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MINES BRANCH INVESTIGATION REPORT IR 66-64

WORK INDEX DETERMINATION OF NORDIC ORE FOR RIO ALGOM MINES LIMITED, ELLIOT LAKE, ONTARIO

by

T. F. BERRY

MINERAL PROCESSING DIVISION

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Mines Branch Investigation Report IR 66-64

WORK INDEX DETERMINATION OF NORDIC ORE
FOR RIO ALGOM MINES LIMITED,
ELLIOT LAKE, ONTARIO

by

T. F. Berry *

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SUMMARY OF RESULTS

The Nordic Ore had a calculated average comparative work index of 16.5 kwh/short ton.

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INTRODUCTION

On May 20, 1966, Mr. J. W. Fisher, P.Eng., of Rio Algom Mines Limited, P. O. Box 10, Elliot Lake, Ontario asked the Mineral Processing Division of the Mines Branch to determine the grindability of a sample of Nordic ore. This ore would then be used as a standard by Rio Algom Mines Limited to determine the comparative grindability of other ores and to calculate their work indices.

Shipment

A 75 lb sample of Nordic ore was received from the Extraction Metallurgy Division of the Mines Branch on June 3, 1966. The investigation was given the project number MP-OD-6610.

DETAILS OF INVESTIGATION

Samples of Nordic and a reference ore were ground according to the Mines Branch procedure⁽¹⁾ and the results which were obtained are shown in Tables 1 and 2. These results were plotted on log-log paper (microns vs percent passing) and from these curves the 80% passing points for "F" and "P" in microns for the ball mill feeds and products respectively were recorded in Table 3.

Using this information in the equation

$$W_i \left(\frac{10}{\sqrt{P}} - \frac{10}{\sqrt{F}} \right) = 19.5 * \left(\frac{10}{\sqrt{P}} - \frac{10}{\sqrt{F}} \right) \quad \text{developed by F.C. Bond}^{(2)}$$

a calculated work index for the Nordic ore was determined.

* Reference ore work index = 19.5 kwh/short ton

TABLE 1

Results of Screen and Infrasizer Tests on Reference Ore

Particle Size	Reference Ore									
	Feed		15 min		20 min		25 min		30 min	
	% ret	% pass	% ret	% pass	% ret	% pass	% ret	% pass	% ret	% pass
+ 10 mesh	0.9	99.1	-	100.0	-	-	-	-	-	-
14 "	15.4	83.7	0.3	99.7	-	-	-	-	-	-
20 "	19.3	64.4	0.2	99.5	-	-	-	-	-	-
28 "	13.9	50.5	0.3	99.2	-	-	-	-	-	-
35 "	10.5	40.0	0.8	98.4	-	100.0	-	100.0	-	100.0
48 "	7.1	32.9	4.5	93.9	0.5	99.5	0.2	99.8	0.1	99.9
65 "	6.2	26.7	16.3	77.6	6.9	92.6	2.0	97.8	0.9	99.0
100 "	5.2	21.5	17.0	60.6	16.8	75.8	12.1	85.7	8.2	90.8
150 "	4.3	17.2	13.9	46.7	17.2	58.6	17.9	67.8	16.3	74.5
200 "	2.1	15.1	6.5	40.2	8.4	50.2	9.6	58.2	9.8	64.7
325 "	2.8	12.3	8.5	31.7	11.3	38.9	-	-	-	-
-325 "	12.3	-	31.7	-	38.9	-	-	-	-	-
+ 56 microns	-	-	-	-	-	-	5.5	52.7	4.0	60.7
40 "	-	-	-	-	-	-	11.1	41.6	12.2	48.5
28 "	-	-	-	-	-	-	7.4	34.2	8.8	39.7
20 "	-	-	-	-	-	-	6.2	28.0	7.5	32.2
14 "	-	-	-	-	-	-	5.6	22.4	6.1	26.1
10 "	-	-	-	-	-	-	4.5	17.9	4.8	21.3
- 10 "	-	-	-	-	-	-	17.9	17.9	21.3	-
Total	100.0	-	100.0	-	100.0	-	100.0	-	100.0	-

TABLE 2

Results of Screen and Infrasizer Tests on Nordic Ore

Particle Size	Nordic Ore										
	Feed		15 min		20 min		25 min		30 min		
	% ret	% pass	% ret	% pass	% ret	% pass	% ret	% pass	% ret	% pass	
+ 10 mesh	0.7	99.3	-	-	-	-	-	-	-	-	-
14 "	20.9	78.4	-	-	-	-	-	-	-	-	-
20 "	20.5	57.9	-	-	-	-	-	-	-	-	-
28 "	12.0	45.9	-	100.0	-	-	-	-	-	-	-
35 "	9.8	36.1	0.1	99.9	-	100.0	-	-	-	-	-
48 "	6.9	29.2	0.6	99.3	0.2	99.8	-	100.0	-	100.0	-
65 "	6.2	23.0	9.3	90.0	3.0	96.8	0.9	99.1	0.8	99.2	-
100 "	5.3	17.7	18.9	71.1	14.5	82.3	7.2	91.9	5.4	93.8	-
150 "	4.2	13.5	18.6	52.5	19.1	63.2	17.6	74.3	15.1	78.7	-
200 "	2.1	11.4	8.9	43.6	10.0	53.2	10.6	63.7	10.9	67.8	-
325 "	2.6	8.8	11.3	32.3	13.8	39.4	-	-	-	-	-
-325 "	6.8	-	32.3	-	39.4	-	-	-	-	-	-
+ 56 microns	-	-	-	-	-	-	8.3	55.4	6.3	61.5	-
40 "	-	-	-	-	-	-	13.7	41.7	15.0	46.5	-
28 "	-	-	-	-	-	-	9.8	31.9	10.9	35.6	-
20 "	-	-	-	-	-	-	8.3	23.6	9.3	26.3	-
14 "	-	-	-	-	-	-	6.1	17.5	6.8	19.5	-
10 "	-	-	-	-	-	-	4.6	12.9	4.9	14.6	-
- 10 "	-	-	-	-	-	-	12.9	-	14.6	-	-
Total	100.0	-	100.0	-	100.0	-	100.0	-	100.0	-	-

TABLE 3

80% Passing Points of Feeds (F) and Products (P)
and Calculated Work Indices

Sample	Reference Ore microns	Nordic Ore microns	Work Index kwh/short ton
Feed	1120	1260	
15 min grind	231	180	15.1
20 " "	165	144	16.9
25 " "	140	120	16.9
30 " "	120	104	17.1

CONCLUSIONS

When compared against a reference ore of known work index (19.5 kwh/short ton) the Nordic ore had a calculated average work index of 16.5 kwh/short ton.

This ore may now be used as a standard against which other ores having similar grinding characteristics may be compared.

REFERENCES

- 1 Berry T. F. and Bruce R. W., "A Simple Method of Determining the Grindability of Ores", Proceedings of the Third annual Meeting of the Canadian Gold Metallurgists, Jan. 1966 pp 41-49, Canadian Mining Journal July 1966, Vol. 87, No. 7 pp 63-65.
- 2 Bond F. C., "The Third Theory of Comminution", A.I.M.E. Trans., 1952, pp 193, 484. Mining Engineering May 1952.