MINERALOGY +
PARAGENETIC
STUDY '85
VEIN CLAIMS

A Mineralogical And Paragenetic Study Of Vein Samples From The Vein Claims Using Ore Microscopy

Submitted to Mr. Godfrey Walton
Chevron Canada Resourses
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by Michael J. Gray

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Acknowledgements

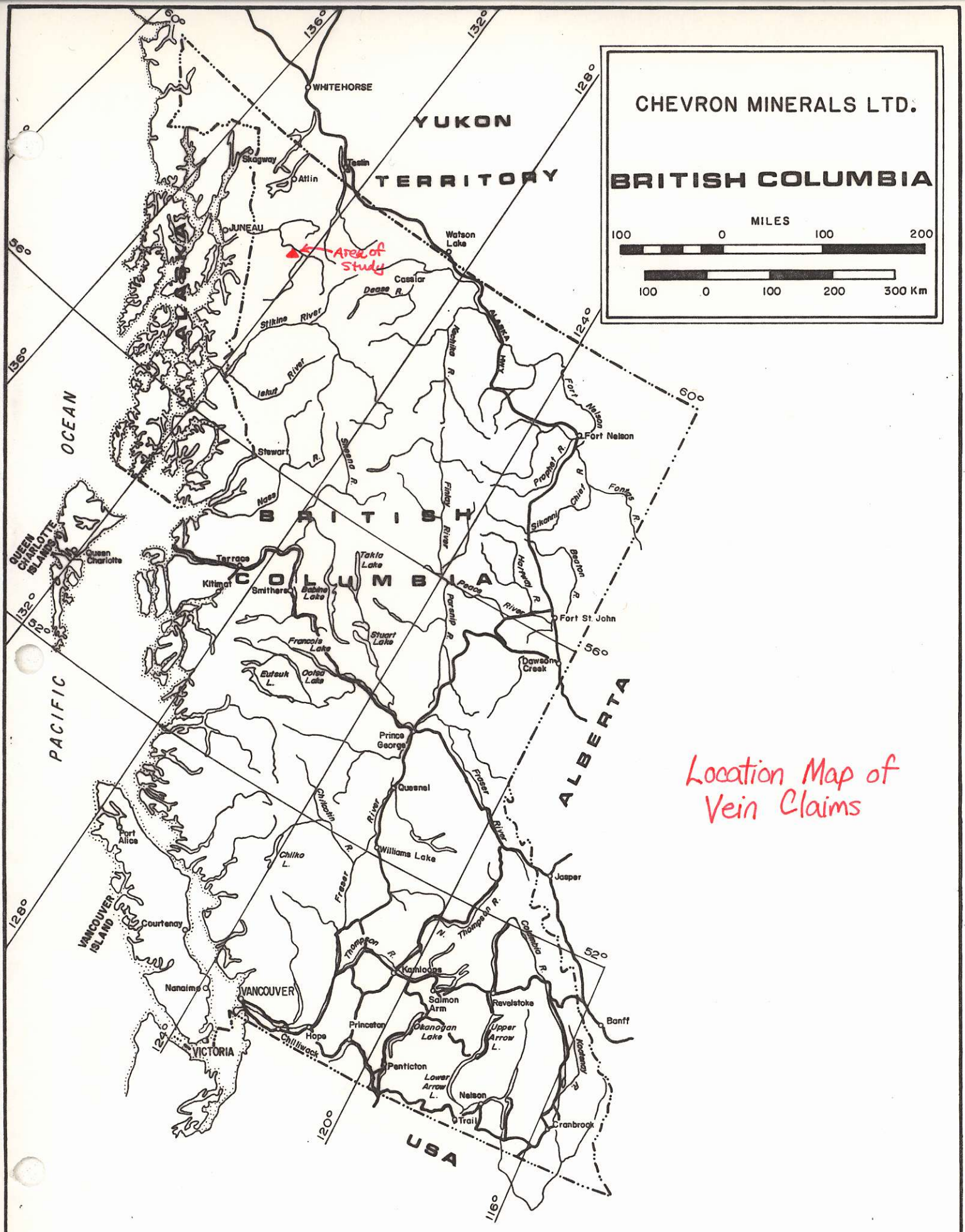
I would like to thank Godfrey Walton of Chevron Canada Resourses Limited for allowing me to use samples from the Vein Claims for study in this report, and for his assistance in sample collection. I would also like to thank Ed Montgomery for his time and efforts photographing sections and rock slabs.

Introduction

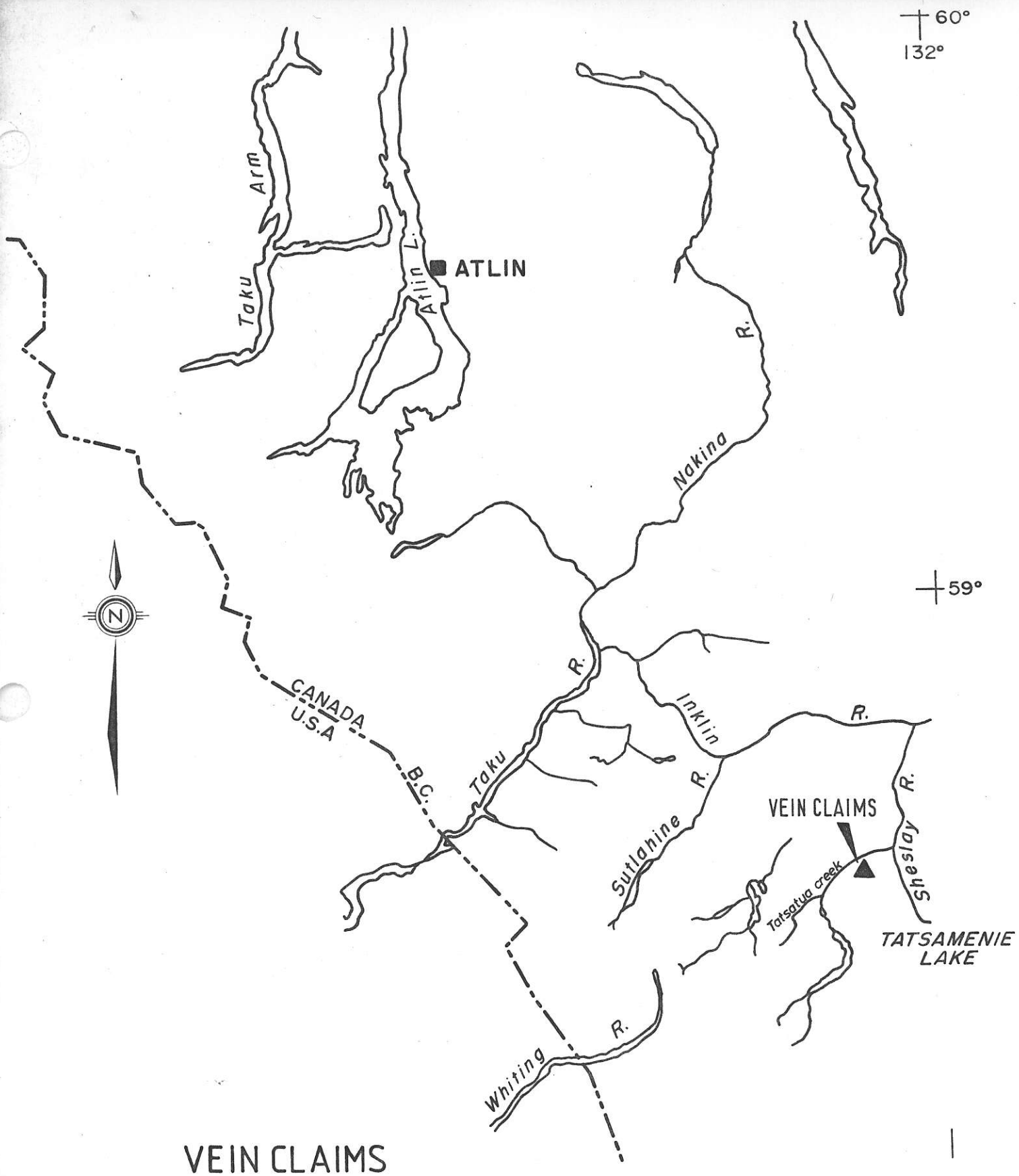
The area of study is the Vein claims, a vein type deposit, located in Northwestern British Columbia and held by Chevron Canada Resources es Limited. During the 1984 field season one day was spent collecting samples from a number of different veins, which were used to prepare polished sections discussed in this report. Microscopic analysis was used on the polished sections to determine mineralogy, textures and paragenetic relationships. Geochemical results were available only on a few of the samples used in this report.

Location and Access

The area of study is located in Northwestern British Columbia, roughly 96km South of Atlin and 70km East of the Canada-United States border. The coordinates for the study area are (58 30'N, 132 13'W). Access is limited to helicopter as the nearest road is at Telegraph Creek, roughly 50km to the Southsoutheast.



Location Map of Vein Claims



VEIN CLAIMS
LOCATION MAP
M504

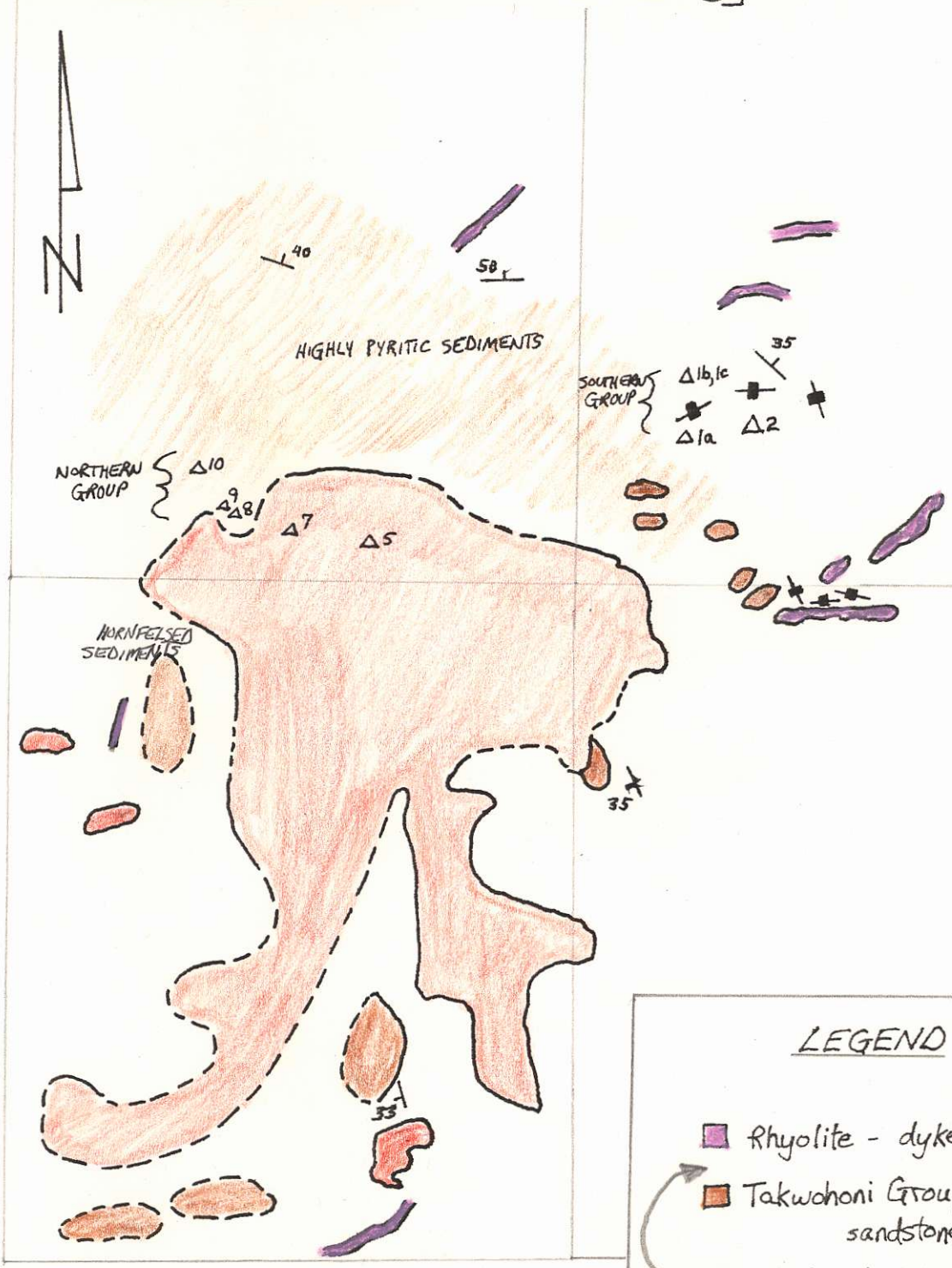
FIG. 1

Geology

The Vein Claims are underlain by Jurassic Takwohoni Group sediments comprised of siltstones, sandstones, and conglomerates. This assemblage of sediments has been intruded by an Upper Jurassic to Cretaceous aged hornblende diorite stock, which is well exposed in the southwest portion of the claims. This intrusive event has caused hornfelsing of the siltstone and sandstone up to 1km away from the contact, and hornfelsing of the conglomerate up tb 500m from the contact.

A number of rhyolite dykes and sills, probably Tertiary age according to Souther, have crosscut the Takwohoni sediments, but are not seen to intrude the hornblende diorite. The dykes range from .5m to 2m in width. The mineralization is associated with quartz veins, also probably Tertiary , which occur in the hornblende diorite and the Takwohoni sediments. These veins are traceable over 150m and vary in width from 2cm to 50cm. The quartz veins have vertical to near vertical dips, and have local swelling in which the veins attain their maximum width.

Sketch Map of Vein Claims Geology



SCALE 1 cm ≈ .25 Km or 1:25,000

0 .5 1 Km

LEGEND

- Rhyolite - dykes, sills
- Takwahoni Group - siltstone, sandstone, conglomerate
- Hornblende Diorite
- ——— Geologic contact
- ––– approx, inferred
- /30 bedding strike with dip.
- vein strike with dip.
- vein with vertical dip.
- Δ vein sample location

Microscopic Analysis

Gangue

The main gangue mineral observed in all of the sections is quartz. Quartz is the most abundant mineral in most hand specimens but not necessarily in polished sections. The quartz is mainly coarse to medium grained although some fine grained cherty quartz was noted. Grains are euhedral to subheral, and often form vugs, and exhibit comb texture. The sulphides are both included in the quartz grains as in the case of arsenopyrite, and also clearly interstitial to the quartz as in the occurrence of stibnite. The quartz in a few areas possibly replaces arsenopyrite in a vermicular fashion.

The only other gangue mineral present in the section is calcite, probably Fe-rich as it is orangey white on its weathered surface. The carbonate occurs as crosscutting veinlets in the quartz veins. Carbonate grain size is generally fine, although there are some local coarser grains. No suphides appear to be associated with the carbonate veining event.

Pyrite

Pyrite occurs in varying amounts, and is the only sulphide present in all sections. It generally occurs as subhedral grains of varied size, often in interlocking aggregates producing a granular texture. In one section it occurs as veinlets in arsenopyrite grains. Deformation of the pyrite includes broken grains with minor brecciation, to strongly fractured an granulated grains which has produced aligned fragments. The grains and fragments are pitted and corroded to varying degrees by goethite and limonite. Pyrite has mutual boudries with quartz, arsenopyrite, tetrahedrite and sphalerite, and appears to be replaced by stibnite on its outer edges in one case. Pyrite is somewhat more abundant in the Northern group of samples.

Arsenopyrite

Arsenopyrite is present in most sections, and seems to be more abundant in the Southern group of samples. It occurs generally as wedge shaped euhedral to subhedral grains , medium grain size. It also occurs as massive granoblastic aggregates which have undergone mechanical

deformation, and exhibit cataclastic textures. No signs of post-deformation growth healing of arsenopyrite were observed, rotation of fragments and rounding is evident. The deformation effects are clearly more intense adjacent to the vein walls and grade to less deformed grains near the center of the vein. Very few inclusions and no gold was found in the arsenopyrite under high power.

Sphalerite

Sphalerite occurs as large subhedral to anhedral grains, and is present in half of the sections studied. The sphalerite is relatively dark gray, possibly indicating a high iron content. Although a good internal reflection was not observed, positve identification could be based on the presence of chalcopyrite emulsion texture. Rows of chalcopyrite droplets probably define crystallographic directions in the sphalerite. Depletion of emulsoid chalcopyrite in sphalerite near chalcopyrite fracture filling, probably is a result of remobilization of the chalcopyrite. Sphalerite has mutual boundries with pyrite, arsenopyrite, quartz, and stibnite. It is replaced by tetrahedrite and chalcopyrite along fractures.

Chalcopyrite

Most of the sections studied have at least some chalcopyrite. It occurs as ovoid droplets and tiny veinlets in sphalerite, and also as veinlets in quartz. These occurrences represent two phases of chalcopyrite in the vein system. A third possible phase is seen to surround stibnite grains. The emulsoid chalcopyrite in sphalerite is commonly seen as rows of ovoid drops, defining crystallographic directions within the sphalerite. Remobilization of chalcopyrite is evidenced by a depletion of emulsion texture seen adjacent to irregularily shaped chalcopyrite veinlets in some cases. The chalcopyrite occurring as veinlets in the quartz has irregular shaped grains and a discontinuous nature, mainly interstitial to the quartz.

Tetrahedrite

Only two of the sections studied contain tetrahedrite. The same two also have the only stibnite observed. The tetrahedrite occurs as irregular veinlets in sphalerite along fractures and cleavages, sometimes having islands of sphalerite in the middle of them, suggesting replacement of the sphalerite. Individual tetrahedrite grain outlines are not clear owing to its isotropic nature. Tetrahedrite also occurs with

stibnite, appearing as a matrix to the fine felty mats of stibnite. Silver assays support the presense of a silver bearing mineral in one of the two samples, the other had no data available.

Stibnite

Small amounts of stibnite (3-4%) occur in two of the sections studied, one from the Northern group and one from the Southern group. The stibnite occurs as fine grained often felty masses which are generally interstitial to coarse grained euhedral quartz crystals. It also occurs interstitial to tetrahedrite grains, and within a few chalcopyrite grains. Numerous elongate crystals are folded and warped, characteristic of initial stages of stibnite deformation. Identification was aided by oberving cleavage on radiating stibnite needles in quartz, under crossed polars.

Covellite

Covellite is found in a few of the sections but only in small amounts where it usually rims chalcopyrite grains. It also occurs as irregularily shaped grains near

chalcopyrite. No evidence of covellite replacing chalcopyrite was noted, but its presence does indicate supergene sulphide conditions have been present in at least parts of the vein system.

Goethite

Goethite is present in varying amounts in all sections studied. It mainly occurs as a fine grained oxidation product along fractures of pyrite grains and outside pyrite grains as rims. In one case it has completely replaced a narrow pyrite veinlet in arsenopyrite.

Scorodite

Scorodite, although not positively identified in section, is abundant in some hand specimens. It occurs as a fine grained weathering product along fractures of arsenopyrite grains, often with goethite.

Paragenesis

The paragenesis of the veins studied was determined from grain relationships and textures seen both in hand specimen and polished section. The paragenesis of the Northern and Southern group of samples were considered together.

Quartz is the first mineral deposited as evidenced in vein walls of handspecimens where it forms crustiform layers. Euhedral arsenopyrite is next and is found interstitial to the early quartz grains and within slightly later quartz grains. It is also the next closest band to the vein wall as seen in handspecimens. Wedge shaped arsenopyrite rhombs are commonly within pyrite. The coexistance of pyrite with arsenopyrite allows an upper temperature limit be placed on mineral formation at this time of 491 C + or - 10.

Sphalerite is deposited next, commonly as fairly large crystals that are fractured and found within some pyrite cubes, indicating the pyrite comes later. The emulsoid chalcopyrite as rows of droplets and pseudo-rods within the sphalerite has probably exsolved and been deposited simultaneously with the sphalerite.

Pyrite appears to be deposited next, it crosscuts arsenopyrite and is itself crosscut by a second generation of quartz. This second generation of quartz is in the form of tiny fractures filling veinlets.

A second chalcopyrite phase is deposited with tetrahedrite simultaneously, and also by itself as irregularily shaped grains interstitial to gangue. Tetrahedrite invades sphalerite fractures with no depletion at junctions where they cross. Islands of sphalerite in the tetrahedrite veins, probably indicate tetrahedrite replaces sphalerite.

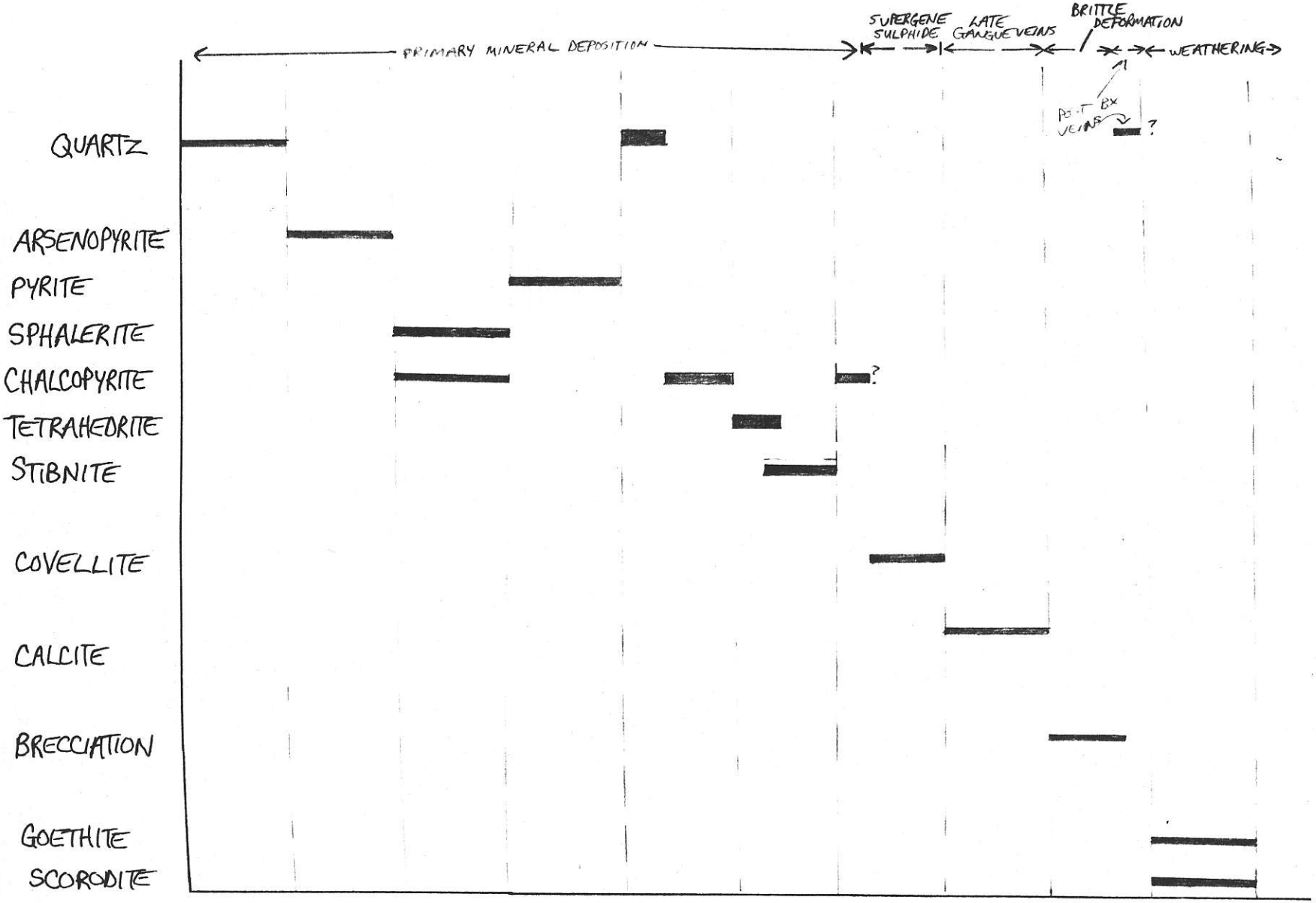
Stibnite is fine grained, interstitial to early quartz, and the later tetrahedrite. At this stage the depositional environment has a maximum temperature equal to that of stibnites melting point of 556 C , but in fact must be somewhat lower than the 491 C defined by arsenopyrite-pyrite equilibrium. This concludes the primary sulphide deposition.

Covellite forms as a secondary mineral and usually rims chalcopyrite. At this stage the veins are probably <.5km from the surface environment.

Narrow veins of calcite , with no associated sulphides, crosscut the existing gangue and sulphides. This is followed by a brittle deformation event which causes microfaulting, and brecciation. Minerals closest to the vein walls have experienced the most severe deformation.

Finally, near surface weathering has oxidized the sulphides of exposed veins to produce limonite, goethite, scoridite, and stibikenite all of which are seen in hand sample.

LINE DIAGRAM DEPICTING PARAGENETIC RELATIONSHIPS



Conclusions

Analysis of the combined observations made on the polished sections in this study allow some conclusions to be made on the paragenesis and economic value of these veins.

The silver anomalies result from the presence of up to 5% tetrahedrite in the veins. Gold was not identified in the sections although assays indicate it is present.

A temperature of 491 C + or - 10 can be assigned as the maximum temperature of deposition upon the formation of pyrite as it is in equilibrium with arsenopyrite.

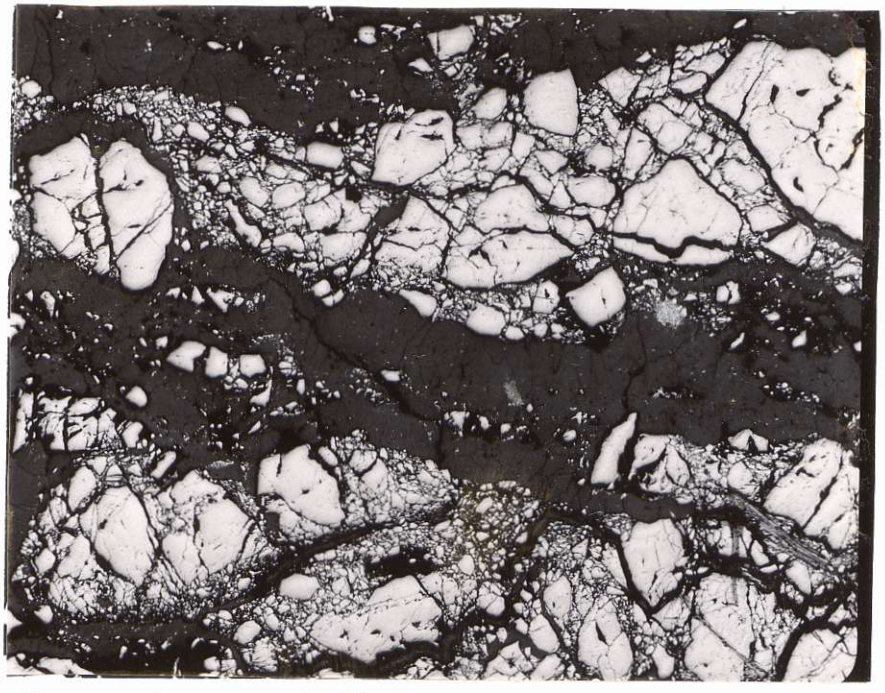
Only weak generallizations can be made of possible zoning of the veins. Calcite veining and strong brecciation, along with relatively abundant pyrite seem to be characteristic of the Northern group of veins. Whereas, abundant arsenopyrite and lower sphalerite are more characteristic of the Southern group of veins.

Chevron holds the VEIN mineral property, but has been discouraged from further exploration because of the narrow vein widths, and the rather low precious metal grades. Added to these negative features is the problem of silver being in the tetrahedrite structure, not only is it

undesirable to have the antimony in the ore but it also occurs as narrow veinlets which would cause difficulties in liberation. High arsenopyrite contents are also undesirable as an arsenic contaminant can dilute ore concentrations and create toxic byproducts.

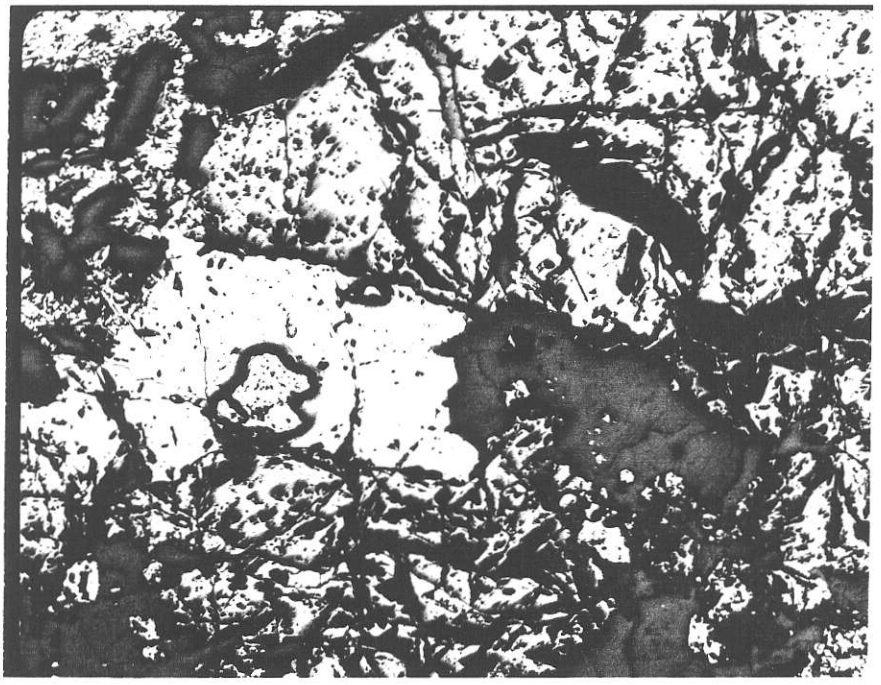
Appendix I: Photomicrographs

(Photomicrograph 1)
Photomicrograph of euhedral quartz (dark), with fine grained interstitial stibnite (sb), needles. Note the tetrahedrite (tt), also with minor interstitial stibnite. (Planed polarized light, 56X, V-10)

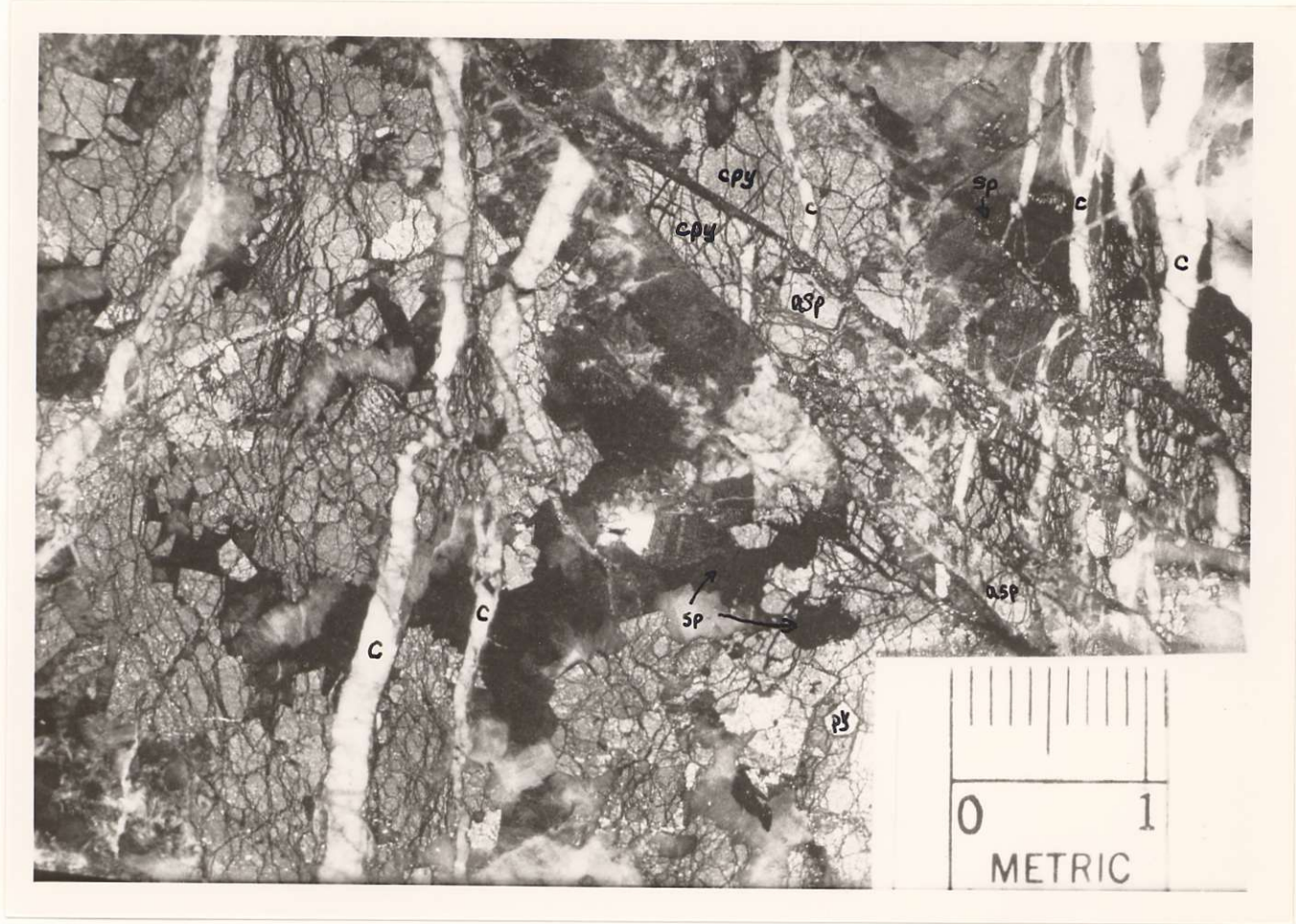


(Photomicrograph 2)
Photomicrograph of brecciated, milled, and fractured arsenopyrite grains. Post breccia quartz veins (dark), cut across the arsenopyrite (asp), parallelto aligned fragments. (Plane polarized light, 40X, V-2)

(Photomicrograph 3)
Photomicrograph of arsenopyrite grains invaded by chalcopyrite and pyrite veinlets, and corroded along branching fractures by scorodite. (Plane polarized light, 40X, V-1b)



(Photomicrograph 4)
Photomicrograph of tetrahedrite (tt), its intergrain relationships and occurrence with stibnite, and sphalerite. (Plane polarized light, 40X, V-1c)



(Photograph 1)
Photograph of sample V-8 rock slab, showing crosscutting relationships of calcite veins (c), and microfaults. Note the displacement of the chalcopyrite (cpy) near the top-center of the photo, and the displacement of numerous carbonate veins. Granulation of chalcopyrite, arsenopyrite (asp), pyrite (py), and sphalerite (sp), occurs along the microfaults seen in the Northeast part of the photo.

Appendix II: Photographs

Typical exposure of one of the veins, with subsequent weathering. The vein is 10 cm wide and ~~is~~ crosscuts hornsfelsed siltstone. (Strike 083, dip 88NE, -V-1)

Appendix III: Worksheets

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- Polish a little better

Sample No. V-10

Handspecimen - Quartz-carbonate vein, has orangy-brown weathered surface (limonite) and an overall banded texture. Quartz has comb texture as noted in some crustiform layers, other layers are fine grained sulfides and coarse grained calcite. Minor Mn-oxide staining present, and limonite envelopes around carbonate noted.
MODE sulphides/opaques: pyrite (4%), sphalerite (2-3%), arsenopyrite (1%), chalcopyrite (trace) galena (<1%), stibnite (?) (<1%)

Polished Section

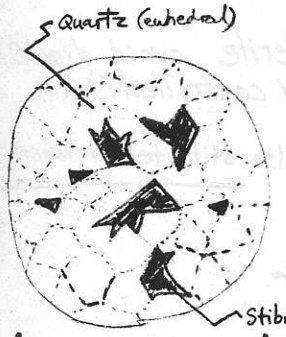
Gangue: Quartz, Calcite
Opaque Minerals: Pyrite, Sphalerite, Chalcopyrite, Arsenopyrite, Stibnite, Goethite

see me & well discuss

OPAQUES	%	SIZE LARGE / MODE
pyrite	15	3mm / 2mm
sphalerite	10	4mm / 2.5mm
arsenopyrite	5	2.5mm / .3mm
stibnite	3	.8mm / .15mm
goethite (tetrahedrite)	<1	—
chalcopyrite	1	/ tiny spherical blobs
GANGUE		
quartz	62	} 1.4×.4mm / .8×.2mm
calcite)	3	

maybe some #77 → ? or elsecall stibnite

contains Fe



stibnite interstitial to euhedral quartz 1.07mm
(fig. 1)

Quartz - occurs as euhedral hexagonal crystals (evid. open space filling), commonly have arsenopyrite inclusions, and some stibnite.
- form euhedral aggregates and have stibnite interstitial (fig. 1)
- fill fractures in pyrite and sphalerite, and as inclusions in some sphalerite grains.

w/ later gangue

Calcite - rusty weathering and fractures highlight cleavage, only occurs in one small area.
- late infilling between quartz grains

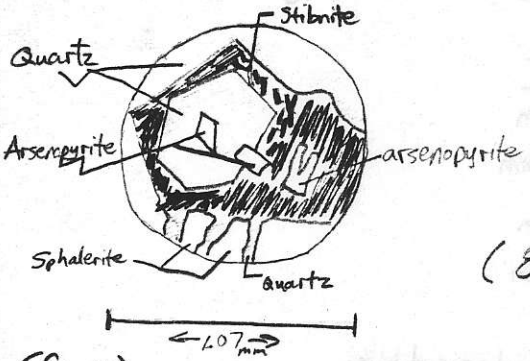
% total opaques	MINERAL	COMMENTS
(43%)	Pyrite	- has mutual grain boundries with sphalerite, arsenopyrite, chalcopyrite, stibnite, quartz - pyrite occurs generally as relatively large subhedral grains, although some euhedral pyritehedrons are present, exhibits granular texture locally - includes arsenopyrite rhombs in grains occasionally, stibnite (?) in one case. - minor limonite alteration along grain boundries and fractures, quartz is generally a bit rusty

elaborate ←

(Pyrite cont'd)
- noted caries texture with sphalerite
- appears to surround sphalerite & occurs in one locality as cross cutting fracture in py ⇒ ~~sph~~ sphal earlier

(29%) Sphalerite - largish subhedral grains in mutual contact with pyrite, stibnite, arsenopyrite, gangue
- emulsion texture, has tiny ovoid chalcopyrite inclusions, (exsolution?), commonly in rows and some chalcopyrite possibly replacing along fractures. &/or remobilized
- fractured and infilled by quartz, often contain quartz grains within, and includes euhedral arsenopyrite grains
- surface is pitted, possibly due to poor polishing techniques, also as stibnite blebs are disseminated in some sphalerite and plucked partially out.

(14%) Arsenopyrite - occurs as small wedge shaped rhombs mainly (euhedral)
- larger grains are subhedral and often fractured and filled by quartz and stibnite.
- mutual grain boundries with pyrite, stibnite, sphalerite, gangue
- as inclusions of varying size in gange, sphalerite, and pyrite (see fig. 2)



(fig 2) openspace filling seen by euhedral gangue. Arsenopyrite rhombs early so included in quartz grains.

also inclusions in py; occasionally wins py where it appears to replace it

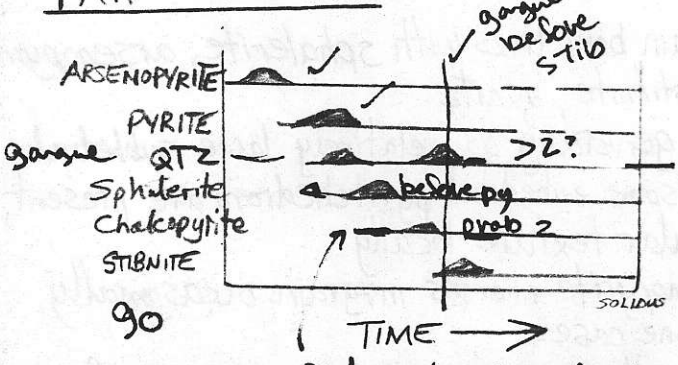
(8%) Stibnite - commonly occurs as masses of stubby rulerlike crystals in contact with quartz and sphalerite
- identified by habit and cleavage, seen as inclusions in quartz (civg visible)
- intersertal texture with quartz, stibnite comes in late and fills between euhedral quartz crystals (Fig. 1)

same for sphal & aspy to lesser so

(3%) Chalcopyrite - occurs mainly as emulsion texture in sphalerite, ovoid droplets disseminated and in rows (crystalgraphically controlled?). Also replaces sphalerite along some fractures.
- has quartz inclusions in rare "free" grains, also stibnite(?) inclusions.

(3%) Goethite - minor amount, along pyrite fractures and grain boundries.

PARAGENESIS



90

Prob cont w/ sphal also & then replacement &or remobil

see additional sheet for discussion

ID: 5/5
Des = 7/4/10
Interp 4/5
Sample Narrative 5/5

22/25

Handspecimen - Quartz vein, weathers brown-rusty brown, has vugs and comb texture (quartz), limonite coats the walls of the vugs. Alteration includes limonite, scorodite, jarosite(?) and stibikenite (white). Sulphides occur in narrow bands and in disseminations.

MODE Sulphides/Opaques: arsenopyrite (10%), pyrite (7%), sphalerite (3%), stibnite (1%)

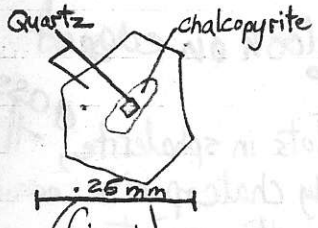
Polished Section

Gangue: Quartz
Opaque Minerals: Pyrite, Arsenopyrite, Sphalerite, Stibnite, Tetrahedrite, Goethite Chalcopyrite, Covellite

OPAQUES	%	SIZE LARGE/MODE	
pyrite	35	2mm/1.5mm	clusters to 1.5cm
arsenopyrite	9	1.5mm/.8mm	
sphalerite	6	3mm/1.7mm	
tetrahedrite	5	.3mm/.5mm	
stibnite	4	<.05mm	
chalcopyrite	1	—	
goethite	1	—	
covellite	trace	—	
GANGUE			
quartz	40%	1.5mm/.8mm	

Quartz - euhedral to subhedral grains, contains inclusions of chalcopyrite, arsenopyrite, tetrahedrite - in one case chalcopyrite has a quartz inclusion as well (fig. 1)
- crudely layered w/ sulphides
- probably

Show me this - sounds interesting



(fig 1)
Quartz with inclusion of chalcopyrite, which in turn has quartz inclusion

CONT'D

% of total sulphides — COMMENTS

(58%) Pyrite – subhedral to anhedral, commonly as granular clusters

this applies to all minerals → any particular relationships here ← mutual boundries with sphalerite, stibnite, quartz, tetrahedrite
- speckled appearance from alteration pits
IE → - appears to be most commonly assoc w/ tt. where it surrounds & fills in around grains

(15%) Arsenopyrite – occurs as euhedral to subhedral crystals in arsenopyri bands, largely discontinuous stringers.
- often see crystals grown over an included by later arsenopyrite
- mutual boundries with quartz, pyrite, sphalerite
- altered on fractures and pitted by scorodite(?)

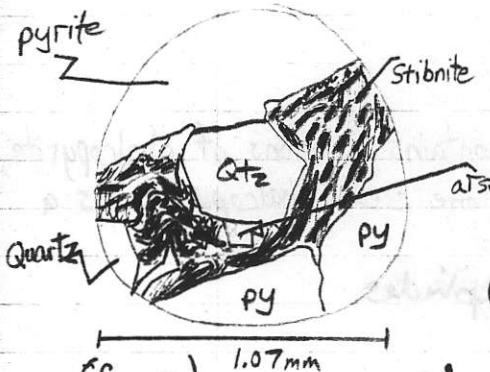
Probably sul stages of py, asp & gangue-all at beginning of paragenetic sequence – may sort out. see paragenesis for eg w temp

examination of hands

(10%) Sphalerite – occurs as largish grains (3mm), and smaller (1mm) grains, generally anhedral and well fractured, and containin numerous inclusions (chalcopyrite, arsenopyrite
- minor chalcopyrite displaying caries texture with sphaler ite.

(8%) Tetrahedrite – occurs mainly with stibnite as poorly formed crystals with stibnite inclusions, mutual boundries also with arsenopyrite, sphalerite, pyrite.
surrounds py ⇒ later
- also occurs replacing? sphalerite along fractures

(7%) Stibnite – occurs as a late interstitial mineral to qtz grain size
- often warped and deformed around early crystals (see fig 2)
- appear to be squeezed and aligned into cracks (mechanically moved into?)
- has a felty look on low power.
— appears to replace py – look on edge of py grains



(fig 2)
Stibnite (blue) deform

(2%) Chalcopyrite – occurs as tiny ovoid dots in sphalerite, sometimes in rows, – mainly chalcopyrite occurs interstitial to quartz, and some within quartz
& py, asp ⇒ late stage
- a few grains have covellite rims, possible supergene enrichment.

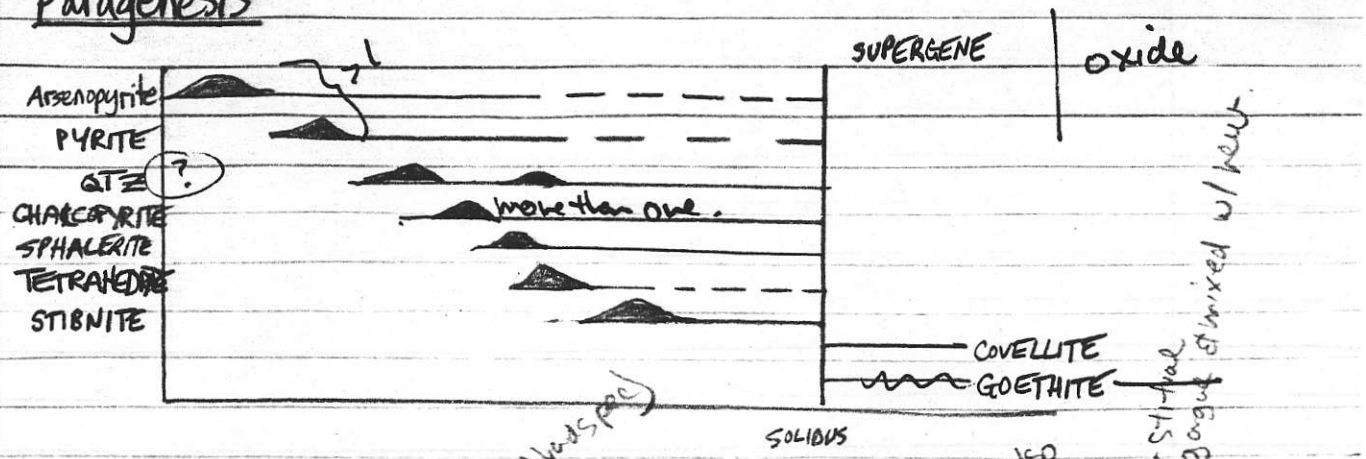
(2%) Goethite – along fractures of pyrite with quartz fillings.
(trace) Covellite – rims on a few chalcopyrite grains

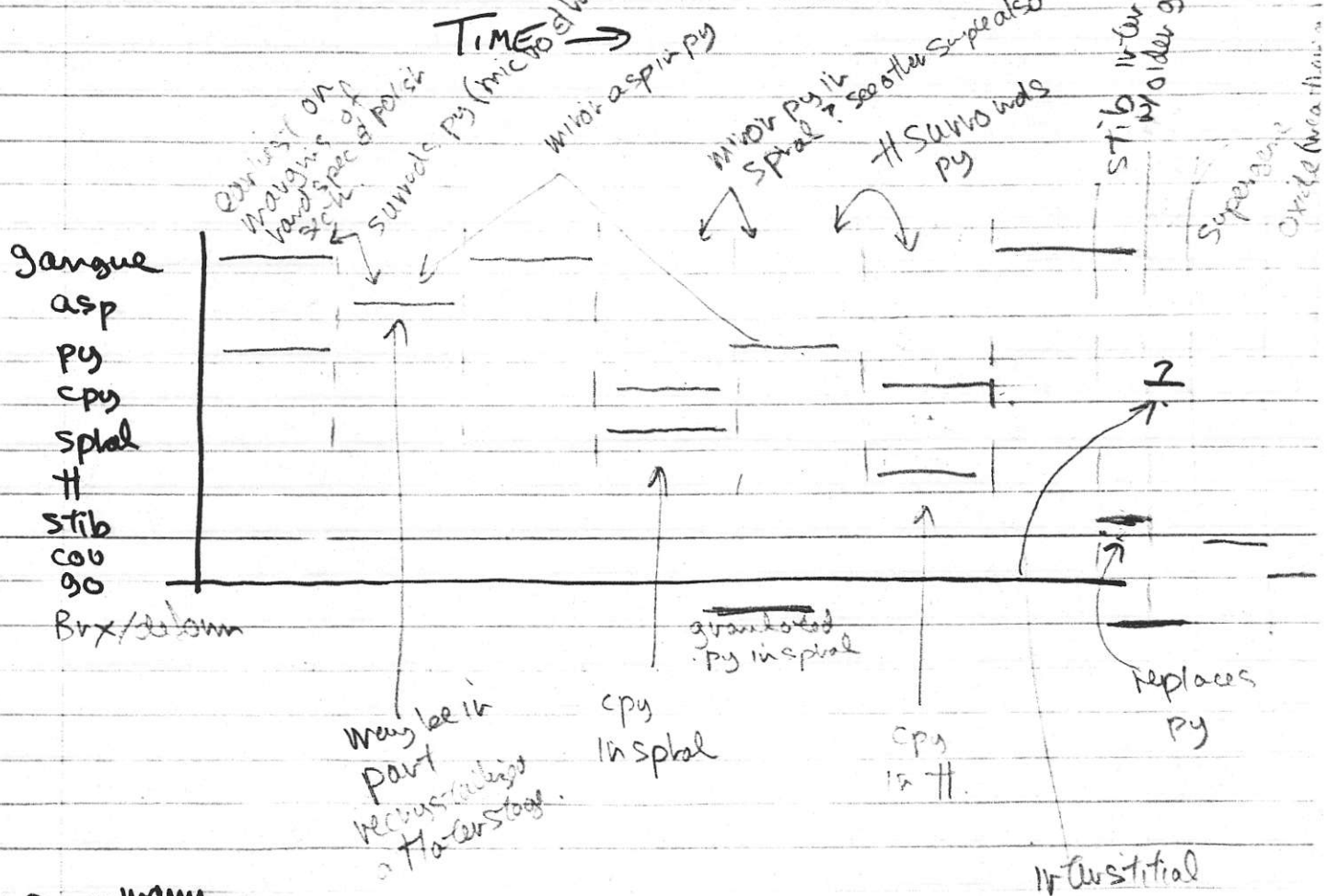
V-1c (JA3T1.-117, 118)

Orientation	Width	GEOCHEM (ppm) Cu	As	Sb	Au	Ag	ASSAYS Au	Ag
088 / 83S	5cm	162	43	9.2	5ppb	.1	—	—
		234	41	5.6	5ppb	.1	—	—

(V-1c Cont'd)

Paragenesis





- good summary but your descriptions could elucidate individual mineral relationships more as those are important in determining paragenesis.

ll interstitial cpy maybe earlier or entirely assoc w/ ll - in other sample contains stib.

Sample No. V-5

Handspecimen - Quartz vein, with rusty weathering and a trace of malachite staining. Quartz is cherty looking in some areas, otherwise it is euhedral and forms numerous vugs. Sulphides have mainly been leached out, as bands and fractures of limonite and jarosite(?) remain. Of the sulphides still present the pyrite occurs as discontinuous bands, while chalcopyrite appears as blebs.

MODE SULPHIDES/OPAQUES: 2-3% pyrite, 1% chalcopyrite, <1% covellite.

Polished Section

Gangue: Quartz
Opaque Minerals: Pyrite, Goethite, Covellite

OPAQUES	%	SIZE LARGEST/MODE
pyrite	10	.6mm / .25mm
goethite	3	—
covellite	1	.2mm / .15mm
chalcopyrite	<1	.2mm / .1mm
sphalerite	trace	—
GANGUE		
quartz	86	1.75mm / 1mm

Quartz- three possible generations observed, first is cherty looking gray quartz in handspecimen, which is distinctly different than the coarse euhedral grains that are also whiter under x-polars. The third stage appears as fine quartz producing a druzy texture, and vugs.

% TOTAL OPAQUES	MINERAL	COMMENTS
(67)	Pyrite-	has not taken polish very well, perhaps too much topography exists on the section. - occurs as euhedral to subhedral cubes localized in bands or clumps associated with fractures. - grains generally small and interstitial to coarse quartz grains

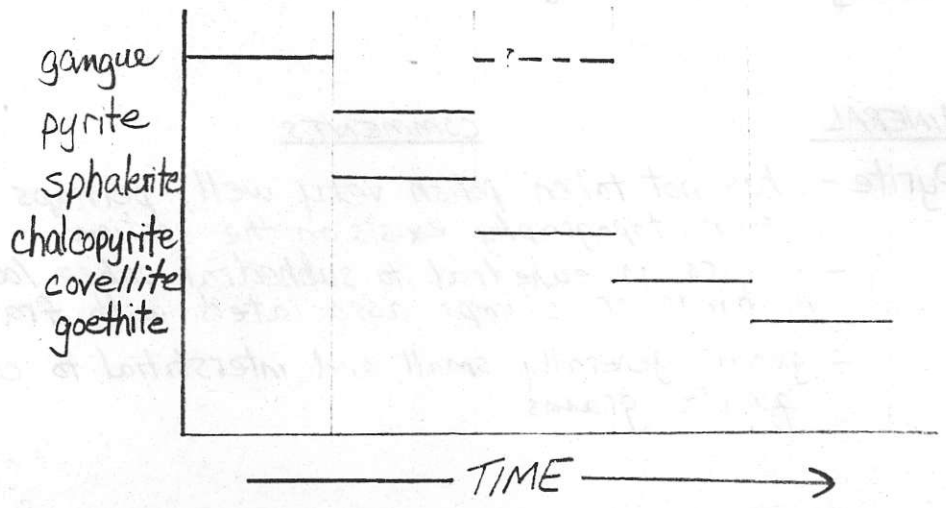
(20) Goethite - present in fractures throughout polished section (quartz), also present along fractures of pyrite grains and around pyrite grains.

(7) Covellite - dissappears upon polishing, shows up with orangy chalcopyrite tarnish, tends to surround chalcopyrite and possibly replaces it.

(6) Chalcopyrite - minor occurrence, has irregularily shaped outlines and appears as blotchy grains. Mutual boundries with pyrite, sphalerite, and quartz.
- with pyrite the boundries often have goethite between the grains, with sphalerite boundries are smooth and distinct, and with quartz they are irregular - chalcopyrite is interstitial.
- quite an intense yellow, but noted included sphalerite along with chalcopyrite emulsion (extremelyfine)

(trace) Sphalerite - v. minor occurrence, only 1 or two grains observed.
- included in chalcopyrite grains, do not appear to be getting replaced. The sphalerite also has "tiny droplets of chalcopyrite disseminated throughout one grain - emulsion texture.

PARAGENESIS



V-5 (G3T1-142)

Orientation	Width	GEOCHEM Cu	As	Sb	Au	Ag	ASSAYS Au	Ag
089/90	5-9cm over 50m	>10000	1300	560	395ppb	>100.0	—	—

084/835

Sample No. V-9

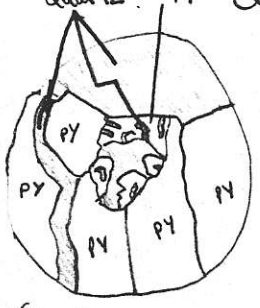
Handspecimen - Quartz vein, has rusty weathering, and some limonite fracture coatings. Quartz is euhedral as seen in numerous vugs. Sulphides occur as aggregates of euhedral looking crystals, and as stringers (fairly irregular). Trace scorodite

MODE: Sulphides/Opaques: 30% Pyrite, trace Chalcopyrit

Polished Section

Gangle: Quartz
Opaque Minerals: Pyrite, Arsenopyrite, Goethite,

OPAQUES	%	SIZE LARGEST / MODE
pyrite	71	3mm / 1.5mm
arsenopyrite	4	.8mm / .35mm
goethite	<1	—
GANGUE		
quartz	25	.65mm / .4mm



(Fig 1)
Arsenopyrite grain with crude vermicular texture of included quartz

Quartz - occurs as subhedral to euhedral crystals, and is included as small grains within the pyrite while pyrite was not noted in quartz.
- appears to replace arsenopyrite as vermicular intergrowths (fig 1), this apparent replacement is quite extensive in some of the arsenopyrite grains, and pseudomorphs the rhombs.
- fills fractures in pyrite grains, and often is the boundry between pyrite grains

% TOTAL % OPAQUES	MINERAL	COMMENTS
(93)	Pyrite-	has mutual grain boundries with quartz and arsenopyrite the boundries with arsenopyrite are quite sharp as the arsenopyrite is fairly euhedral and is included in the pyrite in many cases - occurs a subhedral interlocking grains, an overall granular texture - the pyrite is somewhat fractured, and has goethite (minor) a quartz infilling. Some brecciation occurs in the wider fractures

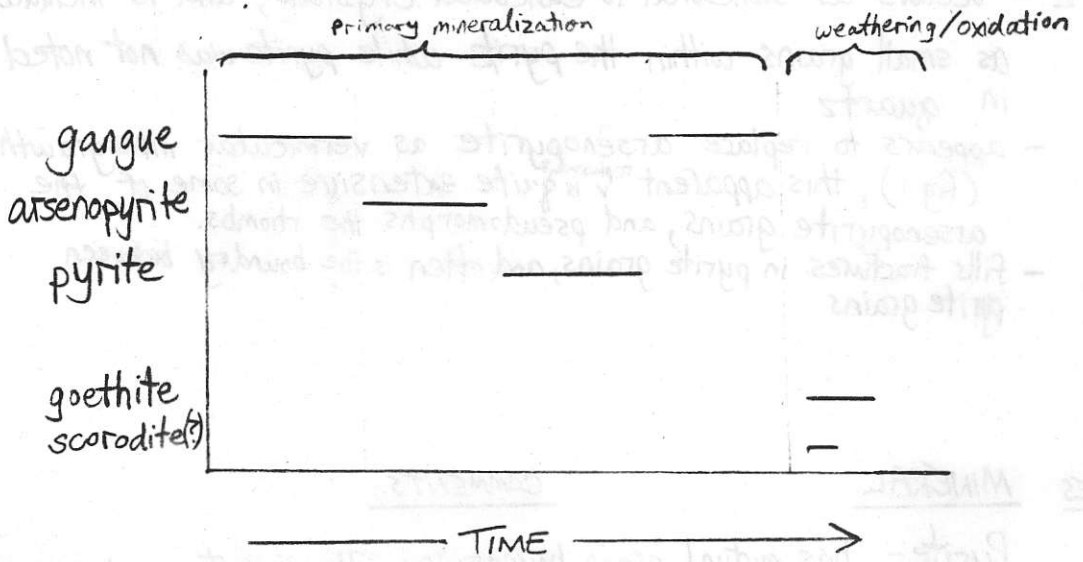
(Pyrite Cont)

- quartz is included in many pyrite grains, as well as fairly euhedral arsenopyrite, which the pyrite grows around.
- pyrite has taken a good polish probably because it is so abundant.

(6) Arsenopyrite - occurs quite evenly distributed throughout the polished section, as euhedral and subhedral grains. The smaller grains tend to be euhedral, while the larger grains are generally subhedral.
- has pyrite growing around it (appears so), and one grain is actually within the pyrite, also has crude vermicular intergrowths of quartz (fig 1) in some grains and is corroded along fractures possibly by scorodite(?), the larger grains are much more infiltrated by gangue. (apparent replacement)

(<1%) Goethite - minor amount, occurs along pyrite fracture and grain boundries.

PARAGENESIS



Sample No. V-2

Handspecimen

- Small Quartz vein with massive arsenopyrite. Vein has rusty brown weathering and abundant waxy scorodite. Cataclastic textures are seen near vein walls, as sheared and brecciated arsenopyrite grains - preferentially orientated Cut surface display a pseudo boxwork structure, individual holes are lined with scorodite

MODE: sulphides/Opaques: 35% arsenopyrite, 1% pyrite

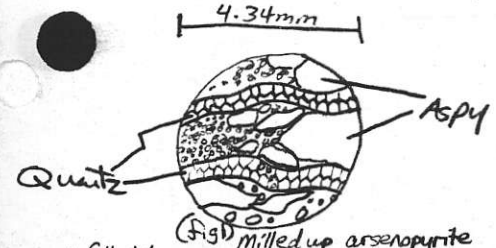
Polished Section

Gangue: Quartz
Opaque Minerals: Arsenopyrite, Pyrite, Chalcopyrite, Goethite

OPAQUES	%	SIZE LARGEST/MODE
arsenopyrite	60	2.5mm/1mm
pyrite	<1%	.5mm/.3mm
chalcopyrite	<1%	—
goethite	trace	—
covellite	trace	—
GANGUE		
quartz	40	1.5mm/.3mm

Quartz - occurs as two phases, one is euhedral quartz grains with interstitial arsenopyrite and has minor fractures, the other occurs as narrow veinlets (~.2 mm wide) a late stage cross cutting event, - the veinlets have nicely developed euhedral quartz grains which exhibit comb texture.

% TOTAL OPAQUES	MINERAL	COMMENTS
(97)	Arsenopyrite -	occurs as massive granoblastic aggregates which have undergone mechanical deformation, and display cataclasis textures. The arsenopyrite does not show any signs of post deformation healing. Infilling of milled up arsenopyrite by quartz. - the cataclasis textures show rotation of fragments and are strongest near one of the vein walls, overall a linear fabric has been imposed on the aspy



(fig) Milled up arsenopyrite infilled by quartz, and has crosscutting Qtz veins

see (fig 1)

(Aspy Cont'd)
- arsenopyrite grains noted in quartz crystals (early phase)
- through the mechanical deformation, the larger grains appear like short lensoid (small pods) grains, // to the cataclastic fabric.
- tiny grains appear to have been caught up in parts of the late stage quartz veining.
- gangue and scorodite are fracture fillings, gangue possible replacive as it sometimes is vermic

(~2%) Pyrite - minor occurrence, as euhedral to subhedral crystals, have mutual boundries with arsenopyrite and gangue, the boundries with gangue and quartz fairly sharp, ~~sh~~ with chalcopyrite are smoother
- some grains have been broken, but do not appear to be milled or greatly reduced in size.

(~1%) Chalcopyrite - occurs as tiny grains isolated interstitial to gangue, and as fracture fillings. Some of the fracture fillings have tiny arsenopyrite islands, possible replacement. The chalcopyrite is generally discontinuous in the fractures, but does appear to penetrate the arsenopyrite in some grains along weak "splits."
- possibly some bornite patches present in the chalcopyrite (exsolution?)

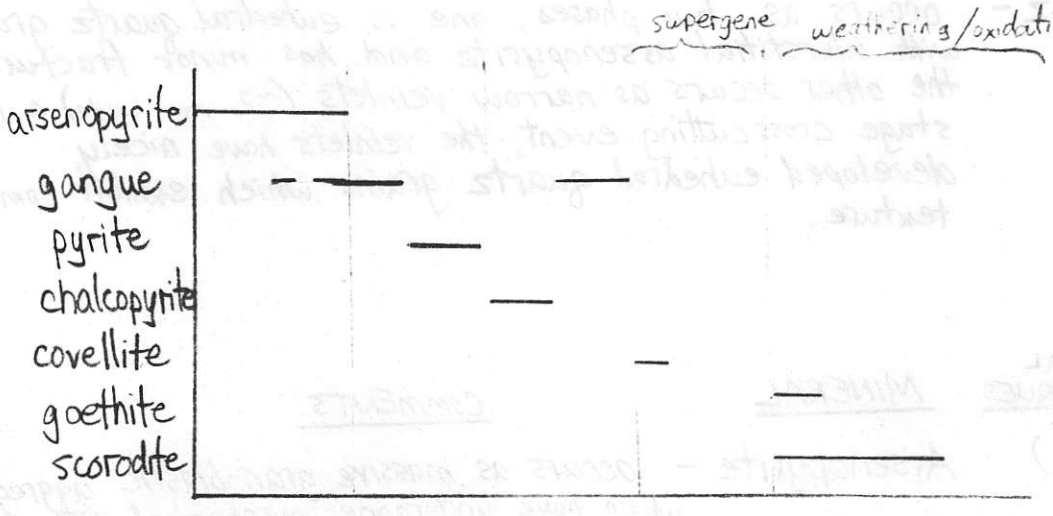
(trace) Covellite - v. minor one spot occurrence, associated with chalcopyrite and gange. No conclusive evidence for replacement.

(trace) Goethite - small amount along fractures.

(1-2%) Scorodite - exibits caries texture with gange, appears/occurs as blobs with no associated remnant arsenopyrite

PARAGENESIS

LINE DIAGRAM



V-2 (JA3TI-102)

Orientation	Width	Au ASSAYS	Ag
080/90	6-8cm	2.1g/tonne	69 grams/tonne

Sample V-1b

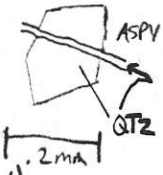
Handspecimen

Polished Section

Gangue: Quartz
Opaque Minerals: Arsenopyrite, Pyrite, Chalcopyrite, Sphalerite, Goethite

OPAQUES	%	SIZE LARGEST/MODE
arsenopyrite	26	3mm/1.5mm
pyrite	5	/.35mm
chalcopyrite	2	
sphalerite	1	—/.04mm
goethite	1	—
covellite	trace	—
GANGE		
quartz	65	.25mm/.15mm

Quartz - occurs as euhedral to subhedral grains, with interstitial arsenopyrite, chalcopyrite and pyrite. Quartz also infills fractures of the arsenopyrite and crosscuts earlier quartz crystals. (fig 1)



(fig 1) 2nd generation of qtz crosscutting euhedral quartz grain

% TOTAL SULPHIDES	MINERAL	COMMENTS
(74)	Arsenopyrite	- occurs as rather massive bands of subhedral to anhedral crystals. The arsenopyrite is well fractured, many are branching, overall a preferred orientation is noted ⊥ to strike of the bands/vein. (fig 2) - coarser grained than the other other sulphides and has taken a fairly good polish. - fractures are filled mainly by quartz but also by pyrite, chalcopyrite and goethite

(fig 2) Depiction of fractures branching in arsenopyrite grains

(Arsenopyrite Contd)

(14) Pyrite - occurs as subhedral grains either isolated between gangue, or as cluster of grains. Also occurs as tiny veinlets in the arsenopyrite (maximum width = .15mm) possibly replacive as veinlets as veinlets splay off into the arsenopyrite and end in the middle of a grain.
- veinlets are crosscut by a late generation of quartz.
- quartz included in some grains

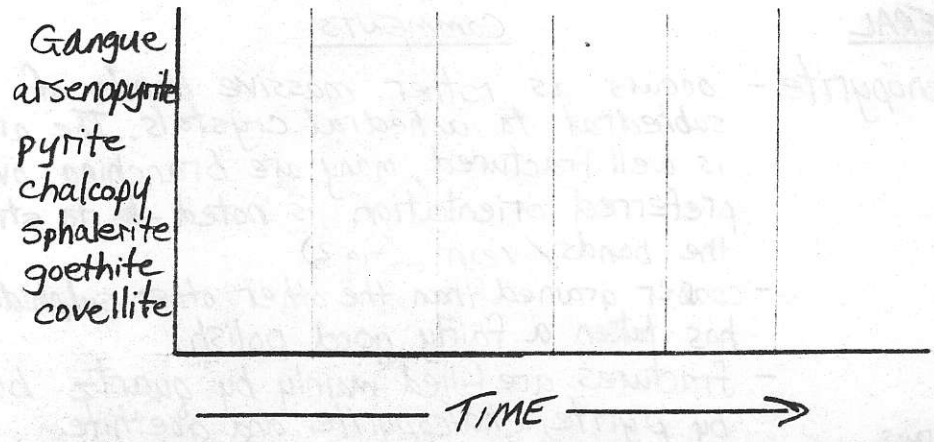
(6) Chalcopyrite - occurs as discontinuous small bands interstitial to quartz grains, having smooth but irregular outlines. (also)
- includes some sphalerite grains, which themselves have v. tiny chalcopyrite dots.
- also occurs v. similarily to the pyrite in arsenopyrite (veinlets), also possibly replacive of arsenopyrite.
- has mutual boundries with pyrite and quartz

(3) Goethite - common along fractures in the arsenopyrite - possibly the product of pyrite veinlets starting to weather out.

(3) Sphalerite - minor occurrence, only with the chalcopyrite as subhedral included grains

(trace) Covellite - minor occurrence with chalcopyrite, did not appear to be replacing chalcopyrite.

PARAGENESIS



V-16 (JA3T1-100)

Orientation	Width	GEOCHEM Cu	As	Au	Sb	Ag	ASSAYS Au	Ag
079/90	5-10cm	—	—	—	—	—	1.6g/tonne	11g/tonne

Sample No. V-7

Handspecimen

Polished Section

Gangue: Quartz, Calcite
Opaque Minerals: Pyrite, Sphalerite, Goethite, Chalcopyrite

OPAQUES	%	SIZE LARGEST/MODE
pyrite	20	1.5mm / .5mm
sphalerite	5	2.5mm / .6mm
goethite	1	—
chalcopyrite	1	.2mm / <.1mm
unidentified	trace	— / <.1mm
GANGUE		
quartz	70	2mm / .6mm
calcite	3	- / <.1mm

Quartz- euhedral grains and fragments, fragments are subangular to subrounded and include broken grains (<1cm - <1mm)
- also occurs as matrix, of breccia - fine grained

Calcite- crosscuts quartz, but appears to be pre-brecciation as no distinct continuous veinlets are observed.
- brownish tinge probably due to Fe content of calcite.

% TOTAL OPAQUES	MINERAL	COMMENTS
(74)	Pyrite	- occurs within fragments of quartz, it itself has been highly fractured and granulated to produce parallel to subparallel fragments - strongly pitted and corroded by goethite and limonite.

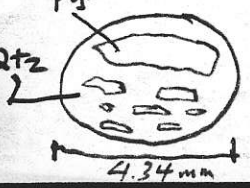


fig 1 - elongate pyrite frags in qtz.

(Pyrite cont)

- contain inclusion of quartz (?)
- no mutual boundries with sphalerite or chalcopyrite.

(19) Sphalerite - one particular grain appears frozen, as fragments are peeling off of it.
- rotated fragments seen localized by other larger fragments, - granulated.
- no chalcopyrite seen in large fragment, but smaller fragments have cpy near their grain boundries - no evidence for replacement.
- occurs mainly as non-aligned fragments.

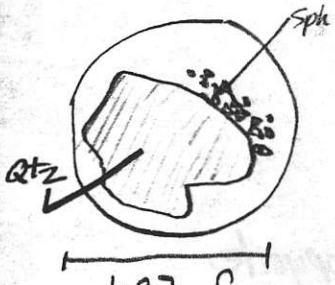


fig 2

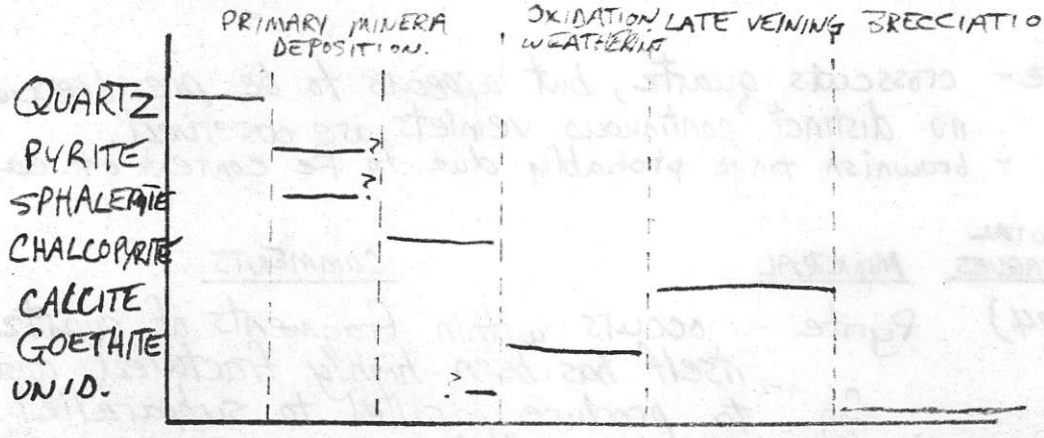
Sphalerite fragments localized at quartz grain edge.

(4) Goethite - substantial amount associated with pyrite, along fractures, and as rims around grains.

(4) Chalcopyrite - small <.2mm grains, broken and rotated in quartz matrix.

(trace) Unidentified gray mineral - in contact with pyrite, as small anhedral looking grains. Properties include mod. anisotropism, low reflectivity, softer than pyrite, gray-brown tint, no clvg., no bireflectance, has no internal reflection
- quartz within this mineral

PARAGENESIS



Sample V-8c (cut subparallel to Fe-carbonate veins)

Handspecimen

Polished Section

Gangue: Quartz, Iron-Carbonate
Opaque Minerals: Arsenopyrite, Goethite-(Scorodite(?)), Pyrite.

OPAQUES	%	SIZE LARGEST/MODE
arsenopyrite	62	3mm/1.5mm
goethite	} 3	—
scorodite(?)	}	—
pyrite	<1	—
stibnite?	<1	tiny needles
GANGUE		
quartz	20	1.5mm/.4mm
iron-carbonate	15	.5mm/.2mm

Quartz - occurs mainly as fine subhedral grains, and has arsenopyrite fragment included in a fracture filling generation of quartz.
- crosscut by Fe-carbonate veins
- appears to be a possible 3rd generation of quartz in the form of vugs, although no crosscutting relationships were noted the color of the vuggy quartz was different in x-nicols.

Iron Carbonate - the brownish staining in handspecimen is also distinct here, and conspicuous along fractures. The carbonate is subhedral equigranular and occurs as late veins with a few fractures.

- the contact between the carbonate and the quartz seems to have a concentration of tiny detrital oxide/sulphide fragments
- side of polished section displays carbonate vein offset by a microfault.

% TOTAL OPAQUES	MINERAL	COMMENTS
(93)	Arsenopyrite	- grains are subhedral mainly, occur as coarse masses, with little quartz, the arsenopyrite has been quite fractured. - fracture filling include quartz with later oxidation to scorodite and goethite. The fillings appear to have caused brecciation of arsenopyrite grain walls, as fragments are caught up in filling material. (Fig 1) - no healing of fractured grains noted - no replacive textures noted of quartz in arsenopyrite, but arsenopyrite appears to be included in quartz grains.
(5)	Goethite	- quite abundant as found on fractures of arsenopyrite possibly includes scorodite along fractures but no positive identification made.
(1)	Pyrite	- only a few subhedral grains located, mutual grain boundries only with quartz
(1)	Stibnite(?)	noted, tiny needles as inclusions in quartz grains, too small for positive identification.

Fig. 1
fractured grain of arsenopyrite

PARAGENESIS