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Nov. 19, 1970

TO: H. Lanier

FROM: C. K. Chase

SUBJECT: Metallurgical Tests on Blackwall Sandstone
Copper Ore (Salem Claims Near Moab,
Leased by Lory Free)

The Blackwall copper deposit was sampled in many surface showings and some blasted areas with the object of obtaining as representative a sample as possible under the existing circumstances. The "Moab Tongue" of the Entrada sandstone is a closely-sized (about 48 to 60 mesh), loosely-cemented white sandstone containing copper values as malachite with minor azurite. The minerals exist in both a powdery and a crystalline form. The mineral is a part of the sparse cementing material between sand grains but does not appear to penetrate the grains.

The sample was crushed through 1/2 inch, put through a laboratory rolls, then screened on a 28 mesh screen. The screen oversize was carefully broken down to sand grain size by mortar and pestle until all passed the 28 mesh screen. An effort was made not to crush individual sand grains. The sample was then thoroughly mixed.

Mechanical Sand-Slime Test

A 500-gram portion of the mixed ore was cut from the sample and put into the laboratory Fagergren attrition machine with 400 ml. of water. The pulp was stirred vigorously for 1/2 hour at the resulting 56% solids. The charge was then sluiced into a large beaker, diluted with additional water, and a good proportion of the slimes were decanted after a short settling period. The sands were again slurried with additional water and the slimes decanted. This was repeated a total of three times. Next, the slimes were separated from a small amount of inadvertent sands. The two products, sands and slimes, were separately filtered, dried, weighed and assayed for copper. Some mechanical losses of pulp occurred during the attrition operation. Results were as follows:

<u>Product</u>	<u>Weight, g.</u>	<u>% Weight</u>	<u>Assay % Cu</u>	<u>Weight Cu, g</u>	<u>Percent Copper Distribution</u>
Heads	500.0		0.46	2.29	
Slimes	31.4	6.3	5.1	1.61	64
Sands	<u>465.8</u>	<u>93.7</u>	0.19	<u>0.89</u>	<u>36</u>
Totals	497.2	100.0%		2.50	100%
Calculated Head	497.2		0.46	2.29	

$$\text{Accountability} = \frac{2.50 \times 100}{2.29} = 109\%$$

Acid Environment Sand-Slime Test

Next, an attrition test at pH2 was performed. Again, 500 grams of ore were put into the attrition machine with 250 ml. of water, resulting in a pulp at 67% solids. A total of 3.5 ml. of concentrated sulfuric acid was added, to attain and maintain a pH of 2 in agitated pulp. The charge was stirred for 1/2 hour, then a sand-slime separation was performed by decantation as before. As a final step, the slimes were separated from the pregnant liquor by filtration and washing. The solid products were dried, weighed, and assayed. The pregnant liquor was measured and assayed. Some mechanical losses by spillage occurred.

<u>Produced</u>	<u>Weight or Volume</u>	<u>% Weight of Solids</u>	<u>Copper Assay</u>	<u>Grams Copper</u>	<u>Percent Copper Distribution</u>
Heads	500.0 g		0.46%	2.30	
Slimes	24.1 g	5.2	0.43%	0.10	4.4%
Sands	444.0 g	94.8	0.02%	0.09	3.9%
Leach liquor	<u>2880 ml.</u>	<u>—</u>	0.73%	<u>2.10</u>	<u>91.7%</u>
Totals	468.1 g	100.0		2.29	100.0%
Calculated Head	468.1		0.46	2.15	

$$\text{Accountability} = \frac{2.29 \times 100}{2.15} = 107\%$$

$$\text{Acid Consumption} = \frac{(3.5 \text{ ml.})(1.84 \text{ S.G.})(.95)}{2.1 \text{ g. copper leached}} = 2.9 \text{ lb. H}_2\text{SO}_4 \text{ per lb. copper leached.}$$

$$= 24 \text{ lb. H}_2\text{SO}_4 \text{ per ton of original ore treated.}$$

Discussion - Wet mechanical sand-slime shows interesting concentration possibilities but recovery is rather low. Dry mechanical sand-slime would be less attractive.

Acid consumption on this example of the "Moab Tongue" of the Entrada sandstone is in a favorable range and leachability on this oxidized sample is satisfactory. It should be noted, however, that our sample was of necessity mostly from the exposed surface of the mineral occurrence and may not necessarily represent the processing characteristics of mineral not on the surface.

Since the sandstone is of great permeability, it is probable that the copper is largely, if not entirely, in the oxidized rather than the sulfide form, but this point will be checked during drilling.

The thickness of the mineralized sandstone member varies but may be as great as 100 feet in places. Near some of the strong faults north of Moab, mineralization may exist in other sandstone members resulting in a greater vertical column of copper deposition, but whether significant tonnage can be developed here is unknown at the present.

Sand-slime operations on clean sandstones such as these offer the possibility of early rejection of over 90% of the total ore weight after a short leach. This promises a moderate-sized counter-current decantation thickener circuit for recovery of the soluble values from the slimes.

Clement K. Chase

CKC:td