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OTTAWA

MINES BRANCH INVESTIGATION REPORT IR 67-2

# MINERALOGICAL EXAMINATION OF A LEAD-ZINC ORE FROM FENNIX MINES LTD. YELLOWKNIFE, NORTH WEST TERRITORIES

by

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COPY NO. 23

JANUARY 30, 1967



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SUMMARY OF RESULTS

A sample of a lead-zinc ore from Fennix Mines Limited, Yellowknife, N. W. T. was examined mineralogically. The investigation revealed that the sample consists primarily of sphalerite, galena, marcasite, arsenopyrite and pyrite. The sphalerite and galena occur as small masses and inclusions in gangue, and as inclusions in, and as intimate intergrowths with, the other minerals in the sample. The marcasite, arsenopyrite and pyrite occur largely as medium- to coarse-grained inclusions in gangue, sphalerite, galena and in each other. Other minerals identified in the sample include chalcopyrite, anatase, pyrrhotite, tetrahedrite, covellite, goethite, ilmenite, magnetite, quartz, chlorite, siderite, dolomite, smithsonite and anglesite.

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## INTRODUCTION

A sample of a lead-zinc ore was received from T.O. Llewellyn of the Mineral Processing Division on October 28, 1966. Mr. Llewellyn requested that the sample be examined to identify the minerals in the ore, and their association, with particular reference to the presence of lead, zinc, silver and gold-bearing minerals. Mr. Llewellyn stated that the ore was originally submitted to the Mines Branch by Fennix Mines Limited, P.O. Box 190, Yellowknife, N.W.T.

## SAMPLES

The samples received were from two zones of the ore body, and were labelled Zones # 1 and # 3. The sample from each zone consisted of a number of small fragments of rock and about 100 grams of head sample. The fragments were composed largely of gangue, some of which contained small areas of mineralization. An analysis of the head samples from each zone was provided by Mr. Llewellyn and is shown in Table 1.

TABLE 1

Analysis of the Head Samples from Zones # 1 and # 3

	<u>Pb</u>	<u>Zn</u>	<u>Ag</u>	<u>Au</u>
Zone # 1	4.16	4.32	2.27	0.02
Zone # 3	4.32	3.66	3.00	0.04

## METHOD OF INVESTIGATION

Polished sections were prepared from a number of mineralized fragments from each of the samples, and examined microscopically. In addition, the -100 + 270 mesh sizes were screened from each of the head

samples, and separated into sink and float sub-fractions by means of heavy liquids. The float sub-fractions were run on the X-ray diffractometer to determine the principal gangue constituents, while one polished section was prepared from the gravity-sink sub-fractions from each zone, and examined to determine the liberation characteristics of the ore minerals. The minerals in the polished sections were identified by microscopical and X-ray diffraction studies.

## RESULTS OF INVESTIGATION

Since the samples from zones #1 and # 3 are mineralogically similar, they will be discussed as one sample in the report.

### General Character of the Ore.

The metallic minerals in the ore consist primarily of sphalerite, galena, marcasite, arsenopyrite and pyrite, with small amounts of chalcopyrite and anatase, and traces of pyrrhotite, tetrahedrite, covellite, goethite, ilmenite and magnetite.

The gangue minerals consist chiefly of quartz and chlorite, with small amounts of siderite, dolomite, smithsonite and anglesite.

The ore minerals occur as small masses and coarse- to fine-grained inclusions in gangue, and often form intimate intergrowths with each other.

### Detailed Mineralogy.

#### Sphalerite

The sphalerite occurs in the ore as small masses and coarse- to fine-grained inclusions in gangue. These small masses and grains range in size from about 5 microns to 2 millimetres. Sphalerite also occurs as inclusions in galena, pyrite, marcasite and arsenopyrite, which vary from about 8 to 500 microns in diameter. In addition, the sphalerite contains

inclusions of galena, pyrite, arsenopyrite, marcasite, goethite, chalcopyrite, pyrrhotite and gangue. These inclusions range in size from about 2 to 450 microns. The sphalerite also forms intimate intergrowths with galena, pyrite, arsenopyrite and gangue. In a few places the sphalerite is rimmed with a thin border of goethite.

#### Galena

The occurrence of galena in the ore is very similar to that of sphalerite. It was found as small masses and coarse- to fine-grained inclusions in gangue. These vary from about 2 microns to 1.5 millimetres in size. A large number of grains of galena were found as inclusions in sphalerite, and to a lesser degree in pyrite, arsenopyrite, marcasite, and chalcopyrite. These grains range from about 5 to 400 microns; most, however, are less than 100 microns in diameter. The galena contains inclusions of sphalerite, marcasite, pyrite, arsenopyrite, gangue, chalcopyrite and tetrahedrite, which vary in size from about 15 to 500 microns. Again, as with the sphalerite, the galena forms intimate intergrowths with some of the metallic and gangue minerals.

#### Marcasite, Arsenopyrite and Pyrite

The marcasite, arsenopyrite and pyrite in the ore are of almost equal size and quantity, and occur in a similar manner. They occur largely as medium to coarse-grained inclusions in gangue, sphalerite, galena and in each other. These grains vary in size from about 10 microns to one millimetre; most however, are larger than 80 microns. They were found to contain a small number of inclusions which consist mainly of galena, sphalerite and gangue. They also form intimate intergrowths with each other and with galena, sphalerite and gangue. The inclusions in the marcasite, arsenopyrite and pyrite range from about 5 to 400 microns in size. A few grains of marcasite were observed as inclusions in chalcopyrite, and in addition, goethite was found in fractures in a few pyrite grains.

#### Chalcopyrite

Only a small amount of chalcopyrite occurs in the ore. It is present as coarse- to fine-grained inclusions in gangue, and as generally smaller inclusions in sphalerite. These inclusions range from about 5 to 800 microns in diameter, but those in the sphalerite are smaller, and most do not exceed 50 microns in size. A few grains of chalcopyrite also were

found in galena, and in a few instances contained inclusions of marcasite. One of the larger grains of chalcopyrite in gangue contained several inclusions of tetrahedrite.

#### Anatase

Anatase occurs as numerous very small inclusions disseminated through the gangue. These inclusions range in size from about 3 to 50 microns.

#### Pyrrhotite

The pyrrhotite consists of a number of small inclusions in sphalerite and pyrite, varying from about 10 to 80 microns in diameter.

#### Tetrahedrite

As mentioned previously, a few grains of tetrahedrite, varying in size from about 10 to 50 microns, were found in chalcopyrite. X-ray diffraction patterns of the tetrahedrite show that it may be the argentiferous variety called freibergite. In addition, a few grains of a mineral with similar microscopical characteristics were found in galena. These grains, however, are very small, generally less than 15 microns, and a positive identification could not be made.

#### Covellite

The only covellite found in the ore consists of a few very small inclusions in gangue-filled fractures in pyrite.

#### Goethite

A small amount of goethite occurs in the ore. It was found as thin rims on a few grains of sphalerite, as inclusions in sphalerite, and as fillings in a few fractures in pyrite. The rims of goethite vary from about 5 to 25 microns in width, while the inclusions range from about 15 to 80 microns in size. X-ray diffraction patterns of the goethite show that it is probably partially amorphous.

### Ilmenite and Magnetite

A few small grains of a mineral microscopically similar to ilmenite were found in the ore. These generally were less than 10 microns in diameter, and could not be definitely identified.

Although no magnetite was found in the polished sections of the ore, a few grains were found in the polished sections of the head sample.

### Gangue

The gangue is composed chiefly of quartz and chlorite, with small amounts of siderite, dolomite, smithsonite and anglesite.

## CONCLUSIONS

A number of conclusions can be drawn from the microscopical examination of the polished sections of the ore and head samples.

The sphalerite is generally fairly coarse in size, and except for some of the inclusions of galena, chalcopyrite and pyrrhotite, the inclusions in the sphalerite should largely be liberated. This opinion was substantiated by the microscopic examination of the -100 + 270 mesh fractions of the head samples, in which it was found that the sphalerite had been largely liberated.

Galena, however, may present a problem in obtaining adequate liberation. Even though galena occurs in the ore in masses up to 1.5 millimetres in size, a large number of grains are present as small inclusions in sphalerite and gangue. It was found in the microscopical examination of the head samples that, although much of the galena was present as free grains, a fairly large number of grains were present as inclusions in, and combined grains with, sphalerite and to a smaller degree with pyrite, and gangue.

No gold or silver-bearing minerals were found in the ore. Although some tetrahedrite was found in chalcopyrite, it could not be absolutely identified as the argentiferous variety known as freibergite. Nor could the very small grains of the similar mineral in galena.