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MINERALOGY OF THE BLUEBIRD-  
MAYFLOWER VEIN, ROSSLAND, B.C.

A report submitted in partial fulfilment of the requirements of the course in mineralogy in the Fourth Year of Applied Science at the University of British Columbia

Derek Davidison

The University of British Columbia

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## INTRODUCTION

In the spring of 1947, a company known as Rossland Mines Limited, was organized for the purpose of making a detailed geological and geophysical survey of what is called the Rossland South Belt. The area to be surveyed included the Bluebird and Mayflower mineral claims which had been mined during the Rossland mining boom some forty years ago. This survey indicated further ore occurrences on the Bluebird-Mayflower vein, and as the author was employed on this exploration work, it was with this interest that the following study was made.

The Bluebird-Mayflower sulphide zone

is mineralogically different from the famous copper-gold ores of the Northern Belt. This Southern zone is primarily a silver-lead-zinc area and the amount of copper present in the ore is small.

PRELIMINARY HISTORY, AND PRODUCTION  
FROM THE BLUEBIRD-MAYFLOWER  
MINERAL ZONE

(1)

According to Drysdale, the Mayflower mine was discovered in 1899. The ore from this mine reached a maximum of one hundred dollars a ton ( 1915 prices ) and the value of the ore was chiefly due to the silver content. Lead, zinc and some gold also added to the ten<sup>or</sup>~~ess~~ of the ore.

In 1948, E. H. Lovitt Ltd., leased the Mayflower mine from Rossland Mines Ltd., and proceeded to mine some 500 tons of ore. Of this amount 250 tons were concentrated and shipped to the smelter at Trail.

(1) Drysdale, Charles W., Memoire 77, Geological Survey of Canada

The 250 tons of ore gave the following assay values;

zinc.....	2.87%
lead.....	0.9 %
silver.....	2.1 oz/ton
gold.....	0.04 oz./ton

No further mining has taken place at the Mayflower since that date.

The Bluebird mine produced about 500 tons of ore between the period 1908 to 1914. The ore averaged about \$35. a ton and ran as high as \$80. a ton. Drysdale states that the zinc content of the Bluebird ore ran as high as 6 % and that stibnite was found in association with the zinc sulphide. However the stibnite later proved to be boulangerite. The chief values from the Bluebird ore~~s~~ was also attributed to the silver content.

#### LOCATION

The Mayflower and Bluebird mineral claims are located in the Rossland camp of the Trail Mining Division in British Columbia. These claims are approximately one mile south-east of

the town of Rossland along the C.P.R. railroad and are reached by a good logging road.

#### GENERAL GEOLOGY

The Bluebird-Mayflower mineralization zone cuts through two rock formations of Carboniferous age. The oldest formation is called the Mount Roberts Sedimentary formation and this outcrops extensively on the Bluebird claim. The Mount Roberts is composed chiefly of dark coloured slate which passes into arenaceous forms with which occur some calcareous beds. The slates contain pyrite as an accessory mineral. There are also some volcanic tuffs in this formation.

The attitude of the Mount Roberts at the point where the vein outcrops is approximately N 10° E and dips 20° West. This attitude is not persistent and changes rapidly within a hundred feet of the vein outcrop.

The second formation is called the augite porphyry. This outcrops on the Mayflower claim and is the younger of the two rock formations. The Mayflower vein cuts through the

augite porphyry and strikes about east-west.

The veins in this area cut through both the previously mentioned rock formations, and this point is well illustrated by the Homestake vein some 1200 feet to the north of the Bluebird-Mayflower vein.

The veins in the south belt have an approximately east-west strike, and may vary from one to three feet in thickness. It would appear<sup>as</sup> if these veins formed in parallel fractures as the result of orogenic movements in the area. This point is further emphasized by the fact that the Mount Roberts formation outcrops at a higher elevation than the augite porphyry.

#### GENERAL MINERALOGY

The mineralogy of the South belt cannot be correlated with that of the North area. First of all, the chief sulphides of the south area are, arsenopyrite, sphalerite, galena and boulangerite while those of the north section are mainly pyrrhotite and chalcopyrite. Pyrite is found in abundance in both areas.

(2)  
According to Bruce, there are two distinct periods of mineralization in the north area, and this point seems to carry over to the southern area as well. However this appears to be the only point in common between the two areas.

There is an interesting point which should be mentioned here in connection with the Bluebird-Mayflower vein. This is, that about 300 feet to the south of the Mayflower there is an outcrop of massive arsenopyrite. This outcrop ~~is~~ occurs on the approximate continuation of the strike of the above vein. This arsenopyrite contains free gold, but the important connection is that both the Bluebird and Mayflower have the mineral arsenopyrite in their ores.

The examination of ten polished sections from the Bluebird and Mayflower mines indicated the presence of the following minerals;

Group 1: As major constituents of the ores,  
pyrrhotite, pyrite, arsenopyrite, galena,  
sphalerite and boulangerite.

(2) Bruce, E.L., Bulletin 4, 1917, British Columbia Department of Mines



Group 2: As minor constituents of the ores,  
chalcopyrite, tetrahedrite and ~~beryl~~  
~~berylite~~ pyrargyrite.

Group 3: As gangue minerals,  
calcite and quartz.

The successful mines of the south belt in the early part of this century owed their success to the high silver values obtained from the ores. The Homestake has reported silver values of 180 ounces to the ton while the Mayflower had as much as 150. The minerals in which the silver occurs have not been described before as far as the author can find out and it is therefore believed that this is the first time that such minerals as tetrahedrite and pyrargyrite have been described for this area.

Prior to 1947, the mineral boulangerite<sup>(3)</sup> was mistaken for stibnite and all the early literature from this area reports the presence of this latter mineral.

(3) Warren, H.V., and Thompson, R.M., American Mineralogist 1949, pp. 458 - 459

DETAILED MINERALOGY

Sphalerite occurs in fine grained to massive forms in both the Bluebird and Mayflower mines. The mineral is dark - brown to black in colour and thereby probably has a high iron content. The zinc sulphide from the Mayflower assayed 0.72 % cadmium on a shipment <sup>of ore</sup> made in 1948. The percent of cadmium is a little above average for the sphalerites of southern B.C. with the average running about 0.55 %. The amount of sphalerite is greater in the Bluebird area with assays as high as 6 % while the Mayflower shipment of ore in 1948 had about 3% zinc in the ore.

The sphalerite from this area contained thin blades of chalcopyrite. These needle-like blades are not numerous, and their presence is expected because most polished sections of this mineral show this feature. The sphalerite is closely associated with the pyrite, pyrrhotite, galena and boulangerite.

Galena: The galena is found chiefly in the Mayflower ores, and here it occurs in a massive form which shows cleavage cubes. The galena is

argentiferous and with it are associated the ~~the~~<sup>minerals.</sup> tetrahedrite and pyrargyrite<sup>^</sup>. The Bluebird is more heavily mineralized with boulangierite while the Mayflower has more galena.

Pyrite appears as the most consistent sulphide throughout the Bluebird-Mayflower vein. The pyrite commonly occurs as cubes and occasionally as pyrite~~hedrons~~, and ~~as~~<sup>in</sup> a massive form.

Pyrrhotite~~s~~ is found in massive coarse grained form particularly in the Mayflower area. This mineral shows rounded fragments and an absence of vugs. It is closely associated with the sphalerite and pyrite and appears to be almost absent in the sections containing considerable boulangierite.

Arsenopyrite: Massive arsenopyrite was found in an outcrop a few hundred feet to the south of the Mayflower portal. The mineral was coarse and massive and showed crystal faces which averaged more than 1/8 of an inch. Free gold was found in association with the arsenopyrite. The Bluebird ore has coarse grained arsenopyrite in close association with the boulangierite. ~~with~~ The former mineral forms ~~ing~~<sup>s</sup>

islands in a sea of massive boulangerite.

Boulangerite appears as a massive to prismatic mineral particularly in the Bluebird ores. This mineral has not got the high metallic luster of galena and was mistaken for many years as stibnite. The boulangerite is closely associated with the pyrite and arsenopyrite in the Bluebird ores and to some extent it is intergrown with the galena from the Mayflower as a eutectic intergrowth.

Chalcopyrite is found in a small amount in the Mayflower area. It is closely related to the pyrrhotite and in places forms a rim about this latter mineral. The chalcopyrite was not visible to the naked eye in samples from the Mayflower mine.

Tetrahedrite is not observed in the hand specimens but can be picked out by the 10 power hand lens on the polished sections. This mineral is related closely with the boulangerite and galena<sup>en</sup>, but is much more abundant in the boulangerite. In each case the tetrahedrite appears to be replaced by the galena and boulangerite.

Pyrrargyrite: Only a few small blebs of this mineral

were found from the Mayflower ore. In each case the pyrargyrite was surrounded by massive galena and in no place was it observed in association with the boulangerite. The pyrargyrite was not definitely identified by spectrographic analysis but etch tests and strong internal reflection indicate that it is either this or a closely related ruby silver. The maximum particle size of the pyrargyrite was about 20 microns.

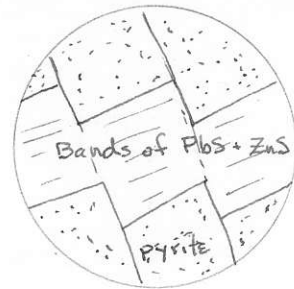
Gold: The section of massive arsenopyrite from an outcrop to the south-east of the Mayflower showed free gold particles between the grain boundaries in the arsenopyrite. The maximum size of the gold particles was about 80 microns and they appeared in only one isolated part of the section. The Mayflower ore has run as high as \$12. in gold and this gold may be related to the arsenopyrite in the ore.

Calcite in a massive form which showed rhombohedral cleavage was found in the Mayflower ore. This mineral does not appear in any quantity in the Bluebird section of the area.

Quartz appears as the chief gangue mineral at the Bluebird mine. It is closely related to the boulangerite and is massive, clear to opaque, and shows no comb structure.

#### MISCELLANEOUS DATA

One of the most outstanding features shown by many of the polished sections is that of post ore movement. This is well illustrated by the following diagram taken from a polished section in the Mayflower area.



The fact that post ore movement has taken place is also shown by considerable fracturing of the massive galena and boulangerite.

Drysdale has stated in his genesis of the North belt ores that the only post ore activity

effecting the lodes in that area was the forming of some post ore dykes. The formation of these dykes may be <sup>reflected by</sup> ~~responsible for~~ the fracturing of the ores in the Bluebird-Mayflower area.

The movement along these minor faults does not appear to be great as the diagram on page twelve shows the extent of this movement, and there is no evidence of alteration or shearing along these minor fault planes.

#### PARAGENESIS

In working out the paragenesis of the Bluebird-Mayflower vein, the author has fallen back on the idea set forth by Bruce, that there may be two periods of mineralization. If this is the case, then what evidence is there to support this view? The polished sections have shown one good indication that there is possibly two distinct and separate eras of mineralization. This is shown by the presence of euhedral crystals of both pyrite and arsenopyrite in a massive groundmass of galena and boulangerite. These crystals have quite sharp regular shapes and they look like islands

floating in a sea of massive galena and boulangerite. If this point is accepted, then the minerals such as pyrrhotite, pyrite and arsenopyrite would be placed in the first period of mineralization.

The second stage in the process appears to have started off with the formation of such minerals as sphalerite, tetrahedrite and chalcopyrite. This ~~phase~~ phase cannot be definitely dated as it might well occur as the last stage in the first period of deposition. However the sphalerite does not show the granulation that the pyrite and arsenopyrite do and therefore these minerals are put in the early second period.

The boulangerite and galena along with the ruby silver mineral formed the last stage of mineralization. The first two minerals in this group show replacement textures that would place them in the last group to form.

From the minerals present and their mode of occurrence, the Bluebird-Mayflower vein appears to be a mesothermal type of hydrothermal deposit.



ACKNOWLEDGEMENTS

The author would like to take this opportunity of thanking Dr. R.M. Thompson for his trouble in making spectrographic analysis to ? *X Ray photos* confirm the identification of minerals, and to both Dr. Thompson and Dr. H.V. Warren for the assistance rendered by discussion of the problem in this report.

## Addition to Page 14

Paragraph 3:

The replacement textures shown by the galena and boulangierite are illustrated in the polished section by stringers of these minerals working their way into the pre-existing minerals such as shown by the sphalerite. Also, there are rounded grains of sphalerite along the margins of the galena-sphalerite and ~~galena~~ boulangierite-sphalerite borders. These grains of sphalerite are completely surrounded by the latter forming minerals, but are so closely related to the edges of the massive sphalerite that they can be quite definitely said to be replaced by these later minerals.

Paragraph 4:

The amount of pyrrhotite present in the ore is small compared to volume of pyrite, galena, boulangierite and sphalerite. The reason for stating this is that the pyrrhotite is the only mineral observed in these ores that would classify the deposit as a high temperature hydrothermal

deposit.

The presence of such minerals as tetrahedrite and ruby silver (pyrargyrite) tend to be indicative of the mesothermal type of deposit. These minerals are closely associated with sphalerite and galena (also boulangerite) which is a characteristic of this type of deposit.

Some banding of the sphalerite and galena in the Mayflower ores, along with the coarse-grained texture of the mineral is further evidence that this is a mesothermal type of hydrothermal deposit.