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THE MINEROLOGY OF THE PELLAIRE MINERAL CLAIMS
BRITISH COLUMBIA

by

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A report prepared as partial fulfillment
of the course in Geology 409.

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CONTENTS

GEOLOGY 409

Introduction

This report deals with the minerology revealed in hand specimens and polished sections of ore from the Pellaire group of mineral claims, Toseko Lake, British Columbia. The mode of occurrence of the veins is quite similar to that of other veins occuring on the east flank of the Coast Range batholith. The presence of two tellurides and the suspected presence of another makes the minerology of the Pellaire group rather unique.

The study of these sections was carried out as part of the course in mineralography given by Dr. H.V. Warren, University of British Columbia.

Acknowledgments

The writer wishes to thank Dr. H. V. Warren and Dr. R. M. Thompson for procuring the suites of specimens worked on, and for the guidance and instructions given.

Appreciation must also be expressed for the work of Bob McCasson, a fellow student who carried out a spectroscopic analysis on a specimen, the results of which are incorporated in this report.

GENERAL GEOLOGY

The Pellaire property is located in the Clinton Mining division, about six miles south west of the south end of Toseko Lake. Development work on the claims is being carried out by Pellaire Mines Limited, a subsidiary of Quebec Gold Mining Corporation of Ontario.

The property is about 120 miles from Vancouver as the crow flies, and may be reached by motor road from Williams Lake.

The showings on the claim lie close to the eastern contact of the Coast Range batholith, where sediments and volcanics of Mesozaic age are intruded by the batholithic complex of igneous rocks, mainly Jurassic in age. The veins on the Pellaire claims, five in number are approximately parallel to and on the south side of the south east-north west trending contact.

All the veins are in plutonic rocks except a small portion of No. 5 vein that runs an undetermined length into the volcanics. The veins vary from a few inches to about 2 feet in width and some can be traced for about 500 feet along the strike. In general the dip is about 45^{o} north east, toward the contact.

GENERAL MINERALOGY

Macroscopic Examination

A report on the mineralogy of this ore would not be complete without a brief description of the hand specimen. Secondary minerals that were not observed under the microscope were found in the hand specimen with the aid of a hand lens.

The metallic sulphide content of the ore is very small in the specimens worked and the content of sulphide would not greatly exceed 1 per cent. The sulphides present occur in white, srystalline, vugy quartz. Granular masses of chalcopyrite form nearly all of two hard specimens. Malachi‸te, secondary, after chalcopyrite occurs as irregular streaks and coatings in some samples. A small amount of azurite may be seen, leading one to suspect the presence of tetrahedrite. On careful examination of freshly broken samples one can see tiny lustrous specks up to 1 m.m. in length that are quite sectile, the writer believes this to be hessite.

The ore weathers to a typical limonite stain near the surface. Samples that came from a fair depth are weathered to a bluish-black color. The bluish-black material is concentrated in cracks and nugs in the quartz, and in some cases forms a fairly continuous coating. While breaking specimens for polished sections a piece of the bluish material about ¼ inch long and 1/8 inch wide was found in the quartz. The outside of the material was weathered to a sooty, soft black residue, a head test for manganese proved negative. Breaking off a bit of the material and inspecting it under the binocular microscope led the writer to believe the material was mostly azurite. A spectroscopic analysis of the supposed azurite showed the following to be present in order of abundance: Cu., Ag., Te., Bi., Fe., Si and Pb. This might indicate the presence of bismeth telluride that was not observed under the microscope. A piece of the material can be found accompanying the polished sections.

Description of Sections

Six sections were made from Superpanner tips and middlings. Prior to Superpanning about 10 pounds of "high" grade ore and 15 pounds of "low" grade ore were reduced to minus 100 mesh. The two products were tabled separately. A magnetic separation was then made by Dr. R. M. Thompson, the resulting sections are:

No. 1. Low grade magnetic tip

No. 2. Low grade non magnetic tip

No. 3. High grade non magnetic tip

No. 4. High grade magnetic tip

No. 5. High grade non magnetic tip

No. 6. High grade non magnetic middling

Of these sections No. 1, No. 4, No. 5 and No. 6 are the best. Section No. 1 contains mostly hessite and pyrrhotite, No. 4 pyrrhotite, hessite, some chalcopyrite, sphalerite and tetrahedrite, No. 5 chalcopyrite and hessite, No. 6 chalcopyrite, tetrahedrite and sphalerite.

Considerable difficulty was experienced in finding pieces of ore that contained enough sulphide to be useful in microscopic study.

Sections No's 7 to 13 show the mode of occurrence and relations of the sulphides and gangue. Section No. 7 shows sphalerite, tetrahedrite and altaite, No. 9 shows euhedral grains of pyrite, No. 10 sphalerite and chalcopyrite. The remainder of the sections show very little.

Microscopic Examination

Chalcopyrite

This mineral occurs as granular weathered masses in surface samples, and as scattered grains in quartz and sphalerite, and as veinlets in quartz. The scattered grains vary from a minute size up to about 900 microns. The surface of the chalcopyrite is generally pitted and weathered as can be seen in section No. 5. The pits are circular to oblong in shape and generally less than 25 microns across. In some grains at least 50 per cent of the surface is covered with the small, dark, circular pits. These pits appear to have resulted from the weathering out of hessite, as hessite can be seen in some of the grains of chalcopyrite. Rounded blebs of very blue corellite up to 150 microns in diameter can be seen replacing chalcopyrite.

Pyrrhotite

Isolated grains in the quartz appear to contain all the pyrrhatite. The mineral is best observed in section P.1., the low grade magnetic tip. Here the grains occur generally as rounded shapes about 400 microns in diameter. Hessite occurs as rounded blebs up to about 25 microns across and may cover nearly all of the surface of the pyrrhotite. Some of the pyrrhotite shows no hessite whatsoever but these grains are very few.

Pyrite

This mineral occurs as euhedral to subhedral grains

200 microns in size. Many grains show a ring of limonite or a fragment of limonite attached to the edge. In section No. 5 blebs of hessite about 15 microns in diameter occur in pyrite.

Sphalerite

This mineral can be seen in considerable abundance in section P. 10. Here it occurs filling microscopic irregular fractures in quartz as scattered disseminations, and as irregular masses enclosing blebs of chalcopyrite.

Tetrahedrite

This mineral occurs as small disseminations in quartz. In section No. 7 it occurs cutting sphalerite.

Hessite

The presence of hessite was observed as disseminations in quartz, but more typically in egg shaped inclusions in chalcopyrite, pyrite and pyrrhotite. The inclusions are generally from 20 to 50 microns in their largest diameter. Veinlets of gold can be seen in individual pieces of hessite in section P. 1. The veinlets are very close together about 5 microns wide and up to 25 microns long and are generally parallel to one another.

As can be seen in section No. 5 hessite weathers more readily than the other materials, the chalcopyrite and pyrite are practically unaltered while the inclusions of hessite in them remain as weather pits. This tendency to alter readily may explain the high silver content of the spectrographed residual material and the fact that high values in silver and gold are found in the bluish-black quartz. That the values in gold and silver are higher in the bluish-black weathered quartz than in the limonite stained material is surprising. This appears to be the reverse of what is normally found in weathered outcrops, the bluish stained quartz came from below the limonite upper portion, and contains high values where as assays on the weathered outcrop are reported to be quite low. This fact has a direct bearing upon successful prospecting as a deposit of considerable value could be overlooked because values are not found in the weathered outcrop. The weathering of hessite appears to be quite complex, however it would appear that unless the hessite contains native gold negligible values would be obtained from a limonite outcrop.

Altaite

In section No. 7 pieces of this mineral up to 1 m.m. long and ½ m.m wide may be seen. The surface of the mineral is quite tarnished and could easily be overlooked unless touched with a neddle, the weight of which is sufficient to scratch the surface. Apparently the altaite failed to polish as its surface is below the level of the quartz, in which it occurs in fractures and openings. The description, "some-what sectile" is borne out by the occurrence, a needle may be pushed into the mineral but when the needle is bent the mineral fractures. Numerous micro-chemical tests gave positive reaction for lead and tellurium. A micro-chemical test for gold was carried out on the altaite. Several priamatic pleochroic crystals resulted indicating the presence of some gold.

Gold

The presence of native gold veining hessite has already been mentioned. In sections made from the super-panner tip small bits of free gold were seen. The bulk of the gold appears to be associated with hessite. In section No.5 a speck of gold was seen in limonite surrounding an enhedral grain of pyrite. The gold could have been left behind after the weathering of the hessite that enclosed it or may have been associated with the pyrite.

PARAGENESIS

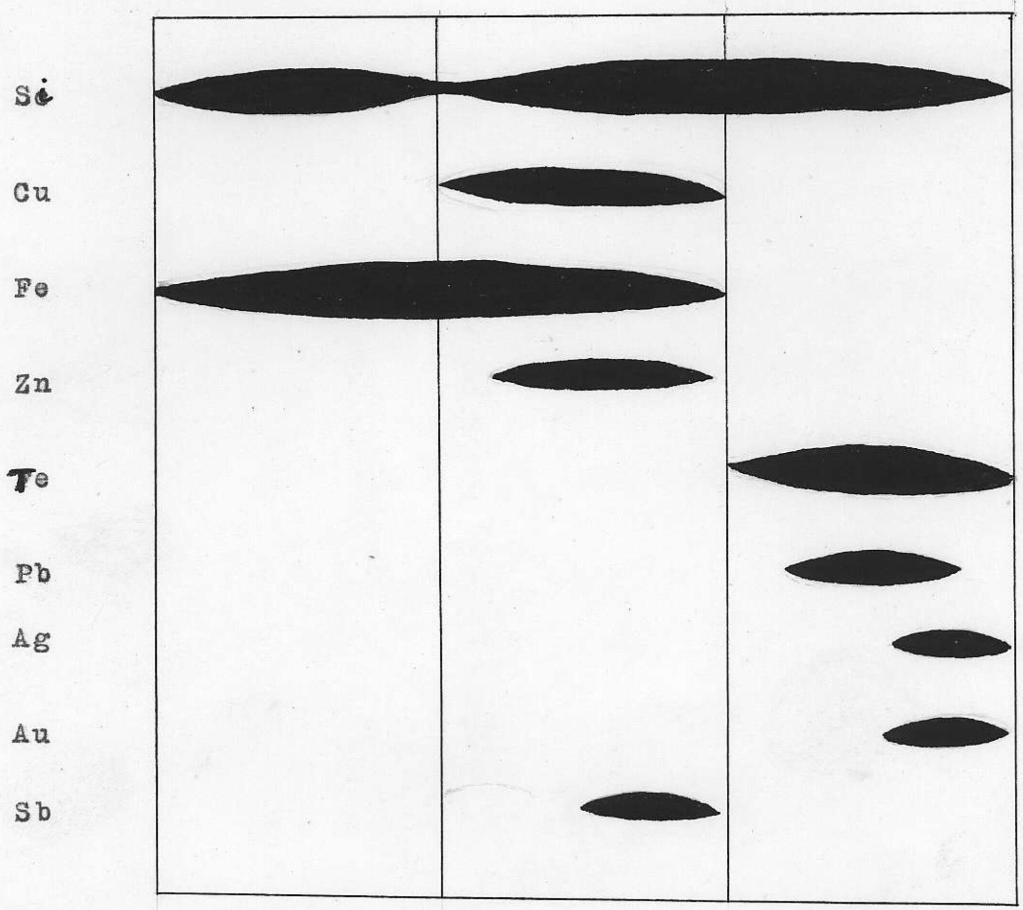
The following minerals were found and are listed below in order of abundance

chalcopyrite
pyrrhotite
pyrite
sphalerite
hessite
altaite
tetrahedrite

Secondary minerals

limonite
malachite
azurite
covellite

PARAGENETIC DIAGRAM



Deposition of the minerals appear to have taken place in four stages.

1. quartz and pyrite
2. Tetrahedrite, sphalerite, chalcopyrite, pyrrhotite and quartz.
3. Hessite, altaite and gold
4. Secondary minerals.

Chalcopyrite and sphalerite were deposited simultaneously, tetrahedrite and pyrrhotite closely followed the deposition. Hessite in some cases appears simultaneous with chalcopyrite and pyrrhotite and in others as replacement of these two minerals. Gold was deposited later than the telluride and can be seen veining hessite.

Two ages of quartz can readily be seen in hand specimens. Small crystals of the younger quartz have grown at an angle to the larger crystals of the older quartz.

MILLING

Grinding to minus 200 mesh and cyanidation of the concentrate should give a high recovery on this ore. As the values occur in very small disseminated particles but are much higher in specific granity than the gangue, fine grinding would give a good gravity separation.

Considerable difficulty has been encountered in the milling of telluride ores. It might be necessary to roast the concentrates and float the cyanide tails. Metallurgical tests would be required to see if this is necessary.

CONCLUSIONS

The presence of hessite even in very small amounts in a deposit will add considerably to its value. Dana reports hessite to contain approximately 60 per cent silver and up to 5 per cent gold. In the Pellaire group native gold is found with the hessite hence greatly increasing its importance and value.

Telluride deposits differ mineralogically from other precious metal deposits in that the metallic mineral content is very low.

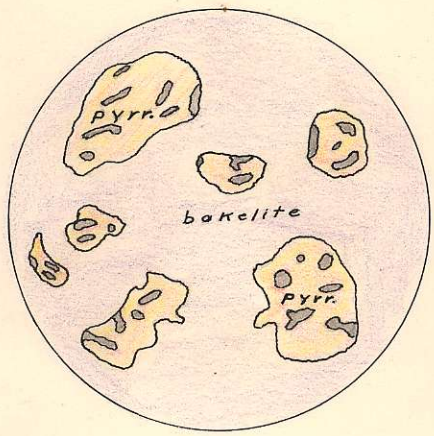
The low assays from the limonite outcrop can probably be explained by the ready weathering and unstable nature of the hessite. The gold left behind in the limonite is that which occurred as free gold associated with the hessite, what became of the gold contained in the hessite is difficult to say. Lindgren (P.880) shows that in the presence of $M.N.O_2$ and sodium chloride waters gold can be carried away in solution. Sodium chloride waters are present in nearly all localities and $M.N.O_2$ may be present in the Pellaire ore as indicated by stains on the quartz. The gold is redeposited at a depth where the concentration of ferrous sulphate from the weathering of pyrite is sufficient to cause precipitation. This results in a rich zone below the limonite outcrop. This type of reaction could account for the depth distribution of the Pellaire values. If the concentrations of $M.N.O_2$, sodium chloride waters and ferric sulphate from pyrite were not great enough some of the larger particles of gold might be left behind in the weathered outcrop.

Consideration of the above theory should be taken into account before condemning a property because of low values within a short distance of the surface.

ILLUSTRATIONS I

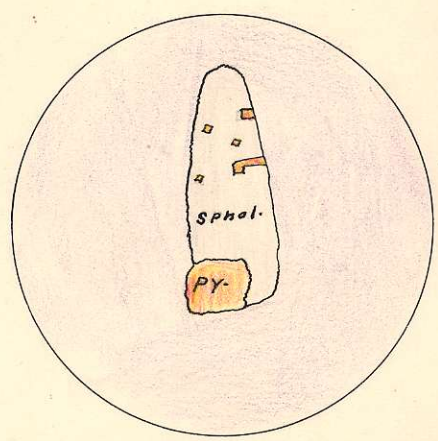
For all drawings field diameter is 1800 microns
magnification 100x

Section No. 1



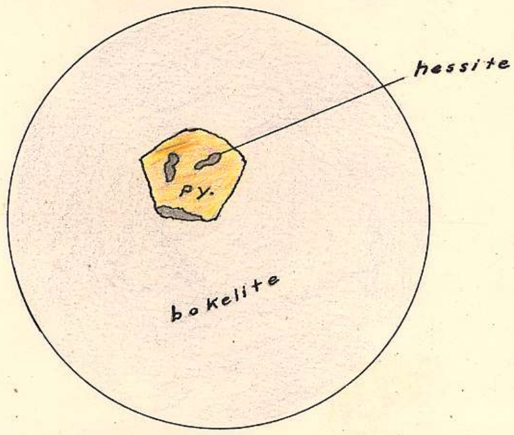
Hessite as rounded blebs replacing pyrrhotite (pyrr.)

Section No. 1



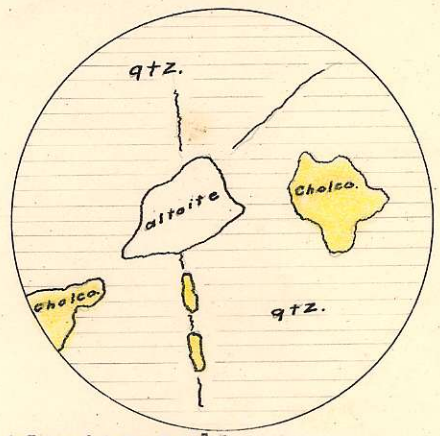
Sphalerite and euhedral pyrite

Section No. 2



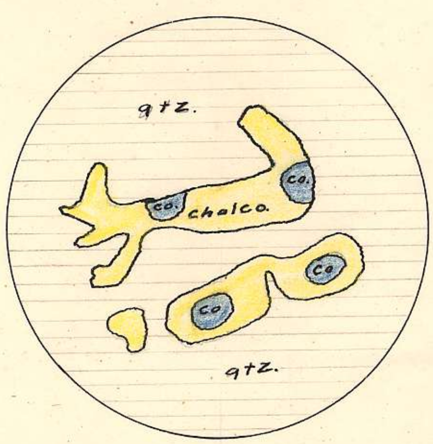
Hessite replacing pyrite

Section No. 7



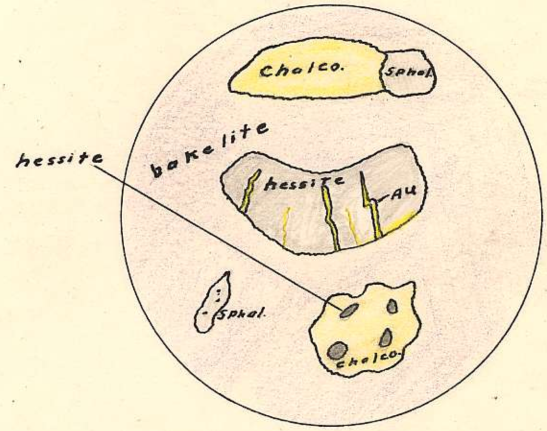
Altaite and
chalcopyrite in fractures
and voids in quartz.

Section No. 7



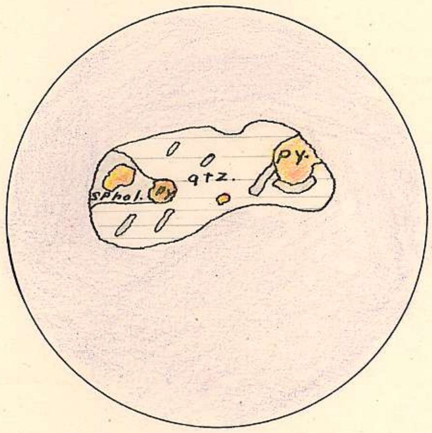
Covellite (Co) replacing
Chalcopyrite

Section No. 5



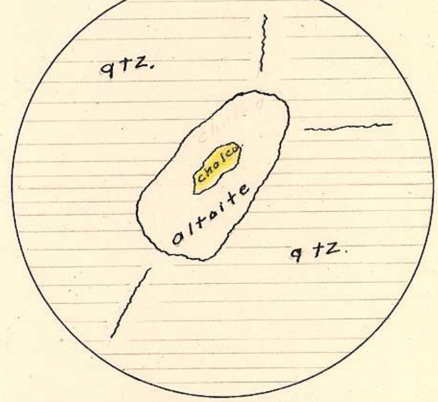
Gold veining hessite.
Chalcopyrite and
sphalerite and chalcopyrite
and hessite

Section No. 5



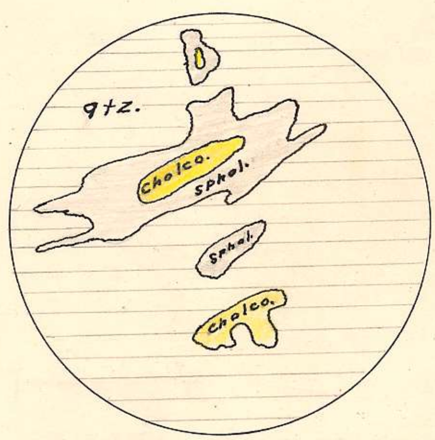
Relation of quartz, pyrite and sphalerite

Section No. 9



Altaite replacing Chalcopyrite at fracture junction in quartz

Section No. 10



Sphalerite replacing chalcopyrite

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