DIVISION OF
ORE DRESSING AND
METALLURGY

DEPARTMENT OF MINES
CANADA

MINES BRANCH

O T T A W A July 21st, 1930.

R E P O R T

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ORE DRESSING AND METALLURGICAL LABORATORIES

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By A.K. Anderson.

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Shipments: Two shipments of ore, gross weight 390 pounds, the first contained in four sacks and the second in two sacks were received at the Laboratories on March 17, 1930 and April 2, 1930. These came from the Animikie Mines, Ltd., 8 Cumberland Street South, Port Arthur, Ontario, S.W. Ray, Secretary, E.C. Tripp, President.

Characteristics of the Ore: The ore consisted of a limestone and calcite gangue carrying a small amount of iron sulphide. The silver is present chiefly as proustite, ruby silver.

Purpose of Experimental Tests: The shipments were made for the purpose of determining the best method to employ for the

recovery of the contained values. The two lots were combined for testing.

Sampling and Analysis: The combined lots were stage crushed and quartered by passing through a Jones Riffle Sampler until a representative portion was secured for analysis. This showed the shipment contained 46.0 oz. silver and 0.02 oz. gold per ton.

Experimental Tests: The majority of the tests were made to determine the most suitable flotation reagents to use for the concentration of the silver in the ore. Some few cyanide tests were also carried out to note what recoveries could be obtained by this process.

Flotation

All flotation tests were made on 1000 gram portions of the ore crushed to pass a 14 mesh screen, ground with water in a porcelain mill containing iron balls to approximately 80% through 200 mesh. The pulp was then floated in a mechanically agitated flotation machine with reagents as noted in the tests.

Test #1

Reagents in Pounds Per Ton

To Ball Mill		To Flotation Machine	
Soda Ash	4.0	Potassium Ethyl Xanthate	0.14
		Pine Oil	0.06

Product	% Wt.	Assay Au oz/ton	Assay Ag oz/ton	% Values Au	% Values Ag
Flotation conc.	6.04	0.28	684.00	84.6	88.0
" tail.	93.96	trace	6.00	15.4	12.0
Heads (cal.)	100.0	0.02	46.95	100.0	100.0

Potassium xanthate and pine oil in a circuit alkaline with soda ash give a recovery of 88% of the silver in a rougher

concentrate assaying 684,00 oz. silver per ton. Six oz. silver remains in the tailing.

Test #2

In this test the ore was ground with 4 pounds soda ash per ton and floated first with 0.10 pounds American Cyanamid reagent #208 and 0.06 pounds pine oil. After removal of this concentrate an addition of 0.10 pounds aerofloat #25 was made and a second concentrate removed.

Product	% Wt.	Assay		% Values	
		Au oz/ton	Ag oz/ton	Au	Ag
Concentrate #1	3.6	0.36	962.60	48.7	76.4
Concentrate #2	3.5	0.30	216.80	39.4	16.6
Tailing	92.9	trace	3.40	11.9	7.0
Heads (cal.)	100.0	0.026		100.0	100.0

A screen analysis of the tailing shows,-

Mesh		% Wt.	Assay	
			Au oz/ton	Ag oz/ton
	+100	1.4	0.15	162.80
-100	+150	6.5	0.02	5.23
-150	+200	8.9	trace	2.04
-200		83.2	trace	0.72
		100.0		

This screen analysis indicates the possibility of the presence of native silver as shown by the very high assay of the +100 mesh portion. Fine grinding to at least 150 mesh is apparently required.

Test #3

The effect of aerofloat #25 alone was investigated in the test. 5.0 pounds per ton soda ash was added to the grinding mill and 0.20 pounds per ton aerofloat to the flotation machine.

Product	% Wt.	Assay		% Values	
		Au oz/ton	Ag oz/ton	Au	Ag
Flotation conc.	4.8	0.52	884.00	100.0	94.1
" tail.	95.2	trace	2.80	-	5.9
Heads (cal.)	100.0	0.02	45.10	100.0	100.0

American Cyanamid Company's aerofloat #25 appears to be efficient in the flotation of the ore.

Test #4

Canadian Industries Limited flotation reagent Flotagen was next tried. Soda ash equivalent to 5 pounds per ton of ore was added to the grinding mill and 0.20 pounds per ton Flotagen to the flotation machine.

Product	% Wt.	Assay		% Values	
		Au oz/ton	Ag oz/ton	Au	Ag
Flotation conc.	6.1	0.38	698.20	100.0	92.0
" tail.	93.9	trace	3.92	-	8.0
Heads (cal.)	100.0	0.023	46.27	100.0	100.0

Flotagen added to the cells gives a slightly lower recovery and a lower grade product than that in test #3.

Test #5

In this test Flotagen was ground with the ore instead of being introduced into the circuit after grinding.

Product	% Wt.	Assay		% Values	
		Au oz/ton	Ag oz/tn	Au	Ag
Flotation conc.	5.3	0.32	829.90	84.8	94.8
" tail.	94.7	trace	2.54	15.2	5.2
Heads (cal.)	100. 0	0.02	46.39	100.0	100.0

It is apparent that adding this reagent to the grinding circuit gives better results than adding it to the flotation cells. The grade of concentrate and recovery are higher than in the preceding one.

Test #6

In this test, the ore was ground finer than in preceding tests, 90% passing 200 mesh. Flotation was made in a circuit alkaline with 5 pounds soda ash per ton. Aerofloat #25 was added at the rate of 0.20 pounds per ton. The concentrate was cleaned to note what grade of product could be obtained.

Product	% Wt.	Assay		% Values	
		Au oz/ton	Ag oz/ton	Au	Ag
Concentrate	2.1	0.54	1999.50	64.8	87.0
Middling	8.8	0.07	36.00	35.2	6.6
Tailing	89.1	trace	3.50	-	6.4
	100.0	0.017	48.28	100.0	100.0

The combined middling and concentrate represent a recovery of 93.6% of the silver. Cleaning this gives a 2000 oz. concentrate. In practice the middling would be returned to the circuit and the contained values recovered in the concentrate.

Test #7

In this test table concentration was tried. 1000 grams of the ore was ground with water in a ball mill to pass 80% through 200 mesh and then concentrated on a small Wilfley table.

Product	% Wt.	Assay		% Values	
		Au oz/ton	Ag oz/ton	Au	Ag
Table conc.	2.5	0.50	1241.20	72.0	67.4
" tail.	97.5	0.005	15.40	28.0	32.6
Heads (cal.)	100.0	0.017	46.04	100.0	100.0

Table concentration does not give the recoveries secured by flotation.

Cyanidation

To determine the recovery obtained by cyaniding the raw ore, 200 gram portions were ground to pass 100, and 150 mesh, and then agitated with a 6.3 pound cyanide solution, 3:1

dilution for 48 hours with the following results.

Mesh	CaO added lb/ton	Tailing Assay Au oz/ton	Tailing Assay Ag oz/ton	% Rec.	lb/ton Reagent consumption KCN	lb/ton Reagent consumption CaO
100	3.0	trace	5.64	87.7	6.9	2.2
100	6.0	trace	3.52	92.3	6.6	4.5
150	3.0	trace	12.94	71.9	6.9	2.2
150	6.0	trace	3.94	91.4	6.0	4.5

These results indicated that ore ground to pass 100 mesh is attached as readily as when ground to pass 150 mesh.

A recovery of 92.3% of the silver is obtained within 48 hours with a cyanide consumption of 6.6 pounds per ton of ore treated.

Flotation followed by Cyanidation

A 1000 gram portion of the ore -14 mesh was ground in water to pass 90% through 200 mesh. Soda ash at the rate of 5 pounds per ton was added to the mill. A flotation concentrate was then removed by the addition of 0.20 pounds aerofloat #25 per ton.

After floating, the tailing was dewatered and cyanided for 48 hours with a 5.0 pounds cyanide solution, 3:1 dilution. Lime at the rate of 3 pounds per ton was added.

Product	% Wt.	Assay Au oz/ton	Assay Ag oz/ton	% Values Au	% Values Ag
Flotation conc.	5.41	0.40	829.00	100.0	95.7
" tail.	94.59	trace	2.12	-	4.3
Heads (cal.)	100.00	0.02	46.85	100.0	100.0

Cyaniding the above tailing reduces this product from 2.12 oz. to 0.72 oz. silver per ton, a recovery of 66.0% of the silver not recovered by flotation.

However, this saving amounts to but 1.4 oz. per ton, not sufficient to warrant the expense of cyaniding.

Summary and Conclusions: From the above results it is seen that concentration by flotation can be depended on to yield a recovery of 95% of the silver in the ore.

By refloating the rougher concentrate a product containing 2000 oz. silver per ton can be obtained.

This product may either be shipped to a smelter or treated hydrometallurgically for extraction of the gold and silver.

Which one of these two alternatives to adopt can best be determined by the owners as costs will be the deciding factor.