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

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 854.

Pyrite Ore from the Ontario Nickel Corporation Limited Property in Hastings County, Ontario.

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Shipment:

Fifteen bags of ore, net weight 1,850 pounds, were received on February 5th, 1940, from the Ontario Nickel Corporation Limited property in Hastings county, Ontario. The shipment was submitted by the Ontario Nickel Corporation Limited, 38 King Street West, Toronto, Ontario, per B. W. Watkins.

Characteristics of the Ore:

Hand specimens were examined to determine the character of the ore.

The gangue is composed of dark grey and light grey rock. The metallic minerals are essentially pyrite, which occurs as coarse to fine grains disseminated in the gangue.

Sampling and Assaying:

The ore was crushed and sampled by the standard method. The assays were as follows:

Pyritic sulphur	-	28.82 per cent
Total sulphur	-	29.08 "
Copper	-	Nil.
Arsenic	-	0.15 per cent
Gold	-	0.0025 oz./ton.

Purpose of Investigation:

The purpose of the investigation was to determine the recovery of pyritic sulphur by table concentration when the ore is crushed to pass through an 8-mesh screen.

Results of Experimental Tests:

The ore, crushed dry to about 8 mesh, was fed to a Richards pulsating launder classifier which distributed the classified products to three concentrating tables. The concentrates obtained assayed as follows:

	Sulphur, per cent
No. 1 table concentrate (coarse product) -	47.78
No. 2 " " (intermediate ") -	51.42
No. 3 " " (fine ") -	50.46

Only 51.66 per cent of the sulphur in the

ore was in the concentrates. The middling products from Tables Nos. 1, 2 and 3 contained 29.10, 6.14 and 1.26 per cent of the sulphur, respectively. The combined tailings from the three tables contained 11.84 per cent of the sulphur in the ore and assayed 10.54 per cent sulphur.

Concentration of the ore by flotation was not investigated in great detail. The few tests conducted showed that the ore is amenable to flotation treatment. In Test No. 1 a concentrate was obtained which assayed 48.55 per cent sulphur and contained 85.6 per cent of the sulphur in the ore. The middling contained 7.9 per cent of the sulphur; part of this would be recovered in mill practice, thus increasing the recovery. The flotation tailing assayed 4.98 per cent sulphur and contained 6.5 per cent of the sulphur in the ore. The ratio of concentration was 1.98 into 1. This test was carried out one day after the ore was crushed.

The ore oxidizes quite readily; this is shown by the lower recovery in Test No. 2, which was conducted three weeks after crushing the ore. In this test, only 64.5 per cent of the sulphur was in the concentrate. The tailing contained 20.7 per cent of the sulphur in the ore and assayed 13.77 per cent sulphur.

In order to attain high pH value in the flotation solution, an appreciable amount of soda ash had to be added. In Test No. 3, 9.0 pounds of soda ash per ton gave a pH of 9.8.

DETAILS OF EXPERIMENTAL TESTS:

Table Concentration.

Mill Run No. 1.

The ore was crushed dry to about 8 mesh and 1,140 pounds was fed to a Richards pulsating launder classifier at the rate of 506 pounds per hour. This classifier distributed the classified products to three concentrating tables. The rates of feed to these tables were as follows:

No. 1 Table -- coarse product -- about 240 pounds per hour.

No. 2 Table --intermediate size product -- about 200 pounds per hour.

No. 3 Table -- fine product -- . -- 60 pounds per hour.

Results of Tabling Test:

Product	Weight, per cent	Sulphur Assay, per cent	Sulphur Distribution, per cent	Insoluble, per cent
No. 1 table conc.	11.58	47.78	19.52	6.99
No. 2 " "	13.33	51.42	24.17	1.54
No. 3 " "	4.48	50.46	7.97	3.20
Total conc.	29.39	49.84*	51.66	
No. 1 table middling	28.60	28.86	29.10	
No. 2 " "	8.07	21.56	6.14	
No. 3 " "	2.10	17.02	1.26	
Total middling	38.77	26.70*	36.50	
No. 1 table tailing	7.89	13.04	3.63	
No. 2 " "	18.42	9.84	6.39	
No. 3 " "	5.53	9.32	1.82	
Total tailing	31.84	10.54*	11.84	
Feed	100.00	28.36*	100.00	

* Calculated value.

The ratio of concentration was 3.40 into 1.

(Mill Run No. 1, cont'd) -

Screen Analyses of No. 1 Table Products:

Mesh	No. 1 Table Concentrate			No. 1 Table Middling			No. 1 Table Tailing		
	Wt., per cent	S, per cent	Dstn, per cent	Wt., per cent	S, per cent	Dstn, per cent	Wt., per cent	S, per cent	Dist'n, per cent
+ 6				0.9	22.61	0.7	0.2	7.18	0.1
- 6 + 8	0.6	31.24	0.4	11.3	27.38	11.2	10.7	11.86	12.0
- 8 + 10	0.6	32.66	0.4	21.9	26.95	21.3	47.7	11.34	50.5
- 10 + 14	1.3	30.67	0.8	15.8	23.41	13.4	24.8	10.74	24.8
- 14 + 20	4.3	36.64	3.4	15.1	23.62	12.9	10.4	8.22	8.0
- 20 + 28	4.6	41.94	4.1	11.3	26.51	10.8	4.7	6.54	2.9
- 28 + 35	23.4	48.17	24.0	11.3	30.89	12.6	0.8	7.04	0.5
- 35 + 48	35.2	51.00	38.3	6.6	37.28	8.9	0.2	15.26	0.3
- 48 + 65	21.4	46.88	21.4	3.6	39.37	5.1	0.2	21.86	0.4
- 65 +100	7.0	39.21	5.8	1.7	39.63	2.4	0.2	15.88	0.3
-100 +150	1.4	40.89	1.2	0.4	39.63	0.6			
-150 +200	0.2	38.22	0.2	0.1	34.99	0.1	0.1	26.28	0.2
-200									
Total	100.0	46.93		100.0	27.70	100.0	100.0	10.71	100.0

Screen Tests:

Mesh	Feed Wt., per cent	Weight, percentages: No. 1 Table Feed	No. 1 Table Conc.	No. 1 Table Midd.	No. 1 Table Tailing	No. 2 Table Feed	No. 2 Table Conc.	No. 2 Table Midd.	No. 3 Table Feed	No. 3 Table Conc.
+ 6				0.9	0.2					
- 6 + 8	2.9	10.1	0.6	11.3	10.7	1.1		1.0		
- 8 + 10	9.4	37.9	0.6	21.9	47.7	4.1		3.5		
- 10 + 14	6.2	18.6	1.3	15.8	24.8	3.6		4.1		
- 14 + 20	6.2	10.3	4.3	15.1	10.4	4.9		6.0		
- 20 + 28	6.1	5.3	4.6	11.3	4.7	5.7		6.5		
- 28 + 35	9.0	6.1	23.4	11.3	0.8	9.3	1.7	10.9		
- 35 + 48	7.6	5.3	35.2	6.6	0.2	12.3	4.7	14.7		
- 48 + 65	10.2	4.1	21.4	3.6	0.2	16.4	17.6	18.5	1.5	0.5
- 65 +100	9.9	1.8	7.0	1.7	0.2	18.9	23.6	15.0	4.4	4.2
-100 +150	8.7	0.3	1.4	0.4		12.3	27.1	9.6	10.9	13.6
-150 +200	7.3	0.1	0.2	0.1	0.1	7.2	16.5	4.1	14.7	20.5
-200	16.5	0.1				4.2	8.8	6.1	68.5	61.2
Totals	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

The recovery of pyritic sulphur was low. Not all of the minerals are liberated at the fineness of grind used in this test; an appreciable amount of the sulphur-bearing minerals was in the table middlings.

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Laboratory Flotation Tests.

Test No. 1.

A 2,000-gramme sample of ore was ground to 56.3 per cent minus 200 mesh with 2.0 pounds of soda ash per ton of ore. The pulp was transferred to a flotation machine. One pound of copper sulphate, 0.3 pound of potassium amyl xanthate and 0.124 pound of pine oil per ton of ore were added to the flotation cell and the froth was removed. The rougher flotation concentrate was cleaned by re-floating. No additional reagents were used in the cleaning operation.

Results of Flotation:

Product	Weight, per cent	Sulphur Assay, per cent	Sulphur Distribution, per cent	Cu, per cent	As, per cent	Insoluble, per cent
Feed	100.00	28.62	100.0			
Concentrate	50.47	48.55	85.6	Nil	0.09	9.96
Middling	12.18	18.50	7.9			
Tailing	37.35	4.98	6.5			

The ratio of concentration was 1.98 into 1.

Test No. 2.

A sample of ore was ground to 75.3 per cent minus 200 mesh with 2.0 pounds of soda ash per ton of ore. The following reagents and amounts were added to the flotation cell: copper sulphate, 1.0; potassium amyl xanthate, 0.3; and pine oil, 0.124, pound per ton. The rougher concentrate was cleaned by re-floating.

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(Test No. 2, cont'd) -

Results of Flotation:

Product	Weight, per cent	Sulphur Assay, per cent	Sulphur Distribution, per cent
Feed	100.00	28.57	100.0
Concentrate	43.23	42.58	64.5
Middling	13.73	30.89	14.8
Tailing	43.04	13.77	20.7

The ratio of concentration was 2.31 into 1.

Flotation Test No. 1 was carried out one week after the ore was received, and one day after crushing a portion of the sample received to minus 14 mesh. Test No. 2 was carried out on the same sample as Test No. 1 but three weeks after it was crushed to minus 14 mesh.

The lower recovery in Test No. 2 may be due to surface oxidation of the ore.

Test No. 3.

A sample of ore was ground to 79.5 per cent minus 200 mesh with 6.0 pounds of soda ash per ton of ore. The following reagents and amounts were added to the flotation cell: soda ash, 3.0; potassium amyl xanthate, 0.3; pine oil, 0.124, pounds per ton. The rougher concentrate was cleaned by re-floating.

(Continued on next page)

(Test No. 3, cont'd) -

Results of Flotation:

Product	Weight, per cent	Sulphur Assay, per cent	Sulphur Distribution, per cent	Insoluble, per cent
Feed	100.00	29.05	100.0	
Concentrate	49.41	46.16	78.5	12.15
Middling	8.74	30.92	9.3	
Tailing	41.85	8.46	12.2	

Ratio of concentration = 2.02 into 1.

pH of flotation solution = 9.8.

The above test was run three months after the ore was received and one week after crushing to minus 14 mesh.

Conclusions:

The combined concentrates from the three tables (Mill Run No. 1) assayed 49.84 per cent sulphur and contained 51.66 per cent of the sulphur in the ore. The middlings from the three tables contained 36.50 per cent of the total sulphur.

Some of the sulphur in the middlings from the three tables and also the coarse table tailing (tailing from Table No. 1) could be recovered by placing a ball mill or a rod mill in the circuit to grind these products in order to liberate the mineral

particles and then repassing the product to the feed. In this way it may be possible to increase the recovery to about 65 to 70 per cent. A still higher recovery could be attained by treating the table tailings in a flotation circuit.

Test No. 1 shows that the ore is amenable to flotation concentration and that on fresh ore no difficulty should be encountered in making a marketable grade of product.

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