

161B. 090 Woodbine (1)

019269

Nick Hughes

Sample # W.B. = 1 a.

### Handsample:

- mineralogy (sulphides)

5% pyrite

5% sphalerite - black → Reddish black

< 1% Galena - fine grained, associated with sphalerite

- Host rock:

- Altered volcanic flow rocks probably of Andesitic comp. - sulphides exist in brecciated regions within the Host.

- Alteration of wall rock includes silicification and variable amounts of chloritic and pyritic and carbonaceous alterations.

Textures: This rock displays bouding, dissemination and replacement textures of the sulphides.

- The pyrite appears to have formed large replacement blebs in the breccia fragments.

- the sphalerite is banded in the spaces between fragments.

- the Galena, pyrite, and sphalerite also appear to be disseminated throughout the breccia.

### Polished Section:

- Mineralogy:

Sulphides

10% pyrite

12% sphalerite

1% Galena

3% chalcocopyrite

- 2% covellite - maybe due to polishing

Gangue

Quartz

Calcite

trace tetrahedrite -

higher polishing brightness than Galena  
grey with lower reflectance than Galena  
Associated with sphalerite along boundaries  
with pyrite - pH almost the same as chalcopyrite  
- slight bluish tint

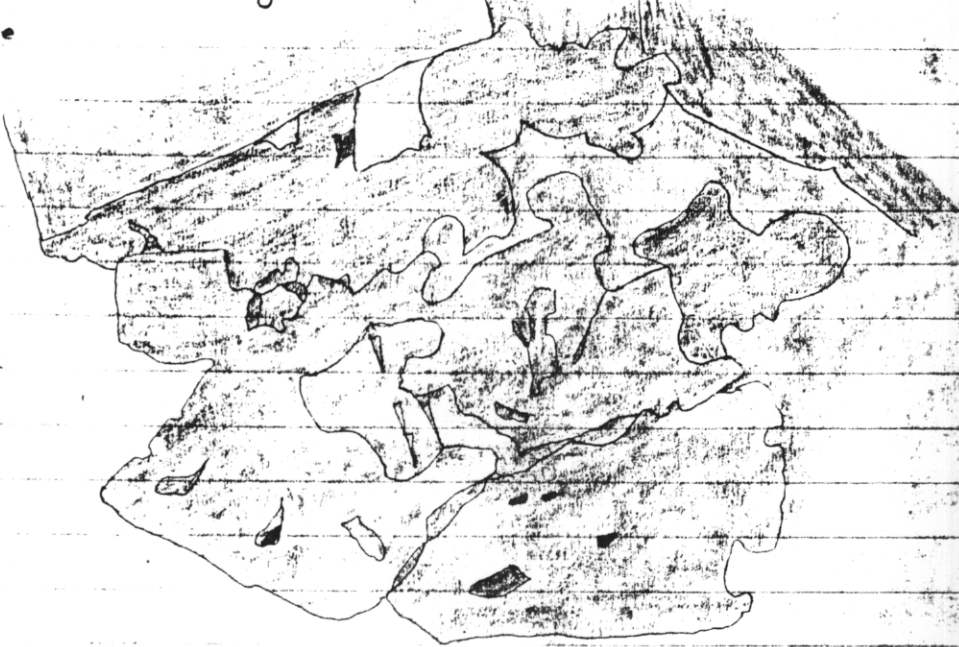
trace mineral X

- too fine grained for complete I.O.D. (i.e. 0.01mm)  
Probably pyrite or Arsenopyrite - cubic + rhombic  
in shape - white with fairly high reflectance - middle  
Anisotropic found associated with Galena and sphalerite

textures and mineral relationships

- pyrite has good crystal faces, but it has been fractured and replaced by Galena sphalerite and chalcopyrite

- - pyrite
- - chalcopyrite
- - galena
- - sphalerite with emulsion textured chalcopyrite



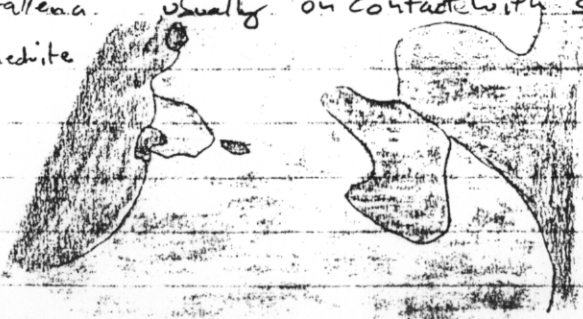
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← 0.5mm →

- There appears to be some definite recrystallization of pyrite forming euhedral xtal surfaces in open spaces. See diagram next page
- There is also some gangue minerals that have euhedral x-tals projecting into open spaces. Most of the gangue in the veins is calcite + Qtz
- tetrahedrite occurs as small inclusions within Galena usually on contact with sphalerite

■ - tetrahedrite



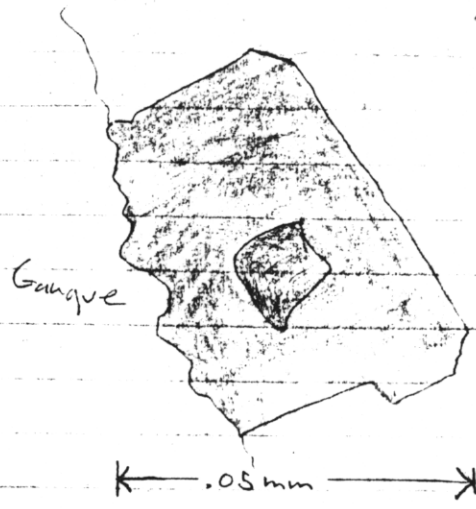
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← 0.1mm →

- covellite forms small alteration rims around some chalcopyrite grains - or inclusions when associated with galena

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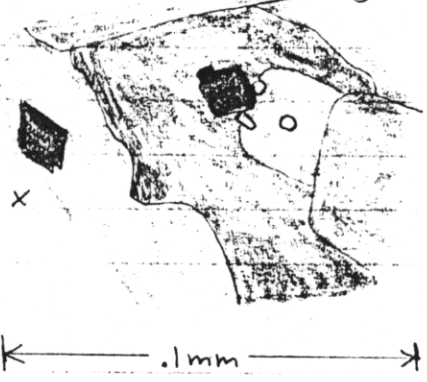


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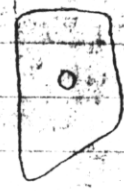


- mineral x forms euhedral crystals within sphalerite and Galena

□ - Gangue  
■ - mineral-x

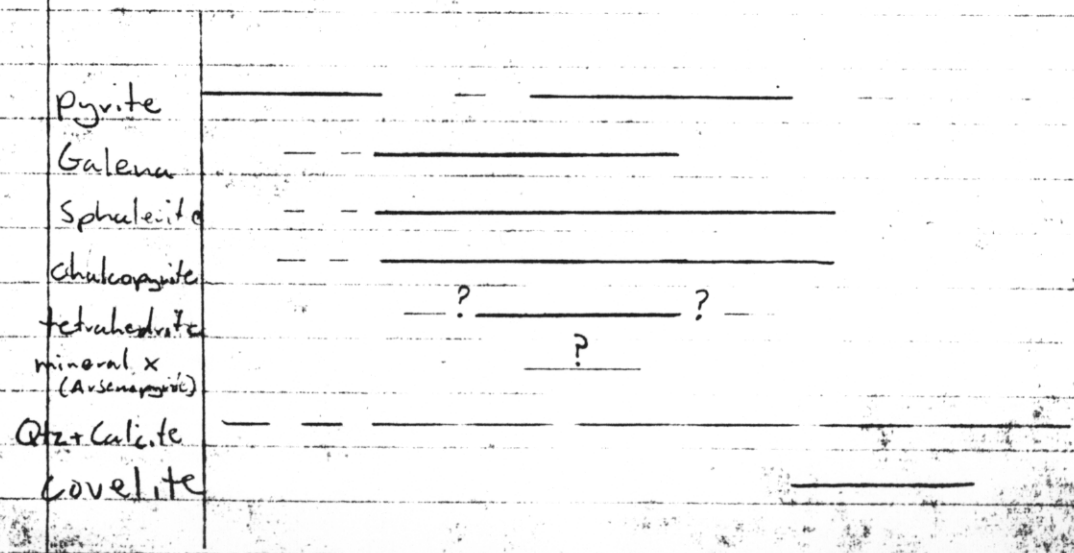


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- large quantities of chalcopyrite as inclusions in sphalerite. sometimes there is strong crystallographic control

diagenetic sequence



Sample # WB - 1b

Hand Sample:

- Mineralogy (sulphides):
  - 5% pyrite
  - trace of Galena
- Host rock:
  - Altered brecciated volcanic rock probably andesitic composition - the rock has been shot through with chlorite, quartz and calcite veins
  - The Alteration includes Alteration to chlorite and some silica and pyrite flooding.
- textures: - Some of the pyrite is drawn out parallel to the chlorite vein, while in other areas the pyrite appears as replacement in some of the breccia fragments. The pyrite ranges from large ground up masses to fine grained disseminated grains. the galena appears as small grains disseminated through the pyrite parallel to the chlorite vein. chlorite occurs in thin veins surrounded by earlier silica veining

polished section:

Sulphides

15% pyrite

1% sphalerite

- trace Galena

trace Gold (incomplete extinction)

trace chalcopyrite (high reflectance)

Gangue

10% Quartz

5% Calcite

20% chlorite

5  
textures:

pyrite - mainly concentrated in two veins that surround the chloritic zone. form large masses of pyrite grains. these grains are fairly inclusion rich and range from ragged irregular masses to euhedral cubes. there are some (i.g. pyrite cubes throughout altered wall rock but the chlorite zone is completely devoid of pyrite

Sphalerite - occurs in veins as large irregular masses with chalcopyrite emulsion. It also occurs as skeletal blende crystal that have been eroded by chlorite. This sphalerite in the chlorite zone lacks any emulsion textured chalcopyrite.

Galena - found associated with sphalerite but also found as a central core in what appeared to be an open space which was filled with calcite & then Galena

Chalcopyrite - occurs as emulsion texture in sphalerite and as f.g. disseminated particles through out some regions of the altered host rock. very low concentration

Gold - occurs as ultra fine grained interstitial blebs within the chlorite zone. Gold ranges from less than 1 micron up to ~10 microns in diameter. appears to have grown around crystal outcrops

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within the chlorite zone

Calcite - forms fairly large euhedral rhombs  
which appear to have grown in open  
spaces.

- Pyrite \_\_\_\_\_
- Sphalerite \_\_\_\_\_
- Galena \_\_\_\_\_
- Gold \_\_\_\_\_
- Chalcopyrite \_\_\_\_\_
- Chloritic Alt. \_\_\_\_\_
- Quartz \_\_\_\_\_
- Calcite \_\_\_\_\_

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Sample # WB - 2a

Polished section:

- Mineralogy:

Sulphides

- 30% sphalerite
- 10% pyrite
- 10% chalcocopyrite
- < 1% Galena

± tetrahedrite - slightly bluish grey - associated with sphalerite & chalcocopyrite  
 pH = chalcocopyrite

Gangue:

- calcite
- Quartz
- chlorite

- textures:

- pyrite: pyrite is disseminated throughout varying in size from 2mm → .01mm. The larger masses have many inclusions of sphalerite displaying emulsion texture with chalcocopyrite. The larger grains tend to be fractured with chalcocopyrite replacing them along fracture surfaces - especially broken up along thin veinlets that transect the section. Some of the large xstals are perfect cubes with emulsion textured sphalerite inclusions and these cubes are then surrounded by emulsion textured sphalerite, other grains

appear to have been ~~slightly~~ replaced by sphalerite.

- sphalerite + chalcocopyrite
- pyrite



← 5mm →



← 2mm →

- some inclusions of chalcocopyrite

- sphalerite - Some large masses of sphalerite with emulsion textured chalcocopyrite included in it. The larger masses branch out into other

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Sulphides and gangue minerals. The Sphalerite masses are also included, and in contact with grains of chalcopryite that are significantly larger than the emulsion chalcopryite. Large masses also contain inclusions pyrite, galena and Calcite. Sometimes in small veinlets

- calcite



- fringes often show micropenetration into gangue minerals

Chalcopryite - extremely varied occurrence. It occurs as small (~.001mm) almost rectangular blebs as ~~an~~ emulsion texture with sphalerite. It occurs as large masses both within a sphalerite mass and rimming sphalerite masses. This



← Chalcopryite appears to have grown and connected itself together incorporating sphalerite and pyrite inclusions. The chalcopryite also occurs as a replacement of pyrite within fractures and sometimes as a rimming. The chalcopryite was also associated with a phase of calcite veins where it occurs as Salvages (not quite at edge of vein, but close). This appears to be the last mineralizing phase

W/In sphalerite

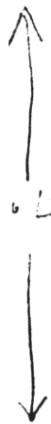
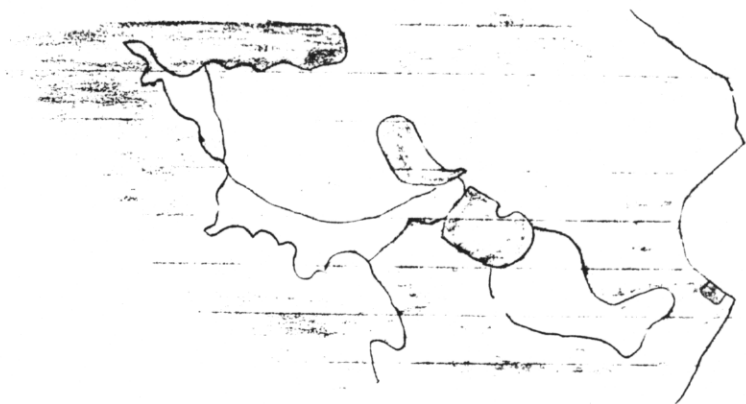


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Galena - most commonly associated with sphalerite  
Chalcopyrite. Less commonly as inclusions in  
sphalerite and gangue minerals.

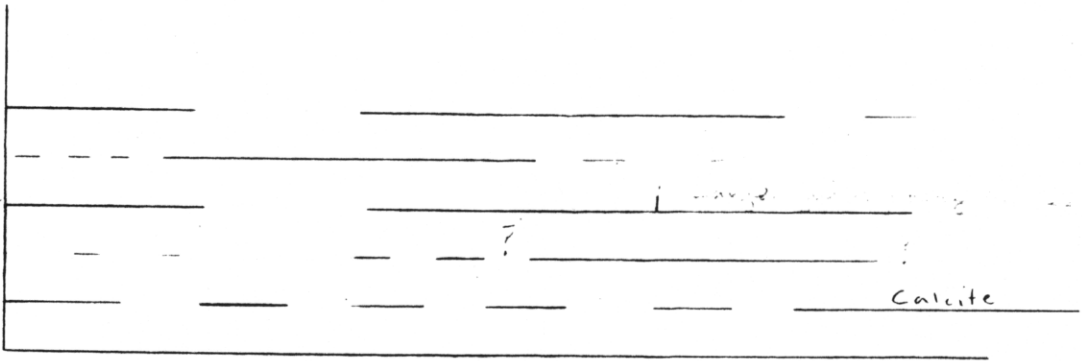
gangue  
Galena



0.4

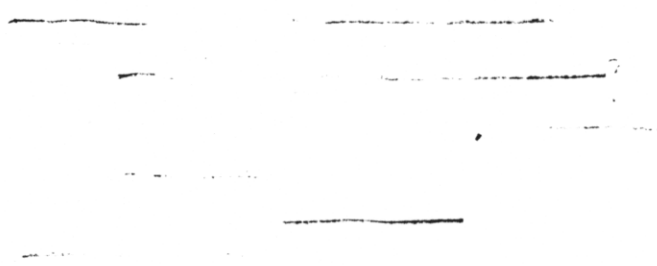
tetrahedrite - occurs as small inclusions (commonly) within sphalerite and galena. Chalcopyrite inclusions.

Sphalerite  
~~Pyrite~~  
~~Chalcopyrite~~  
tetrahedrite  
Gangue



time

At  
Nick  
sphalerite  
chalcopyrite  
tetrahedrite  
gangue



translucent  
metallic  
and

WB - 3a

Hand specimen:

- Mineralogy

- 30% Sphalerite
- ~2% pyrite
- trace chalcopyrite - along edges of sphalerite veins
- 50% Altered host rock
- 1% Calcite + Qtz - Scattered in sphalerite veins
- trace of yellow oxide (scorodite?)

- Host rock - appears to be a highly altered Andesite flow that has been fractured and brecciated. The alteration includes pyritization, chloritization and silicification with minor what appears to be late stage carbonatization

- Sulphide textures

- pyrite has been finely disseminated throughout with some larger blobs being concentrated in veins of Sphalerite
- Sphalerite occurs in coalescing veins that grew in open spaces between breccia fragments. The Sphalerite ranges in colour from black to reddish brown
- Chalcopyrite - associated with sphalerite veins as small inclusions

Thin Sections:

Mineralogy

Sulphides:

- 30% - Sphalerite
- 2% - pyrite
- 3% - chalcopyrite + trace tetrahedrite
- <1% - Galena - light association with chalc + sph.
- trace - coselite - as alteration around rims of chalcopyrite at edges of veins.

THIS piece of rock  
is a sample  
from the veins

Important gangue minerals

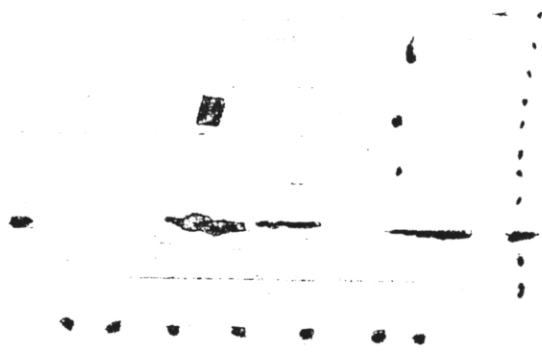
- Quartz - Salty
- Sphalerite veins (+ Arsenopyrite)
- Calcite - rhombic
- Chalcopyrite - large grains

textures

- Sphalerite: occurs as veins veins veins,  
it is not not not chalcopyrite not not not (leading to)

a crystallographically  
contorted enclaves  
texture. Sphalerite  
is not fingered  
in the vein  
boundaries. The penetration  
in the vein is  
gangue is not not  
deep. Sometimes

- Sphalerite
- Chalcopyrite



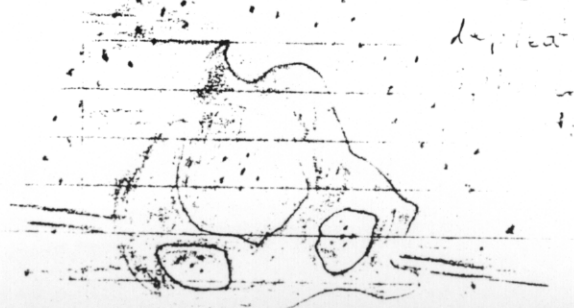
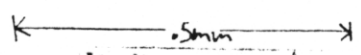
found as  
inclusions within pyrite. Along peripheries of  
veins, sphalerite appears to have been at least  
partially replaced by a mineralization of gangue

including quartz, calcite & chlorite. Chalcopyrite that is finely intergrown  
with chlorite is very light and has no chalcopyrite in it - difficult to identify but through comparison  
study with other grains one finds that there is a complete transition from chlorite to  
the not so obvious.

- pyrite - large grains (approx. 0.5mm to 1mm).

These veins have many inclusions of  
and some chalcopyrite, grains have  
sphalerite veins are found and replaced by pyrite

- chalcopyrite - occurs as veins veins veins  
oriented veins veins veins. These are  
large grains with veins veins veins  
instead of veins veins veins within them.



These larger grains appear to have  
depleted the first chalcopyrite in the surrounding  
matrix. Often associated with veins veins veins  
typical - large veins veins veins  
chalcopyrite

Sometimes the chalcopryite is penetrated by Euhedral Calcite rhombs.

Galenite <sup>+ pyrite?</sup> intercoupled with chalcopryite but sometimes as inclusions within Sphalerite. Mostly unbedded with some associated with covellite interstitially with pyrite + quartz.

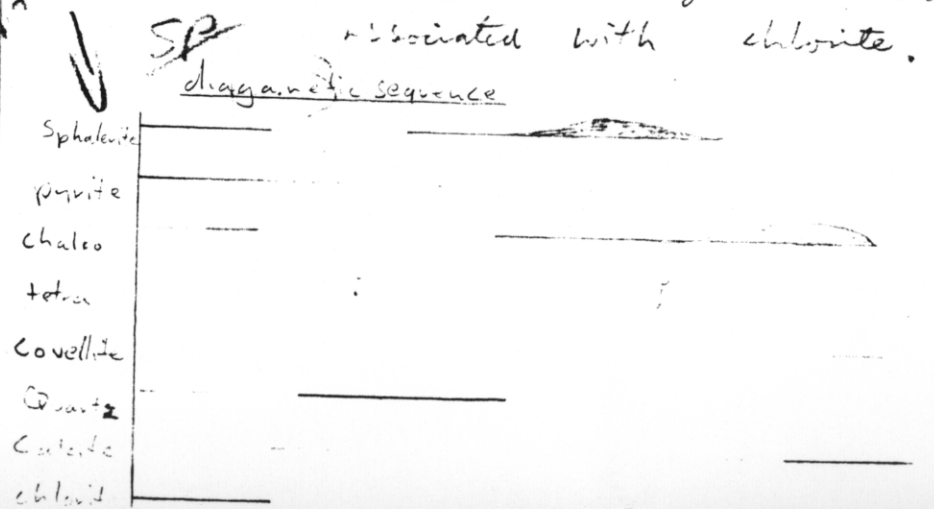
Covellite: - Alteration rim on some chalcopryite grains - usually grains that are close to vein boundaries.

Gangue minerals - All the gangue minerals have fairly distinct paragenetic relationships. Quartz occurs as vein saunders and no rims around wall rock islands within veins. Calcite appears to have formed after them creating been deposited later is perfect shows cutting into chalcopryite. Chlorite appears to be mainly an alteration product of the host rock and appears to have a fair amount of control over the position of the sulphide within the wall rock. Sphalerite has formed several blonde crystals which lie any chalcopryite when they are associated with chlorite.

hydrothermal  
pyrite  
pyrrhotite

hydrothermal  
alteration

Synsaccul  
pyrite



WB - 36

Hand Specimen?

- sulphide mineralogy
  - 5% pyrite
  - 1% sphalerite
- Host rock - highly altered flow rock probably of Andesitic composition. Contains white phenocrysts (~ 2mm) of K-feldspar. The rock has been altered and fractured. Alteration assemblage includes silica, chlorite and minor sericite. The fractures have been filled with calcite, pyrite and sphalerite. Some of the veins have bar work structures present.
- textures: - multiple veining including minute silica veins ~ 1mm and sulphide veins that curve in many directions. The rock could be a breccia with the open spaces between fragments being filled with sulphides. Some of the sample is fairly vuggy with calcite precipitating within the vugs. Hydro zincite is present on weathered surfaces.

Polished section:

- mineralogy:

Sulphides + important gangue

- 5% pyrite
- < 1% sphalerite
- trace chalcocite
- trace tetrahedrite

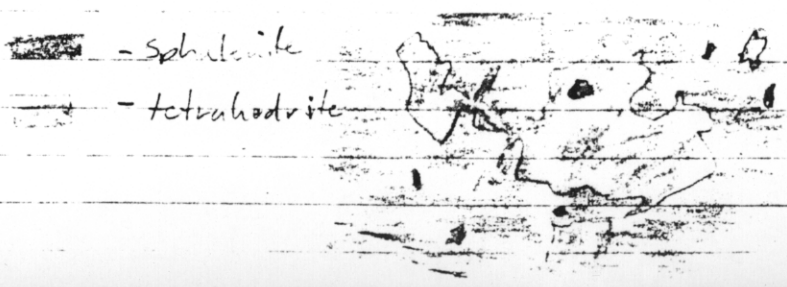
1% Quartz in veins

textures

- pyrite - large range in size and euhedrality disseminated throughout wallrock with concentrations in veins. pyrite within the wallrock appears to be more euhedral, and the pyrite in the veins is fractured and being replaced sphalerite + chalcopyrite. Much of the pyrite has inclusions of sphalerite and chalcopyrite within them. In many crystals it is hard to determine if the relationship between pyrite and sphalerite is replacement or actual inclusions of sphalerite within pyrite.

Sphalerite - occurs in veins and as disseminated grains throughout altered host rock. The sphalerite in the host rock is light in colour and appears as a whitish yellow under crossed nicols. They appear to be remnant crystals that have been destroyed through the growth of chlorite. The sphalerite occurring in the veins is darker and appears black under crossed nicols. The sphalerite has an ultrafine grained inclusion texture of chalcopyrite throughout most of it. It often contains relatively large amounts of Tetrahedrite. It is often associated with larger grained chalcopyrite.

tetrahedrite - occurs exclusively with sphalerite usually as irregular masses which may be replacing or growing syngenetically with the sphalerite.



- it occurs in both the light disseminated sphalerite as well as in the larger vein sphalerite. The colour of the sphalerite may vary.

thickness. chalcocite is also associated with sphalerite in much the same fashion.

chalcocite : occurs in several ways. It occurs as an ultra fine grained emulsion in sphalerite. It also occurs as larger more irregular masses within sphalerite and along edges of sphalerite veins. It also occurs as a replacement of pyrite within the wallrock but close to the vein. Larger grains within the sphalerite create depletion halos lacking in iron textured chalcocite.

- pyrite \_\_\_\_\_
- Sphalerite \_\_\_\_\_
- Chalcocite \_\_\_\_\_
- tetrahedrite \_\_\_\_\_
- alteration \_\_\_\_\_ chlorite \_\_\_\_\_
- Gangue veining \_\_\_\_\_

WB-4a

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Hand specimen:

- Sulphide mineralogy:

25% pyrite

5% sphalerite

5% chalcopyrite

- Host rock - altered & brecciated andesitic flow rock - fragments contain white K-spar phenocrysts. rock has been altered to a resulting alteration assemblage of chlorite, silica carbonate.

- Textures - Sulphides form veins that surround and sometimes penetrate fragments - larger veins display distinct banding. The sulphide veins appear to have been followed by the emplacement of large calcite veins

polished section:

Sulphide + important gangue mineralogy

-30% pyrite

8% sphalerite

5% chalcopyrite

< 1% Galena

trace tetrahedrite

30% Quartz



textural relationships.

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pyrite: Coarse grained (up to 10 mm). Euhedral when associated with Qtz, but usually fractured and irregular when associated with other sulphides. Often contain inclusions of Sphalerite, chalcopyrite + Galena + Tetrahedrite? is also being replaced by Sphalerite, chalcopyrite and tetrahedrite

sphalerite - generally forms large masses with chalcopyrite, both as emulsion and as large irregular masses, and tetrahedrite. These masses penetrate fractures in pyrite and start replacing the pyrite. It also occurs with chalcopyrite in small veins through Quartz - sphalerite in large chalcopyrite masses is generally devoid of emulsion textured chalco.

chalcopyrite - intimately associated with sphalerite and tetrahedrite - forms both small emulsion blebs + large irregular nests in sphalerite. It also occurs as veins in Qtz and as a replacement of pyrite - occurs along grain boundaries in Qtz

Galena - occurs in every situation sphalerite and chalcopyrite occur - fair amount as replacement - fairly localized

Quartz - fairly euhedral crystals except where in contact with sphalerite and to a lesser degree chalcopyrite

tetrahedrite - rare tiny grains associated with Galena and chalcopyrite.

textural relationships.

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Quartz - fairly euhedral crystals except where in contact with sphalerite and to a lesser degree chalcopyrite

tetrahedrite - rare tiny grains associated with Galena and chalcopyrite.

Wb - 4b - same rock as 4a but from a less mineralized section

polished section

Sulphides & important gangue

- 10% pyrite
- 10% Sphalerite
- 2% chalcopyrite
- trace Galena
- Quartz
- Calcite
- trace tetrahedrite

textures:

pyrite - grains in host rock are fairly euhedral, and grains in contact with other sulphides are irregular in shape because they are being replaced by sphalerite, chalcopyrite + tetrahedrite. some grains contain inclusions of these other minerals.

occurrence of pyrite is exactly the same as for the other sections - appears to be a minor remnant of rextl.

sphalerite - occurs in veins with euhedral + etched chalcopyrite + coarse grained chalcopyrite & galena and calcite laths. occurs as replacement as well as inclusions in pyrite. inclusion of chalcopyrite are irregular, but there appears to be some crude crystallographic growth contact. also found with chalcopyrite as minor penetrating veinlets around gangue crystal faces and fractures - especially Qtz.

tetrahedrite - found as grains within and bounding galena

(8)

Galena - found associated with sphalerite and chalcoprite also found as monomineralic inclusions in pyrite and in small blebs veinlets in Qz. much the same as in other samples.

occurs along grain boundaries in calcite  
chalcoprite - associated with sphalerite + tetrahedrite and commonly contains calcite laths. also found partially disseminated through altered wallrock with blonder sphalerite + minor tetrahedrite. found as a replacement or as inclusions within pyrite. also found as minor pseudoveinlets along Qz crystal faces and in fractures

Qz - occurs in euhedral masses often with interstitial pyrite, chalcoprite, sphalerite and tetrahedrite. peripheral edges of Qz masses are fairly rounded with no distinct crystal faces

Calcite - occurs as euhedral crystals within sulphide veins plus as well formed crystals in contact with Qz.

pyrite \_\_\_\_\_  
sphal. \_\_\_\_\_  
Gal \_\_\_\_\_  
Chalca \_\_\_\_\_  
Qz \_\_\_\_\_  
Calcite \_\_\_\_\_

WB-5a

Hand specimen

Sulphide mineralogy

- 710% pyrite
- 1% sphalerite

Host rock - multi-phases alteration of an andesite breccia. fragments show many alteration zones.

Info From thin section: slide # WB-5a

- central core - diameter ~ 1.5mm

- ~80% sericite
  - 10% chlorite
  - 10% Qtz fractures
  - 1% pyrite
- fuzzy mass with little to no textural information

- first rim - Not continuous actually a subzone of the central core

- 50% chlorite
- 40% sericite
- 10% f-y Qtz

- second rim - 3.4mm thick

- 60% Quartz - tri-modal occurrence
- 30% - as ultrafine grained foam textured masses, - associated with sericite
- 30% as large grained foam texture
- 30% K-spar - large elongate xtals
- 5% chlorite - evenly distributed throughout
- 5% sericite - some in f-y masses - some in fractures - some as f-y masses pseudomorphing probably plagioclase.
- 1% pyrite - euhedral xtals

Z 20

Outer rim - .5 mm thick (variable)

100% chlorite - deflects around

large k-spar crystals

- inter fragment veins

40% Quartz - euhedral x'tals <sup>some cross chlorite zone</sup>  
<sub>- often have central sericite inclusions</sub>

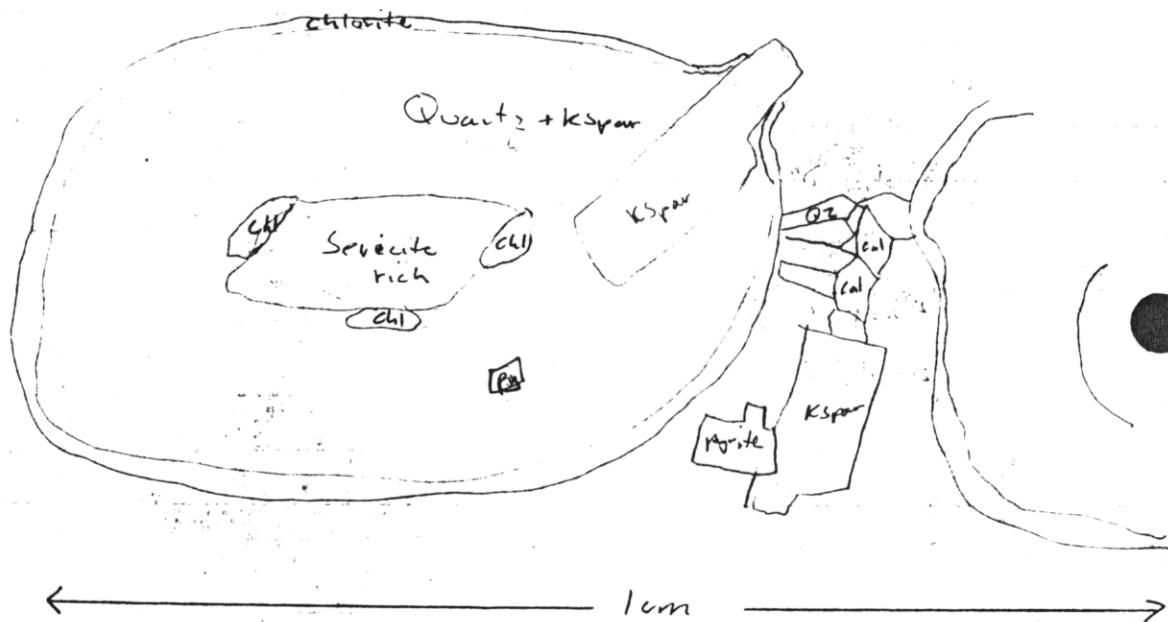
20% Calcite - central location within vein

10% sericite - associated with calcite

10% sulphides

20% k-spar - large tabular x'tals

trace chlorite



- Altered fragments range in size up to ~4cm

polished section:

Sulphide & important gangue mineralogy

15% pyrite

<1% sphalerite

trace chalcocopyrite

trace tetrahedrite (rare)

Calcite

Quartz - due to problems of identification this category includes k-spar - which is reasonable because Qz + k-spar appear to have similar appearance at almost the same time

textures:

pyrite - fairly euhedral throughout. fine-grained

pyrite is disseminated throughout altered

fragments. Coarse grained pyrite exists in the veins with sphalerite + chalcopyrite. pyrite contains inclusions of sphalerite + chalcopyrite. It is also being replaced by these same minerals in the veins. maybe some minor recrystallization in veins

- Sphalerite - occurs with chalcopyrite within the veins, and occasionally in small fractures penetrating the breccia fragments. Contains emulsion textured chalcopyrite.

- pyrite  
- Sphalerite with emulsion chalcopyrite



associated with calcite and Qz. replaces pyrite. true inclusions within pyrite have little or no chalcopyrite

- chalcopyrite - occurs frequently in mono-mineralic blebs along grain boundaries of Qz + Kspar. found as both inclusion and replacement of pyrite. occasionally associated with tetrahedrite.

- tetrahedrite (rare) - associated with chalcopyrite and sphalerite.

Quartz, calcite, Kspar - see thin section analysis. →

pyrite	_____	_____	_____	_____
chalcopyrite	_____	_____	_____	_____
sphalerite	_____	_____	_____	_____
tetrahedrite	_____	_____	_____	_____
chlorite	_____	_____	_____	_____
Quartz	_____	_____	_____	_____
Kspar	_____	_____	_____	_____
serp	_____	_____	_____	_____
calcite	_____	_____	_____	_____