

*Sketchy
little on metallurgical aspects.
2nd class.*

A MICROSCOPIC STUDY OF MINERALS FROM
THE SILVER STANDARD MINE

600292

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Joseph Donald Giegerich
University of British Columbia
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THE SILVER STANDARD MINE

Introduction

Purpose

A number of specimens from the Silver Standard Mine were examined microscopically in polished sections to determine the metallic minerals present and their paragenesis.

Location and History of Mine

The Silver Standard property lies in the Omineca Mining Division near Hazelton, B.C., and is owned by Silver Standard Mines Limited. The property is located on Glen Mountain about six miles by road from Hazelton, and covers a group of 14 crown granted claims.

The veins were first discovered in 1908 on a spot where the rocks were well exposed. A mill was built to treat the ore in 1913 and frequent shipments of concentrates were made until 1921. A flotation mill was installed in 1948 when the present company took over the ownership, and since then

the property has been producing almost continuously.

In a period from 1947 to 1950, the gross contents of the concentrates were: gold 3,420 oz.; silver 1,321,935 oz.; lead 2,405,418 lbs.; zinc 5,395,968 lbs.; and cadmium 64,945 lbs.

General Geology

Most of the Hazelton group rocks are tuffaceous and argillaceous sandstones and grey ~~sandstones~~^{wackes}. They are of a grey color in beds a few feet thick which are interbedded with rocks of a variety of colors but of the same composition. Many of the beds have been altered by the introduction of carbonate and pyrite. The beds underlying the property form the west limb of an anticline and dip west and south at angles less than 20 degrees.

There are ten veins on the property, all occurring along strong fault fissures in the sedimentary rocks and dipping from 50 to 70 degrees southeast. The ore consists of banded and massive galena, sphalerite and tetrahedrite with associated pyrite and arsenopyrite in quartz gangue. The ore carries a high silver content with an appreciable gold content in some of the veins. The veins are very variable in mineral content throughout their length and depth.

Megascopic Examination

A wide variety of selected specimens were available for examination; however, because of the fractured and vuggy nature of the rock, polished sections could not be made from some of the specimens. In many of the specimens milky white quartz was present in relative abundance, and generally speaking

constituted a large portion of the gangue. Frequently the quartz was found bordering large masses of galena and sphalerite, and where the quartz was badly fractured, veinlets of galena sometimes filled the fractures in a very irregular pattern. Another gangue mineral that was fairly abundant was a soft, schisty greenstone which was probably part of the Hazelton sediments. This gangue mineral seemed to be frequently associated with the tetrahedrite. In specimens containing many vugs and cavities chlorite was present with calcite in large amounts. In the cavities were small crystals of quartz, sphalerite and pyrite. A buff siderite also formed part of the gangue and appeared to be associated with small veinlets of tetrahedrite.

The metallic minerals that were observed included galena, sphalerite, tetrahedrite, chalcopyrite, pyrrhotite, pyrite, and arsenopyrite. Some specimens contained almost pure galena with small amounts of tetrahedrite scattered throughout. Chalcopyrite was noticed only in very minute amounts, and no large quantities of pyrite were associated with the galena, sphalerite or tetrahedrite. Arsenopyrite, a mineral not found in any of the polished sections, was seen associated in small quantities with the chlorite.

Microscopic Examination

Pyrite

The pyrite in the polished sections was easily determined by its color, hardness, pitted surface, and distinct crystal outline. Only one section showed any relatively large

masses of pyrite and in this specimen the mineral was closely associated with pyrrhotite. In most of the sections pyrite occurred as isolated grains about 200 to 300 microns in size scattered throughout the large masses of galena, sphalerite and tetrahedrite. The pyrite was never found present with these three minerals in large quantities.

Pyrrhotite

The pyrrhotite, which was encountered only in one polished section, was recognized by its characteristic pinkish color, extreme anisotropism, and negative reaction to HNO_3 . Closely associated with the pyrrhotite were large masses of pyrite. It was difficult to determine the order of deposition, but the manner in which the pyrite crystals were completely surrounded by masses of pyrrhotite suggested the pyrite was possibly earlier. Also bordering the pyrrhotite was a small stringer of pyrargyrite-bearing galena. The occurrence of pyrrhotite may be an indication that the deposition began at a high temperature.

Sphalerite

Sphalerite was easily identified under the microscope by its characteristic mouse-grey color, relative softness, and resin-colored internal reflection. Where specimens did not exhibit internal reflection, identity was verified by etch tests with HNO_3 and HCL .

Almost all of the specimens examined contained large uncontaminated masses of sphalerite. This suggested that the sphalerite-bearing ore would give a high mill recovery. In some instances, however, the sphalerite was intimately associated



Figure 1. Replacement Texture Showing Galena Replacing Sphalerite

with the galena as shown in Fig. 1. This picture is a good example of a replacement texture which shows how the galena has corroded a grain of sphalerite. The light grey material is tetrahedrite. This type of texture only existed along the contact between the galena and sphalerite and was ^{not} widespread throughout the main masses of the two minerals. In some cases the sphalerite grains reach a size of 1000 microns. Sphalerite was also present in very small abundance along the boundaries between tetrahedrite and galena. In some of the larger masses of sphalerite small blebs of chalcopyrite in sizes up to 100 microns were scattered irregularly. However, these were few.

Tetrahedrite

Tetrahedrite was distinguished by its light grey color, its isotropic property, and its negative reaction toward all etch reagents.

The manner in which tetrahedrite was present in the specimens varied appreciably. In some instances the tetrahedrite formed large masses which contained very few other minerals. In other cases the tetrahedrite formed small irregular veins in the quartz and other gangue minerals, and was closely associated with other metallic minerals. Frequently the tetrahedrite was associated with galena. The contact between the two minerals suggested a replacement of the tetrahedrite by galena, and in many instances tetrahedrite grains were scattered irregularly throughout the galena masses. This is illustrated by the island and sea texture shown in Fig.2.

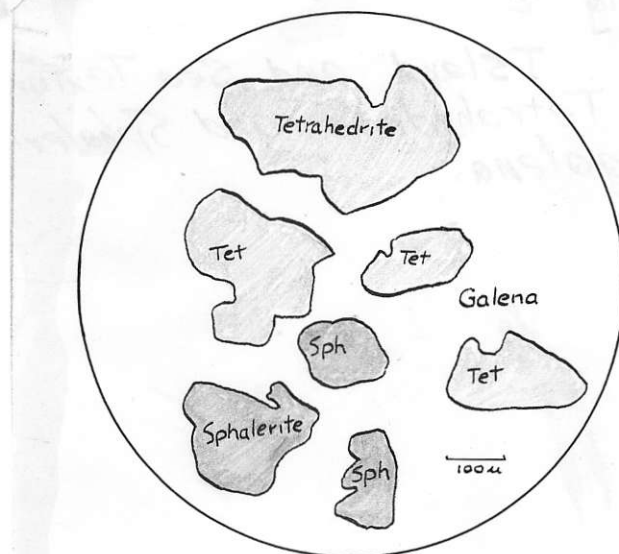


Figure 2. Island and Sea Texture of Tetrahedrite and Sphalerite in Galena

Another polished section examined showed tetrahedrite associated with meneghinite. In this instance isolated grains of tetrahedrite were found in a groundmass of meneghinite which suggested deposition of the tetrahedrite prior to the meneghinite. Some of the tetrahedrite grains exhibited a reaction rim of bournonite as shown in Fig. 3.



Figure 3. Tetrahedrite Grains
Surrounded by Bournonite
in a Matrix of Meneghinite

Galena

Galena was easily distinguished by its color, etch tests and polish. Its polish was the most significant of all properties since the triangular pits and right-angled fractures almost immediately indicated its presence.

Most of the galena examined occurred as large massive quantities almost entirely free from other minerals. Galena of this type would be easy to mill and should show a high recovery. Enough evidence has been discussed under previous headings to show that the galena was later than both the sphalerite and tetrahedrite. Besides having replaced both these minerals in place, galena also filled fractures in both the gangue and the metallics to form long, narrow, irregular veinlets.

Chalcopyrite

Chalcopyrite was easily differentiated from any other mineral by its color and chemical inertness.

Although present only in small quantities, the chalcopyrite was widely distributed. Small isolated grains from 200 to 300 microns in size were frequently found along the tetrahedrite-galena boundaries. In the sphalerite, chalcopyrite was sometimes found occupying narrow veinlets along fractures, thus indicating that the sphalerite was earlier. Some of the mineral was present in the galena as shown in Fig. 4. The presence of the sharp angular corners makes the chalcopyrite appear later. However, in such cases the chalcopyrite is closely associated with the tetrahedrite, and therefore suggests a second deposition of tetrahedrite.

Only one specimen contained any appreciable masses of chalcopyrite. Therefore, if this mineral were present in sufficient quantities to warrant recovery, the ore must be

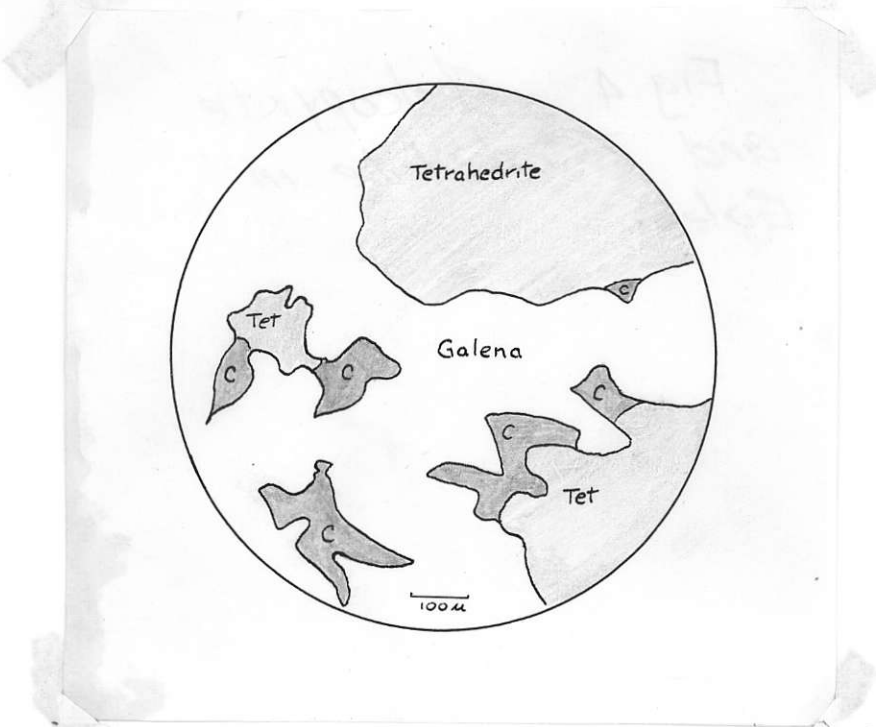


Figure 4. Chalcopyrite and Tetrahedrite in Galena

ground to sizes in the range of 200 microns to free it.

Bournonite

Bournonite was identified by the following properties:

Color - almost galena-white with a slight greenish tinge.

Etch - irridescent stain with aqua regia.

Anisotropism - greenish-grey to purple with multiple twinning.

This mineral was present in the polished sections in two different forms. It was commonly observed as small grains in the galena, and appeared as though it had been deposited simultaneously with the galena. The other manner in which the bournonite occurred was as a reaction rim around the tetrahedrite as illustrated in Fig. 3. This may be an indication that a solid solution was formed at higher temperatures.

Pyrargyrite

Pyrargyrite was identified by its bluish-grey color, ruby-red color under reflected light, and etch reactions.

In most cases the pyrargyrite occurred as small grains in the galena and along the galena-quartz boundaries. It also occurred much less frequently in the tetrahedrite. The size of the majority of grains were in the 50 to 150 micron range.

Meneghinite

The identity of this mineral was based on the following properties

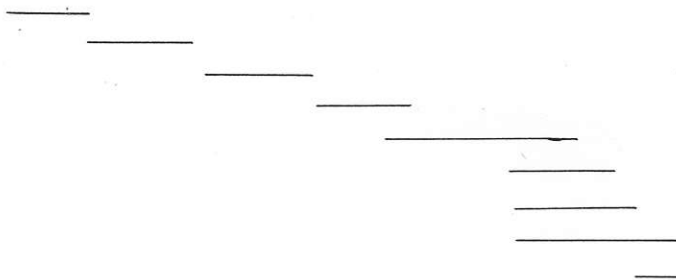
Hardness - C
 Color - light grey
 Anisotropism - strong, showing a light-grey to blue coloration
 Etch tests - With HNO_3 a wave advances rapidly over the face³ of the mineral.
 With HCL, fumes stain.

The occurrence of this mineral was noted only in one polished section. It was present in relative abundance and, as shown in Fig. 3 formed the groundmass around tetrahedrite particles. From all indications the mineral appears to have replaced the gangue mineral which is siderite.

Summary

The metallic minerals present and their paragenetic sequence can be listed as follows:

Pyrite
Pyrrhotite
Sphalerite
Meneginite
Tetrahedrite
Chalcopyrite
Bournonite
Galena
Pyrargyrite



Judging from the minerals and the textures present, this deposit may be classified as an epithermal replacement. The vuggy nature of some of the hand specimens and the presence of sulpho-salts with galena and sphalerite are evidence towards formation at a low temperature. The presence of arsenopyrite and pyrrhotite may indicate that the deposition began at high temperatures.