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CONCENTRATION OF MAGNETITE FROM BURNABY ISLAND, B. C.

by

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MINERAL PROCESSING DIVISION

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SUMMARY OF RESULTS

Drill core rejects were grouped into four samples for the investigation. Iron analyses of the head samples and concentrates were as follows:

	Feed	Concentrate % Fe		
	% Fe	Uncrushed ore	10 m grind	28 m grind
Sample 1	56.08	64.11	66.24	-
" 2	42.37	56.69	58.52	59.54
" 3	51.82	63.20	65.43	-
" 4	57.71	63.80	65.43	66.65

The uncrushed ore and the ore ground to -10 mesh produced concentrates which contained less than 30% -100 mesh material and so would be acceptable to the Japanese steel mills.

A composite sample of other drill core rejects and all test rejects, containing 55.88% iron, was concentrated at finer grinds, producing concentrates grading up to 70.0% iron. All concentrates, however, contained too many fines to meet Japanese specifications.

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INTRODUCTION

Shipment

A shipment of drill core rejects, weight 161 lb, was received October 11, 1963, from J.J. Crowhurst, General Manager, Mastodon-Highland Bell Mines Ltd., Suite 502; 1200 West Pender Street, Vancouver 1, B.C.

Location and Description of Property

In his covering letter Mr. Crowhurst stated that the property containing a magnetite iron orebody is located on Burnaby Island in the South Queen Charlotte Islands, B.C.

The orebody lies under the floor of the sea on the east coast at the the south end of Burnaby Island. It appears to be at least 1000 ft long and about 70 ft thick. Its top edge is from 100 to 200 ft below the floor of the sea which is about 30 to 40 ft deep at high tide over the orebody area. The orebody dips from quite flat to minus 60 degrees towards the east. A preliminary calculation based on the present drilling results indicates that about 4 million tons of 53% total acid soluble iron might be expected.

Purpose of Investigation

Mr. Crowhurst stated that the company staff is preparing a feasibility study of the ore and wished to determine how much of this iron ore could be recovered by magnetic concentration at a grind of 65% plus 100 mesh. Thirty per cent minus 100 mesh represents the finest particle distribution presently accepted by the Japanese steel mills which are the most logical buyers of iron ore concentrates on the West Coast. The small size of the orebody does not make pelletizing feasible.

Sampling and Analysis of Shipment

The company sent Mr. R.C. Smith, of their staff, to discuss procedures they wished to investigate.

Mr. Smith arranged the samples of drill core into groups which consisted of the following:

TABLE 1

Description and Analysis of Samples

Sample	Drill Hole No.	Core Reject No.	Weight lb	Fe Analysis %
1	20	21, 22, 23 24, 25	26	56.08
2	21	27	6	42.37
3	18 & 19	18, 19, 20	16	51.82
4	15 & 16	4, 5, 6, 7, 8, 10,11, 12, 13	49	57.71

A head sample was riffled out of each of the above samples. The remaining drill core rejects No. 1, 2, 3, 9, 14, 26, 28, 29, 30, weighing 63 lb, were retained and later combined with the test rejects from Samples 1, 3, and 4. A head sample was riffled out of this combined sample, which was designated as Sample 5, and was found to contain 55.88% iron.

All of the analyses in this report were made by Coast Eldridge Engineers & Chemists Ltd., 125 East 4th Ave., Vancouver 10, B.C.

All iron analyses were designated Total Iron (Fe) on the Certificates of Assay.

DETAILS OF TESTS

Test 1 Dry Magnetic Concentration of the Samples Before Crushing

Under the direction of Mr. R. C. Smith, portions of the ore as received were riffled from Samples 1 to 4 for dry magnetic concentration by a laboratory-size Ball-Norton dry belt separator.

The products of the tests were assayed for iron and a screen test was made on each concentrate. Screen fractions from Sample 1 were assayed for iron. As all four samples were treated similarly the four tests are designated Test 1 with the appropriate sample number.

TABLE 2

Test 1 Results of Magnetic Concentration by the Ball-Norton Separator on the Ore as Received

Product	Weight %	Analysis % Fe	SiO_2	Al_2O_3	TiO_2	S	P	Distn % Fe	R/C
Sample 1									
Feed*	100.0	55.82						100.0	
Mag conc	82.9	64.11	4.70	1.55	0.08	0.04	0.03	95.2	1.21:1
Tailing	17.1	15.65						4.8	
Sample 2									
Feed*	100.0	40.70						100.0	
Mag conc	59.2	56.69	8.82	1.63	0.09	0.31	0.03	82.5	1.69:1
Tailing	40.8	17.48						17.5	
Sample 3									
Feed*	100.0	51.3						100.0	
Mag conc	74.8	63.2	5.64	1.54	0.07	0.04	0.02	92.1	1.34:1
Tailing	25.2	16.05						7.9	
Sample 4									
Feed*	100.0	57.35						100.0	
Mag conc	86.9	63.80	5.26	1.45	0.06	0.09	0.04	96.7	1.15:1
Tailing	13.1	14.63						3.3	

*Calculated.
R/C - ratio of concentration.

TABLE 3

Test 1 (Cont'd) Results of Screen Tests on the Magnetic Concentrates of Test 1

Mesh	Magnetic Concentrates Test 1			
	Sample 1 Wt %	Sample 2 Wt %	Sample 3 Wt %	Sample 4 Wt %
+ 3	6.7	1.8	2.8	4.2
+ 4	8.6	12.0	7.3	10.4
+ 6	17.0	20.4	17.1	15.7
+ 8	18.3	18.3	15.4	16.3
+ 10	11.1	11.4	9.6	11.3
+ 14	6.8	7.0	7.2	7.1
+ 20	5.4	5.7	6.3	5.7
+ 28	3.7	4.0	4.7	3.8
+ 35	3.2	3.3	4.3	3.2
+ 48	2.6	2.5	3.5	2.5
+ 65	2.4	2.2	3.4	2.4
+100	2.6	2.0	3.4	2.4
-100	11.6	9.4	15.0	15.0
	100.0	100.0	100.0	100.0

TABLE 4

Test 1 (Cont'd) Results of Screen Analysis of the Ball-Norton Concentrate of Test 1 Sample 1

Product	Weight %	Analysis % Fe	Distn % Fe
Feed*	100.0	63.74	100.0
+ 3 m	6.7	59.33	6.3
+ 4 m	8.6	61.57	8.3
+ 6 m	17.0	63.20	16.9
+ 8 m	18.3	63.80	18.3
+ 10 m	11.1	63.80	11.1
+ 14 m	6.8	62.99	6.7
+ 20 m	5.4	64.21	5.5
+ 28 m	3.7	63.70	3.7
+ 35 m	3.2	64.62	3.2
+ 48 m	2.6	65.02	2.6
+ 65 m	2.4	66.04	2.5
+100 m	2.6	67.16	2.7
-100 m	11.6	67.06	12.2

*Calculated.

Tests 2 & 3 Dry and Wet Magnetic Concentration at -10 M

The four magnetic concentrates from Test 1 were screened on 10 m and the oversize was crushed to -10 m. Each -10 m concentrate was split into two parts. One part was used for Test 2, dry magnetic concentration and the other part was used for Test 3, wet magnetic concentration.

The dry tests were made with the Ball-Norton separator as in Test 1. The wet tests were made with the Crockett laboratory-size belt separator. A concentrate and a tailing were produced from each sample.

TABLE 5

Test 2 Results of Dry Magnetic Concentration at -10 M

Product	Weight % In test	Weight % In orig feed	Analysis % Fe	Distn % In test Fe	Distn % In orig feed Fe	R/C
Sample 1						
Feed*	100.0	82.9	64.30	100.0	95.2	
Mag conc	96.0	79.6	66.24	98.9	94.1	1.3:1
Tailing	4.0	3.3	17.78	1.1	1.1	
Sample 2						
Feed*	100.0	59.2	56.28	100.0	82.5	
Mag conc	93.8	55.5	58.52	97.5	80.4	1.8:1
Tailing	6.2	3.7	22.66	2.5	2.1	
Sample 3						
Feed*	100.0	74.8	63.32	100.0	92.1	
Mag conc	95.6	71.5	65.43	98.8	91.0	1.4:1
Tailing	4.4	3.3	17.07	1.2	1.1	
Sample 4						
Feed*	100.0	86.9	64.0	100.0	96.7	
Mag conc	97.1	84.4	65.43	99.3	96.0	1.2:1
Tailing	2.9	2.5	15.65	0.7	0.7	

*Calculated.

TABLE 6

Results of Screen Tests on Concentrates

Mesh	Test 2 Dry Concentration			
	Sample 1 Wt %	Sample 2 Wt %	Sample 3 Wt %	Sample 4 Wt %
+ 14	13.2	18.6	13.1	14.8
+ 20	17.7	21.6	17.1	21.0
+ 28	12.5	14.5	12.4	13.2
+ 35	9.8	10.4	9.9	9.2
+ 48	7.1	6.7	7.4	6.0
+ 65	6.5	5.3	6.7	5.1
+100	6.6	4.9	6.8	5.3
-100	26.6	18.0	26.6	25.4
	100.0	100.0	100.0	100.0

TABLE 7

Test 3 Results of Wet Magnetic Concentration at -10 M

Product	Weight %		Analysis %					Distn %		R/C
	In test	In orig feed	Fe	SiO_2	Al_2O_3	S	P	In test Fe	In orig feed Fe	
Sample 1										
Feed*	100.0	82.9	63.96					100.0	95.2	
Mag conc	97.1	80.5	65.43	4.10	1.48	0.04	0.03	99.3	94.6	1.2:1
Tailing	2.9	2.4	14.63					0.7	0.6	
Sample 2										
Feed*	100.0	59.2	55.82					100.0	82.5	
Mag conc	95.0	56.2	57.91	8.72	1.54	0.27	0.03	98.5	81.3	1.8:1
Tailing	5.0	3.0	16.46					1.5	1.2	
Sample 3										
Feed*	100.0	74.8	63.06					100.0	92.1	
Mag Conc	96.1	71.9	65.02	4.77	1.26	0.05	0.02	99.1	91.3	1.4:1
Tailing	3.9	2.9	14.83					0.9	0.8	
Sample 4										
Feed*	100.0	86.9	64.26					100.0	96.7	
Mag conc	97.7	84.9	65.43	4.50	1.34	0.07	0.04	99.5	96.2	1.2:1
Tailing	2.3	2.0	14.43					0.5	0.5	

*Calculated.

TABLE 8

Results of Screen Tests on Concentrates

Mesh	Test 3 Wet Concentration			
	Sample 1 Wt %	Sample 2 Wt %	Sample 3 Wt %	Sample 4 Wt %
+ 14	13.8	19.0	14.0	13.9
+ 20	18.8	22.0	18.7	19.6
+ 28	12.5	14.8	12.9	12.9
+ 35	9.7	10.6	10.1	9.3
+ 48	6.9	7.0	7.3	6.4
+ 65	6.0	5.4	6.6	5.5
+100	6.5	4.9	6.4	5.6
-100	25.8	16.3	24.0	26.8
	100.0	100.0	100.0	100.0

Test 4 Magnetic Concentration of -28 M Ore

The remaining ore of Sample 2 and a portion of the ore of Sample 4 were concentrated separately at -28 m by the Jeffrey-Steffensen separator. The products of each test were a concentrate, a middling and a tailing. A screen test was made on each concentrate.

TABLE 9

Results of Magnetic Concentration at -28 M

Product	Weight %	Analysis % Fe	Distn % Fe	R/C
Sample 2				
Feed*	100.0	40.28	100.0	
Mag conc	52.0	59.54	76.9	1.9:1
Midds	4.8	45.72	5.5	
Tailing	43.2	16.46	17.6	
Sample 4				
Feed*	100.0	54.45	100.0	
Mag conc	73.1	66.65	89.4	1.4:1
Midds	2.6	56.08	2.7	
Tailing	24.3	17.68	7.9	

*Calculated

TABLE 10

Results of Screen Tests on Concentrates

Mesh	Sample 2 Wt %	Sample 4 Wt %
+ 35	27.7	21.4
+ 48	17.8	13.5
+ 65	11.9	10.5
+100	9.0	9.7
-100	33.6	44.9
	100.0	100.0

Tests 5 to 9 Magnetic Concentration of Combined Samples at Different Grinds

The ore from Sample 5 was used for this series of tests. This sample, as was mentioned before, was made up of the test rejects from Samples 1, 3 and 4 as well as some unused drill core rejects.

Test 5 Magnetic Concentration of -20 M Ore

A portion of -20 m ore was concentrated by the Crockett Wet belt separator. A screen test was made on the concentrate.

TABLE 11

Results of Magnetic Concentration at -20 M

Product	Weight %	Analysis % Fe	Distn % Fe	R/C
Feed*	100.0	56.86	100.0	
Mag conc	82.8	66.25	96.4	1.2:1
Tailing	17.2	11.79	3.6	

*Calculated.

TABLE 12

Results of Screen Test on -20 M Concentrate

Mesh	Wt %
+ 28	10.6
+ 35	13.2
+ 48	10.2
+ 65	10.3
+100	10.8
-100	44.9
	100.0

Tests 6 to 9 Magnetic Concentration at -28, -65, -100, and -150 M

Four samples of -20 m ore were ground to -28 m, -65 m, -100 m, and 150 m and concentrated on the Jeffrey-Steffensen separator.

A concentrate, a middling and a tailing were produced from each sample. A screen test was made on each concentrate.

TABLE 13

Results of Magnetic Concentration

Product	Weight %	Analysis % Fe	Distn % Fe	R/C
Test 6	Feed -28 m Ore			
Feed*	100.0	54.45	100.0	
Mag conc	72.8	67.46	90.2	1.37:1
Midds	3.0	56.69	3.1	
Tailing	24.2	15.04	6.7	
Test 7	Feed -65 m Ore			
Feed*	100.0	54.17	100.0	
Mag conc	71.4	68.58	90.4	1.4:1
Midds	2.4	60.96	2.7	
Tailing	26.2	14.22	6.9	
Test 8	Feed -100 m Ore			
Feed*	100.0	55.60	100.0	
Mag conc	69.6	70.0	87.6	1.44:1
Midds	2.8	65.43	3.4	
Tailing	27.6	18.19	9.0	
Test 9	Feed -150 m Ore			
Feed*	100.0	53.14	100.0	
Mag conc	68.0	69.70	89.2	1.47:1
Midds	1.4	65.02	1.7	
Tailing	30.6	15.75	9.1	

*Calculated

TABLE 14

Results of Screen Tests on the Magnetic Concentrates

Mesh	Test 6 Wt %	Test 7 Wt %	Test 8 Wt %	Test 9 Wt %
+ 35	11.8	-	-	-
+ 48	10.8	-	-	-
+ 65	10.2	-	-	-
+100	10.4	14.6	-	-
+150	10.0	18.7	8.0	-
+200	11.2	17.8	12.6	6.8
+325	12.1	17.5	19.2	20.8
-325	23.5	31.4	60.2	72.4
	100.0	100.0	100.0	100.0
-200	35.6	48.9	79.4	93.2

CONCLUSIONS

Results of the investigation showed that the uncrushed ore could be cobbed magnetically. With the exception of No. 2 sample the grade of concentrate produced was always greater than 63% iron.

By grinding the cobbed concentrates to -10 mesh the grade of all concentrates except No. 2 were increased to over 65% iron. All concentrates produced at -10 mesh contained less than 30% -100 mesh material and so would be acceptable to the Japanese steel mills.

Finer grinding on a composite sample of the ore produced concentrates containing as much as 70% iron but the amount of fines in the concentrate was greater than the specifications allowed.

WSJ/Jg