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O T T A W A June 5th, 1940.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 852.

Concentration of Fluorite from the Cook Claims,
Beauchastel Lake, Montbeillard Township,
Rouyn-Noranda Area, Quebec.

BUREAU OF MINES
DIVISION OF METALLIC MINERALS

ORE DRESSING AND
METALLURGICAL LABORATORIES

CANADA
DEPARTMENT
OF
MINES AND RESOURCES
MINES AND GEOLOGY BRANCH

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Shipment:

A sample of fluorspar rock, weight 300 pounds, was received on February 29th, 1940, from the Cook claims, Beauchastel Lake, Montbeillard township, Quebec.

The shipment was submitted by Mr. Al. Cook, 166 McNabb Street North, Hamilton, Ontario.

Characteristics of the Rock:

Examination under the binocular microscope revealed that the material consists essentially of purple fluorspar (fluorite) intimately intergrown with quartz and some brecciated, siliceous wall rock. There is a small content of metallic sulphides, comprising sphalerite, pyrite, and galena.

Specifications of Fluorspar:

The commercial grades of fluorspar depend on the uses for which it is required. The following are the chemical and physical specifications for the principal grades:

Grade	Assays, per cent			Size, mesh
	CaF_2, min.	$CaCO_3$, max.	SiO_2, max.	
Metallurgical spar	85	-	5	1 inch to 48 mesh.
Glass	95	-	3	55% -100 to 45% -290 mesh.
Enamel	95-98	Low	2.5	60% -100 mesh.
Acid spar	98	1	1	80% -100 mesh.

Sulphur and base metals are objectionable in all grades and must be very low.

Sampling and Assaying:

The rock was crushed and sampled and assayed as follows:

Fluorite	(CaF_2)	- 53.4 per cent
Silica	(SiO_2)	- 35.5 "
Sulphur	(S)	- 1.68 "

Experimental Results:

Concentration of the fluorite by flotation will yield a product of acid spar grade. The recovery is low, however, and a product suitable for the glass or enamel trade can be made which will yield a higher recovery of fluorite.

The sulphides interfere in making a metallurgical spar and tabling tests conducted for this purpose were not successful. It is evident from the analyses of table products that the silica and fluorite are closely associated and that fine grinding is necessary to separate these minerals.

The sulphides can be successfully removed by flotation.

Summarized Results.

Test No.	Product	Weight, per cent	Assays, per cent CaF_2	Assays, per cent SiO_2	Recovery of fluorite, per cent	Number of cleanings
3.	Concentrate from raw rock	24.6	97.92	0.93	45.1	3
6.	Concentrate from raw rock	38.3	94.08	4.44	67.5	3
7.	Concentrate from minus 48 mesh	22.2	97.54	1.00	40.6	4
8.	Concentrate from raw rock	36.4	96.82	1.59	66.0	4
9.	Concentrate from reground middlings	30.6®	95.81	2.85	58.6	5

® Per cent of middlings.

Experimental Tests:

The method adopted for flotation was to grind the fluorspar rock with soda ash and sodium silicate in water to a fineness of around 70 per cent minus 200 mesh.

The pulp was conditioned with potassium amyl xanthate and the sulphides floated off using pine oil as frother. After removal of the sulphides quebracho was added as a silica depressant and American Cyanamid reagent 708 was added as a collector for the fluorite. This reagent is also an efficient frother. A rougher concentrate was removed and this was cleaned three to five times. During cleaning, small additions of quebracho, 708 or oleic acid were made.

Tests Nos. 1 and 2.

These tests were of a preliminary nature to determine the flotation conditions. The sulphides float readily and are practically all removed in a few minutes. It was observed that the fluorite collector, 708, should not be added in one lot. This produces a violent froth, which is non-persistent. A more uniform froth is obtained by adding the reagents in small amounts.

Test No. 3.

A sample of minus 14 mesh fluorspar, 1,000 grammes in weight, was screened on a 65-mesh screen and the plus 65 mesh ground in a grinding jar with 1 pound soda ash per ton. The screening was carried out to prevent making excessive fines. It is not thought that

selective grinding has any advantages.

The minus 65 mesh product was added to the ground pulp and the whole conditioned in a Fagergren laboratory cell with 1.2 pounds sodium silicate per ton, 0.1 pound potassium amyl xanthate per ton, and floated with 0.124 pound pine oil per ton.

After the sulphides had been removed the pulp was again conditioned with 0.4 pound of quebracho per ton and 0.96 pound oleic acid and 0.2 pound of Reagent 708 per ton were added to float the fluorite as a rougher concentrate. This concentrate was cleaned three times.

Results:

Product	Weight, per cent	Assays, per cent CaF_2	Assays, per cent SiO_2	Distribution of fluorite, per cent
Feed	100.0	53.4		
Sulphide conc.	7.8	-	-	
Fluorite conc.	24.6	97.92	0.93	45.1
Middling	5.4	-	-	
Tailing	62.2	-	-	

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No assays were made on Test No. 4.

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Test No. 5 was a table test. The results were not satisfactory.

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Test No. 6.

The minus 14 mesh fluorspar was ground without screening with 1 pound soda ash and 1.2 pounds sodium

silicate per ton. The sulphides were floated as in the previous tests. For the rougher fluorite concentrate, 0.8 pound quebracho per ton and 1.0 pound of Reagent 708 per ton were added. A further addition of 0.3 pound of Reagent 708 was made during the three cleaning floats.

Results:

Product	Weight, per cent	Assays, per cent CaF_2	Assays, per cent SiO_2	Distribution of CaF_2, per cent
Feed	100.0	53.4		100.0
Sulphide conc.	10.4	19.28		3.8
Fluorite conc.	38.3	94.08	4.44	67.5
Middling	26.2	51.86	42.97	25.4
Tailing	25.1	7.07		3.3

Analysis of Sulphide Concentrate.

Lead	-	10.58 per cent
Zinc	-	18.56 "
Iron	-	9.80 "

Screen Test on Flotation Tailing.

Mesh		Weight, per cent
+ 65	-	1.0
- 65 +100	-	6.5
-100 +150	-	15.0
-150 +200	-	18.5
-200	-	59.0
		100.0

Screening, Tabling, and Flotation.

Test No. 7.

This method was carried out to determine the possibility of making a metallurgical spar from the coarser sizes and an acid or glass spar from the fines.

Treating the coarse sizes on tables was not

satisfactory due to factors already mentioned, namely, the presence of sulphides and association of fluorite and silica.

Details of the test are given as a matter of record.

The minus 14 mesh rock was screened to give three products, -14+28 mesh, -28+48 mesh, and -48 mesh. The first two were tabled separately. The fluorite concentrates contained considerable sulphide minerals. These were floated off the -28+48 mesh product, but the +28 product was too coarse to be cleaned by flotation. The minus 48 mesh product was ground and treated by flotation in the manner already described.

The following table shows the assays of the products and the distribution of the fluorite:

Product	Weight, per cent	Assays, per cent CaF_2	Assays, per cent SiO_2	Distribution of CaF_2, per cent
Table conc., -14+28	3.1	51.44	-	3.0
" " -28+48	10.5	67.52		13.3
Sulphide conc., -28+48	0.6	o		o
" " (flotation)	8.0	20.0*		3.0
Table tailing, -14+28	5.1	25.27		2.4
" " -28+48	11.3	37.44		7.9
Flotation conc.	22.2	97.54	1.00	40.6
Flotation middling	18.8	57.20		20.1
Flotation tailing	20.4	25.43		9.7
Feed	100.0	53.4		100.0

* Approximate.

A screen test on the fluorite flotation concentrate showed that 84.6 per cent was minus 200 mesh.

It would appear from the above results that apart from the difficulty of separating the sulphides in the coarse sizes, it requires comparatively fine grinding to separate the fluorite from the quartz. The table concentrates are too low in grade to be of any economic value.

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Test No. 8.

A sample of fluorspar was ground to have approximately 70 per cent minus 200 mesh. Soda ash, 1.0 pound per ton, and sodium silicate, 2.4 pounds per ton, were added to the grind.

The sulphides were floated off in the usual manner, conditioning for 3 minutes with potassium amyl xanthate and floating for 6 minutes.

The rougher fluorite concentrate was taken off after conditioning 2 minutes with 0.4 pound quebracho per ton and floating 10 minutes. 0.6 pound of Reagent 708 per ton was used.

In the first cleaning 0.4 pound quebracho per ton was used and 0.2 pound Reagent 708. In the second cleaning 0.192 pound oleic acid was added and an equal amount in the third cleaning. In the fourth cleaning 0.1 pound Reagent 708 was used.

Results:

Product	Weight, per cent	Assays, per cent		Distribution of fluorite, per cent
		CaF_2	SiO_2	
Feed	100.0	53.4		100.0
Sulphide conc.	12.1	7.05		1.6
Fluorite conc.	36.4	96.82	1.59	66.0
Middling	29.9	54.74	40.53	30.6
Tailing	21.6	4.34		1.8

The middling products contain approximately the same amount of fluorite as the feed. For the purpose of determining if this product could be further concentrated, a number of middling products were combined, reground, and re-floated. The results are shown under Test No. 9.

Test No. 9.

The material was ground with soda ash and sodium silicate and a rougher concentrate taken off using 0.8 pound quebracho per ton and 0.6 pound Reagent 708 per ton. The rougher concentrate was cleaned 5 times. In the first, 0.8 pound quebracho was added and in the second, 0.472 pound oleic acid per ton. No reagents were added in the last three cleanings.

Results:

Product	Weight, per cent	Assays, per cent		Distribution of CaF_2, per cent
		CaF_2	SiO_2	
Feed	100.0	50.00		100.0
Fluorite concentrate	30.6	95.81	2.85	58.6
Tailing	69.4	29.81	62.26	41.4

Conclusions:

The results of the investigation have disclosed that the presence of sulphide minerals and the close association of the fluorite and the silica make it impossible to produce a satisfactory grade of metallurgical spar by gravity concentration methods.

Flotation gave more encouraging results and by fine grinding, at least 70 per cent minus 200 mesh, fluorite concentrates of a grade suitable for acid spar, glass spar or enamel spar were produced. Flotation of fluorite is not difficult and Reagent 708 or oleic acid are satisfactory collectors and frothers. The sulphides are readily removed by preliminary flotation using xanthates as collectors. The silica is depressed by sodium silicate and quebracho. The recovery is around 65 per cent. Re-treatment of the middling would increase this figure to 70 per cent or better.

The economic treatment of the ore will be dependent on the extent of the deposit and the demand for the grade of spar produced by flotation methods.

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