Microscopic Examination

of the

J & L Ore

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by

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Geology 9

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THE J. & L. ORE:

The J. & L. Ore has of late become of more than normal importance for two reasons:

(1). It is a good grade of a lead-zinc ore.

(2). It contains a considerable amount of arsenic which increases its importance no little amount in the metal market of to-day.

Broadly speaking the problem is one of separation of the various minerals into marketable concentrates. The microscopic problem narrows down to one of association of the different minerals. I say association principally because ore dressing experiments upon samples of ore have led to the conslusion that some hithertofore undiscovered association is hindering satisfactory treatment of this ore by flotation.

HISTORY

The J. & L. Ore body was discovered first in 1898. It became apparent at an early date that considerable tonnage could be expected so that the strike interested many. Innumerable attempts were made to treat the ore but with little success. Apparently the aim of the first investigators was to produce a gold Concentrate. Bralorne Gold Mines took an option on the property but allowed the option to drop when their efforts to produce a gold concentrate failed. Numerous other individuals interested themselves for a time, the latest to hold an option was the Consolidated Mining & Smelting Co. Under the direction of S. Gray tests were run on the ore at the Company's laboratory at Kimberley. The report issued by the Metallurgist was that separation of the zinc and lead could be accomplished by ordinary flotation processes, however, nearly 50 per cent of the gold went to the failing and could not be recovered. For this reason the Company dropped the option. Latest experimenter on the project is the University Department of Mining and Metallurgy.

Location

The five claims of the J. & L. group are situated about 30 miles north of Revelstoke on the east fork of Carnes Creek. A truck road approaches to within eight miles of the claims. A foot trail spans the distance from the road to the claims. The topography is such as to afford ready access for a highway or rail line. The claims are owned jointly by several individuals, the main holder is Mr. T. E. Arnold of Vancouver, B.C.

Geology

Information regarding the geology of the J. & L. group can be obtained from the Summary Report of H. C. Gunning 1928 Geological Survey of Canada. The following are exeerpts from the report.

Rocks in the vicinity of the J. & 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 at intervals by open cuts and trenches for several thousand feet up and across the hillside. The mineralized zone is not continuous. In places it reaches a width of six to eight feet. The hanging wall consists of schist and the footwall of limestone. Gouge is present in many places. The sulphides occur as veinlets, lenses or bunches.

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 replacements, particularly of the footwall marble.

Analysis of the Ore

A sample of this ore was ground in a rolls to -10 mesh, riffled to obtain a representative assay sample and pulverized. The assay was as follows.

Pb	7.5	Insol	16.5
Zn	9.8	MgO&Sb	trace
Fe	21.2	S	22.8
CaO	2.1	H2O	0.86
Cu	-0.14	Au	0.64 oz.
As	-14.8	Ag	6.0 oz.

Mineralolgy

There were no large specimen of the ore avilable. The pieces which were mounted for examination had been ground to pass a 3 mesh screen. The pieces were chosen at random.

The minerals identified were

pyrite
arsenopyrite
sphalerite
galena
chalcopyrite
tetrahedrite
bournonite

No gold was seen in any of the specimen. Confirmation of the minerals was based on the following facts noted:

1. Pyrite - brass yellow colour; hardness 6
2. Arsenopyrite - galena white colour; hardness 6.5; diamond-shaped cross sections were abundant.
3. Sphalerite - gray colour; hardness 4; showed resinous-coloured internal reflection under the arc lamp; Zn test obtained by microchemistry.

4. Galena - characteristic white colour; hardness Z.; a few triangular pits were noticed.

5. Chalcopyrite - characteristic brass yellow colour; hardness ; distinguished from gold by its negative reaction to KCN.

6. Tetrahedrite - light greyish colour; unable to get good hardness test; reacted negative to HCl, HNO_3, $FeCl_3$, KOH and $HgCl_2$; By michrochemical methods a test for antimony and copper was obtained.

7. Bournonite - gray colour; unable to get hardness test; was tarnished by HNO_3. and was not affected by KCN. $FeCl_3$ KOH or $HgCl_2$. A michrochem test was obtained for copper lead and antimony. The only difficulty is that the lead may have arisen from the galena in which the Bournonite was, and the copper from the tetrahedrite.

Section No. 1.

In one piece finely disseminated arsenopyrite and pyrite are found with quartz. There is slight showing of sphalerite in the pyrite and specks of a light mineral which might have been very fine galena.

In a second piece there is considerable arsenopyrite and pyrite in large blobs with showings of sphalerite in the pyrite.

In the third piece there were large areas of sphalerite and galena with considerable tetrahedrite found in the galena and generally in regions adjoining a blob of pyrite.

Small showings of chalcopyrite are noted in this specimen. It is always found in the sphalerite and commonly of the order of 10 microns, or less, in size.

Fair amounts of calcite were noticed in this specimen in all three pieces.

In this specimen it was noted that sphalerite of the order of 40-50 microns was locked in the arsenopyrite. All the sphalerite, whether occurring with the pyrite or galena, was quite fine grained.

Specimen No. 2.

In one piece considerable galena occurs with the pyrite. It was noted that some of the galena was of the order of 10 to 20 microns when it appeared with the pyrite.

It was noted, with some surprise that chalcopyrite always occurs with calcite in the pyrite in this specimen. It was further noted that again the chalcopyrite was very fine-grained.-of the order of 15-20 microns.

Sphalerite occurs with the pyrite and calcite but not with the galena.

In the second piece there were great quartz areas with arsenopyrite. In this piece the arsenopyrite was in large blobs of the order of 350-400 microns or larger.

In this second piece there was no galena noted but some sphalerite and calcite were seen occurring with arsenopyrite. In some places arsenopyrite is replaced by the pyrite.

In a few places sphalerite was found finely disseminated in the quartz.

In the third piece pyrite occurs in abundance and has fractured with galena filling in the fractures.

Several instances of the fracturing of the arsenopyrite and the depositing of quartz were noted in the specimen.

Specimen No. 3.

It was in this specimen, the mineral identified as bournonite was found. It occurred with the tetrahedrite and there were only faint showings of it.

The tetrahedrite was always found in the galena and nearly always in contact with the sphalerite or pyrite. There was quite a considerable showing of it in this specimen.

There was considerable calcite in this specimen.

In the second piece pyrite was found disseminated through the galena. It occurred in small round nodules.

Some quartz was noticed with the pyrite.

The chalcopyrite was very fine-grained and occurred with the pyrite in the galena.

In this specimen there was noticed stringers of sphalerite extending into the fractured pyrite.

In the third specimen there were noticed large areas of sphalerite having minute inclusions of pyrite of the order of 50 microns.

Paragenesis:

The ore seems to be so complex as to render an exact determination of deposition impossible. It seems fairly evident that the arsenopyrite and pyrite were deposited first. Afterwards there was a period of fracturing and the deposition of calcite and quartz. Probably there was further movement and a later deposition of the chalcopyrite galena tetrahedrite and sphalerite. The galena seems tb have come in last of all.

CONCLUSIONS.

Several interesting facts became apparent with reference to subsequent treatment of the ore. It is quite evident from the standpoint of flotation that trouble with the zinc flotation will be encountered.

The dissemination of fine-grained sphalerite through the pyrite belies the difficulty in this direction. It might be stated here that tests completed have borne out the truth of this statement. It does not seem likely that there is enough tetrahedrite to constitute any problem. The galena is not so fined grained as the sphalerite and is not locked in the pyrite, indicating that its recovery by flotation should not be difficult. (This has also been proven by experiment.) There remain two other considerations. (1) the recovery of the gold and silver (11) the recovery of the arsenic. This latter problem would seem to fall into the same class as the sphalerite as far as flotation is concerned, for although considerable of it occurs in large pieces, there are great areas in the specimen showing it to be very finely disseminated. It might be of interest to mention here that tests just completed have shown that 98% of the arsenic in the ore can be recovered by roasting and 93% of the gold and silver by chloridizing.

DISTRIBUTION OF GOLD AND SILVER

The distribution of the gold and silver is of particular interest because it was due to the difficulty of recovering the gold that the C. M. and S. Company abandoned their option on the property.

Separation of about 100 grams of the ore ground to -100 and +200 mesh was obtained on the superpanner. The products obtained were galena, arsenopyrite, pyrite and calcite-quartz. There was considerable difficulty in getting a suitable galena tip. Finally the -200 mesh reject was superpanned and a much better galena showing was obtained. Inspection with a glass showed that most of the sphalerite seemed to be with the pyrite. The results obtained, although not precise, are sufficient to obtain a fair idea of the distribution. Overlapping is due principally to the arsenopyrite and pyrite, for though a definite separation of the two was obtained, there was still some dilution of the one by the other. The head assay was as follows:

Au - 0.65 oz. per ton.

Ag - 6.00 oz. per ton.

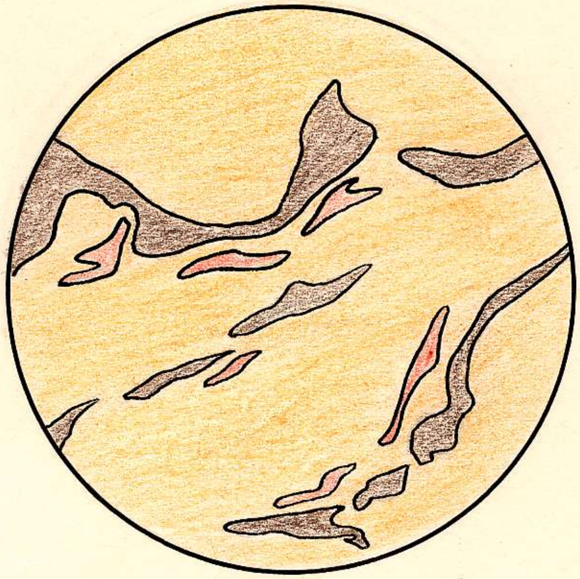
The results were as follows. It should be noted that no attempt was made to size the products and obtain an estimate of the distribution:

	% Total Weight	Distribution %	
		Au	Ag
Galena	8.5	10.1	61.3
Arsenopyrite	29.9	43.9	17.6

(Continued)	% Total Weight	Distribution % Au	Distribution % Ag
Pyrite	42.0	31.2	14.2
Calcite-Quartz	19.6	11.2	4.4
	100.0	96.4	97.5

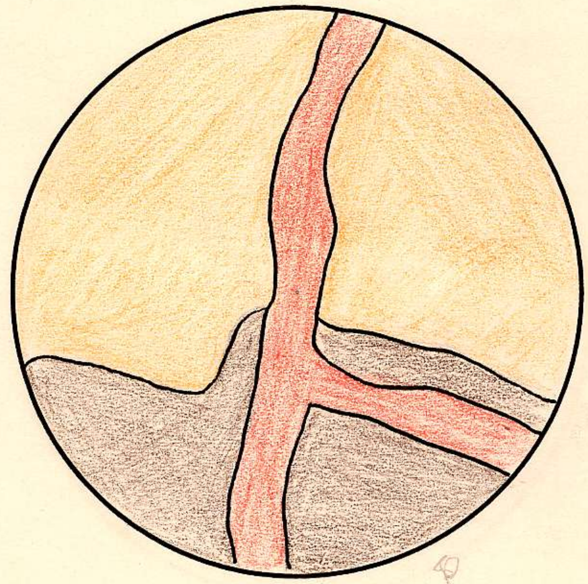
It can be seen that the bulk of the silver is associated with the galena. Its recovery, then, should present no great problem. The gold, however, is a different matter. As can be seen, about 75% of the gold is associated with the pyrite and arsenopyrite. This fact probably explains the difficulty encountered in the attempts to recover it by cyanidation. Further investigation into the size of the gold particles will probably give additional information as to their occurrence.

X 250



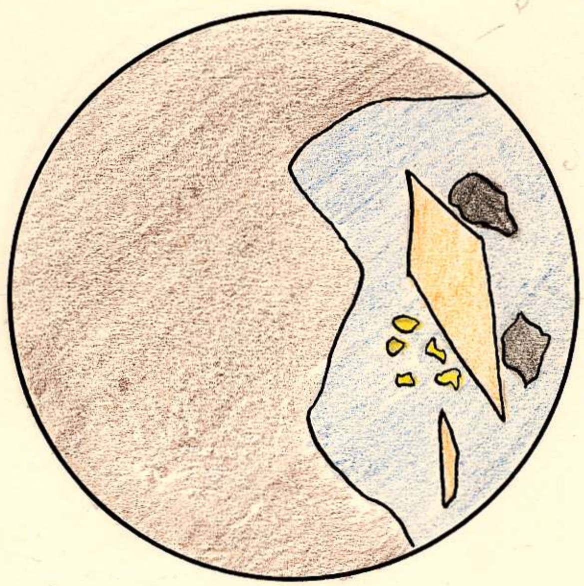
	Pyrite
	Sphalerite
	Quartz

X 100



- Quartz.
- Arsenopyrite
- Pyrite

x 250



Galena

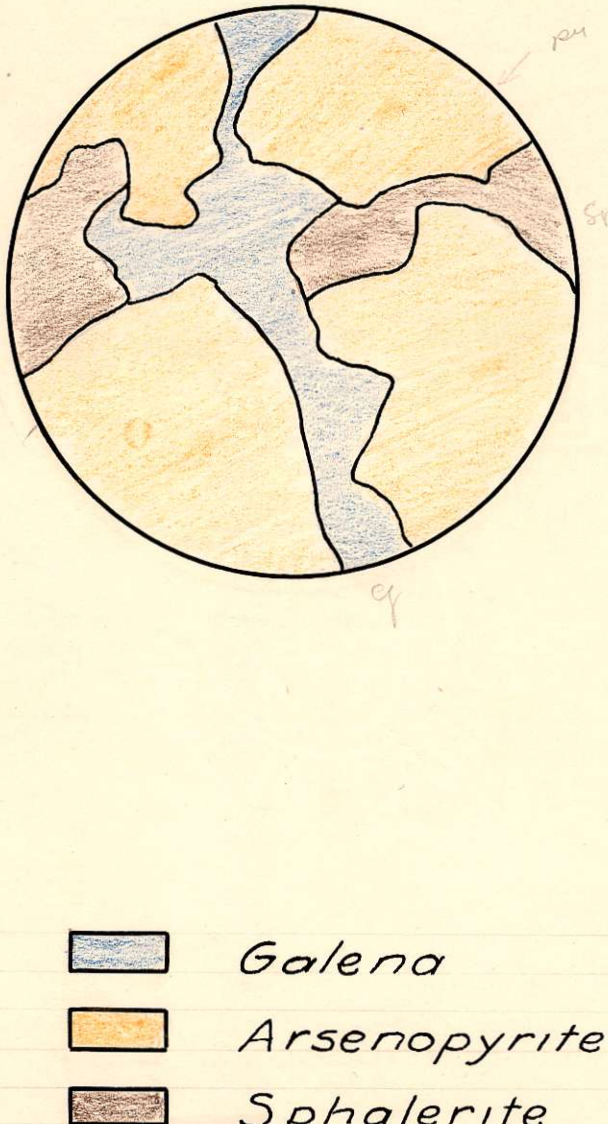
Pyrite

Arsenopyrite

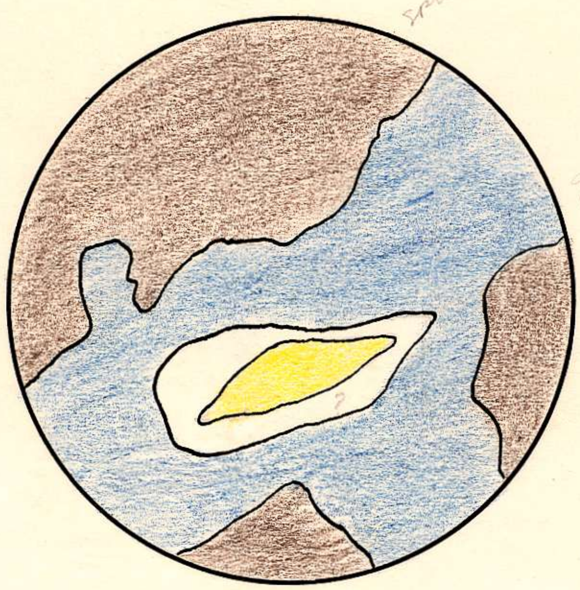
Chalcopyrite

Calcite

X 250



X 250



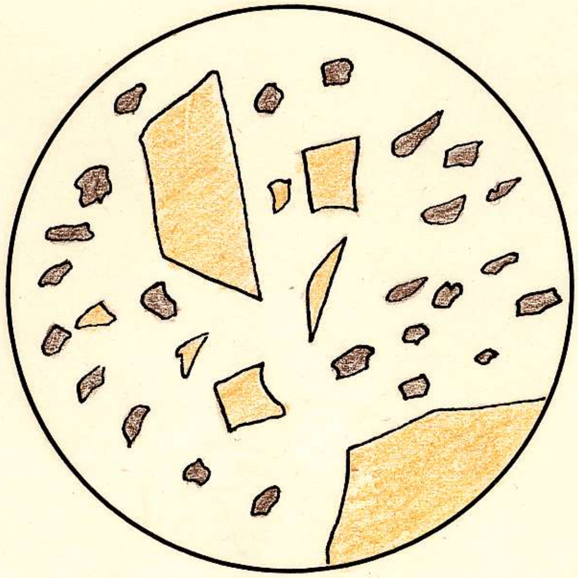
Bournonite

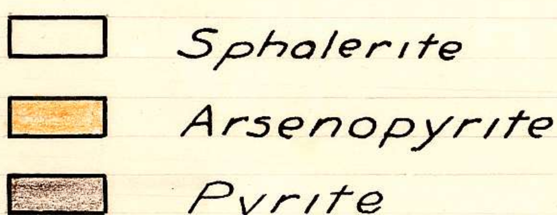
Tetrahedrite

Sphalerite

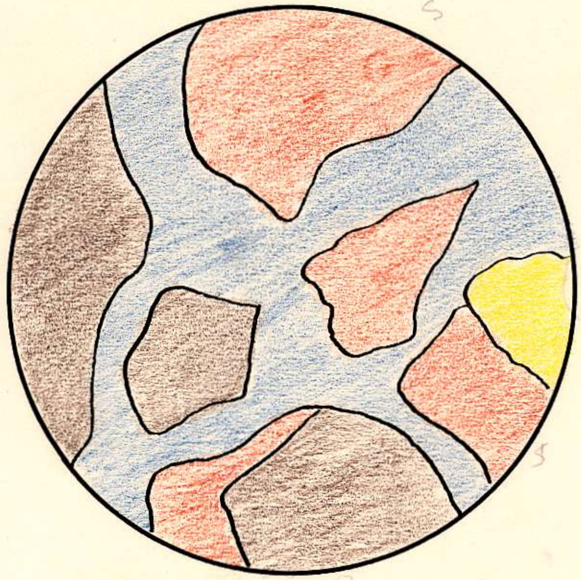
Galena

X 250





x250

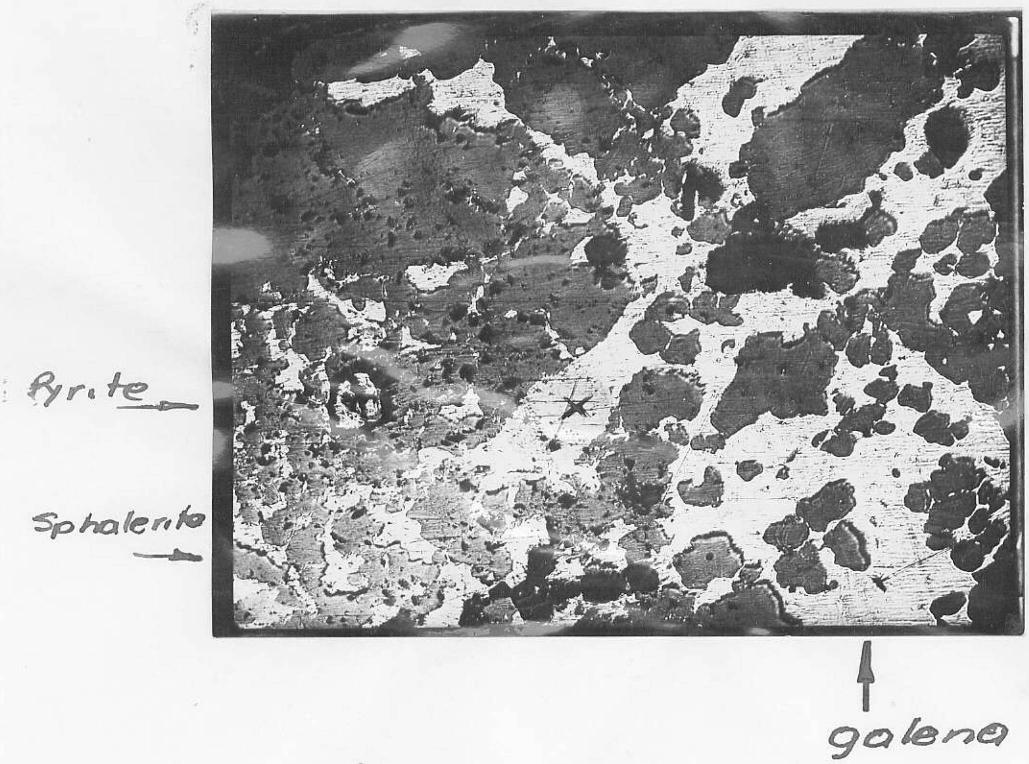


Sphalerite

Galena

Pyrite

Tetrahedrite.



X = Tetrahedrite