# A MINERAGRAPHIC EXAMINATION OF ORE

# FROM THE PREMIER MINE.

BY

A. E. KILLIN

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" CONTENTS "

# A Mineragraphic Examination of Ore from the Premier Mine.

Location: The Premier Mine is located just north of the International Boundary on the western slope of Bear River Ridge on the Cascade River. It is about 150 miles north of Prince Rupert and easily accessible by wagon road from Stewart at the head of Portland Canal.

Geology: The Premier mine lies in the Salmon River Map-Area. A general summary of the geology of the area ia given below.

## Bear River Formation.

This formation consists mainly of volcanics and is known in the district as greenstone. The rocks grade from coarse agglomerates of irregular masses of purple and green andesite at the bottom, to tuffaceous or ash rocks, green and purple in color, at the top.

## Salmon River Formation.

This formation overlies conformably the Bear River formation and consists mostly of a conglomerate with pebbles composed of fragments of the underlying volcanic rocks.

## Mass Formation.

The dominant rock in this formation is a black argillite with some interbands of clastic material resembling sandstone.

The passage from the underlying Salmon River formation is a transitional one, the conglomerates and slates being interbedded near the base.

Premier Sills.

These sills are tabular masses of quartz porphyry intruded between the bedding planes of the tuffs of the Bear River Formation. The sills were intruded prior to the period of mountain building and were later folded at the time of the intrusion of the Coast Range Batholith.

Coast Range Batholith.

The rocks of the batholith include both granites and gabbros but are largely granodiorite, a greyish white rock of "pepper and salt" appearance consisting of plagioclase and hornblende with some orthoclase usually as phenocrysts. Biotite in many cases accompanies the hornblende.

Granite Dykes.

These dykes belong to the diorite family and vary from a coarse - grained diorite to a quartz porphyry.

They are very numerous in the northern part of the area where they occur in belts.

Pliestocene.

The Pliestocene is represented by drift and fluvio-glacial deposits.

Post Pliestocene.

The present streams, having their origins in glaciers, are rapidly filling their beds with gravel and silt deposits.

In the vicinity of the mine, the upper sediments have been removed and the ore occurs in the underlying volcanic series consisting of:-

Dense fragmental andesitic tuff
Dense near-surface intrusions of andesite — Greenstone
Coarse tuffs, agglomerates and breccias.

Rocks corresponding to the Premier Sills occur in the mine as a large irregular stock.

Both the volcanics and the porphyry were extensively sheared and highly altered before the intrusion of the batholith. Later these rocks were cut by numerous large diorite and granodiorite dikes and the last phase of igneous intrusion was the injection into the series of numerous lamprophyre dikes.

The rocks were highly altered by regional metamorphism so that the original mineral constituents are almost wholly replaced by chlorite and sericite with minor amounts of calcite and epidote. A later alteration has been superimposed on these altered rocks by the injection of mineralizing solutions along fracture planes. The minerals formed at this stage, to distances upwards of 100' from the veins, are pyrite, chlorite, quartz, sericite, apatite and calcite. Silicification within 10 feet of the vein has been extensive.

Veins:- The veins are essentially of two types. The first type is a replacement of the country rock along the fracture zones, which act as ore channels. At lower depths, the rocks are not so easily replaced and the veins change to narrow, more massive sulphide bodies of lower grade. These veins are thought to be the result of space filling.

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Laboratory Examination of the Ores.

The following discussion is written from information obtained by the examination of polished sections of ore from the mine.

The numbers of the specimens and the localities in the mine where they were collected are listed below.

No. 12 -- 1304 drift at elevation 1350 feet.
No. 15 -- Stope 13B. at elevation 1450 feet.
No. 18 -- Stope 12B. at elevation 1260 feet.
No. 22 -- 1070 level at elevation 1070 feet.

Mineralogy:-

The following minerals were noted in the sections examined.

| Ore Minerals. | Gangue Minerals. |
|---|---|
| Pyrite | Quartz |
| Sphalerite | Calcite |
| Galena | |
| Chalcopyrite | |
| Electrum | |
| Argentite | |
| Ruby Silver. | |

Sphalerite and pyrite were found to be the most abundant sulphides, while quartz was found to be the most important gangue mineral. Galena and argentite were fairly abundant and chalcopyrite occurred disseminated throughout the sphalerite. Specks of electrum were found in sections 15 and 18 (See drawings.) but none were found in sections 12 or 22. Calcite was found in all specimens and seemed to have a definite relationship to the gold.

The minerals usually occurred as fine to medium grained sulphide particles in a quartz or calcite gangue.

Paragenesis.

There appears to have been three mineralizing epochs. The first was an injection of quartz and pyrite. This solidified and was fractured by the second mineralizing solutions, and the fractures healed with sphalerite and galena. The sphalerite contains disseminated blebs of chalcopyrite. Following this period and overlapping it, came the third mineralizing period which brought in the argentite, electrum and calcite.

The Minerals:-

1. Pyrite: Pyrite is one of the earliest vein minerals to form. It was brought in with the quartz and they crystallized together. The quartz-pyrite boundaries are generally smooth. The pyrite has been fractured and the fractures healed with quartz, and sulphides. The pyrite was not remelted during the later mineralizing epochs. The contacts of the pyrite with the

sphalerite, electrum and argentite are not intimate, but are fairly smooth.

The pyrite occurs in great abundance in all sections. In some of the sections, it occurred as hiatal or even-sized grains but in other sections there is no uniformity to the grain size.

2. Sphalerite: Sphalerite is the most abundant sulphide mineral in the specimens examined. It occurs in irregular masses and blebs throughout the specimens. This mineral is found replacing quartz and pyrite. The sphalerite-quartz boundaries are very irregular. The sphalerite-pyrite boundaries are a little more regular but are not intimate. Scattered throughout the sphalerite are rounded blebs and masses of chalcopyrite. The sphalerite chalcopyrite boundaries are smooth and intimate.

In most cases where electrum was noted, there was sphalerite in close contact with it. This, however, was not always the case, as in View 1., Section 15. The sphalerite-electrum contacts were smooth and fairly intimate, but the electrum was found in close association with argentite and both veining sphalerite.

It was concluded that the sphalerite came in later than the pyrite, but ahead of the argentite and electrum.

3. Chalcopyrite:- This is a minor constituent mineral in the sections examined. It was found in scattered, rounded blebs and masses in the sphalerite. The small rounded form of the masses and the smooth, intimate contacts indicate contemporaneous deposition with the sphalerite.

4. Argentite:- Argentite was fairly abundant in the sections examined. It occurs in a similar manner to sphalerite, but in smaller, irregular grains and masses. There is no uniformity to the grain size throughout the sections.

Argentite is found in contact with all the other mineral constituents, except galena, chalcopyrite and ruby silver.

The argentite-electrum contacts are smooth and very intimate. Argentite was present with electrum in all cases.

The argentite-sphalerite boundaries are smooth and fairly intimate. Argentite was noted veining and replacing the sphalerite. The argentite-pyrite boundaries are generally smooth but not intimate. Argentite was found veining the pyrite in company with calcite and electrum.

The argentite-quartz boundaries are extremely irregular.

The argentite-calcite boundaries are generally smooth and fairly intimate.

5. Electrum:- Electrum is a gold-silver alloy. It was found in sections #15 and #18, as small blebs, associated with argentite, calcite and in most, but not all, cases sphalerite.

In section #18, the electrum is entirely surrounded by pyrite, argentite and sphalerite. The electrum-argentite boundaries are smooth and intimate as were the electrum-sphalerite boundaries. The boundaries of these three with pyrite were smooth but not intimate. No calcite was noted in the immediate vicinity of these ~~rocks~~ minerals.

6. Galena:- Galena was found scattered throughout the sections. It was hard to establish any relationships, but it is thought to be contemporaneous in deposition with the electrum and argentite.

7. Ruby Silver:- This mineral occurs in veinlets and cracks in the quartz. No relationships pretaining to the time or manner of deposition of this mineral were made.

One small speck of ruby silver occurs in calcite in section #15. (See View 2, Section #15.)

8. Calcite:- Calcite was found fairly abundantly in the specimens. It seems to have a definite relationship to the electrum deposition. Calcite is frequently found veining pyrite and quartz.

Conclusion:- The rocks containing the ore deposits are Jurassic in age and consist of andesitic tuffs and a granodiorite feldspar porphyry. These rocks have suffered two periods of alteration.

An intense period of alteration caused by regional metamorphism at the time of the batholithic intrusion, and a later and less intense period of alteration caused by the injection of mineralizing solutions. This later alteration consisted mainly of a silicification of the rock.

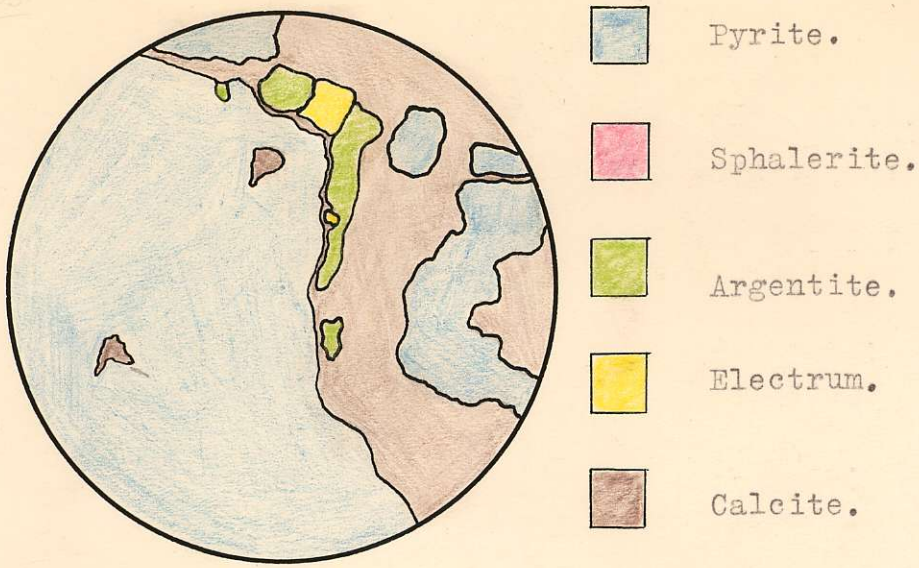
The veins have been formed in two ways; one was by replacement of the rocks in vicinity of fractures which acted as ore channels. The other type is by filling of the fracture spaces with massive sulphides.

Formation of the veins can be divided into two distinct periods:

1. Replacement of country rock by quartz and pyrite.

2. Later replacement of the first deposition by two overlapping periods. The first of these periods brought in sphalerite and chalcopyrite. The second period; argentite, galena, electrum and calcite.

It is probable that the electrum is responsible for the gold values throughout the mine.



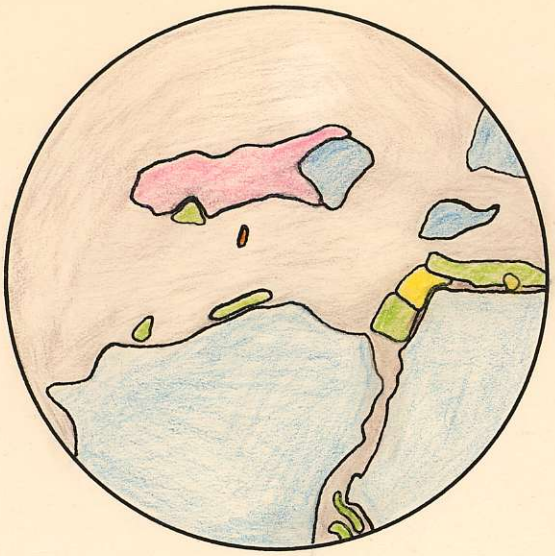

View #1. Section 15.

The minerals present in the view are:

Pyrite, argentite, electrum and calcite.

The intimate argentite-electrum boundaries can be clearly seen and the less intimate pyrite-argentite and pyrite-electrum boundaries are plainly shown.

There is no sphalerite in contact with the electrum in this view, which is unusual.



Pyrite.

Sphalerite.

Argentite.

Electrum.

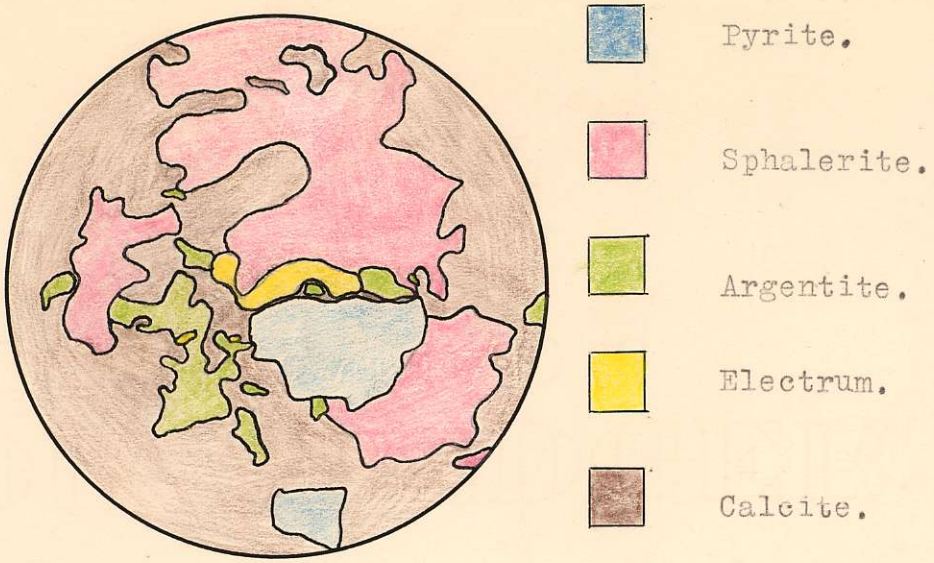
Calcite.

Ruby Silver.

View #2. Section 15.

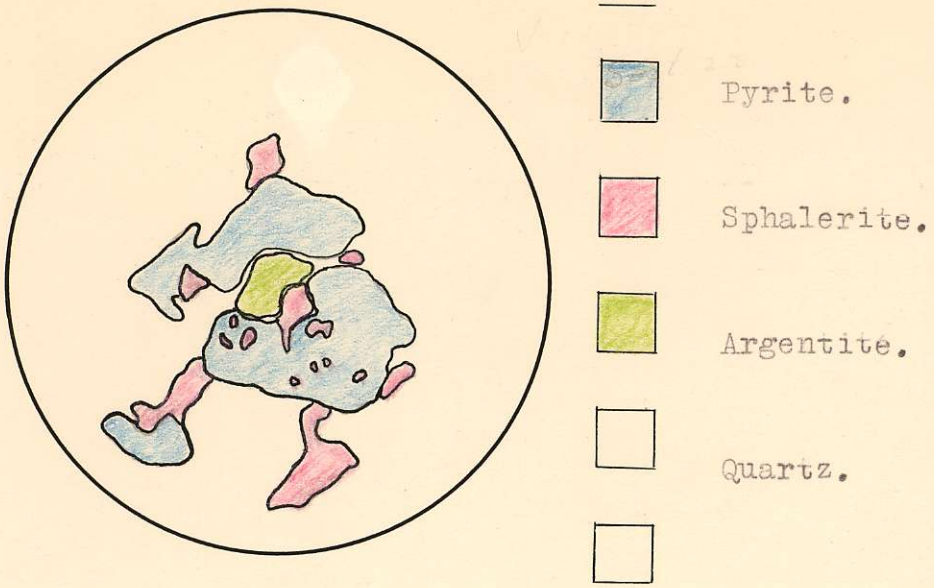
This is a slightly different view of the electrum found in View 1. It was drawn to show the small speck of ruby silver occurring in the calcite. This is very unusual as no ruby silver was found in any other parts of this section.

The calcite and argentite can be seen healing a fracture in the pyrite in the lower right hand side of the view.



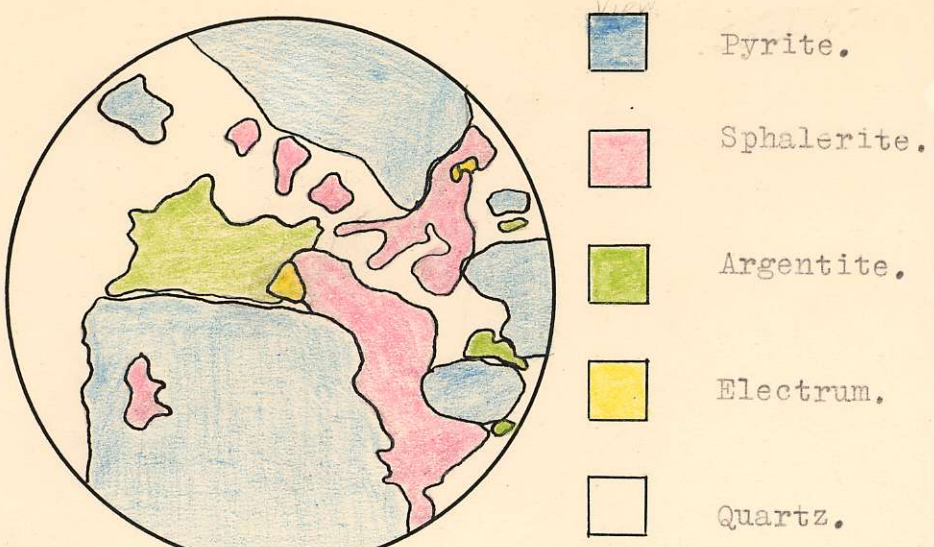

View #3. Section 15.

This view illustrates the typical mode of occurrence of the electrum, as irregular blebs in association with argentite and sphalerite.



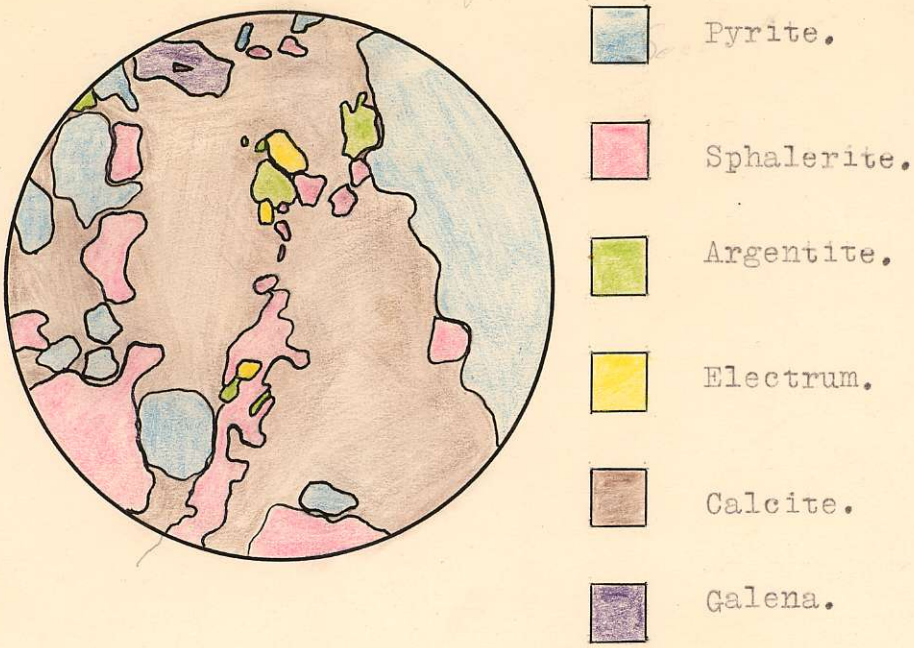

View 4. Section 22.

In this view, argentite and sphalerite can be seen healing fractures in, and replacing pyrite.



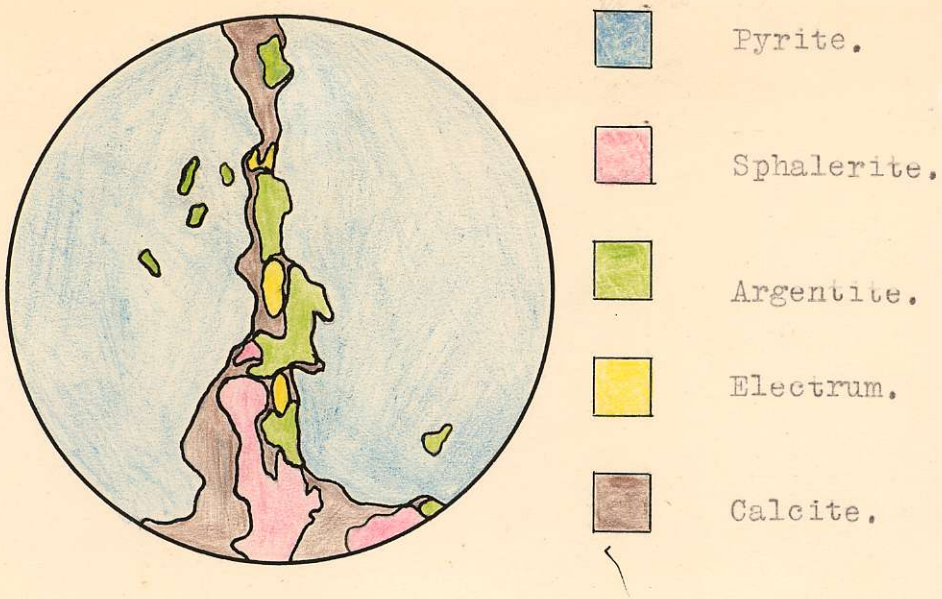

View 5. Section 18.

This was the only occurrence of electrum noted in this section. The electrum is entirely surrounded with argentite, sphalerite and pyrite, and does not seem to be associated with calcite in this view.




View 6. Section 15.

This view is interesting because electrum and argentite are seen replacing sphalerite.




View 7. Section 15.

This view shows argentite, electrum, sphalerite and calcite healing a large fracture in pyrite. The smooth rounded character of the electrum blebs can be clearly seen in the drawing.