8.9

Nice job.
Few minor mistakes only.

MICROSCOPIC EXAMINATION OF THE KAY GROUP ORES
OMINECA MINING DIVISION, BRITISH COLUMBIA

A report submitted
in partial fulfilment of the course Geology 409
at the University of British Columbia

Winter Session 1952-1953

Kenneth Albert Markland.

April 11, 1953.

2296 Tolmie Street,
Vancouver 8, British Columbia,
April 11, 1953.

Dr. H. V. Warren,
Professor of Mineralogy,
University of British Columbia,
Vancouver, British Columbia.

Dear Sir:

I herein submit for your approval and as partial credit for the Geology 409 course the report, "Microscopic Examination of the Kay Group Ores, Omineca Mining Division, British Columbia".

Respectfully yours,

Kenneth A. Markland

Kenneth A. Markland.

ACKNOWLEDGEMENTS.

The writer is especially indebted to Dr. R. M. Thompson, Assistant Professor of Geology, under whose guidance the study was made. His critiscisms and advice on various mineralographic problems were greatly appreciated. I am indebted to Mr. E. D. Dodson, labratory assistant, for photographs and willing assistance. I thank Mr. J.A. Donnan for his supervision and help in preparing the numerous polished sections.

Since none of those mentioned read the manuscript in its final form, the writer is alone responsible for any shortcomings and mistakes.

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ILLUSTRATIONS

Introduction*

Location.

The Kay group claims are located in the Omineca Mining Division on the hillside west of the Bralorne Takla Mercury Mine. The main showings lie along the northwesterly trending fault zone at an elevation from 4300 ft. to 4500 ft. The area is serviced by a secondary road from Takla Landing, 36 miles away. Other than by plane, lake and river barges are the sole means of communicating freight the 110 miles between Takla Landing and Fort St. James. From Fort St. James to Vanderhoof on the C.N.R. line is 41 miles of good gravel road.

History.

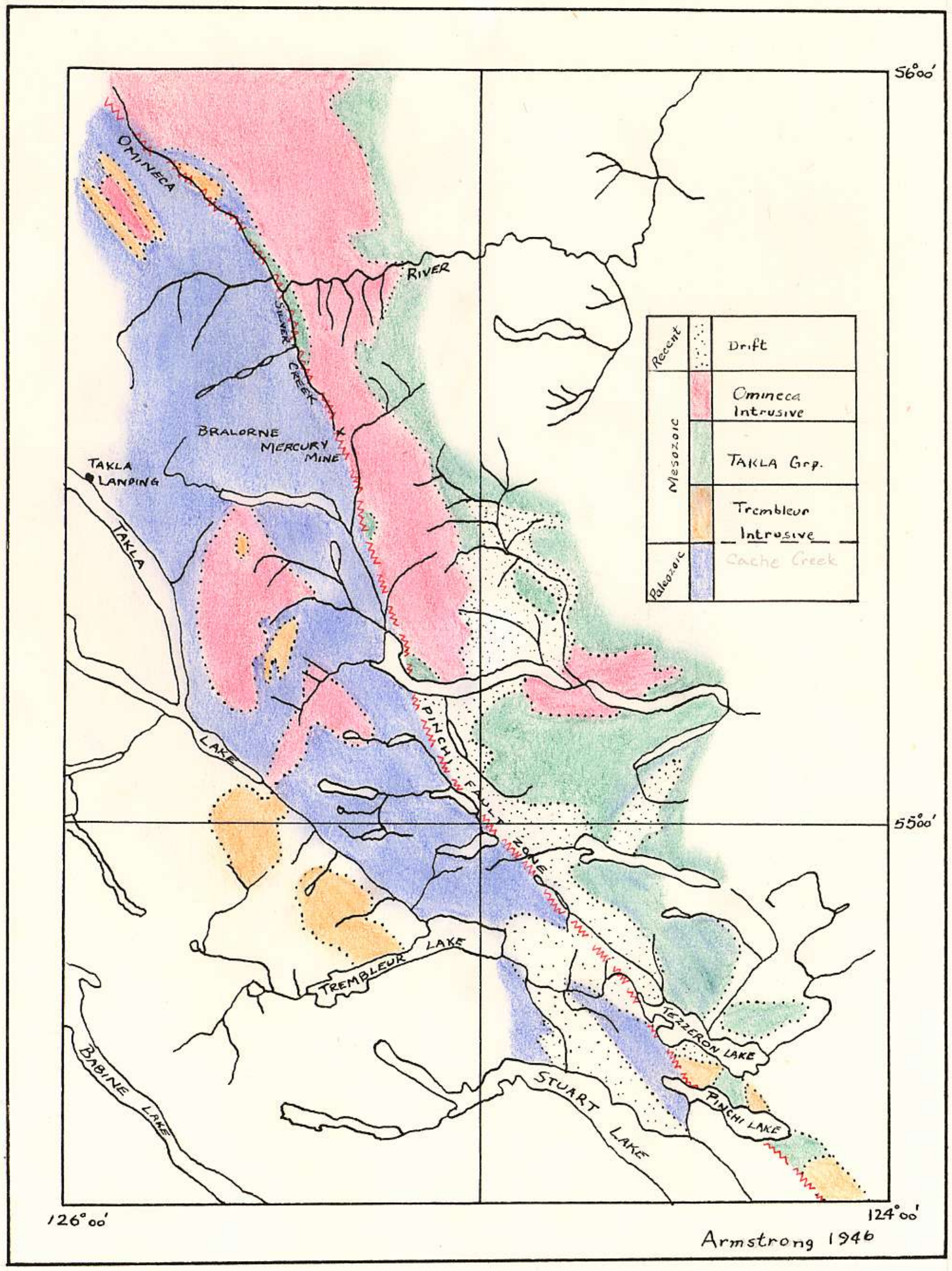
The claims were staked in September of 1944. First assays from surface pits were impressive, running as much as 100 oz of silver per ton with an appreciable gold content. Underground development was initiated but assays were low and disappointing. Three hundred and twenty feet of workings along the fault zone and several surface pits were the extent of development. Three occurrences of heavy sulphides 700 ft. apart was all that was shown in the exploration to prove property.

General Geology.

The Pinchi Lake fault zone, some 150 miles long, strikes northwest and brings steeply folded Permian limestones and sediments into juxtaposition with upper Triassic-Jurassic sediments and volcanics.

The claims are underlain mainly by blue-grey Cache Creek limestone. Near the showings is a northwesterly trending band of crushed argillite. Several feldspar porphyry dykes cut the limestone and argillite. A subsidiary fault of the main Pinchi Lake fault runs through the camp and follows approximately along the band of crushed argillite. Subsequent mineralization has followed closely along this fault. The mineral bearing solutions probably arose along the main Pinchi Lake fault.

*J.E.Armstrong, Northern Part of Pinchi Lake Mercury Belt, B. C. Paper 44-5.
J.E.Armstrong, Fort St. James Map Area Cassiar and Coast Districts B. C. Mem. 252.



Scale?

Generalized Geologic Map.

Megascopic Description.

Specimens from the Mine.

Of the specimens from the mine there appears to be a twofold subdivision into those predominantly rich in stibnite and those rich in arsenopyrite. Those rich in arsenopyrite are dark massive sulphides, compact, moderately crystalline with minor veins of stibnite. The stibnite rich specimens are massive, slightly more friable, moderately coarsely crystalline with disseminated arsenopyrite, pyrite, and sphalerite. Quartz is the main gangue mineral associated with the ore.

Specimens from Surface Pits.

The specimens from the pits are weathered, badly fractured, massive, coarsely crystalline stibnite with some very minor sphalerite. Partially healing the fractures is a gangue with disseminated blebs of realgar. Most of the vugs and fractures have some secondary fibrous, radiating antimony oxide.

Host Rock.

Little can be said here as actual specimens were not available for study but the host rock associated with the ore provides some clue. The observations are listed below.

1. A black, friable, and sheared argillite. There was no evidence of mineralization in the argillite.

2. A dark apparently silicified argillite fractured and mineralized with pyrite.

3. A siliceous rock apparently crushed and presumably from the shear zone. It has been mineralized with stibnite, pyrite and arsenopyrite.

Microscopic Description.

The following list gives the minerals identified in the polished section in order of abundance.

Ore Minerals	Gangue Minerals
Stibnite	Quartz
Jamesonite	Unknown gangue "Cervantite"
Arsenopyrite	Realgar
Sphalerite	Calcite
Andorite	
Argentiferous Tetrahedrite	
Chalcopyrite	

Stibnite - $Sb_2 S_3$

Stibnite is the dominant mineral in most all sections. It is commonly bladed or occurs as confused or radiated aggregates. It is intimately associated with jamesonite, and andorite and to a lesser extent tetrahedrite and sphalerite. Sections studied from surfact pits were almost exclusively stibnite with minor associated jamesonite. These specimens show twinning so common in stibnite. (Fig. 5.)

The KOH etch test serves to readily distinguish stibnite from its associated minerals. Textural relations indicate stibnite was the last ore mineral to be deposited.

Jamesonite - $4PbS.FeS.3Sb_2S_3$

Jamesonite was identified in all sections. Associated with and often replaced by stibnite it ranged in size from 10 micron blebs to confused aggregates 500 microns across. It is frequently observed corroding arsenopyrite or replacing smaller arsenopyrite crystals and exhibiting the typical arsenopyrite diamond cross-section. Small blebs of chalcopyrite occur in the jamesonite but they are rare.

Its white color, softness and strong anisotropism separate it easily from its associated minerals except stibnite.

Arsenopyrite - Fe As S

Arsenopyrite is typically seen in most any section as diamond shaped rhombs replacing or contiguous with pyrite. It and pyrite are the only two minerals found to any extent mineralizing the wall rock. The size of individual grains averages around 100 microns but varies on either side from corroded remnants of less than 5 microns across to masses of several square millimeters. Fracturing and later healing with quartz after arsenopyrite mineralization has resulted in a cockade texture. Arsenopyrite was one of the more easily recognizable minerals in the suite.

Pyrite - Fe S_2

Pyrite is present in the wall rock as euhedral crystals, and in the ore as euhedral crystals, irregular masses, or corroded remnants. The pyrite content of the ore would probably not exceed 4% by volume. A Grain size of 500 microns ~~are~~ is most common. Its visual characteristics and hardness renders it easy to identify.

Sphalerite - Zn S

Sphalerite is intimately associated with jamesonite, stibnite andorite and tetrahedrite. It commonly occurs as masses 800 microns across and almost always shows an "emulsion" texture of exsolution chalcopyrite. The chalcopyrite is commonly randomly distributed but is occasionally observed oriented along the crystallographic directions of the sphalerite. Sphalerite and chalcopyrite are capable of solid solution above temperatures from 350° C to 400° C (Edwards). This indicates that 350° C is the minimum temperature at which sphalerite could be deposited. Its grey color and strong deep red-brown internal reflection make it easy to spot.

Andorite - $2PbS. Ag_2S. 3Sb_2S_3$

Andorite is a rare mineral (Short) but in this ore occurs in greater abundance than tetrahedrite with which it is easily confused. A definite anisotropism and effervescence with aqua regia distinguishes it from tetrahedrite and associated minerals. It occurs as masses from 2 millimeters to 60 microns in or associated with sphalerite, jamesonite and stibnite. Andorite responds very well to etch tests and can be singled out on this bases alone. Microchemical tests verified the results of the etch test. There was no textural relation observed between andorite and tetrahedrite so their paragenetic sequence can only be inferred.

Argentiferous Tetrahedrite - $5Cu_2S.\ 2(Ag,Cu,Fe)S.\ 2Sb_2S_3$

Since silver assays on the ore were not known, the name argentiferous tetrahedrite was used in preference to freibergite. It is found mainly as rounded to irregular masses in or cutting sphalerite. Several masses show exsolution blebs of chalcopyrite which have a tendency to collect near the margins of the tetrahedrite. Chalcopyrite exsolves from tetrahedrite at temperatures around 500°C (Edwards). It is on this basis that tetrahedrite has been placed genetically ahead of andorite. A microchemical test indicated a high silver content in the tetrahedrite.

Chalcopyrite - $Cu_2Fe_2S_4$

Chalcopyrite is rare in the ore and is found as an "emulsion" in sphalerite and tetrahedrite. The blebs of chalcopyrite show some crystallographic orientation in the sphalerite but more often there is a random distribution. Several instances were observed where the chalcopyrite blebs were exsolved as clusters. There is no doubt that the chalcopyrite in the sphalerite is a result of exsolution.

The chalcopyrite-tetrahedrite relationship appears to be the exsolving of chalcopyrite from tetrahedrite. The chalcopyrite is present in the tetrahedrite as exsolution masses ranging from 50 to 10 microns across. There is a tendency for the chalcopyrite to be found near the edges of the tetrahedrite. No textures were observed to indicate the chalcopyrite was later than the tetrahedrite.

Gangue Minerals.

Crystalline quartz is the main gangue mineral in the ore. It has been replaced or corroded by most ore minerals. There is an early quartz mineralization forming the main gangue mass and late quartz mineralization filling fractures.

Calcite is present in the ore in very minor amounts and came in in the late stages of mineralization.

Little can be said of the unknown gangue except that it is present, replacing the ore and healing fractures. Figure 4 shows the gangue pseudomorphous after stibnite. Small pustules of realgar occur erratically distributed through the gangue.

Paragenesis

The following table gives the sequence of events in the formation of the deposit.

Temperature of Deposition

From the minerals present and from exsolution relations it seems apparent that this deposit includes both epithermal and hypothermal temperature ranges. The following relations serve to support the foregoing statement.

1. Tetrahedrite and jamesonite are indicative of deposition below 500° C*.
2. Stibnite and realgar indicate temperatures of deposition below 250° C*.
3. Exsolution chalcopyrite in sphalerite indicates a minimum temperature of formation of 350° C*.
4. A much higher temperature of deposition is indicated by tetrahedrite and chalcopyrite which exsolve at a minimum temperature of 500° C*.

This deposit represents the telescoping of two or possibly three types of hydrothermal mineralization.

Type of Mineralization

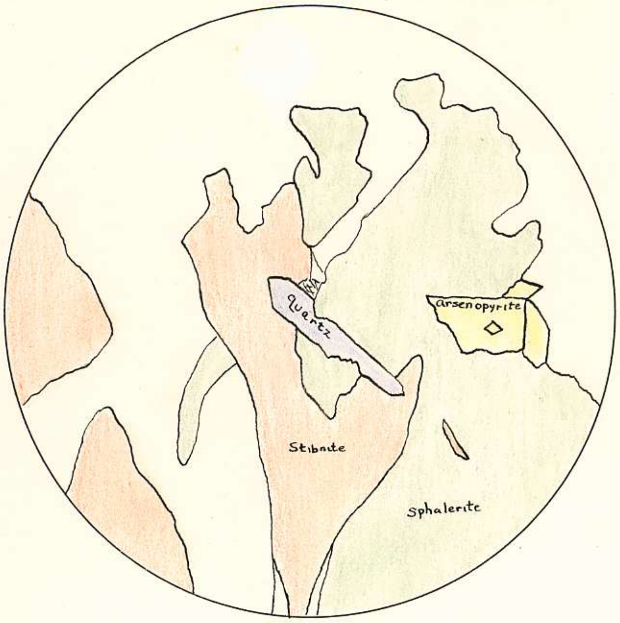
Considering the above discussion, the relative coarseness of the grains, the megascopic observations, the description of the property and the type of mineralization in the area, the writer believes this is an epithermal deposit.

Vertical Zoning

Very little can be said here due to the limited number of specimens examined. The following points summerized all that can be said.

1. Stibnite is very abundant in specimens from surface pits so much so as to exclude nearly all other minerals. Stibnite is not as abundant in specimens from the mine.
2. Silver values high near the surface decreased markedly with depth. (Armstrong)

* Edwards.



x40

Figure 1

Sphalerite Corroding Quartz and Arsenopyrite
Stibnite Replacing Sphalerite

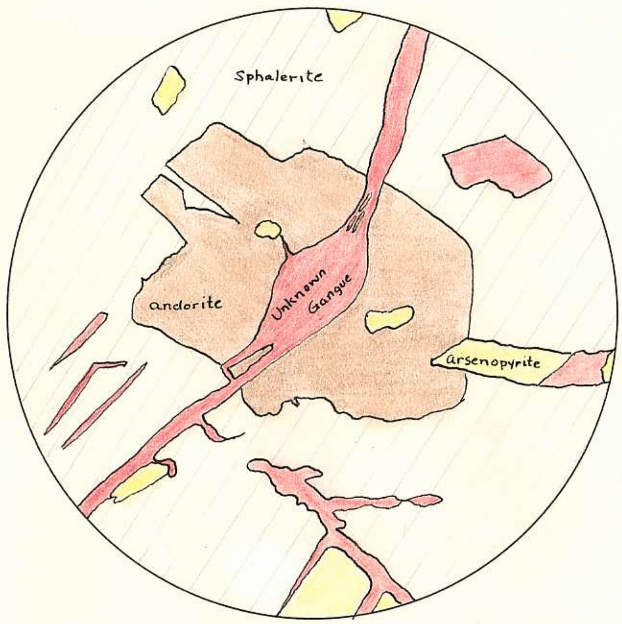


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Figure 2

Andorite Replacing Sphalerite and
Arsenopyrite and cut by late fracture

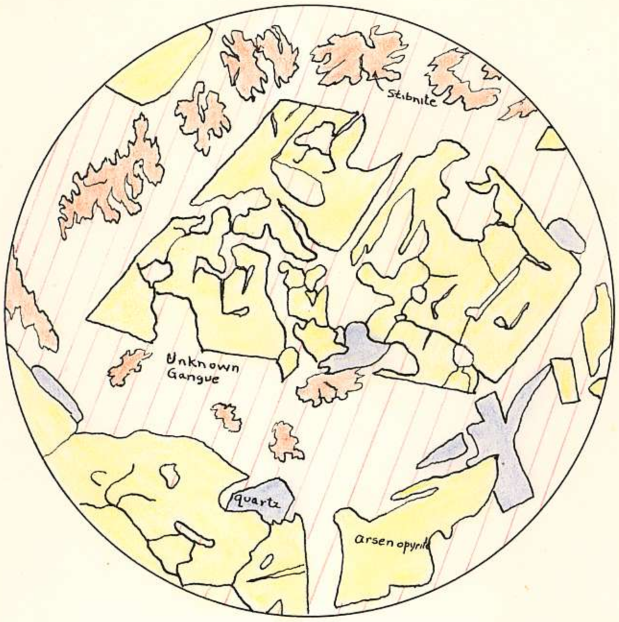

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Figure 3

Gangue Replacing Stibnite
and Arsenopyrite

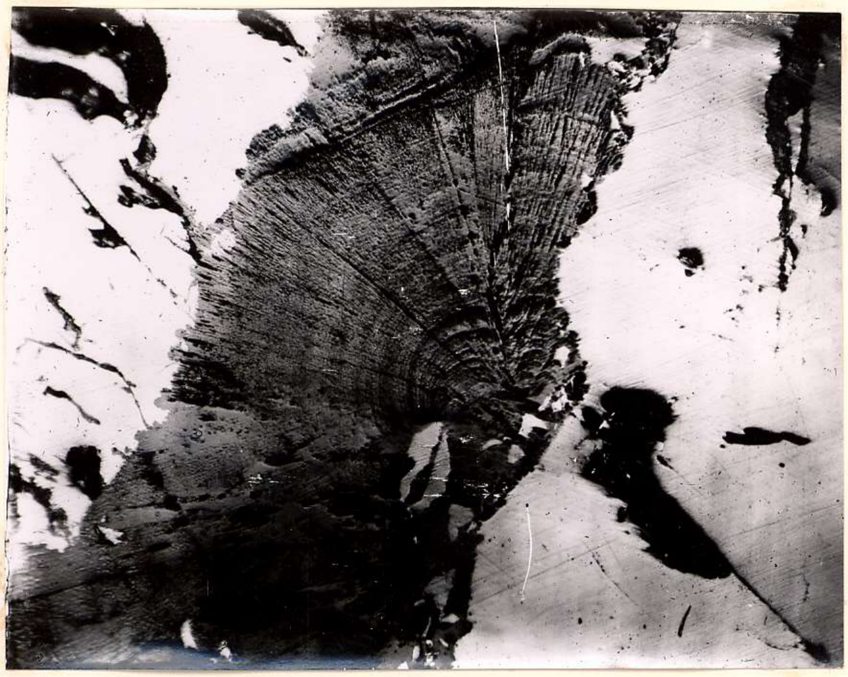

Figure 4

Gangue Pseudomorphous after Stibnite

Figure 5

Twinning in Stibnite

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