DEPARTMENT OF MINES AND RESOURCES

BUREAU OF MINES

CANADA

Ottawa, May 29, 1946.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 2055.

IR 2055

Flotation and Cyanidation Tests on a Sample of Gold Ore from Hasaga Gold Mines Limited, at Red Lake, Ontario.

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BUREAU OF MINES
DIVISION OF METALLIC MINERALS
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Shipment:

A shipment of three bags of rock, total weight 105 pounds, was received on February 21, 1946. The shipment was submitted by Hasaga Gold Mines Limited, Red Lake, Ontario, per A. E. Pugsley, manager.

Location of Property:

The property from which this ore was taken is located along the border of Dome and Heyson townships, in the Red Lake area of Ontario.

Purpose of Tests:

These tests were conducted in order to compare the relative merits of the two following processes:

(1) Straight cyanidation of the ore.

(2) Flotation of the ore followed by cyanidation of the concentrate.

Sampling and Assaying:

The sample submitted was assayed and reported as follows:

Gold	-	0.075 oz./ton.
Silver	-	0.08 "
Copper	-	None detected.
Iron	-	2.00 per cent
Sulphur	-	0.68 "
Arsenic	-	None detected.
Insoluble	-	88.06 per cent.

A sample of minus 20 mesh ore was panned but no free gold was noticed. The sulphides recovered in the pan were then decomposed with nitric acid and several grains of gold, in a wide range of sizes, were observed.

Results of Experimental Tests:

The tests conducted showed enough coarse gold present to give erratic results at times. They also showed that straight cyanidation was somewhat more efficient than cyanidation of flotation concentrates.

Conclusions:

For straight cyanidation the ore should be ground all through 48 mesh and about 40 per cent minus 200 mesh. A 48-hour agitation period should be sufficient.

A jig or gold trap should be used in the grinding circuit between the mill and the classifier, in order to prevent the accumulation of coarse gold there. Any gold so recovered should be amalgamated and the amalgamation tailing sent on to the agitators. In this way 94 to 95 per cent of

(Conclusions, cont'd) -

the gold should be extracted.

Should it be decided to float the ore, this same precaution should also be taken. In this case a unit cell equipped with a gold trap might be used in the grinding circuit.

The tests indicate that, on the average, extraction will be perhaps 2 or 3 per cent better by straight cyanidation than by cyanidation of concentrates. The best that can be hoped for is to make a flotation tailing equal to the cyanide tailing from the ore. To this must be added the cyanide tailing from treatment of the flotation concentrate.

Description of the Ore:

Six polished sections were prepared from the sample and examined microscopically for the purpose of determining the character of the ore.

Gangue -

Gangue consists of fine-textured, dark grey country rock which contains a considerable amount of fine disseminated carbonate and some quartz. In two or three of the polished surfaces it shows a schistose structure and probably represents a silicified and carbonated greenstone schist.

Metallic Minerals -

Metallic mineralization is sparse and gangue forms most of the six polished sections.

Pyrite predominates as moderately coarse to fine crystals and grains disseminated sparingly through gangue. Very small quantities of ilmenite and chalcopyrite are present as rare tiny particles in gangue and in pyrite. No gold was seen in the sections, but this is to be expected because of the very small amount of the metal in the ore sample.

DETAILS OF INVESTIGATION:

Tests Nos. 1 and 2. - Straight Cyanidation.

Samples of the ore, dry crushed to minus 20 mesh, were ground in cyanide solution till about 38 per cent of the ore was finer than 200 mesh.

The samples were agitated for periods of 24 and 48 hours, after which a screen analysis was made on each of them. During the agitation period, cyanide was maintained at approximately 1.0 pound NaCN per ton and protective alkalinity was maintained with lime.

Screen Analyses of the Cyanide Tailings.

Mesh Size	Weight, per cent	Assay, Au, oz./ton	Distribution of Gold, per cent	Extraction, per cent
24 Hour Cyanide Tailing -				
+48	3.44	0.009	6.37	
-48 +65	10.64	0.0075	16.41	
-65+100	16.60	0.0075	25.60	
-100+150	18.94	0.005	19.48	
-150+200	12.14	0.005	12.48	
-200	38.24	0.0025	19.66	
Average tailing	100.00	0.0049	100.00	93.47
48-Hour Cyanide Tailing -				
+48	4.07	0.0073	7.11	
-48 +65	11.53	0.005	13.79	
-65+100	17.09	0.005	20.44	
-100+150	18.53	0.005	22.16	
-150+200	12.24	0.005	14.64	
-200	36.54	0.0025	21.86	
Average tailing	100.00	0.0042	100.00	94.40

Summary of Results, Tests Nos. 1 and 2:

(Feed Sample Assay, 0.075 oz./ton Au.)

Test No.	Tailing assay, Au, oz./ton	Extraction, per cent	Reagent consumed, lb./ton Ore NaCN	Reagent consumed, lb./ton Ore CaO	Final Titration, lb./ton Sol'n. NaCN	Final Titration, lb./ton Sol'n. CaO
1	0.0049	93.47	0.24	1.48	0.98	0.26
2	0.0042	94.40	0.28	1.52	0.96	0.24

(Continued on next page)

(Details of Investigation, cont'd) -

These tests indicate that at the above grind, or perhaps a little finer, 94 to 95 per cent of the gold in the ore can be extracted by cyanidation. With coarse gold taken out and amalgamated a slightly higher extraction might be expected. The following test was conducted to investigate this point.

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Test No. 3. - Amalgamation and Cyanidation.

A sample of the ore was ground in water for the same period as in Tests Nos. 1 and 2. The pulp was then amalgamated with new mercury for one hour. The amalgam was separated and assayed, and the amalgamation tailing was sampled for assay and a portion of it agitated in cyanide solution for a period of 24 hours.

The results of this test are summed up in the following table:

Amalgamation tailing assay	-	0.014	oz./ton gold
Amalgam assay (2.38 mgm. gold)	-	0.070	" "
Feed sample assay (calc.)	-	0.084	" "
Cyanide tailing assay	-	0.004	" "
Extraction (on basis of average feed sample, 0.075 oz./ton gold)	-	94.67	per cent

For purposes of comparison the foregoing results are taken as representative of what might be expected from cyanidation of the ore with or without removal of coarse gold.

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Test No. 4. - Flotation.

A flotation test was conducted on a sample of the ore with a screen analysis of the flotation tailing as follows:

(Continued on next page)

(Details of Investigation, cont'd) -

Charge to Ball Mill -

Ore	-	2000 grams at -20 mesh
Soda ash	-	1.0 lb./ton
Aerofloat No. 25	-	0.035 "
Water	-	1500 grams
Grinding time,	-	15 minutes

Reagents to Cell -

Reagent No. 301	-	0.05 lb./ton
Reagent No. 208	-	0.05 "
Pine oil	-	0.10

The products were weighed and assayed for gold and a sample of the flotation tailing was agitated in cyanide solution for a period of 48 hours.

Screen Analysis of Flotation Tailing.

Mesh Size	Weight, per cent	Assay, Au, oz./ton	Sulphur, per cent
+65	6.35	0.085	0.049
-65+100	14.45	0.005	0.052
-100+150	20.94	0.005	0.062
-150+200	14.43	0.005	0.062
-200	43.83	0.0025	0.044
Average tailing	100.00	0.009	0.052

The relatively high assay in the plus 65 mesh fraction indicates that coarse gold has escaped flotation and should be collected by a jig or gold trap in the grinding circuit.

The results of this test are summarized as follows:

Product	Weight, per cent	Assay, Au, oz./ton	Distribution of gold, per cent
Concentrate	2.79	2.46	88.69
Tailing	97.21	0.009	11.31
Feed Sample (calc.)	100.00	0.077	100.00

A sample of the flotation tailing was agitated in cyanide solution for 48 hours and gave a cyanide tailing assaying 0.003 ounce per ton in gold, indicating that some

(Details of Investigation, cont'd) -

readily soluble gold is going out in the flotation tailing.

Other flotation tests gave the following tailing assays:

0.005
0.005
0.005
0.007
0.0039

The first four tailing assays above were obtained on 5-assay-ton lots of bulk tailing sample, while the fifth was obtained by a screen analysis which again showed the plus 65 mesh fraction to be somewhat higher than the finer ones.

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Tests Nos. 5 and 6. - Cyanidation of Flotation Concentrates.

Two 12,000-gram lots of ore were floated, each of them in 2,000-gram batches. The concentrates and tailings from each test were collected together and sampled for assay. The concentrates were then reground about 60 per cent finer than 325 mesh and agitated in cyanide solution for periods of 72 hours. In each case the cyanide tailing assay was 0.015 ounce per ton in gold.

Summary of Results, Tests Nos. 5 and 6:

Test No. 5.

Product	Weight, per cent	Assay, Au, oz./ton	Distribution of gold, per cent
Concentrate	3.65	1.14	89.62
Tailing	96.35	0.005	10.38
Feed Sample (calc.)	100.00	0.046	100.00
Cyanide tailing from concentrate	3.65	0.015	
Average tailing	100.00	0.0054	

Extraction on basis of average head (0.075 oz./ton gold): 92.80 per cent.

(Details of Investigation, cont'd) -

Reagents consumed:

		Lb./ton Conc.	Lb./ton Ore
NaCN	-	3.91	0.14
CaO	-	6.36	0.23

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Test No. 6.

Product	Weight, per cent	Assay, Au, oz./ton	Distribution of gold, per cent
Concentrate	3.85	2.71	93.94
Tailing	96.15	0.007	6.06
Feed Sample (calc.)	100.00	0.111	100.00
Cyanide tailing from concentrate	3.85	0.015	
Average tailing	100.00	0.0073	

Extraction on basis of average head (0.075 oz./ton gold): 90.26 per cent.

Reagents Consumed:

		Lb./ton Conc.	Lb./ton Ore
NaCN	-	3.73	0.14
CaO	-	7.56	0.29

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For purposes of comparison of the results of Tests Nos. 5 and 6 with those of Tests Nos. 1, 2 and 3, extractions in all cases are based on the average head sample assay of 0.075 ounce per ton in gold, rather than on the calculated head sample assay for any individual test where this may have been possible.

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