

O T T A W A

September 22nd, 1941.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1096.

Magnetic Concentration of Magnetite Ore  
from the Childs Iron Mine,  
Hastings County, Ontario.

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(Copy No. 26)

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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from the Childs Iron Mine,  
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Shipment:

A shipment of magnetite ore, having a net weight of 9,431 pounds, was received on July 10th, 1941, from the Frobisher Exploration Company Limited, Bancroft, Ontario. This ore, taken from the Childs iron mine, in Hastings county, Ontario, was submitted for magnetic concentration tests.

Characteristics of the Ore:

The ore consisted of a fairly coarse-grained magnetite in which the mineral was well disseminated throughout the gangue. No massive magnetite was noticed. The ore was very friable and had a tendency to break to grain size on handling. No pyrite was observed during the crushing of the ore.

Results of Investigation:

1. The coarse magnetic cobbing tests were unsatisfactory from the point of view of the recovery of the iron and the structure of the final concentrates. The magnetic concentrate assayed 53.24 per cent iron, 0.022 per cent sulphur, 0.026 per cent phosphorus, and 17.03 per cent insoluble. The screen test gave 21.4 per cent minus 20 mesh material in the concentrate, which would necessitate the removal of all this material. This, in turn, would lower the grade below the base grade required. For the above reasons it is considered that coarse magnetic cobbing is not applicable to this ore.

2. A high-grade concentrate with a good recovery of the iron can be obtained by grinding to minus 10 mesh and making a wet magnetic separation. The concentrate from this would require sintering. The concentrate assayed 68 per cent iron, 0.02 per cent sulphur, 0.007 per cent phosphorus and 4.17 per cent insoluble. The iron recovery was 94.2 per cent and the recovery of magnetic iron was 98.4 per cent.

DETAILS OF TESTS:

The ore was divided into two separate lots. Lot No. 1 was used for coarse magnetic cobbing tests and Lot No. 2 was used for fine grinding and wet magnetic separation tests.

(Continued on next page)

(Details of Tests, cont'd) -

Table No. 1. - Feed Samples.

Lot No.	Weight, :		Assays, Per cent			
	pounds	per cent	Fe	S	P	Insol.
Lot No. 1	5,220	55.4	44.36	0.026	0.029	22.49
Lot No. 2	4,203	44.6	43.89	0.028	0.029	21.66
Combined	9,423	100.0	44.15	0.027	0.029	22.12

COARSE MAGNETIC COBBING TEST - LOT NO. 1.

The ore set aside for the coarse cobbing test was stage-crushed through a 1½-inch screen. The ore was then sized on the screen sizes given in Table No. 3 and each screen size passed separately over the magnetic separator (Ball-Norton type).

Table No. 2. - Assays and Recoveries.

Product	Weight, :		Assays, Per cent				Recovery of iron, per cent
	per cent	per cent	Fe	S	P	Insol.	
Feed	100.0	44.36	0.026	0.029	22.49	100.0	
Concentrate	61.2	53.24	0.022	0.026	17.03	73.5	
Tailing	38.8	30.35	0.033	0.034	31.11	26.5	

Ratio of Concentration : 1.63:1.

Table No. 3. - Screen Analysis.

Product	FEED		CONCENTRATE		TAILING	
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
	Weight	Fe	Weight	Fe	Weight	Fe
-1½+1 in.	32.8	44.00	30.2	50.22	36.9	35.98
-1 +¾ in.	16.6	41.91	13.0	48.55	22.3	35.98
-¾ +½ in.	11.0	42.93	10.2	49.21	12.4	34.82
-½ +¼ in.	11.0	42.64	12.4	49.21	8.7	27.92
-¼ +20 mesh	9.5	46.09	12.8	53.24	4.3	12.81
-20 mesh	19.1	48.06	21.4	64.76	15.4	11.57
Total	100.0	44.36	100.0	53.24	100.0	30.35

Conclusions from Coarse Magnetic Cobbing Test:

1. The ore is not amenable to coarse magnetic cobbing.
2. A satisfactory grade was not produced until the ore had been crushed to minus  $\frac{1}{4}$  inch.
3. The concentrate contained 21.4 per cent of the material in the minus 20 mesh size. This makes the product unsatisfactory structurally. Removing this material would lower the grade below the base grade required.
4. The recovery was low, as indicated by the high iron content of the tailing.
5. The ore was very friable and crushed readily, producing a large proportion of fines. Fines were even produced by the ordinary handling of the ore.

FINE GRINDING TESTS - LOT NO. 2.

In this test the ore was crushed to minus  $\frac{1}{2}$  inch and then ground in a ball mill in closed circuit with a 10-mesh vibrating screen. The undersize went to a Roche wet magnetic separator. The middlings from the separator were returned to a Dorr classifier for thickening, the sands being returned to the ball mill and the overflow to waste.

The ore ground very readily, giving a high-grade concentrate with good recovery.

Table No. 4. - Assays and Recoveries.

Product	Weight, per cent	Assays, Per cent				Recovery of iron, per cent
		Fe	S	P	Insol.	
Feed	100.0	43.89	0.028	0.029	21.66	100.0
Concentrate	60.7	63.14	0.024	0.007	4.17	94.2
Tailing	39.3	6.42	0.034	0.064	48.69	5.8

Ratio of Concentration: 1.65:1.

Recovery of Magnetic Iron  
(by Davis tube): 98.4 per cent.

(Fine Grinding Tests, cont'd) -

A preliminary test, using the rejects from the coarse cobbing test, was run and gave identical results at a slightly finer grind.

Table No. 5. - Screen Test of Concentrate.

Screen Size	Weight, per cent	Cumulative Weight, per cent
+ 35	6.7	6.7
+ 48	10.7	17.4
+ 65	14.9	32.3
+100	15.4	47.7
+150	13.9	61.6
+200	10.0	71.6
-200	28.4	100.0
	100.0	

Table No. 6. - Analysis of Concentrate.

	Per cent
Soluble Iron	67.93
Sulphur	0.02
Silica	2.87
Aluminium oxide	0.76
Magnesium oxide	0.18
Calcium oxide	0.89
Titanium	0.01
Manganese	0.10
Phosphorus	0.02

Conclusions from Fine Grinding Tests:

1. A high-grade concentrate with very good recovery of the iron can be made by grinding the ore to minus 10 mesh and making a wet magnetic separation.
2. There is very little contaminating mineral, the sulphur and phosphorus being very low.
3. It would be necessary to sinter the concentrate to make a satisfactory furnace feed product.

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