Geology 9 Exercise

MICROSCOPIC EXAMINATION OF J. & L. ORE

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I L L U S T R A T I O N S

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I Introduction:

The J. and L. group of five claims is situated on the East Fork of Carnes Creek about 33 miles northerly from Revelstoke, B. C. The claims are at an elevation of 2,650 feet on the shoulder of Goat Mountain.

Access to the property by road is possible to within a distance of eight miles. The remaining distance is suitable to easy road building but at present the expense is not justified.

II Geology:

The general geology of the Eastern District, in which the J. and L. group lies, is given in a report by H. C. Gunning in Geological Survey of Canada, Summary Report, 1928.

The rocks in the vicinity of the J. and L. deposit are chiefly schist and limestone with occasional bands of quartzite. The vein or mineralized zone occurs at or near a schist-limestone contact that strikes 65 to 75 degrees west (magnetic) and dips 30 to 55 degrees to the north east (into Goat Mountain). This contact has been traced for several thousand feet up and across the hillside. The mineralized zone is not continuous throughout this distance.

In places it reaches a width of six to eight feet. The hanging wall consists of schist and the foot wall of limestone. Gouge is present in many places. The sulphides occur as veinlets, lenses, or bunches, occasionally as much as three feet wide but usually not more than twelve to sixteen inches. The vein matter has been extensively altered and decomposed by oxidation. In places the vein is entirely decomposed.

"The schist on the hanging wall of the vein is an altered quartzite sheared to sericite schist. Under the microscope it is seen to consist of quartz, pyrite in cubes, sericite, and a little talc. The ore lies along a well-defined shear zone on the contact of marble and schist and has been formed in part by filling of the shear zone and in part by replacement, particularly of the foot wall marble." ..(1)

III Development:

The vein has been opened up at numerous points both horizontally and vertically. The data gained from this development and from outcrops show the vein to extend 4000 to 5000 feet horizontally and at least 1000 feet vertically. A recent estimate places the probable tonnage at roughly 800,000 tons of ore. An average assay of several samples from different parts of the property is:

(1) H. C. Gunning, G. S. of Canada, 1928

Au	0.30 oz/T	S	30.0%
Ag	5.0 "	SiO_2	16.0%
Pb	5.0%	CaO	2.0%
Zn	6.0%	Mo	Tr.
Cu	0.5%	W	Tr.
Sb	0.3%	Sn	Tr.
As	15.0%	Co.	Nil
Fe	25.0%	Ni	Nil

The principal obstacle encountered in opening up this property has been the difficulty of treating the ore in any way that will show a profit. Metallurgical tests have been conducted by a number of leading laboratories and by individual metallurgists but, so far, without much success.

IV Examination of the Ore:

A. General Remarks:

The ore from which the samples were picked was a supposedly representative sample of five hundred pounds shipped to the University for metallurgical investigation. The specimens were chosen at random, an effort being made to get as many different specimens as possible. Nine specimens were mounted in dammar gum and polished. On examination it was found that three were so extremely fine-grained as to be impossible to work with intelligently. Four of the remaining specimens were chosen as being representative of the ore. Superpolished sections were later made but added little to the information gained from the hand-polished sections.

B. Megascopic Examination:

Numerous specimens were broken from the ore and examined under a hand lens. They fell into three main divisions as follows, the first predominating:-

1. These specimens consisted of massive sulphides with a few irregular small inclusions of quartz. The only minerals readily distinguished were arsenopyrite, pyrite, and sphalerite, with small amounts of pyrrhotite in three specimens. The rest of the sulphide mass was too finely granular to make distinction between different minerals possible with the hand lens. The only evidences of oxidation were small vugs and discoloration of the pyrite.

2. These specimens were a mixture of bands of course and fine grained sulphides in quartz and were as a rule attached to specimens in (1.) above. Pyrite, arsenopyrite, sphalerite, some calcite and odd specks of galena were observed. The quartz was of a sugary texture strongly suggesting partially recrystallized quartzite, but this texture may have been due to movement in

the vein. Weathering of pyrite was pronounced with several small spots showing deposition of limonite in cracks.

3. These specimens showed irregular sulphide deposition in calcite. The sulphide crystals were larger. Pyrite, arsenopyrite and galena were readily distinguished as well as small bands or clusters of sphclerite crystals. The calcite gangue contained included quartz crystals suggesting replacement of the quartz by calcite. Small vugs were common and oxidation of pyrite and sphalerite was quite distinct. The specimens were heavily stained in some places.

V Microscopic Examination:

A. Identification of Minerals:

Section 1.

(a) Pyrite occurs in large amounts as fractured and pitted grains.

(b) Arsenopyrite is slightly less abundant than pyrite and like pyrite is in large broken grains.

(c) Sphalerite occurs as a massive filling replacing pyrite, arsenopyrite and gangue minerals.

(d) Chaleopyrite occurs as a few small grains included in calcite and as minute grains in sphalerite.

(e) Galena is seen to be replacing calcite in a few scattered areas. A few very small grains can be seen in the sphalerite.

(f) Gangue minerals are mostly calcite with some quartz and another soft unidentified mineral.

(g) Anglesite can be seen replacing galena around some of the grain boundaries of galena.

(h) Tetrahedrite occurs as minute inclusions in chalcopyrite.

Section 2.

(a) Pyrite is the predominating mineral and occurs as large broken grains.

(b) Arsenopyrite is present as scattered grains intermingled with pyrite.

(c) Sphalerite occurs in smaller amount than pyrite and replaces pyrite, arsenopyrite, and gangue minerals. It contains specks of chalcopyrite and galena.

(d) Galena occurs as a few small grains replacing calcite.

(e) Chalcopyrite occurs similarly to galena and contains a few small areas of tetrahedrite.

(f) Gangue is predominately calcite with a few included rounded grains of quartz.

Section 3.

(a) Pyrite and arsenopyrite occur as in Sections 1. and 2.

(b) Sphalerite occurs massively as an interlacing between other sulphides replacing both sulphides and gangue.

(c) Galena forms a veined structure in sphalerite. It also is seen replacing pyrite, arsenopyrite, and gangue. Galena is more abundant in this specimen than in any other studied.

(d) Chalcopyrite occurs as small grains in sphalerite.

(e) Gangue is almost entirely quartz with a few small areas of calcite included in it.

Section 4.

(a) Pyrite and arsenopyrite occur as above with arsenopyrite predominating.

(b) Sphalerite is about half as abundant as arsenopyrite and is replacing pyrite, arsenopyrite and gangue.

(c) Galena occurs in less amount than sphalerite and replaces it.

(d) Chalcopyrite is in small amounts in galena and sphalerite. It is also seen veining arsenopyrite and pyrite. It contains small areas of tetrahedrite.

(e) Chalcocite is seen in small areas as replacement in galena.

(f) Anglesite occurs replacing galena.

(g) Covellite occurs replacing chalcopyrite.

(h) Gangue is predominately quartz, with a little calcite present.

(i) Unknown mineral. A small area of an unknown mineral was seen under 200 power. It was anisotropic and gave michrochemical tests for antimony and lead. It may have been boulangerite .

The following is a complete list of the minerals identified:

1. Pyrite
2. Arsenopyrite
3. Sphalerite
4. Galena
5. Chalcopyrite
6. Tetrahedrite
7. Chalcocite
8. Covellite
9. Anglesite
10. Calcite
11. Quartz
12. Boulangerite (?)

Although pyrrhotite was identified in the hand specimen, it was not observed under the microscope in any of the sections examined.

B. Grain Size:

Section 5. is included to show the extremely fine intergrowth of minute grains that is characteristic of the J. and L. ore. An attempt was made to measure the grains that were considered to be of average size for Pyrite, Arsenopyrite, Galena, and Chalcopyrite. These sizes were as follows:

Pyrite	-	360	microns
Arsenopyrite	-	310	"
Galena	-	60	"
Chalcopyrite	-	66	"

In each case 40 grains from each section were measured, the sizes given being, therefore, the average of 160 grains. Unfortunately, this measurement means very little since the bulk of the ore is similar to that shown in specimen 5. Measuring these grains would require more time than is available; an examination of this specimen under high power was sufficient to show that an attempt to free the minerals by fine grinding would be neither practical nor possible commercially.

C. Paragenesis:

The fractured and pitted appearance of the grains of pyrite and arsenopyrite and their close association indicate that they were deposited first contemporaneously. Fracturing of the vein followed with subsequent deposition of quartz. The calcite present appears to be replacing quartz. Sphalerite and chaleopyrite seem to be contemporaneous and are found veining and replacing pyrite, arsenopyrite, calcite and quartz and hence are of later origin. Galena is found replacing sphalerite and the earlier minerals and is therefore later than sphalerite. Tetrahedrite is probably of the same age as chaleopyrite. Anglesite and covellite are alteration products from erosion of the vein and are the latest minerals formed. The age of the chalcocite is indefinite but it also is probably secondary.

VI Conclusion:

In considering the ore from a metallurgical standpoint, the microscopic investigation has made three facts apparent. First, the ore is too fine-grained and the sulphides too finely intergrown to make production of clean concentrates possible by selective flotation. Second, the pyrite and arsenopyrite are for the most part fairly coarsely crystalline. If, as previous investigators have stated, these minerals carry the gold it might be possible to obtain sufficient concentration of them by flotation to give fairly good gold recovery. Third, the oxidation of the vein material, especially of the galena, would also hinder separation of base metals by selective flotation.