O T T A W A November 29th, 1940.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 934.

Sink-and-Float Tests on Two Samples of Fluorite Ore from Madoc, Ontario.

#27

Bureau of Mines
Division of Metallic
Minerals.

Ore Dressing
and Metallurgical
Laboratories

CANADA

DEPARTMENT
OF
MINES AND RESOURCES

Mines and Geology Branch

O T T A W A November 20th, 1940.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 934.

Sink-and-Float Tests on Two Samples of Fluorite Ore from Madoc, Ontario.

Shipment:

Two samples of fluorite ore were received on August 14th, 1940, from the Dominion Fluorspar Company Limited, Madoc, Ontario. One sample, designated Material before Screening, weighed 100 pounds and the other, designated Screen Rejects, weighed 185 pounds.

Location of Property:

These samples were taken from a property located at Madoc, Hastings county, Ontario.

Character of the Ore:

Fluorite and barite in a gangue of limestone, calcite and a small proportion of quartz. The mineralization is coarse and much of the ore is freed as coarse as 1 inch; but a proportion remains as chats down to fine sizes, particularly fluorite-calcite chats and fluorite-barite chats.

The Material Before Screening as received consisted of a small proportion of large lumps up to 4 inch and a large proportion of fines (approximately 50 per cent was minus 8 mesh). The Screen Rejects sample was more even in size--the maximum was about 1¼ inch and there was only 15 per cent of minus 8 mesh material. Both samples, which are from the same source, were soft and produced much fines on crushing.

Sampling and Assaying:

Owing to the small size of the samples and the coarse crushing size, no head sample was taken for assay. Head sample assays calculated from the products of tests are as follows:

	(Per cent)		
	$CaCO_3$	CaF_2	$BaSO_4$
Material Before Screening -	30.50	54.88	11.86
Screen Rejects -	42.07	37.69	13.10

Experimental Tests:

The object of the tests was to determine the suitability or otherwise of the ore for concentration by the Huntington-Heberlein process. A series of small-scale bucket tests was conducted in which a density separation is effected under static conditions in a bath of substantially stable galena medium. The medium is a suspension of fine galena in water and its density can be controlled to an accuracy of less than 0.01 by alteration of the proportions of galena and water. The medium is the same as would be used in a large-scale operation.

Preliminary tests showed that both samples of ore should be treated with medium of 2.80 specific gravity and that nothing finer than 6 mesh should be treated by the process. The maximum size of feed to the process is -$\frac{3}{4}$ inch for the screen rejects and -$\frac{1}{2}$ inch for the material before screening.

One test was made on each sample of ore under the above-mentioned conditions, the results of which are to be found in the following tables:

(See tables on
following pages)

(Experimental Tests, cont'd) -

Results:

Screen Rejects.

Table I. - Distribution of Products from Crushing.

Product	Weight, per cent	Assays, per cent			Distribution, per cent		
		$CaCO_3$	CaF_2	$BaSO_4$	$CaCO_3$	CaF_2	$BaSO_4$
S. F. feed	66.70	49.62	27.52	14.62	78.68	48.71	74.43
Fines	33.30	26.93	58.05	10.06	21.32	51.29	25.57
Head sample	100.00	42.07	37.67	13.10	100.00	100.00	100.00

Table II. - Distribution of Products from Sink-and-Float Separation.

S. F. conc.	36.72	10.30	49.74	37.56	7.62	66.37	94.33
S. F. tailing	63.28	72.44	14.63	1.31	92.38	33.63	5.67
S. F. feed	100.00	49.62	27.52	14.62	100.00	100.00	100.00

Table III. - Summary of Products from Pre-Concentration.

S. F. conc.	24.49	10.30	49.74	37.56	6.00	32.33	70.21
Fines	33.30	26.93	58.05	10.06	21.32	51.29	25.57
Product for further conc.	57.79	19.88	54.53	21.71	27.32	83.62	95.78
S. F. tailing	42.21	72.44	14.63	1.31	72.68	16.38	4.22
Head sample (cal.)	100.00	42.07	37.67	12.10	100.00	100.00	100.00

(Note: The results on the run-of-mine ore are given on the next page.)

(Continued on next page)

(Experimental Tests, cont'd) -

Results, cont'd -

Run-of-Mine Ore.

Table I. - Distribution of Products from Crushing.

Product	Weight, per cent	Assays, per cent			Distribution, per cent		
		$CaCO_3$	CaF_2	$BaSO_4$	$CaCO_3$	CaF_2	$BaSO_4$
S. F. feed	34.22	52.25	25.99	16.05	58.63	16.21	46.30
Fines	65.78	19.18	69.91	9.68	41.37	83.79	53.70
Head sample	100.00	30.50	54.88	11.86	100.00	100.00	100.00

Table II. - Distribution of Products from Sink-and-Float Separation.

S. F. conc.	30.92	10.09	39.56	47.19	5.97	47.06	90.93
S. F. tailing	69.08	71.13	19.92	2.11	94.03	52.94	9.07
S. F. feed	100.00	52.25	25.99	16.05	100.00	100.00	100.00

Table III. - Summary of Products from Pre-Concentration.

S. F. conc.	10.58	10.09	39.56	47.19	3.50	7.63	42.10
Fines	65.78	19.18	69.91	9.68	41.37	83.79	53.70
Product for further treatment	76.36	17.92	65.71	14.88	44.87	91.42	95.80
S. F. tailing	23.64	71.13	19.92	2.11	55.13	8.58	4.20
Head sample (cal.)	100.00	30.50	54.88	11.86	100.00	100.00	100.00

The results may be summarized as follows:

(1). Screen Rejects -

	Per cent
Proportion of ore available for S. and F. feed -	66.70
" " " as untreatable fines -	33.30
Proportion of ore rejected as waste -	42.21
" " " to further treatment -	57.79

The product to further treatment, S. F. concentrate

(Continued on next page)

(Experimental Tests, cont'd) -

Results, cont'd -

plus untreatable fines, contains 27 per cent of the calcite and 83 per cent of the fluorite, the remainder of these minerals having been rejected as waste. The concentrate assayed 49.74 per cent CaF_2 and 37.56 per cent $BaSO_4$. The fines assayed 58.05 per cent CaF_2 and 10.06 per cent $BaSO_4$. The waste product assayed 72.44 per cent $CaCO_3$ and 14.63 per cent CaF_2.

(2). Material before Screening -

	Per cent
Proportion of ore available to S. and F. feed	- 34.22
" " " as untreatable fines	- 65.78
Proportion of ore rejected as waste	- 23.64
" " " to further treatment	- 76.36

The product to further treatment contains 45 per cent of the calcite and 91 per cent of the fluorite, the remainder of these minerals having been rejected as waste. The concentrate assayed 39.56 per cent CaF_2 and 47.19 per cent $BaSO_4$. The fines assayed 69.91 per cent CaF_2 and 9.68 per cent $BaSO_4$. The waste product assayed 71.13 per cent $CaCO_3$ and 19.92 per cent CaF_2.

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Conclusions:

Owing to the softness of the constituent minerals, resulting in large quantities of untreatable fines, particularly in the case of the material before screening,

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(Conclusions, cont'd) -

the proportion of ore available to sink-and-float feed has been greatly reduced. During the tests it was observed that the Material Before Screening contained a greater proportion of crystalline calcite than did the Screen Rejects. This material was apparently not retained on the screen and appeared to be more refractory to the process owing to the fact that it was often attached to barite or fluorite.

While the final products from both samples are of nearly the same grade it will be noted that the material before screening required crushing to -½ inch while the screen rejects were crushed to -¼ inch.

We understand that the treatment of the fines need not be considered in this investigation.

Referring to the proportion of the ore treated by Sink-and-Float, eliminations of 63 and 69 per cent were obtained. These waste products carried some fluorite and recoveries were not particularly good. The 'sink' contained 10 per cent $CaCO_3$ and a considerable proportion of barite. Further separation of these minerals could not be effected by sink-and-float and the alternative for production of metallurgical spar is jigging and tabling.

Satisfactory jigging tests could not be carried out on the small amounts of 'sink' available from these samples, and if this suggestion is to be followed up it

(Continued on next page)

(Conclusions, cont'd) -

is recommended that a 10-ton sample of representative ore be sent in. This will enable the ore to be tested in the sink-and-float plant and the 'sink' to be tested in a multi-cell jig.

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