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DEPARTMENT OF MINES AND RESOURCES
BUREAU OF MINES
CANADA

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Ottawa, July 31, 1946.

R E P O R T
of the
ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 2084.

Cyanidation and Concentration Tests on a Sample
of Silver-bearing Material taken from the
Bed of Cobalt Lake, at Cobalt, Ontario.

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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.

(Copy No. 13.)

O T T A W A

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of Silver-bearing Material taken from the
Bed of Cobalt Lake, at Cobalt, Ontario.

Shipment:

Seven bags of the material, total weight 309 pounds,
was received on June 19, 1946. The sample was submitted by
A. Hasselbring, Manager, Silanco Mining and Refining Company
Limited, Cobalt, Ontario.

Location of Property:

The sample submitted is said to have been taken from
the bed of Cobalt Lake but the exact location of the spot from
which it was taken is not given. It might be mentioned here
that approximately half a dozen properties operating in this
area, using as many different processes, dumped mill tailings
promiscuously into this lake years ago. The results of the
following tests must therefore be considered as applicable
only to the sample submitted.

Sampling and Assaying:

The shipment received was sampled and assayed, and reported as follows:

Gold	-	Trace.
Silver	-	3.91 oz./ton
Copper	-	0.042 per cent
Nickel	-	0.012 "
Cobalt	-	0.018 "
Iron	-	5.04 "
Sulphur	-	0.20 "
Arsenic	-	0.10 "
Antimony	-	None detected.
Insoluble	-	77.66 per cent

Purpose of Tests:

The tests were conducted to find out whether or not any worthwhile quantity of silver could be recovered economically from the sample submitted, and by what means.

Results of Experimental Tests:

About 70 per cent of the silver can be extracted in 48 hours without grinding and this figure can be raised to 80 per cent by grinding the feed finer than 100 mesh.

By flotation a very small amount of very high-grade concentrate can be produced with or without grinding.

The tailing loss will be reduced by 5 to 10 per cent of the total silver by grinding the feed finer than 100 mesh.

Conclusions:

The results of tests conducted on the sample submitted indicate that as much as 70 per cent of the silver can be extracted by cyanide solution without grinding. The solution used in these tests carried 3.0 pounds of sodium cyanide per ton. A high lime content in the cyanide circuit seems to reduce the quantity of cyanide consumed. The material as received is about 12 to 14 per cent coarser than 35 mesh and about 31 per cent finer than 200 mesh. If it be ground all through 100 mesh, extraction by cyanide solution will be

(Conclusions, cont'd) -

increased to about 80 per cent.

Flotation tests were conducted on the sample with and without grinding and in all cases a small amount of very high grade concentrate was produced after cleaning, leaving a cleaner tailing product to be circulated.

When the material was fed to flotation as received a little more than than 42 per cent of the silver was lost in the tails. When the feed was ground finer than 100 mesh the tailing loss was reduced to 35 per cent in one test and to 32 per cent in another.

Taking the current price of silver as 90.5 cents per ounce the value of the feed is \$3.54 per ton. The extra 10 per cent recovery resulting from grinding will therefore amount to 35 cents per ton in money and will have to pay the cost of grinding and classification.

Since the character of the contents of Cobalt Lake will vary widely from place to place, it must be stressed here that these results apply only to the sample submitted.

Character of the Sample:

No polished sections were made because the sample as received was rather finely ground. The gangue constituents, however, were mostly carbonates and siliceous matter, while the metallic constituents were only traces of copper, nickel and cobalt minerals.

DETAILS OF INVESTIGATION:

Tests Nos. 1 to 4. - Cyanidation.

Samples of the feed material were agitated in cyanide solution, 3.0 pounds NaCN per ton, for periods of 24 and 48 hours, without grinding, at a dilution ratio of 2:1. Protective alkalinity was maintained with lime which was added at the rate of 2.0 pounds per ton of ore to Tests Nos. 1

(Details of Investigation, cont'd) -

and 3 and 10 pounds per ton of ore to Tests Nos. 2 and 4. No further additions of lime were found necessary during the agitation periods. The cyanide tailings were filtered, washed, and assayed for gold.

Screen Analysis of Cyanide Tailing, Test No. 3.

Mesh Size	Weight, per cent	Assay, Ag, oz./ton	Distribution per cent of Content
+35	12.50	2.69	26.85
-35 +48	6.70	1.94	10.38
-48 +65	11.55	1.40	12.91
-65+100	12.50	1.10	10.98
-100+150	14.80	0.71	8.39
-150+200	11.10	0.66	5.85
-200	30.85	1.00	24.64
Average tailing	100.00	1.25	100.00

This screen analysis would indicate that the best extraction would be obtained by grinding the feed finer than 100 mesh. The higher assay in the -200 mesh fraction might indicate an accumulation of fine metallic silver or silver minerals. An amalgamation test was made to determine the effect of metallic silver, if present, on the cyanide tailing. The results indicated that no metallic silver was present.

Summary of Results, Tests Nos. 1 to 4.

Test No.	Agitation Period, hours	Tailing assay, Ag oz./ton	Extraction of silver per cent	REAGENTS			
				Final Titration, lb./ton NaCN	Consumed lb./ton feed CaO	NaCN	CaO
1	24	1.36	65.22	2.60	0.24	1.74	1.60
2	24	1.44	63.17	2.64	2.12	1.59	5.63
3	48	1.25	68.03	2.68	0.24	2.52	1.49
4	48	1.14	70.84	2.88	1.88	2.11	6.07

Test No. 5. - Grinding Before Cyanidation.

A sample of the feed material was ground in cyanide solution until about 75 per cent of it would pass through a 200-mesh screen. The pulp was then agitated for 48 hours at 2:1 dilution. Cyanide was maintained at 3.0 pounds of sodium

(Details of Investigation, cont'd) -

cyanide per ton of solution and protective alkalinity was maintained with lime. The tailings were filtered, washed and assayed for gold.

Results of Test No. 5:

Feed sample - 3.91 oz. Ag./ton
 Tailing assay - 0.75 "
 Extraction - 80.82 per cent

Reagents -

Reagents Consumed, lb./ton ore		Final Titration, lb./ton solution	
NaCN	CaO	NaCN	CaO
2.38	3.21	2.80	0.40

Reducing Power of Pregnant Solution -

66 c.c. $\frac{N}{10}$ $KMnO_4$ /litre.

Test No. 6. - Flotation Without Grinding.

A sample of the feed material was pulped in a flotation machine and floated as follows:

Charge:

Feed material - 2,000 grams
 Soda ash - 0.20 lb./ton
 Reagent No. 301 - 0.10 "
 Aerofloat No. 25 - 0.035 "
 Coal tar Creosote No. 4 - 0.064 "
 Sodium silicate - 1.50 "

 pH of pulp - 9.6
 Conditioning time - 5 minutes

 Potassium amyl xanthate - 0.10 lb./ton
 Pine oil - 0.05 "

The concentrate was cleaned twice and both cleaner tailings were combined. Sodium silicate was added to the cleaning cells.

Results of Test No. 6:

Product	:Weight,:		:Distribution	
	: per	: Assay,	: of silver,	
	: cent	: Ag, oz./ton:	: per cent	
Concentrate	: 0.131:	1,136.51 :	39.14	
Cleaner tailing	: 2.160:	32.10 :	18.23	
Flotation tailing	: 97.709:	1.66 :	42.63	
Feed sample (calc.)	: 100.00 :	3.804:	100.00	

(Details of Investigation, cont'd) -

Test No. 7. - Flotation After Grinding.

This test was conducted to determine the effect of grinding on flotation. The reagents used were the same as those used in Test No. 6. The concentrate was cleaned three times, the first cleaner tailing being kept separate while the second and third were combined. The feed was ground practically all through 100 mesh and 75 per cent finer than 200 mesh.

Results of Test No. 7:

Product	Weight, per cent	Assay, Ag, oz./ton	Distribution of silver, per cent
Concentrate	0.108	1,399.23	44.04
1st cleaner tailing	3.405	14.61	14.50
2nd and 3rd cleaner tailing	0.232	144.52	9.76
Flotation tailing	96.255	1.13	31.70
Feed (calc.)	100.00	3.43	100.00

Finer grinding will reduce the tailing loss and improve the grade of concentrate if operating technique is directed to that end. The economic value of grinding, however, remains doubtful.

Test No. 8. - Flotation After Grinding.

In this test the feed was ground the same as in Test No. 7. Caustic soda was substituted for soda ash in the reagent combination. The concentrate was cleaned twice and both cleaner tailings were combined for assay. Otherwise, conditions were the same as in test No. 7.

Results of Test No. 8:

Product	Weight, per cent	Assay, Ag, oz./ton	Distribution of silver, per cent
Concentrate	0.178	1,079.11	55.93
Cleaner tailing	1.166	26.60	9.03
Flotation tailing	98.656	1.22	35.04
Feed (calc.)	100.00	3.43	100.00

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(Details of Investigation, cont'd) -

The foregoing flotation results may be taken as indicative of what might be expected in a commercial operation. The products may vary somewhat with operating conditions but it should be possible to keep up the grade of the final concentrate and recover perhaps 60 per cent of the silver.

It is apparent, from the results of this investigation, that cyanidation will yield a higher return than will flotation from treating material represented by the sample furnished. Whether or not to regrind depends on the cost per ton. Thirty-five cents per ton additional recovery can be expected by so doing. If a large daily tonnage is milled, actual costs may be lower than this figure.

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