O T T A W A December 31st, 1940.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 940.

Concentration of Chromite Ore from the Port au Port Bay District, Newfoundland.

BUREAU OF MINES
DIVISION OF METALLIC MINERALS
—
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CANADA
DEPARTMENT
OF
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Shipment:

Two samples of chromite ore, one high-grade and one low-grade, total weight 30 pounds, were received on November 15th, 1940, from K. J. Springer, President, Springer, Sturgeon Gold Mines Limited, 67 Yonge Street, Toronto, Ontario. The samples originated 13 miles east of the mouth of the Fox Island river, Port au Port Bay district, Newfoundland.

Sampling and Analysis:

After cutting, crushing and grinding by standard methods, a sample of each lot of ore was obtained which assayed as follows:

		High Grade	Low Grade
		(Per cent)	
Cr_2O_3	-	41.01	1.31
FeO	-	13.82	10.76

Characteristics of the Ore:

Samples of the high-grade ore which were examined under the binocular microscope showed that the ore consisted essentially of chromite and a light-green coloured serpentine gangue. The definition between the mineral and the gangue is quite sharp and almost all the particles are free at relatively coarse sizes.

Six polished sections, three from each of the high-grade and the low-grade ores, were prepared and examined microscopically.

Low-Grade Sample -

Gangue forms the bulk of the sections and consists of soft, dark, clouded, greenish brown and light greenish yellow material. In some places it presents a net-like pattern containing hard angular fragments which most likely represent the original material from which the serpentine has been derived. The pecular reticulated structure suggests that the original mineral was olivine. In one or two etching tests a slight effervescence was noticed, indicating the presence of a small amount of finely disseminated carbonate.

The metallic mineral content of the polished sections

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is small and is represented chiefly by chromite. This mineral preponderates largely as coarse irregular grains unevenly and sparsely disseminated through gangue. Magnetite, with probably some admixed "limonite", is present in small amount as medium to fine irregular grains in gangue and along fractures in chromite. Practically negligible quantities of pyrite and a grey unknown mineral are visible in the sections. The former occurs as small angular fragments in magnetite; the latter as tiny rods and irregular particles in chromite and in gangue against chromite. This mineral was negative to all standard etching reagents and could not be determined with certainty. However, its physical properties suggest that it may be ilmenite.

High-Grade Sample -

The gangue is essentially the same in this sample as in the one described above but is much less in amount.

Metallic mineralization is much heavier in this sample and is represented solely by chromite. This mineral is abundant, largely as coarse disseminated grains varying in size from several millimetres down to a fraction of a millimetre. Nearly all of the grains are fractured and cut by veinlets of gangue, some of which show replacement of the chromite while others show none. Also, nearly all grains contain numerous small inclusions of gangue which are probably due to replacement of the chromite by gangue; in some places this replacement has proceeded to such an extent that all that remains of the chromite is numerous, tiny, ragged remnants in gangue.

Experimental Tests:

All the tests reported were by jigging and tabling. Preliminary flotation tests did not justify further investigation by this means.

GRAVITY CONCENTRATION.

Test No. 1.

The ore crushed to minus 14 mesh without further grinding was passed twice over a single compartment Denver Mineral Laboratory Jig. The slime portion of the jig tailing was reserved and the sands passed over a laboratory-size concentrating table. The results are as follows:

Product	Weight, per cent	Assays, per cent				Distribution, per cent	
		Cr_2O_3	Cr⊕	FeO⊕	Fe	Cr	Fe
No. 1 jig conc.	36.13	49.87	34.12	16.21	12.60	45.57	41.90
No. 2 jig conc.	3.83	53.36	36.51	17.05	13.25	5.17	4.70
Table conc.	16.59	49.60	33.94	16.98	13.20	20.81	20.16
Table tailing	12.26	18.30	12.52	8.81	6.85	5.67	7.73
Table middling	14.61	41.00	28.05	14.60	11.35	15.15	15.28
Table slimes	9.40	17.47	11.95	8.62	6.70	4.15	5.80
Jig slimes	7.18	19.07	13.05	8.62	6.70	3.46	4.42
Totals	100.00	39.53⊕	37.05	13.97	10.86⊕	99.98	99.99

⊕ Calculated.
Ratio of concentration = 1.77:1.

It is indicated by this test that although this ore was not ball milled the slime loss is appreciable.

Test No. 2.

The ore at minus 14 mesh was first screened dry to remove the minus 35 mesh. The plus 35 mesh ore was ground

(Continued on next page)

(Test No. 2, cont'd) -

until it all just passed the 35-mesh screen. The dry screened material was combined with the ground pulp and all passed over the Denver mineral jig. The jig tailings were then passed over the laboratory concentrating table. The slime fractions from both the jig tailing and the table tailing were combined. By the method of screen classification used the slime loss was not materially increased. The test results are as follows:

Product	Weight, per cent	Assays, per cent				Distribution, per cent	
		Cr_2O_3	Cr⊕	FeO⊕	Fe	Cr	Fe
Jig conc.	29.58	51.50	35.23	16.92	13.15	38.23	32.89
Table conc.	30.08	54.35	37.19	16.98	13.20	41.03	33.59
Table tailing	15.78	19.30	13.21	17.50	13.60	7.64	18.15
Slimes	24.56	21.26	14.55	9.52	7.40	13.10	15.37
Totals	100.00	39.85⊕	27.27	15.21	11.82⊕	100.00	100.00

⊕ Calculated.
Ratio of concentration = 1.68:1.

A screen analysis of the slime and sand tailings is as follows:

MESH	SANDS		SLIMES	
	Weight, per cent	Cumulative per cent	Weight, per cent	Cumulative per cent
+48	5.3	5.3	-	-
+65	12.8	18.1	0.1	0.1
+100	18.8	36.9	0.3	0.4
+150	20.1	57.0	1.0	1.4
+200	12.8	69.8	1.4	2.8
-200	30.2	100.0	97.2	100.0

Test No. 3.

The ore at minus 14 mesh was ground through minus 35 mesh and passed over the laboratory concentrating table.

A screen analysis of the concentrate was as follows:

MESH	CONCENTRATE Weight, per cent	CONCENTRATE Cumulative per cent
+ 35	0.4	0.4
+ 48	11.0	11.4
+ 65	22.8	34.2
+100	23.1	57.3
+150	19.4	76.7
+200	10.2	86.9
-200	13.1	100.0

The concentration test results are as follows:

Product	Weight, per cent	Assays, per cent Cr_2O_3	Assays, per cent Cr⊕	Assays, per cent FeO⊕	Assays, per cent Fe	Distribution, per cent Cr	Distribution, per cent Fe
Table conc.	61.13	53.14	36.36	17.11	13.30	81.35	75.75
Table sands	18.37	18.73	12.81	8.62	6.70	8.61	11.46
Table slimes	20.50	19.56	13.38	8.62	6.70	10.04	12.79
Totals	100.00	39.93⊕	27.32	13.80	10.73⊕	100.00	100.00

⊕ Calculated.
Ratio of concentration = 1.64:1.

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Test No. 4.

In this test the ore charge at minus 14 mesh was ground 49.4 per cent minus 200 mesh. The pulp was passed through a hydraulic classifier to produce a sand and a slime fraction. These fractions were passed over laboratory

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(Test No. 4, cont'd) -

concentrating tables with sand and slime riffles. From the results of this test it is evident that a considerable degree of concentration took place in the hydraulic classifier, as 58 per cent of the weight of the sample contained approximately 70 per cent of the Cr_2O_3 in the ore.

A screen analysis of the hydraulic classifier products is as follows:

MESH	SANDS		SLIMES	
	Weight, per cent	Cumulative per cent	Weight, per cent	Cumulative per cent
+ 48	0.2	0.2	-	-
+ 65	4.0	4.2	-	-
+100	19.9	24.1	-	-
+150	28.3	52.4	-	-
+200	26.1	78.5	12.0	12.0
-200	21.5	100.0	88.0	100.0

The results of the tabling test are as follows:

Product	Weight, per cent	Assays, per cent Cr_2O_3	Assays, per cent Cr⊕	Distribution of Cr, per cent	Ratio of concentration
Sand table conc.	43.38	54.32	37.17	56.24	2.3:1.
Sand table middling	13.55	39.60	27.09	13.11	
Sand table tailing	2.19	5.48	3.75	0.29	
Slime table conc.	7.60	54.64	37.39	10.14	13.2:1.
Slime table middling	4.53	47.64	32.60	5.27	
Slime table tailing	29.75	20.57	14.07	14.95	
Totals	100.00	40.94⊕	28.01	100.00	1.96:1.

⊕ Calculated.

Test No. 5.

In this test, which was conducted on the low-grade sample of ore, the charge was ground all through 35 mesh. The pulp was then passed over a laboratory concentrating table.

A screen analysis of the sand tailing was as follows:

Mesh	SAND TAILING: Weight, per cent	SAND TAILING: Cumulative per cent
+ 28	0.2	0.2
+ 35	0.2	0.4
+ 48	12.6	13.0
+ 65	18.2	31.2
+100	21.4	52.6
+150	18.9	71.5
+200	14.2	85.7
-200	14.3	100.0

The results of the tabling test are as follows:

Product	Weight, per cent	Assays, per cent: Cr_2O_3	Assays, per cent: Cr®	Assays, per cent: FeO®	Assays, per cent: Fe	Distribution, per cent: Cr	Distribution, per cent: Fe
Table conc.	5.70	10.57	7.23	16.89	13.10	50.92	9.18
Table middling	11.72	2.71	1.85	12.61	9.80	26.84	14.13
Table sands	47.29	0.43	0.29	9.91	7.70	17.18	44.79
Table slimes	35.29	0.17	0.12	9.46	7.35	5.06	31.90
Totals	100.00	1.18®	0.81	10.46	8.13®	100.00	100.00

® Calculated.
Ratio of concentration = 17.5:1.

This test on the low-grade ore does not indicate any possibility of making a commercial grade of concentrate from this ore. The Cr_2O_3:FeO ratio is not satisfactory and together with the low recovery shown the results are not promising.

Summary:

The various tests conducted on the high-grade ore indicate that fairly good recoveries may be made by jigging and tabling or by tabling alone. The amount of slimes produced has a considerable influence on the recoveries obtainable but it seems possible that plant operations could be so arranged that sliming may be kept to a minimum.

The concentrates that have been produced from the sample seem quite satisfactory, that is, the chrome:iron ratio is in accordance with market requirements. Of course the fine size of the concentrate will reduce the premium for coarse size, but this will be somewhat offset by the high chrome content.

An interesting point with regard to the concentrate is the fact that, although several different types of concentration were used, the grade of the concentrate never was higher than 55 per cent Cr_2O_3. This is probably due to the gangue inclusions in the chromite grains that were mentioned in the paragraphs concerning the characteristics of the ore.

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