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August 6th, 1940.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 881.

Cyanidation Tests on a Gold Ore  
from Birch Lake, Patricia  
District, Ontario.

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CANADA

Bureau of Mines  
Division of Metallic  
Minerals

DEPARTMENT  
OF  
MINES AND RESOURCES

Mines and Geology Branch

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Shipment:

One bag of ore, weighing 26 pounds, was received on June 19th, 1940. The sample was submitted by Norman W. Byrne, Greenlee Mines, Limited, 1306 Star Building, 80 King St.W., Toronto, Ontario.

Character of the Ore:

Special samples of ore from this property were examined microscopically and described in a report (No. M-737-S) issued by the Mineragraphic Laboratory under date of May 30th, 1940.

The present sample of ore is very similar to the previous sample although the metallic mineral content is somewhat less.

Location of Property:

This property is located at Birch Lake, in Patricia district, Ontario.

Sampling and Assaying:

The sample was assayed and reported as follows:

Gold	=	0.25 oz./ton
Silver	=	0.05 "
Copper	=	0.01 per cent
Iron	=	3.72 "
Sulphur	=	1.70 "

Experimental Tests:

A series of small-scale tests, covering amalgamation, cyanidation and flotation, was conducted on the ore to determine how it might be treated.

A barrel amalgamation test showed that 72 per cent of the gold was free when the ore was ground 60 to 65 per cent finer than 200 mesh. At the same grind, 92 per cent of the gold can be recovered in a flotation concentrate, and a little better than 93 per cent extracted by cyanidation in 48 hours. While

most of the gold is readily soluble, the microscopic examination shows that the majority of it is quite fine. Hence any improvement in extraction over the results obtained here will depend on finer grinding.

Typical tests are described in detail, as follows:

Test No. 1 - Barrel Amalgamation.

A sample of the ore was ground to 63 per cent through 200 mesh in a ball mill, and amalgamated with mercury for one hour. The amalgamation tailing was assayed for gold. The object of this test was to determine the amount of gold that was set free by this amount of grinding.

Results:

Feed sample	- 0.25 ounce per ton gold
Amalgamation tailing	- 0.07 " " " "
Extraction	- 72 per cent

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Test No. 2 - Flotation.

A sample of the ore was ground to 65 per cent through 200 mesh in a ball mill with 2.0 pounds soda ash per ton added to the charge. A concentrate was then floated with the following reagents:

Amyl xanthate	- 0.10 lb./ton
Pine oil	- 0.10 " "

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(Test No. 2, cont'd) -

The products were assayed for gold. A sample of the tailing was examined for free gold with the aid of a superpanner, but none was found.

Summary of Results:

Product	: Weight : : per cent :	Assay : Au : : oz./ton :	Distribution : of gold, : per cent :
Flotation conc.	5.6	3.82	91.9
" tail.	94.4	0.02	8.1
Feed (cal.)	100.0	0.234	100.0

Ratio of concentration = 17.8:1.

Tests Nos. 3 and 4 - Cyanidation.

Samples of the ore were ground to 60 - 65 per cent through 200 mesh in cyanide solution. The pulps were then agitated for period of 24 and 48 hours at 1.5:1 dilution. The solution was kept at 1.0 pound per ton NaCN by additions of the salt from time to time. Samples of the tailings were examined for undissolved free gold with the aid of a superpanner, but none was found.

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(Tests Nos. 3 and 4, cont'd) -

Screen Analyses of Cyanide Tailings:

24-Hour Tailing Sample - Test No. 3.		
Mesh	Weight, : per cent	Assay, : Au oz./ton
+100	: 5.6	0.03
-100 +150	: 13.6	0.02
-150 +200	: 19.4	0.02
-200	: 61.4	0.02
Cyanide tailing	: 100.0	0.0205

48-Hour Tailing Sample - Test No. 4.		
Mesh	Weight, : per cent	Assay, : Au oz./ton
+100	: 5.9	0.02
-100 +150	: 12.5	0.02
-150 +200	: 16.0	0.02
-200	: 65.6	0.015
Cyanide tailing	: 100.0	0.0167

Summary of Results, Tests Nos. 3 and 4:

(Feed sample assay, Au 0.25 oz./ton.)							
Test No.	Agitation, : hours	Assay, : oz./ton	Extraction, : per cent	Final titration, : solution	Reagents : consumed, : lb./ton ore	NaCN	CaO
3	24	0.0205	91.8	1.00	0.27	0.30	3.60
4	48	0.0167	93.3	1.04	0.30	0.44	4.15

The foregoing screen analyses indicate that the ore will have to be finely ground in order to obtain high extraction. The required period of agitation will be in the neighbourhood of 36 to 48 hours.

Test No. 5 - Cyanidation.

A sample of the ore was given a preliminary grind in cyanide solution, after which the pulp was treated on a concentrating table where most of the sulphides and coarse gangue were taken out. The table concentrate was reground in cyanide solution, and then reunited with the table tailing. The pulp was then agitated in cyanide solution, 1.0 pound per ton NaCN, for 42 hours.

The object of the test is to obtain a finer overall grind than in Tests Nos. 3 and 4, and also to selectively grind the sulphides and determine whether or not the refractory gold is associated with the sulphide minerals or the gangue.

To do this, the cyanide tailing was infrasized and the products assayed for gold and sulphur.

Summary of Results:

(Feed sample 0.25 oz./ton Au.)						
Particle size		Weight		Assay		Distribution,
in microns		: per cent		: oz./ton : per cent		: per cent
						Au : S
+56		22.0		0.02	0.36	29.5 4.7
-56 +40		16.0		0.02	1.05	21.5 10.0
-40 +28		11.5		0.015	1.68	11.6 11.5
-28 +20		10.4		0.015	2.41	10.5 14.9
-20 +14		9.1		0.01	2.78	6.1 15.1
-14 +10		7.1		0.01	2.77	4.8 11.7
-10		23.9		0.01	2.26	16.0 32.1
Cyanide tailing		100.0		0.0149	1.68	100.0 100.0

Extraction = 94.0 per cent.

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(Test No. 5, cont'd) -

The gold and sulphur assays on the infrasized product indicate that the refractory gold is associated with the gangue minerals rather than with the sulphides.

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Conclusions:

Tests conducted on this ore indicate that about 94 per cent of the gold can be extracted by cyanidation with the ore ground 75 to 80 per cent through 200 mesh.

The microscopic examination of the special sample revealed the presence of a considerable quantity of extremely fine gold associated with the gangue minerals. The gold and sulphur assays in the infrasizer analysis in Test No. 5 show further evidence that the refractory gold is locked up in gangue minerals and not associated with the sulphides. Fine grinding will be necessary to expose this gold to the dissolving action of cyanide solution.

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