Geol. 409 April 13/60

Premier Suite

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Geol. 409 Problem IV April 13 1960

## Premier Suite

### Megascopic Examination

Two general types of ore were represented by the suite. The first is a highly sheared, black, almost fissile material containing up to 20 percent pyrite and 1 percent or less electrum. Much of the black matrix appears to be sheared galena.

The pyrite occurs as discrete sub-rounded grains varying from ½ mm. to 4 mm. in diameter with the majority about 2 mm.. Some crystal faces occur but most surfaces are fracture surfaces. The roundness of the grains probably resulted from rolling during shearing. The electrum occurs as flattened grains up to 1 mm. thick and 5 mm. wide. It was noted as small grains in post shearing cavities. The surfaces of the grains are smooth and rounded and do not appear to have undergone shearing. This texture coupled with the presence of electrum in late cavities indicates that it post-dates the shearing and is probably supergene. The galena in the black matrix shows a dark irridescent to black tarnish and is extremely fractured.

The second type of ore consists of about 10 to 15 percent of sulfides and sulfosalts in a dominantly quartz and feldspar gangue. In some specimens the gauge is mainly a highly altered felspathic rock but in general such fragments make up less than 50 percent of the gangue. Quartz and feldspar are present in about equal proportions. Relative proportions of ore minerals vary from specimen to specimen but overall chalcopyrite would make up about 5 percent and tetrahedrite about 5 percent of the material. Ruby silvers were also noted. Pyrite was present but not common in this type of ore.

## Microscopic Examination

### Minerals Identified

A In Black Sheared Material

Pyrite - Grains were rounded and showed extensive internal fracturing.

Electrum - Occurs as irregular flattened grains as noted in handspecimen. Etch tests confirmed electrum. Microchemical tests and the quite yellow colour indicated that it is probably a gold-rich variety.

Galena and Tetrahedrite - The dark fissile matrix was too susceptable to plucking to polish well. Wherever a polish was obtained the material was found to be fine grained fragmented galena or tetrahedrite with galena predominating slightly. The galena appears to be argentiferous. It shows a dark tarnish in hand specimen and gives a positive microchemical test for silver. The tetrahedrite gave a negative silver test but this may be due to the presence of copper in the mineral.

B In Quartz-Feldspar Material

Pyrite - Occurs as poorly polished residuals

Chalcopyrite - Found in close association with tetrahedrite and sphalerite and also as exsolution blades and blebs in sphalerite.

Tetrahedrite - Occurs in close association with chalcopyrite.

Sphalerite - Usually found as large grains enclosed in chalcopyrite and to a lesser extent in tetrahedrite. It invariably contains about 5 percent of exsolution chalcopyrite and shows a good internal reflection. How identified

Polybasite. - Replaces tetrahedrite near boundrys with chalcopyrite and replaces chalcopyrite near boundrys with sphalerite. It gives a good red powder when scratched

Pearcite - This ruby silver occurs as a 1mm diameter grain which was seen only ~~in~~ contact with chalcopyrite.

Stephenite - Minor amounts of this mineral were seen as grains and small replacement veinlets in tetrahedrite.

Argentite - Argentite was noted occuring in two ways. About 90 percent of the argentite seen was in fractures in chalcopyrite usually adjacent to tetrahedrite. Where these fractures encountered tetrahedrite they either pinched off completely or contained small amounts of polybasite. The second occurance of argentite was apparently formed as narrow rims on the borders of cavities occupied by molten native bismuth. The argentite was invariably found on the sides of cavities bordered by chalcopyrite rather than tetrahedrite.

Native Bismuth - This mineral occurs as sub-rounded blebs partly rimmed by argentite as noted above. These blebs often show an open spongy core. This spongy area is usually open but is sometimes occupied by stephenite. Native bismuth also fills fractures and veinlets ~~tion~~ connected with the blebs and cutting adjacent tetrahedrite and stephanite. These fractures contain nearly as much bismuth as the main blebs so they could not represent excess bismuth forced out on cooling. It is possible that this minor fracturing occured during the time when the bismuth was solidifying. At this point molten bismuth could have migrated from the partly molten cores of the blebs to leave the observed spongy structure. A very poorly developed polysynthetic twinning was noted in some areas.

## Primary Minerals In Order Of Abundance

| Sheared Material | | Quartz-Feldspar Material | |
|---|---|---|---|
| Galena | 25 % | Chalcopyrite | 37 % |
| Pyrite | 20 % | Tetrahedrite | 32 % |
| Tetrahedrite | 20 % | Quartz-Feldspar (gangue) | 15 % |
| Electrum | 1% | Pyrite | 6 % |
| | | Sphalerite | 5 % |
| | | Polybasite | 2 % |
| | | ? Pearcite | 1 % |
| | | ? Native Bismuth | 1 % |
| | | ? Stephenite | ½ % |
| | | Argentite | ½ % |

## Supergene Minerals

The only supergene mineral noted was electrum which was found in the sheared material only. It comprised about 1% of this type of ore.

## Significant Textures And Paragenesis

In the black highly sheared material primary features have been destroyed. Galena showed good triangular pits and has had its clevage emphasized by stress. The supergene electrum shows ~~rounde~~ smooth rounded and ridged surfaces and some wire-like forms.

The quartz-feldspar material appears to have undergone two periods of fracturing. The first brecciated the country rock. This allowed the entrance of fluids which altered the rock fragments and deposited quartz, feldspar and ore minerals. A poorly developed crustification banding was shown by these minerals. Later minor fracturing occured giving rise to veins of later feldspar and minor ~~qur~~ quartz up to ½ inch wide.

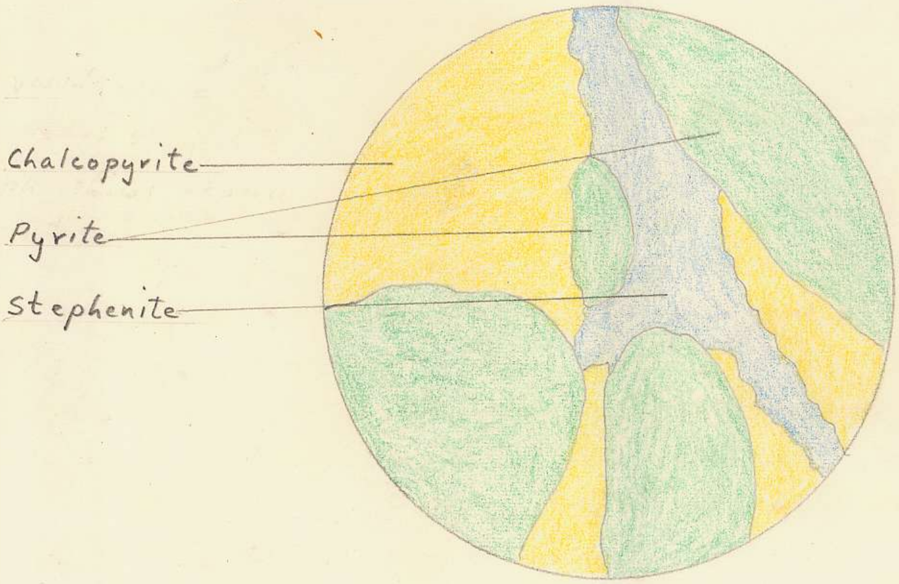
Figure I

Rounded Residuals of pyrite in chalcopyrite. Later stephanite shows reverse caries texture against chalcopyrite

Figure II

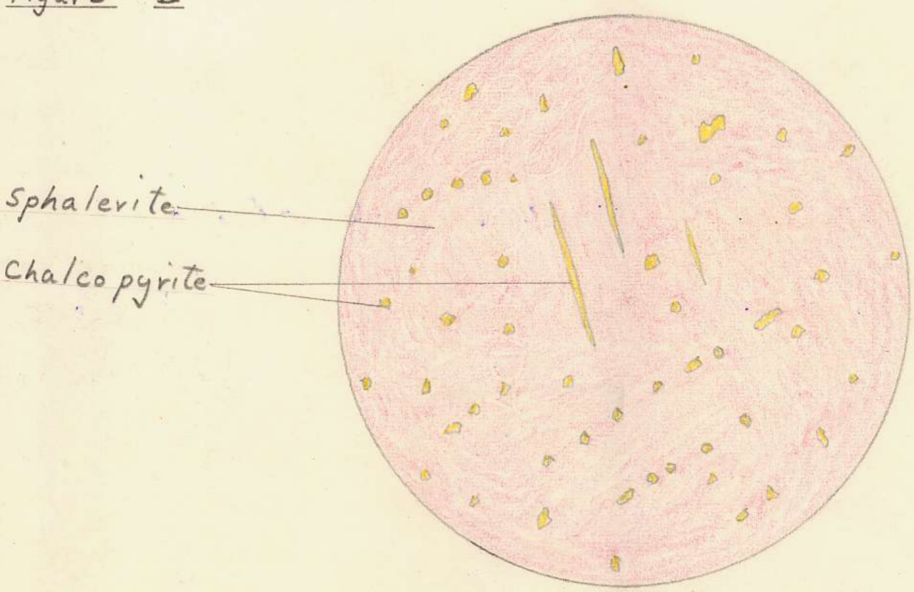
Exsolution texture of chalcopyrite in sphalerite showing orientation of blebs and blades of chalcopyrite.

Figure I




X 132

Figure II

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Of the ore minerals pyrite forms residual grains in chalcopyrite and ruby silvers. The chalcopyrite seems to be moulded onto the pyrite rather than replacing it.

Chalcopyrite, Tetrahedrite and Sphalerite made up the second period of mineralization. These three minerals all show caries or mutual boundry textures against one another. A second generation of chalcopyrite later resulted from chalcopyrite exsolution from sphalerite. This exsolution chalcopyrite shows oriented blades and blebs as well as random blebs in sphalerite.

The third group of minerals to form were the ruby silvers and argentite. These minerals were never seen in contact but all are later than the second group. Polybasite replaces tetrahedrite as veinlets and also replaces chalcopyrite along borders with chalcopyrite. Pearcite shows a mutual boundry relationship with chalcopyrite. Stephenite replaces tetrahedrite as veinlets and shows a reverse caries texture with chalcopyrite

Figure III

Blebs and veinlets of native bismuth in tetrahedrite and chalcopyrite. Argentite rims the native bismuth along borders with chalcopyrite.

Figure IV

Mutual boundry relationships between tetrahedrite and chalcopyrite. A late argentite vein cuts both minerals

Figure III

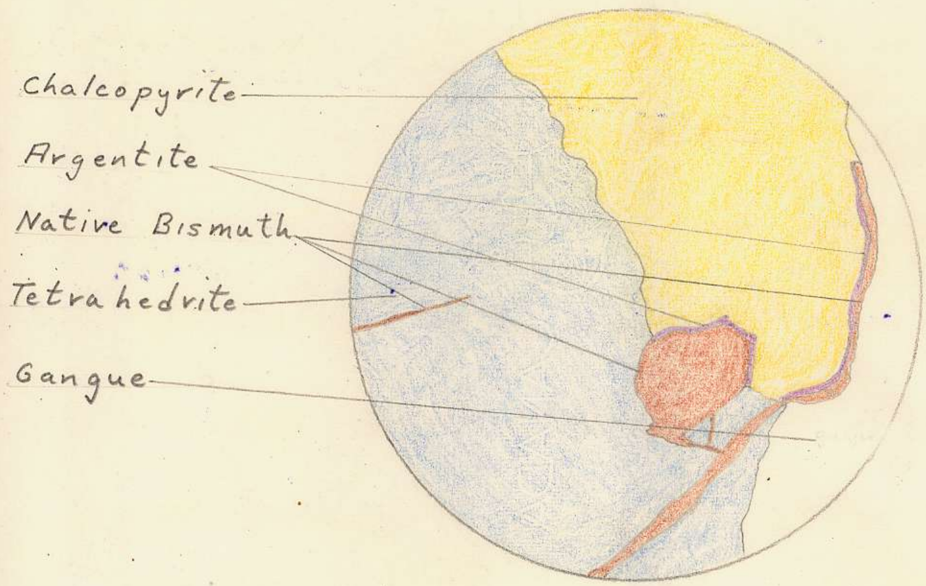


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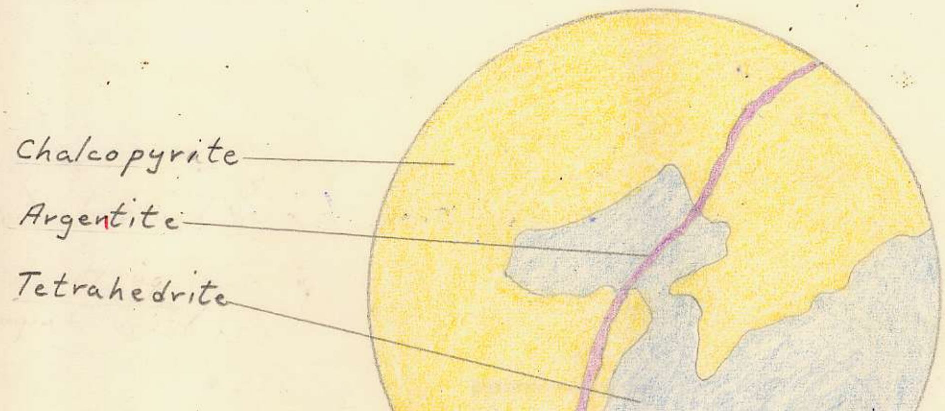
Figure IV

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Stephanite shows a fairly long period of deposition and carrys over into the fourth period.

The minerals deposited in the fourth period of deposition were native bismuth and minor amounts of stephenite. Bismuth was probably present in the molten state during part of the third stage ~~during~~ At this time the argentite rims were formed. When facturing presumably occured during the solidification of the bismuth stephenite was still being deposited Thus native bismuth in fractures may be seen cutting stephenite while stepenite occupys some of the spongy areas in bismuth that were left when molten bismuth migrated into the fractures.

## Temperature Classification

The ore minerals were deposited over a temperature range of at least 100 degrees. The temperature of exsolution of sphalerite and chalcopyrite is 350-400 degrees (Buerger in Edwards). ~~The lower on~~ Presumably the pyrite and the second group of minerals were deposited above this temperature. The lower end of the range may be determined more closely. Native bismuth, in the last group to form, crystalizes at 271 degrees (Edwards).

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April 15/60
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Atrocious spelling!