O T T A W A December 26th, 1940.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 938.

Hematite Ore from the Belcher Islands, Quebec.

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Shipment:

A 123-pound sample of hematite ore from the Belcher Islands, Quebec, was received on November 12th, 1940, from Mr. R. T. Gilman, President, Dominion Fluorspar Company Limited, Madoc, Ontario.

This sample was forwarded originally for 'Sink-and-Float' separation tests, the results of which were reported elsewhere.

Sampling and Analysis:

The sample was crushed, cut and ground by standard methods to give a sample for analysis. This sample assayed:

Iron	-	43.36 per cent
SiO_2	-	29.10 "
P_2O_5	-	0.05 "
Sulphur	-	0.02 "
TiO_2	-	0.03 "

Characteristics of the Ore:

A megascopic examination of hand specimens of the ore shows two types of ore to be represented in the sample, as follows:

A. Dull, fine-grained, compact looking, red hematite.

B. Metallic, coarser-grained, steel grey, specular hematite.

Both varieties are hard and heavy but "B" is somewhat harder and heavier than "A".

Six polished sections, two from type "A" and four from type "B", were prepared and examined under the reflecting microscope for the purpose of determining the character of the ore.

Gangue -

The gangue is highly siliceous, consisting largely of quartz in both types. A small amount of carbonate in small white patches is sporadically scattered through the sections from "B", but none was detected in those from "A".

Most of the gangue is intimately associated with iron oxide, largely as a fine-grained admixture in which the two ingredients vary in all proportions, with

(Continued on next page)

(Characteristics of the Ore, cont'd) -

here gangue predominating and containing finely divided iron oxide, and there the latter mineral predominating and containing finely divided gangue. (See Figures 1 and 2). On the whole, gangue is more abundant in type "A" than in type "B".

Metallic Minerals -

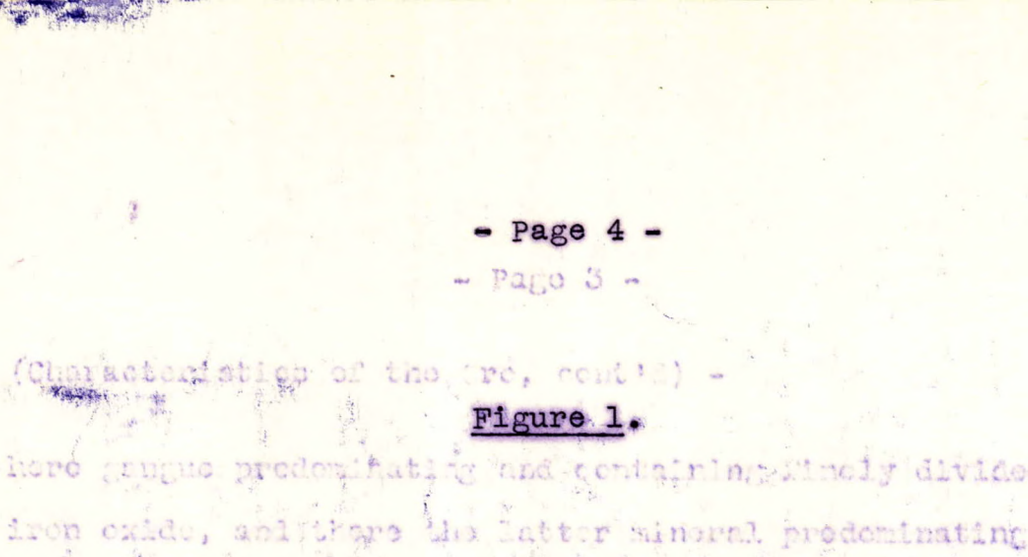
Hematite is the preponderant metallic mineral. It appears to be finely crystalline and is often very finely divided, some of the smallest grains approaching the limit of resolution of the microscope (approximately 1 micron in size). In places the grains exhibit ragged, lacy edges which probably are the result of attack and replacement by quartz. As already noted, the hematite is somewhat coarser grained in "B" than in "A", but in polished sections the former variety is seen to enclose small local areas of the latter.

Magnetite in minor quantities is present in type "A" as irregular grains and subhedral crystals disseminated throughout the hematite gangue admixture. (See Figure 1). The grains average 40 microns (approximately 325 mesh) and enclose tiny inclusions of hematite and gangue.

The samples examined may be considered to be roughly representative of the ore submitted.

(See Figures 1 and 2,
on Pages 4 and 5.)

Figure 1.



Photomicrograph showing lean area from type "A" in which gangue predominates and contains finely divided hematite and a few disseminated grains of magnetite.

Hematite	-	white;
Magnetite (M)	-	white;
Gangue	-	grey; and
Pits	-	black.

Magnification - 200X.

(See Figures 1 and 2, on Pages 4 and 5.)

Figure 2.

Photomicrograph of a richer area, type "B", showing coarser hematite containing finely divided gangue. Note also the very fine sizes of some of the iron oxide.

Hematite - white;
Gangue - grey; and
Pits - black.

Magnification - 200X.

EXPERIMENTAL TESTS:

The test work consisted of gravity concentration, flotation, and reduction. Owing to the extremely fine grinding that was necessary only representative tests are shown.

Gravity Concentration.

Test No. 1

In this test, the ore at minus 14 mesh was ground in a ball mill to all pass through a 48-mesh screen. Grinding was at 66 per cent solids.

The pulp was passed over a laboratory-size Wilfley concentrating table.

Results of Test No. 1:

Product	Weight, Grams	Weight, Per cent	Assay, Fe, per cent	Units	Distribution, per cent
Table conc.	316.2	15.03	57.54	864.83	19.25
Table middling	798.5	37.96	47.25	1,793.61	39.91
Table sands	259.8	12.35	38.11	470.66	10.47
Table slimes	729.0	34.66	39.37	1,364.56	30.37
Totals	2,103.5	100.00	44.94⊕	4,493.76	100.00

⊕ Calculated.

Ratio of concentration = 6.6:1.

Screen Analysis, Test No. 1.

Mesh	Weight, per cent: Middling	Slimes
+ 48	-	-
+ 65	0.40	-
+100	4.70	-
+150	19.70	0.10
+200	22.80	0.10
-200	52.40	99.80
	100.00	100.00

This test indicates that a fairly high-grade concentrate may be produced, but the recovery will be very low.

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Flotation Tests.

Test No. 2

In this test the ore at minus 14 mesh was ground in a ball mill until 47.2 per cent passed through 200 mesh. Grinding was at 66 per cent solids.

Reagents to the mill were 2.5 pounds per ton sodium silicate.

The pulp was transferred to a 2,000-gram flotation cell and floated at 20 per cent solids. Reagents to flotation were 5.6 pounds per ton oleic acid and 0.075 pound per ton of pine oil.

The rougher concentrate was cleaned with 0.3 pound sodium silicate per ton.

Results of Test No. 2:

Product	Weight, Grams	Weight, Per cent	Assay, Fe, per cent	Units	Distribution, per cent
Flot. conc.	781.5	38.80	46.83	1,817.00	42.48
Flot. middling	426.5	21.18	42.00	889.56	20.79
Flot. tailing	806.0	40.02	39.27	1,571.58	36.73
Totals	2,014.0	100.00	42.78⊕	4,278.14	100.00

⊕ Calculated.

Ratio of concentration = 2.6:1.

Screen Analysis, Test No. 2 Tailing.

Mesh	Weight, per cent
+ 48	-
+ 65	0.60
+100	7.60
+150	25.70
+200	18.90
-200	47.20
	100.00

(Flotation Tests, cont'd) -

Test No. 3.

In this test the ore at minus 14 mesh was ground in a ball mill to pass 47 per cent through 200 mesh. Grinding was at 66 per cent solids. No reagents were fed to the ball mill.

The ground pulp was transferred to a 2,000-gram flotation cell and floated at 20 per cent solids. Reagents to the flotation cell were:

	Lb./ton
Concentrated hydrochloric acid	- 11.0
Sodium oleate	- 1.1
Oleic acid	- 0.175
Pine oil	- 0.05

The sodium oleate and oleic acid were added in stages but although they produced a voluminous froth only a small amount of mineral was floated.

The pH of the flotation pulp was 3.7.

Results of Test No. 3:

Product	Weight: Grams	Weight: Per cent	Assay, Fe, per cent	Units	Distribution, per cent
Flot. conc.	404.0	19.81	45.36	898.58	20.73
Flot. tailing	1,635.5	80.19	42.84	3,435.34	79.27
Totals	2,039.5	100.00	43.34*	4,333.92	100.00

* Calculated.

Ratio of concentration = 5:1.

This test showed that flotation in an acid pulp, as recommended by some authorities, is not applicable to this ore.

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Reduction Tests.

Test No. 4

A sample of the ore was dry-ground 87 per cent minus 200 mesh and reduced with gas at a temperature of 450° C. to form magnetite. Analysis of the product showed reduction to be 91 per cent complete.

A small sample of the magnetized product was treated in a Davis tube magnetic concentrator to see if any worthwhile separation of the iron from the gangue could be effected. The concentrate was retreated in the tube to shake out as much of the gangue as possible.

This treatment failed to produce a high-grade iron product owing to the intimate association of the gangue and the iron oxide as shown by the microscopic examination and the accompanying photomicrographs.

The magnetic concentrate assayed 48.4 per cent iron and contained 27.74 per cent of acid insoluble.

Summary and Conclusions:

This particular iron ore does not appear to be amenable to any of the more common methods of concentration. The close association between the hematite and the silica present in the ore would make it necessary to grind this ore much finer than was done in these tests before the iron mineral was free. However,

(Concluded on next page)

(Summary and Conclusions, cont'd) -

grinding to such fine sizes is expensive, and then the problem arises of handling any concentrates that may be produced. It would be necessary to sinter these concentrates, which again is an expensive treatment.

This ore does not seem to be suitable for commercial recovery of the iron.

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