J. D. Johnston

OTTAWA May 26th, 1942.

REPORT

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1234.

Sink-and-Float Tests on Samples of Quartz Ore from Powell Rouyn Mine at Noranda, Quebec.

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DEPARTMENT of MINES AND RESOURCES MINES AND GEOLOGY BRANCH

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Shipment:

BUREAU OF MINES DIVISION OF METALLIC MINERALS

ORE DRESSING AND METALLURGICAL LABORATORIES

Two samples of ore, weighing 425 pounds, were received on February 16th, 1942. The samples were submitted by D. S. Johnston, Powell Rouyn Gold Mines Limited, Noranda, Quebec.

Location of Property:

This property is situated in Rouyn township, Temiscamingue county, northwestern Quebec, about one mile from the town of Noranda.

Character of the Samples:

While no microscopic examination was made of the present shipment, it is the same type of siliceous ore that has been submitted on previous occasions and described in reports issued in 1937, 1939, and 1940.

Sampling and Assaying:

While no assay sample was taken from the shipment, head sample assays calculated from the products of tests are as follows:

	Sio _S , per cent	Cola, oz./ton
- ¹ / ₂ inch rock	 73.74	0.128
+J inch rock	71.30	0.118

Experimental Tests:

A series of small-scale sink-and-float tests was conducted on each of the samples submitted to determine their suitability or otherwise for concentration of the highly sillceous minerals by the sink-and-float process.

The working principle of this process is to separate according to their respective densities the lighter portions of the one from the heavier portions in a bath of substantially stable galena-water suspension. The suspension serves the purpose of a solution of high specific gravity and is adjusted to such density as will allow the heavier portion of the one to sink while the lighter portion floats and is skimmed off. The density of the separating medium is adjusted by simply altering the proportions of the galena - Page 3 -

(Experimental Tests, cont'd) -

and the water.

Naterial finer than 8 mesh cannot be treated by this process under any circumstances and for any given ore the lower size limit may be coarser yet. The upper size limit is usually decided by the character of the ore and depends on the size at which the minerals to be separated are broken free from each other. The upper size limit is often somewhere in the neighbourhood of one luch.

The $-\frac{1}{2}$ inch sample submitted was acreened on 8 mesh and the oversize treated without further crushing. The $+\frac{1}{2}$ inch sample submitted was crushed to minus one inch and the -8 mesh material screened out. Sink-and-float tests were conducted on the -1.[#]+8 mesh fraction.

The tests will be described in detail as follows:

Test No. 1. - Size-Density Analysis of -1 Inch Rock.

Material Finer than 8 mesh was screened from this sample, weighed, and assayed for gold and silica. The material coarser than 8 mesh was treated as follows:

A density separation was made at a medium density of 2.625. The float was taken out as a finished product and the sink was retreated at 2.65, giving an intermediate float and a second sink product. The second sink product was again retreated at 2.675, giving a second intermediate product and a final sink product.

Each of the density fractions was then screened on 3-, 4- and 6-mesh screens and the different sizes wore weighed and assayed.

The results of this test are laid down in the following table:

SIZE-DENSITY ANALYSIS.

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(S.F. Test No. 31 - Powell Rouyn)		ىرى بۇرىي بىرىيىتى ^ب ىلىرىدى بىر بىرىيىتى بىرىيىتى بىرىيىتى بىرىيىتى بىرىيىتى بىرىي	∽j inch kock									
Size Fractions	-6+8)	lesh	-4+6]/	lesh	2+5-	inesh	i -2"+3 mesh					
			- : e 1	ght!	ropo	rtio	ns »					
DENSITY FRACTIONS	Size frac- tion	s.f. feed	Size frac- tion	% S.F. feed	Size frac- tion	j. S.F. foed	ہُ Jize frac- tion	j S.F. feed				
Float & 2.075	73.41	4.64	66,21	5,57	48.85	6,65	20.98	15.03				
Float & 2,65; sink & 2,625	20,1S	1,27	S0°89	1,76	24,11	3,28	18.09	12,96				
Float (2,675; sink \in 2,65	4.54	0.29	7,40	0.62	13.14	l,78	20,35	14.59				
sink & 2.675	1,93	0,12	5,53	0.47	13,93	1.89	40,58	29.08				
Total =	¥100.00	6.32	100.00	s,42	100.00	13,60	100.00	71,66				
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	Si02	Å.21	S102	Au	\$10 ₂	Au	<u> </u>	AU				
Float © 2.625	80.78	0,08	80.10	0_07	82,66	0.06	86.22	0,06				
Float 2 2,65; sink © 2,625	68,28	0.09	73.94	0.09	84.76	0,10	77.04	0.06				
Ploat @ 2.675; sink @ 2.65	60,12	0.18	64.48	0.14	69,88	0.14	79.36	0.10				
Sink & 2.675	39,92	1.98	43,98	0.46	49,30	0.22	58.42	0.19				
	• <u> </u>	1		i.	and the second s			and the second se				

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-J. Inch Rock

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- Page 5 -

(Test No. 1, cont'd) -

It will be noted that in almost every case the grade of product, with respect to silica, goes up as the particle size increases. The opposite is true with respect to the gold. This would indicate that the grade of the silica product could be raised by screening the feed to sink-and-float on 4 or 6 mesh but recovery would be lower.

The figures in the size-density analysis have been reduced to a density analysis by combining together all the fractions obtained at each separating density. The minus 8 mesh fines are also incorporated in this table in the proper proportion.

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Product	0	per	0 0 0 0 0 0	5102	lan an a	3	Gold,	6	per c	ent
	0	cont	6	90r	cont	<u>, C</u>	z./ton		S102 :	Gold
Float @ 2.625	000	25.47	8	83.	62	5 0 1	0.065	000	29,17:	12,69
Float @ 2,65;	0	·	2	Ū	4	4		9	e d	-
sink @ 2,625	0	15.40	00	77.	50 s	5	0.072	00	16.34:	8.49
Float @ 2,675;	0 0		4 0		ŧ	20		ê	9 5	
sink @ 2.65	ŝ	13.81	00	77.	54 :	5	0.107	¢. 0	14.66:	11.37
Sink @ 2,675	ŝ	25,22	0	57.	58 s	B	0.203	5	19,89:	39.43
-8 mesh fines	ð	20.10	2	72.	10 :	5	0.18	0 0	19,94;	28°05
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Ore	3]	00,00	9	73.	03 :	5	0.130	\$	100.00:	100.00
	ŝ		ä					6	0 6 1000-100-100-100-100-100-100-100-100-10	2 446-100 million for the first state of the

This test indicates that with a separating density of 2.675 a product assaying 80.21 per cent SiOg and representing 54.78 per cent of the weight of one treated would be floated off leaving sink plus fines to be treated in the cyanide plant. The two products together would assay 0.193 ounce per ton in gold. (Experimental Tests, cont'd) -

Test No. 2. - Confirmatory Test on -1 Inch Rock.

This separation was made in bulk on a sample of rock in the size range $-\frac{1}{2}$ inch +8 mesh. The separating densities were 2.675 and 2.70. This test was conducted to confirm the first test and, in addition, to find out whether or not any further recovery could be effected by using a higher separating density.

Summa ry	oſ	Results	, Test No	. 2.		
	ĉ	Weight,	Assa	y S	: Distri	bution,
Product	9 9	per :	: S102,	; Gold,	; per	cent
and a strain the second state in the second strain and the second strain the second strain the second building	6) 0	cont :	per cent	soz./ton	: <u>SiO</u> 2	; Gold
Float @ 2.675 Float @ 2.70; sink @ 2.675 Sink @ 2.70 -8 mesh fines	2000 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	51.78 11.64 16.48 20.10	83.62 71.88 50.76 72.10	0,06 0,14 0,20 0,18	58,10 11,23 11,23 11,22 19,45	: 26,67 : 13,99 : 28,29 : 31,05
OZ.6	0 0 0 0 0 0 0 0 0 0 0 0	100.00	74.52	6 0,117	; ;100,00	; ;100,00 ;

Separating at a density of 2.70, the average grade of the float would be 31.47 per cent 510_2 and 0.075 cunce gold per ton and the feed to the cyanide plant would assay 0.189 cunce gold per ton. If the separation is made at a density of 2.675 the feed to the cyanide plant would assay 0.177 cunce gold per ton.

Test No. 5. - Size-Density Analysis on + Inch Rock.

This sample of rock was crushed finer than one inch and everything finer than 8 mesh screened out. A size-density analysis was then made as follows: The rock was sized on a series of screens at 1/8" intervals starting with 7/8 inch and going down to $\frac{1}{2}$ inch. On each of these sized fractions a series of density separations was made similar to the procedure in Test No. 1. Separations were made at the following medium densities: 2.65, 2.675, and 2.70. The results of this test are laid down in the following table; SIZE-DENSITY ANALYSIS.

(S.F. '	Test	No.	32	-	Powel	1	Rouyn)
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+ Inch Rock

NUX CO

Size Fractions	- ¹ 2+8 Me	sh	-5/8"+1"		- <u>3</u> "+5/6"		-7/8"+2"		-1 147/81	
DENSITY FRACTIONS	% Size frac- tion	100 S	- Wei % Size frac- tion	ght % S.F. feed	Fro X Size frac- tion	por % S.F. feed	<u>i c n</u> Size frac- tion	S.F. S.F. feed	% Size frac- tion	Z S.F. fçod
Float @ 2,65	47,46	12.79	22.00	3,74	12.00	2°05	16.55	4.17	10,63	1,49
Float @ 2.675; sink @ 2.65	18,92	5.10	20,13	3,42	23.35	3,94	9.43	2,37	14.41	5,02
Float @ 2.70; sink @ 2.675	12,50	3.37	27.64	4,70	18,49	3,12	33.64	8,46	34 92	4,90
. Sink @ 2.70	21.12	5_69	30,23	5,14	46,16	7.79	40,38	10.16	40.04	5,61
TOTAL -	100,00	26,95	100.00	17.00	100.00	16.87	100,00	25,16	100,00	14,02
£72,227,227,429,429,426,436,436,436,446,446,446,446,437,437,447,447,437,427,447,447,447,447,447,447,447,447,44	Assa per o	ys, ent	Assa per c	ys, ent	Assays, per cent		Assays, per cent		Assays, per cent	
£252 %24444773644763466476346644253666476944200000000000000000000000000000000000	Si02	A12	\$10 ₂	Au	S102	Au	SiOg	; Au	S102	Au
Float @ 2.65	82,80	0.07	90,58	0.07	91,34	0,05	91,58	0_05	85,24	0.08
Float @ 2,675; sink @ 2,65	76.40	0.10	83.02	0.06	83,92	0.08	86,60	0,09	88,20	0_25
Float @ 2.70; sink & 2.675	69.40	0.14	73.60	O'II	74.30	0.15	76.70	0.13	75.00	80.0
Sink @ 2.70	48,50	0.18	54、30	0.20	55,00	0.14	58,60	0.11	54.60	0.14

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42 Inch Rock

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(Test No. 3, cont'd) -

Here again it will be noticed that as the particle size increases the grade of the products rise in silica and drop in gold as a general rule. There seems to be some evidence of a departure from this rule in the coarsest fraction, which might indicate that -7/8 inch is the economical upper size limit. The indications are indefinite, however, and a confirmatory test conducted on a sample of ore crushed -7/3inch failed to show any improvement in grade with respect to silica. It may therefore be that the upper size limit has not yet been reached.

Following is a density analysis calculated from the figures in the size-density analysis:

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Product	; per	: Si02,	; Gold,	per (3 <i>6)] (</i>	
Construction and and and an	: cent	per cont	soz./ton	s 102	; Gold	
Float @ 2,65	: 22,15	: 86,38	; ; 0,065 ;	26,69	; 11,86	
Float @ 2.675; sink @ 2.65	; ; 15,43	: 82,35	: 0,104 ;	17.72	: 13.09	
Float & 2.70;	°	0 9 1000 1 0 10				
sink @ 2,675	: 22,45	: 74,46		83.31	; 22°04	
-8 mesh fines	: 51.47 : 8.50	: 54.82 : 69.34	: 0,22	8,85	: 15,28	
ETCS 32/10-FTEXPOP CHETTLATE EXCEPTEMENT AV STRUKTUR VIEW STRUKTUR ST	0 3 99955555-6755567597876745577 9	0 0 1003075000000000000000000000000000000000			0 0 0 0	
Ore	100.00	; 71,70	: 0,122 ; ;	100.00	100.00	

If a separation be made at a density of 2,675 the float would assay 84,73 per cent silica and 0,081 ounceper ton gold. The feed to the cyanide plant would assay 0,147 ounce per ton gold. If a separation were made at a density of 2,70 the float would assay 80,89 per cent silica and 0,096 ounce per ton gold. The feed to the cyanide plant would then assay 0,162 ounce per ton gold. (Experimental Tests, cont'd) -

Test No. 4. - Confirmatory Test on +1 Inch Rock.

In this test the separations were made in bulk at densities of 2.675 and 2.70. The object of the test was to confirm the results indicated by the size-density analysis. The products were assayed for silica and gold. For this test the size range of the ore was -1"+8 mesh.

Stammary	01	' Resul	ts	Test No.)。4	a				
	e V	eight,	°	Assay	JS		0 0	Distri	bu	tion,
Product	5	per	e 0	S102, :	; Go	ld,	00	per	ce	nt
	ŝ	cent	:p	er cent;	;QZ.	/ton	3	S1.02	6 0	Gold
an dan mutakan dara kana da kana kana da kana kana da kana kan	ŝ	The second s	0				000	NALL AND AND A STOLEN A	0	THE REAL PROPERTY OF THE PARTY OF THE PARTY OF
Float @ 2.675	0	32,71	70	85.55 :	; 0	.07	2	39.87	20	18.72
Float @ 2.70;	2.9		v				ŝ		3	
sink 😃 2.675	0	25.94	0	72,50	e 0	°07	0	26,79	ő	14.84
Sink @ 2,70	e D	32,35	0	53.04	: C	.19	00	24.45	v	50,25
-8 mesh fines	ò	9,00	0	69.34	3 0	.55	50	8.89	20	16,19
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ore	:1	.00.00	1. 5	70.19	; O	.122	:]	00,00	00	100.00
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If the separation be made at a density of 2.70 the float would assay 79.78 per cent silica and 0.070 ounce per ton gold and the feed to the cyanide plant would assay 0.197 ounce per ton gold. If the separation be made at 2.675 the feed to the cyanide plant would assay 0.148 ounce per ton gold.

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Test No. 5. - Further Confirmatory Test on the Inch Rock.

In this test the ore was crushed -7/8 inch and the separation made on the size range -7/8"+8 mesh. Separations were made at densities of 2.675 and 2.70. This test was conducted to see if the silica assay of the float would be any higher because of the finer crushing, the size-density analysis having indicated this possibility.

(Continued on next page)

(Test No. 5, cont'd) -

DIAMMEL CY	or nesur	LA LOST W	0,0,		
	:Weight,	: Assay	\$	Distri	butlon,
Product	: per	; SiO2,	: Gold,:	por	cont
	: cent	:per cent	:oz./ton:	S102 :	Gold
and a sold a sold. Land a section section of the solar sold and and and and the section of the section of the s	Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q	an a	0 0	v atomicizzania a construe de la construcción de la construcción de la construcción de la construcción de la co La construcción de la construcción d	##1540###CC29497###C47*9498800##220
Float @ 2,675	: 42.40	: 83.64	: 0.06 :	49.24 :	22,86
Float @ 2.70;	0	0 9	o	3	
sink @ 2,675	: 14.03	: 74.58	: 0.12 ;	14.53 ;	15.13
· Sink @ 2.70	: 33,57	: 57.08	: 0,14 :	26,60 :	42.24
-8 mesh fines	: 10.00	: 69.34	: 0.22 :	9,63 :	19.77
ምርሮጀምስ ይደምር በይቀንደበር ሲደስ የአለባ የርጉሥ በርሃ ይዲ አንድ እር የአንድ የሚያውለክ ድር በበዚህ አንድ የሚያስት ዓህን እንደ የማም ዓም ት ትርስቶ የአንድ በአንድ አ	0 0	0	° °	0 D	
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Separating the ore at a density of 2,675 would give a product for cyanidation assaying 0,149 ounce per ton in gold. Separating the ore at a density of 2.70 would give a float product assaying 81.39 per cent silica and 0.075 ounce per ton in gold, leaving a product for cyanidation assaying 0.158 ounce per ton gold.

A comparison of the results of Tests Nos. 4 and 5 reveals only slight differences and these may be attributed to peculiarities of the samples rather than to the difference in crushing.

CONCLUSIONS:

The results of these tests indicate that the grade of product to be used as smelter flux can be improved by this process and at the same time the feed to the cyanide plant will also be improved.

The ore can be treated successfully in the size range -1"+8 mesh and it is possible that this upper size limit might be increased. At the same time, however, the grade of

(Conclusions, cont'd) -

the float product with respect to silica could be improved by moving the lower size limit up to 4 or 6 mesh. This, of course, would reduce the tonnage available for sale to a smelter.

The size-density analyses indicate that the coarse sizes produce the highest grade floats and it would therefore be wise to treat the ore at the coarsest size possible.

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