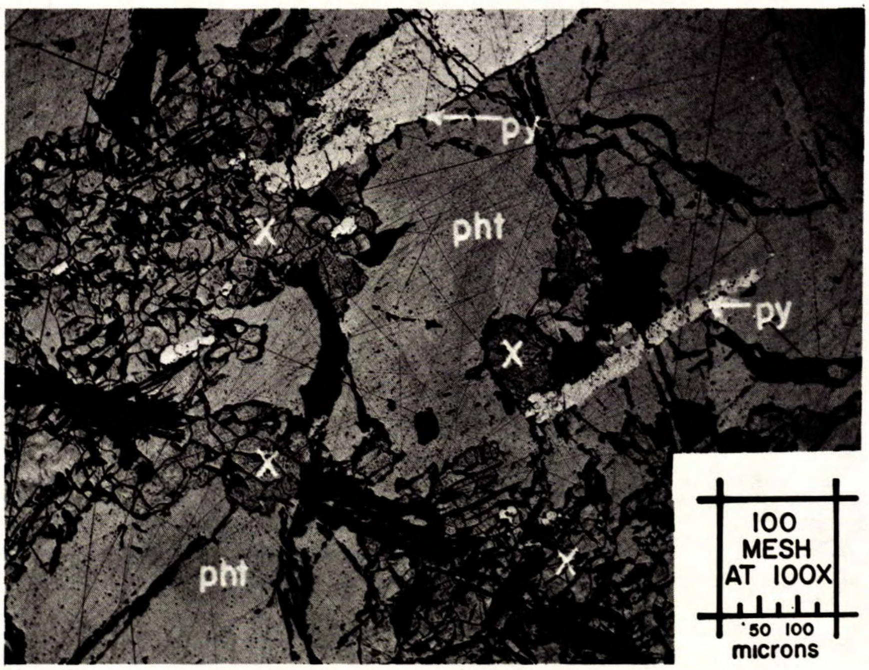

Figure 5. Photomicrograph of polished section showing large grains of pyrrhotite (pht) cut by veins of pyrite (py). The pyrite contains intimate intergrowths of chalcopyrite which cannot be seen in this photomicrograph because of lack of contrast. The secondary nickel mineral (X) is also present.