Geology 409

Providence Mine - Greenwood.

Introduction

The Providence mine is situated on the north side of Providence Creek about one mile north of Greenwood. A good automobile road connects the mine with the trans-Canada highway.

This mine lies within the highly altered rocks that border a large granodiorite stock. The ore shoots occur within a quartze vein that strikes north 50 degrees east and dips 40 to 65 degrees southeast. The vein has been traced for more than 1,200 feet, and ranges from less than an inch to 2½ feet in width. The enlargement of the vein in places is due to intersection of the mineral zone with pre mineral faults.

Megascopic Description

The ore minerals lie in fractures and in areas of brecciation in a white massive quartz vein and in the immediate adjacent areas on either side of the quartz vein in the chloritic shist. Mineralization is only of very minor amounts in the shist.

Minerals that can be seen by eye or with aid of hand lens are: pyrite, chalcopyrite, sphalarite, tetrahedrite, galena, pyrargyrite and native silver.

Chalcopyrite and pyrite are closely associated and are in tiny fractures of $\frac{1}{8}$ inch and less across. The chalcopyrite is massive and only in small amounts. Whereas, pyrite shows crystal faces where it has not been brecciated and is widely distributed throughout the ore. In some instances small well formed, clear quartz crystals accompany pyrite and chalcopyrite.

Sphalarite is dark brown - black and crystalline. One hand of sphalarite with a little galena and tetrahedrite measures $3" \times 2" \times 2\frac{1}{2}"$. The Galena in this sample is crystalline, shows cube faces $\frac{1}{8}"$ across, and has veined into the sphalarite. Tetrahedrite is closely associated with galena and is massive, steel grey in color.

Pyrargyrite is deep red with an adamantine lustre. It occurs in tiny veinlets that range in width of $\frac{1}{4}$ inch and smaller. These veinlets have minute veinlets that branch perpendicularly from the main veinlet and are not much more than $\frac{1}{8}$ inch in length. Pyrargyrite also occures as thin patchy films on the slickensided surfaces of the chloritic shist that is immediately adjacent to the vein.

Native silver, in the largest hand specimen is in dendritic plates about $\frac{1}{64} \times \frac{1}{4} \times \frac{1}{4}$ inches in size. The silver is soft, flexible, sectile and has an irridescent tarnish. Along with an unknown mineral, native silver is in close association with a white calcite gangue.

The unknown mineral is black, soft, only slightly sectile and has at least one cleavage. No crystal forms of this mineral were recognized, but I would suspect that it form dendritic structures.

Pyrhotite, that was identified in polished section was not recognized in any of the ore specimens.

Microscopic Descriptions.

Pyrite

Pyrite is pale yellow, isotropic, and has a stippled surface. In many cases it shows good crystal form, whereas in other instances it is fractured and brecciated. Pyrite is replaced by sphalarite, tetrahedrite and pyrargyrite particalary where it has been crushed. - See figure 1 and 2.

Pyrrhotite.

Pyrrhotite is creamy pink in color, anisotropic brown grey to blue grey and has a high reflectivity. It is replaced by chalcopyrite, and sphalarite - Fig. 3.

Sphalarite

Sphalarite is grey-brown in color and has resiny-brown internal reflection. In many instances it has exsolation blebs of chalcopyrite giving it a mottled texture. However, not all sphalarite contains exsolution chalcopyrite. Tetrahedrite, chalcopyrite and pyrargryite replace sphalarite

Chalcopyrite

Chalcopyrite is brassy yellow in color and is isotropic. It replaces pyrrhotite and sphalarite (Diag 3) and is itself strongly replaced by pyrargryite.

Galena

Galena is white in color, isotropic and takes a poor polish as shown by triangular pits. Bournonite has exolved from galena as tiny inclusions. Galena has preferentially partially replaced sphalarite and is itself replaced to a small extent by pyrargryite and tetrahedrite.

Bournonite

Bournonite is gray-white and has very little difference in relief when against galena. It is in galena as exolvion inclusions - Fig. 2.

Tetrahedrite

Tetrahedrite is grey brown in color, completely isotropic and takes a poor polish. It is closely associated with pyrargyrite It replaces pyrite and galena to a small extent and preferentially sphalarite.

Pyrargyrite

Pyrargyrite is bluish-grey in color and has anisotropism which is often obscured with deep red internal reflection. It replaces replaces pyrite sphalarite and chalcopyrite.

Native silver and the unknown mineral were not seen in polished section.

Metal Content of Ore

Up to 1930 the average value of metal per ton of ore produced were as follows.

Silver	130	oz/ton
Lead	32.6	lbs/ton
Gold	.562	oz/ton

The gold content of this ore could be accounted for as the free gold mentioned in other reports. However, no free gold was identified in the ore specimens available.

Paragenesis.

The Providence mine lies almost entirely within the highly altered rocks that border a large granodiorite stock. The mineralized quartze vein attributes it's existance to the residual hydrothermal solutions derived from this stock. The quartze vein was deposited first and then later fractured, allowing the penetration of ore forming fluids.

The first sulphide deposited was pyrite as small crystals in both the quartze vein and in the adjacent chlorite shist. Pyrrhotite was next, however, the extent of the deposition of pyrrhotite is not known from the specimens in this suite.

Sphalarite was the next mineral to be deposited and it shows an exsolution texture of exsolved chalcopyrite blebs. This indicates that the sphalarite was deposited above 350 - 400° C. Sphalarite has replaced pyrite to some extent especially where the pyrite has been brecciated by fault movements.

Chalcopyrite does not appear in very large amounts and it is difficult to fit it's existance into the paragenetic sequence. However, on the basis of the information extended in figure 3, it appears to come after sphalarite and replace sphalarite and pyrrhotite.

The next mineral deposited was galena that preferentially, partially replaced sphalarite. On the cooling of galena bournonite was exolved from galena as tiny inclusions.

Tetrahedrite, in close association with pyrargyrite was next deposited. Sphalerite has be replaced partially by tetrahedrite in many instances. If also replaces pyrite and chalcopyrite ably in minor amounts.

Pyrargyrite was deposited along with tetrahedrite and after. If accompanies tetra hedrite in many veinlets and also replaces chalcopyrite and sphalarite.

Native silver was not seen in the polished sections, however I would suspect that if came after pyrargyrite. The unknown mineral mentioned in the hand specimen description is in close association with a calcite gangue as is native silver. On this evidence I would say that the unknown came about the same time as native silver if not before.

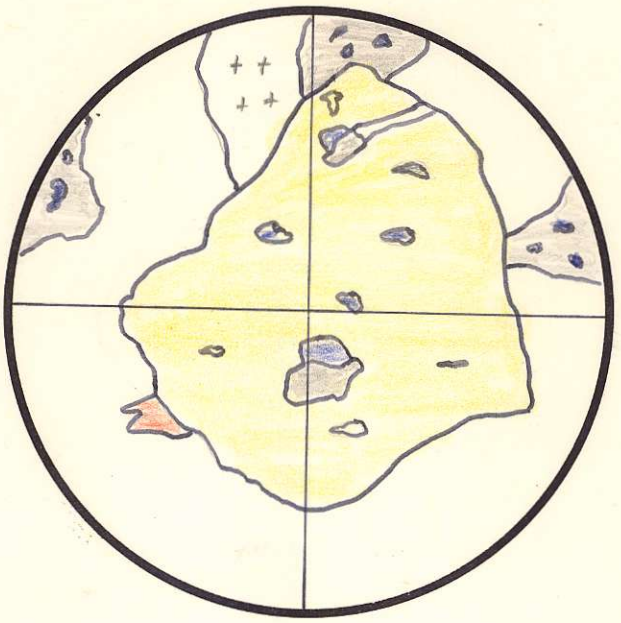
Classification of Mineral Deposits.

This mineral deposits could be classified as a low meso thermal type.

Since there are a variety of minerals present, I would suspect that the ore forming fluids entered a pre heated channel and precipitated the minerals in an area of strong thermal gradient.

Figure 1

X 260

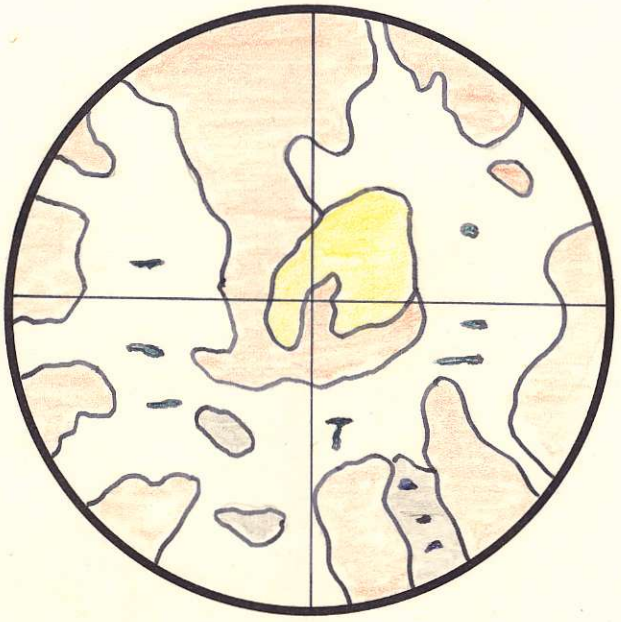


Replacement of pyrite by Tetrahedrite and Pyrargite

Pyrite
Sphalarite
Galena
Bornonite
Pyrargyrite
chalcopyrite
Quartze

Figure 2

X 65

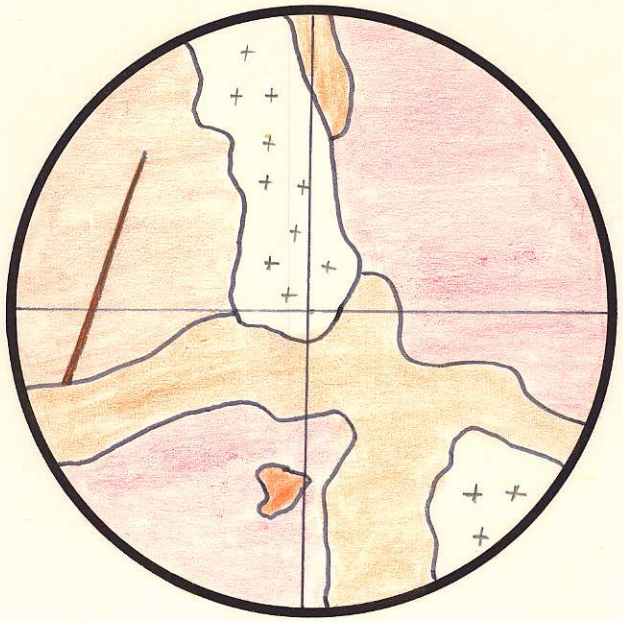


Sphalarite replacing pyrite

Galena replacing Sphalarite

Figure 3

X 260

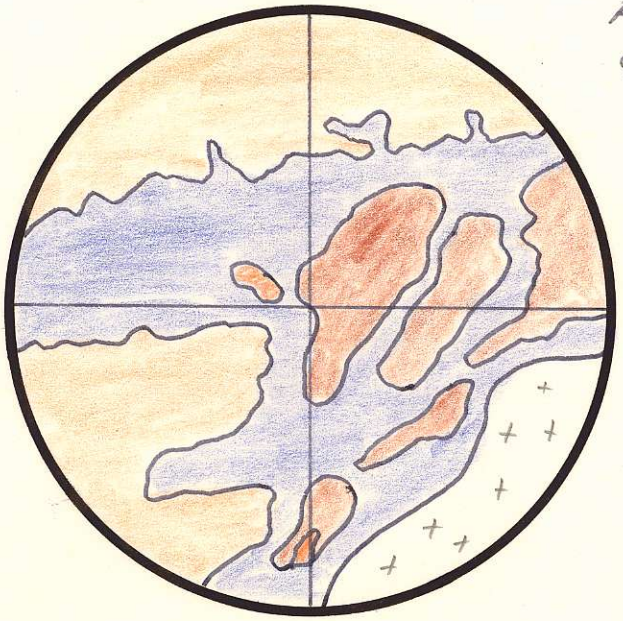


Replacement of pyrrhotite and sphalarite by chalcopyrite

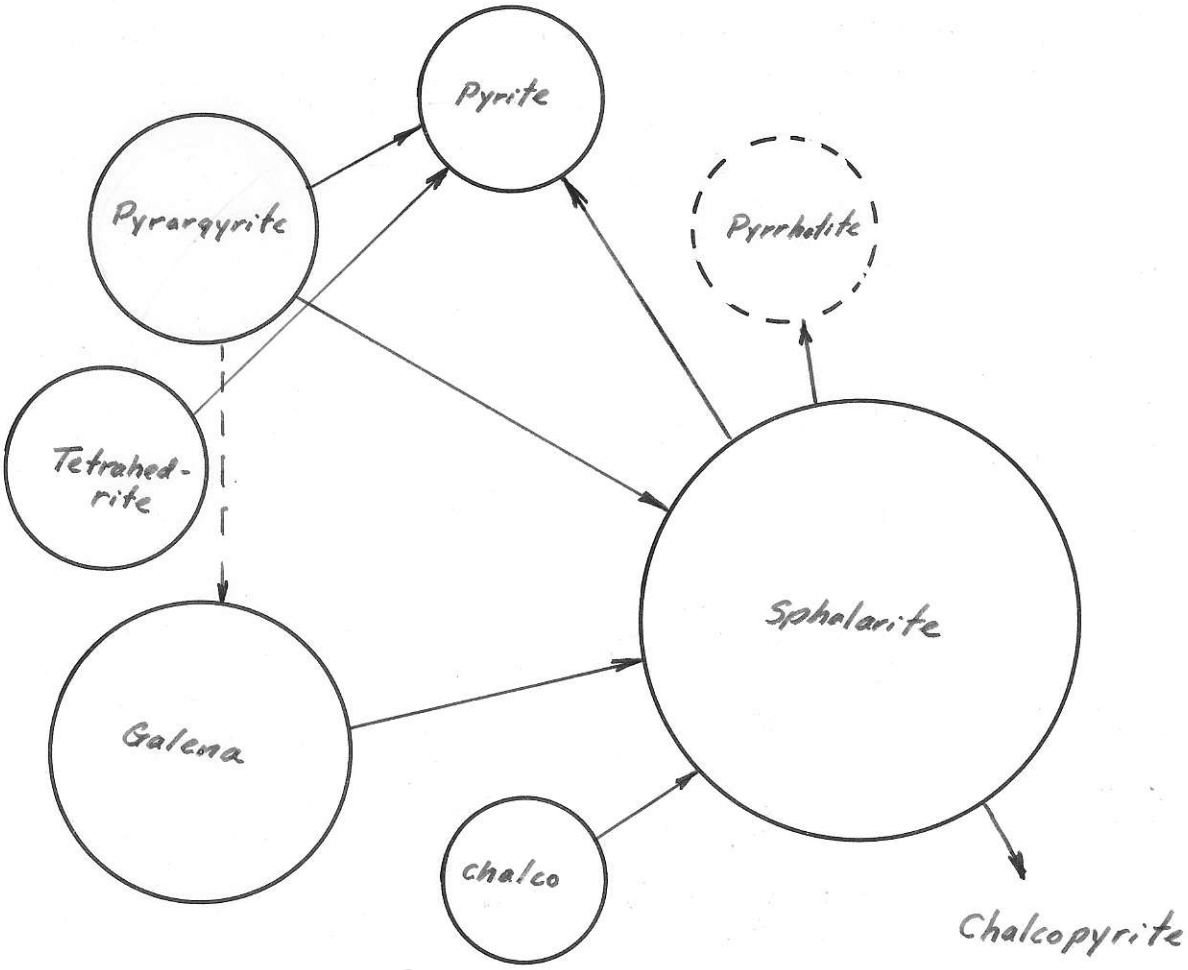
Pyrrhotite
Chalcopyrite
Sphalarite
Pyrargyrite
Quartze

Figure 4

X 260



Replacement of chalcopyrite and sphalarite by pyrargyrite.



Van der Veer Diagram.

References.

B.C. Dept. of Mines : Annual Report
B.C. Minister of Mines 1897 – 1934

Department of Mines and Resources

Mines and Geology Branch.

Geological Survey

Paper 45-20

English is terrible
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