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CONCENTRATION OF MICA FROM VALEMOUNT, B. C. (PROJECT MP-IM-6116)

by

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SUMMARY OF RESULTS

A process for the recovery of mica from schist was devised using:

1. Jaw crushing for primary comminution,
2. Rod milling to free and delaminate the mica,
3. Wet tabling to concentrate the mica, and
4. Wet magnetic separation to remove dark grains from the product.

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INTRODUCTION

A sample of micaceous schist from the deposit of Georgian Minerals Industries Ltd., near Valemount, B.C., was submitted with the request that laboratory-scale rod milling and beneficiation tests be carried out to develop improvements in an existing mill circuit. The sample reached Ottawa on Aug. 25, 1961.

DESCRIPTION OF SAMPLE

The sample as received consisted of 1000 lb of mica schist, approximately -4 inch in size.

The muscovite and biotite mica present were chiefly -8 mesh. The main gangue materials were quartz and garnet.

TEST WORK

Tests were made comparing 1) four types of crushing systems, 2) the effect of feed rates and steel loads in rod milling, and 3) types of gravity concentration on sized fractions. The extent to which dark mica could be removed from wet-table concentrates by the Jones Wet Magnetic Mineral Separator was also determined.

Crushing

To find the most suitable method of preparing feed for a rod mill, portions of the sample as received were passed through a jaw crusher, a rolls, a cone crusher, and a hammer mill. All machines, except the hammer mill, were choke fed.

Results are shown in Table 1.

TABLE 1

Comparison of Crushing Systems

	Jaw		Rolls		Cone		Impact
Discharge Opening	½ in.	¼ in.	½ in.	¼ in.	½ in.	¼ in.	
Product (%)							
+ 3/4 in.	4.3	0	27.0	2.5	10.7	1.2	0
- 3/4 in. + 4m	41.0	30.0	34.9	46.8	48.2	53.5	20.3
- 4m	54.7	70.0	38.1	50.7	41.1	45.3	79.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Jaw crushing produced the most satisfactory rod mill feed.

Grinding

Seven tests were run in a small laboratory rod mill. The feed rate, per cent solids, and load of rods were varied. Mill feed was a minus 3/4 in. jaw-crusher product.

Results are given in Table 2.

TABLE 2

Rod Milling

Test No.	1	2	3	4	5	6	7
Solids (%)	50	50	25	25	25	25	25
Feed Rate (lb/min)	1	0.5	1	0.5	1.5	1	1
Rod Load (lb)	51	51	51	51	51	51	65
Product (%)							
+ 4m	0.6	0.4	0.2	0	1.2	1.6	0
- 4 + 8	3.0	0.3	1.0	0.1	2.0	2.5	0.6
- 8 + 14	10.5	1.4	6.6	1.7	8.7	7.7	5.6
-14 + 20	10.5	4.9	12.7	6.0	10.2	9.6	9.2
-20 + 35	17.6	9.8	16.6	11.5	26.5	25.4	27.1
-35 + 80	33.0	42.5	36.9	40.1	31.7	33.1	37.3
-80	24.8	40.7	26.0	40.6	19.7	20.1	20.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

The best overall results were obtained in Test No. 7 where good delamination occurred in all -8 mesh products and comparatively little -80 mesh material was produced.

Concentration

All products from the rod mill tests were combined and dry-screened, with results as shown in Table 3.

TABLE 3

Screened Fractions from Composite Rod Mill Products

Mesh	Product (%)	Comments
+ 8	3.4	Mainly non-mica
- 8 + 35	48.9	Mainly mica
-35 + 60	21.1	" "
-60 + 100	12.9	" "
-100	13.7	" "
Total	100.0	

Humphreys Spiral and Wet-Table tests were made on the -8 + 35 mesh and the -35 + 100 mesh fractions.

Tables 4 and 5 show the pertinent results obtained.

TABLE 4

Humphreys Spiral Tests

Test No.	Feed Size	Feed Rate (lb/min)	No. of Ports Open	Conc (wt %)	Tail (wt %)
1	- 8 + 35m	80	5	85.3	14.7
2	- 8 + 35m	50	5	74.5	25.5
3	- 8 + 35m	50	5	78.2	21.8
4	-35 + 100m	38	5	79.0	21.0
5	-35 + 100m	37	5	82.5	17.5
6	-35 + 100m	41	5	74.2	25.8
7*	-35 + 100m	32	5	54.1	45.9

*Wash water was reduced with each succeeding test. In Test No. 7 the wash water was shut off.

Good separations were not obtained by the Humphreys Spirals.

TABLE 5

Wet-Tabling Tests (Rectangular Deck, Slope 5°)

Test No.	Feed Size	Conc (wt %)	Midd No. 1 (wt %)	Midd No. 2 (wt %)	Tail (wt %)
1	- 8 + 35m	23.3	18.7		58.0
2*	- 8 + 35m	29.1	25.8		45.1
3	-35 + 100m	4.9	26.1	54.3	14.7
4*	-35 + 100m	23.9	43.8	26.8	5.5

* Feed rate for the second test in each size was twice that of the first test.

Good separations in the concentrate and middling fractions were obtained by wet tabling.

Magnetic Separation

A series of four tests using the Jones Wet Magnetic Mineral Separator was run on the wet-table fractions to remove a small amount of dark material from the white muscovite.

Table (shows the results of this work.

TABLE 6

Jones Separator Tests on Wet-Table Fractions
(Salient Plates, Wash Water Head 3 ft)

Test No.	1	2	3	4
Size	- 8 + 35m	- 8 + 35m	-35 + 100m	-35 + 100m
Material	Wet Table Conc & Midd	Wet Table Tail	Wet Table Conc & Midd No. 1	Wet Table Tail
Mag-10amp	11.3	31.3	8.9	39.3
Mag-25amp	5.2	4.0	2.5	0.9
Non-mag	83.5	64.7	88.6	59.8
Total	100.0	100.0	100.0	100.0

In all cases, the non-magnetic fractions were substantially free of dark particles.

DISCUSSION

Georgian Minerals Industries was primarily interested in improving the recovery of + 80 mesh mica. It was desirable, therefore, to produce a minimum of - 80 mesh mica.

Of the four crushing systems compared in the preparation of rod mill feed, jaw crushing gave the best overall results both for reduction ratio and for production of -80 mesh fines.

Rod milling Test No. 7 produced the best overall grind. The - 80 mesh product was at a minimum and the + 8 mesh was nearly all non-mica. It was found that unless ground to substantially all - 8 mesh, the mica remained as books. In Test No. 7 almost all the - 8 + 80 mesh fractions were composed of delaminated mica and non-mica particles, with no mixed grains.

The best results of the Humphreys Spiral tests are shown in Table 4. Separation in all cases was poor. Fine non-mica fragments tended to concentrate with the mica.

Wet-tabling tests gave good results. The combined concentrate and middling in Test No. 2 (Table 5) is essentially all mica and represents 54.9% of the test feed weight. In Test No. 4, the concentrate and first middling are mainly mica and together equal 67.7% of the test feed; the second middling contains enough mica for recirculation.

The Jones wet magnetic separator tests produced a white, high-grade, "non-magnetic" mica by removing the magnetic dark biotite, etc. This type of equipment could be used to upgrade the normal product.

CONCLUSIONS

(1) Jaw crushing produces a feed satisfactory for rod milling.

(2) Rod milling gives a product that, after screening, can be used for wet tabling.

(3) Wet tabling of screened fractions, -8 +35 mesh and -35 +100 mesh, separates the mica from the gangue with good recoveries.

(4) The mica products from wet tabling can be upgraded to a whiter material with one pass through the Jones Wet Magnetic Separator set either at 10 amps or, preferably, at 25 amps.

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