

GEOLOGY 409

W. N. Jeffrey

Mining 4

600139

A MINERALOGRAPHIC STUDY OF FLOTATION PRODUCTS OF A COPPER ORE

Source of Ore and Treatment

The object of this mineralographic examination was to determine the minerals present and to get an idea of their percentages and how they occurred in some milling products. The material studied was a low grade ore from the Bethlehem Copper Company's property at Highland Valley near Ashcroft, B.C.,

This ore had been crushed and ground to passing 35 mesh with approximately 50 per cent of the material -200 mesh. The tails from several flotation tests were classified and the granular portion concentrated on a Wilfley shaking table. Briquettes were made from the concentrate material. Another portion of the table concentrate was superpanned and briquettes made of the superpanner concentrate. Some of the flotation concentrate was also made into briquettes.

Granular Table Concentrate

This material was mostly quartz and contained much magnetite ($\text{FeO} \cdot \text{Fe}_2\text{O}_3$) and a fair amount of malachite ($\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$). This mineral vigorously effervesced in 1:7 HCl. Most of the malachite occurred as free particles. Much of the malachite *in preground material* occurred as films on the surfaces and in the cracks of quartz particles and gangue particles. Chalcopyrite was also present both as free and as middling particles sometimes showing an oxidized surface. Little pyrite was seen.

Table Concentrate in Polished Briquettes

The minerals and their physical conditions were studied more carefully in the superpanner concentrate. Therefore that information is given under that heading. However, a count of the more important mineral particles was taken on this material and is given in the following table. The count is too small to be considered truly representative of the minerals present.

| MINERAL | OCCURRENCE | | SIZE IN MICRONS | | |
|--------------|------------|----------|-----------------|--------------|------|
| | free | middling | Size range | Average size | |
| | | | | free | mid- |
| Malachite | 421 | 204 | 33.6 to 112 | 54.9 | 53.2 |
| Chalcopyrite | 31 | 65 | 11.2 to 33.6 | 25.2 | 16.8 |
| Magnetite | 122 | 176 | 11.2 to 112 | 19.6 | 25.8 |
| Pyrite | 72 | - | - - - | 38.1 | - |

Superpanner Concentrate in Polished Briquettes

The polished briquettes of this material showed the following minerals upon microscopic examination

Malachite

Malachite appeared in fair quantity. It was identified by its dull gray-greenish pitted surface, greenish edges, hardness of D. It was usually spotted by shining the light obliquely under the microscope to show the typical "malachite green" colour of the particles. Occasionally acid was applied to see if a certain grain would effervesce. Most often as can be seen from the count of the table concentrate, this mineral appears as free particles which are usually larger than the other valuable mineral grains. However, it must be remembered that a certain percentage of these assumed free particles can be expected to be attached to gangue particles invisible at the surface.

Magnetite

There was a good deal of this mineral in proportion to the other metallic minerals. It was identified by its high magnetic nature and by its hardness F, and by its tendency to yield to pressure. It appears to be associated with quartz.

Chalcopyrite

This mineral was relatively scarce. It was identified by its brass yellow colour, hardness C, and its inertness to KCN. It appeared most often as middlings, sometimes completely surrounded by other gangue or other minerals such as magnetite. One or two particles had a border of chalcocite.

Galena

Galena appeared in a few grains. Considering the concentration of the original ore reached by this point, very roughly 900:1. Even then a little of this could have come from previous ore samples on the Wilfley table. The galena was identified by its reflected white colour, hardness of B, and presence of triangular pits and square corners.

Pyrite

This mineral was rather scarce, also, considering the concentration it had gone through. The indication of course is that it is not present in quantity in the original ore. It was identified by the pale brass yellow colour, pitted surface and hardness of F (not scratched by needle). It is usually in free grains.

Chalcocite

Chalcocite was present in such little quantity in this material that it will not be considered here. Likewise, it was assumed there must be a grain or two of bornite in this material but none was seen.

Flotation Concentrate in Polished Briquettes

The minerals found were in order of decreasing quantity malachite, chalcopyrite, bornite, chalcocite, pyrite, covellite, and molybdenite.

Malachite

The malachite was usually free but sometimes contained small spots of magnetite.

Chalcopyrite

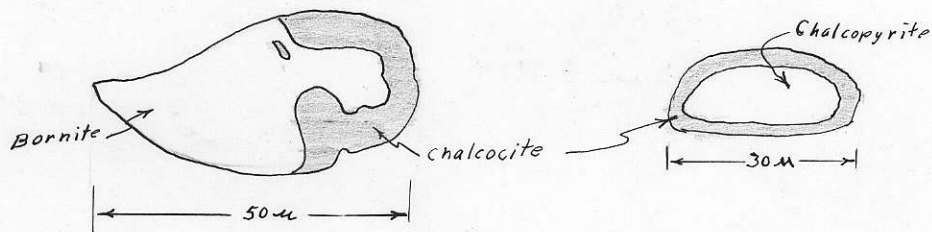
Chalcopyrite appeared in a great range of sizes from 1.4 to 84 microns. Much of it was associated with chalcocite. Some of the particles were middlings.

Bornite

Bornite was present in quantity but less than chalcopyrite. Bornite was identified by its pink colour, hardness B, and brown stain resulting from an application of KCN. These particles were in the order of 50 microns across. This mineral also had chalcocite borders on some particles.

Chalcocite

Chalcocite appeared sometimes as discrete particles but often as a band surrounding or partially surrounding chalcopyrite or bornite. Chalcocite was determined by its blue gray colour, hardness B, and blue stain resulting from application of FeCl_3 .



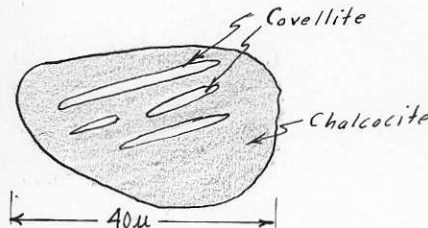
Pyrite

Pyrite was present only as a few grains. This mineral is of little importance in this ore since there is not enough of it to affect flotation.

Covellite

Covellite appeared in very few particles. In the chalcocite particles in which it appeared it formed lath-like streaks.

It was identified by its indigo blue colour and its strong anisotropism showing white, blue and orange polarization colours. Galena also appeared in few grains.



Molybdenite

There was only one particle of this mineral seen. It was identified by its white colour, hardness B, anisotropism and polarization colours white, light violet and black.

Conclusion

From a mineral dressing point of view the pyrite content of this ore is of little importance because it is present in such small quantities. Covellite too, is in such small quantities it is of little importance. Moreover the covellite was seen only in the flotation concentrate which is a good place for it to be. The molybdenite appears to be quite a rarity. What molybdenite there is present, is very readily floated. Bornite and chalcocite float excellently, for there was almost none of these minerals found in the flotation tailings, that is, in the table or superpanner concentrate. Chalcopyrite also floats very well. The chalcopyrite present in the flotation tailings was usually a middling product or finally disseminated in gangue. The very small amounts of galena present were mostly in the flo-

tation tailings. Because of the small quantity present, this fact is of no importance. The magnetite is very well depressed with most of it appearing in the flotation tailings.