MINERALOGY OF THE SHEEP CREEK MINE

by

W.T. Irvine

5th Year Geological Engineering

April, 1937

Geology 9 Report

MINERALOGY OF THE SHEEP CREEK MINE

(QUEEN MINE)

Location#

The Queen Mine is located in the Sheep Creek mining district. The property lies along the valley of Woldie (Wolf) Creek immediately above its junction with Sheep Creek. It is connected by a 10-mile automobile road with the town of Salmo, on the Great Northern Railway.

Geology#

The property lies in rocks of the Pre-Cambrian Reno and Quartzite Range formations. The Reno formation consists of brittle quartzite, limestone and argillite. The Quartzite Range formation is composed of massive white quartzite, argillaceous quartzite and slaty argillite.

The ore occurs in four, east-west, gold-bearing fissures which cut rocks of the Reno and Quartzite Range formations. The fissures have been filled with quartz,

Walker J.F. Mem. 172. Can. Geol. Surv.

carrying sulphide minerals. The ore deposits are believed to be genetically dependent upon the Nelson batholith of post-Triassic age.

Mineralogy

The following minerals were identified in polished sections of the ore:

Pyrite	Sphalerite
Arsenopyrite	Galena
Pyrrhotite	Quartz
Chalcopyrite	

Pyrite (FeS_2)

The pyrite occurs as euhedral crystals and as irregular disseminations in a gangue of quartz. In section 4 the quartz and pyrite were found occupying a regular fracture system in sphalerite. In Section 2, however, a euhedral pyrite crystal was found to be incised and corroded by chalcopyrite, which in turn is considered to have been introduced earlier than sphalerite. This would show that the pyrite was introduced in two separate periods, before and after the introduction of the sphalerite.

Pyrrhotite (Fe_xS_{x+1})

Pyrrhotite occurs both in massive crystalline aggregates and as irregular disseminations in most of the sections. In Section 3 it was seen to be cut by sphalerite,

and in Section 2 it was observed to have a mutual relationship with chalcopyrite when observed under ordinary light. When examined under crossed nicols with a high power oil immersion lens, however, it was seen that a few narrow injections of chalcopyrite occurred along grain boundaries in the pyrrhotite. From this it is thought that the chalcopyrite probably was introduced at or about the same time as the pyrrhotite, but that its period of crystallization extended beyond that of the pyrrhotite.

Arsenopyrite ($FeS_2 \cdot FeAs_2$)

Arsenopyrite is present in very small quantity in Sections 2 and 5. It was found to occur in intimate association and contact with pyrite.

Chalcopyrite ($CuFeS_4$)

Chalcopyrite occurs both as irregular disseminations closely associated with pyrrhotite, and as more regular, isolated disseminations in quartz. In Section 2 it was observed incising and corroding a euhedral pyrite crystal. Its relationship with pyrrhotite has been already discussed.

Sphalerite (ZnS)

Sphalerite occurs largely as large irregular disseminations connected by a network of irregular veinlets of the same mineral which cut the quartz gangue. It is chiefly associated with pyrite and galena. The galena has a more or less mutual relationship with the sphalerite, but

the presence of small galena veinlets cutting the sphalerite as in Section 1 suggest that the galena was later than the sphalerite in its final crystallization. The relationship of the sphalerite to the two periods of pyrite introduction has been already discussed.

It is noteworthy that the sphalerite examined in these sections has very little chalcopyrite associated with it. This is rather unusual, as chalcopyrite and sphalerite are almost always intimately associated.

Galena (PbS)

Galena occurs in quite small irregular disseminations and veinlets, and is closely associated with sphalerite.

Quartz (SiO_2)

Quartz is the gangue mineral of this ore. All the other minerals cut quartz, and it is considered to have been the first mineral to have been introduced. A second generation of quartz, accompanied by pyrite was found to occupy fractures in sphalerite. This was seen in Section 3.

Gold (Au)

The only gold seen in the ore was not seen in a polished section, but was observed in a hand specimen. One small piece of gold was seen in quartz and was later examined under a microscope. The particle of gold was about .75mm by .1mm and occurred in a specimen which also contained disseminations of pyrrhotite, chalcopyrite and sphalerite.

Assays - Picked Samples

	Au, Oz. per ton
1. Sphalerite with slight amounts of galena and quartz	0.16
2. Pyrite, about 75% pure, the remainder quartz	3.60
3. Pyrrhotite, pure	trace

- Ore

1. Sphalerite with some pyrite and quartz	0.12
2. Coarsely crystalline pyrite with quartz and a little sphalerite	4.76

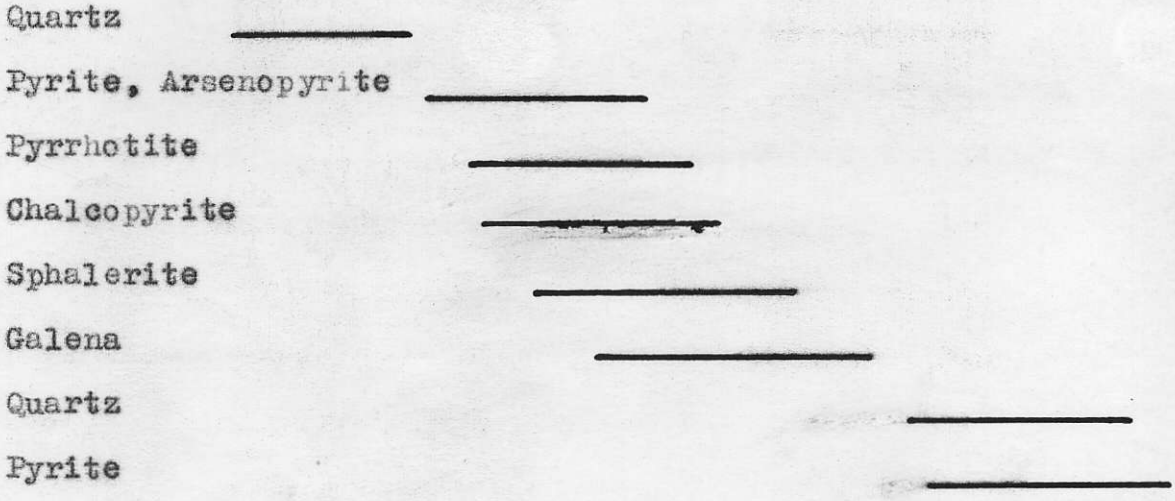
Distribution of Gold

As shown by the assays, gold is associated with the coarsely crystalline pyrite, and to a less extent with impure sphalerite.

The fact that gold was not seen in the polished section of the coarse pyrite, and the presence in another part of the ore of a sizable particle of free gold, seems to indicate that the gold may be present in fairly coarse grains. These coarse grains would 'salt' an assay, yet at the same time might be spaced so that a single section would not expose any gold.

Probable Paragenesis

1. Introduction of quartz
2. Introduction of pyrite and arsenopyrite.
3. Introduction of pyrrhotite
4. Introduction of chalcopyrite
5. Introduction of sphalerite
6. Introduction of galena
7. Fracturing and introduction of quartz
8. Introduction of pyrite



Summary and Conclusion

a. The facts presented would show that gold is associated with coarsely crystalline pyrite, and is probably present, to a large extent, in fairly coarse grains.

b. There are two distinct periods of mineralization. In the

second period, pyrite and quartz are introduced. Since gold is known to occur mainly with pyrite and quartz it is probable that it was introduced in the second period of mineralization.

c. It is improbable that all the gold is present as coarse particles. A small proportion, usually not over 10%, of the gold, has been found by experience with a good many ores, to be intimately associated with the sulphide minerals in a fine state.

d. The following treatment is recommended for the ore.

1. Cyanidation to recover the coarse gold.
2. Flotation of the residue to recover the sulphides.
3. Smelting of the sulphides to recover the intimately associated gold.

Description of Polished Sections

Section 1

Megascopically the section appears to consist of large, irregular disseminations of a dark brown sphalerite, surrounded by a quartz gangue. The disseminations of sphalerite appear to be connected by a network of irregular veinlets of the same mineral.

Under the microscope, galena is found in small irregular patches surrounded by sphalerite, or along the contact between the sphalerite and the quartz. Small veinlets of galena radiate from the larger bodies, cutting the

sphalerite. There is no evidence of erosion along the contacts between the galena and the sphalerite.

Also observable under the microscope are small, fairly regular bodies of chalcopyrite, surrounded by quartz.

Section 2

Megascopically this section is seen to contain large irregular, isolated disseminations of pyrrhotite, together with smaller bodies of pyrrhotite and chalcopyrite. The gangue is quartz.

Under the microscope, the chalcopyrite is seen to occur principally in a small vein, where it is closely associated with pyrrhotite. Small dispersions of pyrite intimately associated in a few places with arsenopyrite are also seen.

The section is cut by a long regular fracture. This fracture has cut bodies of pyrrhotite, and is filled, in places, by chalcopyrite and pyrrhotite.

Section 3 Dama Section

When examined megascopically this section appears to consist of irregular veinlets and disseminations of pyrrhotite occurring rather sparsely in a quartz gangue.

Under the microscope, small irregular patches of sphalerite are seen in contact with the pyrrhotite. The sphalerite is deeply corroded in places by pyrrhotite.

Section 4 Dama Section

Megascopically this section is seen to contain large, irregular disseminations of pyrite and sphalerite in a gangue of quartz.

Under the microscope, the sphalerite is seen to be cut by a series of regular parallel fractures which are in turn filled by quartz accompanied by pyrite.

Section 5 Bakelite Section

In this section euhedral pyrite crystals in a quartz gangue can be seen megascopically.

Under the microscope there are seen to be small disseminations of chalcopyrite, arsenopyrite and sphalerite in the quartz gangue. These minerals are present in very small amount.

Although ore of this type assayed from 3 to 4 ounces of gold per ton, no gold was seen in the section after a very careful examination with a high power microscopic lens.