BENEFICIATION OF OLIVINE FOR MAYLAND MINING CORPORATION

by
William McDaniel
Senior Mineral Engineer

ABSTRACT

A composite drill-cutting sample from a dunite deposit in Yancey County was beneficiated by a procedure involving grinding, scrubbing, talc flotation, and gravity separation in heavy liquid. The product met requirements for loss on ignition, but only 55% of the ore weight was recovered in the product.

79-17-P

BENEFICIATION OF OLIVINE FOR MAYLAND MINING CORPORATION

by
William McDaniel
Senior Mineral Engineer

Sample No. 4607 - WTM Notebook No. 6

BACKGROUND

Mayland Mining Corporation of Spruce Pine is interested in developing an olivine deposit which is located in Yancey County about 2¼ miles northwest of Kona. Mr. Carl Merschat with the State Geologic Survey Section has examined the deposit and has discussed his findings with Mr. James Redmon, a representative of that company. During a conference of MRL personnel with Mr. Redmon and Mr. Merschat on July 9, 1979, it was agreed that the Minerals Research Laboratory would conduct beneficiation tests on drill cuttings from the deposit. The objective was to produce a product containing less than 1% loss on ignition, the maximum allowable in foundry sand.

SAMPLES

On July 9, Mr. Redmon brought to the Laboratory cuttings from seven drill holes in the deposit. Mr. Merschat chose the better footage sections from each hole and combined these to form a composite sample of each hole. The loss on ignition was determined for each of these seven samples, as shown in Table 1.

TABLE 1

LOSS-ON-IGNITION ANALYSES OF SEVEN COMPOSITE SAMPLES

Description		LOI
Hole 1	12' - 46'	3.78
Hole 3	0' - 20' & 30' - 70'	6.77
Hole 4	34' - 60'	4.60
Hole 5	0' - 70'	5.36
Hole 6	20' - 50'	5.54
Hole 8	30' - 50'	8.42
Hole 9	20' - 30'	5.08

These ignition losses indicate that the rock contains a large quantity of hydrous alteration minerals and that considerable beneficiation will be necessary to meet foundry sand specifications.

All of these samples, except Hole 8, were combined as shown in Table 2 to obtain one composite sample, identified as Lab 4607, for use in the processing studies. The cuttings from Hole 8 were excluded because of the high ignition loss (8.42%).

TABLE 2

SAMPLES COMBINED TO FORM LAB SAMPLE NO. 4607

Hole No.	Footage Interval	Length of Sample(ft)	% of Total Footage
1	12' - 46'	34	14.8
3	0' - 20' & 30' - 70'	60	26.1
4	34' - 60'	26	11.3
5	0' - 70'	70	30.4
6	20' - 50'	30	13.0
9	20' - 30'	10	4.4
Lab 4607	Composite	230	100.0

A 200-g aliquot of this final composite (Lab 4607) was screened 30 minutes on a Ro-Tap to obtain the screen analysis shown in Table 3.

TABLE 3

SCREEN ANALYSIS OF FINAL COMPOSITE SAMPLE (LAB 4607)

U.S. Size	% Wt	Cumul. % Wt
+16	14.7	14.7
-16+20	2.5	17.2
-20+30	3.9	21.1
-30+40	7.5	28.6
-40+50	12.0	40.6
-50+70	13.2	53.8
-70	46.2	100.0
Total	100.0	-

BENEFICIATION PROCEDURE

Two portions of Lab 4607 were treated by a rigorous and fairly complex process involving grinding, scrubbing, talc flotation, and heavy liquid separation. In previous research, it has been shown that the results of heavy liquid separation can be duplicated reasonably well by treatment on a wet shaking table, either in laboratory or commercial operations.

The two tests were conducted under almost identical conditions, except that grinding time was 1½ minutes in Test 1 and 3 minutes in Test 2. In each case, a 600-g sample of Lab 4607 was ground in an 8 X 8 3/4-in. batch rod mill at 60% solids and with 1 pound NaOH per ton of feed. The ground material was deslimed on a 325 mesh screen, dried at 250°F, and then screened to remove a small amount of oversize. The undersize was scrubbed intensely for 15 minutes at 73% solids and with 1 pound NaOH per ton. Scrubbing was done with a 2-tiered, 12-bladed, 3-in. diameter impeller turning at 1200 rpm in a 3¼-in. diameter octagonal pot. After desliming,

the scrubbed material was conditioned 3 minutes at 54% solids with 0.2 lb H-26 frother per ton of feed. Talc was then floated in a Denver D-1 batch flotation cell. The machine discharge or concentrate was dried at 250°F, and a 5-g sample was split out and analyzed for loss on ignition. A 100-g sample of the machine discharge was separated in a four-step heavy liquid process using tetrabromoethane with a specific gravity of 2.96. The three products obtained in heavy liquid (floats, mids, and sinks) were each analyzed for loss on ignition.

RESULTS

In Test 1, using a 1½-minute grind, 74.6% of the ore weight was recovered as a flotation concentrate which analyzed 3.74% loss on ignition. Heavy liquid separation of this flotation concentrate produced a final "sink" product analyzing 0.72% loss on ignition and representing 55.4% of the original ore weight. Table 4 summarizes results of Test 1.

TABLE 4

WEIGHT DISTRIBUTION AND ANALYSES OF PRODUCTS FROM TEST 1

Product	% Wt	LOI
Grind Slimes	12.7	-
+US 40	1.8	-
Scrub Slimes	8.7	-
Talc Froth Prod.	2.2	-
-2.96 H.L.Floats	17.3	12.6
H.Liquid Mids	1.9	2.74
+2.96 H.L. Sinks	55.4	0.72
Lab 4607	100.0	

Although the screen analysis of the Test 1 final "sink" product was not obtained, it should be similar to the screen analysis of the Test 1 flotation machine discharge which is shown in Table 5.

TABLE 5

SCREEN ANALYSIS OF FLOTATION MACHINE DISCHARGE FROM TEST 1

US Size	% Wt	Cumul. % Wt
+50	12.8	12.8
-50+70	25.4	38.2
-70+100	26.3	64.5
-100+140	12.1	76.6
-140+200	10.1	86.7
-200+325	10.7	97.4
-325	2.6	100.0
Total	100.0	

Increasing the grind to three minutes in Test 2 resulted in very few changes in overall results. Flotation recovered 72.3% of the ore weight in a machine discharge analyzing 3.56% loss on ignition. Separation of this machine discharge in tetrabromoethane produced a "sink" product analyzing 0.73% loss on ignition and representing 54.1% of the ore weight. Results of Test 2 are summarized in Table 6.

TABLE 6

WEIGHT DISTRIBUTION AND ANALYSES OF PRODUCTS FROM TEST 2

Product	% Wt	LOI
Grind Slimes	15.8	-
+HS 50	2.7	-
Scrub Slimes	6.8	-
Talc Froth Prod.	2.4	-
-2.96 H.L.Floats	16.0	13.1
H.Liquid Mids	2.2	2.51
+2.96 H.L. Sinks	54.1	0.73
Lab 4607	100.0	

The screen analysis of the flotation concentrate from Test 2 is shown in Table 7.

TABLE 7

SCREEN ANALYSIS OF FLOTATION MACHINE DISCHARGE FROM TEST 2

US Size	% Wt	Cumul. % Wt.
+70	18.1	18.1
-70+100	34.2	52.3
-100+140	17.1	69.4
-140+200	11.5	80.9
-200+325	15.1	96.0
-325	4.0	100.0
Total	100.0	

CONCLUSIONS

This ore is more highly serpentinized than most North Carolina dunite deposits that have been considered as sources of foundry sand. This high degree of alteration is indicated by the high ignition losses of the original drill cuttings.

Most of the serpentine was liberated and removed by the process investigated. The heavy liquid step was particularly effective in separating the serpentine from the olivine. These results indicate that tabling alone might produce a concentrate with the desired, 1% or less, loss on ignition.

However, the high serpentine content presents a recovery problem. In order to reject sufficient serpentine, it seems necessary to reject about 45% of the original ore weight. By comparison, acceptable olivine can be obtained from many North Carolina dunites with a loss of less than 25% weight.

The possible use of this rock as steel flux might warrant investigation. Ignition loss requirements are not as strict for this market, but the stone must be tough. Detailed specifications for flux stone do not seem to be readily available.