CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

OTTAWA

MINES BRANCH INVESTIGATION REPORT IR 58-142

CONCENTRATION TESTS ON A SAMPLE OF BIRD RIVER (MANITOBA) CHROMITE ORE SUBMITTED BY STRATMAT LIMITED, MONTREAL, QUEBEC

by

G. O. HAYSLIP

MINERAL DRESSING AND PROCESS METALLURGY DIVISION

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SUMMARY OF RESULTS

Tabling of the ore, ground to minus 35 mesh, produced the desired grade of concentrate, 16.8% Cr, with a recovery of 85.2%. The Humphreys Spiral produced a higher grade concentrate, 20.9% Cr, but the recovery dropped to 63.8%. Sink-float tests gave recoveries of 59.9% with a grade of 16.2% Cr and 77.4% with a grade of 14.5% Cr. Jigging tests were unsuccessful.

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INTRODUCTION

Location of Property

The property from which the shipment was said to have been taken is located in the Bird River area of southeastern Manitoba.

Shipment

The shipment was submitted under the direction of Dr. G. C. Monture, Vice-President, Stratmat Limited, Room 725, 56 Sparks Street, Ottawa, Ontario. The shipment consisted of equal parts of jaw crusher discharge, minus 4 in. run-of-mine, and rod mill feed. This ore was part of a larger shipment which had previously been sent to Cobalt, Ontario, where a plant test had been carried out on part of the shipment.

Nature of Investigation Requested

From information given verbally by Dr. Monture, it was learned that the company desired to produce a chromite concentrate with a grade of approximately 16% Cr and as high a recovery as possible. This grade of concentrate was desired as it was thought that the best furnace results could be obtained with a concentrate of the above grade. A schedule of tests to be carried out was submitted by Mr. H.R. Banks, Metallurgical Consultant, and this schedule was followed with only slight variations.

Sampling and Analysis

No sampling was done on the ore as received and all head assays were calculated from the test products obtained. The calculated head assays checked the head assay of the shipment received at Cobalt. All chemical analyses were done at the Niagara Falls, Ontario, laboratory of Stratmat Limited.

DETAILS OF INVESTIGATION

The sample of minus 4 in. run-of-mine ore and of the jaw crusher discharge were crushed to minus 1 in. in a laboratory jaw crusher and the minus 4 mesh material was removed by screening.

A portion of the minus 1 in. plus 4 mesh material was used for sink-float tests and the minus 4 mesh material was used for jigging tests.

The rod mill feed sample was crushed to minus 4 mesh and the entire sample was ground in a 21 in. by 30 in. low discharge rod mill in closed circuit with a 35 mesh screen. The minus 35 mesh product constituted the feed for the table and Humphreys Spiral concentration tests.

Test No. 1

A sink-float bucket test was carried out on a portion of -1 in. + 4 mesh ore at a medium specific gravity of 3.1. The float product from this test was retreated at a specific gravity of 3.0. The products obtained were washed, dried, and screened on 3/4 in. and 1/2 in., and the sized fractions were weighed, sampled, and assayed.

Results of Test No. 1

Product	Weight, %	Assays, %		Distribution, %	
		Cr	Fe	Cr	Fe
Feed	100.0	10.13	11.06	100.0	100.0
Sink @ 3.1					
+3/4 in.	18.7	16.01	13.76	29.5	23.3
-3/4 in. + 1/2 in.	10.3	15.51	14.10	15.8	13.1
-1/2 in. + 4 mesh	8.6	17.22	15.02	14.6	11.7
Total sink @ 3.1*	37.6	16.15	14.14	59.9	48.1
Sink @ 3.0					
+3/4 in.	3.6	6.76	9.75	2.4	3.2
-3/4 in. +1/2 in.	4.2	8.72	10.78	3.6	4.1
-1/2 in. + 4 mesh	4.7	13.48	13.64	6.3	5.8
Total sink @ 3.0*	12.5	9.94	11.55	12.3	13.1
Float @ 3.0					
+3/4 in.	8.3	2.31	7.11	1.9	5.3
-3/4 in. +1/2 in.	10.0	2.95	7.45	2.9	6.7
-1/2 in. + 4 mesh	12.4	4.91	8.60	6.0	9.7
Total float @ 3.0*	30.7	3.57	7.82	10.8	21.7
-4 mesh fines	19.2	8.97	9.86	17.0	17.1

* Calculated

Test No. 2

A sink-float test similar to Test No. 1 was carried out at a medium specific gravity of 2.95, with the float product being retreated at a specific gravity of 2.90.

Results of Test No. 2

Product	Weight, %	Assays, %		Distribution, %	
		Cr	Fe	Cr	Fe
Feed	100.0	10.9	11.3	100.0	100.0
Sink @ 2.95					
+3/4 in.	25.7	13.84	12.84	32.7	29.1
-3/4 in. +1/2 in.	16.9	14.66	13.53	22.8	20.1
-1/2 in. + 4 mesh	15.3	15.58	13.76	21.9	18.5
Total sink @ 2.95*	57.9	14.54	13.23	77.4	67.7
Sink @ 2.90					
+3/4 in.	2.7	2.84	7.45	0.7	1.8
-3/4 in. +1/2 in.	2.2	2.74	7.68	0.6	1.5
-1/2 in. + 4 mesh	3.8	7.75	9.52	2.7	3.2
Total sink @ 2.90*	8.7	4.98	8.42	4.0	6.5
Float @ 2.90					
+3/4 in.	2.9	1.78	7.45	0.5	1.9
-3/4 in. +1/2 in.	4.4	1.35	7.00	0.5	2.7
-1/2 in. + 4 mesh	6.9	2.77	7.34	1.8	4.5
Total float @ 2.90*	14.2	2.12	7.26	2.8	9.1
-4 mesh fines	19.2	8.97	9.86	15.8	16.7

* Calculated

Test No. 3

A portion of the -4 mesh fines was passed over a Richards pulsating-type jig. A second portion had the -35 mesh fraction removed and also was passed over the jig. Neither test was successful, probably due to the fact that a large number of the grains were combined ore and gangue and, also, due to the small size of the jig, 3 in. x 3 in., which caused a considerable amount of wall effect and so hindered the operation of the jig.

Results of Test No. 3(a)

Product	Weight, %	Assays, %		Distribution, %	
		Cr	Fe	Cr	Fe
Feed	100.0	9.19	8.80	100.0	100.0
Concentrate	29.9	11.56	11.01	37.6	37.4
Tailing	70.1	8.18	7.86	62.4	62.6

Results of Test No. 3(b)

Product	Weight, %	Assays, %		Distribution, %	
		Cr	Fe	Cr	Fe
Feed	100.0	9.24	10.10	100.0	100.0
Concentrate	13.4	13.77	12.38	20.0	16.4
Tailing	86.6	8.54	9.75	80.0	83.6

Test No. 4

The total lot of the rod mill feed sample was screened on 4 mesh and the oversize crushed to -4 mesh. The lot was then ground in a 21 in. x 30 in. low discharge rod mill in closed circuit with a 35 mesh screen. A screen test of the ground material gave the following results:

Mesh	Weight, %
+48	10.4
-48 +65	18.8
-65 +100	15.6
-100 +150	10.2
-150 +200	6.4
-200	38.6

This material was fed to a No. 14 Deister Diagonal-Deck table at a feed rate of 1125 lb/hr. Due to the arrangement of the table and its launders it was necessary to take a wide middling cut, which, as it turned out, was very fortunate. All products were dried, weighed, sampled, and assayed.

Results of Test No. 4

Product	Weight, %	Assays, %		Distribution, %	
		Cr	Fe	Cr	Fe
Feed	100.0	10.25	11.03	100.0	100.0
Table concentrate	15.8	25.05	22.93	38.6	32.9
Table middling	36.3	13.16	12.38	46.6	40.7
Combined conc + middling	52.1	16.8	15.6	85.2	73.6
Tailing	47.9	3.17	6.08	14.8	26.4

Test No. 5

The rejects from the different table products were recombined and fed to the Humphreys Spiral concentrator at the rate of 1625 lb/hr. The concentrate and middling were cut from the pulp stream in accordance with standard operating practice. The products were dried, weighed, sampled, and assayed.

Results of Test No. 5

Product	Weight, %	Assays, %		Distribution, %	
		Cr	Fe	Cr	Fe
Feed	100.0	10.7	11.2	100.0	100.0
Spiral conc.	25.8	22.13	20.99	53.5	48.2
Spiral midds.	6.8	16.22	15.25	10.3	9.2
Combined conc. + middling	32.6	20.9	19.8	63.8	57.4
Spiral tailing	67.4	5.73	7.11	36.2	42.6

CONCLUSIONS

Tabling of the ore ground to minus 35 mesh produced the grade of concentrate desired. This grade was obtained by taking a middling cut larger than is usual in practice and combining it with the concentrate.

The concentrate produced by the Humphreys Spiral was higher in grade but the recovery was lower. This was due to the fact that only a small amount of middling was taken.

The sink-float tests produced either a concentrate higher in grade and lower in recovery, or lower in grade with average recovery. Both grade of concentrate and recovery could be improved slightly by treating the fines by tabling and adding the table concentrate to the sink product.

Jigging tests were unsuccessful. The specific gravity of particles ranged from 2.85 to 3.6 and no separation could be made between them. There was a considerable amount of side wall effect due to the small size of the jig, 3 in. x 3 in., and this undoubtedly hindered any possible separation.

These tests were carried out under the direction of the Company and were limited in scope. There are several questions which are unanswered and it is felt that more testing should be done.

From observation of the tests carried out it would seem that a coarser grind could be used for the table and spiral tests. Also, in the case of the spiral, a larger middling product should be taken. This should increase the recovery and help to bring the concentrate down to the desired grade. It might be advantageous also to size the feed before concentration.

GOH/DV