600399

MINERALOGICAL STUDY

of the

GRANDUC COPPER DEPOSIT

Geology 409

Assignment Number IV

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MINERALOGICAL STUDY OF THE GRANDUC COPPER DEPOSITS

Introduction

The object of the study was to determine which metallic minerals are present in the deposit and to estimate their relative abundance. The amenability of the ore to ore dressing and effects of the minerology on mining methods was also noted.

The study was based on the following, polished sections: 1, 2, 3, 4, 5, 6, 7, 10, 11, 12, 13, 14 and 16 and hand specimens associated with the polished sections and additional hand specimens which were collected by W. R. Bacon. All the polished sections and hand specimens were obtained from the Geology Department of the University of British Columbia.

Location of Property

The property is held by Granduc Mines Limited. The company holds 207 claims and fractional claims at the head of the Leduc River. The property is located 25 miles north, 35 degrees west of Stewart, B. C. The Granduc showings are known as 1A, 2A, 2B and 2C.

Geology

Reference.

The deposits are in the Coast Mountains immediately east of the large granitic complex that forms the backbone of the range. The Granduc showings stand out as reddish-brown patches against the more sombre gray and green shades of the surrounding country rocks.

The 2A, 2B and 2C deposits are mineralized shear zones in metamorphosed sediments. They occur in steeply dipping sediments that strike east of north.

In 1953 the company started exploration of the deposits. Development work has been confined to the 2A zone and the immediate vicinity. The main rocks in the vicinity of the 2A zone are sheared, crushed metamorphosed sediments in which corrugations and drag folds are not uncommon. Quartz, biotite and chlorite are important constituents of these rocks.

Megascopic Description of Hand Specimens

Gangue Minerals:

The important gangue minerals are quartz, chlorite and calcite.

Metallic Minerals:

The metallic minerals in decreasing order of abundance are chalcopyrite, pyrrhotite and pyrite. The metallic minerals occur as disseminated grains and in stringers, veinlets and massive bands that are conformable with the enclosing rocks.

General:

The specimens collected by W. R. Bacon show clearly that the deposit has been formed in a shear zone. One of the specimens contains chalcopyrite that shows evidence of deformation.

The large hand specimen which has been polished on two sides shows evidence of drag folding. It contains a blob of calcite which is rimmed by pyrrhotite. The rim is surrounded by pyrrhotite and chalcopyrite. Chalcopyrite and the pyrrhotite exhibit a mutual boundary texture. Therefore the two minerals were preceeded by the calcite and the pyrrhotite was the next in. When only a small fraction of the pyrrhotite had been deposited chalcopyrite then precipitated simultaneously with it.

Microscopic Examination of the Polished Sections

Optical data and etch tests for all metallic minerals

1. Chalcopyrite $CuFeS_2$
   - Polish - very good.
   - Colour - brass yellow.
   - Hardness - C - not sectile.
   - Anisotropism - weakly anisotropic.
   - Associations - pyrrhotite & sphalerite.
   - Etch Tests - all negative.

2. Pyrrhotite $Fe_{1-x}S$
   - Polish - fair to good.
   - Colour - pinkish cream.
   - Hardness - D^-
   - Anisotropism - strongly anisotropic.
   - Magnetism - distinctly magnetic.

3. Sphalerite ZnS
   - Polish - good.
   - Colour - gray.
   - Hardness - C^-
   - Anisotropism - isometric.
   - Associations - chalcopyrite & pyrrhotite.
   - Etch Tests - all negative except HNO_3 which caused the surface to turn a darker gray.
   - Internal reflection - reddish coloured internal reflection.

4. Galena PbS
   - Polish - good.
   - Colour - galena white.
   - Hardness - B
   - Anisotropism - isometric.
   - Association - pyrrhotite.
   - Etch Tests -
     - $HgCl_2$ - negative.
     - KOH - negative.
     - KCN - negative.
     - $FeCl_3$ - iridescent stain.
     - HCl - iridescent stain.
     - HNO_3 - iridescent and blackened in 15 seconds.

5. Loellingite $FeAs_2$

Polish - fair to good.
Colour - white
Hardness - hard mineral.
Anisotropism - fairly strongly anisotropic polarization colours yellow and blues.

Etch Tests - all negative except HNO_3 which stains brown.

Cross-section is not diamond-shaped but is euhedral.
What form

6. Pyrite

Polish - poor.
Colour - pale brass yellow.
Hardness - F - not scratched by needle.
Anisotropism - isometric.
Crystal shape - pyritohedrous and cubes.
Association - random distribution.

Etch tests - all negative except HNO_3 which stains iridescent.

Textures

Exsolution:

Chalcopyrite in sphalerite - see picture. P. 9.

Unmixing temperature is 350°C.

Rim:

Pyrrhotite rims a blab of calcite.

Mutual boundary:

Pyrrhotite and chalcopyrite.

Sphalerite and galena.

Sphalerite and chalcopyrite.

Paragenetic sequence:

1. Pyrite.
2. Loellingite.
3. Quartz.
4. Calcite.
5. Pyrrhotite.
6. Pyrrhotite, chalcopyrite, sphalerite and galena.

Distribution of the Metallic Minerals

Approximately twenty percent of the polished surface area of all specimens is occupied by metallic minerals. The range of the percent mineralized surface area is from about five percent (sections 7 & 10) to eighty percent in section 16. The minerals in decreasing order of abundance are pyrrhotite, chalcopyrite, sphalerite, galena, pyrite and loellingite. Galena is only an important mineral in section 10.

Mining

The high percentage of pyrrhotite in the ore constitutes a fire hazard. Therefore, the broken ore must not be permitted to accumulate underground in the stopes. Hence shrinkage and caving methods of mining are not suitable for mining this ore.

Milling

The only complicating mineralogical factor is the presence of loellingite. It is not desirable to have this mineral in the concentrates because it contains arsenic. Smelters charge penalties against this obnoxious element.

There is only one grain of sphalerite which contains exsolved chalcopyrite. Also, the ore is fresh. Therefore, there should be no difficulty in seperating the chalcopyrite and sphalerite by selective flotation. The calcite in the ore will fix the flotation p h at approximately 7.5 to 8.5.

Conclusion

The metallic minerals in decreasing order of abundance are: pyrrhotite, chalcopyrite, sphalerite, galena, pyrite and loellingite. The mineralization is generally massive.

Needs x-ray verification.

The mineralogy is very favourable with regard to mineral dressing except for the presence of loellingite which may float with one or all the metallic minerals. Loellingite contains arsenic which is an obnoxious element. Smelters charge penalties when it exceeds a specified amount. The amount specified as a maximum varies with the smelter.

The irreducible minimum.

The high concentration of pyrrhotite in the ore constitutes a fire hazard. The mining method should therefore not be either shrinkage or caving. Sub-level stoping of the type used on the "Lower H" Orebody of the Horne Mine at Noranda, Quebec may be suitable if the wall rock is competent.

180X

EXSOLUTION OF CHALCOPYRITE
IN
SPHALERITE