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By: Rodric Mamau
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MINERALOGRAPHIC STUDY OF THE MINERALOGY, TEXTURES AND ORIGIN OF LEAD-ZINC VEIN DEPOSITS ON THE PLATA GROUP PROPERTY IN THE YUKON.

A report submitted in partial fulfilment for the requirements of a course in Mineralography-Geology 409.

by
RODRIC R.D. MAMU (1974)
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INTRODUCTION

LOCATION

The Plata Group Property of Dynasty Explorations Limited is in the Yukon located about 265 miles Northeast of Whitehorse and about 50 miles West of the Yukon-Northwest Territories border (figure 1).

The property consists of several showings of vein-type Lead-Zinc deposits in Cambrian metasediments and Devonian-Mississippian sediments.

PURPOSE OF STUDY

Mineralographic study of specimens from several mineral veins on the Plata Group property was carried out in order to determine the mineralogy and textures of the different vein deposits. It is hoped that comparison of the mineralogy, textures and structural setting of the different vein deposits will indicate the genetic relationship, if any, of the vein deposits on the property.

The mineralographic data will also be used, in conjuction with the local geology and structural geology of the area, to speculate on the mode of deposition of the ore, controls of mineralization and the history of the deposits.

ACKNOWLEDGEMENTS

The writer wishes to thank Dr. A. Sinclair of the Geological Sciences Center. He acquired the specimens, maps and a company report on the geology of the Plata Group property from Dynasty Explorations Limited and made them available to the writer. The geology both local and regional in this report is based on the unpublished report and maps of Dynasty Explorations Limited.

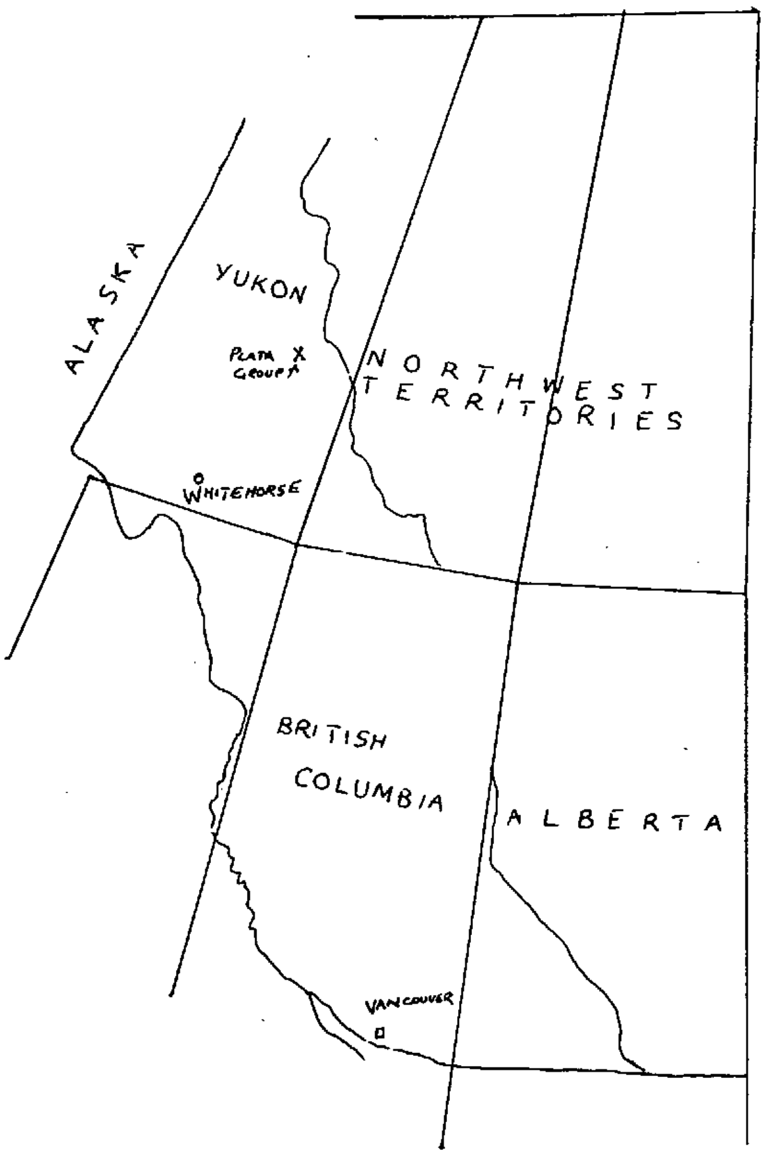


Figure 1

scale 1inch = 300 mls

Location map of the Plata Group

(modified from Roberts, 1973)

GEOLOGY

STRATIGRAPHY

The oldest rocks exposed on the property are Cambrian or older meta sediments. They consist of pale green and maroon phyllites and slates. Interbedded within the phyllites and slates are massive lensoid quartzites and bluish grey massive limestone. The unit is well over 6000 feet thick.

An Ordovician-Silurian unit of black shale and chert overlies the unit of phyllites and slates. This unit, which is up to 2000 feet thick, has interbedded limestone horizons in it.

The Precambrian to Cambrian units are unconformably overlain by a sequence of Devonian-Mississippian sedimentary rock units with a thickness over 15000 feet. The base of the sedimentary sequence consists of a basal chert pebble conglomerate at least 200 feet thick which is overlain by a grey-weathering massive to finely laminated barite unit. The upper portions of the sequence consist of units of massive chert with shale horizons in it, graphitic slate and quartzites and a massive limestone unit with ammonoid concretions.

A quartz porphry/aplite dike of Tertiary age intrudes the rocks in the central part of the area. ~~The stratigraphy is shown in TABLE 1~~.

Structure

Regional attitudes of foliation in the meta sediments and bedding in the sedimentary rocks is West to Northwest and average dip is 50° to the South.

Folding

The Cambrian or older units are folded into large low amplitude open folds with axial trends to the Northwest.

The third set is a set of thrust faults trending 080°. Movement on the thrust faults typically consists of thrusting of Cambrian or older rocks on to younger Devonian-Mississippian sediments. The major thrust is located in the Central part of the property (figure 2). Slickensides indicate movement in a direction 010° to 030° on the fault. The thrust zone of this central thrust consists of footwall gouge formed from breiciation of shale during thrusting and hanging wall gouge of reddish gouge formed from shearing of green and maroon slates. The central part of the thrust zone is occupied by a quartz vein .5 to 5 feet wide.

Mineralization on the property is closely associated with the faults and the quartz vein.

Folding in the Devonian-Mississippian sequence of sedimentary rocks is more complex than in the older rocks. Folds in these units are tighter with both overturned and isoclimal folds common. Axial trends are generally Northwest and they plunge 10° to 40° Northwest.

Faulting

There are three major fault systems in the area. One set, the most dominant in the area, trends 330°. The parallel faults of this set have right lateral movement. One of the faults of this set which offsets the quartz porphry/aplite dike in the western part of the area has a right lateral displacement of about 2000 feet.

Roughly orthogonal to the 330° trending set of faults, is a set of trending 045°. This set has left lateral movement and has a well developed joint set subparallel to it.

SETTING AND GEOLOGY OF VEIN DEPOSITS

Vein mineralization on the Plata Group is of two types: thrust zone mineralization and mineralization in the NE and NW striking orthogonal fault systems. Small high grade veins associated with the orthogonal fault system hold the best economic potential (Roberts, 1973).

VEIN 1

The vein is located in black fault gouge within a fault oriented 015/25° W (figure 2). It is about 50 feet long and has a maximum width of 4.2 feet. The major mineralization consists of massive foliated galena and tetrahedrite (appendices I and II).

VEIN 2

The vein occurs in the fault zone of a fault striking 030° and dipping

55^{o} - 70^{o} West (figure 2). Mineralization is mainly fine to medium grained foliated galena and tetrahedrite as bands and blocks in siderite gangue within the fault shear zone. The vein has been followed for a strike length of 340 feet.

VEIN 5

The vein is a narrow fault zone to the thrust (figure 2). Mineralization is mainly cutiform galena of limited extent due to pinching out of the vein to the South and North. Maximum thickness of the structure is 2.5 feet.

SHOWING 6

The showing consists of high grade galena-tetrahedrite float in a highly sheared footwall black shale and chert of a fault zone (figure 2).

THRUST ZONE

The thrust zone mineralization is located in an East-West striking thrust fault (figure 2). Visible mineralization is confined to the quartz vein in the central part of the thrust zone. Major mineralization includes disseminated pyrite and Arsenopyrite, minor galena and tetrahedrite.

MINERALOGY OF VEIN DEPOSITS

Detailed mineralographic description of polished sections of samples from the vein deposits are presented in Appendix II.

The mineralogies of veins 1, 2, 5, and showing 6 which principally consist of galena with accessory sphalerite tetrahedrite and Ruby Silver are very similar. The only difference between them being the relative amounts of the accessory minerals. For instance, vein deposit 1 is the only one in which ruby silver was encountered during polished section study.

The mineralogy of the thrust zone quartz vein is different from the others in that pyrite and arsenopyrite, besides tetrahedrite and sphalerite occur in significantly large amounts in the quartz vein. Mode of occurrence of the minerals of veins 1, 2, 5, and showing 6 are also similar --- massive galena with tetrahedrite and sphalerite replacing galena. In the quartz vein, however, galena sphalerite, tetrahedrite, pyrite and arsenopyrite all occur as 'cement' in open spaces between quartz grains.

STRUCTURE AND TEXTURE OF VEIN MINERALIZATION

The deposits on the property are solely confined to thrust and fault zones as veins and lensoid bodies within the fault zones which indicates the importance of structural control during deposition of ore and probably movement of ore fluids. Tetrahedrite and sphalerite typically occur in fractures, veinlets and triangular pits in massive galena of veins 1, 2, 5, and showing 6. Replacement of galena by tetrahedrite and sphalerite usually occurs along foliation planes and fractures parallel to foliation in galena probably because of structural weakness of the galena crystal structure along the foliation. The replacement of galena along foliation gives a semblance of lineation of the tetrahedrite and sphalerite grains. Boundaries between galena and sphalerite tetrahedrite are usually irregular and seem controlled by the shape of the fractures and open spaces that were filled by sphalerite-tetrahedrite but contacts between tetrahedrite and sphalerite are smooth and mutual.

ECONOMIC PROSPECTS

Small high grade veins associated with the NE and NW striking faults on the property hold the best economic potential. These are in the form of veins, lenses, pods and shoots and rarely exceed 5 feet in width. The most favourable host rocks for the formation of economic lodes are thick bedded Cambrian or older quartzites and slate (Roberts, 1973).

Vein 1 which is about 50 feet long and 4 feet wide contains 27% lead and 120 ounces silver per ton. Due to its small size and limited tonnage, exploitation is not contemplated.

Over a strike length of 340 feet, the average grade of vein 2 is 35% lead, 5% zinc, and 84 ounces per ton silver. This is the most promising vein on the property. Vein 5 grades 69% lead and 115 ounces per ton silver but due to its small size and because it pinches out North and South, no more work is contemplated on this vein (Roberts, 1973). Showing 6 consists of large blocks of galena float in sheared black shale fault gouge. Average grade of the float is 80% lead and 235 ounces per ton silver.

Permafrost and the excessive amount of black fault gouge shale has hampered further evaluation of this vein's areal extent and importance.

Two areas on the thrust which are probably connected have been mineralized over a strike length of about 4450 feet. The quartz vein in the thrust zone has an average grade of .2 to 119 ounces silver per ton, .01 to .25 ounces per ton of gold. The grade in this zone is not considered high enough to warrant further work.

ORIGIN AND PARAGENESIS

Mineralogic, textural and structural setting similarities between the vein mineralization in the fault zones of NE and NW striking faults argues for same origin of these deposits. The structural setting, in a fault zone, of the thrust mineralization is similar to the others but texture and mineralogy of the thrust mineralization are different from the others. The main difference is that galena, tetrahedrite and sphalerite in the thrust zone deposit are minor and occur mainly as filling in quartz and pyrite intragranular spaces while these are the major minerals of the other deposits.

The vein deposits are closely associated with fault zones; tetrahedrite and sphalerite in massive galena and the quartz vein principally occur in fractures and veinlets parallel to foliation. It would seem that deformation structures played an important role in the migration of ore fluids and deposition or ores.

Faulting and thrusting apparently provided channels for the migration of ore fluids and also provided favourable structural sites for ore deposition. Early stages involved emplacement of the quartz vein in the thrust zone and pyrite was deposited at the same time. The fact that pyrite in the quartz vein, unlike the other sulphides, is not an intragranular phase but is part of the mossaic of quartz grains in the quartz vein supports the idea of contemporareneous deposition of pyrite and the quartz vein. This stage was followed by deposition of arsenopyrite in open spaces in the quartz vein.

This was followed by a stage of high Pb-Zn activity during which the massive galena vein deposits of the NE and NW trending faults was deposited. In the thrust zone, galena deposition was mainly confined to open space filling in both the quartz vein and footwall. Subsequent movements and shearing along the faults caused foliation, vein lets and fractures in the massive galena. These open spaces acted as channels for later ore fluids and also as sites for the deposition of sphalerite, tetrahedrite and ruby silver (vein 1).

The sequence of events in the deposition of the vein deposits on the Plata Group is apparently as follows: -

1. Folding, Faulting of Sediments and Metasediments.
2. Emplacement of the quartz vein in the thrust zone at the same time pyrite was deposited.

3. Deposition of Arsenophyrite in thrust zone.

4. Deposition of galena as massive veins in NE and NW striking faults and as 'cement' in thrust zone.

5. Continued movement and shearing on faults -- causing brecciation, foliation and fracturing of early deposited ore.

6. Deposition of Sphalerite, tetrahedrite and ruby silver (vein 1) in deformation structures formed in Stage 5.

The above model of the formation of ore deposits on the Plata Group property requires that movement along the faults occur repeatedly during and between some of the outlined stages. Because the deposits were apparently deposited in already existent fault zones yet the deposits themselves are foliated, sheared and brecciated, movement during emplacement or after ore bodies must have occurred along the faults.

Assuming same origin for the different vein deposits on the Plata Group property, the paragenesis of the Plata Group deposits is shown in figure 3.

TYPE OF DEPOSITS

The Lead-Zinc vein deposits of the Plata Group have characteristics similar to Sangsters's (1970) vein type lead-zinc deposits. The deposits are not conformable to stratigraphy and like the vein type deposits of Sangster's, mineralized veins of the Plata Group are parallel to major faults in the area.

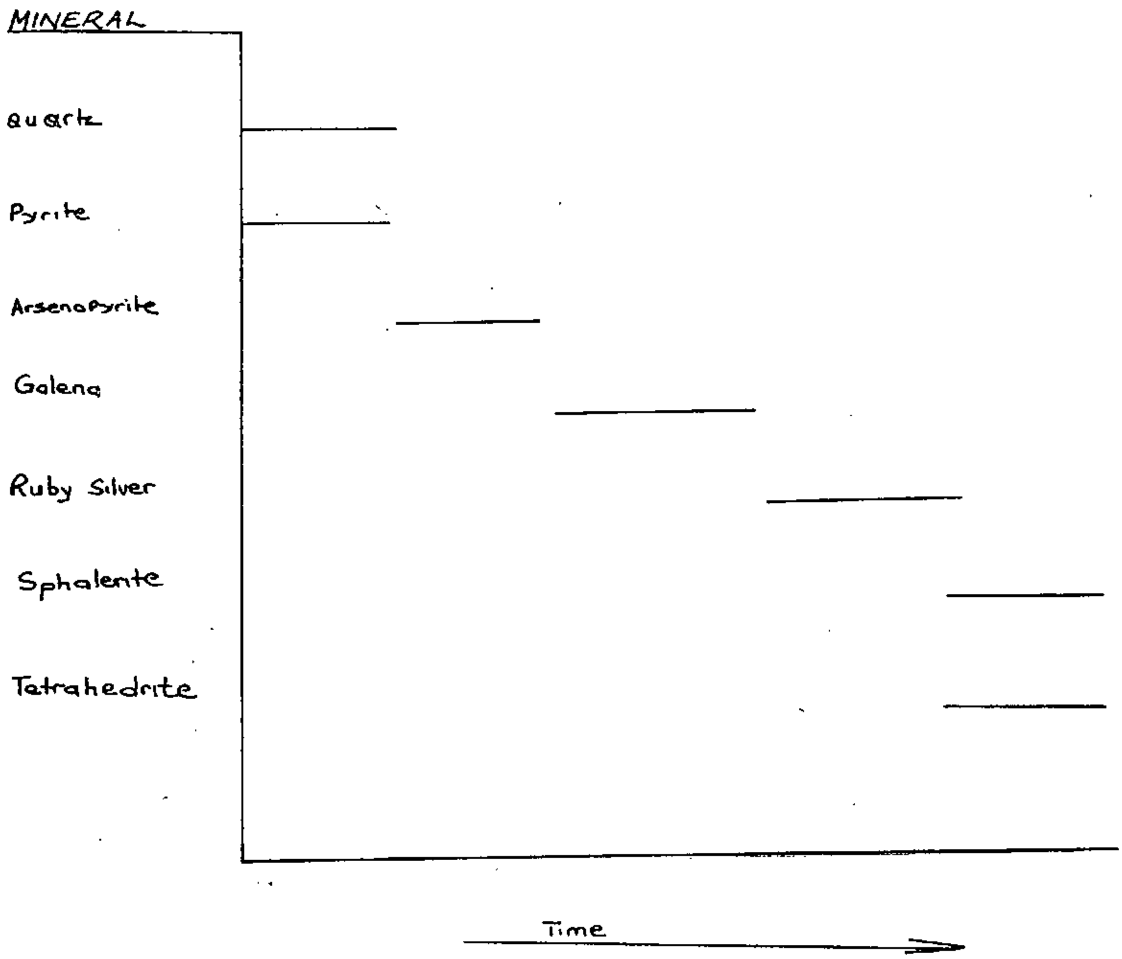


Figure 3

Paragenesis Diagram of Plata Group Mineralization

SUMMARY

1 Vein type deposits containing massive galena, sphalerite and tetrahedrite on the Plata Group property are mostly concentrated in fault zones.

2 The most predominate ore textures are reimplacement textures. Deformation structures like fractures, foliation and brecciation important in replacement of minerals.

3 The major minerals are massive galena and tetrahedrite-sphalerite replace galena.

4 Faulting and thrusting was determinative in both ore fluid migration and emplacement of ore deposits.

REFERENCES

1 ROBERTS, W.,
(1973). - Unpublished report and maps of Dynasty Explorations Limited.

2 SANGSTER, D.F.,
(1970). Metal Logenesis of some Canadian Lead-Zinc deposits in carbonate rocks.

APPENDIX I

Megascopic description of Specimens from the different veins

MEGASCOPIC DESCRIPTION OF SPECIMENS FROM THE DIFFERENT VEINS

VEIN 1 SPECIMENS

Mineralization

-massive galena with sphalerite disseminated in it in fractures. One specimen composed of sheared breccia fragments of galena.

Alteration

-sphalerite is coated with brown Fe-oxides and galena is partially coated with patches of green angelsite.

Texture

-Galena is sheared and some specimens have a strong schistocity (steel galena).

VEIN 2 SPECIMENS

Mineralization

-Two types of galena are represented - a fine grained massive variety without cleavage and a massive coarse grained variety with well developed cleavage.

Alteration

-Both varieties of galena are coated with Fe-oxide orange alteration and patches of green angelsite and also white powdery material (shale fault gouge?).

Texture

-Both varieties are foliated and the variety with cleavage has folded and bent cleavage planes.

VEIN 5

The two specimens from this vein are massive cubiform galena. The specimens are fresh with no obvious deformation features.

SHOWING 6

The mineralization, texture and alteration in the specimens is similar to that of vein 2.

THRUST ZONE

Samples of the quartz vein are equigranular and sulphides are essentially 'cement' in intragranular spaces of quartz grains.

In the more fine-grained footwall samples of the thrust zone, pyrite is more abundant and Pb-Zn minerals constitute a much less percentage than in the coarse-grained quartz vein.

APPENDIX II

Polished Sections Descriptions

POLISHED SECTION STUDY FOR VEIN I

Mineral	Size (Average)	%
Galena	massive	89.5%
Sphalerite	.5 mm	3.5%
Tetrahedrite	.5 mm	5.0%
Ruby Silver		1.5%
Silicates	.2 mm	0.5%

TEXTURAL DESCRIPTION

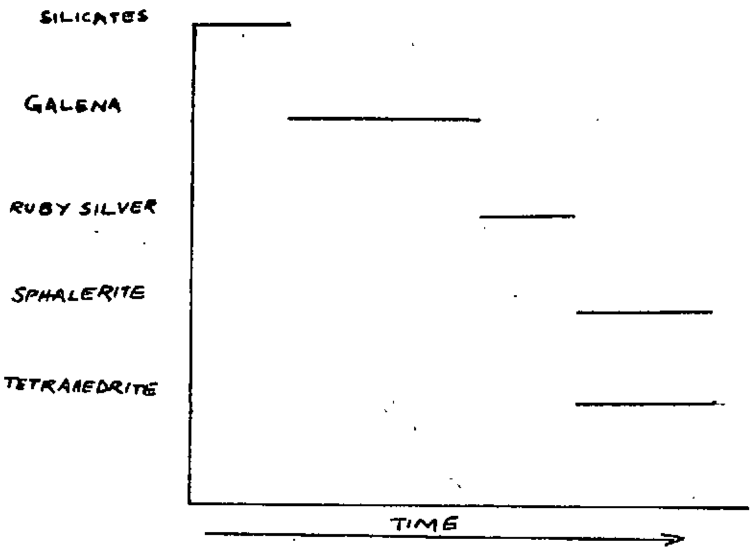
Galena is massive, foliated and has well developed cleavage. Cleavage planes are often bent. Foliation is outlined by fractures and oriented open spaces with the galena that are subsequently filled by sphalerite and tetrahedrite.

Sphalerite and Tetrahedrite occur together and usually have mutual boundaries. They are subhedral to subhedral grains that replace galena along cleavage pits, fractures, and foliation. Contacts between galena and sphalerite-tetrahedrite are irregular and are apparently controlled by the shape of the open spaces they fill in the galena.

Ruby Silver occurs as layers a few microns wide lining the walls of veinlets in galena. The veinlets contain dendritic sphalerite and are up to 4 mm wide.

Silicates occur as disseminated grains.

FIG. 4 PARAGENESIS DIAGRAM OF VEIN I DEPOSIT



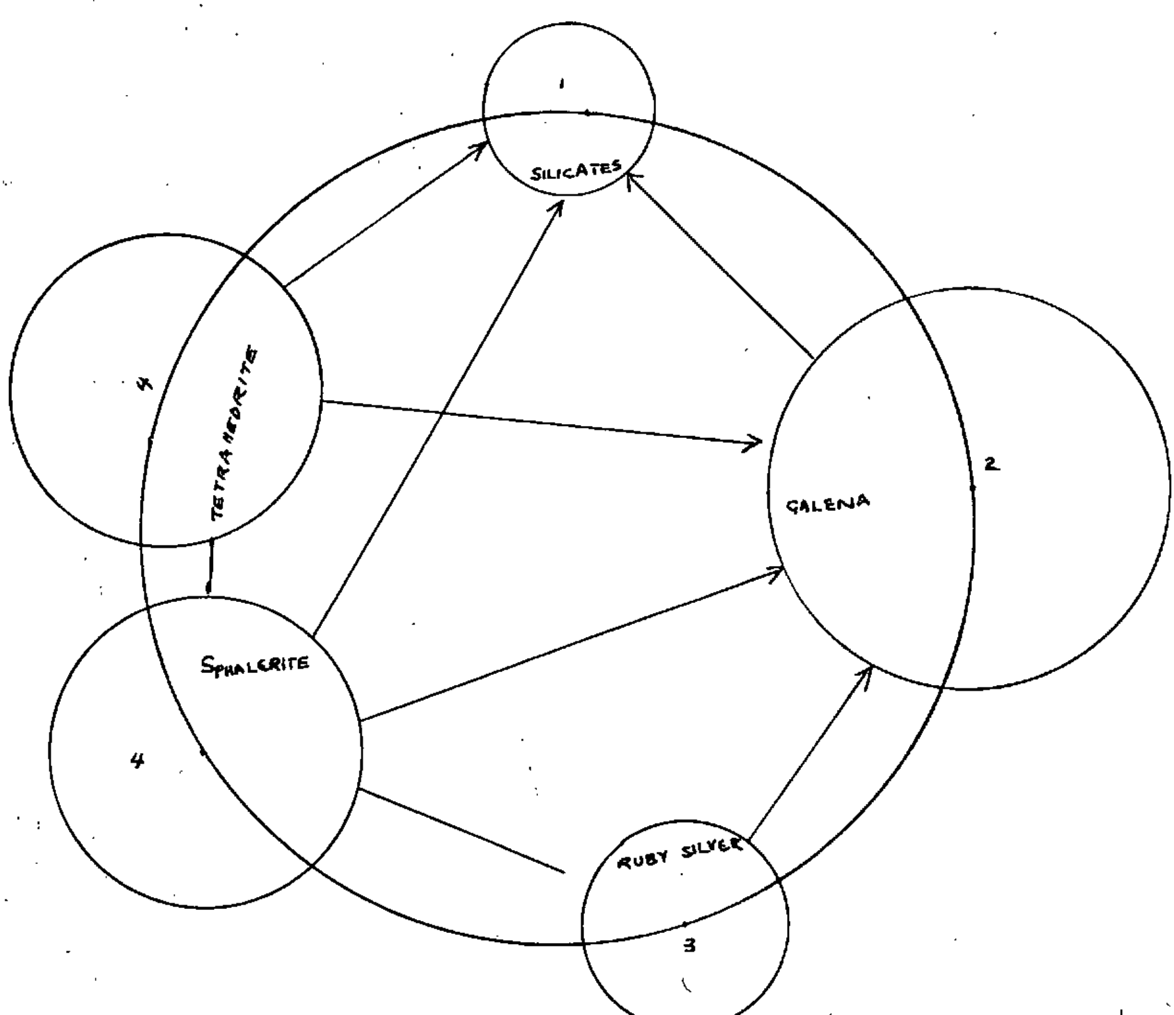


FIG 5: VAN de VEER DIAGRAM OF VEIN I DEPOSIT

POLISHED SECTION DESCRIPTION FOR VEIN 2

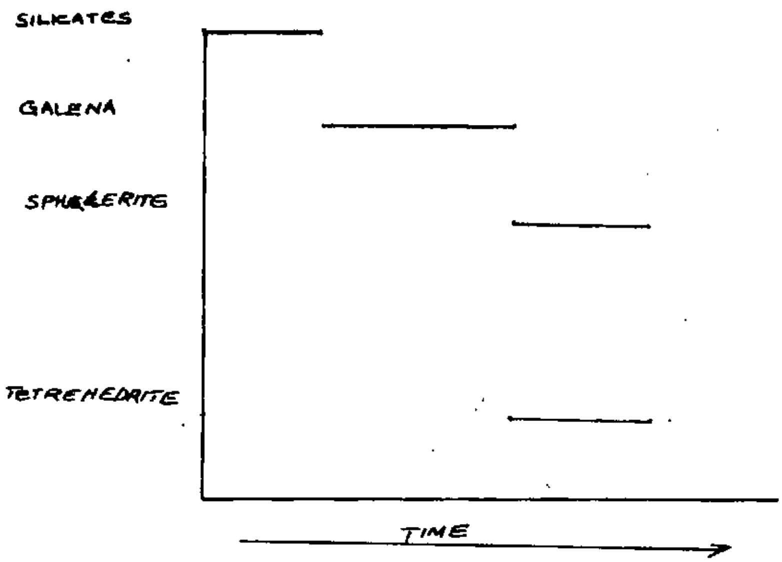
Mineralogy	Grain Size	%
Galena	massive	88%
Sphalerite	.1-.8 mm	10.0%
Tetrahedrite	.2 mm	1.5%
Silicates	.05-.1 mm	0.5 %

TEXTURAL DESCRIPTION

Galena is massive, foliated and has well developed cleavage with characteristic triangular pits. Sphalerite and Tetrahedrite occurs as open space filling in the cleavage pits, in fractures and vein lets in galena.

Sphalerite and tetrahedrite are anhedral to subhedral grains with smooth mutual boundaries. Boundaries between galena and sphalerite-tetrahedrite are jugged and irregular. Silicates occur as small grains disseminated throughout the polished section. Vein 2 textures are very similar to textures in vein 1 and showing 6.

FIG. 8 PARAGENESIS DIAGRAM OF VEIN SHOWING 2



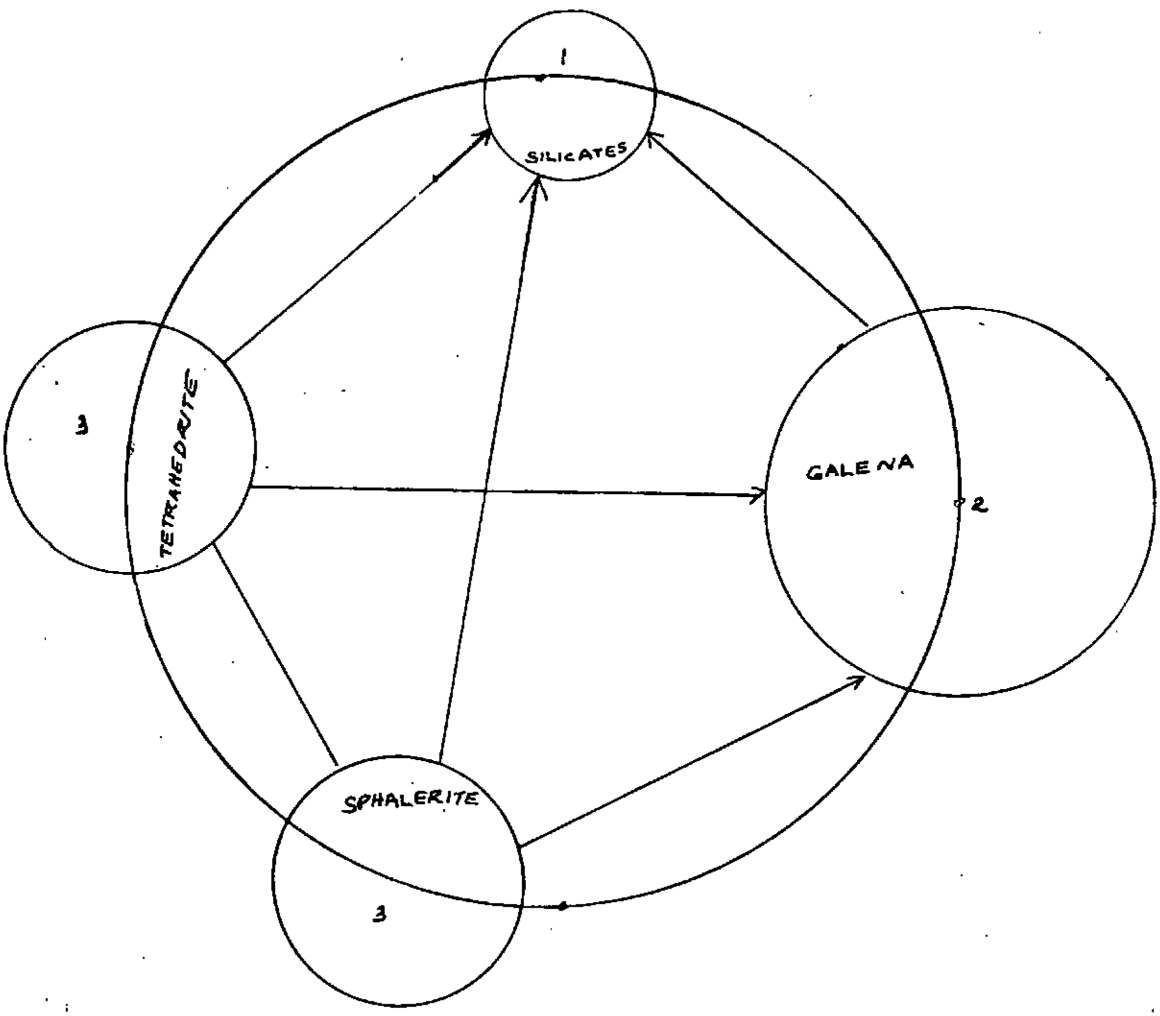


FIG 9 VAN de VEER DIAGRAM OF VEIN SHOWING 2

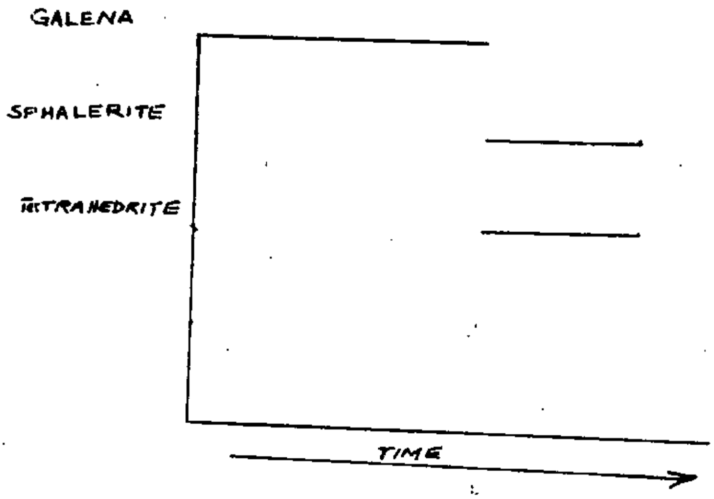
DESCRIPTION OF POLISHED SECTIONS OF SHOWING 6

Mineralogy	Size	%
Galena	massive	97.5%
Tetrahedrite	.5-1 mm	1.0%
Sphalerite	.8 mm (average)	1.5%

TEXTURAL DESCRIPTION

Galena occurs as massive crystals. It has a distinct foliation and well developed cleavage. Galena cleavage planes are bent and kinked by deformation. Many irregular fractures and discontinuous veinlets in galena are parallel to foliation and these together with cleavage pits have been filled with anhedral and subhedral grains of sphalerite and tetrahedrite. Textural relationship between the tetrahedrite and sphalerite which replace galena along foliation, veinlets and in cleavage pits suggests contemporarenous deposition of these two minerals.

FIG 6: PARAGENESIS DIAGRAM OF VEIN 6 DEPOSIT



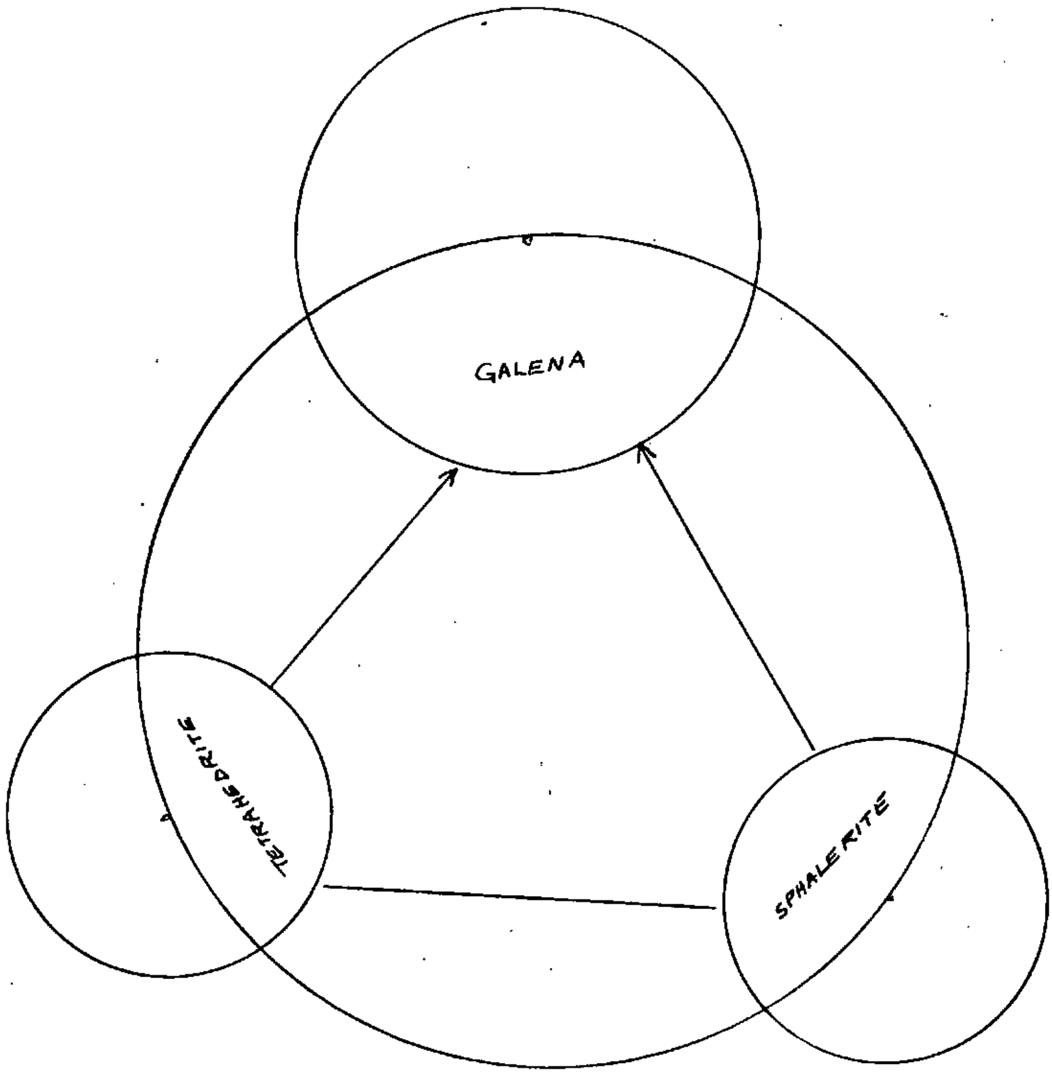


FIG 7: VAN de VEER DIAGRAM OF VEIN 6 DEPOSIT

DESCRIPTION OF POLISHED SECTIONS OF THRUST ZONE (A)

Mineralogy	Size	%
Pyrite	.5 mm	.5%
Quartz	2 mm	93%
Arsenopyrite	average = .5 mm but up to 3 mm	3%
Galena	.1-1.5 mm	2%
Tetrahedrite	.5-1 mm	1.5%

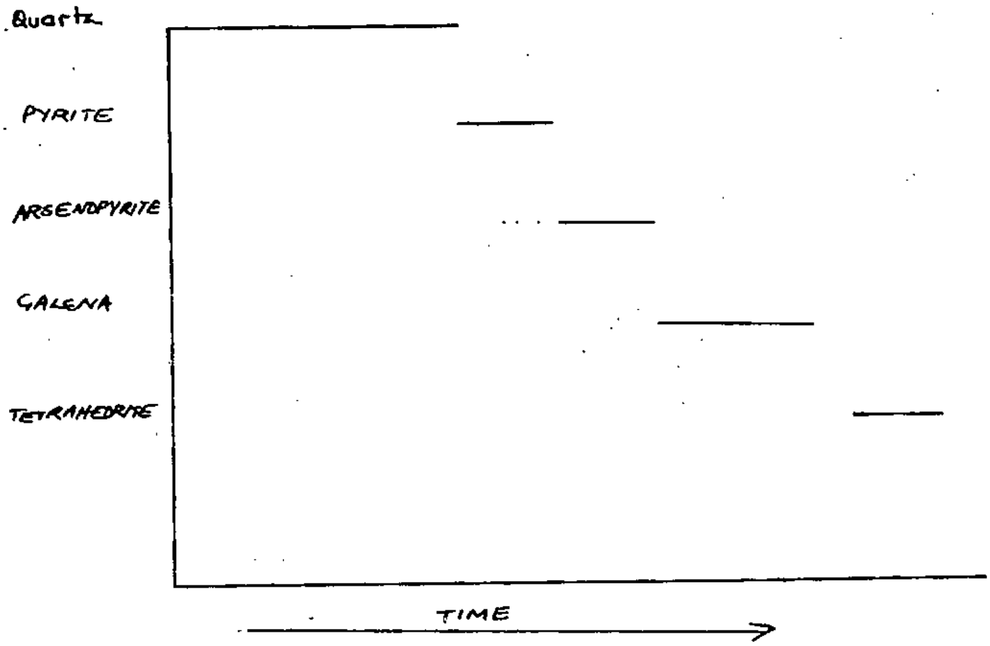
TEXTURAL DESCRIPTION

Quartz grains of the quartz vein are ounded, anhedral and with a sugary fabric. Pyrite grains though generally smaller than quartz grains, have the same texture as quartz grains and together they form the framework mossaic whose open spaces are cemented by the other minerals. The textural similarity of quartz grains of the quartz vein and pyrite strongly suggests crystalization of these two at the same time.

Arsenopyrite occurs as cuhedral lath-like rhombic crystals that replace quartz grains along grain boundaries, fractures and veinlets.

Tetrahedrite-Galena. These minerals typically are very irregular shaped and anhedral. They fill space between quartz-pyrite framework grains. They also surround and replace arsenopyrite along fractures and grain boundaries. Their shape is very much controlled by the shape of the intragranular spaces and open spaces they fill.

FIG. 10 : PARAGENESIS DIAGRAM OF THRUST ZONE



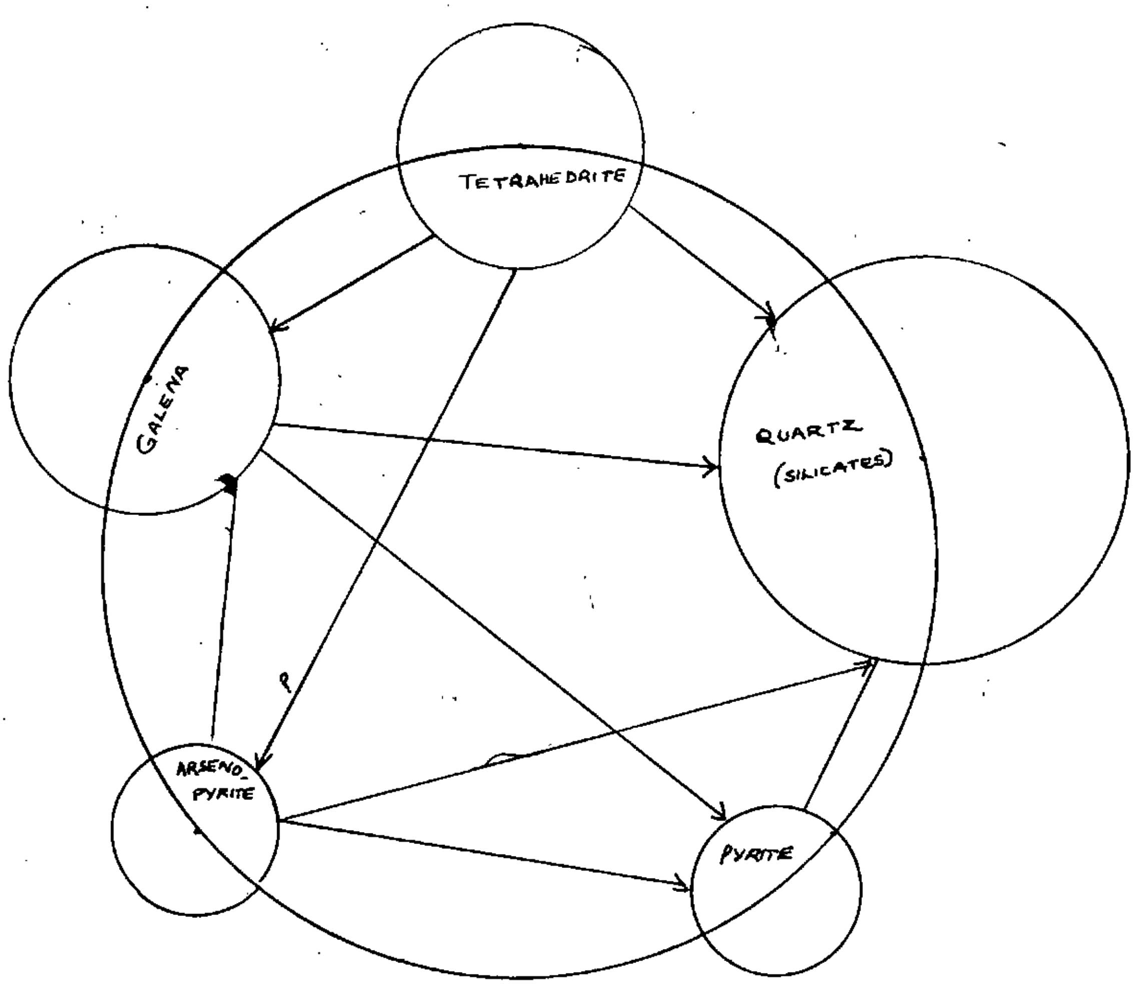


FIG. 11: VAN DE VEER DIAGRAM OF THRUST ZONE

POLISHED SECTION STUDY FOR THRUST ZONE (B)

Mineralogy	Size	%
Pyrite	.5 mm	88%
Tetrahedrite	.1 to over 4 mm	3 %
Galena	.1 to over 4 mm	5 %
Arsenopyrite	.08 mm	2.5%
Silicates	.1 mm	1 .5%

TEXTURAL DESCRIPTION

Pyrite occurs as intensely fractured anhedral to subhedral grains that have replaced silicates so much that silicates now remain only as small grains disseminated in the pyrite.

Arsenopyrite occurs as small euhedral rhombic crystal clusters in intragranular spaces in pyrite grains and also in veinlets in fractured pyrite.

Galena-Tetrahedrite . These two minerals replace pyrite along fractures and also fill intragranular spaces in pyrite. They also replace arsenopyrite along grain boundaries. Where in contact, these two minerals generally have mutual boundaries.