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CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

OTTAWA

MINES BRANCH INVESTIGATION REPORT IR 64-106

WORK INDEX DETERMINATION ON A GOLD ORE FROM EAST MALARTIC MINES LIMITED, MALARTIC, QUEBEC

by

T. F. BERRY

MINERAL PROCESSING DIVISION

NOTE: THIS REPORT RELATES ESSENTIALLY TO THE SAMPLES AS RECEIVED. THE REPORT AND ANY CORRESPONDENCE CONNECTED THEREWITH SHALL NOT BE USED IN FULL OR IN PART AS PUBLICITY OR ADVERTISING MATTER.

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Mines Branch Investigation Report IR 64-106

WORK INDEX DETERMINATION ON A GOLD ORE FROM EAST MALARTIC MINES LIMITED, MALARTIC, QUEBEC

by

T. F. Berry*

- - -

SUMMARY OF RESULTS

The work index (W_i) of the sample of gold ore from East Malartic Mines Limited was 12.9 kwh/short ton. This was the average value obtained by comparing the grindability of the ore with two ores of known work index.

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INTRODUCTION

On July 30, 1964 the Extraction Metallurgy Division of the Mines Branch asked the Mineral Processing Division to determine a work index for an ore from East Malartic Mines Limited.

Location of Property

East Malartic Mines Limited is a gold producer in the Malartic area of northwestern Quebec.

Shipment

A 50 lb sample of the ore was received by the Mineral Processing Division on July 30, 1964.

DETAILS OF INVESTIGATION

Tabulation of Data for Work Index Calculation

Three 2000 g samples of -10 mesh material were obtained from each of two gold ores of known work index (W_i) and from the sample of East Malartic ore. A screen test was done on each ore and on the ground pulps from 15 to 20 min grinds. All grinding was done in the same mill with identical ball loads and pulp conditions. The results were as shown in Table 1.

TABLE 1

Results of Grindability Tests

Particle Size	Comparison Ore A						Comparison Ore B						East Malartic Ore					
	Feed		15 Min		20 Min		Feed		15 Min		20 Min							
	% Ret	% Pass	% Ret	% Pass	% Ret	% Pass	% Ret	% Pass	% Ret	% Pass	% Ret	% Pass	% Ret	% Pass	% Ret	% Pass	% Ret	% Pass
+14 mesh	16.2	83.8	0.1	99.9	-	-	13.1	86.9	-	-	-	-	13.6	86.4	-	-	-	-
+20 "	19.6	64.2	0.1	99.8	-	-	16.9	70.0	-	-	-	-	16.4	70.0	-	-	-	-
+28 "	13.9	50.3	0.1	99.7	-	-	13.0	57.0	-	-	-	-	11.9	58.1	-	-	-	-
+35 "	10.1	40.0	0.2	99.5	-	100.0	10.3	46.7	-	100.0	-	100.0	8.8	48.3	-	100.0	-	100.0
+48 "	6.9	33.3	1.6	97.9	0.3	99.7	7.4	39.3	0.1	99.9	0.1	99.9	6.3	43.0	0.1	99.9	0.1	99.9
+65 "	6.0	27.3	11.3	86.6	4.0	95.7	6.3	33.0	1.6	98.3	0.4	99.5	5.2	37.8	1.1	98.8	0.3	99.6
+100 "	4.8	22.5	17.0	69.6	13.8	81.9	5.2	27.8	8.4	89.9	4.2	95.3	4.6	33.2	6.1	92.7	2.8	96.8
+150 "	4.2	18.3	16.0	53.6	17.3	64.6	4.5	23.3	14.7	75.2	11.9	83.4	4.8	28.4	13.4	79.3	10.3	86.5
+200 "	2.0	16.3	7.5	46.1	9.0	55.6	2.1	21.2	8.7	66.5	8.8	74.6	2.8	25.6	9.9	69.4	9.4	77.1
-200 "	16.3	-	46.1	-	55.6	-	21.2	-	66.5	-	74.6	-	25.6	-	69.4	-	77.1	-
Total	100.0	-	100.0	-	100.0	-	100.0	-	100.0	-	100.0	-	100.0	-	100.0	-	100.0	-

From log-log plots of the size distribution curves, per cent passing versus micron size, the data in Table 2 were obtained: (Note: minor corrections were made to feed curves to allow for scalped feed).

TABLE 2

Data for W_i Calculations

Grind Time, min	Comparison Ore A		Comparison Ore B		East Malartic Ore	
	F	P	F	P	F	P
15	1120	182	1050	110	1170	103
20	1120	135	1050	92	1170	87

where: F = 80% passing size of feed in microns

and P = 80% passing size of product in microns.

Calculation of Work Index W_i

In his Third Theory of Comminution*, F.C. Bond states that W, the work input in kwh/short ton, is equal to:

$$W_i \left(\frac{10}{\sqrt{P}} - \frac{10}{\sqrt{F}} \right)$$, where W_i = work index.

The work index is the kwh/short ton required to reduce a material from theoretically infinite size to 80% passing 100 microns. Since the work input is the same for samples ground in the same mill for equal times and since the work index for the comparison ores is known, the above equation can be used to calculate the unknown work index.

The following table shows the results of the calculated work indices for the East Malartic ore.

*F.C. Bond, "The Third Theory of Comminution", AIME Trans., Vol. 193, p. 484, May 1952.

TABLE 3

Calculated Work Indices

Comparison Ores		East Malartic Ore	
A	B	15 min grind	20 min grind
19.5	-	12.5	14.0
-	13.4	12.5	12.6
Average W_i		12.5	13.3

CONCLUSIONS

This is an ore of medium grindability having an average calculated work index of 12.9 kwh/short ton.

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TFB:DV