GEOL. 409 3H065 HT

MINERALOGRAPHIC REPORT

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Problem #3

PARAGENESIS OF SILVER BEARING LOCALITIES.

March 1965

WHITE MOOSE CLAIMS.

There were no hand specimens present with the polished sections.

Microscopic Determinations

<u>Tetrahedrite</u>: $Cu_{12}As_{11}S_{13}$ (thd)

Polish	- v. good
Color	- light grey to bluish grey
Hardness	- D
Streak	- black
Texture	- "caries texture" with Cp.
Isotropic	
Internal Refl.	- red
Association	- Cp, ga, sl, py.
Etch Tests	
HNO_3	- slow brownish tarnish
others	- neg.

<u>Chalcopyrite</u>: $CuFeS_2$ (Cp)

Polish	- v. good
Color	- yellow
Hardness	- C
Streak	- blackish
Texture	- replacing sl, thd.
Anisotropism	- distinct...greenish brown to grey.
Texture under crossed nicols	- replacement of thd, emulsion with sl.
Association	- thd , sl
Etch Tests	- neg.
Microchem.	- strong test for Cu.

<u>Galena</u>: PbS (Ga)

Polish	- v. good
Color	- "galena" white
Hardness	- B
Streak	- black
Texture	- replacing Cp, Sl, Thd

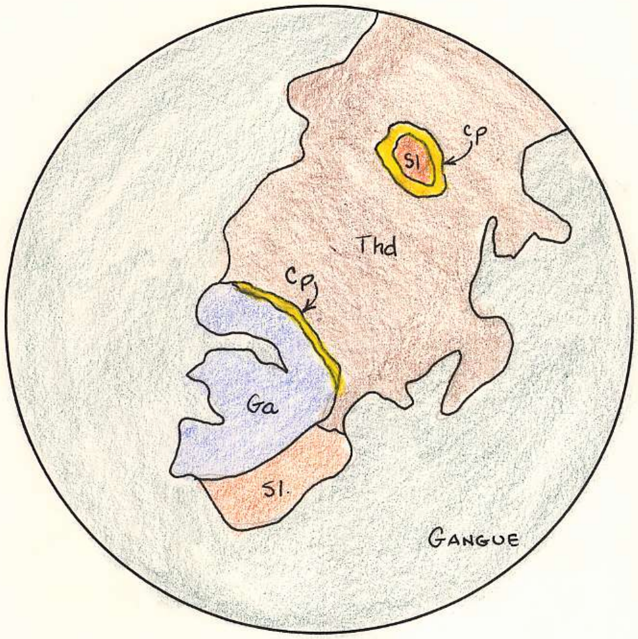


Figure 1. Sketch of Mineral Assemblages, 80X
White Moose Claims.

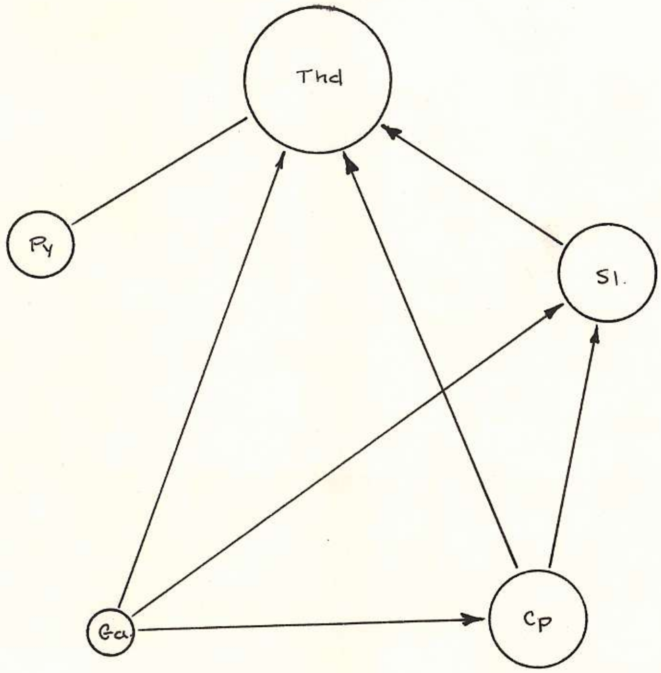


Figure 2. Van deVeer Diagram for Ore Minerals from
White Moose Claims.

Isotropic	
Association	- Cp, Thd, Sl.
Etch Tests	
HCl	- brown to irridescent tarnish which showed evidence of cleavage.
$FeCl_3$	- irridescent stain
HNO_3	- effervescence, stains irredescent to dark grey. Gives off H_2S
Others	- neg.

<u>Sphalerite</u>: (Zn,Fe)S (Sl)

Polish	- v. good
Color	- brownish grey
Hardness	- C
Streak	- blackish
Texture	- "mottled" or emulsion with Cp. replacement of Thd.
Isotropic	
Internal Refl.	- powder shows honey brown int. refl.
Association	- Cp, Thd, Ga.
Etch Tests	
$HgCl_2$	- slight irridescent tarnish that rubbed off.
HNO_3	- dark brown stain.
others	- neg.
Microchem Tests	- strong test for Zn and Fe.

<u>Pyrite</u>: FeS_2 (Py)

- of minor occurrence.

Paragenesis (see Figs. 1 and 2)

Pyrite was the first mineral to form. During hydrothermal activity argentian tetrahedrite replaced the pyrite. Then chalcopyrite and sphalerite replaced the tetrahedrite, themselves in turn being replaced by galena. The argentian tetrahedrite was probably in the form of Freibergite.

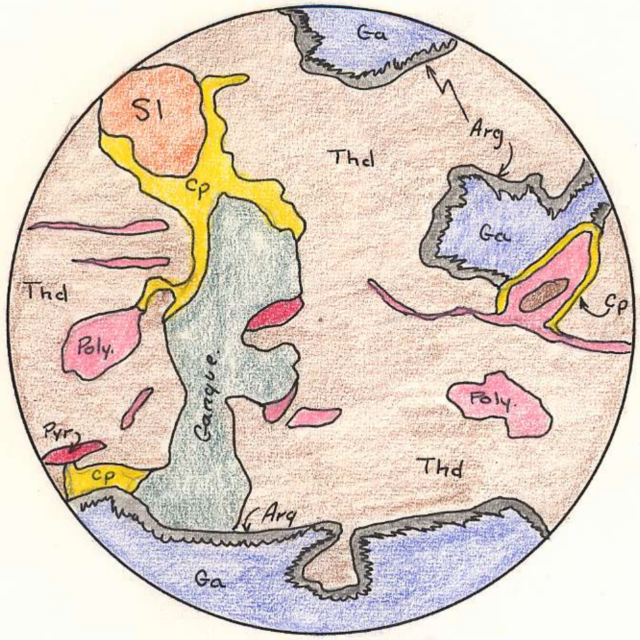


Figure 3. Sketch of Mineral Assemblages. 80X

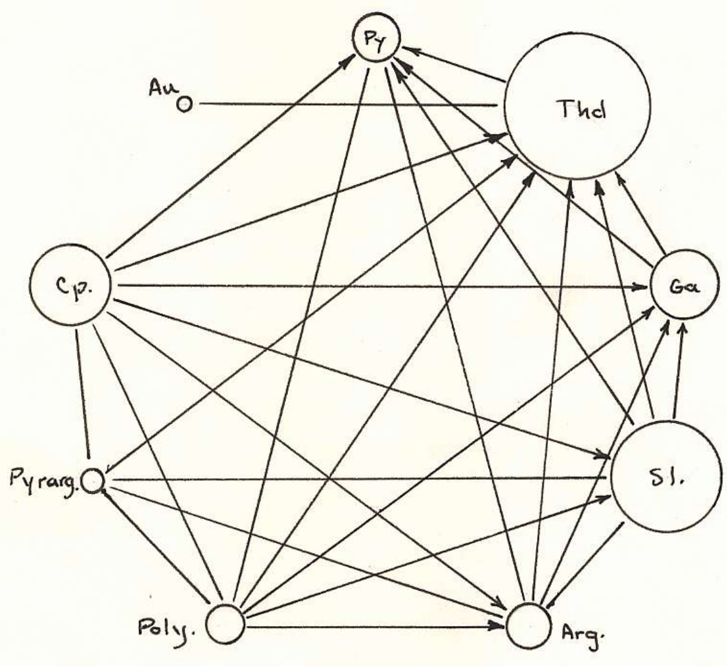


Figure 4. Van deVeer Diagram for Ore Minerals in this Suite.

#2 LOCATION UNKNOWN

The polished sections for this Ag bearing suite contain the following minerals: (see Figs. 3 and 4)

Pyrite: FeS_2 (Py)	- of minor occurrence as primary vein mineral.
Tetrahedrite: (Thd) $Cu_{12}As_{11}S_{13}$	- as bluish-grey, isotropic mineral showing slight reddish-brown internal reflection when powdered. - replacing the Py, and in turn being replaced by Cp, Ga, Pyrarg, Poly, Sl, Arg.
Galena: (Ga) PbS	- as "galena"-white mineral showing triangular pits on surface. - hardness is B, isotropic. - etch tests positive for galena. - as replacement of Py and Thd.
Sphalerite: (Sl) $ZnFeS$	- brownish-grey color, hardness: C, showing honey-brown internal reflection when scratched. Microchem shows strong test for Zn. - as replacement of Py, Thd and Ga.
Argentite: (Arg) Ag_2S	- as greyish-white, weakly anisotropic mineral of hardness A-B. - replacing Thd, Ga.
Polybasite: (Poly) $8Ag_2S.Sb_2S_3$	- light bluish-grey mineral of hardness B. - anisotropism v. strong..blue to olive-green. - etch test: $HgCl_2$ - brown stain. KCN - bluish black stain. $FeCl_3$ - grey stain. KOH, HCl, HNO_3 - neg. - replacement of Thd, Ga, Sl, Arg.
Pyrargyrite: (Pyr) $Ag_3Sb\ S_3$	- Bluish-grey mineral of hardness B, showing strong anisotropism and deep red internal reflection.
Chalcopyrite: (Cp) $CuFeS_2$	- yellow mineral, hardness C, as replacement of Thd, Ga, Sl, Arg.
Native Gold: (Au) Au	- of v. minor occurrence in association with Thd.

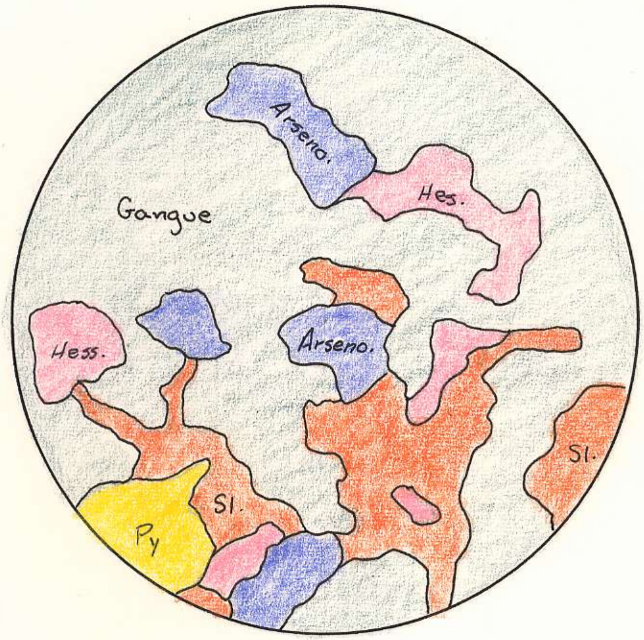


Figure 5. Sketch of Mineral Assemblages, Silver Glance Property. 80X

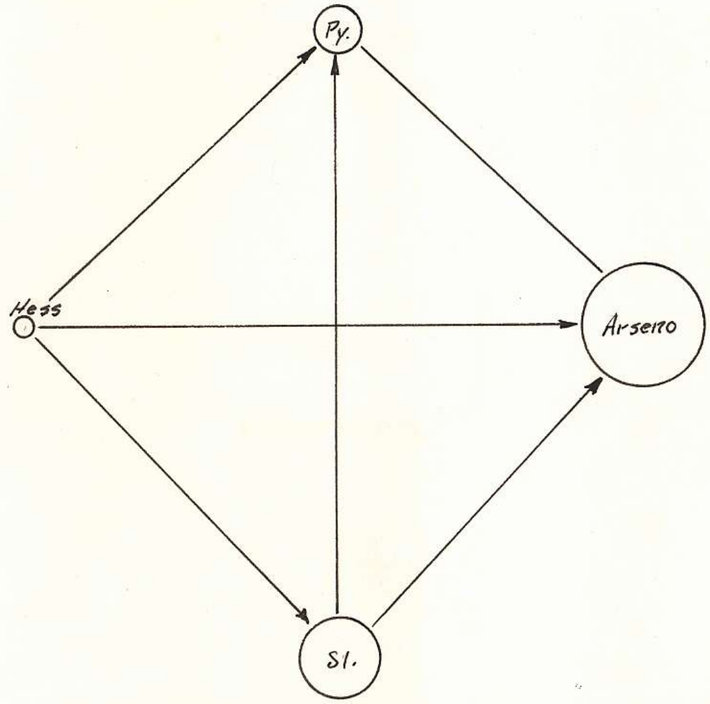


Figure 6. Van deVeer Diagram for Ore Minerals, Silver Glance Property.

#3 SILVER GLANCE PROPERTY

The polished sections contained the following minerals: (see Figs. 5 and 6)

Pyrite: (Py) FeS_2 - primary vein mineral.

Arsenopyrite: (Arseno) FeAsS
- White to creamy white color
- hardness F
- anisotropism v. strong..brownish to bluish.
- etch tests:
  - HNO_3 - irridescent stain.
  - others - neg.
- microchem:
  - strong test for As.

Sphalerite: (Sl) ZnFeS
- grey color, hardness..C, honey brown internal reflection.
- replacement of Py and Arseno.

Hessite: (Hes) Ag_2Te
- Silver white color
- hardness..B
- isotropic, to weakly anisotropic.
- etch tests:
  - $HgCl_2$ - brown stain.
  - KCN - slight grey stain.
  - HCl - brown stain.
  - $FeCl_3$ - irridescent stain.
  - HNO_3 - black stain.
- replacing Py, Sl, Arseno.

This type of mineral occurrence was formed probably as a result of medium temperature Hydrothermal fluids passing through fractures in the country rock.

#4 DEERHORN MINES, LINDQUIST LAKE, B.C.

The minerals in this Ag-bearing suite occur as dendritic intergrowths in cherty rock. They are as follows:

Pyrite: (Py) FeS_2
- minor primary mineral.

Sphalerite: (Sl) $ZnFeS$
- dark grey mineral, isotropic but showing honey-brown internal refl. when scratched.
- hardness..C
- neg. to etch tests.
- replacing Py.

Pyrargyrite: (Pyrarg) Ag_3SbS_3
- greyish mineral of hardness B
- anisotropic.
- internal red reflection.
- has replaced Py, Sl, Thd.

Tetrahedrite: (Thd) $Cu_{12}As_{11}S_{13}$
- bluish grey mineral of harness..B. ?
- isotropic.
- replacing Py, Sl.

Galena: (Ga) PbS
- white colored mineral, hardness..B
- isotropic.
- etch tests:
  - $HgCl_2$ - slow brown stain.
  - HCl - light brown stain.
  - $FeCl_3$ - irridescent stain.
  - HNO_3 - brown stain.
  - others - neg.
- microchem
  - positive Pb test.
- replacement of Thd, Pyrarg.
- exsolution with Frieslebenite.

Frieslebenite: (Fries) $Ag_5Pb_3Sb_5S_{12}$
- white with slight pinkish tint in contact with Ga.
- hardness B
- anisotropic..distinct.
- exsolution texture with Ga.
- etch tests:
  - FeCl - irridescent stain
  - Aqua Reg. - brown stain.
  - others - neg.

A one locality mineral!

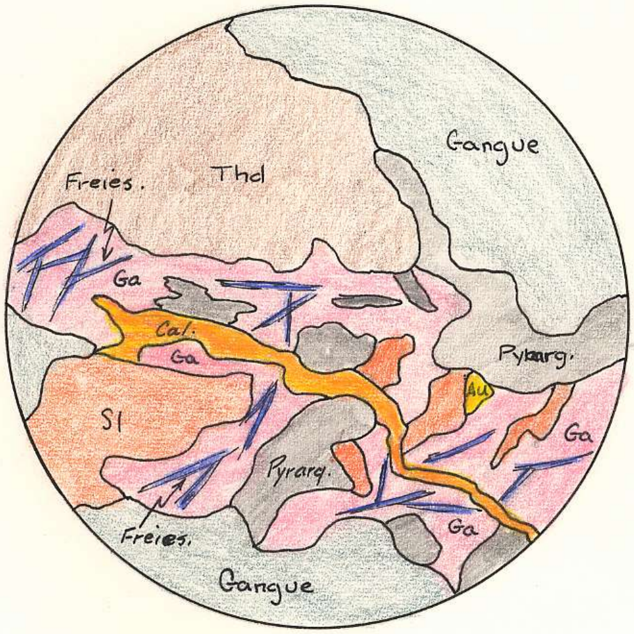


Figure 7. Sketch of Mineral Assemblages, 80X, Deerhorn Mines, B.C.

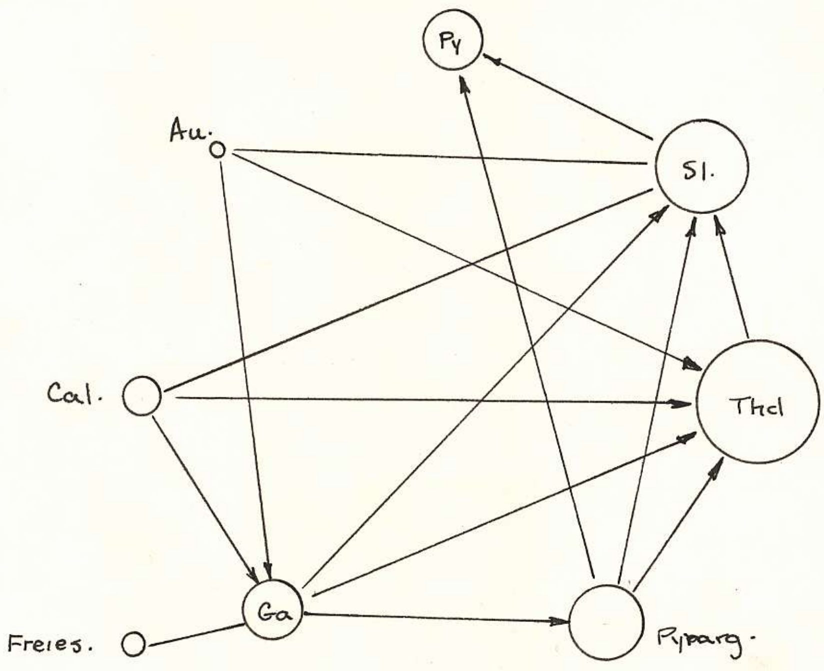


Figure 8. Van deVeer Diagram for Ore Minerals from Deerhorn Mines, Lindquist Lake, B.C.

Calaverite: (Cal) - creamy white mineral of hardness..B
$(Au,Ag)Te_2$ - strong anisotropism..grey to greenish grey.
- etch tests:
  - HNO_3 - black stain
  - others - neg.
- replacement of Sl, Thd, Ga.

Doubtful

Native Gold: (Au) - of very minor occurrence.
Au

In this suite ore deposition would take place under medium temperature hydrothermal conditions, (see Figs. 7 and 8).

Problem #4

A MINERALOGRAPHIC REPORT OF COCHENEUR WILLANS ORE DEPOSIT RED LAKE, ONT.

April-1965

A MINERALOGRAPHIC REPORT OF COCHENEUR WILLANS ORE DEPOSIT RED LAKE, ONT.

The Cocheneur Willans ore deposit is an example of a gold - sulphide deposit in which gold, the only valuable mineral, is associated with sulphides and lead sulpho-salts.

Megascopic Determinations

The gangue rock is mainly carbonate with stringers of quartz. Pyrite and blebs of native gold, up to 2 mm in diameter, are disseminated throughout the rock. Associated with the gold are tetrahedrite, stibnite, berthierite and kermesite.

Some of the tetrahedrite is present as small euhedral tetrahedrons in quartz. Stibnite shows perfect cleavage and warped crystal faces and berthierite crystals have an irridescent coating on them. Cherry red crystals of kermesite are arranged in fragile, radiating clusters within the other lead sulpho-salts.

Reference ?

Microscopic Determinations

The metallic minerals in this suite are as follows in order of occurrence:

Pyrite (Py) FeS_2	- creamy yellow color - hardness...F - as primary mineral replaced by Au and Thd.

Arsenopyrite (As)
$FeAsS$
- creamy white color
- hardness...F
- anisotropic
- habit: as microscopic prismatic crystals
- assocated with Au, Py, Thd.

Native Gold (Au)
Au
- has rusty coating which can only be removed by hard buffing.
- replacement of Py.
- associated with Py, Thd, As, St.
- size ranges up to 2 mm diameter.

Tetrahedrite (Thd)
$(Cu, Zn, Fe)_{12}Sb_4S_{13}$
- light grey color.
- hardness...D, black streak.
- replacement of pyrite.
- isotropic.

association...Au, Py, St, B.
- etch tests:
  - HNO_3 - brown to irrid. tarnish.
  - others - neg.
- microchem:
  - strong test for Cu, Fe, Sb.

Jamesonite (J)
$4PbS.FeS.3Sb_2S_3$
- galena white color.
- hardness...B
- mutual boundary texture with St and B.
- anisotropism strong, blue-grey to brown.
- cleavage visible.
- association with St, B, K.
- etch tests:
  - KOH - irrid. stain.
  - HCl - fumes tarnish brown.
  - HNO_3 - irrid. Stain.
  - Aqua Regia - eff...black stain.
  - others- neg.
- Microchem tests:
  - strong Pb, Sb, Fe.

Stibnite (St)
Sb_2S_3
- creamy white color.
- hardness...B
- replacement texture and mutual boundary texture with berthierite.
- anisotropism very strong, light grey to dark grey.
- twinning under xd nicols.

- association with B, K, J, M, Au, Thd.
- etch tests:
  - KOH - instantaneous stain and yellow coating.
  - KCN - slow light brown st. bringing out scratches.
  - HNO_3 - differential irrid. st.
  - Aqua Reg - eff. black stain.
  - others - neg.

Berthierite (B)
$FeS.Sb_2S_3$

- white color.
- hardness...C
- mutual boundary texture with St.
- anisotropism strong, blue-grey to brown.
- lamellar twinning under xd nicols.
- association...St, J, [redacted], K.
- etch tests:
  - KOH - irrid. tarnish.
  - HNO_3 - slow irrid. stain.
  - Aqua Reg - eff. brown stain.
  - others - neg.
- Microchem:
  - strong test for [redacted], Sb, Fe.

Meneghinite (M)
$Cu_2S.26PbS.7Sb_2S_3$

- white color
- hardness...B
- exsolution with St.
- anisotropism strong, grey to grey-brown.
- association with St.
- etch tests:
  - HNO_3 - slow at first and then fast black st. that advances as wave front.
  - others - neg.
- size: 50-100 microns.

Kermesite (K)
Sb_2S_2O

- grey color.
- hardness...A
- habit...prismatic.
- replacement of St, B, J.
- strong internal reflection - scarlet red.
- association with St, B, J.
- etch tests:
  - KOH - stains dark...yellow coating formed.
  - HNO_3 - light brown stain.
  - others - neg.

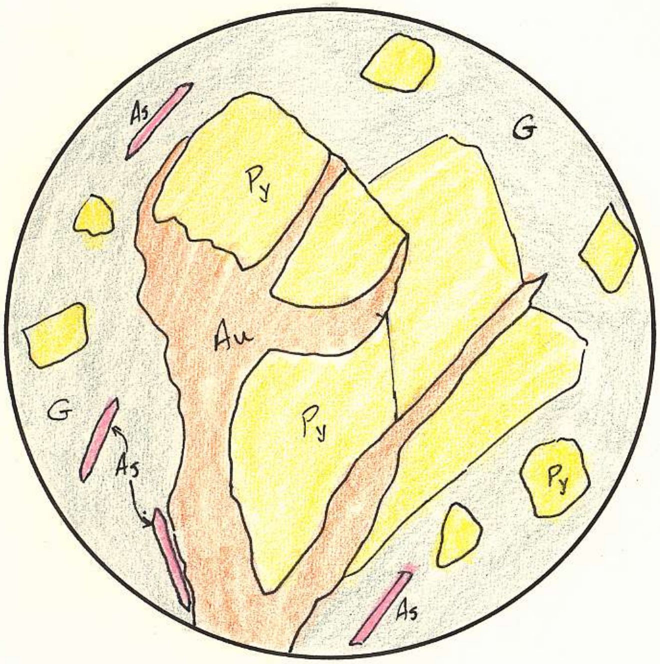


Figure 1. Sketch showing occurrence of gold.

400X

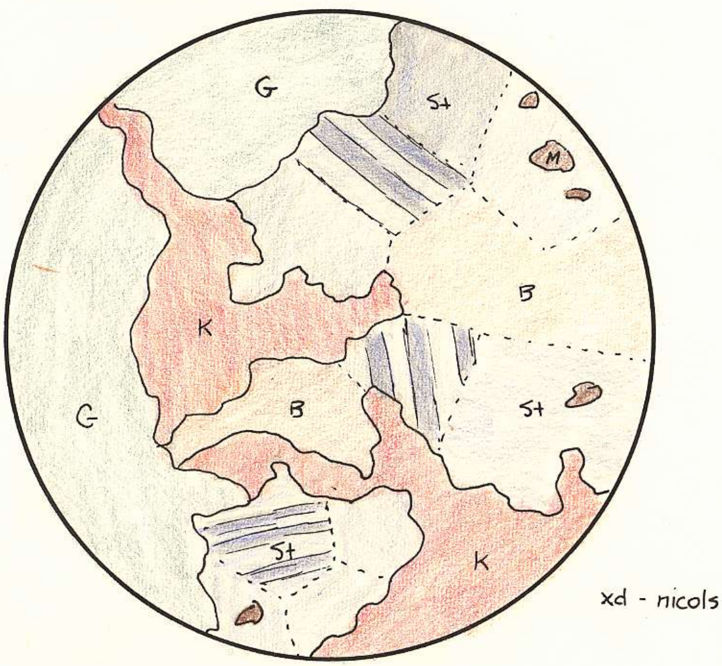
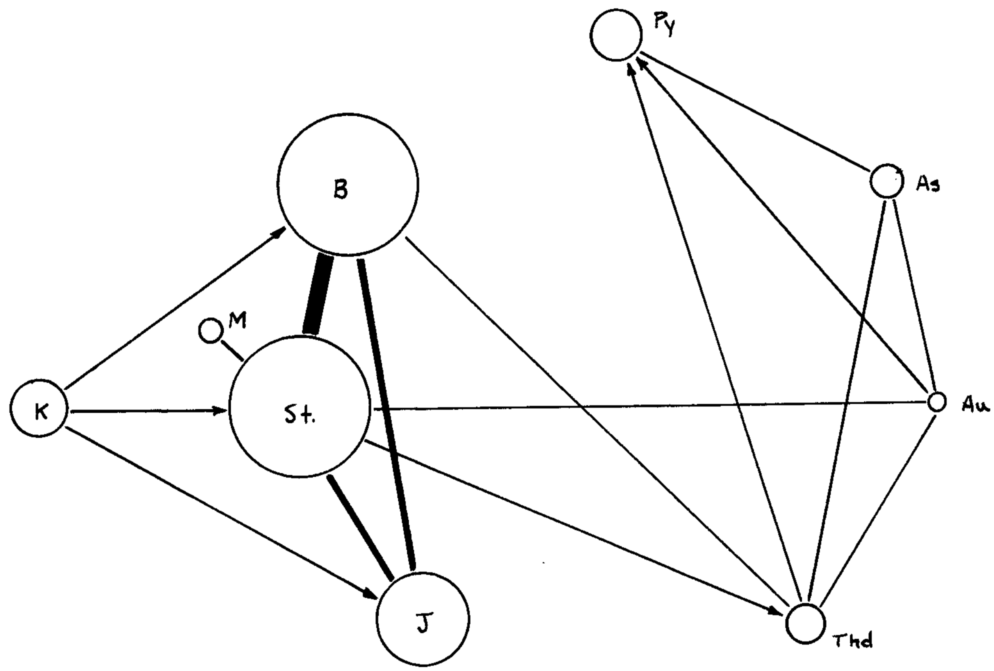


Figure 2. Sketch showing relationship between the lead sulpho-salts.

100X

PARAGENESIS



Pyrite and microscopic arsenopyrite formed at a high temperature. The pyrite became fractured and gold was later introduced into these fractures, replacing the pyrite. Blebs of gold up to 2 mm diameter were formed in this manner. However, gold also formed as blebs (50μ size) disseminated throughout the rock. Tetrahedrite was next to replace the pyrite (see Fig. 1).

Of the lead sulpho-salts, jamesonite formed first, followed by stibnite and meneghinite (exsolution), berthierite. Kermesite was the last mineral to form as a supergene replacement of the other lead sulpho-salts (see Fig. 2).

Type of Deposit

The low temperature stibnite and related lead sulpho-salts in association with higher temperature pyrite, arseno-pyrite and gold suggests that the Cocheneur Willans deposit is of Leptothermal origin. Temperature of mineralization was between 50°C and 300°C. During supergene enrichment kermesite formed in the lead sulpho-salts.

Milling

In order to free most of the gold, the rock would have to be ground to approximately 50 micron size. The gold appears to be quite rusty. This could create a problem in the recovery as it will neither amalgamate nor dissolve in the cyanide solution if the gold has a rusty coating. The rusty coating can be removed by grinding in a ball mill, depending on the size of the gold; however, this would lead to increased milling costs.