Original

A MICROSCOPIC STUDY OF THE GOLD QUARTZ ORE

of the

MUSKETEER MINE, BEDWELL RIVER V.I.

submitted by

Franc. Joubin

as a partial requirement in

Geology 9

- 1942 -

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A MICROSCOPIC STUDY OF MUSKETEER MINE ORE

General Purpose of Study

1. To determine the minerals present.

2. To study their relationship with one another, with especial attention to their relationship with gold.

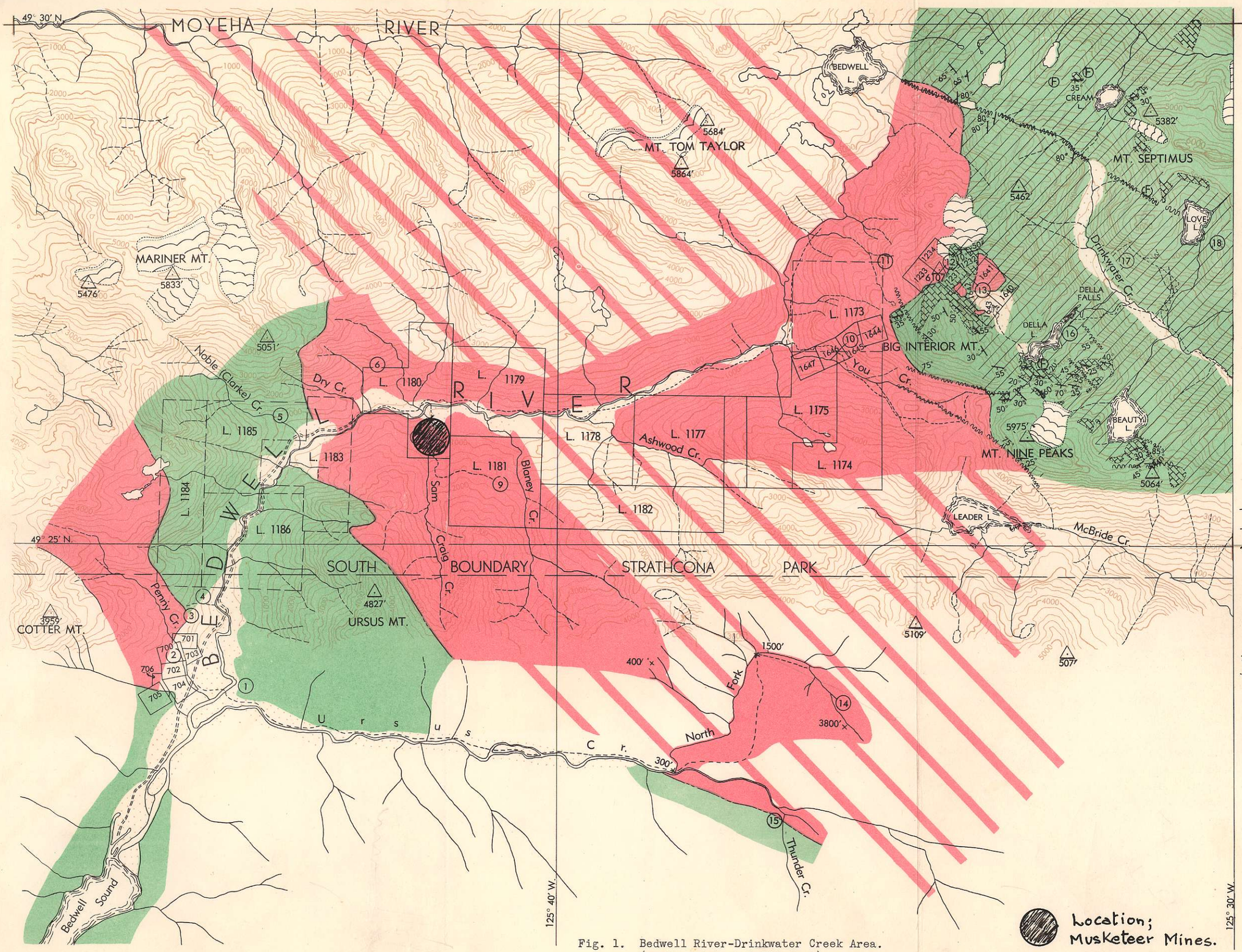
3. To determine if any mineralogical changes are present that might be diagnostic of the "bottoming" of the ore-shoots.

4. To accumulate data toward determining the Metallogenetic Epoch of the "West Coast" gold deposits of which the ore here studied is typical.

Introduction

The specimens of ore studied were principally from the Musketeer Mine at Bedwell River on Vancouver Island.

This deposit is somewhat similar, mineralogically, and structurally, to the typical "West Coast" gold deposits, best illustrated in the Zeballos Camp. The "West Coast" gold veins are characteristically narrow, quartz-sulphide filled fissures, sections of which carry high gold values. The deposits appear to be shallow; becoming rapidly impoverished at around 1,000 feet in depth. Certain mineral-



LEGEND

Recent.

Unconsolidated material.

Mesozoic.

Jurassic and, or, Cretaceous (Coast Range)—granitic rocks, chiefly quartz-diorite.

Note.—Sections indicated by the pattern were not traversed closely and are probably underlain by Coast Range granitic rocks, which may contain roof-pendants.

Palaeozoic and Mesozoic.

Chiefly Lower Mesozoic (Vancouver Group)—andesite, basalt, fine-grained, impure tuffs, limestone.

Permian—limestone, in part recrystallized, also includes at some points overlying thin-bedded siliceous and tuffaceous (?) argillites.

Complex stratigraphically below the Permian limestone; volcanics tuffaceous and argillaceous sediments, generally of fine-grained cherty appearance, of Palaeozoic age; basic intrusives, related to Lower Mesozoic volcanics; and granitic intrusives (Coast Range).

Note.—The Palaeozoic and Lower Mesozoic rocks are invaded by dykes and other small bodies of granitic rock, not mapped, which are related to the larger masses of granitic rock. Dykes are numerous near the contacts of the larger granitic masses.

- Geological boundary defined.
- Geological boundary approximate.
- 70° Fault with dip.
- 50° Bedding or foliation.
- (F) Fossil locality.
- 4827' Triangulation station, with elevation in feet.
- + 3800' Spot elevation in feet.
- Road.
- Trail.
- Glacier.

PROPERTIES

*1. Prosper.	*10. You.
*2. Seattle.	*11. Casino.
*3. Avon.	12. Ptarmigan.
*4. Galena.	13. Big I.
*5. Noble and Noble B.	*14. Trophy.
*6. O.K.	*15. Thunderbird.
7. Joker.	16. Della.
8. Musketeer Mines, Limited.	17. Sherwood.
9. Buccaneer Mines, Limited.	18. P.D.Q

*Described in Bulletin No. 8, 1940—Bedwell River Area.

Scale 1 0 1 Miles

Fig. 1. Bedwell River-Drinkwater Creek Area.
(contour interval 200 feet)

Topography from British Columbia Department of Lands
Map 92 F/5.

ogical changes have been noted in individual ore-shoots as these were "bottomed." However, only limited depth development has been attempted to date to prove whether the changes marking the "bottom" of these shoots may also be diagnostic of the "bottom" of the mine.

The "West Coast" gold deposits appear to belong to one and the same Metallogenetic Epoch and Province. However, the position of the Epoch in the geologic column is not definitely known. The richer gold-bearing sections of the veins have most of the characteristics of the Tertiary Epithermal precious metals type of deposit despite the fact that they occur within quartz-diorite intrusives of Jura-Cretaceous age. Immediately below the gold-bearing horizon the nature of the veins changes (quite abruptly) to a type indicating mesothermal conditions.

Location and Accessibility

Please see attached map.

The Musketeer property is located in the Bedwell River area on the west coast of Vancouver Island. This area lies some 70 miles south-east of Zeballos and 120 miles due west of Vancouver, B. C.

The Musketeer Mine may be reached by car (seven miles) from the head of Bedwell Sound. Bedwell Sound is a port of call for coastal freight boats. The nearest

established communities are Tofino and Clayoquot, some twenty miles distant by water.

History

The presence of gold quartz veins in the area has been known since 1898[1] but they attracted no serious attention until after the publicity given the Zeballos deposits.

The Musketeer property was located in the fall of 1938. A month later, the property was optioned for development by Pioneer Gold Mines of British Columbia.

Development work, in the form of surface stripping, crosscutting, drifting and diamond drilling yielded quite gratifying results through the vertical range (500 feet) that was explored. Twelve or more additional veins were found of which several contained ore-shoots or marginal grade or better.

The construction of a 40 - 50 ton flotation-amalgamation mill was commenced in the fall of 1941. Milling operations were started early in 1942.

General Geology

Rocks of intrusive, volcanic and sedimentary types occur in the general area of the property. The gold bearing veins, however, occur only in the quartz-diorite, about one

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(1) B.C. Provincial Dep't of Mines Annual Reports.

mile from the contact with the volcanics. The veins form a well-defined, parallel fracture pattern.

For further data on the general geology of the mine area, see attached map and enclosure.

Mine Geology and Structure

The ore deposit consists of a series of parallel tension fractures that occur about 200 feet apart. The strike of these fractures is about north-south and their dip about vertical. The fractures are terminated towards the north by a cross-vein which strikes about east-west and dips about 60 degrees to north. The fractures extend south from the cross-vein for 1,000 feet or more when they "feather" out and disappear.

The ore-shoots developed to date on the property occur in the cross-vein and in the north-south veins in the footwall block of the cross-vein. The cross-vein is known as the Main Vein while the north-south vein most extensively developed is known as the Trail Vein. The Trail Vein is considered the better of the two since development work on it has indicated increasing widths and ore-lengths on depth while ore-length and width have decreased on the Main Vein shoots.

The Main Vein occupies a shear and it is characterized by a marked "ribboning" of the vein-matter. (See figure 1 A). The vein fissure is gouged-lined and the walls, although hydrothermally altered, are not mineralized. The

only conspicuous quantity of visible gold seen on the property to date, occurred in a pocket on the Main Vein, near the end of an ore shoot at a point where a prominent amount of dark chloritic (?) material was "inter-ribboned" with the quartz.

The Trail Vein is characterized by vein-matter of different texture and general appearance from the Main Vein. The Trail Vein ore reflects the tension structure of the fissure occupied. The vein-matter, although locally "ribboned," occurs more characteristically as lenses of crystalline-textured, coxcomb quartz with coarse grained sulphides that occasionally show well-defined depositional banding. (See Figure 1 C). Locally, the crystalline-textured lenses occur within and along planes of the "ribboned" material, conveying the impression that they were a separate and presumably final phase of a prolonged period of mineral deposition. (See figure 1 B).

Procedure of Study

I. Verification of the previously determined paragenesis as determined from near-surface specimens. (2)

II. Microscopic study of a suite of specimens from four levels of the mine, with particular attention to any mineralogical changes as depth is gained.

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(2) Sargent, H: Preliminary Report on the Bedwell River Area, B. C. 1940.

III. Separate studies to note any differences in composition or paragenesis between

(a) ribboned vein-matter

(b) the crystalline textured vein-matter

IV. A particular study of the character and mode of occurrence of the gold.

V. A comparative study of the sphalerite in the ore from the Musketeer and other West Coast properties to determine any sympathetic association between minerals exsolved in the sphalerite and gold; this to investigate the popular conception on the West Coast that only sphalerite of certain types and colour will be associated with gold values.

Specimens from three Zeballos properties and two Bedwell River properties were examined in this regard to secure comparative data.

Megascopic Study

The metallic minerals recognizable by the eye and hand lens (x 12) are, in order of abundance:-

Pyrite

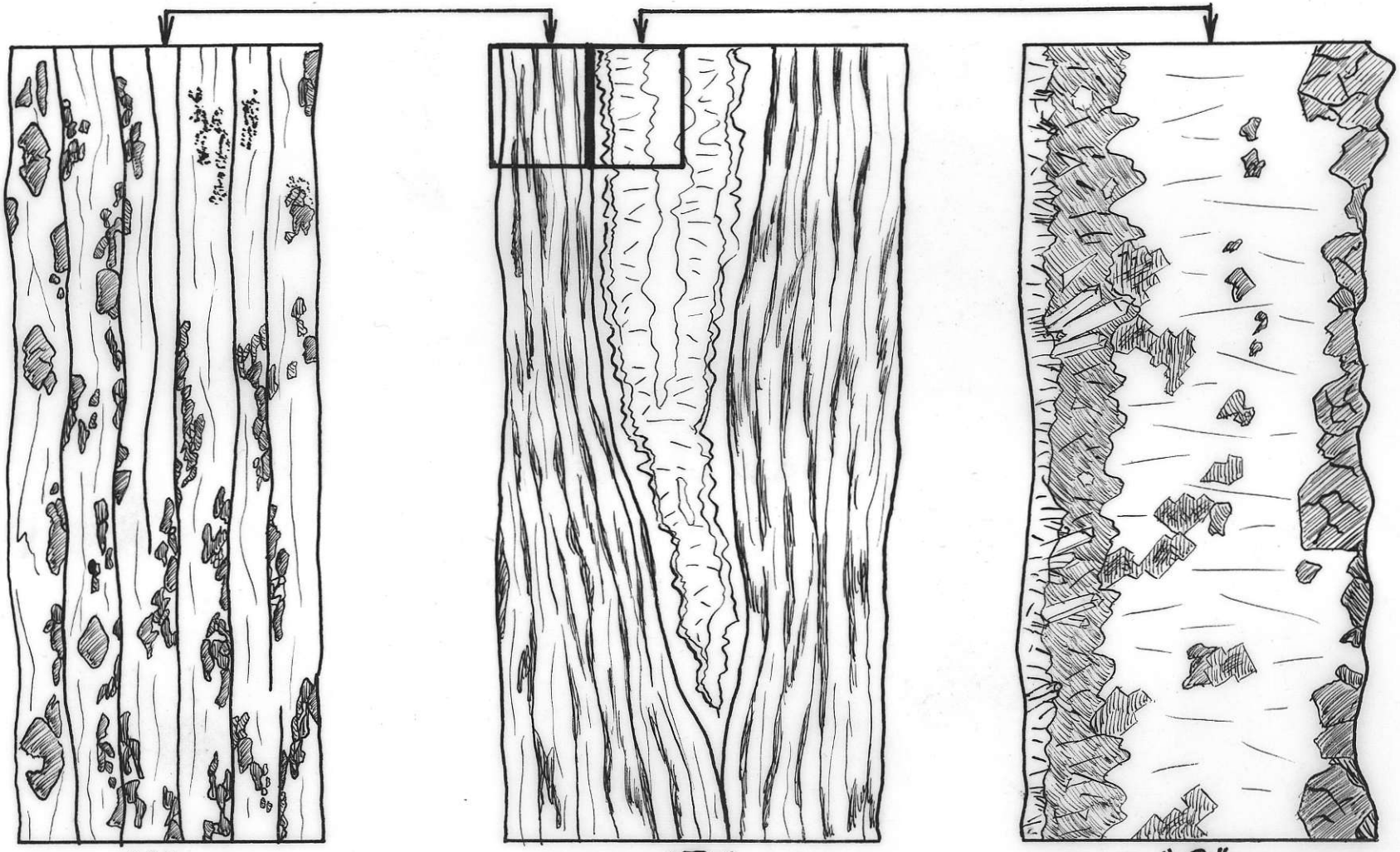
Sphalerite

Galena

Chalcopyrite

Gold

The quantity of sulphides present in the vein-matter varies locally from nil to 47 percent by weight. In the ore-



"A"
Diagrammatic
Sketch
"Ribbon" Quartz
Scale: Natural.

"B"
Diagrammatic
Sketch
Composite Vein
App. Scale: 1/6 Natural.

"C"
Diagrammatic
Sketch
Crystalline Textured
Quartz.
Scale: Natural.

Figure "1

TYPES OF VEIN-FILLING.

shoot sections the vein matter averages in excess of 5 per cent sulphides.

A hand-lens examination reveals clearly the characteristics of the two texturally different but mineralogically similar types. These are illustrated diagramatically in figures 1A, 1B and 1C.

The charcteristics of the ribboned type are:-

I. Close "ribboning" of the vein-matter parallel to the vein walls.

II. Alignment of the sulphides parallel to the "ribboning".

III. Relatively small size of the sulphide particles.

IV. The relatively massive, anhedral quartz gangue.

The characteristics of the crystalline textured type of ore are:-

I. The well developed crystal forms of sulphides and gangue quartz. Sphalerite as tetrahedrons, galena as cubes and chalcopyrite in tetrahedral form were discernible megascopically.

II. The relatively large size of sulphide particles. Most particles are about equi-dimensional and vary from three to ten millimetres in diameter. Many pyrite crystals of pyritohedral form measure eight to ten millimetres across.

III. Some depositional banding of the sphalerite and pyrite is present.

Section 1

Ribboned Ore

Main Vein
10,000 Level
E end, W shoot

Microscopic Study

Metallics occupy approximately 10% of the total area of the section. Minerals present, in order of abundance, are:-

1. Pyrite - 7%
2. Galena - 1%
3. Sphalerite - 1%
4. Gold - 1%
5. Chalcopyrite

Gangue Quartz; crypto crystalline to subhedral; strongly ribboned.

Fabric Sulphides present in relatively small particles except for a few prominent pyrite crystals. These crystals were cubes now distorted to a rhombic outline with longer axis parallel to the ribbon planes. See figure I A.

Under low magnification it was seen that the pyrite, sphalerite, galena and some gold particles were quite intimately clustered together.

The bulk of the gold particles however, occurred away from the sulphides.

All the sulphides (except pyrite crystals) displayed irregular outlines with numerous salients following the micro-brecciation in the quartz. Particularly

was this apparent with sphalerite.

1. Pyrites - Generally gently curved to straight-edged boundaries. Not greatly fractured but the largest crystals (originally cubes) had suffered distortion into rhombic forms.
2. Galena - The galena particles in the section were easily recognizable by the characteristic triangular pitting.
3. Sphalerite - Sphalerite particles were quite "ragged" in outline. All appeared to contain some exsolved chalcopyrite as tiny rows of dots and rods as shown in fig # 6.
4. Gold - Gold is quite plentiful in this specimen. It occurs as an aggregate of small grains or hackly masses, so closely spaced as to resemble a delicate sponge in fabric.
5. Chalcopyrite - This mineral is not plentiful in this section. The particles seen were small and occurred as tips to salients of galena and as small patches within and on the border of sphalerite particles.

Mutual Relationship of Minerals Present

No true veining relationships were seen in this section. Neither was there much convincing replacement criteria. There was, however, some evidence of galena encroaching on pyrite (fig. 2) and gold encroaching galena, pyrite (fig. 2) and sphalerite.

Section 2

Ribboned Ore

Main Vein
10,000 Level
E end, W shoot
Near Section # 1

Microscopic Study

Metallics occupy approximately 7% of the total area of the section. Minerals present, in order of abundance, are:-

1. Pyrite - 5%
2. Galena
3. Sphalerite - 2%
4. Gold

Gangue Quartz; crypto crystalline to subhedral; strongly ribboned.

Fabric Sulphides present in relatively small particles. These particles somewhat isolated except for small local clusters of sphalerite and galena.

As in section " 1, the distribution of sulphides appears to have been primarily controlled by the "ribbon" shear planes and subsidiary microbrecciation therefrom.

1. Pyrite - The pyrite in this section resembled that in section # 1.
2. Galena - The galena particles were conspicuous by their purity from inclusions and regular smooth boundaries.
3. Sphalerite - As in section # 1 the sphalerite is here also ragged in outline and contains exsolved chalcopyrite.
4. Gold - Extremely hackly in outline; within micro-fractures or moulded in the interstices between quartz crystal faces.

Mutual Relationship of Minerals Present

Galena encroaching pyrite and sphalerite. Galena penetrated by tiny quartz crystals. Sphalerite containing exsolved chalcopyrite. Gold encroaching galena, pyrite and sphalerite.

Section 4

Microscopic Study

Ribboned Ore

Main Vein
10,000 Level
Centre, W shoot

Metallics occupy approximately 7% of the total area of the section. Minerals present, in order of abundance, are:-

1. Pyrite - 5%
2. Sphalerite
3. Galena

- 2%

Gangue Quartz; cryoptocrystalline to subhedral; strongly ribboned.

Fabric Similar to sections # 1 and # 2.

1. Pyrite - As in sections # 1 and # 2.
2. Sphalerite - Contains exsolved chalcopyrite, as in sections # 1 and # 2.
3. Galena - As in sections # 1 and # 2.

Mutual Relationship of Minerals Present

Sphalerite encroaching on pyrite.

Galena encroaching on pyrite.

Section 8

Main Vein

850 Level Sta.

Microscopic Study

Metallics occupy approximately 5% of the total area of the section. Minerals present, in order of abundance, are:-

1. Pyrite - 2%
2. Sphalerite - 2%
3. Chalcopyrite
4. Galena

-1%

Gangue Quartz with minor calcite. Quartz subhedral. No "ribboning."

Fabric Sulphide particles relatively large and uniformly distributed. This fact and the semi-crystalline appearance of the gangue gives this section a "mottled" fabric.

1. Pyrite - In slightly fractured, equi-dimensional particles.
2. Sphalerite - Much exsolved chalcopyrite. The borders of the sphalerite "saturated" with chalcopyrite.
3. Chalcopyrite - Quite plentiful in this section. Closely associated with sphalerite.
4. Galena - Particles clear, with generally smooth, even boundaries.

Mutual Relationship of Minerals Present.

Several salients of sphalerite can be seen penetrating pyrite.

Chalcopyrite around and within borders of sphalerite. At one point chalcopyrite appears to vein sphalerite.

Section 7A, B, C.

Ribboned Ore

Main Vein

700 Level

N.B. These three sections were adjoining slices from the same specimen.

Microscopic Study

Metallics occupy approximately the following percentage of the total areas of the sections:

7 A	7 B	7 C
10%	15%	12%

Minerals present, in order of abundance, are:-

Section 7 A	Section 7 B	Section 7 C
1. Pyrite 6%	1. Pyrite 10%	1. Pyrite 7%
2. Sphalerite 3%	2. Sphalerite 3%	2. Sphalerite 4%
3. Galena 1%	3. Galena 2%	3. Galena 1%
4. Gold - 1 small particle	4. Chalcopyrite	4. Gold, 1 particle
	5. Gold { small particles	

Gangue Quartz of crushed, semicrystalline texture and "sago-like" appearance. Strongly ribboned.

Fabric The sulphide particles in these sections were relatively and uniformly small. They were of angular form and appeared to have suffered intense fracturing and redistribution along the ribbon shear planes.

Pyrite - Is much fractured into small angular particles.

Sphalerite - As small ragged particles closely associated with chalcopyrite.

Chalcopyrite - Only one small isolated particle seen in addition to its customary presence in the sphalerite.

Galena - Small particles.

Gold - Very small particles occurring as tips to salients of the galena near pyrite contact.

Mutual Relationship of Minerals Present

In section 7 A, galena and sphalerite encroach pyrite. A small particle of gold occurs at the edge of a pyrite particle. A small quartz crystal penetrates pyrite.

In section 7 B, galena and chalcopyrite encroach on sphalerite. Sphalerite and chalcopyrite encroach on pyrite. A particle of gold on galena-pyrite contact.

In section 7 C, salients of galena penetrate pyrite. An island remnant of pyrite occurs in the galena.

Section 3

Crystalline textured

Ore

Trail Vein

1140 Level

S ore-shoot

Microscopic Study

Metallics occupy approximately 22% of the total area of the section. Minerals present, in order of abundance, are:-

1. Sphalerite - 20%
2. Galena - 2%
3. Pyrite - a few small particles
4. Chalcopyrite - few small particles

Gangue Quartz; as a relatively loose aggregate of subhedral to enhedral, prismatic crystals.

Fabric The sulphide occur as relatively large particles forming the interstitial filling between the quartz crystals of the gangue. This section illustrates particularly well the depositional banding of sphalerite and (to a lesser degree) galena.

Sphalerite - Plentiful and as large particles. Exsolved chalcopyrite present.

Galena - Occurs as large particles with regular borders.

Pyrite - Only a few small isolated particles present.

Chalcopyrite - A small quantity present. Some exsolved in the sphalerite and some as a border segregation in the sphalerite at galena contacts.

Mutual Relationship of Minerals Present

Sphalerite veined by galena. Sphalerite

Section 5

Crystalline Textured Ore

Microscopic Study

Metallics occupy approximately 8% of the total area of the section. Minerals present, in order of abundance, are:-

1. Pyrite - 3%
2. Galena - 3%
3. Sphalerite - 2%
4. Gold - one small particle

Gangue Quartz; a loose aggregate of subhedral crystals.

Fabric Sulphide particles relatively large with somewhat ragged boundaries. Sulphides clustered together.

Pyrite - Irregular patches; slightly fractured.

Galena - Large and clean particles. Penetrated in places by small quartz crystals.

Sphalerite - The usual exsolved chalcopyrite is present.

Gold - A small particle with smooth curved boundaries occurr on contact between galena and quartz.

Mutual Relationship Between Minerals Present

Sphalerite veining and replacing pyrite is well illustrated in this section.

Galena encroaches on pyrite.

Section 6

Crystalline

Textured Ore

Microscopic Study

Metallics occupy approximately 12% of the total area of the section. Minerals present, in order of abundance, are:-

1. Galena - 6%
2. Sphalerite - 5%
3. Chalcopyrite - 1%
4. Pyrite - small amount only

Gangue Quartz; a somewhat loose aggregate of subhedral crystals.

Fabric Sulphide particles relatively large with generlally clean-cut boundaries. Sphalerite tending to be ragged in outline.

Galena - Large clean particles.

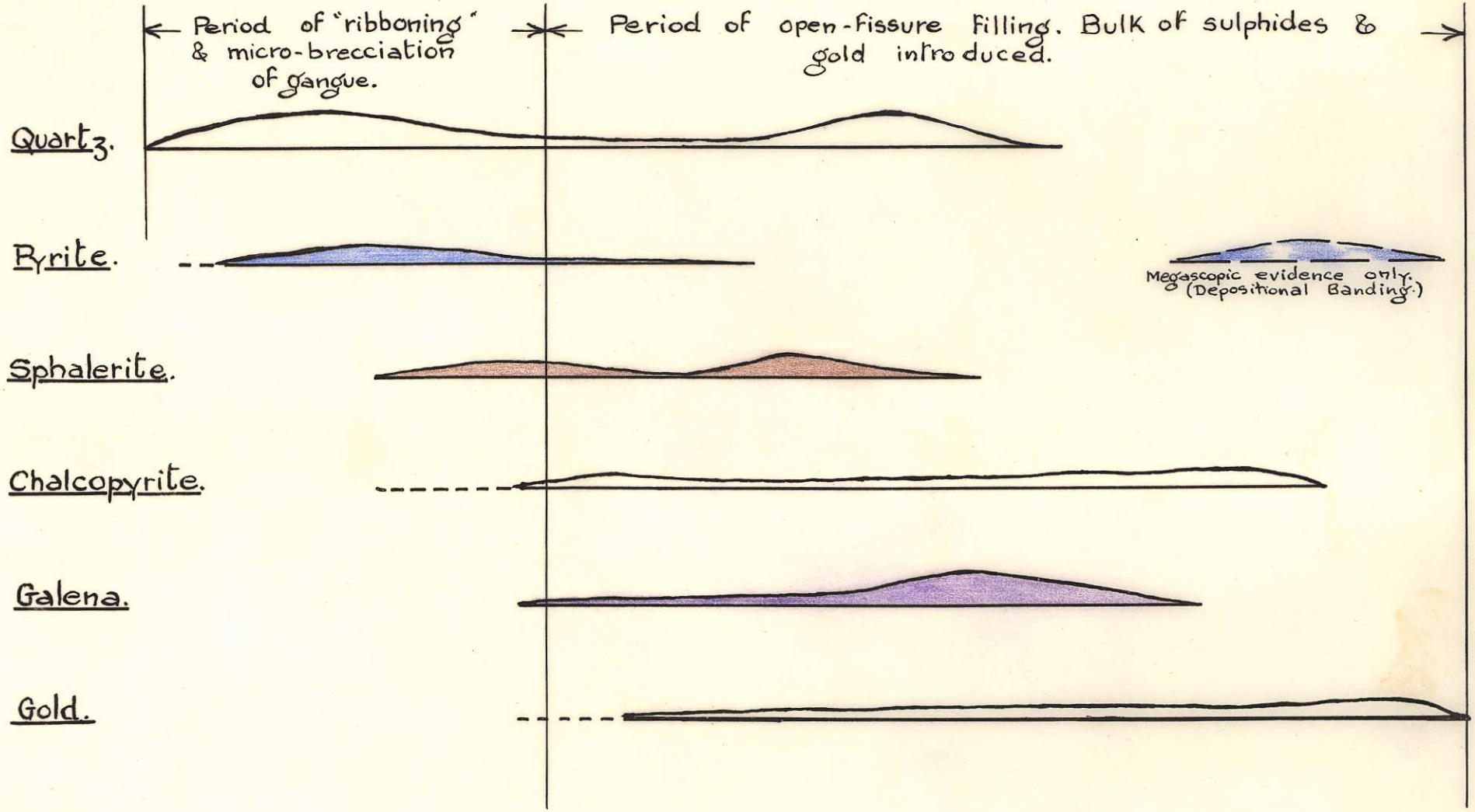
Sphalerite - Irregular particles with exsolved chalcopyrite.

Chalcopyrite - As relatively large particles.

Pyrite - Conspicuously scarce in this section.

Mutual Relationship Between Minerals Present

Chalcopyrite encroaches sphalerite. A galena particle surrounded by chalcopyrite. Galena encroaches pyrites. Particles of sphalerite surrounded by galena.



PARAGENESIS OF MUSKETEER MINE ORE.

FIG. 8

Paragenesis

Convincing veining relationships or replacement relationships are lacking in the sections examined. There is, however, widespread evidence of encroachment of the borders of some minerals by salients of others and it is largely upon such criteria that the paragenesis is determined.

It was determined that the composition and paragenesis of the ribboned ore and crystalline textured ore are similar although these two types differ markedly in several physical aspects.

I. Among the sulphides, there is convincing evidence that pyrite was the earliest. See data on Sections 1,2, 4,5,6,7 and 8, and figures 2,3 and 5.

II. Sphalerite followed pyrite. See data on sections 4,5,7 and 8 and figure 7.

III. Chalcopyrite accompanied sphalerite and its appearance follows an ordered sequence. In some sections, the only chalcopyrite is exsolved in the sphalerite (see figures 4 and 7); in others the chalcopyrite has segregated to form a chalcopyrite-saturated-border phase of the sphalerite (see figure 6); while in other sections the chalcopyrite is completely disassociated from the sphalerite.

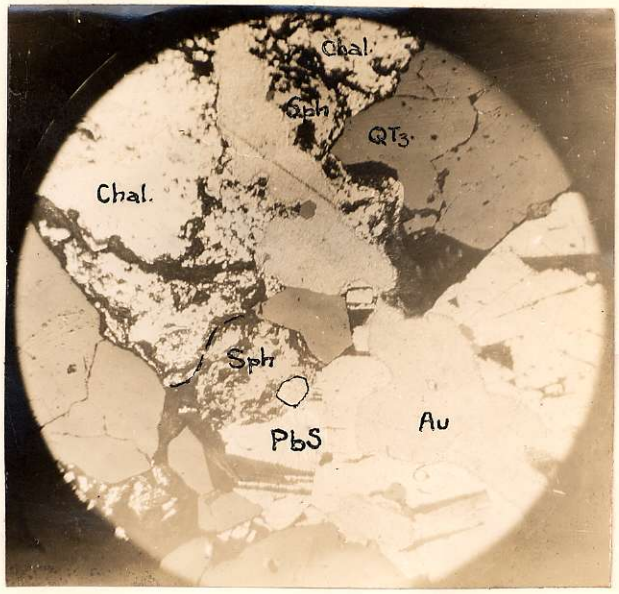
IV. Galena was deposited in the same general period as the chalcopyrite but there is some evidence that the deposition of chalcopyrite continued after the completed

deposition of ~~sphalerite~~. galena.

V. Gold was definitely the last metallic to appear. It occurs occupying micro-fractures in or along the contacts of pyrite, sphalerite and chalcopyrite. Its most common association, however, is with galena wherein it forms "tips" to salients of galena or occurs as rounded particles concentrated at and within the borders of the galena (see plates 1 and 2). The apparent association between gold and galena is strikingly similar to the physical association noted between sphalerite and chalcopyrite.

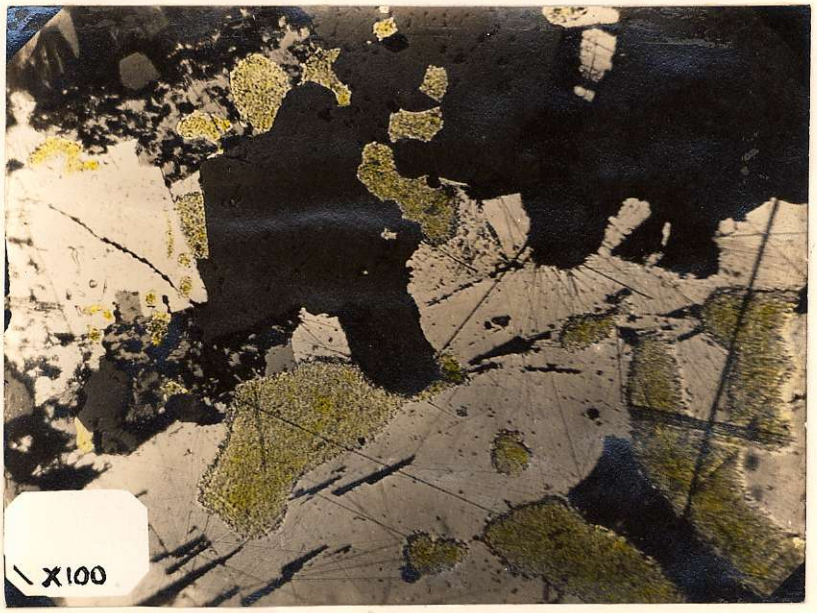
Some of the gold occurs alone and isolated from any sulphides. In such cases it occupies secondary micro-fractures and/or the primary interstices between the quartz crystals of the gangue.

The above age relationships are summarized in figure 8, and illustrated in the plates and sketches following.



X60

Plate "1 - Section X. Note occurrence of gold.



X100

Plate "2 - Section X Note occurrence of gold.

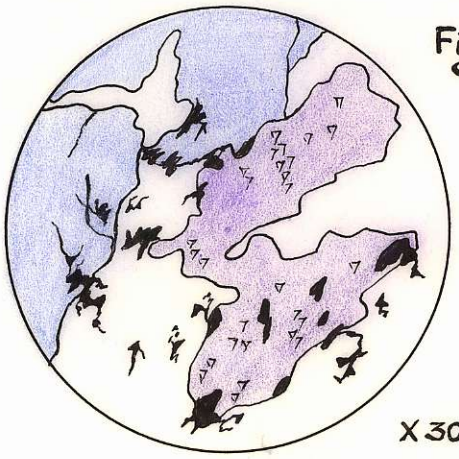
Section #1

- Note occurrence of gold.
- Note curved boundaries of gold in galena; hackly boundaries elsewhere.
- Note large proportion of gold at contacts.

Quartz
Galena
Pyrite
Gold

1 mm.

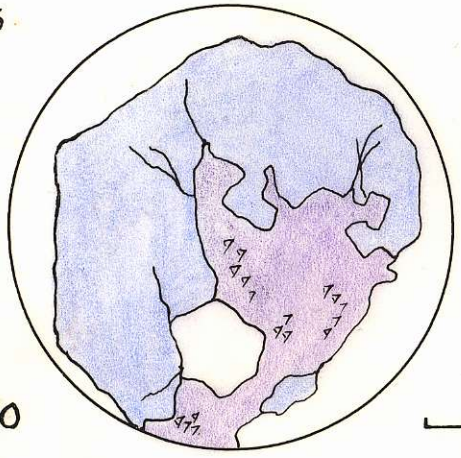
Fig. #2.



X30

Section #1

Fig. #3



X30

Quartz
Galena
Pyrite

1 mm.

- Note large pyritohedron of pyrite.
- Note galena replacing core of same.
- Note quartz crystal penetrating galena and pyrite.

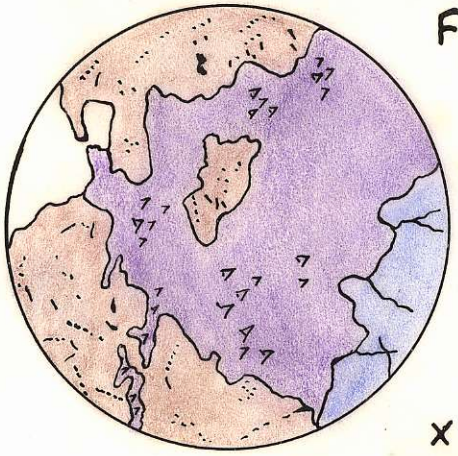
Section #2

- Note galena encroaching and veining sphalerite.
- Note inclusion of sphalerite in galena.

Quartz
Galena
Pyrite
Sphalerite
Chalcopyrite (Exsolved)

1 mm.

Fig. #4



X30

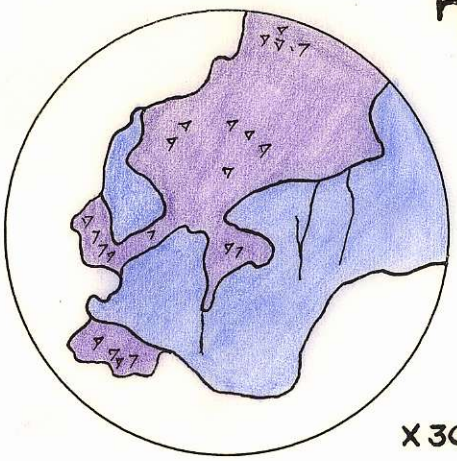
Section "6.

Fig. "5.

- Note galena encroaching (and veining ?) pyrite.

Quartz
Galena
Pyrite

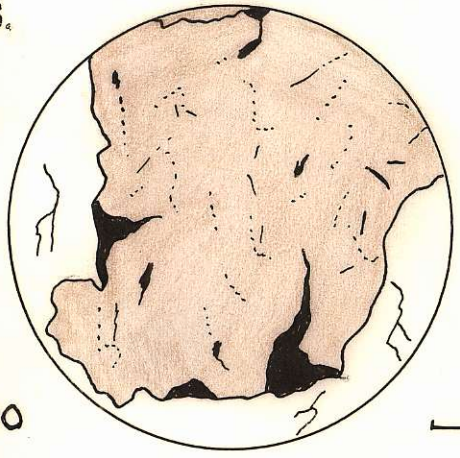
1 mm.



X30

Section "6.

Fig. "6.



X30

Quartz
Sphalerite
Chalcopyrite (Exsolved)

1 mm.

- Note exsolved chalcopyrite in sphalerite.
- Note borders of sphalerite "saturated" with chalcopyrite.

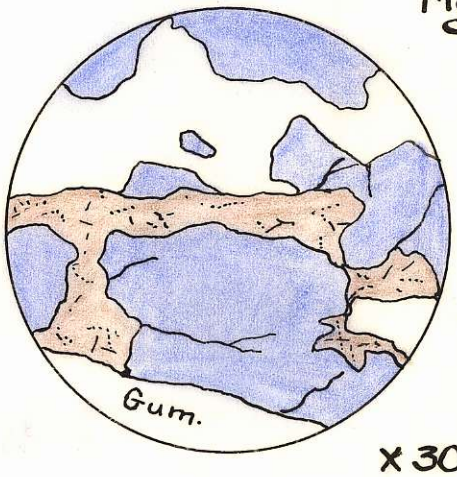
Section "5

Fig. "7.

- Note sphalerite replacing pyrite.

Quartz.
Pyrite
Sphalerite

1 mm.



X30

Microscopic Study of Sphalerite

An effort was made to determine if there is any significant mutual relationship between the gold and chalcopyrite-containing sphalerite, i.e. if the exsolution of chalcopyrite in sphalerite indicates physico-chemical conditions that were suitable for gold deposition.

Sections of vein matter from several West Coast properties were polished and the sphalerite examined under the microscope with the following results:

Property	Location	Gold Content	Exsolved Chalcopyrite	Associated Chalcopyrite
1. Reta	Bedwell R.	Very low	None	Some
2. Peerless	Zeballos R.	Low	None	Some
3. Maguinna	Zeballos R.	.30 ogs. Au.p.t.	Slight amt.	Some
4. Golden Gate	Zeballos R.	1.00 ogs. Au.p.t.	Small amt.	Some
5. Musketeer	Bedwell R.	11.00 ogs. Au.p.t.	Generally present	Some

It will be noted that all the above sphalerite specimens contained exsolved chalcopyrite or were closely associated with chalcopyrite. The only generalization that can be made in view of the above is that the chalcopyrite and sphalerite is closely associated in the West Coast gold ores.

The gold content of the above specimens varied between wide limits (from about 0.01 ozs. to 11.00 ozs. gold p.t.) and a rough correlation appears possible between the

gold content of the ore and the exsolution habit of the sphalerite. A rather incomplete examination of a few random specimens was all that time would permit and so it is felt that the data above can hardly be considered as of a conclusive nature.

Conclusions

Mineralogical

Please refer to figure 8 and Graphs #1 and #2.

The metallics present, in paragenetic order, are as follows:

Pyrite

Sphalerite, chalcopyrite

Galena, gold and silver

There is a close association between the following groups:

(a) sphalerite (tetrahedral:H=3.5-4) and chalcopyrite (tetrahedral:H=3.5-4)

(b) galena (isometric H=2.5-2.75) → gold (isometric H=2.5-3) → silver (isometric H=2.5-3)

In studying each group it is curious to note the striking physical similarities between the group participants. To emphasize this point, the crystallographic habit and hardness are given beneath each metallic.

The presence of silver in the ore was determined by assay. By separation of the sulphides it was found that the bulk of the silver was associated with the galena while a much lesser amount occurred as an alloy with the gold. A critical examination of the galena failed to reveal any argentiferous tetrahedrite, argentite or other silver-bearing mineral. Microchemical tests and etch tests failed to distinguish the presence of the silver.

Since silver is present in varying proportions in all other sulphides it is believed to occur in some form other than as a silver-galena alloy.

The gold appears to have been deposited late. Some contemporaneous deposition with galena is indicated but the bulk of the gold was deposited after galena.

The physical controls influencing gold deposition and distribution are of two types:

(a) secondary micro-brecciation

(b) primary interstitial openings between quartz crystals.

The first type of opening occurs in the massive ribboned ore where post-quartz movement has ribboned the vein filling and micro-brecciated the quartz between ribbons. The gold had access through the gangue via such micro-brecciation and it was deposited therein as a hackly filling with notable lack of replacement.

In the second case, the formation of ore (i.e. the access of gold into the vein) was not dependent on somewhat fortuitous secondary fracturing of the gangue. In this case the gold had access via the primary crevices between the quartz crystals of the gangue. Gold of this mode of occurrence is sometimes of striking appearance; often showing serrated borders composed of triangular indentations where it has been molded about the pyramidal ends of quartz crystals. At first glance such triangular, diamond or rhombic shaped gold particles resemble pseudomorphs after certain sulphides. A closer study however reveals their true mode of origin. The mixed sulphides is the best indicator of the presence of

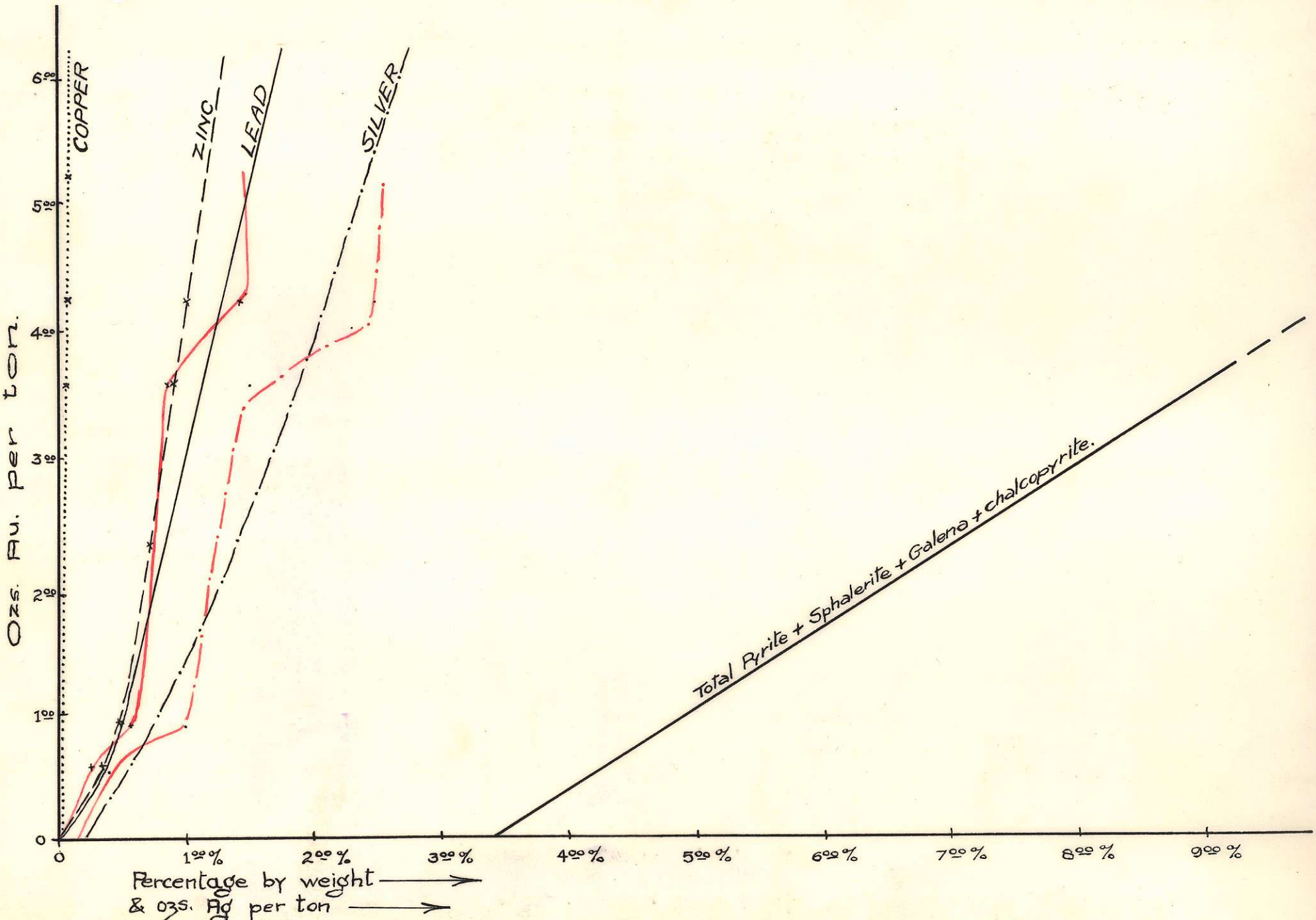
gold. Galena is the best gold indicator among the individual sulphides.

Classification of Deposit

The sulphides present are all of primary hypogene origin. The total absence of pyrrhotite and arsenopyrite and almost total absence of chalcopyrite (note differences with Zeballos ores) marks the Musketeer ore as of lower temperature than the mesothermal type of deposit.

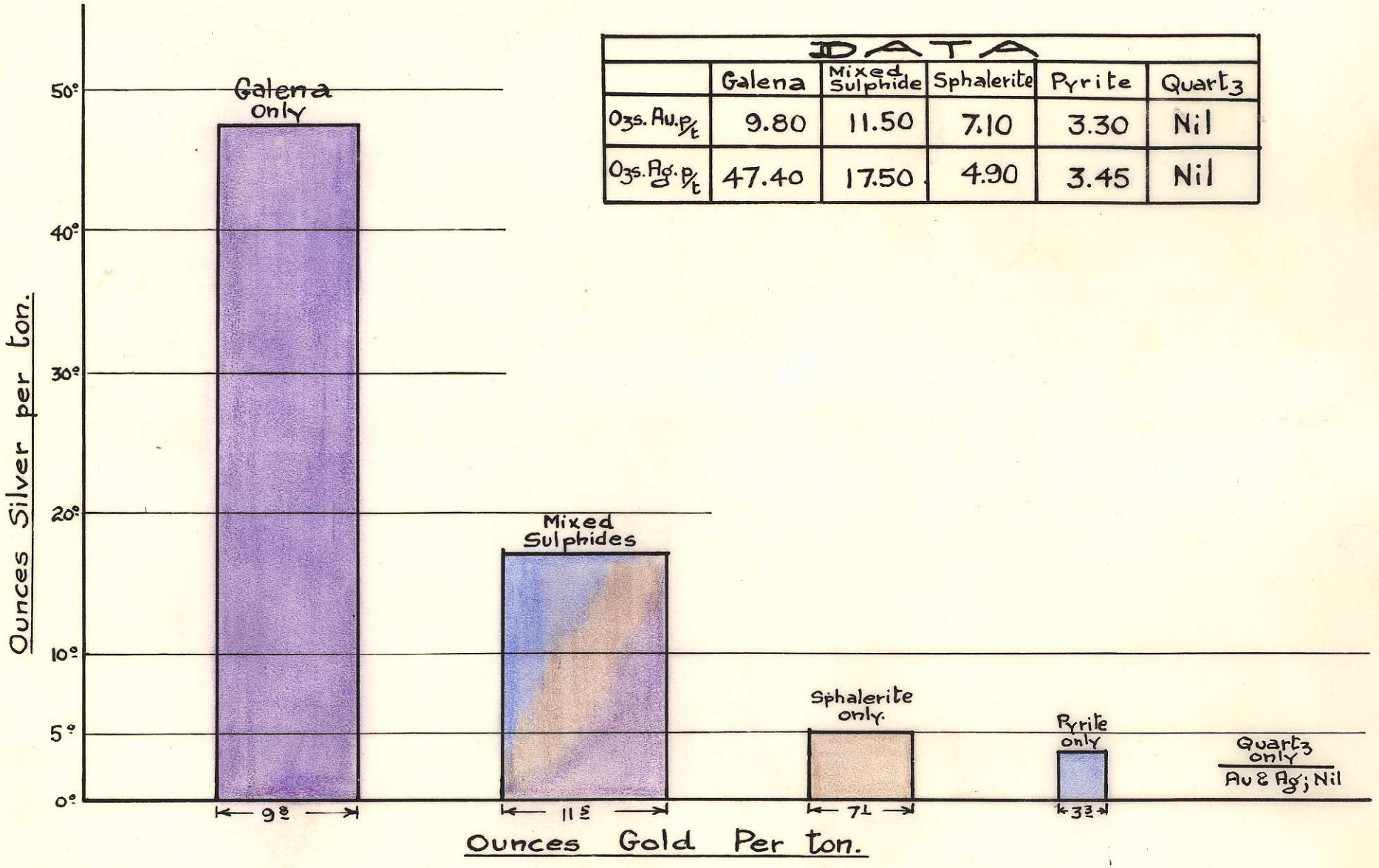
Although the quartz gangue is locally crustified and the sulphides present are acceptable as indicative of a low temperature deposit, still the quartz is nowhere chalcedonic or colloform, the sulphides are the opposite of fine grained and the rich silver bearing minerals of the epithermal type of deposit are lacking.

In view of the available data the deposit may be tentatively classed as belonging between the mesothermal and epithermal types.



Graph # 1

ASSAY VARIATION DIAGRAM



DATA

	Galena	Mixed Sulphide	Sphalerite	Pyrite	Quartz
Ozs. Au. p/t	9.80	11.50	7.10	3.30	Nil
Ozs. Ag. p/t	47.40	17.50	4.90	3.45	Nil

Graph "2. GOLD & SILVER CONTENT OF SELECTED SULPHIDES

Conclusions

Metallurgical

The metallics present, or the gangue, offer no milling difficulties.

Some, but not all of the gold, may be secured by jigs, tables, blankets and/or amalgamation, since it is relatively "free" and relatively coarse in size.

The ore is well adapted to flotation treatment.

It is also adaptable to cyanidation as no cyanicides are present. Some "settling" difficulties might be anticipated however owing to the relatively high sericite gouge content of the altered wall rock included in the ore.

The microbrecciation or crystalline texture of the ore and the friable nature of the sulphides makes for complete, quick and low coast crushing and grinding.

The habit of the gold to be either "free" or along sulphide contacts plus the relatively large size of the particles, suggest that a high percentage recovery should be possible.

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