CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

OTTAWA

MINES BRANCH INVESTIGATION REPORT IR 65-67

MINERALOGICAL EXAMINATION OF A DIAMOND DRILL CORE SAMPLE OF A ZINC-LEAD-SILVER ORE FROM THE TEXAS GULF SULPHUR DEPOSIT IN KIDD TOWNSHIP, ONTARIO

by

W. PETRUK & D. OWENS

MINERAL SCIENCES DIVISION

COPY NO. 27

AUGUST 24, 1965

Mines Branch Investigation Report IR 65-67

MINERALOGICAL EXAMINATION OF A DIAMOND DRILL CORE SAMPLE OF A ZINC - LEAD - SILVER ORE FROM THE TEXAS GULF SULPHUR DEPOSIT IN KIDD TOWNSHIP, ONTARIO

by

W. Petruk * and D. Owens**

SUMMARY OF RESULTS

A diamond drill core sample of a zinc - lead - silver ore from the Texas Gulf Sulphur deposit in Kidd Township, Ontario was investigated mineralogically. The investigation revealed that the sample consists primarily of sphalerite, pyrite and galena. The sphalerite and pyrite occur largely as masses and disseminations in gangue, and contain inclusions of the other minerals in the ore. The galena occurs as irregular masses and inclusions in the sphalerite, pyrite and gangue. Significant amounts of silver are also present. It occurs mainly as native silver but also as a constituent of acanthite, pyrargyrite, stephanite, pearceite and tetrahedrite (?). Other minerals identified in the sample are chalcopyrite, covellite, digenite, bornite, cassiterite, pyrrhotite, marcasite, rutile, quartz, calcite, chlorite, pyroxene, sericite, siderite and graphite.

*Senior Scientific Officer and ** Technician, Mineralogy Section, Mineral Sciences Division, Mines Branch, Department of Mines and Technical Surveys.

INTRODUCTION

A diamond drill core sample of a zinc - lead - silver ore from Kidd Township in Ontario was received from A. Stemerowicz of the Mineral Processing Division on February 1, 1965. Mr. Stemerowicz stated that the sample was submitted to Mines Branch by Mr. R.J.C. Tait, Texas Gulf Sulphur Limited, P.O. Box 430, Lakefield, Ontario, and requested that it be studied mineralogically. As received, the sample consisted of about 200 grams of diamond drill core crushed to about - 10 mesh, and a number of larger diamond drill core fragments.

METHOD OF INVESTIGATION

The crushed material was screened and sized. A representative portion of the -200 + 325 mesh fraction was separated into a metallic mineral concentrate and a gangue fraction by means of a heavy liquid having a specific gravity of 3.30. Polished sections were prepared from the -200 +325 mesh metallic mineral concentrate and four heavily mineralized diamond drill core fragments. One thin section was prepared from a weakly mineralized diamond drill core fragment. The minerals were identified by microscopical and X-ray diffraction studies of the polished and thin sections, and an X-ray diffractometer study of the -200 +325 mesh gangue fraction.

RESULTS OF INVESTIGATION

The minerals found in the sample are sphalerite, pyrite, galena, native silver, acanthite, pyrargyrite, stephanite, pearceite, tetrahedrite(?), chalcopyrite, covellite, digenite, bornite, cassiterite, pyrrhotite, marcasite, rutile, quartz, calcite, chlorite, pyroxene, sericite, siderite and graphite. Sphalerite and pyrite are the principal minerals in the sample. The sphalerite is present as coarse masses, matrix-like material interstitial to pyrite (see Figure 1), and disseminations in gangue (see Figure 2). It contains numerous inclusions of pyrite and the other minerals. The pyrite inclusions are present as irregular grains, cubic crystals, and skeletal remnants (see Figure 3).

The pyrite occurs as masses, inclusions in sphalerite, and disseminations in gangue. The masses contain veinlets and irregular grains of other minerals (see Figure 4).

The galena is present as irregular masses and as inclusions in sphalerite (see Figure 5), pyrite (see Figure 4), and gangue. The galena present in sphalerite and gangue varies from a few microns to about 600 microns; that present in pyrite is finer grained. Some of the large galena grains contain inclusions of pyrrhotite (see Figure 6), sphalerite, pyrargyrite, stephanite and gangue.

The silver occurs mainly as the native metal, but a small amount is present as a constituent of acanthite, stephanite, pyrargyrite, pearceite and tetrahedrite(?). The native silver occurs as veinlets and inclusions in pyrite (see Figure 4), minute rounded blebs in sphalerite (see Figure 7), fine-grained inclusions in gangue, and irregular grains along the boundaries between sphalerite, pyrite, galena and gangue (see Figure 8). Most of the native silver is fine grained and varies from about 5 to 150 microns in diameter. The rounded blebs in sphalerite have an average size of about 25 microns; the grains occurring elsewhere are larger. The acanthite occurs as fine-grained inclusions in pyrite (see Figure 9) and as borders along the edge of native silver. The pyrargyrite and stephanite occur as inclusions in galena and as irregular grains associated with galena (see Figures 6 and 10). The acanthite, pyrargyrite and stephanite do not exceed 75 microns in size, and it is estimated that their average size is about 30 microns. Pearceite was found only as a free grain in the metallic mineral concentrate. The tetrahedrite(?) occurs as fine-grained inclusions in sphalerite (see Figure 11). These inclusions vary from 5 to 35 microns in size and are too small to identify positively. Their optical properties, however, are similar to those of tetrahedrite.

The copper-bearing minerals are chalcopyrite, covellite, digenite, bornite and tetrahedrite(?). Chalcopyrite is the main copper-bearing mineral. It occurs as minute rounded blebs (see Figure 11) and as larger inclusions in sphalerite and pyrite. The larger inclusions vary up to 55 microns in size. The covellite and digenite occur as very narrow borders on a few sphalerite grains and as minute veinlets and irregular grains in sphalerite. Bornite was found only as a free grain in the metallic mineral concentrate.

A small quantity of cassiterite is also present. It occurs predominantly as rounded and irregular grains in sphalerite (see Figure 12) and gangue. These grains vary from about 5 to 70 microns in size.

Pyrrhotite, marcasite and rutile were also found in the sample. The pyrrhotite occurs mainly as inclusions in sphalerite and galena (see Figure 6), and these inclusions vary from about 5 to 100 microns in size. The marcasite and rutile were found only as a few free grains in the metallic mineral concentrate.

Other minerals identified in the sample are quartz, calcite, chlorite, pyroxene, sericite, siderite and graphite.

CONCLUSIONS

The textural relationships listed below are considered to have a bearing on the recovery of the metals from the ore. Each point, however, would have to be assessed by ore beneficiation tests to determine its validity.

1) The sphalerite, present as relatively large grains, contains inclusions of other minerals. This suggests that it may be possible to liberate and recover most of the sphalerite, but the resulting zinc concentrate would probably contain some copper, silver, lead and tin.

2) The copper-bearing minerals occur only as small grains in the sphalerite and pyrite, and it is doubtful whether a high-grade copper concentrate can be obtained from this ore.

3) The galena occurs as fine-to coarse-grained inclusions in the other minerals. This suggests that it may be easy to recover and concentrate the coarse galena grains but difficult to recover and concentrate the finer ones.

4) The silver is present as fine-grained native silver and, to a small extent, as a constituent of silver sulphides. The native silver grains occur in pyrite, sphalerite, gangue and along grain boundaries. It is probable that the largest grains can be liberated by normal grinding but the small ones would remain locked. The extent to which this would effect the recovery of silver from the ore cannot be predicted.

5) The cassiterite occurs as fine-grained inclusions in sphalerite and gangue. It is probable that the larger grains can be liberated by normal grinding but the smaller ones would remain locked in the sphalerite and gangue.

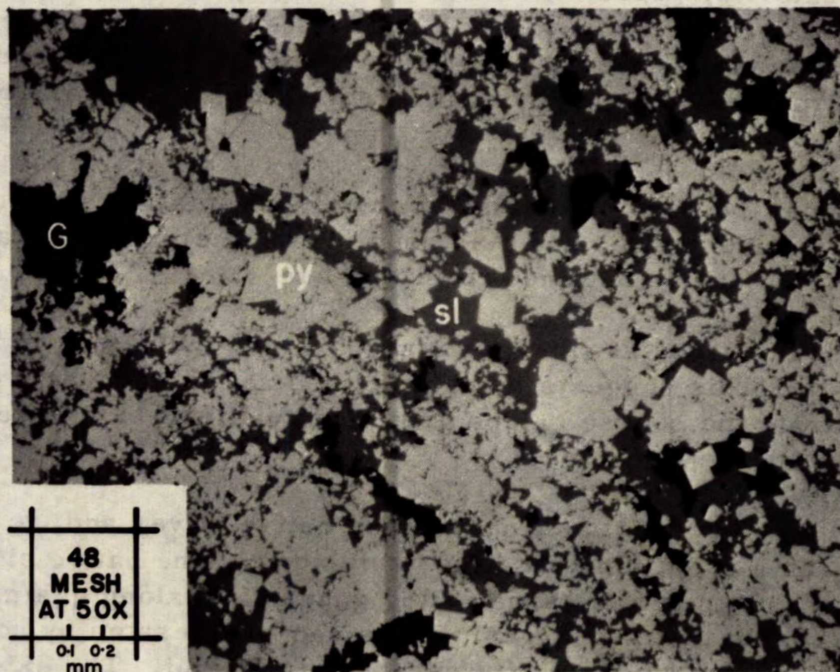

Figure 1 - Photomicrograph of a polished section showing interstitial sphalerite (sl) in pyrite (py) and a few inclusions of gangue (G).

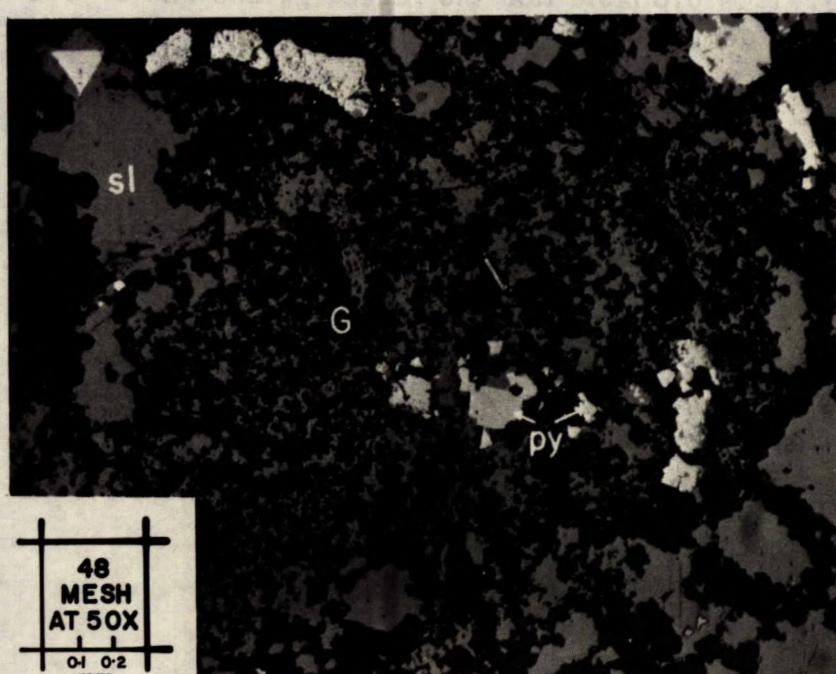

Figure 2 - Photomicrograph of a polished section showing sphalerite (sl) disseminated in gangue (G). A few grains of pyrite (py) are also present.

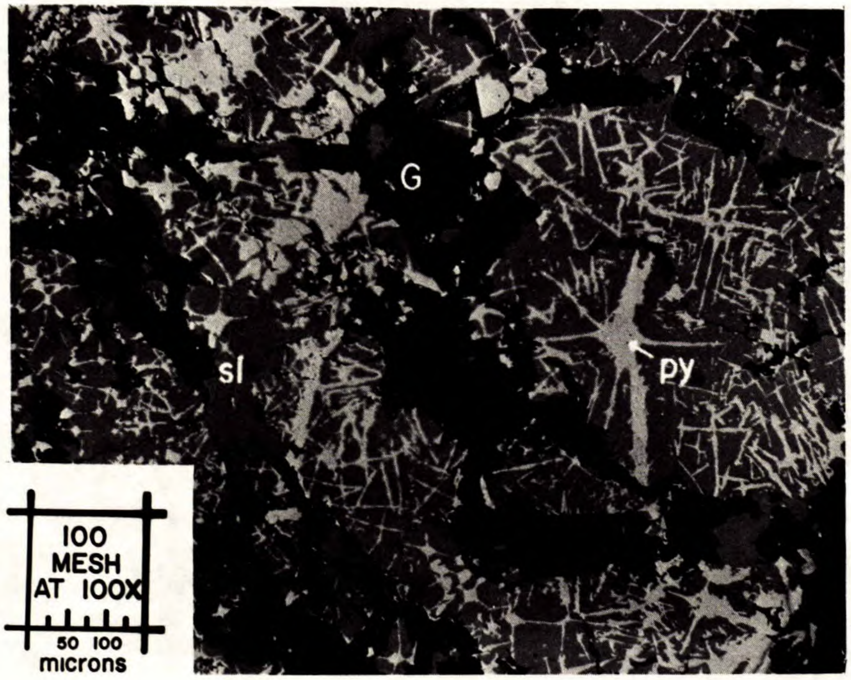

Figure 3 - Photomicrograph of a polished section showing skeletal inclusions of pyrite (py) in sphalerite (sl). The dark area marked (G) represents gangue.

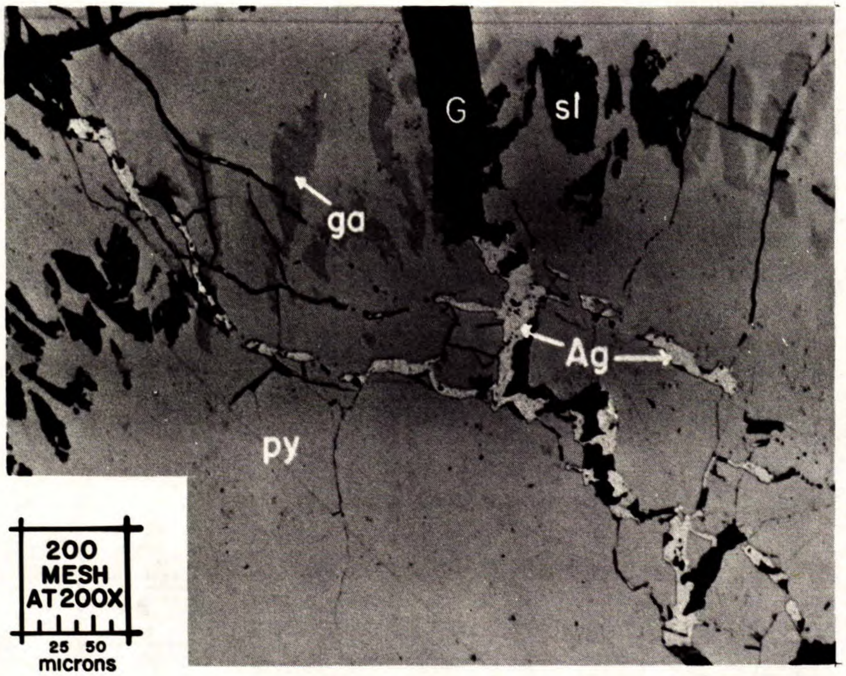

Figure 4 - Photomicrograph of a polished section showing veinlets of native silver (Ag), irregular grains of sphalerite (sl) and galena (ga), and inclusions of gangue (G) in pyrite (py).

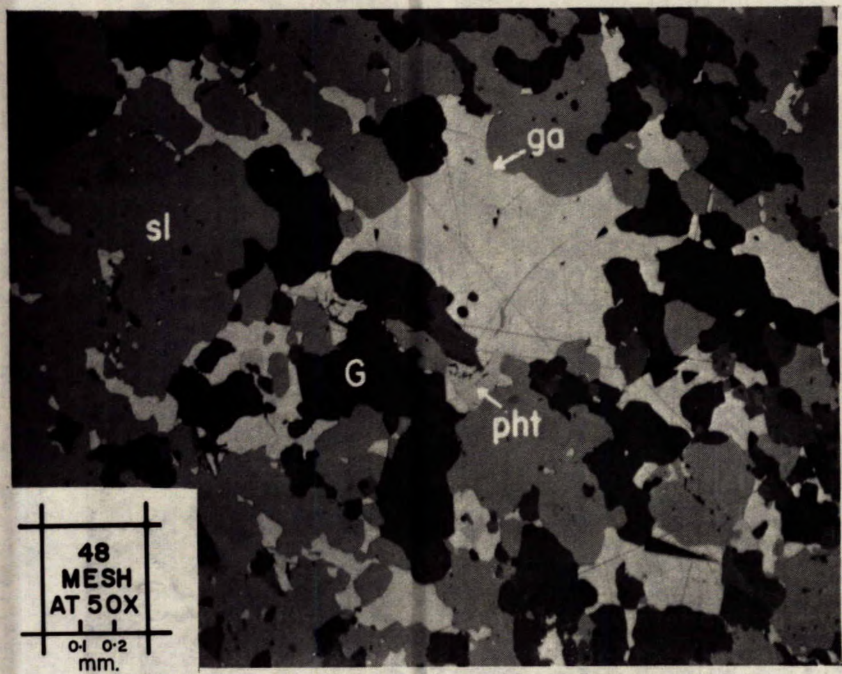

Figure 5 - Photomicrograph of a polished section showing various sized inclusions of galena (ga) in sphalerite (sl) and gangue (G). A few grains of pyrrhotite (pht) are also present in the galena and sphalerite.

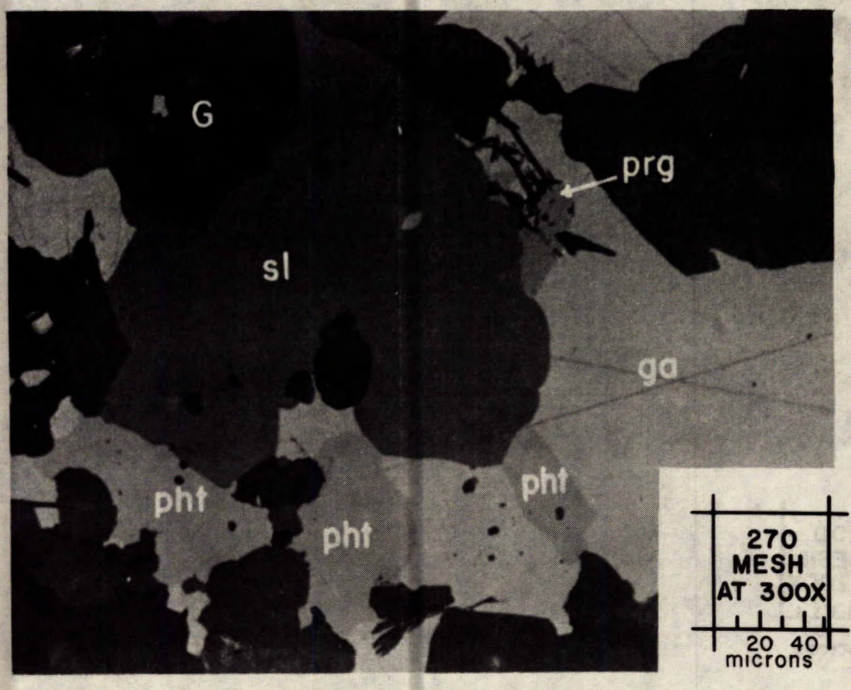

Figure 6 - Photomicrograph of a polished section showing pyrargyrite (prg), pyrrhotite (pht), galena (ga), sphalerite (sl) and gangue (G).

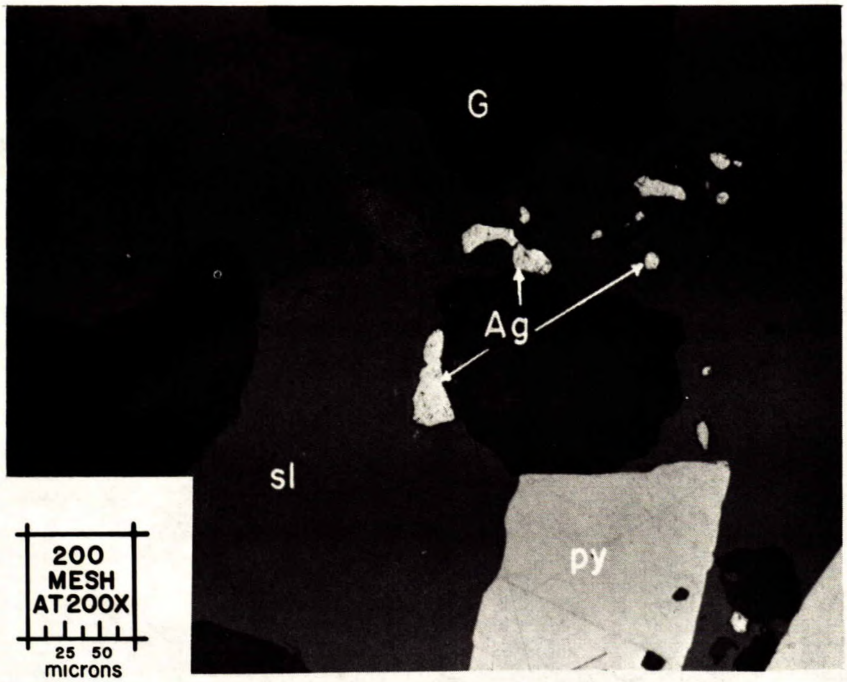

Figure 7 - Photomicrograph of a polished section with immersion oil showing native silver (Ag) in sphalerite (sl). One grain of pyrite (py) and a few inclusions of gangue (G) are also shown.

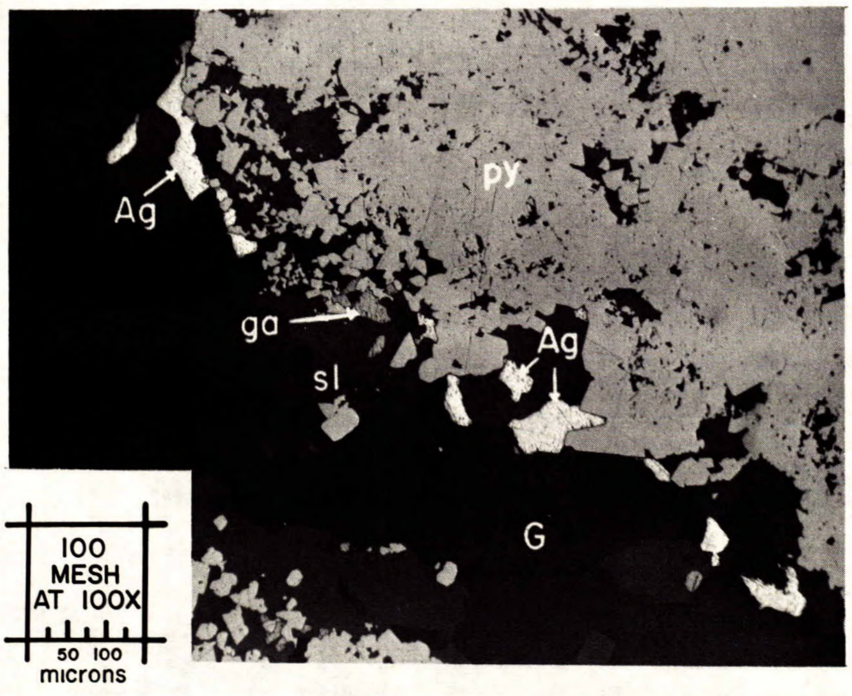

Figure 8 - Photomicrograph of a polished section with immersion oil showing irregular grains of native silver (Ag) along boundaries of sphalerite (sl), pyrite (py) and gangue (G). A few grains of galena (ga) are also present.

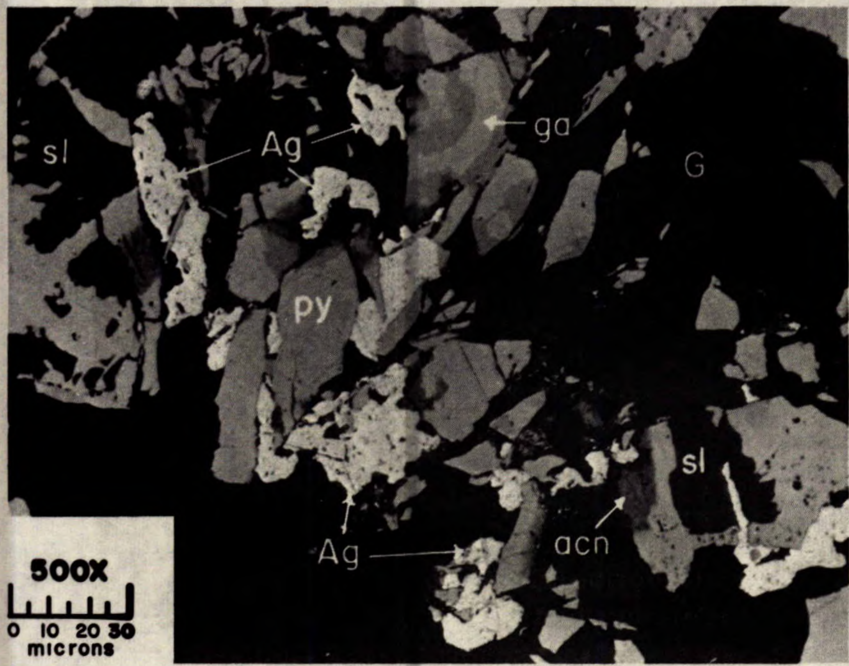

Figure 9 - Photomicrograph of a polished section with immersion oil showing grains of native silver (Ag), acanthite (acn), pyrite (py) and galena (ga). The black areas marked (G) represent gangue.

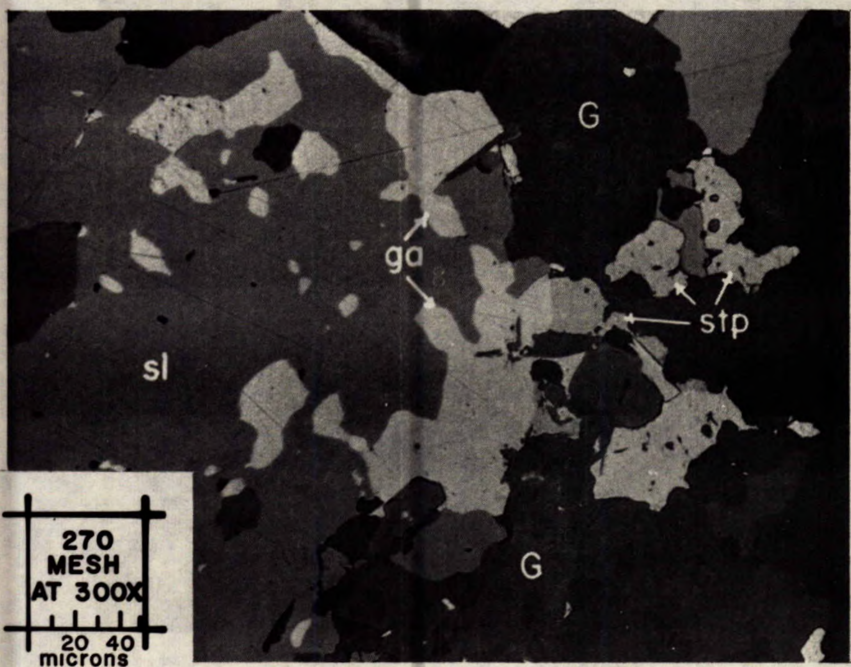

Figure 10 - Photomicrograph of a polished section showing stephanite (stp), galena (ga), gangue (G) and sphalerite (sl).

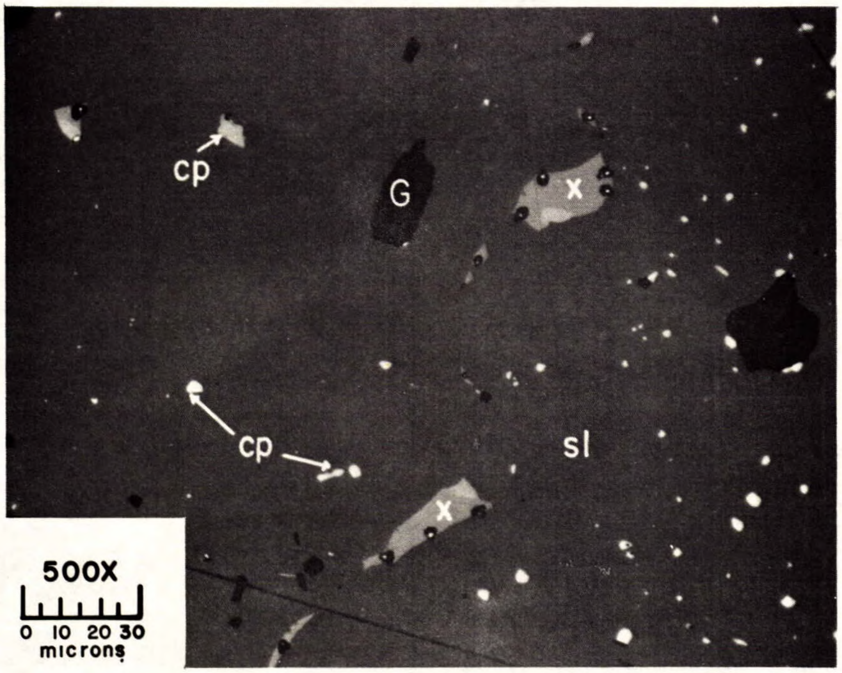

Figure 11 - Photomicrograph of a polished section with immersion oil showing inclusions of tetrahedrite (?) (X), chalcopyrite (cp) and gangue (G) in sphalerite (sl).

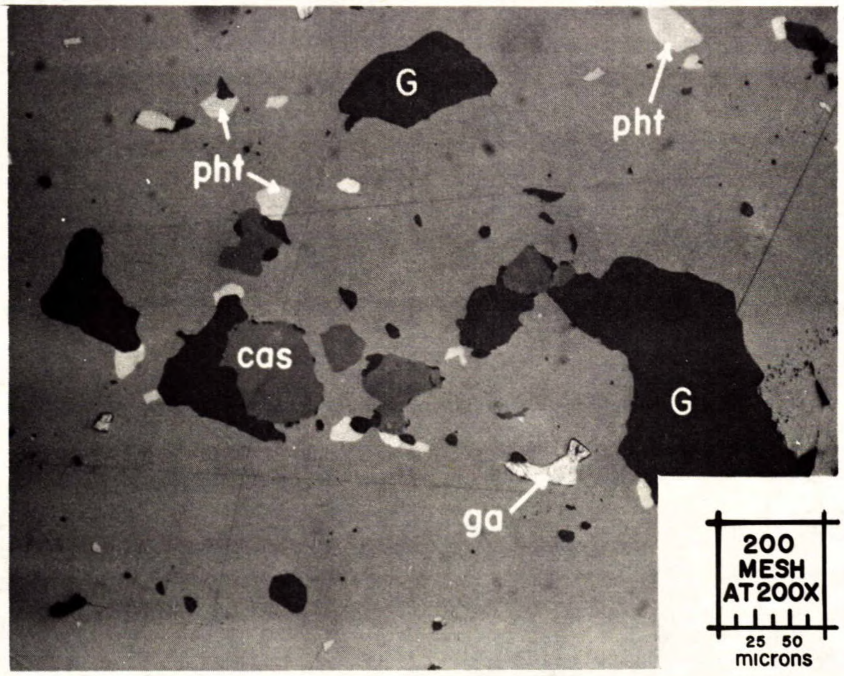

Figure 12 - Photomicrograph of a polished section showing cassiterite (cas), pyrrhotite (pht), galena (ga), and gangue (G) in sphalerite (sl).