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MICROSCOPIC STUDIES ON MILL PRODUCTS FROM THE PINE CREEK AREA, YREKA MINING DISTRICT, IDAHO

By

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Introduction

The ores of the Pine Creek area in the Coeur d'Alenes have always presented a difficult milling problem due to the fine intergrowths of the ore minerals. From time to time, the Idaho Bureau of Mines and Geology has been requested to make microscopic examinations of these mill products. This brief report is a summary of some of this work and is presented to illustrate the extent to which locked middling grains are present in even the finest ground material.

Experimental Procedure

Upon receipt of a sample for examination, a complete wet-dry screen analysis of it is made. A sample from each of the size fractions, representing any appreciable amount of the entire sample is then molded into a bakelite briquette. The undersize from the finest screen is deslimed and the sand portion from this is briquetted. Slimes do not make satisfactory briquettes, nor can they be studied at the magnifications possible with an ordinary metallographic microscope. Each briquette is then polished and prepared for examination under the microscope.

The following pictures are of samples that have been studied in our laboratory.

Figures I, II, and III are of a zinc concentrate from the mill of the Spokane-Idaho Mining Co. Figure I was taken at a low magnification to include as large a field as possible in the picture. It can be readily observed that the number of locked grains is quite large although not much detail is resolved at this magnification. In Figure II the gray particles are sphalerite containing white specks of galena. The three large white particles are pyrite. These are free mineral. The black and gray particle (lower center) is gangue and sphalerite. Close examination reveals blebs of galena in the sphalerite in this particle.

Figure III is a picture of one 100/150 mesh particle from the same concentrate at a high magnification. It is sphalerite containing a fine intergrowth of galena.

Figures IV and V are of a lead concentrate from the same mill. In Figure IV the light gray, fractured grains, many of them showing cubic cleavage, are galena. The smooth, white and somewhat rounded grains are pyrite. The dull gray areas in this picture are sphalerite. It is readily observed that most the locked grains are composed of sphalerite and galena, although one ternary grain of sphalerite, galena, and pyrite is shown in the field.

Figure V is a picture of a ternary grain at a higher magnification. The large, white central area is pyrite. It is enclosed by sphalerite which in turn contains small specks of galena.
Figures VI and VII are pictures of 150/200 mesh particles from a zinc scavenger product of the Spokane-Idaho. The light colored particles in Fig. VI are sphalerite. There are several free grains. The finely intergrown particle in the center of the picture is sphalerite and galena. The other locked grains are largely sphalerite and gangue. Figure VII is a picture of some sphalerite particles at a higher magnification to show the finely intergrown galena. The dark spots shown in the particles are gangue.

Figures VIII and IX are pictures of the 200/325 mesh fraction from a lead scavenger concentrate of the Spokane-Idaho. The particles are mostly sphalerite containing finely intergrown galena. There is an occasional grain of pyrite in the field not readily distinguished from the galena in the photomicrograph. Figure IX is at twice the magnification of Fig. VIII.

Figure X is a photomicrograph of a zinc scavenger concentrate from the Sunset Minerals Inc. The large white particles are pyrite and the gray ones are sphalerite. Most of the white-gray middling grains in this product are sphalerite and pyrite. There is only a trace of galena in the field; that being present occurring as blebs in the sphalerite not distinguishable from the pyrite. Some sphalerite-gangue intergrowth may be observed in this picture.

Figure XI is of an iron concentrate from the same company. The mineral associations shown are essentially the same as in Fig. X except for the increased ratio of pyrite to sphalerite.

Summary

These pictures indicate that the most serious type of locked middling grain in these products is the intergrowth of galena and sphalerite. In many instances it is much too fine to expect appreciable liberation even upon fine grinding. The large amount of slimes that would be produced in any attempt to liberate such particles would undoubtedly be difficult to handle in subsequent flotation. The intergrowth of gangue and ore minerals is evident in some of the photomicrographs but is of a less serious occurrence. All the sections contain pyrite in varying amounts but the grains are not finely intergrown. The pyrite, present as locked middlings, could be liberated without overgrinding.

A square equivalent to the opening in a 200-mesh screen has been drawn on each of the pictures for comparison. It is easily seen from this that some of the galena blebs are only a few microns in diameter.
Fig IX
Lead Scavenger Cone.—200/325 Mesh.

Fig X
Zinc Scavenger Cone.—150/200 Mesh.

Fig XI
Iron Concentrate—150/200 Mesh.
Fig V
Lead Concentrate—125 Mesh.

Fig VI
Zinc Scavenger Conc.—150/200 Mesh.

Fig VII
Zinc Scavenger Conc.—150/200 Mesh.

Fig VIII
Lead Scavenger Conc.—200/325 Mesh.
**Fig I**
Zinc Concentrate—150/200 Mesh.

**Fig II**
Zinc Concentrate—150/200 Mesh.

**Fig III**
Zinc Concentrate—100/150 Mesh.

**Fig IV**
Lead Concentrate—+325 Mesh.