

600379

A MINERALOGRAPHIC STUDY OF THE
MASTODON Ag-Pb-Zn PROPERTY

A mineralographic report submitted during the
Fourth Year of the Course in Geological
Engineering at the University of British Columbia

LAWRENCE J. HOMER

March 17, 1956

Fort Camp,
University of British Columbia,
Vancouver 8, B.C.
March 17, 1956.

Dr. R.M.Thompson,
Associate Professor of Geology,
University of British Columbia,
Vancouver 8, B.C.

Dear Sir:

I am submitting this report entitled "A Mineralographic study of the Mastodon Ag-Pb-Zn Property", in partial fulfilment of the University Calendar requirements of 1955-56, for the course in Fourth Year Geological Engineering.

Yours truly,

Lawrence J. Homer.

Lawrence J. Homer

A MINERALOGRAPHIC STUDY OF THE
MASTODON Ag-Pb-Zn PROPERTY

Introduction

This report was written in conjunction with a detailed mineralographic study of samples from the Mastodon property. The work was done under the direction of Dr. R.M. Thompson during the Spring of 1956.

Location

The Mastodon group are situated in the Big Bend district within the Selkirk Mountain range. The Big Bend district is bounded on the north, east, and west by the Columbia River and on the south by the main line of the Canadian Pacific railway. These boundaries embrace about 2400 square miles of territory. This district, forming the northern

part of the Selkirk Mountain range, is exceptionally rugged. The climate in this area is severe, with the higher elevations having snow on the ground about ten months of the year.

The main camp and mill-site are on the south side of La Forme Creek, four and one half miles by road from a point on the Big Bend Highway, 17 miles north of Revelstoke. The mine is on the divide between La Forme Creek and Carnes Creek and is serviced from the main camp by a 37-degree incline, 2,400 feet long, in conjunction with a narrow-gauge railway 9,000 feet long.

General Geology

Underlying the Big Bend map-area is a great series of metamorphosed Precambrian sediments which strike from north to northwest and dip to the east. Extrusive greenstones are interbedded with the sediments at certain horizons and intrusive rocks of similar appearance are rather sparingly developed. All the rocks are completely folded in a series of essentially isoclinal anticlines and synclines. The sediments include crystalline limestones, quartzites, mica schists, slates, phyllites, argillites, and chlorite schists, and are cut by numerous stocks, dykes and sills of granitic rocks of Mesozoic age.

The Mastodon showings are near the southwestern edge

of a broad, northwesterly trending belt of metamorphosed sedimentary rocks, correlated by Gunning with the upper part of the Windemere group of the Lardeau area to the southeast. The ore bodies are lenticular, bedded zinc-lead replacements in limestone and are localized along or near contacts with limy sericite schist or quartz-sericite schist.

History

The Mastodon showings were discovered in 1989, with the first development work being done in 1916 and 1917 by The Mastodon Mining Company Limited. One ton of sorted ore from this working assayed: Silver, 23.3 oz/ton; Lead, 46.7%; Zinc 15.7%.

The property was relocated in 1932 and was optioned to the Fawn Mining Company Limited. After making a few open-cuts, this company relinquished its option. In 1946 New Jersey Zinc Explorations Limited made a large open-cut on the property. In 1948 the property was bought by D.F.Kidd and associates who continued surface and underground development work in 1949 and 1950. A large amount of development work was done from 1950 to 1953, with the property being ready for production in the latter year. However, with the drop in the price of zinc, the property was forced to close October 31, 1953, and has not been subsequently reopened.

Megascopic Examination

Most of the specimens involve varying degrees of replacement of a sericite schist by Pb-Zn sulphides. The replacement is selective, in that limy layers are completely replaced whereas the intervening schist layers are unchanged. In the lowest grade of metasomatism, sphalerite is the only replacing mineral and forms approximately 20% of the original schist. A complete gradation is apparent between this partially replaced schist and the same schist that has been entirely replaced by sphalerite. Other sulphide minerals are notably absent in these specimens.

In specimens of the schist that have undergone almost total replacement, the copper and lead sulphides are present, while the sphalerite is almost totally absent. A yellow secondary mineral staining the surface of such a specimen was tested for cadmium. This test was negative. However, further tests proved the mineral to be smithsonite (ZnCO_3).

One of the specimens consists of limestone rather than schist. The limestone beds have been strongly crumpled, with several of the beds being selectively replaced by sphalerite. This limestone is a dark blue variety and is partially recrystallized.

A specimen of gossan was tested microchemically, indicating the presence of zinc, iron, and cadmium.

Microscopic Examination

Mineral #1.

Size, mutual relations to other minerals?

This mineral has a grey colour and a hardness of C. A strong internal reflection is noted, with red-brown colours being apparent. Twinning is common. The mineral is isotropic. Etch tests give the following reactions:

aqua regia - stains dark brown; fumes tarnish

HNO_3 , HCl , KCN , FeCl_3 - negative

From the foregoing properties the mineral was identified as sphalerite $(\text{Zn,Fe})\text{S}$.

Mineral #2.

This mineral has a "galena white" colour and a high reflectivity. The hardness is B. Triangular pits, indicating isometric cleavage, are evident. The mineral is isotropic and lacks internal reflection. Etch tests give the following reactions:

HNO_3 - stains black instantly without effervescence.

HCl - tarnishes brown to iridescent

KCN - negative

FeCl_3 tarnishes iridescent.

The entire cleavage, colour and description etch tests identify this mineral as galena (PbS) .

Mineral #3.

This mineral has a olive grey colour with a hardness of D. The reflectivity is less than that of galena. It is isotropic and lacks internal reflection. Etch tests gave the following reactions:

aqua regia, HNO_3 , HCl , FeCl_3 - negative

KCN - stains brown

CrO_3 + HCl - positive, but is too strong an etch solution.

Microchemical tests revealed the presence of copper, iron, zinc and antimony. Silver was negative; however, the potassium bichromate test for silver is critical, so that this does not eliminate the possibility of a small amount of silver being present.

The characteristic colour, together with the etch tests, identifies this mineral as tetrahedrite $(\text{Cu,Fe,Zn,Ag})_{12}\text{Sb}_4\text{S}_{13}$.

Mineral #4.

This mineral is white with a bluish tint and has a hardness of B. Reflectivity is high, similar to that of galena. The mineral is strongly anisotropic showing the colours tan, brown and bluish grey. No internal reflection is evident. Etch tests gave the following reactions:

HNO_3 - starts slow, but then etches quickly in an advancing wave motion - slight effervescence - black stain.

HCl, KCN, FeCl₃, KOH - negative.

These properties narrow the mineral down to either boulangerite or jamesonite. A microchemical test revealed the presence of lead and antimony, with a very slight red colouration, indicating the presence of iron. However, the negative KOH test eliminated jamesonite, so that the iron may have been due to impurities. Thus, the mineral is identified as boulangerite (5 PbS . 2 Sb₂ S₃). *This is the characteristic etch for meneghinite.*

Mineral #5.

This mineral had a hardness of C and a greyish-white colour, being slightly darker than galena. Anisotrophism was distinct, giving pale blue, greenish grey, brown and purple colours. This mineral forms rims between the tetrahedrite and the surrounding galena. Etch tests gave the following reactions;

aqua regia - stains purplish-grey.

HNO₃, HCl, KCN, FeCl₃ - negative

From the foregoing properties and associations, the mineral is identified as bournonite (Pb Cu Sb S₃).

Mineral #6.

This mineral was identified by its hardness, colour and association as chalcopyrite (Cu Fe S₂).

Mineral #7.

Two very small grains with a white colour, hardness of E and a poor polish were thought to be arsenopyrite.

missed obvious cubic octahedral crystals / arsenopyrite.

Mineral #8.

This mineral occurs as fine replacing veinlets cutting boulangerite. It has a characteristic indigo-blue colour and a strong red-brown anisotrophism. Pleochroism was extraordinarily high. These properties identified this mineral as covellite (CuS).

The main gangue minerals present in these specimens is quartz and calcite.

List of minerals present in decreasing order of abundance:

Sphalerite

Galena

~~Boulangerite~~*Murchisonite*

Tetrahedrite

Bournonite

Chalcopyrite

Covellite

~~Arsenopyrite (?)~~*Eurostyfite.*

Textures

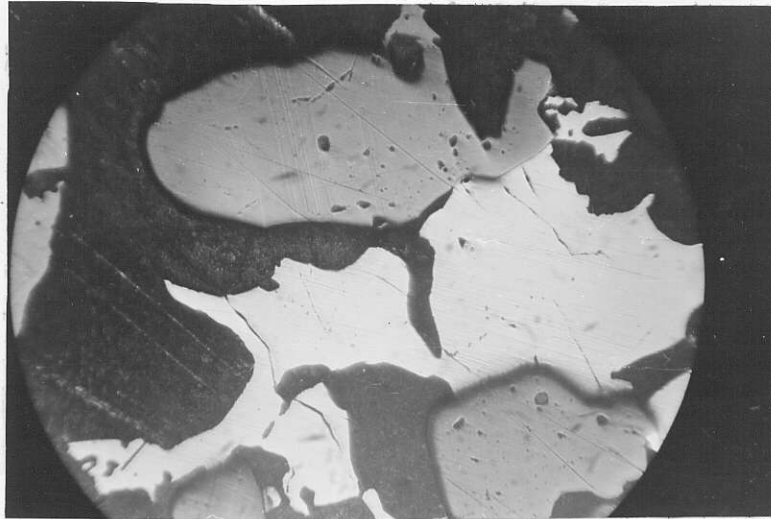


Figure 1. Boulangerite replacing tetrahedrite and sphalerite
(x200)

This photograph shows three minerals:

- (1) Sphalerite - grey blebs, exhibiting twinning
- (2) Boulangerite - etched black with HNO_3
- (3) Tetrahedrite - white-grey tetrahedrite

The boulangerite appears to be replacing both the sphalerite and the tetrahedrite along the borders of these two minerals. The tongue of boulangerite projecting into the tetrahedrite is further evidence of the tetrahedrite being replaced.



Figure 2. Characteristic blebs of sphalerite in boulangierite
(x 200)

This photograph shows the same three minerals as Figure 1. It again shows the replacement of the sphalerite and tetrahedrite. The rounded blebs of sphalerite shown here are characteristic of the Mastodon material. These are remnants of unreplaced sphalerite, which have presented a uniform resistance to the replacing solutions and thus have been replaced equally in all directions. Similar textures are apparent between galena and sphalerite, where the galena is replacing the sphalerite.

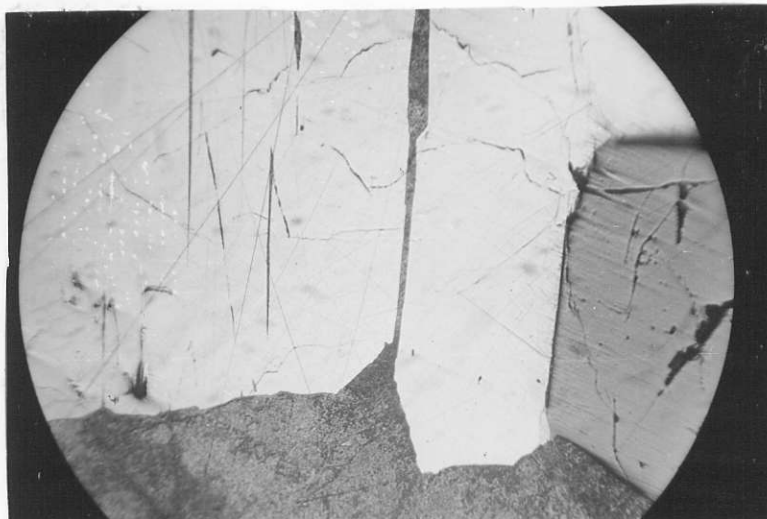


Figure 3. Galena - boulangerite association
(x 200)

This photograph shows three minerals:

- (1) sphalerite - grey bleb on the right side
- (2) boulangerite - white
- (3) galena - etched iridescent with FeCl_3

Both the boulangerite and the galena were etched black by an HNO_3 etch. However, FeCl_3 etches galena iridescent which brought out the texture on this photograph. The galena apparently replaced the boulangerite along parallel lines, which would appear to be the cleavage direction of boulangerite. However, in other places there are scattered remnants of galena in boulangerite indicating replacement of the galena. Thus it would appear that these two minerals are contemporaneous.

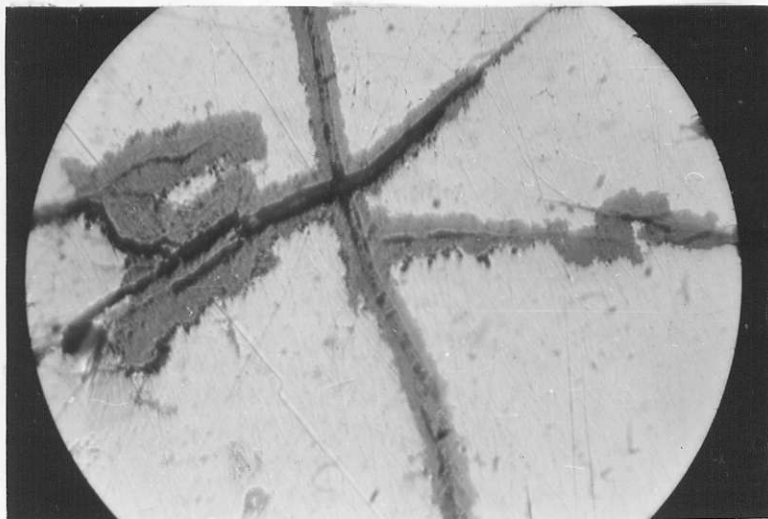


Figure 4. Covellite replacing boulangerite
(x 400)

This photograph shows covellite replacing boulangerite along fractures. This relationship is rare in these samples. The covellite is of supergene origin and percolated through fractures, partially replacing the surrounding boulangerite.

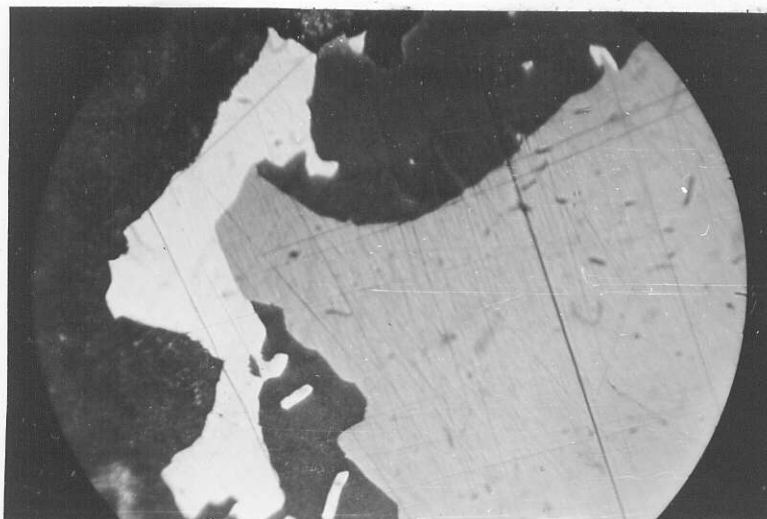


Figure 5. Rim texture

(X 800 OIL IMMERSION)

Figure 5 shows four minerals:

tetrahedrite - light grey

bournonite - etched dark with aqua regia (1 minute)

chalcopyrite - white

galena - etched black with HNO_3

This association was found to be common in these samples. The texture consists of a rim of bournonite surrounding a more or less spherical grain of tetrahedrite. Chalcopyrite is intimately associated with the bournonite and in several cases forms myrmeketic intergrowths with it. Where

the bournonite does not quite complete the rim, there is evidence of the chalcopyrite being replaced by the tetrahedrite.

This rim texture is usually surrounded by galena, and less often by boulangerite. This bournonite rim apparently formed by the replacement of boulangerite by chalcopyrite. This rim has subsequently replaced tetrahedrite to a small extent. Where the surrounding mineral is galena rather than boulangerite it is likely that the boulangerite has been replaced by the galena.

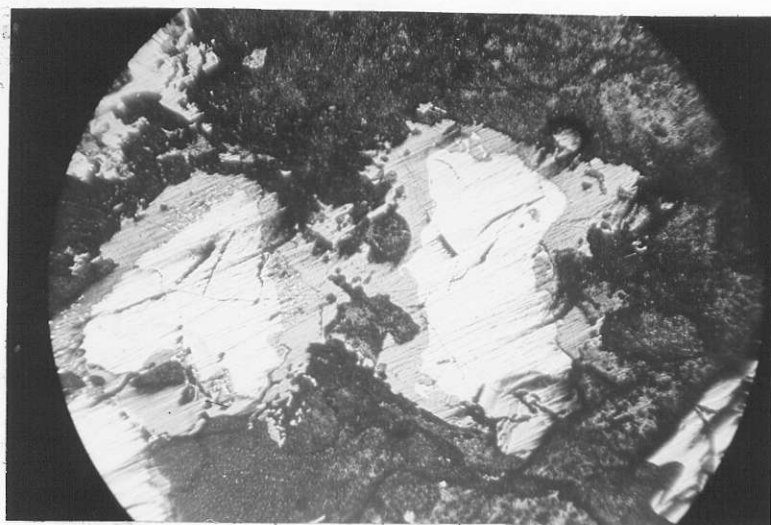


Figure 6. Rim texture

(x 70)

This photograph shows the rim texture under low power.

Minerals visible:

tetrahedrite - white

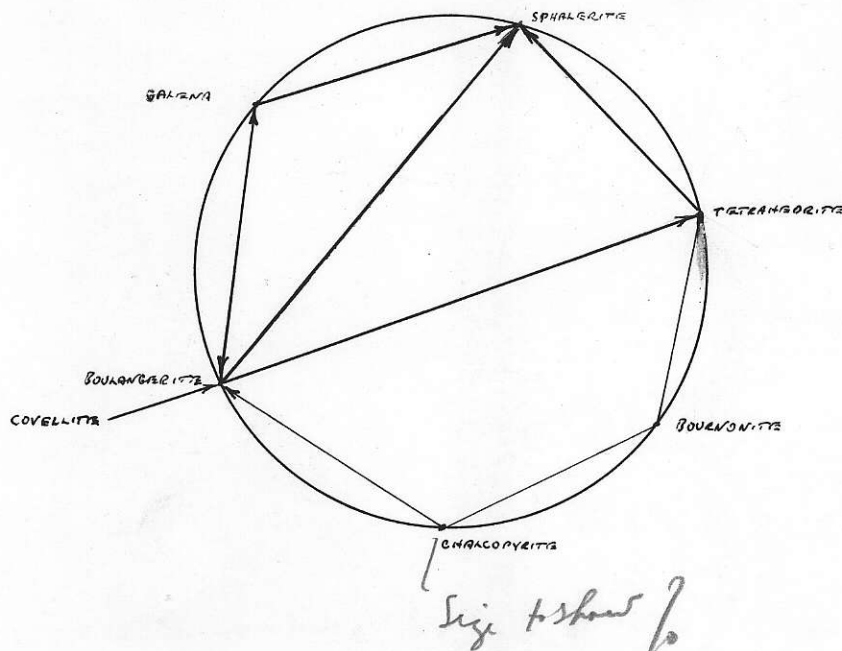
bournonite - grey rims, etched grey with aqua regia (30 seconds)

chalcopyrite - forming a myrmeketic intergrowth with bournonite.

boulangerite - etched black with HNO_3 .

Paragenesis

The paragenetic relations of the ore minerals may be shown by the following diagram:



In all cases sphalerite appears to have been the first mineral to form. This is followed by a small amount of tetrahedrite. Bornite and boulangerite have then been precipitated and have replaced the sphalerite and tetrahedrite. The boulangerite has been replaced in part by chalcopyrite with the formation of bournonite rims. Covellite is a supergene mineral and has replaced boulangerite to a small extent. The deposit appears to be of hydrothermal origin, in the mesothermal range. However, there are no igneous intrusives associated with the deposit, so that the origin is doubtful.

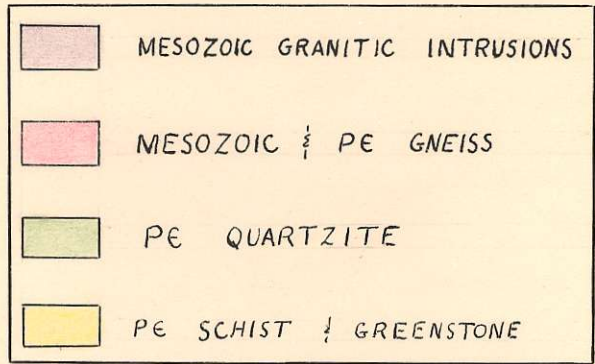
Conclusion

The specimens studied exhibit very good mineralization especially in zinc values. In several cases the sphalerite has completely replaced the former beds. The lead values are due principally to galena, although in some specimens there is also a large percentage of the sulpho-salt boulangerite. Silver was not detected in the samples, but is probably present in the tetrahedrite. It should be noted that the tetrahedrite is commonly surrounded by the bournonite reaction rim, which cause difficulty in flotation. ?

At the present price of zinc, this material is not ore. However, the property was completely developed in

preparation to actual mining in 1953, so that a rise in the price of zinc would probably result in the reopening of this property.

BIG BEND AREA



North ?
Scale ?

Not a single reference
Map with no scale or
arrow.
No discussion of textures.