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OTTAWA November 13th, 1940.

REPORT

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 915.

Flotation of Chalcopyrite-Bornite Ore from the Granby Consolidated Mining, Smelting and Power Company, Limited, Allenby, B. C.

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BUREAU OF MINES DIVISION OF METALLIC MINERALS

ORE DRESSING AND METAILURGICAL LABORATORIES DEPARTMENT OF MINES AND RESOURCES MINES AND GEOLOGY BRANCH

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Shipment:

A 100-pound sample was received on September 17th, 1940, from the Granby Consolidated Mining, Smelting and Power Company, Limited, Allenby, British Columbia.

This sample was an average of the mill heads being treated in the mill during the last four days in August, 1940. - 2880 5 -

Purpose of the Experimental Tests:

The company is desirous of improving their present plant extraction by standard flotation methods.

Characteristics of the Ore:

Six polished sections of ore, similar to the sample that had been submitted by the company for further testing, were prepared and examined microscopically.

The gangue material consists essentially of hard, light to dark, greenish-grey, mottled rock, with patches of light pink feldspar and white carbonate.

The <u>metallic minerals</u> present are, in their order of abundance, chalcopyrite and bornite, with minor quantities of magnetite and pyrite unevenly distributed through the gangue as medium to fine irregular grains.

Metallic minerals are sparse and, on the whole, are rather finely divided. Ghalcopyrite and bornite form the bulk of the metallics. These two minerals are present in intimate association, largely as small masses and irregular grains disseminated in the gangue. Narrow stringers of bornite transecting the gangue are also visible in one or two sections. A considerable percentage of the grains occur in very fine sizes, down to the limits of the microscope (about one micron). Both minerals enclose occasional small inclusions of gangue.

When finely ground, the ore shows some particles of biotite mica. - Pago 3 -

Sampling and Analysis:

The sample was crushed and sampled by standard methods and assayed. The analysis was as follows:

Gold	-	0.015 oz./ton
Silver	دين	0.205 "
Insoluble	eo	74.98 per cent
Iron	-	3,88 "
Copper	-	1.4870 "
Zinc	-	N.I.I.
Arsonic	100	MIL
Antimony	C.27	NIL
Cu0	-	MI.I
Sulphur	مت ه	0.93 per cent.

(* Average calculated head assay, 10 samples)

Experimental Tests:

The tests on the ore were all by flotation. Various reagent combinations were tried and also tests in which stage grinding and flotation was used.

Test No. 1.

In this test 1,000 grams of ore were ground in a jar mill, using steel balls, for 20 minutes, at 70 per cent solids. 1.20 pounds of lime per ton was added to the charge. Reagents to the first stage of flotation were: 0.04 pound per ton Z-4 amyl xanthate, 0.02 pound per ton Reagent 301, and 0.05 pound per ton of pine oil. Reagents to the second stage were: 2.0 pounds NagS, 0.10 pound Z-4 amyl xanthate, and 0.05 pound pine oil per ton. The grind was 62.6 per cent minus 200 mesh.

- Page 4 -

(Test No. 1, cont'd) -

Results:

	: Weip	;ht,	Assey,	: Units:	Distribution,
Product	:Grams	Per	cu,	a 9	$Gu_{\mathfrak{I}}$
	0 0	cont	: p.c.	s Cri s	per cent
ELL'ANALORIANA ANALORIANSI ALGUNDAMETRANGGARANSO	0 0	anone experimenter	a ana ang ang ang ang ang ang ang ang an	16. j. 17. 19. v. 9. 17. juni 27. set 19. st. (19. 20. j	en an
Concentrate No. 1	: 28.1	2.81	36.52	102.62	72.4
Middling No. 1	: 81.5	8.15	2.70	22.00	15.5
Concentrate No. 2	: 4.0	0.40	3.52	1.41	1.0
Middling No. 2	\$ 40.4	4.04	0.35	1.41	1.0
Tailing	:846.0	84.60	0.17	14.38	10.1
Totals	:1000.0	100.00	1.426	141.82	100.0
	3 3				

[©] Calculated.

It is indicated by this test that using xanthates in place of aerofloats it is possible to reduce the tailings on this ore somewhat below those obtained in the plant at the present time. A contributing factor to this showing, was a somewhat longer flotation time than is possible in the plant. The flotation periods were 8 minutes for the first and 6 minutes for the second stage.

Tests Nos. 2 and 3.

In these tests stage grinding to a fine mesh was used, each grinding s tage being followed by flotation. In Test No. 2, the initial grinding period on 2,000 grams of one was 12 minutes at 70 per cent solids. The second and third stages were 8 minutes each. Before each regrind the flotation tailings were allowed to stand for a short time and the excess liquid and slimes were siphoned off. This solution was used in the succeeding flotation stage to bring the pulp density to 20 per cent solids.

In Test No. 3 the initial grinding period was

- Page 5 -

(Tests Nos. 2 and 3, cont'd) -

14 minutes on 2,000 grams of ore at 70 per cent solids. The second stage was also 14 minutes. In both Tests Nos. 2 and 3 the reagents added to the initial grind were, 1.0 pound per ton of soda ash, 0.07 pound per ton of Aerofloat No. 31 and 0.09 pound per ton of Barrett No. 4 oil.

In Test No. 2, 0.07 pound per ton of Aerofloat No. 31 and 0.09 pound per ton of Barrett No. 4 were added to the first regrind and 0.07 pound per ton of Aerofloat No. 31, 0.09 pound per ton of Barrett No. 4 and 0.1 pound per ton of sodium sulphide were added to the second regrind.

In Test No. 3, 0.07 pound per ton of Aerofloat No. 31, 0.09 pound per ton of Barrett No. 4 and 0.1 pound per ton of sodium sulphide were added to the regrind.

In both tests, No. 2 and No. 3, the second concentrates and the cleaner middlings from the rougher concentrates were reground for 8 minutes, then were floated to give the retreatment concentrates.

Reagents added to the flotation cell in Test No. 2 were:

Ib./ton

Rougher Stage:

	Reagent No. 301	94	0.06
	Pine oll	CD	0.075
	Aerofloat No. 31	CD	0.07
Second Sta	с <u>е</u> :		
	Reagent No. 301	e9	0.04
	Pine oil	19	0.05

Third Stage:

Reagent No. 3	301 -	0.04
Pine oil	Ç2	0.05
Aerofloat No.	。31 。	0.07

- Page 6 -

(Tests Nos. 2 and 3, contid) -

Reagents added to the flotation cell in Test

No. 3 were;

Rougher Stage:		T.b./ton
Reagent No. 301	2.5	0.06
Pine oil	c 27	0.075
Aerofloat No. 31	÷	0.07

Second Stage:

Reagent No. 301	925	0,06
Pine oil	43	0.075
Aerofloat No. 31	63	0.07

For Test No. 2 the final tailings were 85.8 per cent minus 200 mesh and in Test No. 3 the final tailings were 83.6 per cent minus 200 mesh.

Nesults, Tests Nos. 2 and 3:

ах из сэнээлэгэгд 212 хэлэг ул хэлэг нэхэг буллам бан багт хаар өдөнөөсэн хэр нээ булс дэмн	: Woigh	C	Assay,	:Units,	:Distribution
Product	:Grams	:Per	s Cu ₂	8	: of copper,
۲۰۰۶ ماند. ۱۹۹۹ - ۲۰۰۵ میرون می	2 0	<u>;cent</u>	per cont	: Gu	: per cent
Test No. 2	0 0 0	『고리JJ·고리가, Each Read 1, 그러들 파가가 두 41:	91.41.8.4.9.750.6C.21.6.8-9.4-0.4.9.76-9-0.883.829	n gilling for fine gilling bergen af the	**************************************
Concentrates	: 86.6	4.39	21.80	95.70	69.07
Final tailings	:1,285.0	65.16	0.09	5.86	4.23
Retreatment	6 0				
concentrates	: 38.6	1.96	9.68	18.97	13.69
Retreatment	8				
middlings	: 290.0	14.71	0.73	10.44	7.54
Slimes	8 271.7	13.78	0.55	7.58	
Totals	:1,971.9	700°00	1.380	138.55	700.00
	0 0	na se a constituir à statement a constituir de la constituir de la constituir de la constituir de la constituir	d 9 An of F 12/20 ST 19 AN 4 ST 910-man & F 12 D 172		6
	3				
Post No. 3	0				
	8	1 0 0			
Concentrates	: 82.0	4.08	25.54	104.20	75.41
Final tailings	:1,560.0	77.63	0.11	8.54	6.18
Retreatment	8				
concentrates	: 16.8	88,0	10.46	8.47	6.13
Retreatment	0 0				
mi.ddl.i.ngs	: 218.5	10.88	1.13	75°58	8.89
Slimes	: 132.5	6.59	0.71	3.39	CC. C
Totals	<u>;</u> 2,009.8	200.00	1.38 ⁰	138.17	100.00

© Calculated.

- Page 7 -

(Tests Nos. 2 and 3, cont'd) -

Fine grinding if it were possible would show an appreciable lowering of the final teilings with a corresponding increase in the final mill recovery. In mill practice using standard thickeners it would not be necessary to discard as large amounts of slimes as were rejected in these tests. Several stages of grinding give low tailing values. In these tests as well as in Test No. 1, longer flotation times than that used in the plant were used. Test No. 2 was floated for 16 minutes and Test No. 3 was floated for 14 minutes.

Tests Nos. 4, 5, and 6.

These tests were run to determine the recoveries that were possible at coarser grinds. From Test No. 4 it is shown that 15 minutes' grinding would reduce the 2,000gram ore charge from 14 mesh to 56.6 per cent minus 200 mesh. In Tests Nos. 5 and 6, grinding times of 6 minutes end 10 minutes were used.

Reagents to the mill were the same in all three tests, being, 1.0 pound per ton of sode ash, 0.70 pound per ton of Aerofloat No. 31 and 0.088 pound per ton of Barrett No. 4.

Reagents to the flotation cell for Test No. 4 were: 0.06 pound per ton of Reagent No. 301, 0.075 pound per ton of pine oil, and 0.07 pound per ton of Aerofloat No. 31. Reagents to the flotation cell for Tests Nos. 5 and 6 were: 0.08 pound per ton of Reagent No. 301,

- Page 8 -

(Tests Nos. 4, 5, and 6, cont'd) -

0.075 pound per ton of pine oil, and 0.07 pound per ton of Aerofloat No. 31.

In Test No. 4 the flotation time was 10 minutes; in Test No. 5, the flotation time was 5 minutes; and in Test No. 6, the flotation time was 4 minutes. In all three tests the rougher concentrates were reground for 5 minutes and cleaned.

Screen tests on these tests showed the fol-

lowing:

Test	No.	4	Tailings	572 173	56 . 6	per	cent	minus	200	mesh.
Test	NO .	5	Tailings Middlings	419 53 8 8 8 10	42.0 68.0	r f	3	22 22	1 M 2 B	79 79
Test "	NO "	6	Tailings Middlings	(1)) (1)) (1))	52.0 72.6	1	0 2	19 20	63 57	79 F7

Results of Tests Nos. 4, 5 and 6;

n an	: Weight	a para ang sa pasa na sa	: Assay,	: Units,	:Distribution
Product	: Grams	Per	: Cus	e e	: of copper,
TITLE IN A CONTRACTOR OF THE DR. S. CONTRACTOR		cont	per cent	e Cu	; per cent
	0				
Tost No. 4	0				
	8				
Concentrates	\$ 50.9	2.55	35.14	89.61	68.99
Middlings	: 113.2	5.68	3.70	21.02	16.18
Tailings	:1,820.0	9176	0.21	19.27	14.83
Totals	:1,992.1	100.00	1.30 ^w	129.90	100.00
and the state of the	O O Designation of the state of		a a a thu an	ᠵᠴᠵᡱᡶᡷᠽᡊ᠁ᡁᡷᢣᢦᡆ᠋᠋ᡔᢑᠣ᠉ᡔ᠆ᡢᡭ᠋ᡷᠴᡸ᠈ᡒᢦᡕᡬᢓᡃᡷ ᠮᡬ᠉	(۲۵۵۹ ۲۵۵۷ ۲۵۵۷ ۲۵۵۲ ۲۵۵۲ ۲۵۵۲ ۲۵۵۲ ۲۵۵۲
	0 0				
Test No. 5	6 G				
An en		معتادهم فم	15 01		40 279
Concentrates		1.55	41.04	04.04	40°77
Middlings	: 140.0	7.02	6.00	4x . 04	30.78
Tallings	1,824.0	91.40 20.00	0,0%	92°AA	00.55
TOLETS	: 198900	100.00	7.98.	798°71	1.00.00
비스마 나는 것 이 같은 것 그 가지는 것은 것 것 같은 것 것 가지는 것 같은 것 같은 것 같이 있는 것 같이 없는 것 같이 않는 것 않는 것 같이 없는 것 같이 않는 것 않는 것 같이 않는	O Lander and Contract on Bellevited & Lyncoler O	we have a state of the second s	AND		and and the second of the second s
Test No 6	0				
$T \land D \land D \land T \land D \land A \land A$	0 0				
Concentrates	. 31.7	1.59	43.40	69.01	52.77
Middlings	120.1	6.02	4.43	26.67	20,39
Tallings	1.844.0	92.39	0.38	35.11	26,84
Totals	:1.995.8	100.00	1.310	1.30.79	100,00
	· ; · · · · · · · · · · · · · · · · ·		K3 U 49 KM		

© Calculated.

- Page 9 -

(Tests Nos. 4, 5, and 6, contid) -

From these tests it is indicated that both the fineness of grinding and the flotation time have a bearing on the recoveries that are possible with this ore. From the appearance of the cells during these tests it was observed that the chalcopyrite present in the ore floats readily in the first 2.5 to 3 minutes; after this time the bornite becomes activated but does not float so rapidly. This indicated, however, that it might be possible to somewhat increase the available flotation time by floating the pulp as it is discharged from the primary grinding circuit at 40 per cent solids. This procedure was carried out in the following tests,

Tests Nos. 7 and 8

These tests were run to determine the possibility of the idea set forth in the foregoing paragraph, that is, the possibility of treating the pulp as it would be discharged from the primary classifiers in the present plant.

In Test No. 7 the 2,000-gram ore charge was ground for 8 minutes at 70 per cent solids with 1.0 pound per ton of soda ash, 0.07 pound per ton of Aerofloat No. 31, and 0.088 pound per ton of Barrett No. 4. This pulp was transferred to a 1,000-gram flotation machine where it was floated for 4 minutes. The reagents to the cell were 0.06 pound Reagent No. 301, 0.07 pound Aerofloat No. 31 and 0.075 pound pine oil per ton. The tailings - Page 10 -

(Tests Nos. 7 and 8, cont'd) -

from this machine were allowed to settle, the slimes siphoned off, and the thickened pulp reground for 6 minutes. Reagents to regrind were 0.07 pound Aerofloat No. 31 and 0.05 pound pine oil per ton. The pulp from the regrind was floated at 20 per cent solids in a 2,000gram flotation cell. The reagents to the cell were 0.04 pound per ton Reagent No. 301, 0.07 pound per ton Aerofloat No. 31, and 0.025 pound per ton of pine oil. Flotation was carried on for 6 minutes.

In Test No. 8 the 2,000-gram ore charge was ground for 9 minutes at 70 per cent solids. The reagents to the mill were the same as in Test No. 7. The ground pulp was floated at 40 per cent solids in a 1,000-gram flotation cell for 4 minutes. The reagents to the cell were: 0.06 pound per ton of Reagent No. 301, 0.07 pound per ton of Aerofloat No. 31, and 0.05 pound per ton of pine oil. The tailings were allowed to settle and the slimes siphoned off. The thickened pulp was reground for 5 minutes. Reagents to regrind were 0.07 pound Aerofloat No. 31 and 0.05 pound pine oil per ton. The second flotation was at 20 per cent solids in a 2,000-gram flotation machine. The reagents to the flotation cell were: 0.04 pound per ton of Reagent No. 301, 0.05 pound per ton of pine oil, and 0.035 pound per ton of Aerofloat No. 31.

In both tests the slimes decanted from the primary flotation tailings were used to bring the flotation pulp in the second flotation to 20 per cent solids. The pH of the flotation pulps was 9.2.

(Tests Nos. 7 and 8, cont'd) -

Enclosed and the Contraction		: Weig	ht	: A5	say, :l	mits,:]	Distridu	tion
Product		;Grams	s Po:	r: C	u., 8	0	of copp	or,
and the second secon	- TUTTE L'ALIGNES	di D Nemen selati di serre selati di se	2 CO:	nt :por	<u>cont:</u>	<u>Cu</u> :	per con	enconstruction of the second sec
(Test No. 7	7)	8					1	
Concentrate 1	Vo. l	: 268.	5 13	.55	7.30	98.92	75.26	
Concentrate 1	No. 2	: 104.	5 5	.28	3.66]	19.32	14.70	
Tailings		:1,485.	9 75	°OJ	0.13	9.75	7.42	
Slimes		: 122.	0 6	.16	0.56	3.45	8.62	
Totals	*********	:1,980.	9 100	•00	1.31 13	51.44	100.00	Lat DOUDLE D
4709-47032004 14222274 24244000 3-762723000 522433 8234 234230-0	• @? <u>15</u> 0 #3441 #2637 326762	0 0	para y tártar a tat up a coi	i constantisti stristic Rich	Tribulinfort for diamate (kal	ANNYSTIZZTX+23,63% 6201/75706/3		
(Test No. 8	3)	0 2 4						
Concentrate 1	10. l	: 151.	0 7	.56 1	2.70 (96.01	72.98	
Concentrate I	No. 2	: 141.	0 7	.06	3.10 \$	21.89	16.64	
Tailings		\$1,704.	9 85	.38	0.16 3	13.66	10.38	
Totals		:1,996.	9 300	.00	1.321	31.56	100.00	EVITAWILEDD

Results of Tests Nos. 7 and 8:

Calculated.

These tests indicate a recovery approaching 90 per cent when the tailings values are considered. This recovery will be lowered somewhat by the discharge of any retreatment tailings to waste, but it must be assumed that this flow-sheet will give a higher per cent extraction than is being obtained at present in the plant.

Tests Nos. 9, 10, and 11.

These tests were made in an attempt to show a difference between the results obtained by floating in pulp made alkaline with soda ash at a pH value of 9.2 and using Aerofloat reagents, and floating in a neutral pulp using manthate alone.

In each tase the one charge was 2,000 grams which was ground at 70 per cent solids for 10 minutes. The

- Page 12 -

(Tests Nos. 9, 10, and 11, cont'd) -

reagents to the mill for the primary grind were;

Test No. 9. -- 1.0 pound per ton soda ash, 0.04 pound per ton Reagent No. 208, and 0.176 pound per ton Barrett No. 4.

Test No. 10. -- 0.05 pound per ton Reagent No. 301 and 0.176 pound per ton Barrett No. 4.

Test No. 11. -- 0.07 pound per ton Reagent No. 301 and 0.176 pound per ton Barrett No. 4.

Reagents to the flotation cell for the primary

float were:

Test No. 9. -- 0.06 pound per ton Reagent No. 301 and 0.075 pound per ton pine oil.
Test No. 10. -- 0.05 pound per ton Reagent No. 301 and 0.05 pound per ton pine oil.
Test No. 11. -- 0.03 pound per ton Reagent No. 301 and 0.05 pound per ton pine oil.

In each test the primary flotation tailings were thickened and reground. The reagents to the regrind were; Test No. 9. -- 0.03 pound per ton Reagent No. 208, and

0.088 pound per ton Barrett No. 4. Test No. 10. -- 0.03 pound per ton Reagent No. 301, and 0.132 pound per ton Barrett No. 4.

Test No. 11. -- 0.06 pound per ton Reagent No. 301, and 0.176 pound per ton Barrett No. 4.

The reagents to secondary flotation were:

Test	No.	9.	C) (21	0.06 pound per ton Reagent No. 301, 0.05 pound per ton pine oil, and 0.02 pound per ton Reagent No. 208.
Test	No.	10.	C") F23	0.08 pound per ton Reagent No. 301, and 0.075 pound per ton pine oil.
Test	No .	11.	හා ආ	0.04 pound per ton Reagent No. 301, and 0.05 pound per ton pine oil.

In Test No. 11 where the concentrates were cleaned

- Pago 12 -

(Tests Nos. 9, 10, and 11, cont'd) -

reagents to the mill for the primary grind were:

Test No. 9. -- 1.0 pound per ton soda ash, 0.04 pound per ton Reagent No. 208, and 0.176 pound per ton Barrett No. 4.

Test No. 10. -- 0.05 pound per ton Reagent No. 301 and 0.176 pound per ton Barrett No. 4.

Test No. 11. -- 0.07 pound per ton Reagent No. 301 and 0.176 pound per ton Barrett No. 4.

Reagents to the flotation cell for the primary

float were:

Test	No.	9.	13 ED	0.06 pound per ton Reagent No. 0.075 pound per ton pine oil.	301	and
Test	No.	10.	= =	0.05 pound per ton Reagent No. 0.05 pound per ton pine oil.	301	and
Test	No.	11.	æ न	0.03 pound per ton Reagent No. 0.05 pound per ton pine oil.	301	and

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Tost	No .	9.	ස ස	0.06 pound per ton Reagent No. 301, 0.05 pound per ton pine oil, and 0.02 pound per ton Reagent No. 208.
Test	No.	10.	س به	0.08 pound per ton Reagent No. 301, and 0.075 pound per ton pine oil.
Test	No.	11.	బా హ	0.04 pound per ton Reagent No. 301, and 0.05 pound per ton pine oil.
	Ir	n Tos	st No	. 11 where the concentrates were cleaned

- Page 1.3 -

(Tests Nos. 9, 10, and 11, cont'd) -

and recleaned, Concentrate No. 1 and Concentrate No. 2 were reground for 5 minutes with 0.01 pound per ton Reagent No. 301 and 0.025 pound per ton pine oil.

In all of these tests the primary flotation was carried out at 40 per cent solids in a 1,000-gram flotation cell and the secondary flotation was carried out at 20 per cent solids in a 2,000-gram flotation cell. The primary float was for 4 minutes and the secondary float was for 6 minutes.

Results of Tests Nos. 9, 10, and 11:

Product : Grams : Per : Cu, : : of copper, : cent :per cent: Cu : per cent (Test No. 9) Concentrate No. 1 : 71.0 3.55 22.326 Concentrate No. 2 : 120.3 6.00 5.84 35.04 26.80 Tailings :1,748.0 87.27 0.17 14.84 .11.35 Slimes : 63.7 5.18 0.651 1.62 1.24 Totals :2,002.9 100.00 1.51° 130.75 100.00 (Test No. 10) : : Totals : 109.7 5.51 3.16 17.41 13.69 Tailings ^{@@@@} :1,590.0 79.88 0.22 17.57 15.82 Slimes : 240.0 12.06 0.32 3.86 3.03 Totals : 240.0 12.06 0.32 3.86 3.03 Totals : 1,990.4 100.00 1.27° 127.17 100.00
<pre> : cent :per cent: Cu : per cent (Test No. 9) : Concentrate No. 1 : 71.0 3.55 22.32⁶ 79.25 60.61 Concentrate No. 2 : 120.3 6.00 5.84 35.04 26.80 Tailings : 1,748.0 87.27 0.17 14.84 .11.35 Slimes : 63.7 3.18 0.51 1.62 1.24 Totals : 2,002.9 100.00 1.31⁹ 130.75 100.00</pre>
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Concentrate No. 1 : 71.0 3.55 22.326 79.25 60.61 Concentrate No. 2 : 120.3 6.00 5.84 35.04 26.80 Tailings :1,748.0 87.27 0.17 14.84 11.35 Slimes : 63.7 3.18 0.51 1.62 1.24 Totals :2,002.9 100.00 1.310 130.75 100.00 (Test No. 10) Concentrates®® :50.7 2.55 34.64 88.33 69.46 Middlings : 109.7 5.51 3.16 17.41 13.69 Tailings®®® :1,590.0 79.88 0.22 17.57 13.82 Slimes : 240.0 12.06 0.32 3.86 3.03 Totals :1,990.4 100.00 1.270 127.17 100.00
Concentrate No. 2 : 120.3 6.00 5.84 35.04 26.80 Tailings :1,748.0 87.27 0.17 14.84 11.35 Slimes : 63.7 3.18 0.51 1.62 1.24 Totals :2,002.9 100.00 1.31 130.75 100.00 (Test No. 10) Concentrates ^{\$0} : 50.7 2.55 34.64 88.33 69.46 Middlings : 109.7 5.51 3.16 17.41 13.69 Tailings ^{\$0\$0\$} :1,590.0 79.88 0.22 17.57 13.82 Slimes : 240.0 12.06 0.32 3.86 3.03 Totals :1,990.4 100.00 1.27 ^{\$\$} 127.17 100.00
Tailings :1,748.0 87.27 0.17 14.84 .11.35 Slimes : 63.7 3.18 0.51 1.62 1.24 Totals :2,002.9 100.00 1.31* 130.75 100.00 (Test No. 10) : : : : : : Concentrates*** : : : : : : Middlings : : : : : : : Tailings**** : : : : : : : : Totals : <t< td=""></t<>
Slimes <th::< th=""> : 63.7 3.18 0.51 1.62 1.24 Totals :2,002.9 100.00 1.31° 130.75 100.00 (Test No. 10) :</th::<>
Totals:2,002.9 100.001.31°130.75100.00(Test No. 10):Concentrates**: 50.72.5534.6488.3369.46Middlings: 109.75.513.1617.4113.69Tailings***: 1,590.079.880.2217.5713.82Slimes: 240.012.060.323.863.03Totals: 1,990.4100.001.27*127.17100.00
(Test No. 10) (Test No. 10) Concentrates®® Niddlings Tailings®®® : 1,590.0 79.88 0.22 17.57 13.82 Slimes : 240.0 12.06 0.32 3.86 3.03 Totals : 1,990.4 100.00 1.27® 127.17 100.00
(Test No. 10) Concentrates ^{\$0} : 50.7 2.55 34.64 88.33 69.46 Middlings: 109.7 5.51 3.16 17.41 13.69 Tailings ^{\$0\$\$\$} : 1,590.0 79.88 0.22 17.57 13.82 Slimes: 240.0 12.06 0.32 3.86 3.03 Totals: 1,990.4 100.00 1.27 ^{\$\$} 127.17 100.00 (Test No. 11)
(Test No. 10) Concentrates ^{\$0} : 50.7 2.55 34.64 88.33 69.46 Middlings: 109.7 5.51 3.16 17.41 13.69 Tailings ^{\$0\$0} : 1,590.0 79.88 0.22 17.57 13.82 Slimes: 240.0 12.06 0.32 3.86 3.03 Totals: 1,990.4 100.00 1.27 ^{\$} 127.17 100.00 (Test No. 11)
Concentrates [*] : 50.7 2.55 34.64 88.33 69.46 Middlings : 109.7 5.51 3.16 17.41 13.69 Tailings ^{**} : 1,590.0 79.88 0.22 17.57 13.82 Slimes : 240.0 12.06 0.32 3.86 3.03 Totals : 1,990.4 100.00 1.27* 127.17 100.00 : (Test No. 11)
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Middlings : 109.7 5.51 3.16 17.41 13.69 Tailings ^{@@@} :1,590.0 79.88 0.22 17.57 13.82 Slimes : 240.0 12.06 0.32 3.86 3.03 Totals :1,990.4 100.00 1.27 [®] 127.17 100.00 : : : : : : :
Tailings@@@@ :1,590.0 79.88 0.22 17.57 13.82 Slimes : 240.0 12.06 0.32 3.86 3.03 Totals :1,990.4 100.00 1.27% 127.17 100.00 : : : : : : : (Test No. 11) : : : : : :
Slimes : 240.0 12.06 0.32 3.86 3.03 Totals :1,990.4 100.00 1.27 [®] 127.17 100.00 (Test No. 11)
Totals :1,990.4 100.00 1.27 [©] 127.17 100.00 (Test No. 11)
(Test No. 11)
(Test No. 11) :
(Test No. 11) :
، مریناند، مانتا ایران استان ایران ایران ۲
Concentrates 06 : 74.2 3.73 27.12 101.16 77.66
Middlings : 108.0 5.42 2.52 13.66 10.49
Tailings 000 " :1,810.0 90.85 0.17 15.44 11.85
Totals :1,992.2 100.00 1.30 130.26 100.00
(Footnotes: 🏾 Calculated. 🔗 Acid insoluble in concentrates:
(Test No. 10, 25.20 per cent;
(Test No. 11, 38.18 per cent.
$^{\odot \oplus \odot}$ pH: Test No. 10, - 9.2; Test No. 11, - 7.8.
Screen size, 370 d 2000 mash 68 00 poor

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(Tests Nos. 9, 10, and 11, cont'd) -

Although Test No. 10 does not show any decrease in the tailings values, the series shows that there is no appreciable difference between the recoveries that may be obtained using Aerofloat or xanthate reagents, or whether the flotation is carried out in a highly alkaline pulp or in a neutral pulp. Thus the increased recovery can be attributed to the somewhat longer flotation time that is afforded by stage flotation.

It seems possible that a greater mill tonnage could be handled by this type of flow-sheet. It has been calculated that for 5,000 tons per day in the existing plant the grinding time would be 35 minutes in the primary circuit and 22 minutes in the secondary circuit. This, of course, will reduce the percentage of minus 200 mesh material produced in the primary circuit but when it is considered that between 7 and 13 per cent of the total weight of the feed will be removed as the primary rougher concentrates, it may be seen that the secondary circuit will be relieved of this much load, therefore the final grind should closely approximate the present mill grind. Following this same reasoning it may be assumed that eight of the No. 30 Denver "Sub-A" cells would be of sufficient volume to give four minutes treatment time on 5,000 tons per day of ore at the 40 per cent solids of the primary classifier overflow. On this same basis if it would not be convenient to combine the overflow from all the classifiers, the overflow from each of the two banks of classifiers

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(Tests Nos. 9, 10, and 11, cont'd) -

could be sent to two 4-cell banks of flotation cells. The present scavenger cells would handle the secondary classifier overflow in conjunction with four of the remaining No. 30 Denver "Sub-A" cells.

Summary and Conclusions:

Small batch laboratory tests are only indicative when used to investigate a milling problem such as the one under discussion. Therefore the recommendations which follow are based on the interpretation of laboratory results and not on actual proved results. It is believed, however, that these recommendations warrant a trial in the mill, and that they will not result in a lower recovery.

It is recognized that finer grinding would improve the recovery but it is understood that no plant expansion is contemplated for such a purpose. Thus, only the following recommendations are made:

1. All the mill feed should be fed directly to the classifiers, to overflow any fines that may have been produced in the crushing plant and thus relieve the ball mills of this much load.

2. Primary flotation should be carried out on the overflow of the primary classifiers at the pulp density of the overflow, that is, 40 per cent solids.

3. The tailings from the primary flotation stage

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(Summary and Conclusions, cont'd) -

should be thickened prior to regrinding. Any excess slimes that are not used in the dilution of the secondary flotation feed should be discarded.

4. The primary and secondary concentrates should be combined and reground prior to cleaning.

5. The cleaner tailings should be returned to the primary rougher flotation circuit and the recleaner tailings should be returned to the rougher concentrates regrind circuit.

6. Reagents combinations seem to have little bearing on the total recovery, although they should be kept as simple as possible.

OS:PES.