Careful worker but bad English, poorly presented, little idea of geology
60 - 65%

The Mineralography of the Emerald Group, Tahtsa Lake, British Columbia.

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INTRODUCTION

(A) LOCATION

The Emerald Group of Sweeney Mountain lies near Eutsuk and Whitesail Lakes at the headwaters of the Nechako River. The district is situated southwest of the Canadian National Railway, about 150 miles west of Prince George and about 120 miles south of Hazelton. Drainage of this area is east to the Nechako River, but the district lies almost on the divide between Fraser and Bulkley River waters. A few miles west is the Coast Range, beyond which short streams lead to salt water at Dean Channel and Gardner Canal.

(B) CHARACTER OF THE COUNTRY

The heavy glaciation of this district has given the plateau country somewhat the appearance of Northern Ontario, and the mountains, the characteristic features of the Northern Coast Range.

Many if not all of the lakes occupy glacial rock basins. The mountain valleys are modified by ice, the spurs truncated, and even the tops of ridges and many summits planed off. Where the peaks are not flat-topped, they are domed or broadly pyramidal.

From the large lakes there is every gradation to the small enclosed pond. The small lakes are usually of irregular shape and are often island studded. They not only occupy rock basins but fill depressions in glacial drift. Frequently they are walled from the ice shove, piling up boulders along the rivers. It is a lake country like Northern Ontario or Quebec. Were it not for the greater elevations culminating in mountains, the plateau country would remind one strongly of Eastern Canada.

(C) GENERAL GEOLOGY

The greater part of the district is underlain by igneous rocks and of these by far the larger part are volcanic origin and contain fragmental volcanics, agglomerates, conglomerates, tuffs, and ash beds which in amounts must almost equal or exceed lava flows. The lavas (mostly basic though a few are acidic) are present in tremendous thicknesses. Granitic dykes form numerous bosses, stocks, and laccoliths. Sedimentary rocks are found in small amounts at a few points, but are quantitatively negligible.

(D) ECONOMIC GEOLOGY

The Geological Survey made by J.R. Marshall in 1924 reported that the mineralization zones lies on the line of contact of a large batholith. The line of contact has proven to be favourable to the formation of valuable mineral deposits. Gold, silver, lead, zinc, and copper have been found in veins in this district.

The silver-lead-zinc deposits of Sweeney Mountain occur both in sedimentary and volcanic rocks.

The survey reported that no tetrahedrite had been seen in the ore up to that date. The specimens from the Emerald which were examined and which were collected in 1931 did not show any tetrahedrite. However, the specimens obtained by Professor Howard from the Emerald Glacier had considerable amounts of tetrahedrite in them.

The Emerald claim and the Emerald Glacier claim are at the same elevation, but about half a mile apart.

It was reported by the survey that the Emerald deposits occur in beds of sheared and altered tuffs and argillites. The shear zone is twenty feet wide.

Underground examinations of the deposit reveals that quartz fills the fractures in the tuffs. The quartz veins are up to eighteen inches wide. The quartz is also fractured and these fractures are filled with cubical and fined grained galena and subordinate amounts of pyrite chalcopyrite, and sphalerite.

The Glacier claims are located on the eastern face of Sweeney Mountain. The deposit which consists mainly of galena(at that time) occurs in a sheared porphyritic andesite veined with white quartz. The shear zone trends north 35 degrees east, has a maximum width of ten feet and averages six feet over a length of 150 feet. The principal showing consists of a three foot vein of quartz beneath a glacier.

(E) HISTORY OF THE PROPERTY

This property was staked in 1915 by Sweeney, Benson and partners. These men did little to develop the property because it was inaccessible.

In November 1917, James Cronin secured an option on the property. Mr. Cronin acted for an Eastern American firm who sent an engineer to the property in 1918. The engineer reported that the claim was in a very disadvantageous location so this company abandoned the deposit.

Mr. Cronin still held the option this time backed by an Idaho Firm.

During the summer of 1919 Mr. Cronin proceeded to develop the Emerald Group. The results of the development work were dissapointing and Mr. Cronin dropped his option on the property.

The Consolidated Mining and Smelting Company took up the option in 1928 and further developed the work done by Mr. Cronin. This company carried out development work until 1931 and then the mine was shut down. The property has not been visited since that time unless someone has done so within the last year.

MINERALOGRAPHY

(A) MACROSCOPIC INSPECTION

Galena - The grain size of galena varies from very coarsely crystaline material, in which the cleavage can be readily seen, to galena which is very fine grained. The fined grained material looks very much like fractured steel.

In some specimens there was banding between the galena and chalcopyrite. The type of banding could not be determined but there were distinct layers between the chalcopyrite and galena. The width of these bands of galena vary from a small fraction of an inch up to fourteen inches.

Some of the coarse galena crystals appeared to have a slight curvature on the cleaved faces. These curved faces could be the results of mild deformation. There were not enough specimens to make any further observations on this feature of the ore, but curvature could be seen under the microscope.

The main mineral in the hand specimens which were collected in 1931 was galena. However, the specimens collected at the Emerald Glacier in 1950 contained much less galena and high amounts of sphalerite.

Sphalerite - Sphalerite was not very abundant in the specimens from the Emerald, but the specimens from the Emerald Glacier claim contained very large amounts of sphalerite. In one specimen it looked as though sphalerite had been precipitated in the cleavage trace of galena, but examination under the microscope revealed that it was a cube of sphalerite around which the galena had precipitated.

The grain size of the sphalerite varied from coarse to fined grain material, but majority of the material was coarse grained. The sphalerite appeared to have two colours, one a dark material and the other a light brown. The appearance of these two types of sphalerite also showed up when flotation tests were run on the ore. English!

Much of the sphalerite showed the banding structure in the same manner as the galena. The banding of the sphalerite showed between layers of quartz.

Chalcopyrite - The chalcopyrite could be readily seen in the hand specimens, but was not nearly as abundant as the galena or sphalerite. The largest particles of chalcopyrite were around 1.5 centimeters in diameter and the smallest particles could not be seen by the naked eye. In some specimens the chalcopyrite was seen in bands with the galena and sphalerite. The tendancy of the chalcopyrite to form bands was much less than the sphalerite or galena because this material was not nearly as abundant as the other two minerals.

Some of the specimens showed no chalcopyrite whatsoever and when chalcopyrite was absent so was the sphalerite.

Pyrite - Pyrite could be seen in the hand specimens but in amounts which were much less than galena, sphalerite and chalcopyrite. The pyrite had a banded structure in one of the hand specimens but was not nearly as distinct as the other minerals.

Pyrite appeared to be coarse grained. The pyrite was not disseminated through any of the previously mentioned minerals, but tended to be contained as fairly large clusters of crystals.

Galena, sphalerite, chalcopyrite and pyrite were the only metallic minerals which could be observed in the hand specimens.

The Gangue - The gangue minerals appear to be of volcanic origin. The volcanic rock is intimately associated with smaller amounts of white quartz and a carbonaceous material which is siderite.

Many of the hand specimens showed considerable amount of hematite. This mineral was probably formed by the oxidation and alteration of the pyrite in the ore. The hand specimens collected in 1931 must have been from the surface showings because of the hematite and also because small amounts of lichen could be seen on some of the specimens.

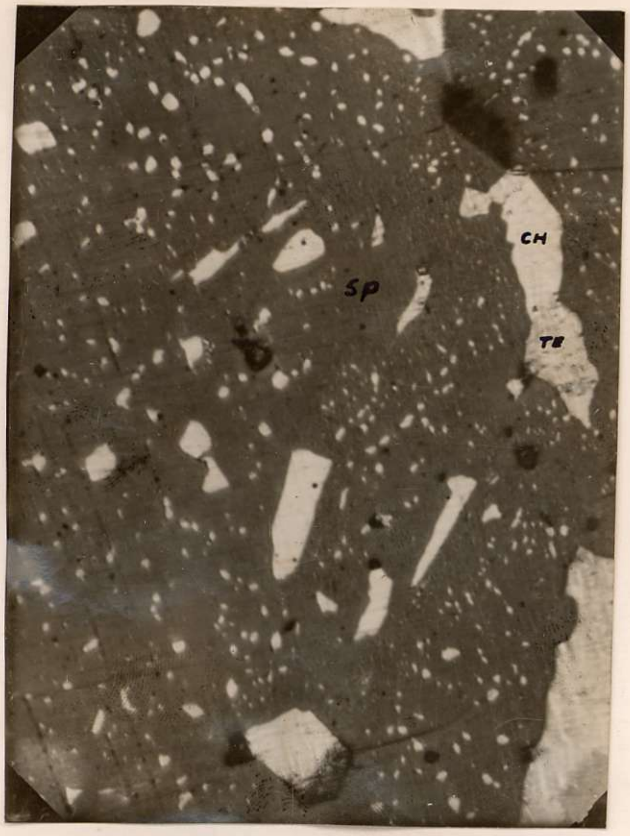

FIGURE 1

WHITE - CHALCOPYRITE

L. GREY - TETRAHEDRITE

D. GREY - SPHALERITE

X-900

FIGURE -2

WHITE - COARSE GRAINED CHALCOPYRITE

D. GREY - SPHALERITE

X-900

FIGURE -3
CHALCOPYRITE IN SPHALERITE.
X - 700

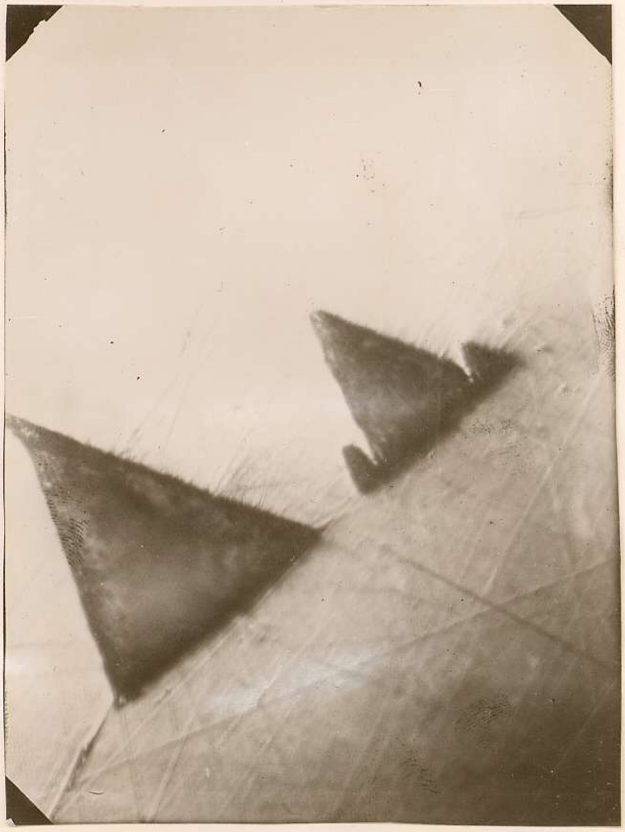

FIGURE - 4
CLEAVAGE IN GALENA.

FIGURE - 5
CUBE OF PYRITE
IN QUARTZ

X- 700

(e) MICROSCOPIC EXAMINATIONS

Eighteen polished sections were made up in order to study the minerals under the microscope. The author made up eleven of these polished sections and Doctor Thompson of the Geology Department of British Columbia made up the other seven.

A table of the metallic minerals contained in each section appears below.

Spec.	Galena	Chalco.	Sphal.	Pyrite	Tetrah.	Pyrrh.
1	x	x	x	x		
2	x	x	x	x		
3	x	x	x	x		
4	x					
5	x	x	x	x		
6		x	x			
7	x	x	x			
8	x	x	x	x		x
9	x	x	x			
10	x	x	x	x		x
11	x	x	x	x		
12	x	x	x	x	x	
13	x	x		x		
14	x	x	x		x	
15	x	x	x	x		
16	x	x	x	x		
17		x	x	x	x	
18	x	x	x		x	

Galena- The galena in most polished sections was easily determined because of the large number of cleavage pits in the particles.

In some of the polished sections the banding of the minerals were much more prominent than in the hand specimens. Fig 6.

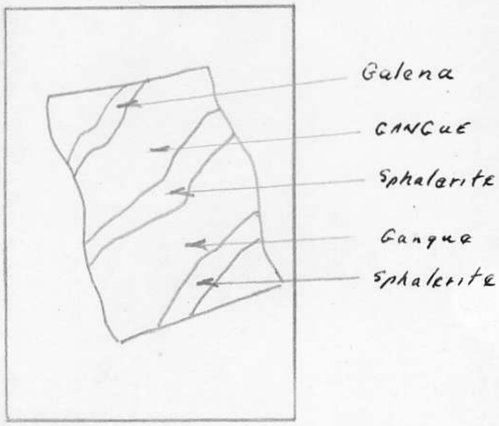

FIG-6

In most of the polished sections the galena was completely separated from the chalcopyrite. There are high silver values in this ore but no silver mineral could be identified in the specimens collected in 1931. Galena can hold up to thirty ounces of silver per ton in solid solution. Microchemical tests were made on the galena but no trace of silver could be found.

Sphalerite - The sphalerite could easily be identified by its internal reflection and the shade of the mineral under the microscope. In some specimens it was difficult to distinguish this mineral because it appeared to have various shades. The same experience was noted in the hand specimens. Sphalerite was by far the most abundant mineral in the samples which were collected recently. Most of the sphalerite was contained in large particles. Some sphalerite was contained as according to?

exsolution from chalcopyrite, which is apparently a rare occurence. (Fig 9) Most of the sphalerite was determined by internal reflection but any doubtful pieces were identified by micro-chemical and etch tests.

Chalcopyrite - Chalcopyrite, although not the most prominent mineral in the ore was the most interesting. It was contained mainly in two ways, either in large particles between 0.5 and 1.5 centimeters or as very minute globules less than ten microns in diameter in sphalerite.(Fig 1) One would conclude from this structure that it would be impossible to liberate all the chalcopyrite from the sphalerite. 50 percent of chalcopyrite was contained as minute particles in the sphalerite. The chalcopyrite was easily distinguished from the other minerals by its characteristic yellow colour.

Tetrahedrite - Tetrahedrite was by far the most difficult mineral to determine in the suite. The main difficulty arose from the fact that the tetrahedrite was contained mainly as small particles at the grain boundaries of the chalcopyrite or small inclusions in the chalcopyrite, but never associated with the galena.(Fig 1.) At first these particles of tetrahedrite were thought to be galena because it was difficult to get a needle on them to test for hardness. After careful examination, points came into view where galena, chalcopyrite and sphalerite were closely associated. The contrast between the three minerals was easily seen, and after careful examination of other minerals the galena turned out to be tetrahedrite. (Fig.7)

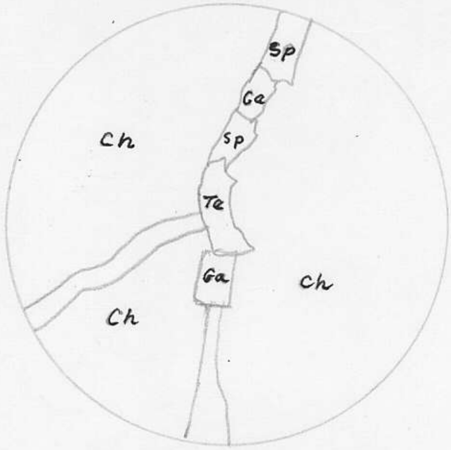

FIG -7
Sp - Sphalerite Te - Tetrahedrite
Ga - Galena Ch - Chalcopyrite

The tetrahedrite was tested for silver but copper always interfered with the tests. However, considerable amounts of silver are in the tetrahedrite because silver assays of the chalcopyrite run as high as 97 ounces per ton of concentrate. This fact further confirmed the result that the tetrahedrite was contained with the chalcopyrite.

Pyrite - Pyrite was contained in the sections in considerable amounts. The mineral was easily discernable from the other minerals by its high hardness, brass yellow colour and by the etch tests. It was noticed that pyrite was very closely associated with the gangue minerals rather than the metallic minerals. One could say that this mineral was deposited

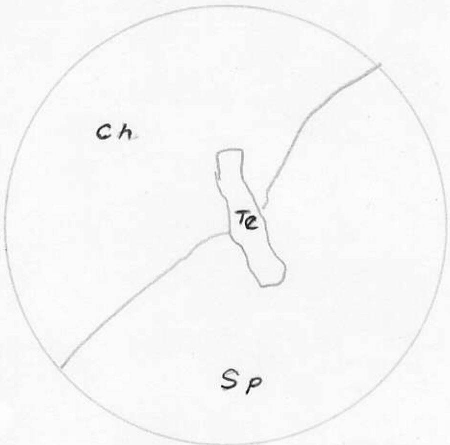

FIG 8
Ch - Chalcopyrite
Sp - Sphalerite
Te - Tetrahedrite

after the quartz intrusions but earlier that the other metallic minerals. It was also noticed that most of the pyrite was contained as cubes and pyritahedrons. (Fig.5)

Pyrrhatite - Pyrrhatite was present in the specimens in very small amounts. The pyrrhatite that could be seen was contained in the galena. The mineral was determined mainly by its characteristic creamy white colour, anisatropism, and etch tests. The particles were too small to dig out and make microchemical tests.

PARAGENESIS

1. Quartz
2. Pyrite
3. Chalcopyrite, galena, tetrahedrite.
4. Galena, pyrrhatite
5. Siderite, hematite

The Emerald Group ore vein is contained in the shear zone of the volcanic rocks. The shear zone is filled with quartz which is highly fractured, and the metallic minerals are contained in the fractures of the quartz.

It was difficult to establish the sequence of the pyrite because the mineral was contained as cubes and pyritahedrons which showed little or no evidence of corrosion. (Fig. 5). It was observed that the pyrite was closely associated with the quartz and it would appear that the pyrite was deposited immediately prior to the quartz. Chalcopyrite, tetrahedrite, sphalerite were probably deposited simultaneously. Sphalerite and chalcopyrite were definitely deposited at the same time because exsolution textures of chalcopyrite in sphalerite could be seen in nearly every polished section. In some specimens the exsolution texture of chalcopyrite from sphalerite could be seen along the crystalographic axes of the sphalerite. (Fig.3). Most of the chalcopyrite in the sphalerite was minute blibs distributed at random throughout the section. (Fig.1)

One specimen showed exsolution intergrowths of sphalerite in chalcopyrite, which are relatively uncommon, because the unmixing occurs at temperatures above 550^{o} C. The sphalerite was precipitated as star-shaped, sketelal crystals along the crystalographic planes of the chalcopyrite. (Fig.9) In the light of this evidence one could say that the ore body was deposited at high temperatures. The paragenesis of the tetrahedrite was a little more difficult to determine, but it was probably deposited at the same time as chalcopyrite and sphalerite. The tetrahedrite was very closely associated with the chalcopyrite, and was either at the grain boundaries of the chalcopyrite, or as ex-solution textures within the chalcopyrite.

The sphalerite was probably earlier than the galena. In one specimen the corner of a cube or dodecahedron of sphalerite could be plainly seen. The galena was probably precipitated around the crystal of sphalerite.

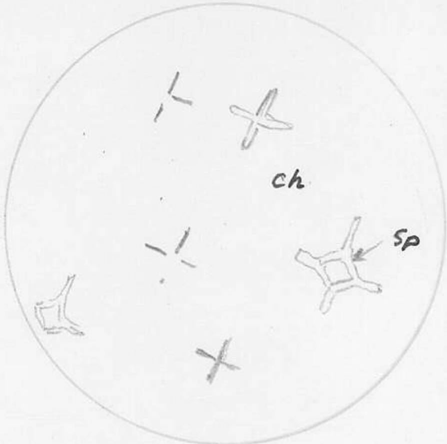

Fig. 9
Ch - chalcopyrite
Sp - Sphalerite

When the specimen was first examined it looked as though the sphalerite had precipitated in the cleavage trace of the galena, but further examination indicated that this assumption was incorrect. (Fig.10).

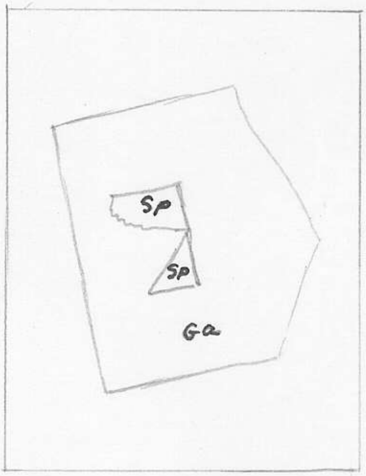

Fig - 10
Sp - Sphalerite
Ga - Galena

Galena and pyrrhotite were probably of simultaneous deposition. None of the Pyrrhotite was associated with chalcopyrite or pyrite but could only be seen in the galena. The amounts as pyrrhotite in each specimen was very small and it was difficult to get any good information on the mineral.

The siderite and hematite were probably the last minerals to form.

Beaause of the two shades of sphalerite, the banding of the minerals and the different grain size of the minerals one might say that this deposit had more than one period of mineralization.

Kept sections

Nos. 1, 10, 16 → Skeletons? ZnS in chalcop.

Twinning in ZnS

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