O T T A W A August 19th, 1941.

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of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1064.

Coarse Cobbing Concentration of Magnetite from the Bessemer Mine, Hastings County, Ontario.

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Shipment:

A sample of magnetite ore having a net weight of 3,953 pounds was received at the Metallic Minerals Division of the Bureau of Mines, 552 Booth Street, Ottawa, Ontario, on July 8th, 1941.

Characteristics of the Ore:

There appeared to be two distinctive types of ore physically:

1. A type in which the ore consisted of massive, fine-grained magnetite with no visible contaminants.

2. A coarse-grained type in which gangue material appeared fairly well disseminated.

Pyrite was visible both as massive pyrite, which was coarsely crystalline, and as fine-grained pyrite in veinlets through the ore.

Calcite crystals were also readily observable to the eye.

Results of Investigation:

A satisfactory concentrate can be made by crushing to minus 1½ inches. The concentrate gave a recovery of 86.0 per cent of the iron, at a ratio of concentration of 1.35:1.

The tailings assayed 24.37 per cent iron and could be stock-piled for future beneficiation. (See Ore Dressing Investigation No. 1045, Bureau of Mines, Ottawa, Ontario, July, 1941).

Table No. 1. - Analysis of Final Concentrate.

Determination		Per cent
Iron (Sol.)	-	52.66
Sulphur	-	0.12
Phosphorus	-	0.016
Manganese	-	Trace
Titanium	-	0.04
SiO_2	-	11.10
Al_2O_3	-	2.86
CaO	-	7.16
MgO	-	2.00

(Results of Investigation, cont'd) -

Table No. 2. - Screen Analysis of Final Concentrate.

Screen Size	Weight, per cent	Fe, per cent	Distribution of iron, per cent
-1½ + 1 in.	35.8	51.37	34.7
-1 + ½ in.	33.7	52.24	33.2
-½ in. +3 mesh	10.9	52.96	10.9
-3+6 mesh	6.2	52.67	6.2
-6+8 "	3.0	52.96	3.0
-8 "	10.4	61.01	12.0
Total	100.0	52.97	100.0

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EXPERIMENTAL PROCEDURE:

The entire shipment of ore was crushed to minus 4 inch size and separated into two lots for separate treatment. The first test was made to determine the optimum size for crushing and the second test was made by crushing to this size.

Table No. 3. - Feed Samples.

Product	Weight, pounds	Assays, per cent Fe	S.	P.	Insol.
Lot No. 1	2,183.5	46.17	0.18	0.17	26.04
Lot No. 2	1,767.5	45.52	0.20	0.17	25.74
Combined	3,951.0	45.88	0.19	0.17	25.91

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Test No. 1.

Lot No. 1 was screened at various mesh sizes and these were separated magnetically. As no machine was available that would handle the coarse sizes, two strong hand magnets of different intensity were used to make the separation. The material down to -1 inch +½ inch was treated in the above manner. The material -1 inch +½ inch to -½ inch +3 mesh in size was treated on the Stearns separator and the remainder was treated on the Ball-Norton

(Test No. 1, cont'd) -

separator.

In the case of the -1 inch +½ inch material the field strength of the magnet on the Stearns was not sufficient to hold the larger pieces of magnetite; consequently the tailing from this fraction was somewhat high.

Table No. 4. - Details of Test No. 1.

Product	Weight		Fe (Soluble)		S,	P,	Insol.,
	Pounds	Per cent	Per cent	Distribution, per cent	per cent	per cent	per cent
Feed	2,183.50	100.0	46.17	100.0	0.18	0.017	23.38
Concentrate	1,218.75	55.8	54.50	65.9	0.14	0.014	18.86
Middling	686.00	31.4	39.51	26.9	0.20	0.020	31.41
Tailing	278.75	12.8	26.13	7.2	0.34	0.023	44.23
Conc. and Middling	1,904.75	87.2	49.10	92.8	0.16	0.016	23.38

Ratio of Concentration:

(1) Concentrate, 1.79:1.
(2) Concentrate and middling, 1.12:1.

Table No. 5. - Screen Analysis of Concentrate.

Product	Weight, per cent	Fe, per cent	Distribution of iron, per cent
+2 in.	19.0	54.52	19.0
-2 +1 in.	56.7	53.96	56.1
-1 +½ in.	6.5	55.40	6.6
-½ in +3 mesh	5.4	55.55	5.5
-3+8 mesh	5.5	50.94	5.2
-8+20 mesh	2.0	55.40	2.0
-20 mesh	4.9	61.88	5.6
Total	100.0	54.50	100.0

In the above test a satisfactory furnace product was made, but there is also a considerable portion of the iron tied up in the middling product which would require further treatment. Also, the grade of the tailings was still somewhat high.

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Test No. 2.

From the information received in Test No. 1 it was decided to crush this lot through 1½ inches and make only a finished product and a tailing, eliminating the middling product.

In treating this ore all the material +½ inch was passed under a large stationary magnet and a constant field strength was used. The remainder was treated on the Stearns separator. The finer material could have been treated on the stationary magnet but due to the time it would have required it was decided to use the Stearns.

The test was quite satisfactory and a concentrate was obtained that assayed 52.97 per cent iron with a recovery of 86 per cent of the iron at a ratio of concentration of 1.35:1. While the tailing is somewhat high, this material could be stock-piled for future treatment.

Details of the test are given in the following tables and in Tables No. 1 and No. 2.

Table No. 6. - Details of Test No. 2.

Product	Weight		Fe (Soluble)		S,	P,	Insol.,
	Pounds	Per cent	Per cent	Distribution, per cent	per cent	per cent	per cent
Feed	1,767.5	100.0	45.52	100.0	0.20	0.017	25.74
Concentrate	1,307.0	74.0	52.97	86.0	0.15	0.014	19.67
Tailing	460.5	26.0	24.38	14.0	0.35	0.025	42.96

Ratio of Concentration = 1.35:1.

Conclusions:

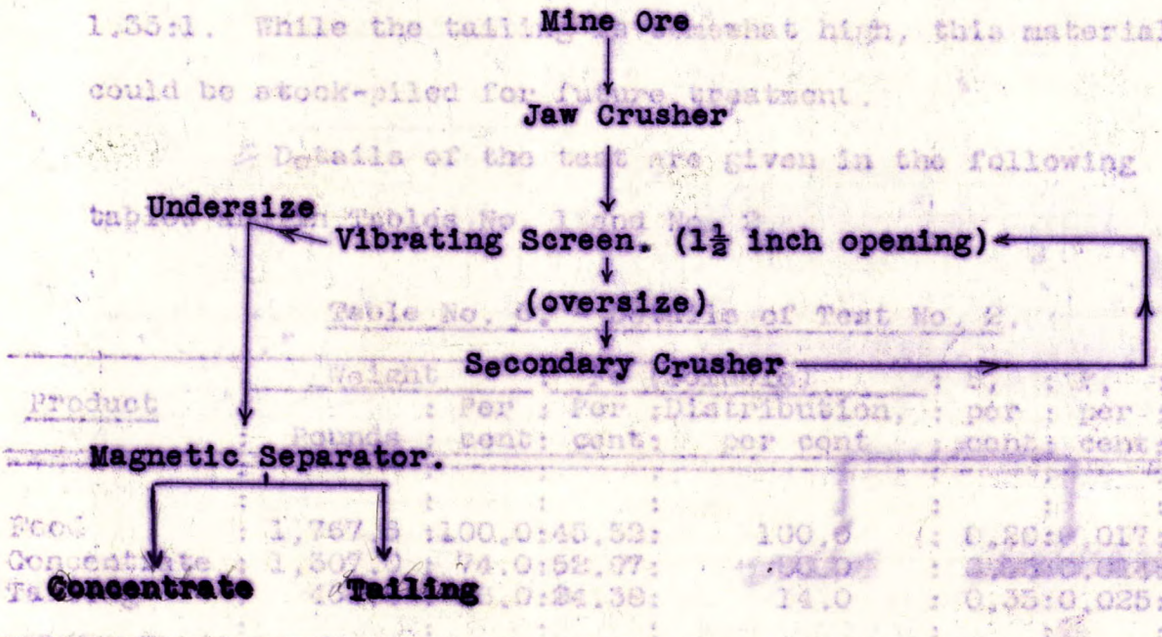
1. A concentrate assaying 52.66 per cent iron and having a recovery of 86.0 per cent of the iron at a ratio of concentration of 1.35:1 can readily be made by crushing to minus 1½ inches.

2. It is not possible to make a low-grade tailing without grinding to minus 14 mesh. (See Investigation No. 1045).

3. The ore is extremely hard and produces very little fines on crushing.

4. It is possible, by hand sorting, to remove the massive magnetite at a sufficiently high grade for shipping. Recovery in this case would be low, however.

5. The flow-sheet suggested is as follows:



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