#### OTTAWA February 24th, 1943.

## REPORT

#### of the

## ORE DRESSING AND METALLURGICAL LABORATORIES.

### Investigation No. 1360.

# Small-Scale Concentration Tests on a Chromite Ore from the Page Claims, Bird River, Manitoba.

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#### Shipment:

A shipment of 1,180 pounds of chromite ore was received on August 31st, 1942, from Mr. Hilding Johnson, Lac du Bonnet, Manitoba. This represented six typical exposures of the chromite band at intervals over a total length of 2,400 feet.

The samples consisted of fresh ore blasted out across the main chromite band over an average width of approximately 7 feet and were taken by Mr. Johnson under the direction of Dr. J. D. Bateman, of the Geological Survey, Mines and Geology Branch, Department of Mines and Resources, Ottawa, Ontario.

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#### Location of the Property:

The Page claims, from which the sample was taken, are situated north of Oiseau River, Lac du Bonnet district, Manitoba. (Sec. 5-6, Tp. 18, R 15E).

#### Sampling and Analysis:

After crushing and cutting by standard methods, a representative sample of the shipment was obtained which assayed as follows:

Chromium oxide	$(Cr_2O_3)$	cup	26,80
Iron (Fe)	5 6	<b>e</b> 0	12,34
Silica $(SiO_2)$		e	10,30

#### Characteristics of the Ore:

Six polished sections were prepared and examined under the reflecting microscope for the purpose of determining the character of the ore.

#### Gangue -

In the polished sections, gangue material consists of soft, fine-textured, dark-grey rock which contains occasional, small, elongated remnants of a harder mineral and probably represents a serpentinized peridotite.

#### Metallic Minerals -

The polished surfaces exhibit abundant chromite disseminated rather evenly through gangue as more or less rounded grains and crystals. These range from 750 microns down to 10 microns or less in size, the average being about 160 microns (-65+100 Tyler mesh). In general, the chromite contains numerous inclusions and veinlets of gangue which are too small to be economically eliminated by grinding. Chromite grains entirely free of gangue inclusions are very rare and, although some grains are almost free, in most grains such inclusions are numerous and in some cases predominate. Approximately average fields are shown in the photomicrographs.

The gangue inclusions are usually scattered at random

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(Characteristics of the Ore, cont'd) -

throughout the chromite but occasionally (1) they show a rough peripheral arrangement in which they form a ring or narrow band around the border of the ore mineral, leaving the centre comparatively free; or (2) they contains rather large round inclusion at or near the centre of the chromite crystal. In some chromite grains where the latter occurs the borders are comparatively free of smaller gengue inclusions. It is to be noted also that many chromite grains have jagged, corroded edges which appear to have resulted from attack and replacement by gangue. See the photomicrographs, Figures 1, 2, and 3.

The shells or rims of the light-grey material, which are almost universal around the chromite grains in the ore from the Chrome Group of claims (our Min, Lab, Report No, M-869-E, God's Lake Gold Mines Limited, Nov. 1942), are not so abundant in the polished sections of this ore but are common in one. They are much less than ten microns in width and probably average not more than five or six microns (see Figure 1). As explained in the report referred to above, this lighter-coloured material is probably an alteration product. In a previous report (our Min. Lab. Report No. M-664-E, Sept, 1939), made on a sample of another chromite ore, borders of similar-looking material were suggested as being reaction shells of magnetite. This suggestion was made because a light-brown stain was left on the border material after long etching with stannous chloride in 1:1 HCl, while the chromite was unaffected. Similar tests made on the sections from this ore were negative. After an attempt had been made to remove some of the border material with a needlepoint, however, one small particle stood on end at the approach of a magnet, but it is not known with certainty whether this particle came from the rim or not. In any case, if magnetite is present it appears to be in very small amount.

> (Pages 4 to 6 are photomicrographs.) ( Text continues on page 7. )

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Figure 1.

1. . . A.

1. 1 . . .

Photomicrograph of polished section showing chromite crystals with narrow, light-coloured borders around the edges and along ganguefilled fractures.

> Borders - almost white. Chromite - light grey. Gangue - grey. Pits - black.

Magnification ~ 200X.

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Figure 2.

Photomicrograph of polished section showing the distribution of small inclusions of gangue in the chromite crystals. Note the comparatively large, round inclusions near the centres of two chromite grains. ;

Chromite	£22#	light grey.
Gangue	63	grey.
Pits	410	black.

Magnification - 200X.

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Figure 3.

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Photomicrograph of polished section showing the corrosion and embayment of chromite by gangue. Also note that the tiny inclusions of gangue are more numerous towards the boundaries of the chromite crystals.

> Chromite - light grey. Gangue - grey.

Magnification - 200X.

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#### Investigative Work:

The character of this ore and the history of chromite concentration point to gravity concentration. This investigation follows that preconception and the report includes the results obtained by table concentration. Flotation also was tried, together with small reconcentration tests, on the gravity concentrates. The possibilities of magnetic separation to increase the chrome-iron ratio were studied,

Table concentration on one ground minus 48 mesh produced a concentrate assaying 42.4 per cent  $Cr_2O_3$  with a chrome-iron ratio of 1.48:1, while, when grinding to minus 10 mesh, the concentrate assayed 33.5 per cent  $Cr_2O_3$  with a chrome-iron ratio of 138:1. A recovery of 85.1 per cent was recorded for the coarse grind while the recovery from the finer grind fell off to 66 per cent. A grind of approximately minus 35 mesh is indicated for best results. The highest grade of concentrate obtainable is about 44.28 per cent  $Cr_2O_3$  and 20.7 per cent Fe, with a chrome-iron ratio of 1.46:1,

The preliminary investigations consisted of grinding through 14 mesh and table concentration of sized portions of the pulp, Microscopic examination showed that only when 48 mesh was reached were 50 per cent of the chromite grains freed of gangue.

When the grade of concentrate reached 40,7 per cent Cr<sub>2</sub>O<sub>3\*</sub> 90 per cent of the grains were free. With a 38 per cent grade, 70 per cent was freed, while a middling product assaying 25.6 per cent contained 80 per cent of attacked chromite-gangue particles. Jigging of minus 100 mesh material in a gold jig produced inferior results.

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(Investigative Work, cont'd) -

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Flotation of the chrome in the ore was attempted, but was not found to be feasible owing to the tendency of the serpentine talc in the gangue to float along with the chromite mineral,

Better results were secured by first removing the tale by flotation, followed by gravity concentration. By this method the grade of table feed was raised from 26.80 per cent  $Cr_2O_3$  (head assay) to 31.4 per cent  $Cr_2O_3$  with a removal of 18 per cent of the ore at a loss of only 5.0 per cent of the  $Cr_2O_3$ . Table concentration of these flotation tailings gave a concentrate assaying 40.6 per cent  $Cr_2O_3$  and an overall recovery of 78.9 per cent of the chromium in the ore. By desliming, prior to table concentration, the grade was raised to 29.0 per cent  $Cr_2O_3$  with a decantation of 6.5 per cent of the weight of the feed. The ensuing table converse centrates assayed 40.3 per cent  $Cr_2O_3$  with an overall recovery of 77.6 per cent of the chromium.

Magnetic concentration in the Davis tube of two lots of table concentrates gave results which showed less than 1.0 per cent of the concentrate to be magnetic.

Superpanning tests on different table concentrates raised the grade less than 1.0 per cent Cr<sub>2</sub>0<sub>3</sub> and did not alter the chromewiron ratio appreciably.

The results of the test work follow:

Part I.	i <b>h</b>	Wilfley Table Concentration.
Part II.	a)	Flotation Concentration.
Part III.		Flotation and Table Concentration Combined,

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## PART I. - WILFLEY TABLE CONCENTRATION.

## Test No. 1 (A to D).

In this test, portions of the ore at minus 14 mesh were ground in water in a ball mill to various degrees of fineness. The pulp density of the grind was 57.0 per cent solids. The pulp was then passed over a Wilfley table, with the following results:

<pre>:Weight,: Assays, : Distribution,: Ratio of Product: per :</pre>	T	est No.	1-A (43,5	<u>per ce</u>	nt minus	200 mesh).	5
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Middling : 22,83: 32,72 : 15,86 : 27,9 : 27,3 : \						•	
Middling : 22,83: 32,72 : 15,86 : 27,9 : 27,3 : \							5 <b>.5:1</b> .
Tailing : 59,02: 19,43: 9,86: 42,9: 43,8:						•	: \
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• Calculated.

#### - Page 10 -

(Test No. 1, cont'd) .

Summary of Test No. 1:

,	0	Chrome-iron	6 6	Assay of	0- 0-	Overall	•	Grind.
Test	0	ratio	•	concentrate,	<b>a</b>	recovery,	0	per cent
No,		of	8 6	Cr203,	:	per cent	90	minus 200
	0	<u>concentrate</u>	2	per cent	С.	<u>Cr203</u>	¢	mesh
•	4		04		é é	an a	¢	alandar ar fallandar och samtandar af sindsamt fra andra sind andra andra andra andra andra andra andra andra a
1-A	ê	1,40:1,	đi đ	42,42	0	64.4	0	43,5
1-B	-	1.36.1.	9	43,04	•	59,0	¢.	65.0
1-•C	<b>6</b> 0	1,38:1,	84	43,39	\$	47.8	<b>a</b> 0	73,6
]∞D	<b>8</b> 4	1.39:1,	0	42,94	÷.	43,1	84	85,9
		an dia mandri ang kanalana ang ka	<b>t</b> .		9		9	

The overall recovery figures were arrived at by the addition of one-half of the middling product to the concentrate. These recoveries are low due to the unclassified feed to the table.

A portion of the concentrates from these tests were treated on the Haultain superpanning machine. The resultant panner concentrates were weighed and assayed for Cr and Fe.

Results:

ж.т.<sup>6</sup>. ...

. Test	° W	eight of panne: concentrate, per cent	:	Ass per Cr203		Chrome=to- iron ratio
leA leB	00 00 00 00	64,93 73,10		42,99	21,55	1,36:1, 1,33:1,
1.0C	000	81,50	00 00	43,44	•1	1,35:1.

Test No<sub>4</sub> 2 (A to I).

In this test, portions of the ore were dry-crushed through a set of rolls to the different sizes as designated. The resultant pulps were then concentrated on Wilfley tables.

(Continued on next page)

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## 🖦 Page ll -

(Test No. 2, cont'd) -

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hanna 1

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Test No. 2.	: Weight,:	Asse	ys, :	Distri	ibution,	Ratio of
Product	per :	per (	iont :	per	cent :	concen⇔
an a fear a star an	<u>cent</u>	Cr203	Fø :	Cr203	Fe :	tration
n a frank drei jegenne sin e staar te feren en de kannen de kannen de staar en staar de staar de staar de staa I						
	: 100,00 :					
Fable conc.	: 60,63 :	32,87 :	: 16,29 :	74.9	: 73.8 :	: 1.6:1.
" middling :	: 26,55 :	20,43	10,58 :	20,4	21.0	
" tailing			5.40 :			;
						2
n men hand till fold tallet følger av skriftet av skriftet folder for skriftet folgen folder folgen folder av s V	an a	₩₩₽1>00000000000000000000000000000000000				۵۰۰۹ ۵۶۰ - ۲۰۰۶ ۵۰۰ - ۲۰۰۶ ۵۰۰ - ۲۵۵۶ ۵۰۰ - ۲۵۵۶ ۵۰۰ ۲۰۰۶ ۲۰۰۶ ۲۰۰۶ ۲۰۰۶ ۲۰۰۶ ۲۰۰۶
Test No. 24	<u>»B (Minus</u>	8 mesh a	und 9,6 p	or cent	minus 20	<u>)0 mesh).</u>
						2
	: 100,00 :					•
lable conc.	: 61,22 :	32,22	: 16,61 :	75,4	r 75.4 :	
" middling						
" tailing	: 13,22 :	10,27 :	: 5,40 :	5.2 :	5.3	
n Classific intractities of the statement of Classific Articles Statement	ф ф а					) ] 
Test No. 2.	C (Minus	10 mesh	and 12.6	ber cer	nt minus	200 mesh)
Feed	: 100,00 :	26,540	: 13,35 <sup>0</sup> :	100,0 :	: 100.0 :	
Fable conc,	: 61,84 :	33,50	16,66 :	78.0	77.2	: 1.6:1.
" middling	23.46	18.98	9.58	16.8	16.9	
			5,40			2
COLLER C				۰ <b>.</b>		•
and such a second s		ب المانية لابيدة المانية الإسلامية المانية المانية الم		the same is a second		-
Test No. 2.	aD (Minus	14 mash	and 19.8	ber cer	nt minus	200 mesh)
Test No. 2.	C C				3	
an na han bar ta yang manan milikan sa ang silika pang na sa	C C				3	
Feed	1.00,00	26,07 <sup>®</sup>	13,21 <sup>0</sup>	100,0	100,0	
Feed Table conc.	100,00 : 56,22 :	26,07 <sup>0</sup> 33,03	13,21 <sup>0</sup>	100.0	100,0 70,3	1,8:1,
Feed Table conc. " middling	100,00 56,22 27,28	26,07 <sup>0</sup> 33,03 21,24	13,21 <sup>0</sup> 16,51 11,11	100,0 71,2 22,2	100.0 70.3 22,9	: ],8:],
Feed Table conc.	100,00 56,22 27,28	26,07 <sup>0</sup> 33,03 21,24	13,21 <sup>0</sup>	100,0 71,2 22,2	100.0 70.3 22,9	: ],8:],
Feed Table conc. " middling " tailing	100,00 56,22 27,28 16,50	26,07 <sup>0</sup> 33,03 21,24 10,36	13,21 16,51 11,11 5,45	100,0 71,2 22,2 6,6	100,0 70,3 22,9 6,8	1.8:1.
Feed Table conc. " middling	100.00 56.22 27.28 16.50 <u>– E (Minus</u>	26,07 <sup>©</sup> 33,03 21,24 10,36 20 mesh	13,21 16,51 11,11 5,45 and 23,0	100,0 71.2 22,2 6,6	100,0 70,3 22,9 6,8 nt minus	1.8:1. 200 mesh)
Feed Table conc. " middling " tailing Test No. 2	100,00 56,22 27,28 16,50 E (Minus	$26.07^{\circ}$ 33.03 21.24 10.36 20 mesh 26.54 $^{\circ}$	13,21 16,51 11,11 5,45 and 23,0 13,50	100,0 71.2 22.2 6,6 ) per cen 100,0	100,0 70,3 22,9 6,8 nt minus 100,0	1.8:1. 200 mesh)
Feed Table conc. " middling " tailing Test No. 2 Feed Table conc.	100.00 56.22 27.28 16.50 E (Minus 100.00	26,07 <sup>©</sup> 33,03 21,24 10,36 20 mesh 26,54 <sup>©</sup> 36,89	13,21 16,51 11,11 5,45 and 23,0 13,50 18,57	100,0 71.2 22,2 6,6 ) per cen 100,0 63,2	100.0 70.3 22,9 6.8 nt minus 100.0 62.6	1.8:1. 200 mesh) 2.2:1.
Feed Table conc. " middling " tailing Test No. 2 Feed Table conc.	100.00 56.22 27.28 16.50 E (Minus 100.00	26,07 <sup>©</sup> 33,03 21,24 10,36 20 mesh 26,54 <sup>©</sup> 36,89	13,21 16,51 11,11 5,45 and 23,0 13,50 18,57	100,0 71.2 22,2 6,6 ) per cen 100,0 63,2	100.0 70.3 22,9 6.8 nt minus 100.0 62.6	1.8:1. 200 mesh) 2.2:1.
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Feed Fable conc. " middling " tailing Test No. 2 Feed Fable conc. " middling	100,00 56,22 27,28 16,50 E (Minus 100,00 45,49 37,51	26,07 <sup>*</sup> 33,03 21,24 10,36 20 mesh 26,54 <sup>*</sup> 36,89 21,59	13,21 16,51 11,11 5,45 and 23,0 13,50 18,57	100.0 71.2 22.2 6.6 ) per cen 100.0 63.2 30.5	100.0 70.3 22,9 6.8 nt minus 100.0 62.6 30.6	1.8:1. 200 mesh) 2.2:1.
Feed Table conc. " middling " tailing Test No. 2 Feed Feed Table conc. " middling " tailing	100,00 56,22 27,28 16,50 E (Minus 100,00 45,49 37,51 17,00	$26.07^{\circ}$ 33.03 21.24 10.36 20  mesh $26.54^{\circ}$ 36.89 21.59 9.75	13,21 16,51 11,11 5,45 end 23,0 13,50 13,50 13,50 13,50 13,50	100.0 71.2 22.2 6.6 9 per cen 100.0 63.2 30.5 6.3	100.0 70.3 22,9 6.8 nt minus 100.0 62.6 30.6 6.8	1.8:1. 200 mesh) 2.2:1.
Feed Table conc. " middling " tailing <u>Test No. 2</u> Feed Table conc. " middling " tailing Test No. 2.	100,00 56,22 27,28 16,50 E (Minus 100,00 45,49 37,51 17,00 F (Minus	26,07 $^{\circ}$ 33,03 21,24 10,36 20 mesh 26,54 $^{\circ}$ 36,89 21,59 9,75 28 mesh	13,21 16,51 11,11 5,45 and 23,0 13,50 13,50 13,57 11,00 5,40 and 24,4	100,0 71.2 22,2 6,6 ) per cen 100,0 63,2 30,5 6,3 ; eper cen	100.0 70.3 22,9 6.8 nt minus 100.0 62.6 30.6 6.8 nt minus	1.8:1. 200 mesh) 2.2:1. 200 mesh)
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Feed Table conc. " middling " tailing " tailing Test No. 2 Feed Table conc. " middling " tailing " tailing " tailing " tailing " tailing " tailing	1.00,00 56,22 27,28 16,50 E (Minus 100,00 45,49 37,51 17,00 -F (Minus 100,00 35,70 46,18 18,12 -G (Minus 100,00 34,95	$26.07^{\circ}$ $33.03$ $21.24$ $10.36$ $20 \text{ mesh}$ $26.54^{\circ}$ $36.89$ $21.59$ $9.75$ $28 \text{ mesh}$ $26.80^{\circ}$ $39.19$ $23.56$ $10.69$ $35 \text{ mesh}$ $26.72^{\circ}$ $40.75$	13,21 16,51 11,11 5,45 and 23,0 13,50 11,00 5,40 13,60 13,50 11,00 5,40 13,50 11,00 5,40 13,50 13,50 13,50 13,50 13,50 13,50 13,50 13,50 13,50 13,50 13,50 13,50 11,00 5,40 13,5	100,0 71,2 22,2 6,6 ) per cen 100,0 63,2 30,5 6,3 ) per cen 100,0 52,2 40,6 7,2 } per cen 100,0 52,2 40,6 7,2	100,0 70,3 22,9 6,8 nt minus 100,0 62,6 30,6 6,8 100,0 52,3 40,1 7,6 nt minus 100,0 52,3 40,1 7,6	1.8:1. 200 mesh) 2.2:1. 200 mesh) 2.8:1. 200 mesh)
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© Calculated,

## - Page 12 -

(Test No. 2, cont'd) -

Test No.	2-H (Minus	48 mesh	and 33,4	per cen	t minus	200 mesh),
Dece Jee etc		, ,				Ratio of
Product		per ce				
The second se	: cent :	<u>Cr203</u> :	F.G :	<u>Cr203 :</u>	F'e	: tration
	: 100.00: 29.38: g: 43.11: 27.51:	42,40 : 24,70 :		39,5 :	46,8 38,5	: 3.4:1. :
an a			8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8		and a state of the	G Charles and Performance and Performance and Carlos Carlo
Test No.	2-I (Minus	65 mesh	and 42.8	per cen	t minus	200 mesh).
Feed	: 100,00:	26,51 <sup>%</sup> :	11,860:	100,0 :	100,0	6 6 8
Table conc,	: 28,22:	42,00 :	19,40 :	44.7 :	46,2	: 3,5:1.
	g : 37,49:	25,10 :	10,80 :	35,5 :	34,2	¢ \$
" tailing	: 34,29:	15,30 :	6,80 :	19,8 :	19.6	\$
· · ·	6 6 6	•	6 4	6 0		<b>6</b>

Calculated. ٩

5.71 A.584

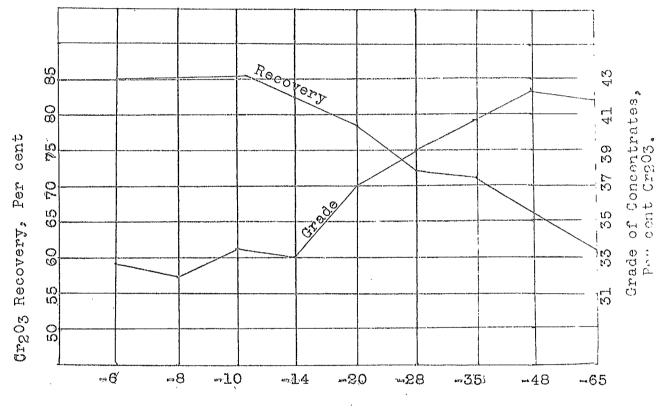
1997 1997 - 1997 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1

Summary	of Results, Tes	st No, 2:		and the state of the
* 5	Chromeairon :	Assay of	: Overall	<b>5</b> O
Test :	ratio :	concentrate,	recovery,	: Grind
No, :	of	Cr203,	per cent	¢
e 	concentrate		Cr203	G S S
No. 0	na line and a state of the state An and the state of the		0	6
S⊷A :	1,38:1	32,87	: 85,1	: - 6 mesh
0 5	D (77) D			: ~ 8 <sup>11</sup>
2∞B :	1,33:1.	32,22	: 85.1	ë *** ⊖ °
а. С. С. А.	7 272.7	33,50	: 86,4	:10 <sup>11</sup>
S**C ÷	1.37:1.	00,00	• UO <sub>4</sub> -±	° ~ TO
S⇔D ;	1,37:1.	33,03	. 82,3	° ⊷14 "
ة <i>ل</i> د «	70.01070		• — · · · · · ·	•
2-E :	1,36:1,	36,89	78,5	: ~20 <sup>11</sup>
Q		2 2	6 e	0 0
2 to F	1,36:1,	39,19	: 72,5	: ∽28 <sup>11</sup>
<b>4</b> 0	:	5	•	a
2⊶G ∶	1,39:1,	40,75	° 71.7	:
8				*
2⊷H :	1,48:1,	42,40	: 66,0	• ⊷48 <sup>11</sup>
°,	1 40-1		• 62,5	: ••65 "
2⇔I :	1,48:1,	42,00		• •••••
0 0		à •	٥ ٩	0 4
	A second	Cl Cargo manteners have a site over proversite the first line of the same second second second second second second The same second	V. 1999 – Maria Maria, Maria Managera, Alexandra Maria, Maria Maria, Maria Maria, Maria Maria, Maria Managera, Ma 1999 – Maria Maria Maria Managera, Maria Maria Maria Maria Maria Maria Maria Maria Managera, Maria Maria Maria M	

- Page 13 -

(Test No, 2, cont'd) -

In order to illustrate the overall recoveries of the chromite and the assays of the different concentrates, the following graph is presented:



Grind, per cent minus mesh size.

Portions of the concentrates from Tests Nos, 2-F, 2-G, 2-H and 2-I were concentrated on the Haultain superpanner, with the following results:

#### - Page 14 -

(Test No. 2, cont'd) ...

Tost Nog	0 0 0	Weight of panner concentrate	0 0 8 0 0 8	per CroOz	cen	r Fe	<u>e</u>	Chrome - iron ratio
2∞F 2∞G 2∞H 2∝I	36 06 00 00 00 00	51,35 66,51 74,20 86,51	02 00 03 00 00 00 00 00 00	41,34 41,73 42,60 42,85	80 80 00 00 00	20,45 20,87 21,34 21,29	4 × 4 × 6 4 × 6 × 6 ×	1,38:1, 1,37:1, 1,37:1, 1,38:1,

## Magnetic Concentrations.

Portions of table concentrates were ground to minus 100 mesh and passed through the Davis tube magnetic separator, with results as follows:

		<u>A Con</u>	centrate				
	:Weight,:	Assa	ys,	:Distrit	oution, :	()	
Product	per :	per c	ent	: per d	cent :	Cr:Fe	
	<u>cent</u> :	Cr203	: Fe	: Cr203	: Fe :	ratio	
and de la france de la france and année de la france de la	0 0 0 0 0 0	anterne more che che anne anne	9 0	0 0	0 0 0		
Feed	:100,00 :	$40_{4}94$	: 20,18	:100,00	:100,00:	1,39:1.	
Magnetic conc,	.: 0,87 :	25,89	: 48,95	: 0,55	: 2.11:	-	
" tailing	3: 99 <b>,13</b> :	41,07	: 19,93	: 99,45	: 97 89:	1,41;1,	
	<u> </u>		0 0	ф Д	6 6 0 4		
		B Con	centrate,	1			
	0 <b>6</b> 6 <b>6</b>	an a	6 0	φ Ω	8 0 0 0		
Feed	:100.00 :	39,77	: 21.05	:100.00	:100.00:	1.29:1.	

an a						04070707000
•						
	No beneficial	. results ar	e appar	ent from	these	
magnetic	concentrations	, the Cr:Fe	e ratio	being pr	actically	

Magnetic conc.: 1,00 : 33,19 : 35,67 : 0,83 : 1,70: " tailing: 99,00 : 39,78 : 20,88 : 99,17 : 98,30: 1,30:1.

unchanged,

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Test No. 2 (A to I) indicates that grinding beyond a critical stage causes excessive sliming of the chromite with a consequent decrease in recovery.

#### - Page 15 -

#### PART II, 19 FLOTATION CONCENTRATION.

A number of tests were made in an endeavour to concentrate the chromite mineral by flotation, using oleic acid, sodium cleate, Emulsol XI, and Orso as collectors; sodium hydroxide, sodium carbonate, and lime as modifying agents; lead nitrate, sodium meta phosphate, ferrous sulphate, tannic acid, and ammonium molybdic as activators; sodium silicate and caustic starch as dispersing agents; and pine oil and cresylic acid as frothers, These tests were not successful in producing a chromite concentrate that compared favourably with the results obtained by table concentration, the chief difficulty being in the floatability of the talc mineral (hydrous magnesium silicate) along with the chromite. However, a number of flotation tests are given below, with the reagents used, To obtain comparative conditions, dry crushing through rolls was adopted in the preparation of the samples in all of these tests, These tests were the better of the numerous results obtained,

As the chrome-iron ratio remains fairly constant at about 1.35:1, it was decided that only  $Cr_2O_3$  assays would be performed on the different products.

#### Test No. 3 (A to F).

In these tests the ore, at minus 14 mesh, was ground in a ball mill to pass 70 per cent minus 200 mesh. Different reagents were added to the grind as noted. The pulp was then transferred to a Denver flotation cell and the chromite concentrate obtained by the addition of different flotation reagents. The products were assayed for  $Cr_2O_3$ .

#### - Page 16 -

(Test No. 3, cont'd) -

The following reagents were added (lb./ton ore):

Alizzian Ido (Carry)	¢	Sodiv	m: S	Jodin	ne	Sođium	9	errous	1 • Ì	lead	<u>.</u>		0		0		۱۹۵۲ - The - Chevrolet of the second seco
Test		hydro		sili								Oleic	:5	odium	1:	Orso:	Emulsol
No.	3:	xide	ŝ	cate	<u>و</u>	ohosphat	e:	phate	4	trate	;	acid	° C	leate	6	¢ 9	XI
A	4 0	0,5	0	4	ې د د	2,0	0 0	1.0	6	0,5	۵ ۵	2,5	0	ait	00 00	ŭ 2	-0
В	\$	0,5	0	3	ŝ	ຂູ້0	0	1,0	÷	0,5	6	1,5	6	0.4	6	<u>د</u> منا م	6 <del>-1</del> 9
C	Ğı C	0,5	•	3	0. C	uit <b>e</b>	00	17 <b>9</b>	e a	851	0 <del>0</del>	2.0	0	423	å	0.4:	0.2
D	0	1.0	4	3	00	1.5	5	10	4	ien	0	2.0	0 4	<b>E</b> 3	ea	0.4:	0.2
년 편	¢ 0	2*0	C 0 4	3 2	•••	3,0	4	<b>6</b> 30	00	é9	60	2,5	0 q	Ca	6	0,4:	0,2
40 ANDER STREET ANDER STREET	0 6			€-2 Niceptationstation		¢۳۰۶ ۲۵۱۲ - ۲۰۰۲ - ۲۰۰۲ - ۲۰۰۲ - ۲۰۰۲ - ۲۰۰۲ - ۲۰۰۲ ۲۰۰۲ - ۲۰۰۲ - ۲۰۰۲ - ۲۰۰۲ - ۲۰۰۲ - ۲۰۰۲ - ۲۰۰۲	o o o o o o o	\$()\$	0 0		4 4	1.0	<u> </u>	C29-07-000-000-000-000-00-00-00-00-00-00-00	â	0.4:	0.2

Results:

•

مت که در دور در		THE OUTD	T	est No.				
Draduat	2	Weight,	6	$Cr_2O_3$		Distribution		
Product	0 0	per cent	0 0 0	assay, per cen		of Cr2O3, per cent	••	concen∽ tration
Feed Flot, conc, "tailing	0 0 0 0 0 0 0 0 0 0 0 0 0	100,00 45,21 54,79	6 6 0 0	26,71 <sup>0</sup> 36,04 19,01		100,0 61,0 39,0	0 0 8 0 0 0 0 0 0 0	2,2:1.
			T	est No <sub>*</sub>	3∞B	¢		
Feed Flot, conc, " tailing		100,00 50,17 49,83	0 4 0 0 0 0	26.69 <sup>®</sup> 36.37 16.93	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	100.0 68.4 31.6	0 8 9 0 9 0 9	2:1.
			Ţ	est No.	3⊷C	C1	Duffing of the	
Feed Flot, conc, " tailing	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	100,00 66,56 33,44	0 0 0 0	26,54 <sup>©</sup> 32,66 14,36		100,0 81,9 18,1	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1.5:1.
TO DE LA DE LA DESCRIPTION DE LA DESCRIPT			Ţ	est No,	<u>3</u> ⇔D	()		ang pananang sebagai kananang pananang sebagai pananang sebagai sebagai sebagai sebagai sebagai sebagai sebagai
Feed Flot, conc, "tailing	00 00 00 00	100,00 75,00 25,00	00	26,65 <sup>©</sup> 31,81 11,86	0 0 0 0 0 0 0 0 0 0 0 0 0	100,0 89,5 10,5	• • • • • • • •	1,3:1.
			T	est No,	3∞E	0 0		
Feed Flot. conc. " tailing	80 00 00 00 00	100,00 74,40 25,60	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	26,67 <sup>\$</sup> 32,59 9,74	6 8 0 0 0 0	100,0 90,7 9,3	60 99 80 0+	1,3:1.
	-		Ţ	est No,	<u>3</u> F	•		
Feed Flot. conc. " tailing	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	100,00 68,50 31,50	4 C C C C C C C C C C C C C C C C C C C	26,64 <sup>®</sup> 33,21 12,34	0 0 0 0 0	100,0 85,4 14,6	8 6 6 0 4 0 4 6 4	1.5:1.
	1		DAKFTU	an an a'		a man an air air an ann an		987777772777777777777777777777777777777

Θ

Calculated. pH of pulps, 8,7 to 9,3, Time of flotation, 15 to 20 minutes.

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(Test No. 3, cont'd) -

A large number of other flotation tests were made using a soda-ash or lime pulp and adding different reagents as previously noted. The results were invariably disappoint-ing, in so far as obtaining a clean chromite concentrate with a good recovery was concerned.

### Test No. 4 (A to F).

In this test, better results were obtained by floating off a talc concentrate and leaving the bulk of the pulp to be subjected to further treatment. Portions of the ore were taken and ground through a set of rolls to pass loo per cent minus 35 mesh. The pulp was then transferred to a Denver flotation cell and conditioned for 10 minutes with soda ash. Different flotation reagents were then added and a talc flotation concentrate was obtained.

$\mathbf{R}$	eagen	ts .	Add	led	Lb.	/ton	Ore:

Test	6	Soda	÷]	Pine	Amine	: A	mine	0	Amine	:2	Amino		
No.	60	ash	•	oil	No. 230	):No	, 2208	3:N	0.9039-5	5:-2	? methy]	- :	Ultra-
atta finikation (if mini kara	6		6	100		6 5	and the second	å		:02	Hexand	)]:	Wet
	0 0	I Distanti Pressione de la compa	a		9 9	6				6	an a	4	₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩
4.ªA	04	2ຸ0	8	0,15:	: 0,14	0	cuiD	9	****	5	1543	0	
4.∞B	0	1.4	å	0,20	¢13	0	0,20	ŝ	\$-04	4 0	4×4	•	*11
4⊷C	0	1,6	00	0,20:	D (C3)	0 0	4233 B	8	0,50	•	649	•	-33
4mD	00	1,8	ŝ	0_20:	6 (÷)	4 4	e.23	å	*)2	ô	0,60	:	-
4.**E	à	1.8	6 0	0,15	63	0 6	6.9	0 0	karib	6. 0	494	•	0,30
4 = F	0	1,8	0	0,15;	5 65	â	٩	ê	*33	â	\$ <b>7</b> 8	0	0.50
1111 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	8		ê	:	\$	\$		ŝ		0		9	

The pH of the pulps varied from 9.6 in Test No. 4-A to 8.4 in Test No. 4-B.

Flotation times were from 16 to 29 minutes.

#### - Page 18 -

(Test No. 4, cont'd) ~

Results:

and and the state of the state	and a second	. Test No. 4-	Α.	111204 WE 11107 .	
Product	:Weight,:		Distribution	6 8	Ratio of
11.0000.0	: per : : cent :	assay, :		0	concen-
Difficiel and the second source without		per cent :	per cent	6 943 <u>775934</u> 5	tration
Feed	: 100,00:	27,57 <sup>0</sup> :	100.0	ā G	
Flot, conc.	: 11,39:	6,71	2,8	e 9	8,8;1.
" tailing		30,26 :	97.2	•	-8-4-2-6
CIADDA: 101-0178-0178-0179-01-01-01-01-01-01-01-01-01-01-01-01-01-				۵ ۵	
		Test No, 4=	•B		S WARMEN DE HER BERTER VERS VERS HER BERTER BERT
##*#\$`ZIELIII:##779-#148797#*EM14#4-6944431783433##################################	C & C	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		<u>0</u>	ماللها الأرابي بر المراجع من المراجع والمراجع والمراجع والمراجع والمراجع من المراجع والمراجع المراجع المراجع ا
Food	: 100,00:	27,76 <sup>0</sup> :	100.0	0 0	
Flot, conc,	: 12,93:	, 5,86 . :		6 6	7.7:1.
" tailing	: 87,07:	31,03 :	97.3	6	
an a state of the second state		0 1.04865	####################################	<u>.</u>	
₽₽1Ç+1341 007 003 <b>338383-481-3</b> 81439-683-97 <b>5</b> 1 <del>038-88668-6894</del> 89	an and a substitution of the state of the st	Test No. 4-	C .		9. (294)
Feed	• 100 00.	00 77 0	200.0	à	
	: 100,00:	28,11*:	100,0	0	
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CALTING	: 92,29;	29,85 :	98°0	ŝ	
n a tha an	C C	rest No. 4.	The state of the s	<u>.</u>	
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Feed	: 100,00:	27,96° :	100,0	•	
Flot, conc.	: 12,55:	5,58 :	<u> </u>	6	8:1,
" tailing	: 87,45:	31,17	97.5	6	~ p
	<u>a</u>	•		•	
		Test Nò, 4.	E	ing ( ) provide it ( ) million -	alayy, afree olicial and a surface of a surface of and and a surface of
<u>a vydany i ny tentina po obsidni v distani obsa ku </u>	0 0 9 0	and and a subscription of the subscription of	993 - 1997 - 199	0. 0	Minister war water and an
Feed	: 100,00:	27.430 :	100.0	0 9	
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" tailing	: 85,48:	30,70 :	95,7	е а	
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No. "Def second Academic and second concerns and a second second second	248.001-0120-01-00100-000-00100-000-00000	Test No. 4-	F.		an a the state of the
Dood		0	100 0	•	
Feed	: 100,00:	27,290 :	100.0	•	<b>C D D</b>
Flot, conc,	: 17,67:	8,98 :	5,8	ê	5.7:1.
" tailing	: 82,33:	31,22 :	94.2	å	

Calculated,

Sec. il

In Test No. 4-G, the froth was very light and had little body. Time of flotation, 29 minutes.

In Tests Nos, 4.A, 4.B, and 4.D the froth was light. Time of flotation, 25 minutes.

In Tests Nos, 4. E and 4. F, where "Ultra-Wet" was used, the froth had more body and the time of flotation was 16 minutes.

#### - Page 19 -

### Test No. 5 (A, B, and C).

In this test, portions of the ore were ground through a set of rolls to different sizes as noted. The pulp was then transferred to a Denver flotation cell, and conditioned with 1.8 pounds of soda ash per ton; the talc was floated by the addition of 0.15 pound pine oil and 0.3 pound Ultra-Wet per ton.

#### Results:

	Test No.	5-A, -	On I	Minus 14 Mesh	Ore.	
				Distribution		
				of Cr <sub>2</sub> 03,		
	: cont	<u>per cent</u>	0 0	per cent	å	tration
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Feed	: 100,00 :	: 26,96 <sup>w</sup>	4	100.0	\$	
Tale, conc,	: 17,18 :	9,81	0 0	6,3	•	5.8:1.
Tailing	:: 82,82 :	30,52 °	2 8	93.7	<b>6</b> .	
EXTERNOLS TO BUILDING AND AND AND AND AND AND	6 6	5	â	and have not to be seen of the substrate state and the second state of	å	
	Test No.	5. B	0n 1	Minus 20 Mesh (	Ore.	
, An the second			9	a - a la grad de la companya de la c	<u> </u>	
Feed	: 100,00	27.040	•	100.0	0	
Talc, conc.				6,8	•	5,5:1,
Tailing			8 6	93 2	•	-,
2 WI D 2440	a comerco i		•	¢Φų×	•	
#19102#1922#1944#1940#1928#128#128#128#12#44#194#23##448#194 1	O		(1 	، ﻣﺎﻳﺪﯨﯔ ﺑﯩﺪﻩﺭﻩ, ﻣﻪﺭﻩﻩ, ﻣﻪ 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 - 1996 -		ang gana ang ang ang ang ang ang ang ang
	Test No.	, 5C, w	0n	Minus 28 Mesh	Ore	Ő
	6 6		4	•	•	
Feed	: 100,00 :	:`` 26 <b>,</b> 92 <sup>w</sup>	6 0	100,0	:	
Talc conc.	: 19,17	12,24	6	8.7		5,2:1,
		30,40		91,3		
Darf San	ě (	3 B	ê		ò s	
	THE THERE WE THE ADDRESS OF THE PARTY OF THE P					

© Calculated.

pH of pulps, 8,9. Time of flotation, 18 minutes.

## Test No. 6 (A, B, and C).

In this test, portions of the ore were crushed through a set of rolls to pass minus 14, minus 20 and minus 28 mesh. The pulps were then transferred to a Denver flotation cell and conditioned with 1,8 pounds soda ash and the talc floated by the further additions of 0.15 pound pine oil and 0.20 pound of Amine No. 2208 per ton.

#### - Page 20 -

(Test No. 6, cont'd) -

Test	t	No. 6-A.	⊷ (	On the N	linus	14 Mesh (	Dre,	
	<u>,</u>	Weight:	1940 - 194 B.	Cr203	6 0	Distribu	ution:	Ratio of
Product	5	per :		assay,	6	of Cr20	)3, :	concen-
997 Director % () 4 <sup>15</sup> Nov. (7) 7 States (12) 1 and 10.12 (1-14) 10 1 (12) (1-14) 10 10 10 10 10 10 10 10 10 10 10 10 10	6 6	cent :		per cer	it :	per ce	ent :	tration
Et diagents en neuen d'Artikan offen net siennet maar uit die die s	C Q	8 8			- anot 11.0-11.00		0 0	al Backhoolen - vaale al 19 vaallet de mensaarek oog stemt de skale Nogelle
Feed		100.00:				100,0	6 6	
-		11.00:		5.73		2,3	0 •	9.0:1.
Tailing	\$	89,00:		29,71	0	97.7	\$ \$	
and the second state of th	è	0 6		a the way operation in the second	0 0		0 0	ingen i 1. setter titterteten 197 Bin en forste på siger beståre a for det som s
Tes	ե	No. 6-B.		On the	Minus	s 20 Mesh	Ore,	
€ \$\$\$\$ ar \$\$\$\$ a week \$\$\$\$ and a second s	6			bi wind, a star part of the	0 0		ی	- A give for your provide the state of the second
Feed	0	100,00:		27,05	5	100.0	a o	
Tale cone.	0	14.72:		6,08	<b>a</b>	3,3	4 0	6.8:1.
Tailing	\$	85,28:		30,67		96.7	0	0
0	e.			- · • • · ·	4	<b>4</b> -	0. A	
Champana and an analog and an and		ward and a construction of the second se	46327-467 BBP	ر المارين المرابعة المسيارية ي 10 م: 40 (1999). مرابع		<u> </u>		and and the second s
Tes	t	No. 6⇔C.	ery.	On the	Minu	s 28 Mesh	Ore,	eranderadağı opu uştuştur.
	0	â.			ĉ		•	
Feed	0	100,00:		26,88	ð i	100,0	0	
Talc conc.	0	13,43:		6,28	°	3.1	0 9	7.5:1.
Tailing	00	86,57:		30,08	¢ •	96,9	0- 6	
	6 5	۵. ۴			ê		a 0	No. FU & DESCRIPTION OF THE DESC
	2.1671	alenyi (ommenden de sen sen sen sen sen sen sen sen sen se		a - alge all diversity and a second				

Calculated,

6 M. M

pH of pulp, 8,9, Time of flotation, 23 minutes.

From the results obtained using different flotation reagents, it appears that the use of Ultra-Wet in conjunction with pine oil is the most satisfactory, and that a minus 35 mesh size would be the proper crushing,

#### PART III, . FLOTATION AND TABLE CONCENTRATION COMBINED.

Test No. 7 (A and B).

In this test, portions of the ore were ground through a set of rolls to pass minus 35 mesh in Test No. 7-A and minus 48 mesh in Test No. 7-B. The pulps were then deslimed and the coarse material concentrated on a Wilfley table. The slime product was then combined with the table tailing, filtered, and transferred to a Denver flotation machine. A talc concentrate was then floated.

4 Page 21 -

(Test No. 7, cont'd) -

Test No, 7.A -

After desliming of the minus 35 mesh material, the slime assayed 7,96 per cent  $Cr_2O_3$  and was 6,56 per cent of the total weight. The remaining pulp was passed over a Wilfley table, with results as follows:

	1.15	IDT	<u>e Concentr</u>	ati	on	
۵. ۵	Woight,	ŝ	Cr203	ô	Distribution:	Ratio of
Product :	per	ŝ	assay,	0	of Cr203, :	concen-
	cent	å	per cent	0 0	per cent :	tration
ů ¢		à		6	مندر <u>از ان می سال و در این از این از مین از مین از مین از این از مین از این از این از این از این از این از این</u> 0 ف	لي وهي استاريو سواري کار په مواريد ويندو مديوه او وي به مو
Feed :	100,00	<u>د</u>	29,42 <sup>©</sup>	8	100.0 :	
Table conc. :	48,87	3 9	40,30	2	66,9 :	2,2:1,
" middling:		8	26.23	å	24.3 :	
" tailing:	23,90	\$	10.82	<b>6</b>	8,8 :	
6 0		8		0	e. S	

Table Concentration.

© Calculated.

The overall recovery was 77.6 per cent Cr203.

The table tailing was then combined with the slimes and transferred to a flotation machine. The pulp was conditioned with 1.8 pounds soda ash and a talc concentrate obtained by the further additions of 0.20 pound pine oil and 0.25 pound of a 10 per cent solution of Emulsol XI in coal oil, per ton.

eter of 1 http://www.flow.eter.com/com/com/com/com/com/com/com/com/com/		•		Flotation,	<b>.</b>			
	ŝ	Weight,	e s	Cr203	ŝ	Distributio	n:	Ratio of
Product	00	per	0.0	assay,	6	of Cr <sub>2</sub> 03,	0	concen-
ellen (1), et alle Provident (1991) de mainten de traches and de traches	0 0	cent	ŝ	per cent	ŝ	per cent	6	tration
₩4437957₩\$E33413742374889₩7679₩1679₩16478		78 8-4 Autompt Incident/20-474/24(8)-10 (Print	5	۵ ۵۹٬۰۰۰ (۵ ۵ ۵۳٬۰۰۰ (۵۰ ۵۰۰ ۵۰۰ ۵۰۰ ۵۰۰ ۵۰۰ ۵۰۰ ۵۰۰ ۵۰۰	6		ě	
Feed	00	100,00	90	8,46 <sup>®</sup>	3 0	100,0	<u>م</u>	
Talc conc.	6 6	31.47	0 4	6,12	00	22.7	•	3,2;1,
Tailing	ŝ	68,53	5	9,54	4 9	77,3	0	
	<u>0</u>		8	Ne Blackser in company of the Second states and	\$		ŝ	ann is suid an tha Barnes Barnes an S Thire is a property singly integration of the second

• Calculated,

#### Test No. 7.B -

This test was performed similarly to Dest No. 7-A but the pulp was crushed to minus 48 mesh instead of the minus 35 mesh used in the previous test.

After desliming of the minus 48 mesh material the slime assayed 11.59 per cent Cr2Oz and was 10,9 per cent of

#### 🖙 Page 22 🛶

(Test No. 7-B, contid) -

the total weight.

Table Concentration,									
	:Weight,:	Cr2Oz	ç	Distribution:	Ratio of				
Product	: per :	assay,	8	of Cr203, :	concen-				
4-9 FTE arts (Source To Source 1) (c) & a second state (C) (Source 1) (c) & protocompatible or each of the second state (c) (c) and (c)	: cent :	per cent	6 6	per cent :	tration				
17		~~ <b>~</b> ~ ~ @	0	0 1 1	and an all and a second s				
Feed	: 100,00:	29,11®	00	100.0 :					
· . · · · · · · · · · · · · · · · · · ·	: 43,30:	42,19	0	62,6 :	2.3:1.				
" middling	N.	25,49	0	27.4 :					
" tailing	: 25,40:	11,50	6	10.0 :					
Called - Real Street - Called			<u>.</u>	0 0					

• Calculated,

The overall recovery of the Cr203, 72,8 per cent.

The table tailing was then combined with the slime product and floated as in the previous test. The pulp was conditioned with 1.8 pounds soda ash/ton and floated with 0.20 pound pine oil and 0.3 pound of 2 Amino -2 methyl -3 Hexanol per ton.

Results of Flotati	tion.
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En El La coltante de	0	Weight,:	Cr203	ŝ	Distribution	1 %	Ratio of
Product	00	per :	assay,	0	of Cr203,	¢ ¢	concen-
antifiZante 20, 313 gament (7,315 %), y 47 47 6000 antificit (7,27,32)	å	cent :	per cent	0 0	per cent	ŝ	tration
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Feed	8	100,00:	11,32°	:	100.0	6 0	
Talc conc,	ŝ	46,65:	8_04	ê	33,1	а 4	2,2:1,
Tailing	0.0	53,35:	14,19	¢ 0	66,9	80	
E way from a fight that the start from the second start of the second start of the second start of the second st	÷.	0 6	and Tanta Anna Anna Anna Anna Anna Anna Anna	â	10 B ET were worked and an even were were the	4	

Calculated,

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#### Test No. 8 (A and B).

In this test, and the ones following, the different flotation reagents were used on various sizes of particles. The ore was first passed through a set of rolls to the required size and the pulp transferred to a Denver flotation cell. The pulp was then conditioned with soda ash, the flotation reagents added, and a talc concentrate obtained. The flotation tailing was then concentrated on a Wilfley table.

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(Test No. 8, cont'd) -

Test No. 8-A -

A portion of the ore was crushed to minus 35 mesh, conditioned with 1.8 pounds soda ash, and floated with 0.20 pound pine oil and 0.18 pound Ultra-Wet per ton.

		F	lotation.			
CITERLES & ANEXALISTICATION INTRODUCTION	: Weight,	0 0	0r203	00	Distribution	Ratio of
Product	: per	0	assay,	0	of Cr203, s	concen-
	: cent	e a	per cent	4	per cent :	tration
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Feed	:100,00	9	26,69 <sup>0</sup>	0	100,0 :	5 1
Talc conco	: 9,38	0	9,02	0 4	3.2 :	: 10.6:1.
Tailing	: 90,62	0 0	28,56	0 0	96,8	
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BARDarde Control College State and Control Control and State of the St		CONTRACTOR OF STR	and a second			

Calculated,

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The pH of the pulp was 8,9.

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an an ann an Shering an an Ann an Ann an Ann an Ann Ann Ann	ô	Weight	р â	Cr203	ŝ	Distributio	n:	Ratio of
Product	ē.	per	ŝ	assay,	5	of $Cr_2O_3$ ,	0	concen-
e kinemi juga mangi minini ni ni ni mangi ana aki sama ang kinema na mangi mangi mangi mangi mangi mangi mangi Mangi mangi man	4	cent	o o	per cent		per cent	ŝ	tration
	6				8		<u>.</u>	
Feed	6 0	100,00	e u	28,56°	4	100.0	0	
Table conc.	°.	553,16	6 8	40,63	•	75.6	0	1,9:1.
" middling		20,97	8	22,37	å	16,4	å	
" tailing	30	25,87	<u>a</u> 0	8,80	4 6	8,0	0	
	60	•	ŝ		40		e e	

Table Concentration of Flotation Tailing

Calculated.

The overall recovery of the Cr203 was 81.1 per cent.

Test No. 8-B +

A portion of the ore was crushed to minus 48 mesh, conditioned with 1.8 pounds soda ash and floated with 0.20 pound pine oil and 0.18 pound Ultra-Wet per ton.

				Flotation,					
an winanya di kalendah kanya kanya kanya mana	0. 6 6	Weight,	0 0	CrgOz	ŝ	Distribution	1 2	Ratio	of
Product	6	per	0	assay,	÷	of Cr203,	0		
	0	cent	\$	per cent	ô	per cent	ŝ	2450-1215	
	0		6	A	3			ومقول والمليك بالاستند بالطارية مستعربين ومكررهم	
Feed	Ġ o	100,00	0	26 <b>.</b> 45 <sup>©</sup>	0 ¥	100,0	а 0		
Talc conc.	0	10.17	è	11,16	4	4.3	6	9.8:1.	
Tailing	60	89,83	60	28,19	<b>0</b>	95,7	0 0		
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✤ Calculated,

#### -» Page 24 👒

(Test No, 8.B, contid) .

[]al	<u>)](</u>	o Concen	tr	ration of F	יומ	otation Tailing	n_	
	00	Weight,	00	Cr203	ê	Distribution	<u>0</u>	Ratio of
Product	00	per	<b>°</b>	assay,	¢	of Cr203,	•	concen∞
Configurate Statement and State and Statements and the statements	4 9	cent	8	per cent	\$	per cent	0 9	tration
WERE BERNER AND	(L 6	147766-16 CHUCL213 440803884 48331-4786	3	an a san an a	0		5	a and a set of the local division of the local of the set
Feed	00	100,00	04	28,28 <sup>®</sup>	0	100,0	<b>a</b> 4	
Table conc.	0	42,10	0	42,38	0	63,1	0	2.4:1.
" middling	å	23,25	•	27,43	8	22°6	•	
" tailing	6	34,65%	ŝ	11.73	¢.	14,4	\$	
-	¢ a		9		00		0	
dalaratika ing malang kanang mpangkanang pangkanang pangkanang pangkanang pangkanang pangkanang pangkanang pan Derivatika ang kanang pangkanang pangkanang pangkanang pangkanang pangkanang pangkanang pangkanang pangkanang p	N. Leitzie im			an ann an an an an an an an an ann an an		an an fallen fan de fallen fan de fallen fallen de fallen de fallen de fallen de fallen de fallen de fallen de Naam fallen fallen de fallen fallen fallen de fallen		a na a na an

© Calculated,

Overall recovery of Cr203, 71.2 per cent.

## Test No. 9 (A to D),

Pertions of the ore were crushed through a set of rolls to pass minus 35 mesh. The pulp was then transferred to a Denver cell and a talc concentrate removed. The flotation tailing was then concentrated on a Wilfley table.

#### Test No. 90A.0

In this test,  $l_{*}8$  pounds soda ash,  $O_{*}15$  pound pine oil, and  $O_{*}4$  pound of 2 Amino-2 methyl -3 Hexanol per ton of ore were used,

Flotation,									
	: Wei	lght,:	Cr <sub>2</sub> 03.	00	Distribution	6	Ratio of		
Product	s pe	er :	assay,	<u>د</u> ٥	of Cr203,	°.	concen		
antini) (M. M. M. L. M. K. J. Mar and M. M. Martini) is provide sufficient of hor setting of the set of the set	8 C(	ont :	per cent	0 4	per cent	8	tration		
_	0 6	Q Q Q		è		6 6			
Feed		)°00 °	26,55®	9	100,0	0			
Talc conc,	: 14	1,41 :	7,61	4	4.1	•	6,9:1.		
Tailing	: 8	5,59 :	29,74	•	95,9				
457 Autors and the same of the state of the	0 0	0 0	an a	C Q	ar 18 - Dal 28 - 1942) a su bas d'in Thomas ar si sinn de Mathie S. 446 (1978)	¢ 0			
\$41.000000000000000000000000000000000000	1.7(3.001)9.8 (41.11) (3ma 6343)	*****	чүчканод на констатууларынан колонун түрүүлөн бай хэмэ	-A. (P. A. 1) Pr-2 (L.) (Press of	A Sound The Contract of Sound Activity Contract of Contract On Contrac	ميرين (د. د. د. د م	fernanzere en rekty (na a erem matthe er a er skar från ander attanden soft		
Tab	le Co	oncent	ration of 1	Flot	ation Tailing	°			
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Feed	: 1.00	2,00 :	$29,74^{0}$	•	1.00,0	<b>0</b>			
Table conc.	-	5,16 :	40 \$63	0	63 0	•	2,2:1,		
" middling		~	26,23	с. а	27.7	4 0			
" tailing			12,29	<b>o</b>	9,3	<b>e</b> 0			
0 4 4 4 4 MALC	0	0 0		0 0	4	0			
and M. A. A. S. M. M. R. R. R. M. S. M. M. M. M. S. M.	and the second		and Descent Carls (1979) and an analysis of the second state of th	100 march 200 miles			and a second s		

• Calculated,

The overall recovery of the Cr203 was 73.6 per cent.

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(Test No. 9, cont'd) -

abuney ant

Test No, 9-B -

Similar to Test No. 9-A, using 1.8 pounds soda ash, 0.20 pound pine oil and 0.25 pound Amine No. 230 per ton with minus 35 mesh feed.

	-			Flotatio	n.			
	8	Weight,	5	Cr203	ŝ	Distribution	â	Ratio of
Product	04	per	<b>0</b> -	assay,	0	of Cr203,	6 8	concen-
an a gana u an	ŝ	cont	() ()	per cent	ŝ	per cent	ŝ	tration
ali ali ang	4		5		ų e	■	å	
Foed	0	100,00 :	6. B	26 <b>、</b> 97®	¢,	100,0	•	
Table conc,	0	18,39 :	њ ф	7,29	å	5,0	•	5.4:1.
Tailing	6	81,61 :	۵ ۵	31,41	•	95,0	0 0	
-	ŝ	:	0		0		0 2	
	1100 PC	and a second		and the second secon		aran ayan kunan kuna Kunan kunan kuna	()() ~ B)	a na manana na sana na
Tab	le	Concenti	e.	tion of Fl	ots	tion Tailing.	-	
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Feed	6	100,00	<b>b</b> 0	31.41 <sup>©</sup>	00	100,00	ŝ	
Table conc,	0	55 56	ц. С	40,59	8	71.4	•	1.8:1.
" middlin	<u> </u>	30,71	6	23 98	· .	23,4	•	•
		14,03		11,55	a 6	5 2	6 6	
			4		3	*	<b>e</b> 0	

٢ Calculated.

The overall recovery of Cr203 was 78,9 per cent.

Test No. 9-C -

Similar to previous tests, using 1.8 pounds soda ash, 0.20 pound pine oil and 0.25 pound of Amine No. 2208 per ton。

			-	Flotatic	n.			
	ŝ	Weight,	¢. 0	Cr203	ŝ	Distribution	ŝ	Ratio of
Product	\$0	per	00	assay	0	of Cr <sub>2</sub> Oz,	•	concen⇔
איז האלי איז איז איז איז איז איז איז איז איז אי	0 6	cent	å	per cent	ŝ	per cent	4	tration
In a strong and a strong with a strong st	¢ 6		6 8		6 0	ni da ta kana ni ang kana ni k	å c	
Feed	4	100,00	00	27°22@	00	100.0	ŝ	
Talc conc,	¢ 2	15.87	64	5,23	• •	3,1	ů u	6,3:1,
Tailing	0	84,13	80	31,41	4	96.9	8	
	00		00		00	_	<u>د</u>	
Table Concentration of Flotation Tailing.								
	44 4 4		() ()	,	8	an a	9	
Feed	00	100,00	4 0	31,31 <sup>©</sup>	<b>e</b>	100.0	4	
Table conc,	•	48,57	4	41,32	03	63,9	0 0	2.1:1.
" middlin	g :	36 66	0	25,63	9	29,9	4	
" tailin		14,77	6 0	13,11	00	6,2	\$	

٨ Calculatod.

Overall recovery of Cr203, 76.3 per cent.

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(Test No. 9, contid) -

#### Test No. 9mD -

Similar topprevious tests using 1.8 pounds soda ash, 0.15 pound pine oil and 0.40 pound Ultra-Wet per ton.

		otation.							
ê	Weight,:	Cr <sub>2</sub> 03	ŝ	Distribution:	Ratio of				
00	per :	assay,	6 0	of Cr203, :	concen				
ê	cent :	per cent	Ĝ	<u>per cent :</u>	tration				
	100 00 : 18,73 : 81,27 :	27,26 <sup>\$</sup> 9,90 31,27	0 0 0 0 0 0 0	100.0 6.8 93.2	5,3;1,				
Table Concentration of Flotation Tailing,									
50 05 50 50 50 40	100,00 56,32 29,96 13,72	31,27° 40,40 24,20 9,26	00 00 00 00 00 00	100,0 72,7 23,2 4,1	1,8:1.				
	30 00 00 00 00 00	<pre>Weight,: per cent l00,00 l8,73 81,27 81,27 i l00,00 i l00,00 i s6,32 i 29,96 l3,72 i l3,72</pre>	per : assay, : cent : per cent : 100,00 : 27,26 <sup>(*)</sup> : 18,73 : 9,90 : 81,27 : 31,27 : : 00,00 : 31,27 <sup>(*)</sup> : 56,32 : 40,40 : 29,96 : 24,20 : 13,72 : 9,26	<pre>Weight,: Cr<sub>2</sub>O<sub>3</sub> : per : assay, : cent : per cent : lOO_00 : 27,26<sup>(0)</sup> l8,73 : 9,90 81,27 : 31,27 centration of Flotation i 100,00 : 31,27<sup>(0)</sup> i 56,32 : 40,40 i 29,96 : 24,20 :</pre>	<pre>Weight,: Cr<sub>2</sub>O<sub>3</sub> : Distribution: per : assay, : of Cr<sub>2</sub>O<sub>3</sub>, : cent : per cent : per cent : 100.00 : 27.26<sup>4</sup> : 100.0 18.73 : 9.90 : 6.8 81.27 : 31.27 : 93.2 Concentration of Flotation Tailing. 100.00 : 31.27<sup>4</sup> : 100.0 56.32 : 40.40 : 72.7 29.96 : 24.20 : 23.2 13.72 : 9.26 : 4.1</pre>				

Calculated,

Overall recovery of Cr203, 78,6 per cent.

#### SUMMARY:

The table concentration tests indicate that grinding beyond a critical size causes excessive sliming of the chromite, with a consequent decrease in recovery. This is borne out in Test No. 4, made by grinding in the laboratory ball mill, and also in Test No. 5, where the ore was stage-ground through the laboratory rolls. From these tests, grinding to minus 35 mesh appears to be the most suitable size.

Flotation of the pulp produced a chromium concentrate assaying  $36_{\circ}3$  per cent  $Cr_2O_{3}$ , the recovery being  $68_{\circ}4$  per cent. With a recovery of  $90_{\circ}7$  per cent  $Cr_2O_{3}$ , the concentrate assayed  $32_{\circ}6$  per cent  $Cr_2O_{3}$ .

Flotation of a talc concentrate prior to further treatment of the flotation tailing raises the grade to 31 per cent  $Cr_2O_3$  with a loss of 5 per cent of the chromium and

#### - Page 27 -

(Summary, cont'd) ~

17 per cent of the weight of the feed.

By desliming the pulp prior to table concentration the grade was raised to 29.0 per cent  $Cr_2O_3$  with a loss of 6.5 per cent of the weight of the feed.

Flotation of the talc, followed by table concentration of the flotation tailing, gave a recovery of 81.0 per cent of the chromium with a grade of 40.6 per cent  $Cr_2O_3$ in the table concentrate.

The chrome to iron ratio of the table concentrates remained fairly constant at 1,35:1. Superpanning of the table concentrates raised the grade very slightly.

A magnetic concentration of the table concentrates in the Davis tube gave results indicating about 1.0 per cent of magnetic material.

The microscopic examination of the polished sections showed that the average size of the chromite grains was 160 microns (-65+100 mesh) and that these grains contain numerous small inclusions of gangue material.

The foregoing summary of the small-scale test work showed that desliming prior to tabling should be incorporated in the flow-sheet. While the removal of the slime by flotation gave the best results on this ore, the tests made by desliming in the usual manner showed comparable results within the limits of experimental error. The excessive flotation time required in order to remove the talcy constituents of the gangue makes this method less practical than desliming by hydroseparator or classifier.

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