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MINERALOGICAL INVESTIGATION OF A Cu-Ag-Bi ORE FROM TERRA MINING AND EXPLORATION LIMITED, CAMSELL RIVER, NORTHWEST TERRITORIES

by

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MINERAL SCIENCES DIVISION

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SUMMARY OF RESULTS

Two separate and distinct mineral assemblages (sulphide and arsenide) are evident in the ore. The two assemblages are so closely associated that the ore must be mined and milled as one assemblage.

Native silver, matildite, and acanthite are the principal Ag-bearing minerals with minor amounts of pearceite, tetrahedrite and an unknown Ag-Pb-Bi sulpho-salt. Native bismuth, bismuthinite and matildite are the principal Bi-bearing minerals. Both native silver and native bismuth show similar textural relationships, occurring in the cores of arsenide rosettes as small as 10 microns in diameter and as liberated fragments several hundred microns in diameter.

The native silver will be the most difficult to liberate and it appears that the ore must be ground to minus 100 mesh to obtain satisfactory liberation.

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INTRODUCTION

A mineralogical investigation of samples from the mine of Terra Mining and Exploration Company, Camsell River, N.W.T., was previously requested by Mr. D. Raicevic, Mineral Processing Division, Mines Branch on May 26, 1972. The results of that study are reported in an Investigation Report IR 72-37.

The samples examined in the earlier study consisted of several 2-inch chips, a fraction of Head Sample #2 and a minus 10-mesh jig concentrate, labelled Test T-1, May 25, 1972.

A request was made by Mr. D. Raicevic to examine another shipment of ore from the mine on August 15, 1972. The samples consisted of mineralized 2-inch chips, labelled Sample #1 (copper ore and silver ore), and a minus 28-mesh jig concentrate of Test 4. The jig concentrate assayed 7653 oz Ag/ton.

The purpose of this study is to determine whether a grinding to minus 28 mesh will liberate the Ag- and Bi-bearing minerals and to provide mineralogical data on grain size and associations to guide future beneficiation tests.

METHOD OF INVESTIGATION

Polished sections were made of mineralized chips from the copper ore, the silver ore, and the jig concentrate. The polished sections were examined by microscope to identify the minerals, their grain size, and their textural relationships.

Mineralogy

In the previous study, twenty-three minerals were identified (Table 1). On the basis of their textural relationships and associations, two separate and distinct mineral assemblages (sulphide and arsenide) were recognized. Samples received for this study, which are considered more representative of the ore, show that the two assemblages are so closely associated that the ore must be mined and milled as one assemblage.

Silver-Bearing Minerals

Native silver, matildite, and acanthite are the principal Ag-bearing minerals with minor amounts of pearceite, tetrahedrite, and an unknown Ag-Pb-Bi sulpho-salt.

Native silver is the most important silver mineral in the ore. It occurs mainly as inclusions in the arsenides, although it was noted in gangue and as fracture fillings in pyrite.

The grain size and textural relations of some typical silver-bearing fragments in the minus 28-mesh jig concentrate are shown in Figures 1 to 5 In grain size, native silver ranges from one-micron inclusions in arsenides to liberated fragments several hundred microns long.

Matildite appears to be the next important silver-bearing mineral. It occurs as inclusions, up to 200μ in diameter, in arsenides (Figure 6).

Acanthite appears to be rare in the ore. The mineral was observed only in the jig concentrate as liberated fragments, several hundred microns long.

Bismuth-Bearing Minerals

Native bismuth, bismuthinite and matildite are the principal Bi-bearing minerals with minor amounts of the unknown Ag-Pb-Bi sulpho-salt.

Native bismuth accounts for the major portion of the bismuth content in the ore. In the jig concentrate, it was frequently observed as liberated fragments (Figures 7 and 8) and as finely disseminated inclusions in arsenides (Figures 9 and 10).

The occurrence of matildite has been discussed above whereas bismuthinite is rare in the ore and occurs as inclusions up to 200 microns in diameter, in arsenides.

TABLE I

Minerals Identified in the Terra Mining and Exploration Co. Ore

Chalcopyrite	
Pyrite	
Marcasite	
Sphalerite	
Galena	
Tetrahedrite	$(Cu,Ag,Fe,Zn)_{12}(Sb,As)_4S_{13}$
Bismuthinite	Bi_2S_3
Native Ag	
Native Bi	
Pearceite	$(Ag,Cu)_{16}(As,Sb)_2S_{11}$
Acanthite	Ag_2S
Niccolite	NiAs with minor Sb
Gersdorffite	NiAsS with minor Sb
Rammelsbergite	$NiAs_2$
Safflorite	$(Co,Fe)As_2$
Skutterudite	$(Co,Ni,Fe)As_3$
Arsenopyrite	FeAsS
Cobaltite	CoAsS
Matildite	$AgBiS_2$
Pavonite	$AgBi_3S_5$
Unknown AgPbBi sulpho-salt	$Ag_2Pb_2Bi_5S_{22}$
Magnetite	
Siderite	

CONCLUSIONS

Native silver and native bismuth are the principal silver and bismuth minerals. Both minerals show similar textural relationships, occurring in the cores of arsenide rosettes and as liberated fragments several hundred microns in diameter. However, inclusions in the arsenides as small as 10 microns are common. Native silver, in particular, occurs as locked grains in the arsenides as shown in Figures 2, 3, 4, and 5.

Although both minerals occur as inclusions in arsenides, native silver will be the most difficult to liberate, and it appears that the ore must be ground to minus 100 mesh to obtain satisfactory liberation. At this grind, most of the native bismuth should be liberated from the arsenides, whereas the native silver should be reduced to fragments consisting of native silver cores in arsenides similar to that shown in Figure 5. The main problem with fine grinding initially is that the native bismuth will fracture more readily than will the other minerals.

ACKNOWLEDGEMENTS

I thank P. O'Donovon and Y. Bourgoin for the polished sections and R.G. Pinard for the photographic assistance.

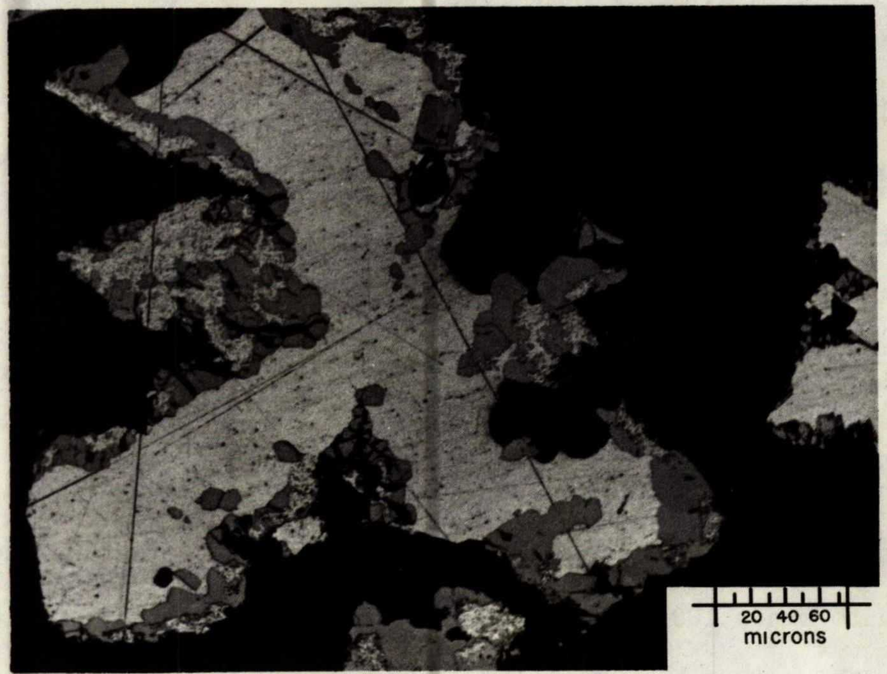

Figure 1. Photomicrograph of a native silver fragment containing inclusions of niccolite (grey).

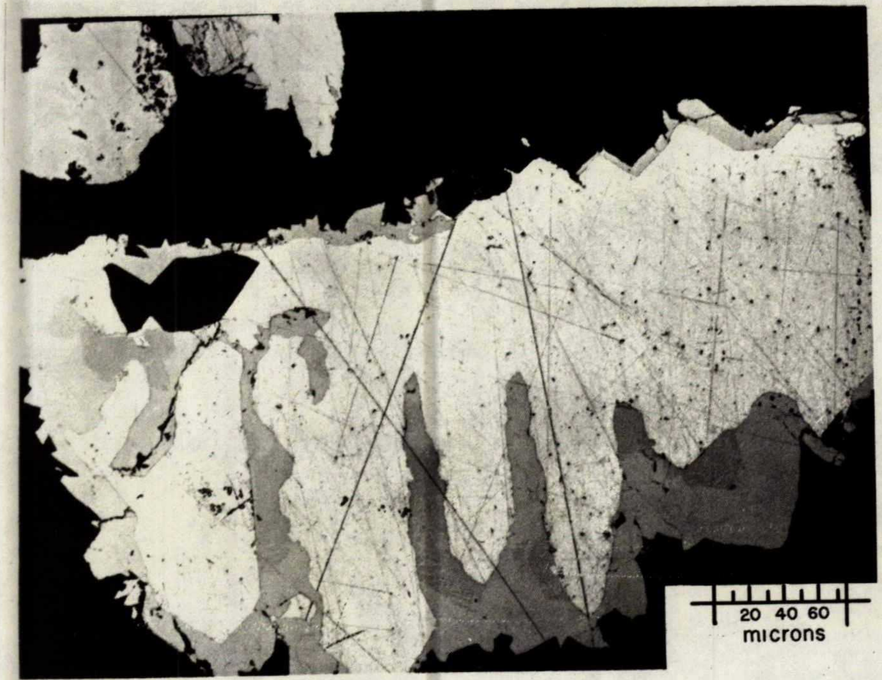

Figure 2. Photomicrograph of native silver (white) surrounded with arsenides (grey).

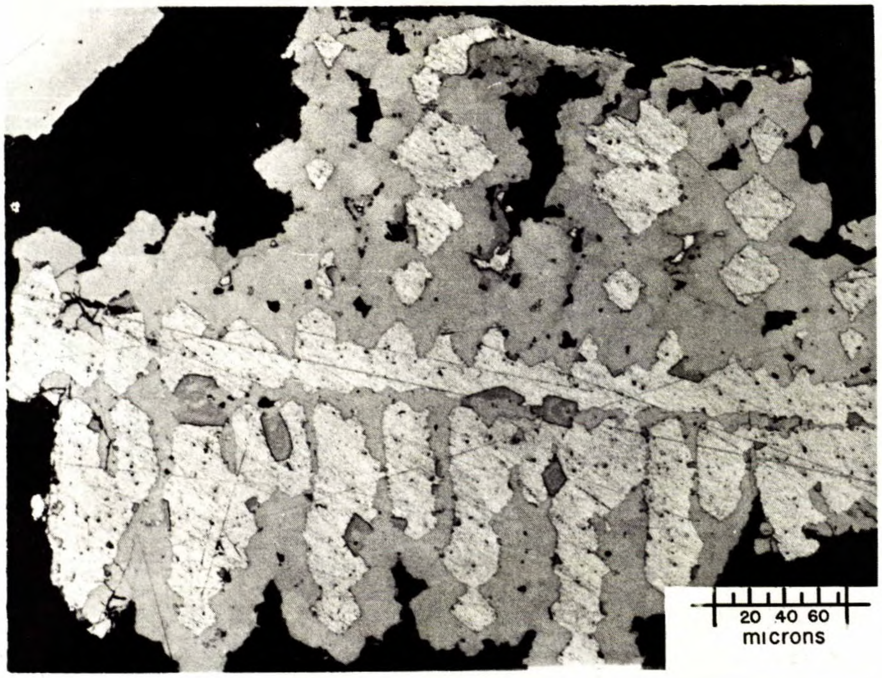

Figure 3. Photomicrograph of dendritic native silver (white) inclusions in arsenides (grey).

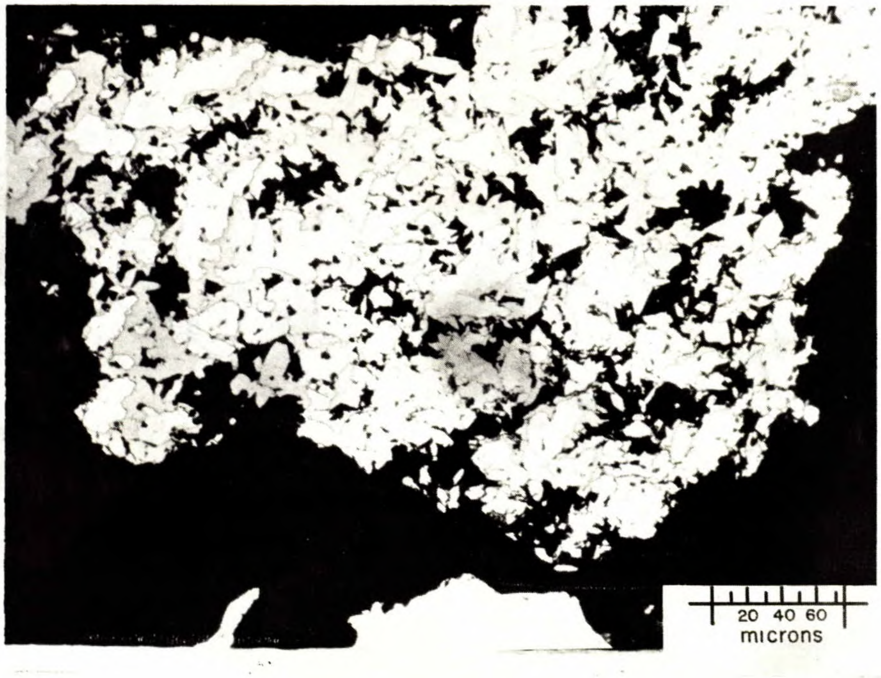

Figure 4. Photomicrograph of native silver (white) inclusions in arsenides (grey).

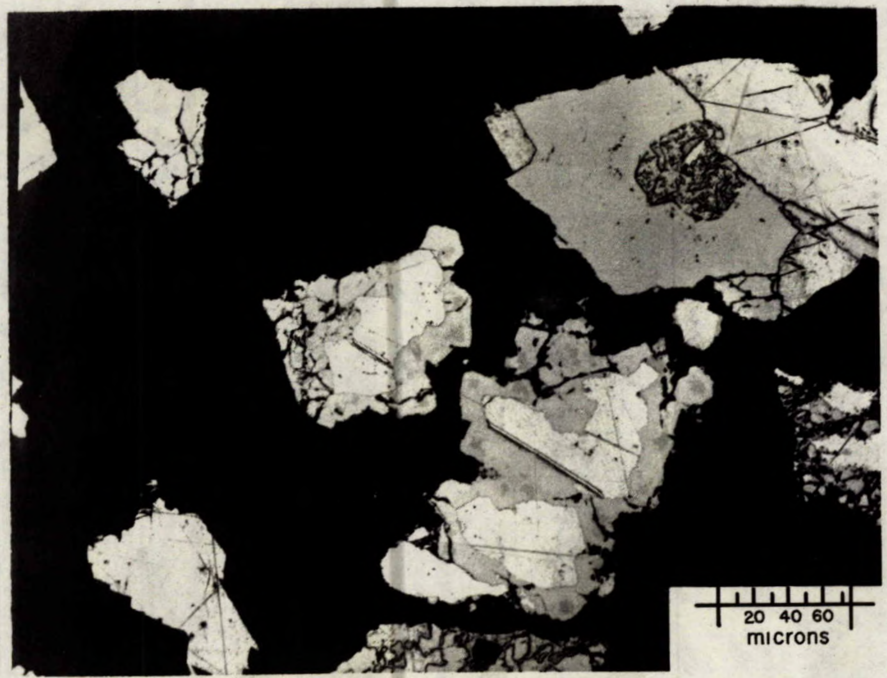

Figure 5. Photomicrograph of two native silver grains (white) enclosed in arsenides (centre of photo), native bismuth associated with an arsenide (top right), and a liberated native bismuth fragment (lower left).

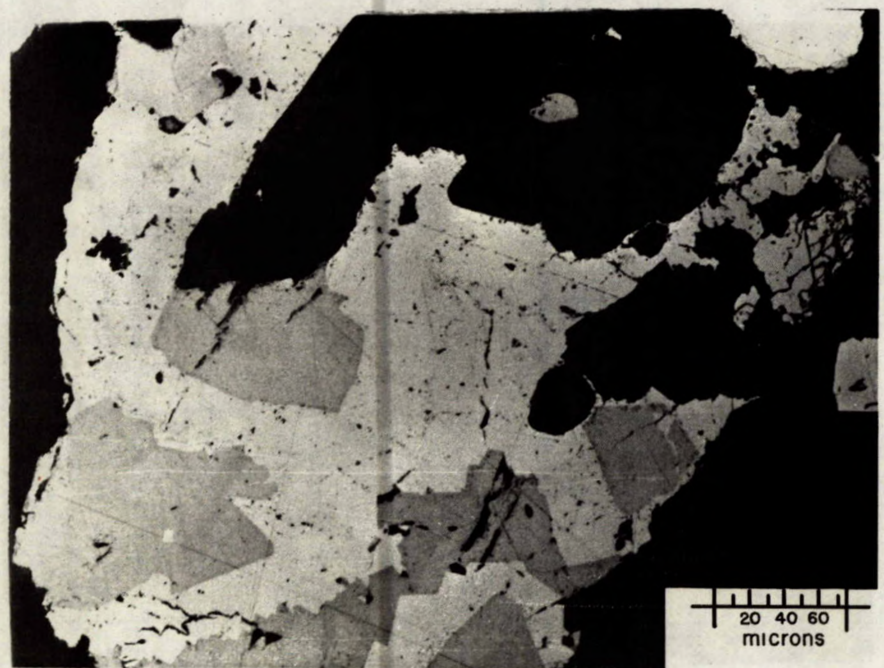

Figure 6. Photomicrograph of matildite (dark grey) enclosed in arsenides (grey).

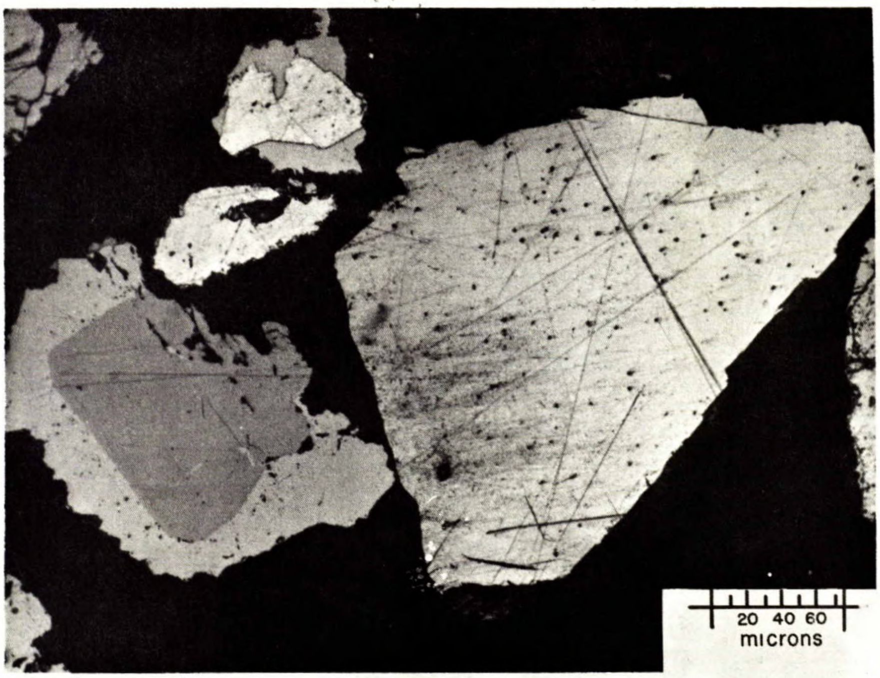

Figure 7. Photomicrograph showing a large liberated fragment of native bismuth, two liberated silver fragments (white), one enclosed in arsenides (top of photo), and a fragment of matildite (dark grey) enclosed in arsenide.

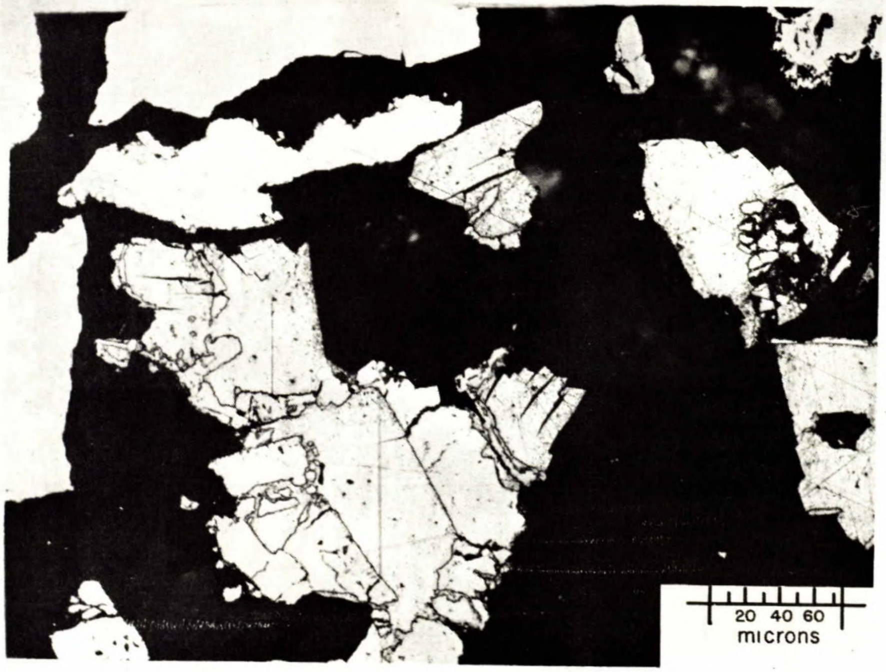

Figure 8. Photomicrograph of liberated native bismuth fragment (grey pitted surface). The white irregular grains in top left portion of photo are native silver.

Figure 9. Photomicrograph of coarse to finely disseminated native bismuth inclusions in arsenides.

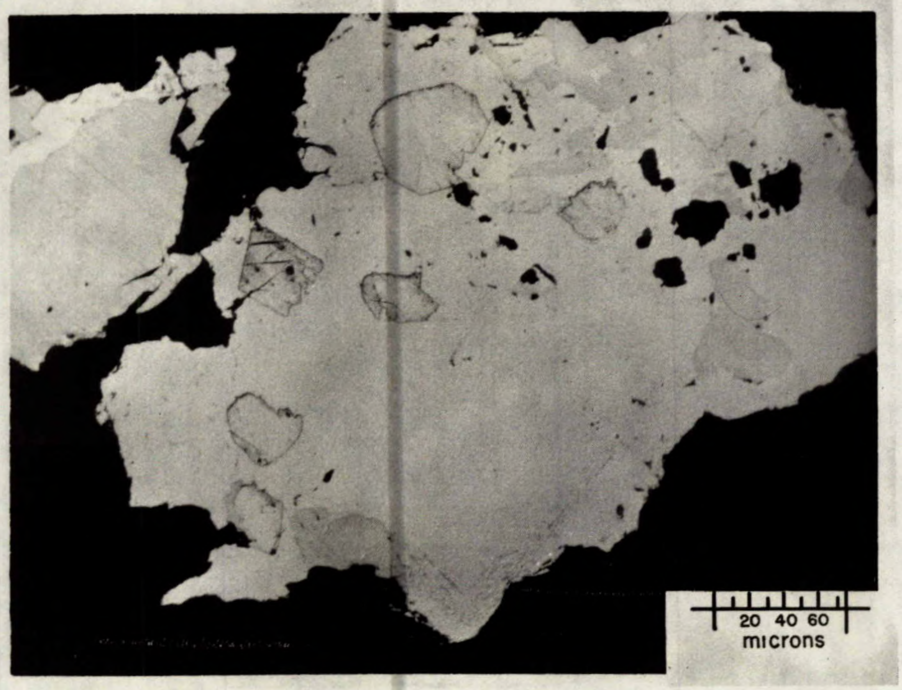

Figure 10. Photomicrograph showing inclusions of native bismuth (grey pitted surface) and matildite (medium grey) in an arsenide fragment.