MACGILLIVRAY GROUP.

Kamloops M.D.

Submitted in partial fulfillment of the requirements of the course in Geological Engineering, Fifth Year, at the University British Columbia.

Geology 9

March 16 1946 Frank Whiting

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Introduction.

The groups of samples came from the MacGillivray claims in the Kamloops Mining Division. The specimens were from three sources: Lone Star claims, Lucky Coon claims, and, as a separate group, D.1 and D.2 float and assorted country rock from the Courageous claims.

Laboratory work consisted of examination of hard specimens, polished section study, and microchemical tests. This was done in January, February, and March of 1946, using the facilities at the University of British Columbia.

As the property is a new prospect, no geological data was available or divulged. The writer had no opportunity to find out what the owner wanted to know. The laboratory investigations, therefore, sought to identify the sulphides, to establish age relations, and to determine grain size.

It was understood that the groups of claims were widely scattered. Accordingly, the descriptions were written treating each group as a unit.

Lone Star.

Considerable differences were found in the several specimens. Most had massive pyrrhotite as a matrix about all the other minerals. The remainder showed an intimate mixture of sulphides and gangue. Many sections were made. Selected ones were described.

Lone Star 9.

This section is typical of the whole suite. Minerals found were arsenopyrite, pyrite, pyrrhotite, sphalerite, chalcopyrite, galena, quartz, calcite, and unidentified gangues.

All the type occurrences are found:

(a) Disseminations in massive pyrrhotite.

(b) Disseminations in massive galena.

(c) Disseminations in massive sphalerite.

(d) Isolated minerals and mixtures of minerals in quartz masses.

In part, a general sequence of deposition is evident. In part, all the minerals seem to have been deposited simultaneously.

Sequence of Deposition.

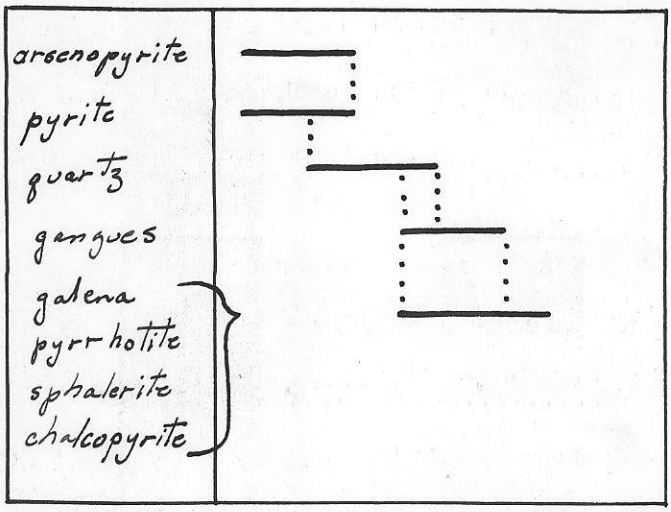
Quartz is found in veins in arsenopyrite and pyrite.

Sphalerite, galena, and pyrrhotite are found in veins in quartz.

Sphalerite, galena, and pyrrhotite are found in veins in calcite.

Scattered gangue minerals are found about and with quartz, and through the soft sulphides. "Vein" means "vein with matching walls."

Sequence.



Simultaneous Deposition.

Plates 1-4 show how the minerals occur in various sequences and in mixtures of crystals. In places, galena seems latest, holding small rounded particles of sphalerite, chalcopyrite, and pyrrhotite. In other places, pyrrhotite is the matrix. This overlapping, with no evidence of a time break between the deposition of the various soft sulphides, and with the strong evidence that the sulphies and the quartz are in part contemporaneous furnished by the type (d) occurrence - see plate 1 -, supports the concept of simultaneous deposition.

Lone Star 7.

This section shows an intimate mixture of all the minerals. The crystals are characteristically minute, though large crystals and aggregates of crystals are common. Megascopically, the section appears highly twisted and mashed, but microscopic examination shows very little fracturing. One fracture in quartz shows pyrrhotite next to the quartz, with galena and sphalerite in the center of the vein. This illustrates the tendency of pyrrhotite to solidify first from a mixture of the minerals.

Plate 3 shows the mixture of minerals with the gangue. The lack of fracturing is evident. Crystals are haphazardly disseminated through the matrix. Simultaneous deposition is suggested.

Lone Star 4.

Pyrrhotite is the most abundant mineral. It is the matrix, and occurs also as six-sided crystals in quartz. It holds galena, sphalerite, quartz, and chalcopyrite patches of irregular form with smooth wavy contacts. The pyrrhotite is really well crystallized, with the crystals locked at the boundaries to give a massive effect. Slight alteration has proceeded along crystal outlines, giving a muddy appearance. Pyrrhotite is cut by late wavy gangue veinlets.

Quartz is scattered through the pyrrhotite, both as separate crystals and as large aggregates of crystals, very little fractured. It contains arsenopyrite and, in interstices between quartz crystals, separate and mixed particles of pyrrhotite, chalcopyrite, sphalerite, and galena. See plate 1 . This is considered strongm evidence for the contemporaneity of copper, lead, zinc, and the pyrrhotite.

Very little pyrite could be found, Arsenopyrite occurs as large and tiny crystals scattered through the other minerals, largely unfractured.

The chalcopyrite is partly tiny blebs in sphalerite, although this is rare. More commonly, it forms separate rounded particles with wavy contacts against the enclosing pyrrhotite.

More than one gangue mineral is present, mostly closely associated with the quartz. A very late gangue, medium gray and of moderate hardness, cuts all the previous minerals.

As shown in the photographs, the minerals are complexly mixed. Any mineral can be found enclosing or enclosed by any other. In general, fracturing and veining are only minor features. Plate 2 shows two type occurrences - several minerals scattered through pyrrhotite, and several minerals, including pyrrhotite, scattered through galena. It is clear that these sulphides were deposited contemporaneously.

Conclusions for Lone Star Claims.

Only one period of mineralization is indicated. The writer believes that precipitation of all the minerals was approximately simultaneous, with a moderately well-defined sequence appearing in some zones, where quartz and the hard sulphides formed slightly earlier than the soft sulphides.

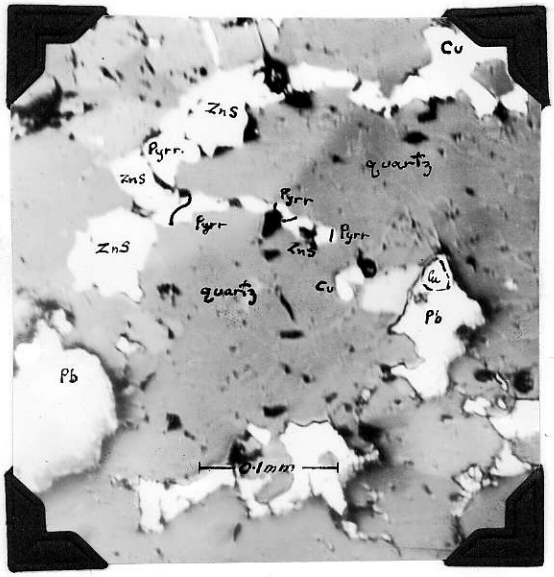


Plate 1.

Section LS 4, Lone Star claims, MacGillivray group.

Irregular masses of the soft sulphides are found in quartz. The wavy contacts and the identical occurrence of the several sulphides indicate simultaneous deposition from the same source as the quartz.

Abbreviations.

ZnS	Sphalerite
Pb	Galena
Cu	Chalcopyrite
Pyrr.	Pyrrhotite.

Data.

Objective	3
Ocular	10×
Exposure	60 sec.
Log	H 26·8 V 50·8
Magnification	315

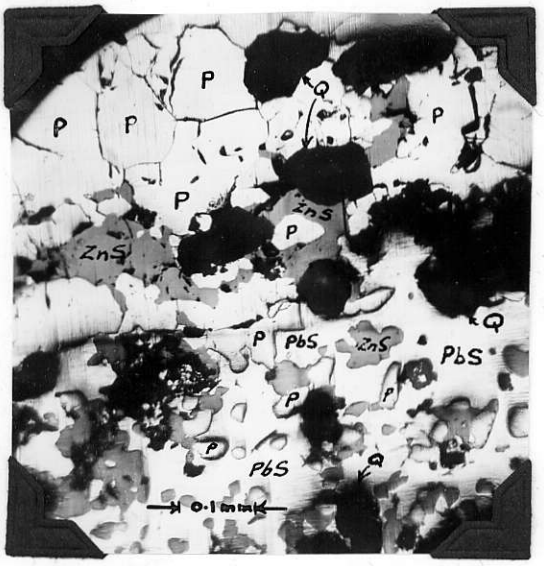


Plate 2.

Section LS 4, Lone Star Claims, MacGillivray group.

Massive pyrrhotite encloses sphalerite, quartz, and minor galena. Massive sphalerite encloses pyrrhotite, quartz and other gangues, and sphalerite. The crystal outlines in the massive pyrrhotite are noticeable.

Abbreviations.

P	Pyrrhotite
PbS	Galena
ZnS	Sphalerite
Q	Quartz

Data.

Objective	3b
Ocular	8x
Exposure	25 scc
Log	H 0.5 V 44.9
Magnification	100

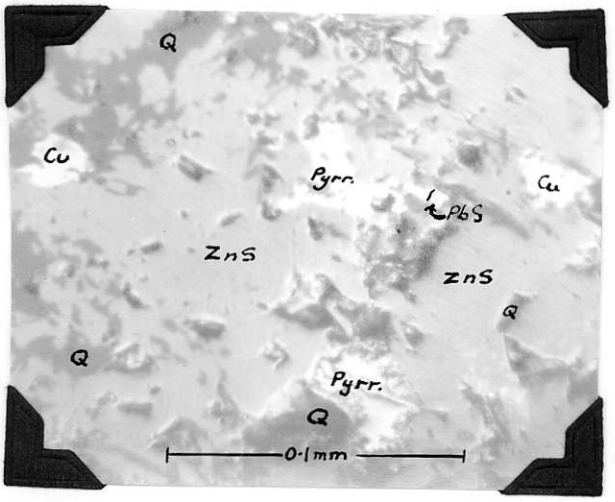


Plate 3.

Section LS 7, Lone Star claims, MacGillivray Group.

Irregular masses of galena, chalcopyrite, pyrrhotite, and quartz in the sphalerite indicate that all were deposited at one time.

Abbreviations.

Pyrr.	Pyrrhotite.
ZnS	Sphalerite.
PbS	Galena
Q	Quartz.
Cu	Chalcopyrite

Data.

Objective	H.P.
Ocular	10x
Exposure	3 min
Log	H 20·5 V 53·1
Magnification	400

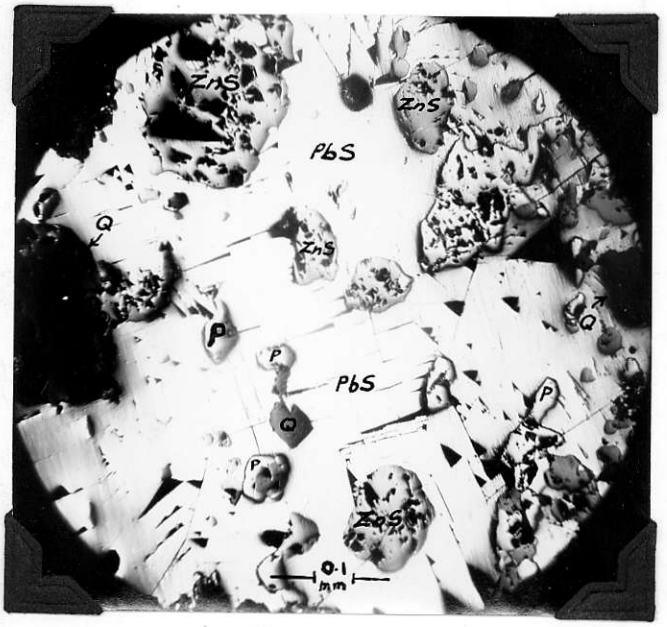


Plate 4.

Section LS 9, Lone Star Claims, MacGillivray Group.

Coarsely crystalline galena holds rounded particles of the other sulphides.

Abbreviations.

P	Pyrrhotite
ZnS	Sphalerite
PbS	Galena
Q	Quartz

Data.

Objective	3
Ocular	10x
Exposure	30 sec.
Log	H 13.6 V 46.0
Magnification	50

Lucky Coon.

The specimens show banded sulphides in quartz. Most of the specimens are oxidized and porous, so few of them made good polished section material. The oxidation has not greatly altered the pyrite.

Sections L.C.1 and L.C.3.

Minerals found are: arsenopyrite, pyrite, quartz, galena, sphalerite, chalcopyrite, and unidentified gangue minerals.

The minerals have been but little fractured. Some cracks with matching walls were found, and used to determine the sequence of deposition.

Arsenopyrite and pyrite seem to be the earliest. Both are well crystallized. Most of the large masses of pyrite have some arsenopyrite aggregates inside or adjacent, with irregularly intergrown contacts. Arsenopyrite is found as large and tiny crystals scattered through the quartz, galena, and sphalerite. Plate 6.

Quartz occurs in masses and separate crystals, a little fractured. It is later than the pyrite and arsenopyrite, for it fills cracks in them.

An unidentified gray gangue mineral, negative to acids, and harder than D, is found commonly about the boundaries of quartz masses, and partly as separate lumps. Some of it is fibrous. Much of the gangue forms irregular inclusions in the quartz, so came with it; some came after quartz and before sphalerite, for it is found between them; and some came with the sphalerite, for it forms distict crystals and masses in it.

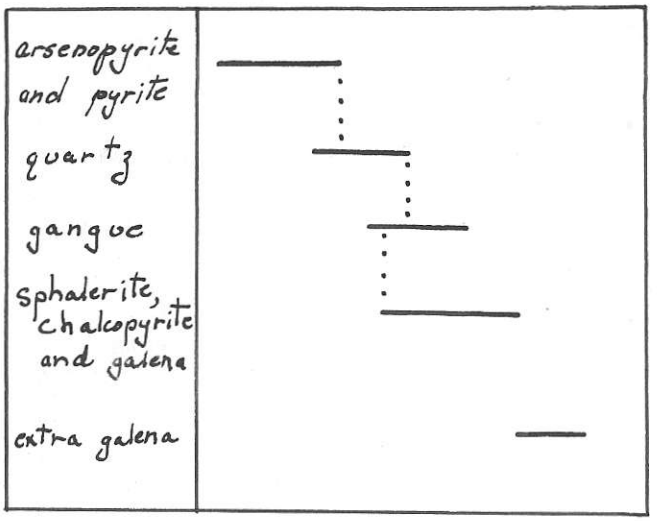
Sphalerite and chalcopyrite are found together as a matrix about quartz, gangue, arsenopyrite, and pyrite, and filling matching-walled veinlets in all four. In part, the chalcopyrite is in lines of tiny blebs in sphalerite, suggesting exsolution.

In part, however, pieces of chalcopyrite occur independently of sphalerite, in lumps equal in size to the associated minerals. A few tiny particles were seen in galena. See plate 5 . Irregular veinlets of sphalerite in quartz indicate that slight replacement of the quartz took place.

Galena is found as a multitude of tiny blebs through sphalerite, with chalcopyrite in larger blebs in sphalerite, and as a massive filling between pyrite and quartz masses, and in cracks in pyrite and quartz.

No pyrrhotite was found.

In general, a sequence of deposition is evident, and this is summarized in the table below. There was some overlapping, however, particularly among the sphalerite, galena, and chalcopyrite. One period of mineralization is indicated.



In quantity, the minerals were estimated to occur in the following order: most - sphalerite, quartz; pyrite; galena, arsenopyrite; gangue; chalcopyrite - least.

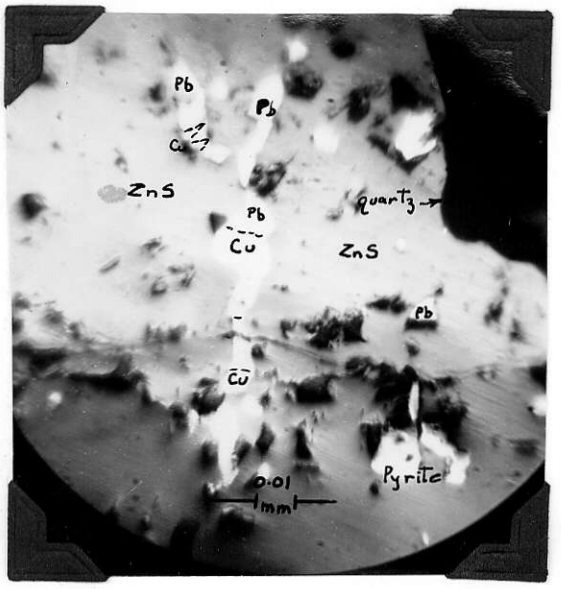


Plate 5.

Section LC 1, Lucky Coon Claims, MacGillivray Group.

Galena and chalcopyrite from an elongated bleb in sphalerite. Other isolated galena blebs are visible. Pyrite is present. Quartz has smooth wavy outlines.

Abbreviations.

Pb	Galena
Cu	Chalcopyrite
ZnS	Sphalerite.

Data.

Objective	H.P.
Ocular	10 x
Exposure	45 sec.
Log	H 21.0 V 51.4
Magnification	500

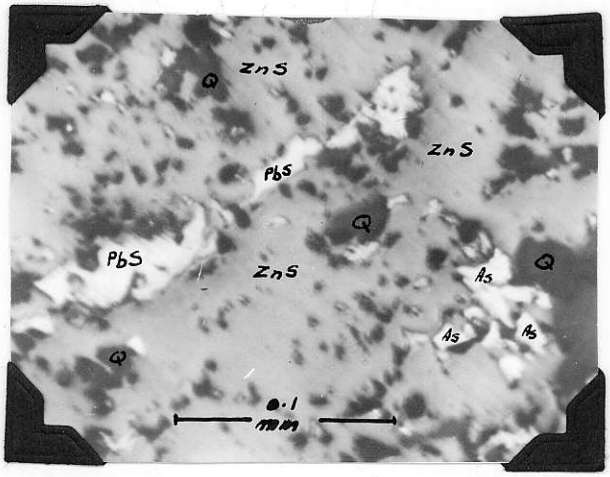


Plate 6.

Section LC 1, Lucky Coon Claims, MacGillivray Group.

Clusters of tiny arsenopyrite crystals are seen in sphalerite. Tiny quartz pieces and an elongated lens of galena are also enclosed by sphalerite.

Abbreviations.

PbS	Galena
ZnS	Sphalerite
As	Arsenopyrite.
Q	Quartz

Data.

Objective	Medium Power
Ocular	Low Power
Exposure	75 sec.
Log	H 4.7 V 51.0
Magnification	285

Float and Country Rock.

The hand specimens of float show banded sulphides in quartz. The quartz is grey to flesh-pink, in irregular to angular masses of crystals, not noticeably fractured or brecciated, both as a matrix about pyrite crystals and as large masses with exceedingly uneven edges. The pyrite is well crystallized, appears somewhat fractured, and is concentrated in narrow bands. Magnetite is fairly abundant, but did not appear in the polished sections. The surfaces of the specimens are oxidized and leached, leaving limonite. Specimen Cour. 2 has sooty black calcite, at first suspected to be chalcocite, but effervescent in acid and containing no copper. Also visible in Cour. 2 is a small amount of golden and white mica, and a few feldspar grains.

Polished Sections.

Cour. 1.

Pyrite is abundant, forming many large crystals. Quartz seems to be the matrix, holding bands of sulphides. Galena is scarce, but coarsely crystalline. Sphalerite is abundant, in part enclosing the pyrite and the aggregates of arsenopyrite crystals. No pyrrhotite was seen. Chalcopyrite is strung out in tiny blebs in sphalerite.

There is a general segregation into pyrite, galena, sphalerite, and quartz bands.

Quartz is found veining sphalerite. Quartz and sphalerite are found in veins in arsenopyrite. Some overlapping is indicated.

Cour. 2.

Minerals found are: arsenopyrite, pyrite, quartz and other gangue

minerals, sphalerite, galena, and chalcopyrite. Pyrrhotite is notably absent.

Arsenopyrite is found as a few crystals in quartz and galena. Pyrite forms irregular lumps and a few crystals, little fractured but containing many inclusions of galena and sphalerite.

Quartz occurs as aggregates of crystals. Scattered through quartz are tiny bits of arsenopyrite, chalcopyrite, and galena. No quartz-filled cracks were found in the pyrite or arsenopyrite, so the three are considered contemporaneous.

Small amounts of calcite were found. Several gangue minerals appear, some fibrous, others angular, others in irregular patches intimately mixed with quartz.

Sphalerite is abundant, not all the particles showing chalcopyrite blebs.

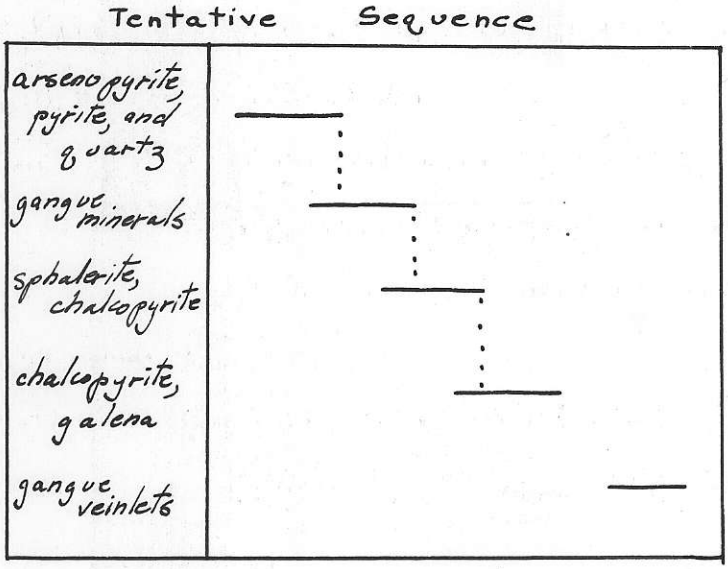
Some chalcopyrite forms blebs in sphalerite, some forms the filling in between quartz crystals, and some, in larger pieces, is found in massive galena, with smooth wavy contacts.

Galena is the most abundant sulphide. It forms the matrix about all the other minerals. Also, it can be found in matching-walled veinlets in pyrite, quartz, and gangue minerals.

A gangue mineral in sharply-angled veins cuts sphalerite and galena. In places the edges of the veins are fuzzy, as though the gangue was replacing galena or penetrating it along cleavage cracks.

The age relations are given in the following table. It may be noted that although the sequence can be compiled, the occurrence of sulphides inside the quartz indicates that there was only one period of mineralization.

The main point of interest in the float specimens is the preponderance of galena, as seen in section Cour. 2.



For the float specimens, the estimate of quantities is:

Most	-	Galena
		Quartz
		Sphalerite
		Gangues
		Pyrite
		Chalcopyrite
		Gangue veinlets
Least	-	Arsenopyrite

Country Rock from MacGillivray claims and Courageous group.

A. Blue-grey limestone, fractured and veined by white calcite. No polished section was made.

B. Thinly-bedded, buff to white limestone with minor sericite along bedding planes. No section was made.

C. Buff quartzite (?) with pits containing limonite. A polished section was made. Sphalerite grains were found sparsely disseminated through the quartzite.

Summary of Work.

Sulphides found during the examination are: arsenopyrite, pyrite, pyrrhotite, chalcopyrite, sphalerite, and galena. Gangue minerals are quartz, magnetite, calcite, feldspar, and other unidentified gangue minerals.

Many of the specimens are massive sulphides. Some are banded sulphides and gangue.

Gold was not seen. Silver values were reported high, but no silver compounds were found. Microchemical tests of the galena did not show silver, but the negative reaction is common for argentiferous galena.

In age relations, a general sequence of deposition was worked out. However, strong evidence for simultaneous deposition was found.

Grain size determinations, as shown in the photographs, suggests that grinding to finer than 200 mesh would be needed to separate the arsenopyrite from the lead and zinc, and to finer than 400 mesh to separate lead and copper from zinc.

The arsenopyrite and pyrrhotite indicate a high temperature deposit. Both of these minerals are found, in part contemporaneous with the galena and sphalerite, in the Lone Star sections. In contrast, the float and Lucky Coon sections have no pyrrhotite, so their temperature type is not clearly defined.