600186

Geology 409 - Suite #4.

RAINBOW MINES

Twenty-Three Mile Camp.

Monica Meding.

Location.

The Rainbow property lies just off the Hope - Princeton Highway about 21 miles east of Hope at the junction of the Skagit and Sumallo Rivers.

History.

The area around the Sumallo River has been prospected since the early part of the century. Many claims have been staked and those of the Twenty - Three Mile camp have been most extensively worked. None have as yet produced any significant amount of ore. The main minerals of interest are those of silver and copper but values in gold, lead, zinc, tungsten, nickel and chromuim have also been reported. The Rainbow property was discovered in 1914 by W. H. Robinson and J. Pennie and was optioned to the Canada - States Mining Development Company. Sorted ore was shipped to Trail that year. Expense of transportation was great and therefore, operations soon ceased. The property was restaked in 1954 by Robinson and optioned to North - Western Holdings, Ltd. and later to Foundation Mines Ltd. The latter have carried out extensive drilling and stripping and there are plans for its development in the near future.

Reference: Davidson, A. The Geology and Mineralogy of the Big Ben No. 1 Claim. B Sc Thesis, 1959.

Geology.

The Rainbow property lies in the Hozameen group, presumably of Carboniferous or Permian age and can probably be correlated to the Cache Creek Groups. Immediately to the east of the property lies the Dewdney Creek group of Cretaceous age and both are surrounded by intrusive rocks related to the Coast Mountains batholith. The Hozameen group consists of sedimentary ~~an~~ rocks, mainly chert, greywacke and arkose, as well as volcanic andesite and pyroclastics. The sediments have been highly deformed and slightly metamorphosed in most areas.

Megascopic Features.

Minerals that were identified in hand specimen were arsenopyrite, chalcopyrite, galena, pyrrhotite, and sphalerite. These are associated with white sugary quartz, siderite and alteration products such as limonite and anglesite.

Specimens numbered "A" contain mainly arsenopyrite with massive, clear to well crystallized quartz or else with sugary ~~qtz~~ quartz. They are often covered with a greenish material which is probably an alteration product.

The "B"-numbered specimens contain pyrite, chalcopyrite, arsenopyrite, sphalerite and pyrrhotite. They are often present in a groundmass of fine sugary quartz, very porous and vuggy. Euhedral quartz crystals grow out into the openings. Pyrite is present as massive, coarsely crystalline material often showing fine striations on cube faces. It is intimately associated with euhedral quartz and is partially intergrown with it in specimen B13. It is also associated with arsenopyrite and chalcopyrite. Chalcopyrite is present as small blebs, in pyrrhotite, sphalerite, pyrite and mixed in the quartz gangue. Arsenopyrite is very abundant in two forms (1) massive in the more dense, solid specimens

(2) as euhedral twinned crystals in a sugary groundmass of quartz.

It is associated with pyrite and chalcopyrite. Sphalerite is present as a massive well-crystallized form and is weathered yellowish to brown on the surface.

Pyrrhotite (B7) appears to be platy and vuggy and tarnished readily on the surface.

Specimen B 2 ~~as~~ consists of quartz, white and sugary. Vugs are lined with long quartz crystals tapered with pyramidal faces. The cavities are stained brown & yellow from limonite and siderite. Some specimens contain a yellow powdery material in cavities which may be anglesite.

In the "C"-numbered specimens, minerals that are present are arsenopyrite, siderite, anglesite, jamesonite, and sphalerite in a groundmass of sugary quartz. In the vuggy cavities, quartz crystals jut out or are interlocking. Jamesonite occurs as masses of small blue needles in vugs or veinlets. Arsenopyrite is present in masses or veins in sugary quartz or as individual penetration-twin crystals. Siderite occurs as masses of radiating crystals showing growth rings or as rosette-like aggregates in vugs. Anglesite occurs as a white or yellowish powder or as minute thin needles in vuggy quartz.

Microscopic Examination

Arsenopyrite $FeAsS$

Arsenopyrite occurs massive as well as in crystal form, which often exhibits long crystal twinning. It is strongly anisotropic, going from blues to brown colors. It is associated with chalcopyrite, pyrrhotite, sphalerite, ~~and~~ quartz and pyrite, as well as with boulangerite particularly where the latter replaces galena

Pyrrhotite $Fe_{(1-x)}S$

In hand specimen, pyrrhotite exhibits good parting. Along these partings and fractures it is replaced by marcasite and pyrite. Marcasite exhibits a scalloped edge texture towards pyrrhotite indicating it is replacing the latter. It contains laths of galena replacing it along parting planes particularly where it is in close association with chalcopyrite and marcasite (in polished section B8(ii)). Rarely, it is seen as remnant inclusions in section B8(i). It is also associated with pyrite and sphalerite.

Marcasite FeS_2

Marcasite occurs along fractures and partings in pyrrhotite. It is similar in color to pyrite and may even be replaced by it in the center of the fractures which have a scalloped boundary towards pyrrhotite. The light and dark colored banding in these veins may be a successive growth texture.

Pyrite FeS_2

Pyrite is massive and coarsely crystalline in hand specimen and shows a cubic crystal form in specimen B13. In polished section it is associated with galena, pyrrhotite, marcasite and arsenopyrite and is seen replacing the latter two minerals. Occasionally it was seen to have inclusions of chalcopyrite along fractures in the pyrite. In one instance, pyrite appeared to be a pseudomorph after arsenopyrite, but this is not certain.

Chalcopyrite $Cu_2S \cdot Fe_2S_3$ $CuFeS_2$

Chalcopyrite is associated mainly with sphalerite and pyrrhotite. It occurs as exsolution inclusions in sphalerite, randomly spaced & of unequal sizes and also occurs in straight lines. It occurs as irregular masses at the boundary with pyrrhotite and has some remnant inclusions of the latter, indicating the replacement of it. It also has feathery and star-shaped inclusions and larger blebs of sphalerite which probably indicates unmixing at temperatures between 350°C to 400°C.

Sphalerite (ZnFe) S

Sphalerite is massive and exhibits cleavage in the hand specimen. In polished section it shows a good red internal reflection and powders light reddish brown when scratched. It is associated with chalcopyrite, pyrrhotite, and galena. Chalcopyrite occurs as bleby inclusion or sometimes along fractures in sphalerite. It also includes needle-like or rectangular masses of jamesonite

Galena Pb S

Galena is coarsely crystalline with numerous triangular cleavage pits. It is associated with boulangerite, pyrrhotite, arsenopyrite, and pyrite. Boulangerite replaces it along an interfingering-type boundary. In pyrrhotite it occurs as numerous parallel thin laths along the cleavage planes indicating replacement of the latter.

Boulangerite $Pb_5 Sb_4 S_{11}$

Boulangerite is white with a slight greyish tinge, slightly darker than galena in color. It is soft and brittle - hardness A or B. Where it occurs replacing galena, its surface is finely pitted and has not as high a reflection as galena. It is oriented in parallel lath or fibrous crystals replacing galena perpendicular to ~~it~~. the boundary. Some masses of boulangerite appear to have been fractured in places and the laths are then distorted and curved. It is most commonly associated with galena and also pyrite.

Tetrahedrite $5Cu_2S \cdot 2(Cu,Fe)S \cdot 2Sb_2S_3$

Tetrahedrite is light brownish grey in color and is isotropic. In polished section C1 it was seen to have blebs and stringers of chalcopyrite and laths and needle-like crystals of bluish jamesonite as inclusions, similar to that in sphalerite.

Jamesonite $4PbS \cdot FeS \cdot 3Sb_2S_3$

Jamesonite is bluish-white in color, somewhat lighter than boulangerite, similar to galena but slightly bluer. It occurs as laths & needles in sphalerite and tetrahedrite as well as scattered throughout the quartz and siderite gangue.

Examination of Thin Sections

In section R 5, a mixture of iron oxide and a carbonate rock occur in a fine grained groundmass of quartz, probably as an alteration product of sphalerite. There are also traces of hornblende and epidote

Section R 3 contains a large amount of mafics in the form of hornblende and biotite. Biotite crystals appear to have small crystals of felspar and this can possibly be called a poikilitic texture. Apatite and opaque minerals are also present in traces.

Section R1 contains interlocking crystals of quartz and plagioclase with large hornblende and partially chloritized biotite phenocrysts. Chlorite occurs as an alteration product of the mafics. The felspar has been partially sericitized and the whole rock has been somewhat silicified.

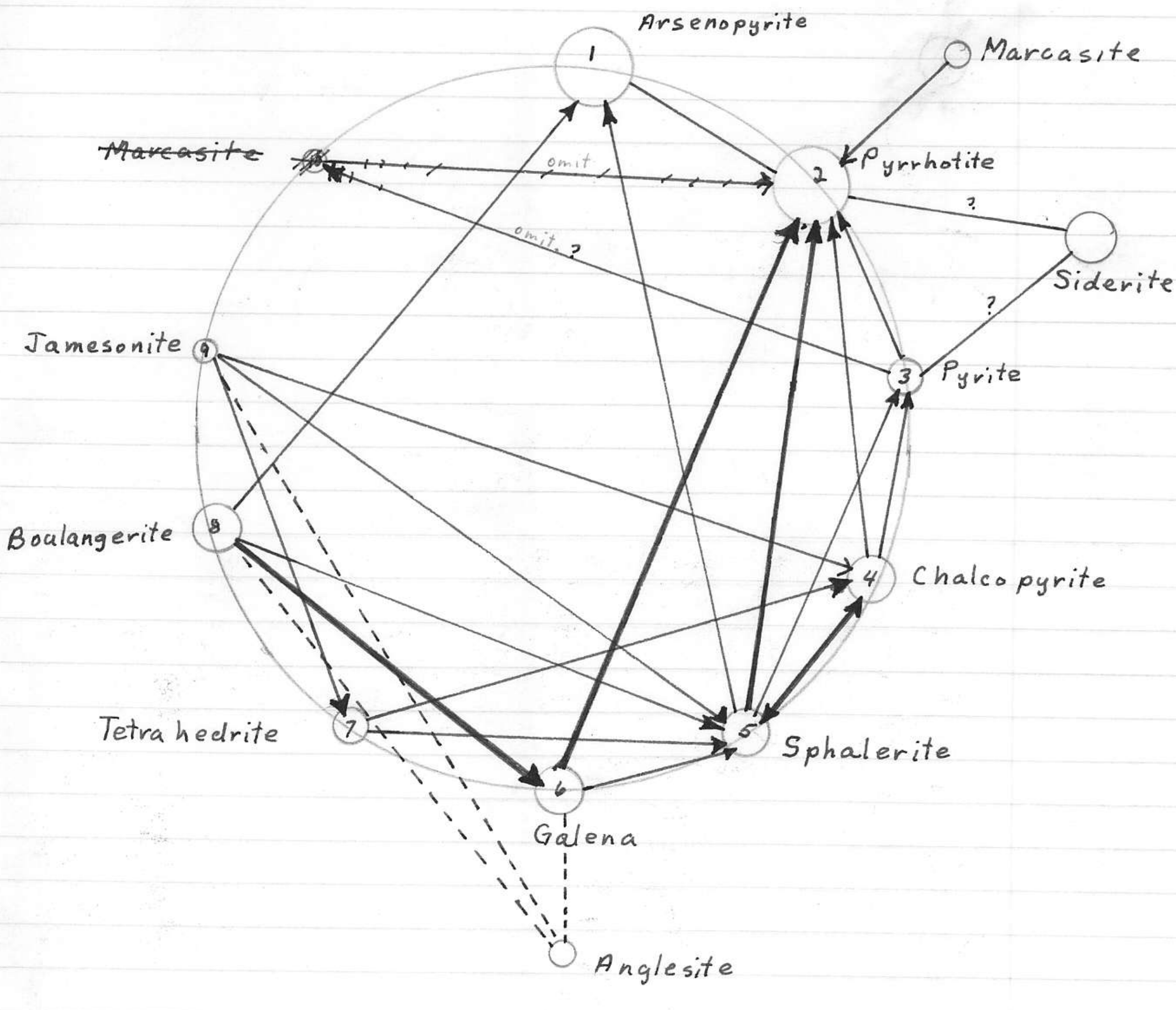
In hand specimen, the hornblende and biotite phenocrysts are large readily visible in specimen R1 but are fine grained and appear to be predominant in specimen R 3.

Alteration Minerals.

Alteration minerals include marcasite, limonite, anglesite as well as chlorite and sericite observed in thin section.

Marcasite alters directly from pyrrhotite and replaces it along fractures. Limonite occurs as a brownish powder on the surface of sphalerite and coats the gangue minerals, siderite and quartz. Anglesite occurs as a yellow powder and slender needles observed under the binocular microscope. A microchemical test gave a positive reaction for lead. Chlorite and sericite were observed in thin section as alteration minerals of the country rock.

PARAGENETIC SEQUENCE



Nature of the Deposit.

The deposit represents a medium temperature hydrothermal deposit. It is a high level deposit as pressures must have been fairly low to produce the porous and vuggy nature of the ore and gangue minerals. Initial temperatures were probably over 500°C due to the presence of arsenopyrite and pyrrhotite, the first minerals to be deposited. The temperature dropped slowly to about 300°C ending with the deposition of low temperature minerals jamesonite and boulangerite. Marcasite then altered from pyrrhotite below 300°C and the formation of siderite occurs at below 250°C. Davidson states that the deposit probably resulted from the quartz diorite intrusion in the vicinity. He observed that the low temperature minerals were more abundant near the intrusion because the heat of it ~~prevented the~~ presented rapid cooling. Slower cooling and a longer period at temperatures around 250°C and above caused more low-temperature minerals to be deposited near the intrusion than farther away. Intense silicification also occurred probably at two different times. The first produced euhedral crystals at higher temperatures, the second produced fine grained sugary quartz around 250°C. In thin section, the quartz diorite appears to have been slightly silicified after its emplacement. Davidson states that the silicification is widespread and increases in the wall rock towards the intrusion. Excess silica from the intrusion probably caused partial silicification of the intrusive rocks themselves near the contact. Fissures from the intrusion acted as conduits for the mineralized solutions

In summary, deposition occurred near the surface and was controlled in temperature by the intrusion resulting in a spread of high to low temperature minerals.

References:

Davidson, A., "Geology of the Big Ben No 7. Claim" BSc Thesis, 1958

Edwards, A.B., "Texture of the Ore Minerals" Aust. Inst. of Mining and Metallurgy, 1954.

Microphotographs

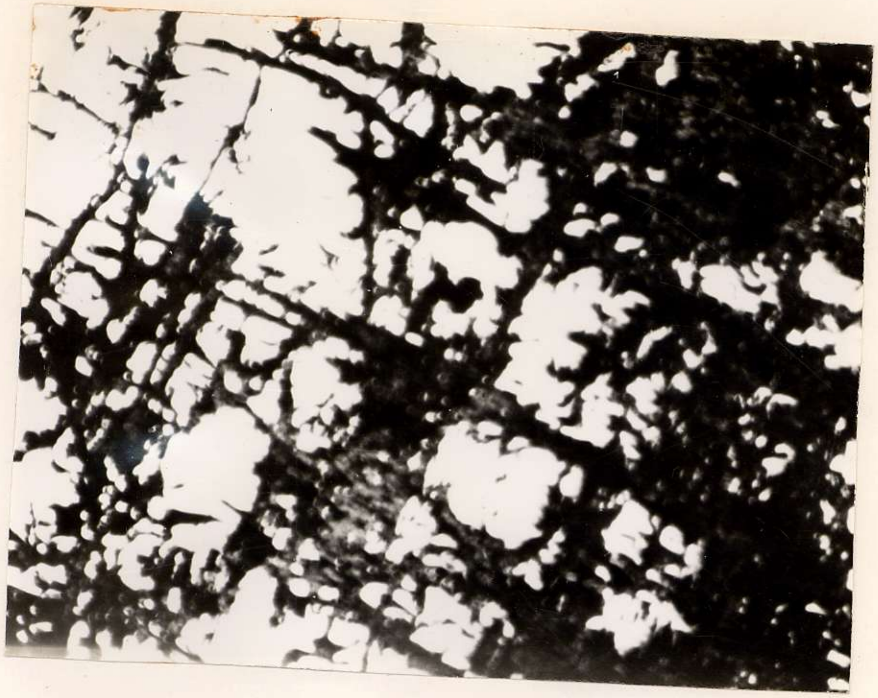


Fig 1. Arsenopyrite fractured and replaced by quartz

Scale?

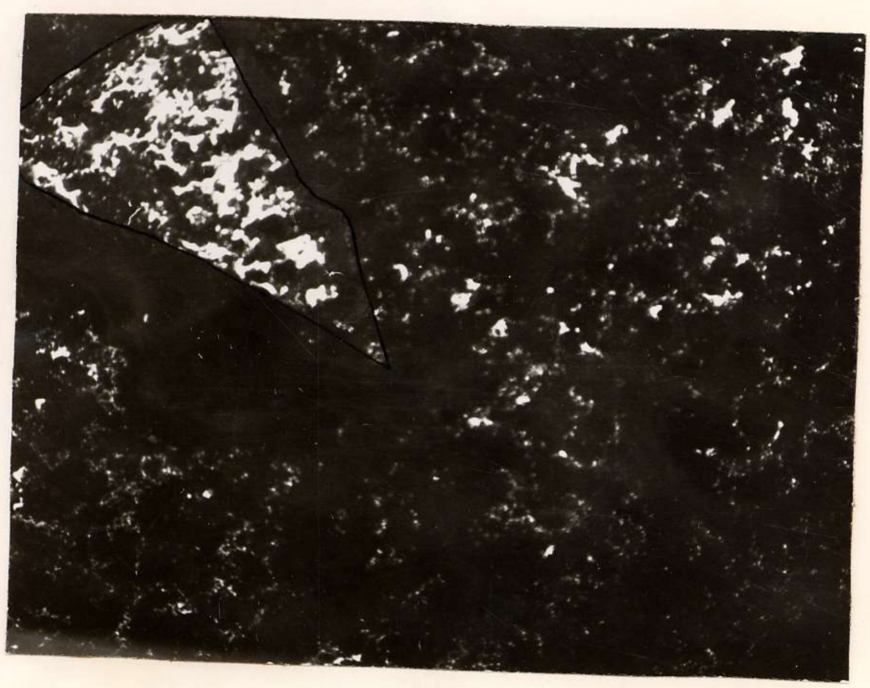


Fig. 2. Arsenopyrite crystal in quartz and siderite gangue

Fig 3. Alteration of pyrrhotite to marcasite along fractures

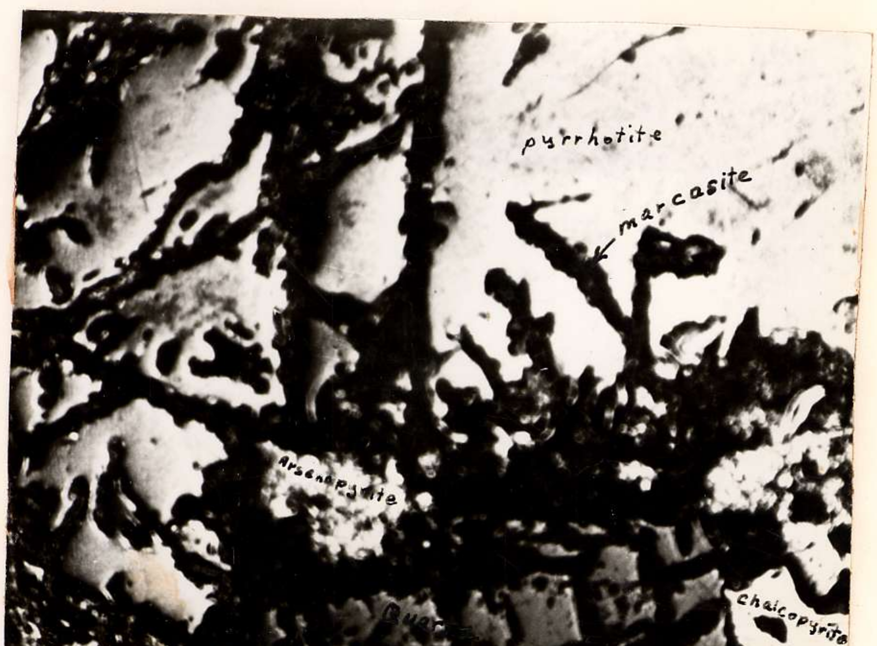


Fig 4. Alteration of pyrrhotite to marcasite

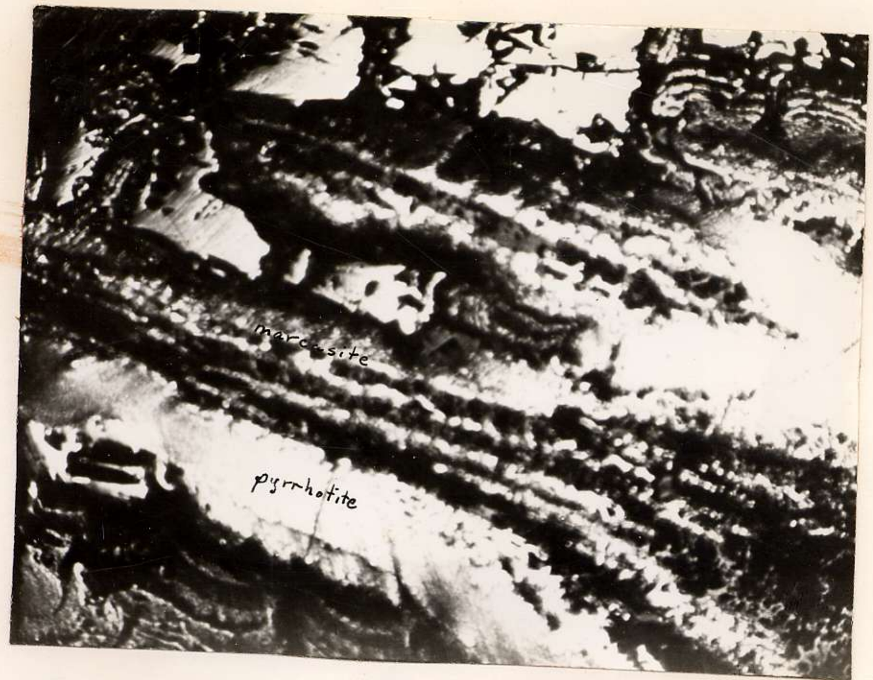


Fig 5. Shows scalloped edge texture of marcasite to pyrrhotite

Fig 6. Alteration of pyrrhotite to marcasite.

Fig 7. Replacement of galena by boulangerite.

Fig. 8. Fibrous boulangerite replacing galena

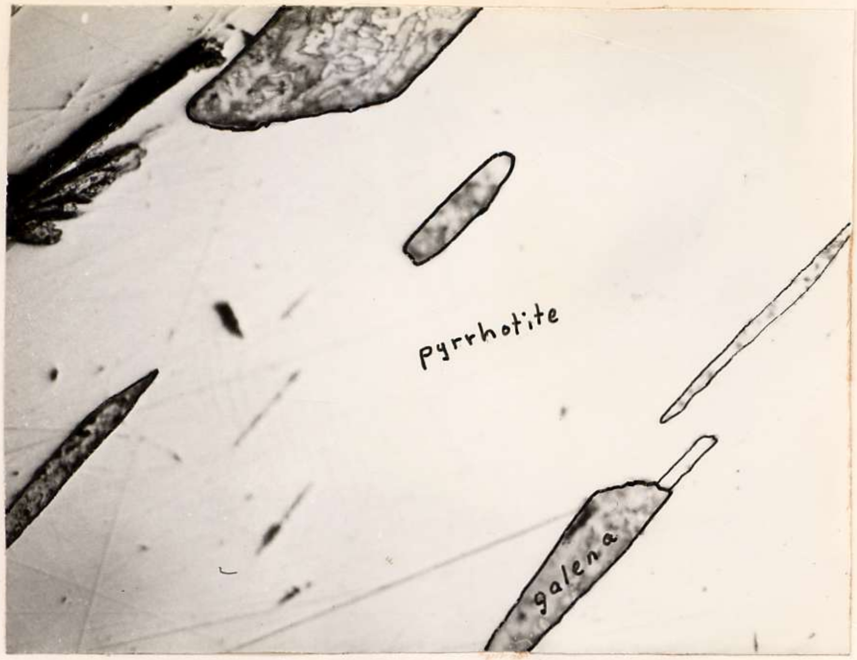


Fig. 9. Replacement of pyrrhotite by galena along cleavage planes

Fig 10. Boundary relations of arsenopyrite (Ar) Chalcopyrite (C), sphalerite (Sp) and cut by quartz vein (dark grey)

Fig 11. Jamesonite in quartz gangue

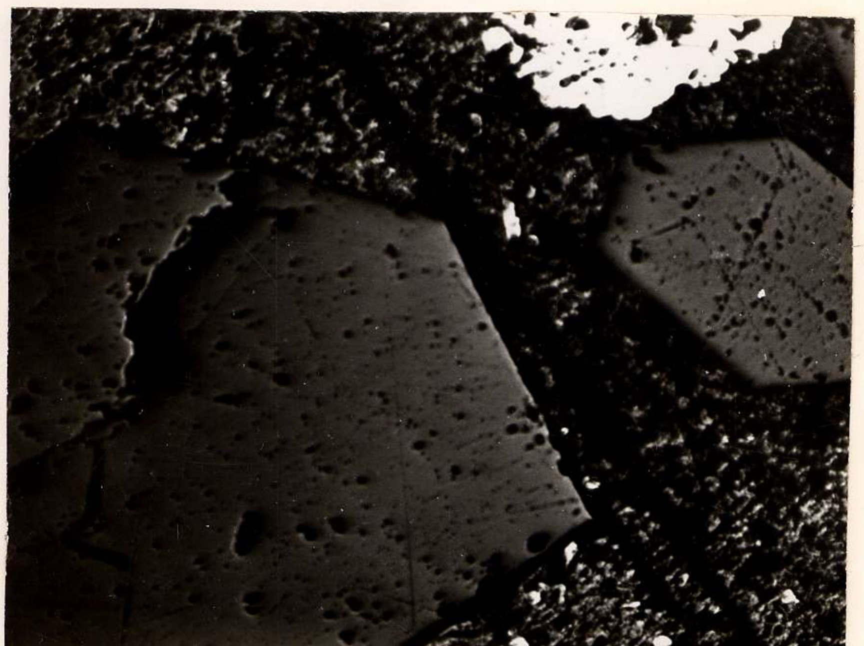


Fig 12. Euhedral quartz crystals

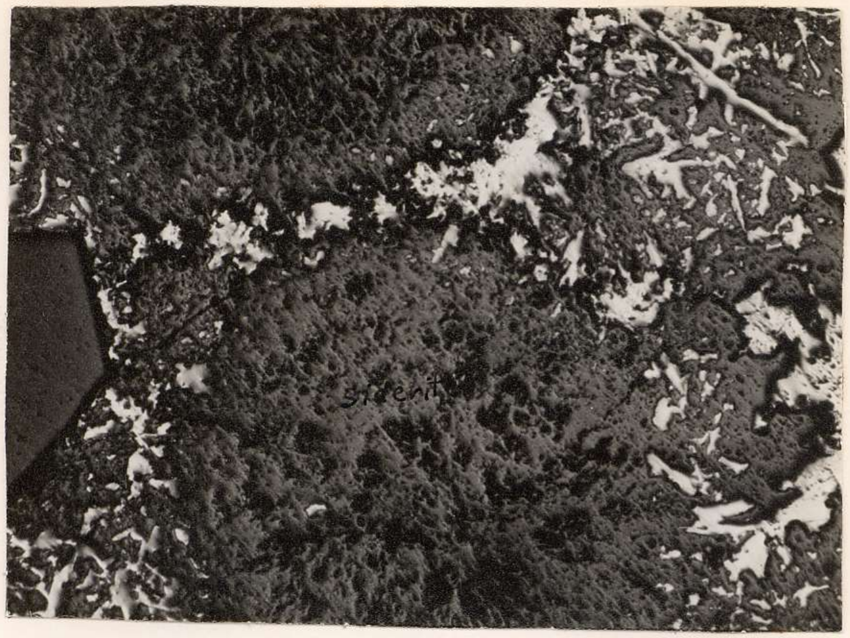


Fig 13 Jamesonite(?) surrounding siderite.

Fig 14. Siderite growth rings surrounded by jamesonite(?)