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MINERALOGICAL INVESTIGATION OF A COPPER-LEAD-SILVER ORE FROM THE BLUE HILL AREA IN MAINE, U. S. A. FOR BLACKHAWK MINING COMPANY

by

W. PETRUK & D. OWENS

MINERAL SCIENCES DIVISION

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SUMMARY OF RESULTS

The copper-lead-silver ore from the Blue Hill area in Maine, U.S.A. contains a wide variety of minerals. The principal copper- and lead-bearing minerals are chalcopyrite and galena respectively, and the silver-bearing minerals are native silver, tetrahedrite and pyrargyrite. The chalcopyrite and galena occur as disseminations in gangue and the silver-bearing minerals are present largely as inclusions in other metallic minerals. Other metallic minerals in the ore are pyrrhotite, sphalerite, pyrite, boulangerite, arsenopyrite, safflorite, gudmundite, marcasite, molybdenite, rutile and ilmenite. The non-metallic minerals are quartz, feldspar, chlorite, pyroxene, amphibole, garnet and calcite.

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INTRODUCTION

Samples of a copper-lead-silver ore from the Blue Hill area in Maine, U.S.A. were received from R.P. Bailey of the Mineral Processing Division on May 28, 1964. Mr. Bailey stated that the samples were submitted to the Mines Branch by Blackhawk Mining Company Limited, 4 King Street West, Toronto, Ontario, and requested that they be studied mineralogically. The samples received consisted of a head sample crushed to about -10 mesh and split drill core labelled Sample Nos. 21, 22, 23, 25 and 27.

METHOD OF INVESTIGATION

The -65 to +200 mesh portion of the crushed head sample was screened out, and separated into density fractions by a series of heavy-liquid separations (specific gravity = 2.96, 3.33 and 3.7). To assist in identifying the ore minerals and studying their intergrowths, polished sections were made from the split drill core samples and from the separated fraction with the highest density. These were examined by a microscope. The other fractions, which consisted primarily of gangue minerals, were studied in oil immersion mounts by means of a petrographic microscope. X-ray powder diffraction analysis was also used in identification. The ore microscopy and X-ray diffraction analyses were carried out by D.R. Owens and verified by W. Petruk, and the petrographic studies were made by W. Petruk. The report was prepared jointly.

RESULTS OF INVESTIGATION

The drill core samples are composed of disseminated metallic minerals in gangue. The metallic minerals are galena (PbS), chalcopyrite ($CuFeS_2$), pyrrhotite ($Fe_{1-x}S$), sphalerite (ZnS), pyrite (FeS_2), native silver (Ag), tetrahedrite ($(CuAgFe)_{12}Sb_4S_{13}$), boulangerite ($Pb_5Sb_4S_{11}$), pyrargyrite (Ag_3SbS_3), arsenopyrite (FeAsS), safflorite ($(Co,Fe)As_2$), gudmundite (FeSbS), marcasite (FeS_2), molybdenite (MoS_2), rutile (TiO_2), ilmenite ($FeTiO_3$), a mineral that is similar to boulangerite, and one that has been tentatively identified as petzite. The non-metallic minerals are quartz, feldspar, chlorite, pyroxene, amphibole, garnet and calcite.

Galena, chalcopyrite, pyrrhotite, and sphalerite are the principal metallic minerals. They occur as irregular grains (see Figure 1), elongated bodies (see Figure 2), and minute blebs in gangue (see Figure 3), and range downward in size from about 1 millimeter. The larger grains

frequently contain smaller inclusions of other ore minerals.

The native silver occurs as minute blebs in galena, chalcopyrite, pyrrhotite, tetrahedrite, and the boulangerite-type mineral, and as in fine-grained intergrowths with these minerals (see Figures 4, 5 and 6).

The pyrite, tetrahedrite, boulangerite, pyrargyrite, arsenopyrite, safflorite, gudmundite, marcasite, the boulangerite-type mineral and petzite (?) occur as inclusions in metallic minerals and as irregular grains in gangue (see Figure 7 and 8). They range from about 1 to 200 microns in size. The boulangerite-type mineral has optical and X-ray diffraction properties similar to those of boulangerite but these properties are not distinctive enough to permit a positive identification. The petzite (?), found only as intergrowths with pyrrhotite and chalcopyrite, has optical properties similar to those of petzite, but it is present as such small grains that it cannot be definitely identified.

Molybdenite (see Figure 9), rutile and ilmenite were found only as isolated grains in gangue.

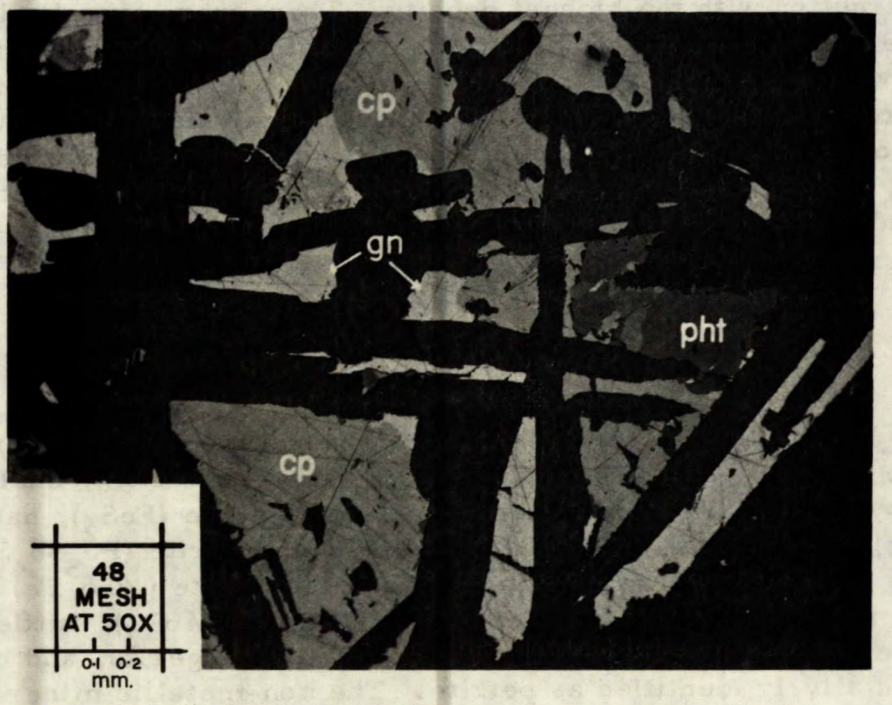

Figure 1. Photomicrograph of a polished section of Sample 25 showing irregular grains of chalcopyrite (cp), galena (gn) and pyrrhotite (pht) in gangue (black).

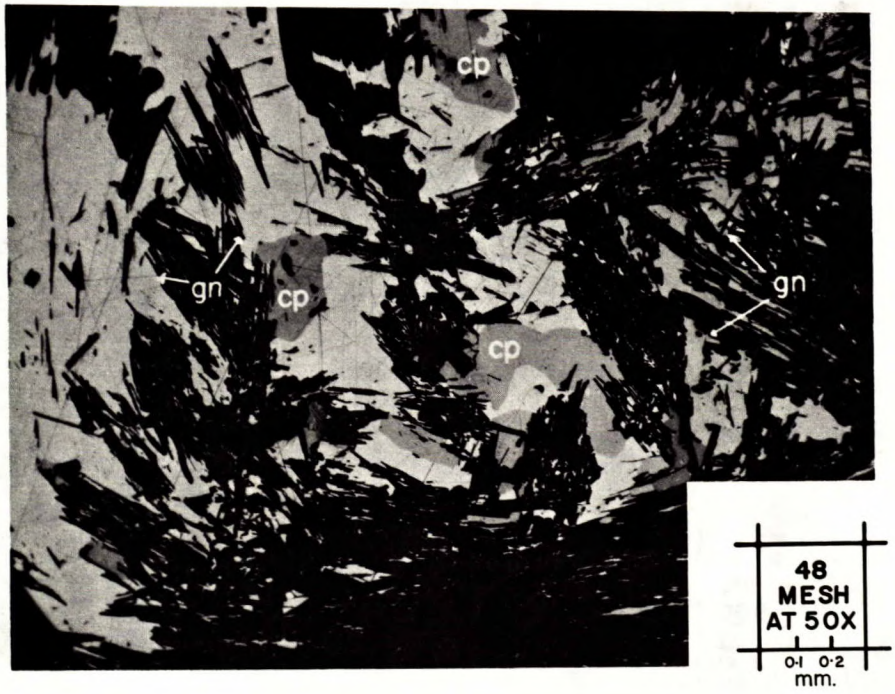

Figure 2. Photomicrograph of a polished section of Sample 25 showing galena (gn) and chalcopyrite (cp) in gangue (black).

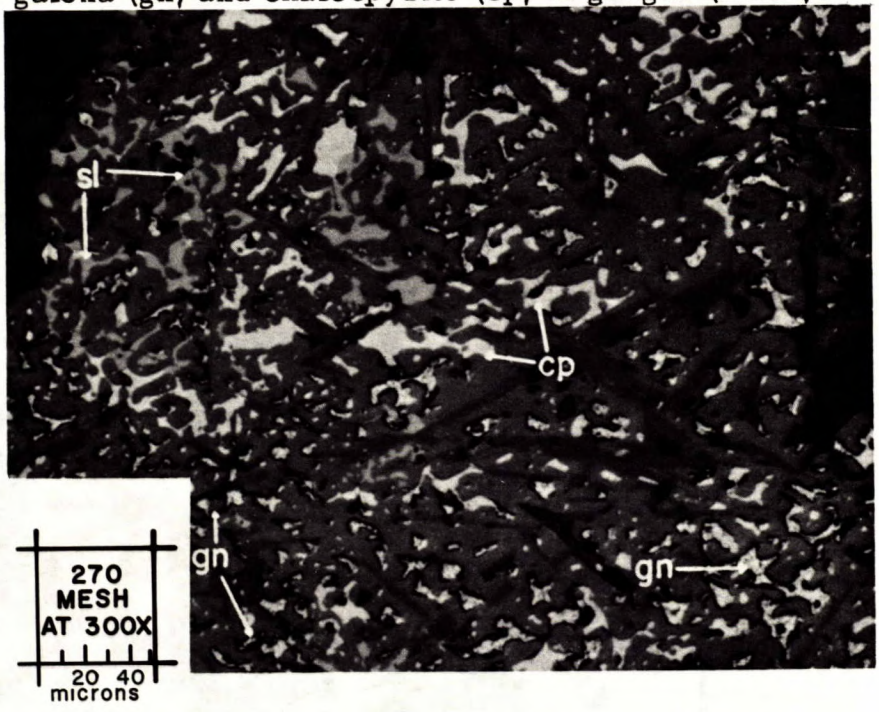

Figure 3. Photomicrograph of a polished section of Sample 21 showing minute blebs of chalcopyrite (cp), galena (gn) and sphalerite (sl) in gangue (grey).

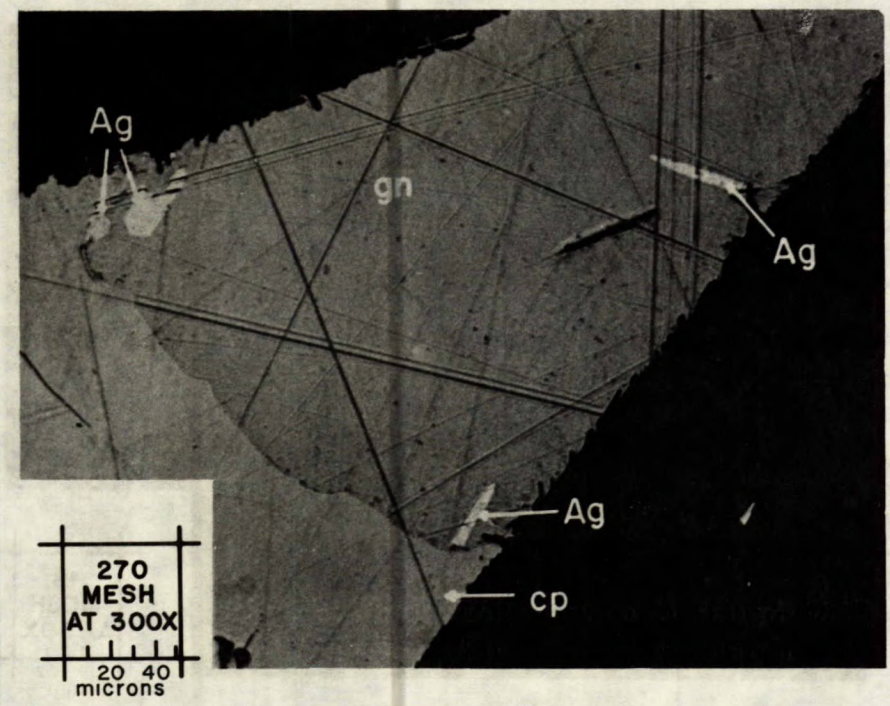

Figure 4. Photomicrograph of a polished section of Sample 25 showing inclusions of native silver (Ag) in galena (gn). The area marked (cp) represents chalcopyrite, and the black area represents gangue.

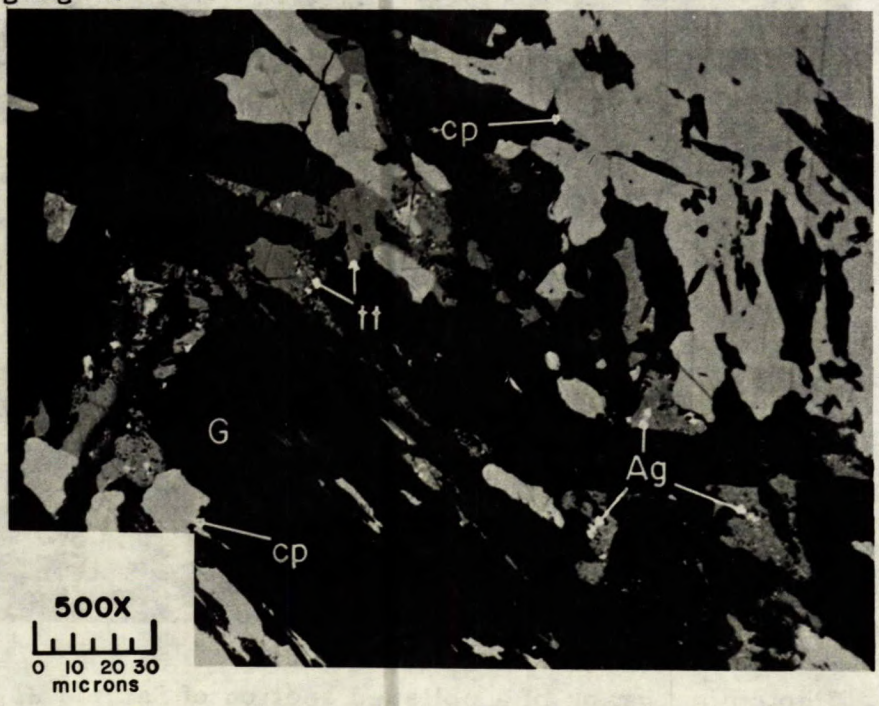

Figure 5. Photomicrograph of a polished section of Sample 22 showing chalcopyrite (cp), tetrahedrite (tt) and inclusions of native silver (Ag) in tetrahedrite. The black area represents gangue.

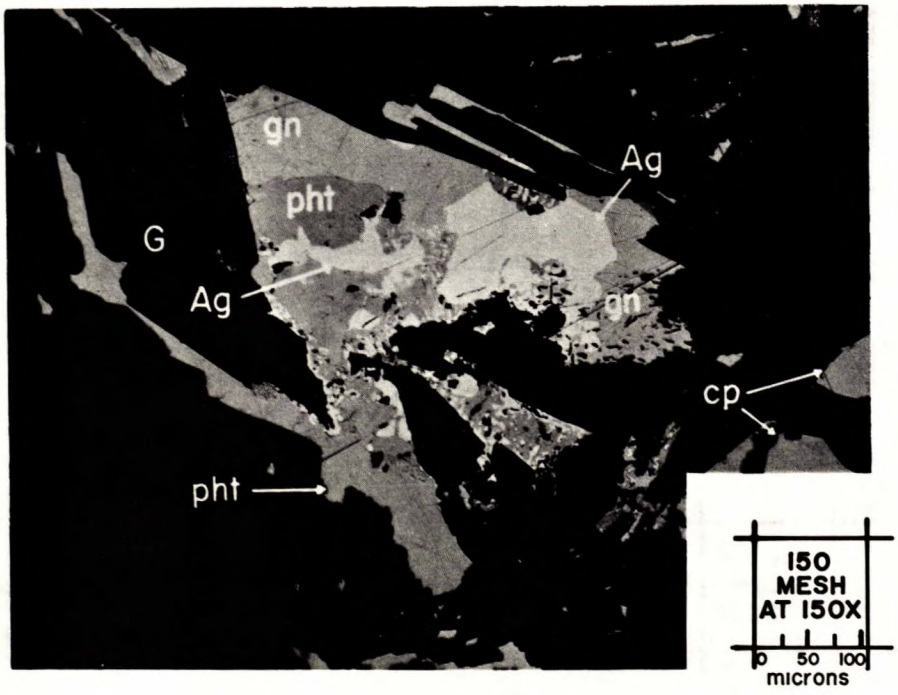

Figure 6. Photomicrograph of a polished section of Sample 22 showing native silver (Ag) in galena (gn) and pyrrhotite (pht). The areas marked (cp) and (G) represent chalcopyrite and gangue respectively.

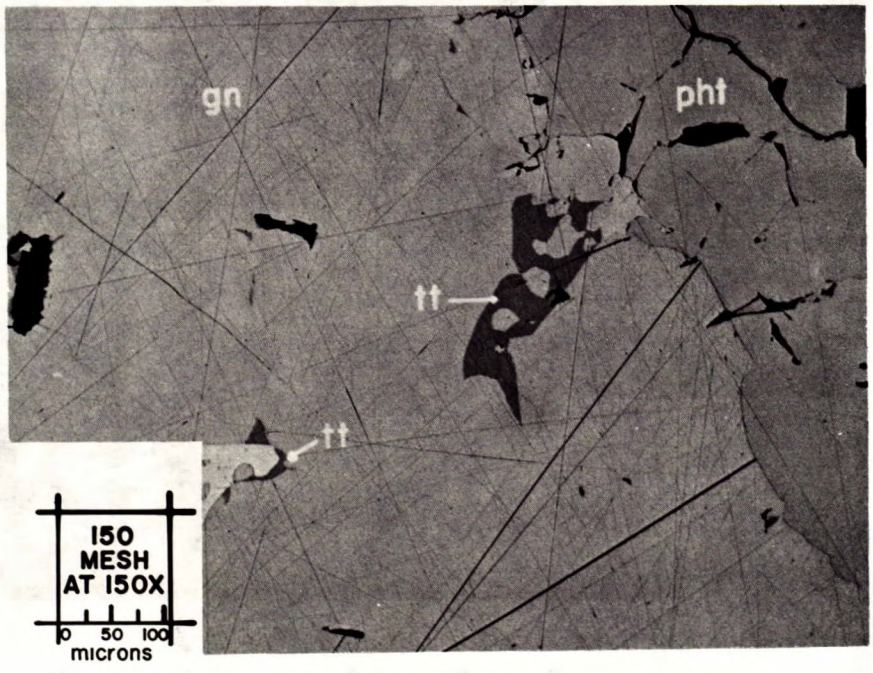

Figure 7. Photomicrograph of a polished section of Sample 25 showing galena (gn), pyrrhotite (pht) and tetrahedrite (tt).

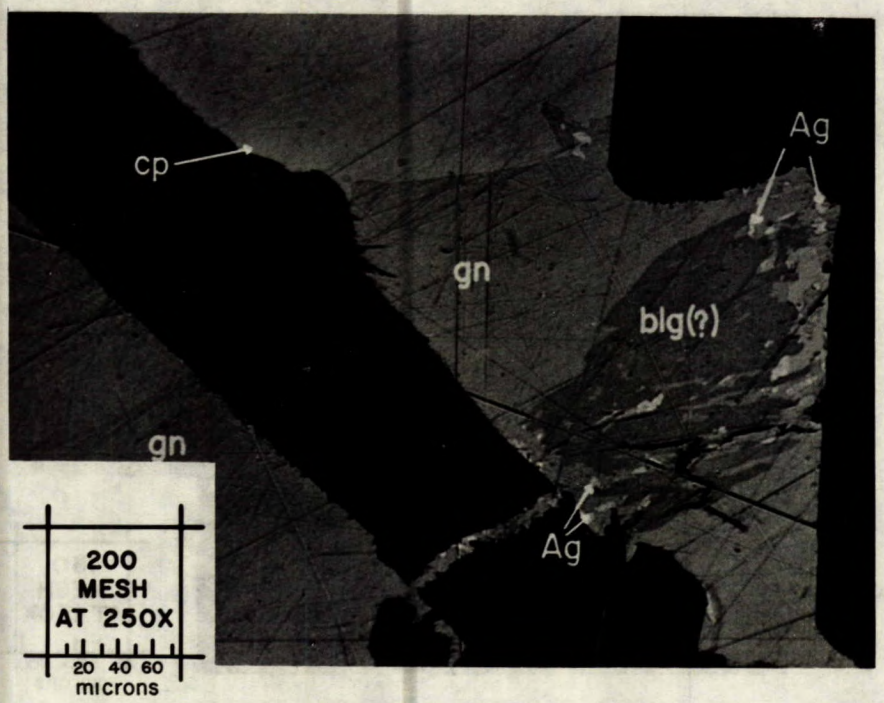

Figure 8. Photomicrograph of a polished section of Sample 25 showing galena (gn), chalcopyrite (cp), the boulangerite-type mineral (blg (?)), and native silver (Ag).

Figure 9. Photomicrograph of a polished section of Sample 23 showing a grain of molybdenite (light grey), some galena (white) and gangue (dark grey).

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