

DEPARTMENT OF MINES AND RESOURCES

BUREAU OF MINES

CANADA

Ottawa, September 28, 1946.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 2111.

Cyanidation and Flotation Tests on Old Mill Tailings
(Silver-bearing) from the Miller Lake O'Brien Property,
Gowganda, Ontario.

Note:

This report relates essentially to the samples as received. It shall not, nor any correspondence connected therewith, be used in part or in full as publicity or advertising matter for the sale of shares in any promotion.

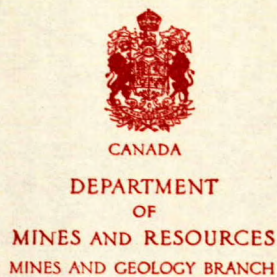
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DIVISION OF METALLIC MINERALS
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ORE DRESSING AND
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(Silver-bearing) from the Miller Lake O'Brien Property,
Gowganda, Ontario.

Shipments:

Two shipments of silver-bearing mill tailing from the former Miller Lake O'Brien property, at Gowganda, Ontario, were received. The first shipment weighing 263 pounds, arrived on February 22, 1946, and the second, a 197-pound sample, reached the Laboratories on April 23, 1946.

Purpose of Investigation:

This property has been acquired by the Siscoe Gold Mines Limited, Siscoe, Quebec. Mr. R. G. Walsh, General Manager, in a letter dated February 18, 1946, requested that a testing program be undertaken for the extraction of silver from the tailings from former operations. The letter stated that the company's program at this property includes the retreatment of some 500,000 tons of tailings with an average content of 4.65 oz. silver per ton. Underground, there are several thousand tons of mill rock and several places where high-grade is showing.

The two shipments on which this investigation was conducted were taken from the tailings dump.

Shortly after the receipt of the samples, Mr. E. H. Devine of the Siscoe Gold Mines Limited arrived at the Laboratories and carried out the main research program on cyanide leaching, agitation and flotation. His report will be forthcoming.

The data included on this report are considered supplementary to work carried on by Mr. Devine.

Sampling and Analysis:

The shipments were sampled by standard methods and were found to contain the following:

	<u>Shipment No. 1</u>	<u>Shipment No. 2</u>
Silver, oz. ton	3.74	3.99
Arsenic, per cent	0.06	0.04
Cobalt, "	0.037	0.05
Copper, "	0.03	0.016
Iron, "	3.69	3.77
Nickel, "	--	0.02
Sulphur, "	0.07	0.07
CaO, "	--	4.40
Insoluble, "	--	75.48

INVESTIGATIVE PROCEDURE:

This report covers the results obtained by agitation in cyanide solution and flotation, both separately and in combination. Various reagent combinations are reported.

Results of Experimental Tests:

Microscopic examination indicates that much of the silver remaining in the tailing is very fine.

A screen analysis of the head sample shows that 21.2 per cent of the silver is reported in the -200 mesh fraction, which assays 7.4 ounces silver per ton, while the other coarser fractions all assay under 4 ounces silver per ton. (Test No. 1.)

Cyanidation of the tailing, as received, yielded extractions of from 68.2 per cent within 24 hours to 79 per cent within 96 hours of agitation. On regrinding the tailing to 73 per cent -200 mesh the extraction was increased to 88.4 per cent within 48 hours and to 90.5 per cent within 72 hours. In these tests solutions of 1, 2 and 5 pounds NaCN per ton were used, to note the effect of increasing the strength of the solution. The tests indicate that the 2.0 pound NaCN solution is the most effective in cyaniding the tailing. The 5 pound NaCN per ton solution is necessary when cyaniding a flotation concentrate. Strengths greater than 5.0 pounds were not tried on the concentrate. (Tests Nos. 2, 4 and 10.)

A screen test was made on a cyanide tailing to show the amount of silver remaining in each screen fraction, when cyanided as received. Then each fraction was concentrated on a Haultain superpanner. It was found, after removing a concentrate, that the residual particles still contained silver. (Test No. 3.)

(Results of Experimental Tests, cont'd) -

A test was made to try the effect of mercuric hydroxide added to the pulp as suggested by Mr. C. W. Dowsett. It did not show any appreciable effect. (Test No. 5.)

A test was made adding lead nitrate to the pulp. This did not result in increased extraction but appeared to reduce the amount of fouling. (Test No. 11.)

Flotation tests made on the tailing as received show a recovery of 60 per cent of the silver in a bulk concentrate which assayed 42.09 ounces silver per ton. This was recleaned to a grade of 113.1 ounces silver per ton with a recovery of 45.5 per cent. It was found that 14.7 per cent of the silver reported in the cleaner tailing. (Test No. 6.)

A sample of the tailing as received was deslimed. The sand portion was screened on 48 mesh. Each portion was treated as a feed in a flotation test and the assay of the feed was a calculated value. The results show that silver could be recovered from the slimes and -48 mesh portion. No satisfactory results from the +48 mesh tailing were obtained without regrounding it. The results of flotation of a rougher concentrate from slimes, -48 mesh and reground +48 mesh tailing were 70.2 per cent, 65.7 per cent and 78.9 per cent of the silver, respectively; these rougher concentrates were recleaned to grades, 49.96 ounces, 234.75 ounces and 124.48 ounces of silver per ton respectively. It was found that up to 31.7 per cent of the silver in the feed reports in the cleaner tailing in these tests. (Test No. 7.)

Regrounding the tailing to 67 per cent -200 mesh resulted in a recovery of 76.4 per cent of the silver in the rougher concentrate which assayed 46.1 ounces per ton and was recleaned to a grade of 84.96 ounces per ton, recovery 69.2

(Results of Experimental Tests, cont'd) -

per cent. The flotation tailing assayed 1.02 ounces silver per ton. (Test No. 8-A.)

Using the same reagents and a grind of 84 per cent -200 mesh resulted in recovering 78.4 per cent of the silver in the rougher concentrate which assayed 35.09 ounces silver per ton. The flotation tailing assayed 0.92 ounce silver per ton. (Test No. 8-B.)

At a grind of 89.6 per cent -200 mesh, 84.3 per cent of the silver was recovered at a grade of 20.09 ounces silver per ton in the rougher. The cleaner concentrate contained 102.08 ounces silver per ton with a recovery of 67 per cent of the silver. The flotation tailings assayed 0.77 ounce silver per ton. (Test No. 8-C.)

Flotation tests were made using a sulphidizing reagent (sodium sulphide) to try to activate the silver. At a grind of 82 per cent -200 mesh the flotation tailing assayed 0.72 ounce silver per ton, and at a grind of 76 per cent -200 mesh the tailing assayed 0.74 ounce silver per ton. The rougher concentrate assayed 24.9 ounces silver ton and the recovery was 82.8 per cent. It was not cleaned. (Test No. 9.)

Further tests, using sodium hydroxide with and without sodium silicate, were made to note the effect of dispersing reagents on the slimes. This resulted in an average flotation tailing assaying 0.96 ounce silver per ton at grinds from 82 to 90 per cent -200 mesh. 78.7 per cent of the silver was recovered in a rougher concentrate assaying 29.88 ounces silver per ton. (Test No. 10.)

Cyanidation tests of rougher flotation concentrates were made to study the extraction of silver. A 5 pound NaCN

(Results of Experimental Tests, cont'd) -

per ton solution was used in agitation periods varying from 24 to 96 hours. The extraction increased from 93.8 per cent in 24 hours to 96.6 per cent in 96 hours. The recovery in terms of original feed varied from 73.9 per cent to 76.0 per cent for these periods. (Test No. 10.)

Settling tests were made by grinding the ore to 84 per cent -200 mesh with 4.0 pounds lime per ton. No cyanide was used. The titration of the pulp for lime showed 0.3 pound CaO per ton of solution. The pulp settled at the rate of 0.355 foot per hour at a dilution of 1.62:1, and 0.50 foot per hour at a dilution of 2:1.

A sample of the tailing as received had a specific gravity of 2.96.

Character of the Ore:

The samples of tailings as received were approximately minus 14 mesh. From a selection of the larger mineral fragments, polished sections were prepared for microscopic examination.

Gangue -

Gangue material is abundant as angular fragments which average about one millimetre in size and consist of fairly hard, light greenish grey rock and white quartz. Tests made on several pieces with acid reveal that they carry rather abundant finely disseminated carbonate.

Metallic Minerals -

Metallic mineralization is very sparse in the polished surfaces and is represented by ilmenite, pyrite, chalcopyrite, and native silver. These minerals occur as occasional to rare small grains, ranging approximately 180 microns (-65+100 Tyler mesh) down to the limits of the micro-

(Character of the Ore, cont'd) -

scope (about one micron) in size. While a few of the metallic particles appear to be free in the mounting medium, the majority of them are in fragments of the gangue.

Several tiny particles of a white mineral enclosed in gangue are visible in the sections. They are too small (the largest is 36 microns in size) to identify definitely but they appear to be soft and may be regarded as metallic silver with reasonable certainty. Hence, if the polished sections are representative of the sample, it can be expected that this metal, or at least a considerable percentage of it, occurs in fine grain sizes.

DETAILS OF EXPERIMENTAL TESTS:

Test No. 1. - Screen Analysis on Shipment No. 1.

A screen analysis was made on the head sample of the first shipment, with the following results:

Results:			
	Weight,	Assay,	Distribution
Mesh	per	Ag,	of silver,
No.	cent	oz./ton	per cent
Feed ^φ	100.00	3.98	100.00
+20	6.88	3.97	6.87
-20 +28	10.92	2.97	8.15
-28 +35	17.52	3.66	16.12
-35 +48	17.86	3.80	17.06
-48 +65	11.82	3.56	10.58
-65 +100	9.70	3.29	8.02
-100 +150	8.62	3.25	7.04
-150 +200	5.20	3.78	4.94
-200	11.48	7.40	21.22

^φ
Calculated value.

STRAIGHT CYANIDATION

Test No. 2.

Samples of the tailing, as received, were agitated in cyanide solution for various periods of time. The

(Details of Experimental Tests, cont'd)

solution was made up to 1.0 pound NaCN per ton and lime was added at the rate of 1.0 pound per ton dry weight of ore. Reagents were added as required to maintain strength of solution. The dilution of the pulp was 1½:1.

Results:

Straight Cyanidation.									
Test No.	Period of Agitation, hours	Assays, Ag, oz./ton	Extraction, Tail-silver, lb./ton	Final Titration, lb./ton Soln.	Reagent Consumed, lb./ton Ore	Reducing power, c.c. 1/10 N KMnO ₄ /L.			
2-A	24	3.74	1.15	69.3	0.8	0.2	0.80	1.7	11.4
2-B	48	3.74	0.98	73.8	0.9	0.05	1.05	1.9	16.9
2-C	66	3.74	0.98	73.8	1.0	0.15	1.70	1.8	"

Test No. 3.

This test was made to determine the results when 5 pounds NaCN per ton was used. The tailing was used as received.

The several tests were agitated for various periods of time. Dilution of pulp, 1½:1.

Results:

Period of Agitation, hours	Assays, Ag, oz./ton	Extraction, Tail-silver, lb./ton	Final Titration, lb./ton Soln.	Reagent Consumed, lb./ton Ore	Reducing power, c.c. 1/10 N KMnO ₄ /L.				
24	3.74	1.19	68.2	3.9	0.15	1.65	1.77		36.0
48	3.74	0.93	75.1	4.6	0.10	2.10	1.85		60.0
66	3.74	0.91	75.7	4.1	0.15	2.55	1.77		80.0
72	3.74	0.88	76.5	4.2	0.15	2.85	1.77		92.0
96	3.74	0.78	79.1	4.8	0.15	2.40	1.77=		96.0

A screen analysis was run on the 66-hour cyanide tailing to discover the amount of silver remaining in the various sized fractions.

(Continued on next page)

(Details of experimental Tests, cont'd) -

	Weight,	Assay,	Distribution
Mesh	per	Ag,	of silver,
No.	cent	oz./ton	per cent
Feed	100.0	1.01	100.0
+28	15.6	1.32	20.5
-28 +48	32.2	1.14	36.4
-48 +65	15.6	0.94	14.6
-65+100	12.2	0.82	9.9
-100	24.4	0.77	18.6

A portion of each of these screen fractions was concentrated on the superpanner. After removing a concentrate from each, the panner tailings were assayed for silver. The results are as follows:

Superpanner Concentration of Cyanide Tailings.

Screen Fractions from Screen Analysis.			
	Weight,	Assay,	Distribution
Products	per	Ag,	of silver,
	cent	oz./ton	per cent
+28 mesh feed	100.0	1.32	100.0
" pan conc. [⊕]	3.5	9.87	26.2
" " tailing	96.5	1.01	73.8
-28+48 Mesh Feed			
Feed	100.0	1.14	100.0
Pan conc. [⊕]	5.3	5.11	23.5
Pan tailing	94.7	0.92	76.5
-48+65 Mesh Feed			
Feed	100.0	0.94	100.0
Pan conc. [⊕]	2.2	6.20	14.7
Pan tailing	97.8	0.82	85.3
-65+100 Mesh			
Feed	100.0	0.82	100.0
Pan conc. [⊕]	4.3	1.26	6.6
Pan tailing	95.7	0.80	93.4
-100 Mesh			
Feed	100.0	0.77	100.0
Pan conc. [⊕]	3.1	3.58	14.4
Pan tailing	96.9	0.68	85.6

[⊕]

Calculated values.

These results indicate that after free silver has been removed, the residual particles still contain silver.

(Details of Experimental Tests, cont'd) -

Test No. 4.

This test was made to determine the results caused by various amounts of reagents and the extractions at different periods of agitation.

Samples of the tailings were ground in jar mills in cyanide solution, dilution 4 parts solids to 3 parts of solution. The grinding period remained constant and a representative screen test showed 73 per cent minus 200 mesh.

Alternate charges were made up to a strength of 1.0 pound and 2.0 pounds NaCN per ton of solution. The amount of lime added was increased in steps from 0.12 pound to 0.50 pound per ton of solution. The ratio of dilution was $1\frac{1}{2}$:1.

After 48 hours agitation, the pulps were filtered, sampled, and repulped in the same solution. Agitation was then continued for a further period of 24 hours. A portion of each sample thus received 72 hours of agitation.

Results:

Cyanidation, 48-Hour Period.							
Test:	Assays, : Ag. oz./ton:	Extraction of : Tail-silver, : lb./ton	Final : Titration, : lb./ton	Reagent : Consumed, : lb./ton	Ore		
No.:	Feed:	ing : per cent:	NaCN:	CaO	NaCN	CaO	
1	:3.88	0.59	84.8	0.68	0.12	1.28	1.82
2	:3.88	0.48	87.6	1.64	0.12	1.70	1.82
3	:3.88	0.52	86.6	0.72	0.21	1.22	4.68
4	:3.88	0.47	87.9	1.68	0.28	1.64	4.58
5	:3.88	0.52	86.6	1.08	0.52	0.68	7.22
6	:3.88	0.45	88.4	2.36	0.50	1.04	7.25

Cyanidation, 72-Hour Period.							
1	:3.88	0.46	88.1	0.92	0.08	1.41	2.28
2	:3.88	0.37	90.5	2.24	0.12	1.80	2.22
3	:3.88	0.43	88.9	1.06	0.28	1.20	5.58
4	:3.88	0.40	89.7	2.36	0.26	1.62	5.61
5	:3.88	0.42	89.2	1.08	0.52	1.17	8.42
6	:3.88	0.38	90.2	2.36	0.52	1.62	8.45

The results indicate that the 2.0 pounds NaCN per ton solution gives a higher extraction than the 1.0 pound

(Details of Experimental Tests, cont'd) -

NaCN per ton solution.

Increasing the period of agitation results in a higher extraction. The test indicates that a high concentration of lime is not required.

N.B.: The feed to the tests was obtained from a 2-bag lot which was resampled and had a head assay of 3.88 ounces silver per ton on the minus 14 mesh ore.

Test No. 5.

This test was made to determine the effect of adding mercuric hydroxide to the pulp at the rate of 1 part mercuric hydroxide to 20,000 parts of ore.

Two samples of tailings were ground in jar mills, in water, dilution 4:3, to 74 per cent minus 200 mesh. The pulp was diluted to a dilution of 2:1. Cyanide was added to the charges at the rate of 5.0 pounds NaCN per ton of solution. Lime was added at the rate of 2.0 pounds per ton of ore.

Mercuric hydroxide was added to the pulp of No. 2; none was added to No. 1. After 24 hours of agitation the pulp was sampled, and the agitation was concluded after 48 hours.

Results:

Cyanidation, 24-Hour Period.

Test:	Assays, :		Extraction of :		Final Titration, :		Reagent Consumed, :	
	Ag. oz./ton :		Tail-silver, :		lb./ton Soln. :		lb./ton Ore :	
No.:	Feed:	ing :	per cent:	NaCN :	CaO :	NaCN :	CaO :	
1 :	3.74	0.44	88.2	5.0	0.5	2.0	3.0	
2 :	3.74	0.45	88.0	5.0	0.5	2.0	3.0	

Cyanidation, 48-Hour Period.

1 :	3.74	0.36	90.4	4.8	0.4	2.4	3.2
2 :	3.74	0.35	90.6	4.8	0.4	2.4	3.2

The reducing power of each of the solutions after 48 hours was 88 c.c. N/10 KMnO₄ per litre.

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(Details of Experimental Tests, cont'd) -

The addition of the mercuric hydroxide did not show any appreciable effect in this test.

FLOTATION.

Test No. 6.

This test was made to observe the recovery by bulk flotation of the tailing as received.

A sample of the tailing was conditioned in a flotation machine with the following reagents:

Soda ash	-	0.2 lb./ton
Barrett's No. 4	-	0.06 "
No. 301	-	0.10 "
No. 208	-	0.10 "
Amyl xanthate	-	0.10 "
Aerofloat No. 25	-	0.05 "

pH of pulp, 9.8

After removing a concentrate, a further addition of reagents was made.

Copper sulphate	-	0.6 lb./ton
Amyl xanthate	-	0.10 "
Pine oil	-	0.05 "

The resulting concentrate was added to the first.

It was noted that there was no appreciable amount of metallic minerals in the froth. The rougher concentrate was recleaned without additional reagents.

Results:

Products	Weight, : per : cent	Assay, : Ag, : oz./ton	Distribution, : of silver, : per cent	Ratio of Concentration
Rougher conc.	5.7	42.09 [Ⓢ]	60.2	17.7:1
Cleaner "	1.6	113.14	45.5	62.9:1
Cleaner tailing:	4.1	14.34	14.7	24.6:1
Flot. tailing	94.3	1.67	39.8	
Flot. feed	100.0	3.96 [Ⓢ]	100.0	

Ⓢ These assays were calculated values.

(Details of Experimental Tests, cont'd) -

Test No. 7.

This test was made to observe the results of desliming the tailing and floating the slimes and sands separately. The sands were screened on 48 mesh, and the plus and minus 48 mesh portions were treated separately.

Flotation of Slimes -

Reagents Added to the Flotation Machine:

Soda ash	-	0.4	lb./ton	(pH, 9.3)
Barrett's No. 4	-	0.06	"	
No. 208	-	0.10	"	
No. 301	-	0.10	"	
Amyl xanthate	-	0.10	"	
Aerofloat No. 25	-	0.05	"	

Condition 10 minutes, flotation 7 minutes.

Recleaned rougher concentrate, no reagents.

Results, Flotation Slimes:

Products	Weight, : per : cent	Assays, : Ag, : oz./ton	Distribution, : of silver, : per cent	Ratio of Concentration
Rougher conc.	16.6	25.85	70.2	6.04:1
Cleaner conc.	6.7	49.96	54.8	49.9:1
Cleaner tailing	9.9	9.50	15.4	10.1:1
Flot. tailing	83.4	2.18	29.8	
Flot. feed	100.0	6.10	100.0	

Flotation of Minus 48 Mesh Ore -

Reagents Added to the Flotation Machine:

Soda ash	-	0.4	lb./ton
Coal Tar Creosote No. 634	-	0.06	

Condition 10 minutes.

No. 208	-	0.1	lb./ton
No. 301	-	0.1	"
Amyl xanthate	-	0.1	"

Condition 3 minutes.

Addition of	
Cresylic acid	- 0.15 lb./ton
Pine oil	- 0.05 "

Flotation for 8 minutes.

Rougher concentrate recleaned, no reagents.

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(Details of Experimental Tests, cont'd) -

Results, Flotation of Minus 48 Mesh Ore:

Products	Weight, : per : cent	Assays, : Ag, : oz./ton	Distribution, : of silver, : per cent	Ratio : of : Concentration
Rougher conc.	: 2.5	116.16	65.7	39.4:1
Cleaner conc.	: 1.0	234.75	59.5	100:1
Cleaner tailing	: 1.5	15.78	6.2	65:1
Flot. tailing	: 97.5	1.39	34.3	
Flot. feed	: 100.0	3.95	100.0	

Flotation of Plus 48 Mesh Ore -

An attempt was made to float this fraction without regrinding. As no appreciable results were obtained, the pulp was removed from the flotation machine and reground in a ball mill.

Reagents Added to the Ball Mill:

Soda ash - 0.4 lb./ton
Coal tar
creosote No. 634 - 0.10 "

Reagents Added to the Flotation Machine:

No. 208 - 0.1 lb./ton
No. 301 - 0.1 "
Amyl xanthate - 0.1 "
Cresylic acid - 0.15 "

Flotation time, 8 minutes.

The rougher concentrate was recleaned twice without reagents. A screen test was made on the flotation tailing.

Results, Flotation of Plus 48 Mesh Ore:

Products	Weight, : per : cent	Assays, : Ag, : oz./ton	Distribution, : of silver, : per cent	Ratio : of : Concentration
Rougher conc.	: 9.8	27.67	78.9	10.2:1
Cleaner conc.	: 1.5	124.48	47.2	76.3:1
Cleaner tail- ing No. 1	: 6.0	11.20	19.7	16.5:1
Cleaner tail- ing No. 2	: 2.5	16.72	12.0	40.5:1
Flot. tailing	: 90.2	0.81	21.1	
Flot. feed	: 100.0	3.45	100.0	

(Details of Experimental Tests, cont'd) -

Screen Test on Flotation Tailing

<u>Mesh</u>	<u>Weight, per cent</u>
-20 +35	0.4
-35 +48	3.8
-48 +65	17.9
-65+100	23.2
-100+150	21.2
-150+200	11.0
-200	22.5

The results indicate that on cleaning the low grade rougher concentrate, 31.7 per cent of the silver in the feed reports in the cleaner tailing.

Test No. 8-A - Flotation.

Test No. 8-A was made to note the effect of regrinding the tailing prior to flotation.

Reagents Added to the Ball Mill:

Soda ash	-	0.6 lb./ton
No. 208	-	0.1 "
Barrett's No. 4	-	0.15 "

Grind, 67 per cent minus 200 mesh.
Dilution, 4:3.

Reagents Added to Flotation:
(pH of pulp, 9.2.)

No. 301	-	0.1 lb./ton
Amyl xanthate	-	0.1 "
Cresylic acid	-	0.15 "

Recleaned the concentrate with 0.05 pound amyl xanthate per ton.

Results:

<u>67 Per Cent Minus 200 Mesh Grind.</u>				
Products	Weight, per cent	Assays, Ag, oz./ton	Distribution, of silver, per cent	Ratio of Concentration
Rougher conc.	6.7	46.12	76.4	14.9:1
Cleaner conc.	3.3	84.96	69.2	20.4:1
Cleaner tailing	3.4	8.54	6.2	29.4:1
Flot. tailing	93.3	1.02	23.6	
Flot. feed	100.0	4.04	100.0	

(Details of Experimental Tests, cont'd) -

Test No. 8-B. - Flotation.

A similar test was made using the same reagents but grinding to 84 per cent minus 200 mesh.

Results:

Products	Weights, : per : cent	Assays, : Ag, : oz./ton	Distribution, : of silver, : per cent	Ratio : of : Concentration
Rougher conc.	: 8.7	35.09	78.4	11.5:1
Cleaner conc.	: 3.5	76.72	68.4	28.8:1
Cleaner tailing	: 5.2	7.42	10.0	19.2:1
Flot. tailing	: 91.3	0.92	21.6	
Flot. feed	: 100.0	3.89	100.0	

Test No. 8-C. - Flotation.

Using a grind of 89.6 per cent minus 200 mesh, the following reagents were tried:

Reagents Added to the Ball Mill:

Sodium hydroxide - 1.0 lb./ton
Sodium silicate - 1.0 "
Barrett's No. 4 - 0.2 "

Reagents Added to Flotation: (pH, 10.2.)

No. 208 - 0.4 lb./ton
No. 301 - 0.4 "
Cresylic acid - 0.10 "
Pine oil - 0.05 "

Flotation time, 8 minutes.

Re-cleaned the concentrate three times without reagents and combined the cleaner tailings for assay.

Results:

Products	Weight, : per : cent	Assays, : Ag, : oz./ton	Distribution, : of silver, : per cent	Ratio : of : Concentration
Rougher conc.	: 17.5	20.09	84.3	5.87:1
Cleaner conc.	: 2.7	102.08	67.1	37.5:1
Cleaner tailing	: 14.3	4.86	17.2	7.0:1
Flot. tailing	: 83.0	0.77	15.7	
Flot. feed	: 100.0	4.06	100.0	

(Details of Experimental Tests, cont'd) -

Test No. 9. - Flotation.

This test was made to note the effect of using a sulphidizing reagent.

Reagent Added to the Ball Mill:

Sodium hydroxide	-	1.0 lb./ton
Sodium sulphide	-	2.0 "
Coal Tar Creosote No. 634	-	0.2 "

Dilution, 4:3

Grind 76 per cent minus 200 mesh.

Reagents Added to the Flotation Machine:

No. 208	-	0.4 lb./ton
No. 301	-	0.4 "
Amyl xanthate	-	0.4 "
Cresylic acid	-	0.1 "
Pine oil	-	0.05 "

Flotation time, 7 minutes. pH of pulp, 10.4.

A similar test was ground 82 per cent minus 200 mesh.

The rougher concentrates were subsequently treated by cyanidation and were not recleaned.

Results of Flotation:

Products	Weights, : per : cent	Assays, : Ag, : oz./ton	Distribution, : of silver, : per cent	Ratio : of : Concentration
Rougher conc.	: 12.5	24.90	82.8	8.0:1
Flot. tailing	:			
No. 1	: 43.6	0.72	8.5	
Flot. tailing	:			
No. 2	: 43.9	0.74	8.7	
Combined tailings:				
Nos. 1 and 2	: 87.5	0.73	17.2	
Calc. feed	: 100.0	3.74	100.0	

N.B.: Flot. tailing No. 1 was 82 per cent
minus 200 mesh.
Flot. tailing No. 2 was 76 per cent
minus 200 mesh.

The sulphidizing reagent appeared to be beneficial
in this test.

(Details of Experimental Tests, cont'd) -

Test No. 10 - Cyanidation of Flotation
Rougher Concentrate.

This test was made to note the extraction of silver, by cyanidation, from flotation rougher concentrates.

Four samples of minus 14 mesh tailing were used to prepare a rougher concentrate for cyanidation.

Reagents Added to the Ball Mill:

Sodium hydroxide	Test A	Test B	Test C	Test D
	(Lb./ton)			
Sodium hydroxide -	1.0	1.0	1.0	1.0
Sodium silicate -	1.0	-	1.0	-
Barrett's No. 4 -	0.2	0.2	0.2	0.2
Grind, -200 mesh -	82%	91%	82%	90%

Dilution, 4:3.

Reagents Added to the Flotation Machine: (Lb./ton)

Amyl xanthate -	0.65	0.75		
No. 208 -	-	-	0.4	0.4
No. 301 -	-	-	0.4	0.4
Cresylic acid -	0.10	0.10	0.10	0.10
Pine oil -	0.05	0.05	0.05	0.05

pH, 10.1.

Flotation time, 8 minutes for each sample.

Results of Flotation:

Products	Weight, : per : cent	Assays, : Ag, : oz./ton	Distribution, : of silver, : per cent	Ratio : of : Concentration
Rougher conc.	10.6	29.38	78.7	9.4:1
Combined flota- tion tailing	89.4	0.96	21.3	
Flotation feed	100.0	4.05	100.0	
Flot. tailing A	22.8	0.98	5.5	
" " B	22.1	0.93	5.1	
" " C	23.1	0.97	5.6	
" " D	21.4	0.96	5.1	

The bulk concentrate recovered by flotation was filtered, washed, sampled, and divided into four charges. Each was then repulped in cyanide solution containing 5 pounds NaCN per ton of solution. Lime was added at the

(Details of Experimental Tests, cont'd) -

rate of 10 pounds CaO per ton of concentrate (dry weight), for protective alkalinity. The pulps were then subjected to agitation for periods of 24, 48, 72 and 96 hours.

Results of Cyanidation of Flotation Concentrate:

	:	:	Extraction	:	:	:	:	:	:
	:	:	of silver,	:	:	:	:	:	:
Period :	Assays,	:	per cent	:	Final	:	Reagent	:	Reducing
of agi-	Ag, oz./ton:	From :	In Terms:	:	Titration,	:	Consumed,	:	power.
tion,	:	Tail-	conc.: of Orig.	:	lb./ton Soln:	:	lb./ton Ore:	:	c.c.N/10
hours	:Feed:	ing :	: Feed	:	NaCN: CaO	:	NaCN : CaO	:	KMnO ₄ /L.
24	:29.88	1.85	93.8	:	73.9	:	3.5	:	1.0
48	:29.88	1.28	95.7	:	75.4	:	4.1	:	0.6
72	:29.88	1.12	96.2	:	75.8	:	4.8	:	0.8
96	:29.88	1.02	96.6	:	76.0	:	4.9	:	0.8
	:			:		:		:	

The calculated combined tailing from flotation and cyanidation was as follows:

After 24 hours of agitation	-	1.06	Ag oz./ton
" 48 "	-	0.99	" "
" 72 "	-	0.98	" "
" 96 "	-	0.97	" "

Test No. 11 - Cyanidation of A Flotation Concentrate.

This test was made to note the effect of adding lead nitrate to the pulp at the rate of one-half pound per ton of solution.

A rougher concentrate containing 82.9 per cent of the silver in the feed was agitated in a five pounds NaCN per ton solution for 24 hours. Lead nitrate at the rate of 0.5 pound per ton of solution was added to No. 1 pulp.

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* Lead nitrate added (0.5 lb./ton solution).

Reducing power of solution:

- (1) 96 c.c. N/10 KMnO₄ per litre.
- (2) 156 " " " " " "

(Details of Experimental Tests, cont'd) -

The lead nitrate reduced the amount of fouling, but did not increase the extraction in this test.

Test No. 12 - Settling Tests.

This test was made to note the rate of settling of the pulp at various dilutions. A sample of the ore was ground in water with 4.0 pounds of lime per ton dry weight. A screen test shows that 84.5 per cent of the ground pulp was minus 200 mesh. No cyanide was used. A sample of the tailing was found to have a specific gravity of 2.96.

The ground ore was placed in a cylinder 2 inches in diameter at a dilution of 1.62:1. Titration for CaO, 0.3 pound per ton solution. Readings of the pulp level were made at intervals of 5 minutes for 1 hour. The pulp was then diluted to 2:1 and a similar set of readings was made.

Results:

		<u>DILUTION, 1.62:1</u>		<u>DILUTION, 2:1</u>	
Time,	Height,	Drop,	Height,	Drop,	
Minutes:	of Pulp, ft.:	in feet:	of Pulp, ft.:	in feet	
0	3.360	--	3.940	--	
5	3.315	0.045:	3.89	0.05	
10	3.285	0.03 :	3.85	0.04	
15	3.245	0.04 :	3.81	0.04	
20	3.220	0.025:	3.77	0.04	
25	3.200	0.02 :	3.72	0.05	
30	3.17	0.03 :	3.68	0.04	
35	3.14	0.03 :	3.64	0.04	
40	3.11	0.025:	3.60	0.04	
45	3.09	0.025:	3.56	0.04	
50	3.06	0.03 :	3.52	0.04	
55	3.035	0.025:	3.48	0.04	
60	3.005	0.03 :	3.44	0.04	
Totals :	0.355	0.355	0.50	0.50	
		ft./hr.		ft./hr.	

Conclusions:

The results of the tests indicate that the tailings, as represented by the samples under investigation, require

(Conclusions, cont'd) -

grinding to obtain a maximum recovery by either cyanidation or flotation.

The 2.0 pound NaCN per ton solution appears to give the best recovery from the tailing for the same periods of agitation. A stronger solution is required for the flotation concentrates.

The use of mercuric hydroxide did not appear to raise extraction.

The addition of lead nitrate to cyanide solution did not increase extraction but appeared to reduce the amount of fouling in the solution.

The tests indicate that by cyanidation 79 per cent of the silver could be recovered from the tailing as received and that by grinding 73 per cent minus 200 mesh up to 90.5 per cent of the silver could be recovered.

By flotation on the tailing, as received, 45.5 per cent of the silver was recovered. On regrinding the tailing, up to 84 per cent of the silver was recovered in a low grade (20 ounces) concentrate.

The overall recovery by combining cyanidation and flotation was only 76 per cent of the silver, depending on the period of agitation of the flotation concentrate.

The final conclusions for treatment were not decided by the methods used in the tests. Further work was done by Mr. Devine both here and at the property.

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WSJ:AKA:LB.