CC
53-133

O T T A W A February 27th, 1943.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1361.

Pilot Plant Test on Chromite Ore from the Page Claims, Bird River, Manitoba.

(Copy No.___.)

900.

O T T A W A February 27th, 1943.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1361.

Pilot Plant Test on Chromite Ore from the Page Claims, Bird River, Manitoba.

==========

Shipment:

Two carloads of ore were received on January 16th, 1943, consisting of a total of 85 tons of chromite ore shipped from the Page claims, Bird River, Manitoba, by the Hudson Bay Exploration and Development Co. Ltd., 500, Royal Bank Building, Winnipeg, Manitoba. The work on this lot was done at the request of the Metals Controller, Department of Munitions and Supply, Ottawa.

The main objective of the treatment was to produce sufficient concentrate for full-scale treatment by the Chromium Mining and Smelting Co. Ltd., Sault Ste. Marie, Ontario. Metallurgical data incidental to the milling of the ore were also obtained and are presented in this report.

Characteristics of the Ore:

The ore was similar in character and analysis to the shipment previously received for small-scale tests. The main characteristics, including the microscopic report, have been detailed in the interim and final reports of the laboratory tests, Reports of Investigations Nos. 1327 (Nov. 20, 1942) and 1360 (Feb. 24, 1943) respectively.

The ore, as received, appeared to have been sorted, as there was no evidence of any large gangue material such as would be expected in the ordinary course of mining.

The microscopic examination indicated that the average grain size of the chromite was 160 microns (-65+100 mesh), which indicated that a relatively fine grind was required for liberation of the chromite.

The highest grade of concentrate that may be expected, approximately 44 per cent Cr_2O_3, was obtained both on the Haultain superpanner and in a narrow band from the Wilfley table. This could be considered as representing the pure mineral.

Preliminary Investigations:

The preliminary investigations have been detailed in the interim report and also the final small-scale test report (Report of Investigation No. 1360, Feb. 24th, 1943) but a summary of the findings is as follows:

Grinding to minus 35 mesh and flotation of the gangue, followed by tabling the flotation tailing gave the best apparent results.

Grinding to minus 35 mesh, desliming, and tabling the deslimed sands gave good results, comparable with the gangue flotation.

Coarse grinding gave a low-grade concentrate (33.5 per cent Cr_2O_3).

Flotation of the chromite was unsatisfactory.

(Continued on next page)

(Preliminary Investigations, cont'd) -

The standard flow-sheet for treating chromite ores appeared to be the most suitable for this ore. This consists of crushing and grinding to avoid production of excessive fines, followed by table concentration of classified products. Regrinding of the table middlings is necessary for maximum recovery. With this ore, desliming is beneficial.

A fairly high slime loss will occur on this ore, due to the fact that the average particle size of the mineral is only 160 microns, requiring a much finer grind than is usual with chromite ores.

Procedure in Pilot Plant Test:

No separate sample was taken of the shipment; a daily feed sample was taken, and the average analysis of the entire lot thus arrived at contained 26.40 per cent Cr_2O_3 and 12.70 per cent Fe. The chrome:iron ratio was 1.42:1.

The ore was broken in the jaw crusher and the Symons cone crusher to approximately $\frac{3}{4}$ inch and fed at the rate of 1 ton per hour to a 4 ft. x 3 ft. grate discharge ball mill. The grate openings were 1/8 inch. The ball mill discharge was screened on a 26-mesh Hum-mer screen and the oversize was returned to the ball mill for further grinding. The minus 26 mesh product was deslimed in a 24-inch-wide Dorr classifier, the overflow going to a Callow cone and the sands to a 2-spigot Richards hydraulic classifier. The first spigot fed a Butchart $\frac{1}{4}$-deck sand table and the second spigot fed a Deister $\frac{1}{4}$-deck sand table. The classifier fines, along with the 24-inch Dorr classifier slimes and the Wilfley $\frac{1}{4}$-deck middlings, went to a Callow cone. The cone overflow was discarded as tailing and the underflow passed over a full-size Wilfley table (slime deck). The middlings from

(Procedure in Pilot Plant Test, cont'd) -

this table were reconcentrated on a Wilfley ¼-deck table.

With the exception of the concentrate, all the material from the Butchart table and the middlings from the Deister table were dewatered in a 12-inch Dorr classifier. The sands were reground in a Denver 2½ ft. x 4 ft. ball mill, the discharge of which joined the discharge from the 4 ft. x 3 ft. primary ball mill.

Tailings were discarded from the Deister and both Wilfley tables, from the Callow cone and from the 12-inch dewatering classifier overflow. All tailings entered a common discharge where a main tailing sample was obtained.

A final concentrate was removed from each of the four tables.

Sampling of various products was done at regular intervals during each day's run.

Details of Test:

The first few days' runs were not sampled completely, as it was necessary to build up the circuit, eliminate minor mechanical defects, and make the necessary changes in the flow-sheet.

Samples taken during this period indicated that a concentrate of 40 to 42 per cent Cr_2O_3 would be obtained. It was found that grinding through a 26-mesh screen gave the best results, from the point of view of both grade and recovery. When grinding through a 20-mesh screen, or coarser, it was not found possible to discard a tailing from either of the sand tables, and the result was that a very large circulating load built up in the regrind circuit. Even at 20 mesh the sand tailing from the Deister table was somewhat high, the tailing assaying 20.16 per cent Cr_2O_3 for the same grade of concentrate.

(Continued on next page)

(Details of Test, cont'd) -

After the circuit had been adjusted samples were taken at various points in the circuit for several days. The details given below are an average day's run.

Weights:

	Pounds per hour	Per cent of feed
Feed	1980	100.0
Middling circulating load	713	36.0
Butchart table concentrate	497	25.1
Deister table concentrate	224	11.3
Wilfley " " (full size)	182	9.2
" " " (¼-deck)	67	3.4
Total table concentrate	970	49.0
Final tailing	1010	51.0

The feed rate to the tables was in the following order:

¼ Butchart: ¼ Deister: Wilfley: ¼ Wilfley = 1:1:1½:3/8.

The Callow cone overflow was all minus 200 mesh and was discarded as final tailing. It contained only 2.2 per cent solids.

Assays:

	Cr_2O_3, per cent
Ball mill feed	26.23
24 inch Dorr classifier sands	30.45
" " " overflow	15.90
Butchart table feed	35.10
" " concentrate	41.75
Deister table feed	30.16
" " concentrate	42.53
" " tailing	7.88
Wilfley table feed	19.75
" " concentrate	40.57
" " tailing	9.74
Wilfley (¼-deck) table conc.	40.48
" " " tailing	8.85
Hydraulic classifier overflow	23.70
Callow cone feed	18.56
" " overflow	12.94
Middling circulating load	27.29
Final tailing	11.50

The Cr:Fe ratio in the concentrate was 1.49:1.

(Continued on next page)

(Details of Test, cont'd) -

Tonnage samples were taken from each table and these, together with their respective assays, give a grade of 41.56 per cent Cr_2O_3 for the total concentrate, with a recovery of 77.6 per cent of the Cr_2O_3. The ratio of concentration was 2.04:1.

A grab sample was taken of the final concentrate while it was being sacked. The analysis of the concentrates, as given by this sample, is as follows:

Determination		Per cent
Cr_2O_3	-	41.60
Fe	-	19.07
SiO_2	-	2.72
Al_2O_3	-	21.74
CaO	-	0.39
MgO	-	9.35

The screen test on the concentrate sample is given below:

Screen	Weight, per cent	Cumulative weight, per cent
+ 35	0.8	0.8
- 35+ 48	5.8	6.6
- 48+ 65	23.1	29.7
- 65+100	21.2	50.9
-100+150	23.6	74.5
-150+200	11.5	86.0
-200	14.0	14.0

The screen tests of the various products are given on Page 7.

TABLE OF SCREEN TEST RESULTS.
(Weight, per cent)

Screen size	Heads	Ball mill discharge	26 mesh screen undersize	24" Dorr classifier sands	Hydraulic Classifier: No. 1 Spigot (Butchart table feed)	Hydraulic Classifier: No. 2 Spigot (Deister table feed)	Hydraulic Classifier: Overflow	Wilfley table feed	Middling circulating load: B.M. feed	Middling circulating load: B.M. discharge	Final tailing	Final concentrate
+1"	3.7											
-1"+¾"	12.5											
-¾"+½"	22.8											
-½"+¼"	23.0											
-¼"+3 mesh	7.7											
-3+4	5.6											
-4+6	3.8											
-6+8	2.9											
-8+10	2.4											
-10+14	1.5	2.0										
-14+20	1.5	1.5										
-20+28	1.3	2.2							0.6			
-28+35	1.8	5.5	3.8	4.6	8.8	1.2			8.2	0.8		0.8
-35+48	2.5	9.5	11.4	11.7	26.6	7.4			25.9	6.0	1.4	5.8
-48+65	1.4	13.1	13.8	21.4	30.5	18.1		0.4	30.0	15.0	2.8	23.1
-65+100	1.7	14.0	18.8	20.2	20.0	30.1	4.0	2.5	19.5	23.8	5.2	21.2
-100+150	1.3	11.4	16.9	21.2	11.2	30.1	22.6	14.4	12.8	25.0	10.8	23.6
-150+200	0.6	7.4	8.2	12.3	2.1	10.4	25.5	18.5	1.8	10.9	5.6	11.5
-200	2.0	33.4	27.1	8.6	0.8	2.7	47.9	64.2	1.2	18.5	74.2	14.0

CONCLUSIONS:

As had been indicated in the preliminary investigations, grinding to approximately 35 mesh and desliming gave the best results.

Grinding to a coarser mesh did not appear very satisfactory, as a large middling load built up which resulted in eventual higher losses in the sand tailings with consequent lower recovery.

The losses occurred mainly in the slimes but settling tests indicated that this loss was at a minimum for the grind and that a larger settling area would not lessen these losses appreciably.

Considering the fineness of the chromite particles in the ore, the recovery of 78 per cent of the Cr_2O_3 at a grade of 41.5 per cent Cr_2O_3 would be considered quite satisfactory.

oooooooooooo
ooooooo
o

KNS:GHB