O T T A W A June 21st, 1940.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 860.

Concentration and Cyanidation Tests on Two Samples of Gold Ore from the Kenora Mining District, Ontario.

BUREAU OF MINES
DIVISION OF METALLIC MINERALS
ORE DRESSING AND
METALLURGICAL LABORATORIES

CANADA
DEPARTMENT
OF
MINES AND RESOURCES
MINES AND GEOLOGY BRANCH

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Shipment:

Two samples of gold ore, marked Nos. 1 and 2 respectively and weighing approximately 100 pounds each, were received on May 27th, 1940. The samples were submitted by J. A. Poirier, Kenopo Mining and Milling Company, Limited, P. O. Box 910, Kenora, Ontario.

Location of Property:

The samples are said to have been taken from Claim No. P-432, in the Kenora mining district of Ontario.

Characteristics of the Ore:

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

Sample No. 1 -

The gangue of Sample No. 1 consists of dark grey, fine-textured silicates and quartz which in places show a distinct schistosity. Areas of grey and locally iron-stained quartz occur in the rock, and finely disseminated carbonate is abundant.

The metallic minerals present are, in their order of abundance in the sections: pyrite, pyrrhotite, "limonite", magnetite, chalcopyrite, and sphalerite. Pyrite and pyrrhotite are very common; they occur as disseminated irregular grains, largely in the rock gangue and rarely in the quartz. Both minerals have been altered by surface agencies and are partly replaced by "limonite", which also is to be seen as brown stains. A small quantity of magnetite occurs as disseminated grains and a very small quantity of chalcopyrite is present as isolated small grains. Sphalerite is exceedingly rare.

Sample No. 2 -

This sample appears to be fresher and not to

have suffered surface alteration. It is composed of a gangue of white to dark-grey quartz and silicates with some traces of schistosity shown locally. Tiny black needles in the quartz may be tourmaline. Some carbonate is present.

The chief metallic mineral is pyrrhotite, which occurs rather commonly as irregular grains and stringers. Occasional grains of pyrite are disseminated in the rock. A small quantity of chalcopyrite occurs as irregular grains, sometimes associated with pyrrhotite. Magnetite is disseminated in the rock, but does not appear to be as abundant as in Sample No. 1. Three grains of native gold were seen in gangue; they are 50, 35, and 20 microns in size, respectively.

Sampling and Assaying:

The samples were crushed, assayed, and reported as follows:

	Au, oz./ton	Ag, oz./ton
Sample No. 1:		
	0.24	0.04
	0.24	
	0.24	
	0.24	
	0.24	
	0.245	
Sample No. 2:		
	0.13	0.05
	0.14	
	0.14	
	0.15	
	0.15	
	0.16	

In addition to the above bulk sample assays,

(Sampling and Assaying, cont'd) -

1,000 grams of each sample was ground in a ball mill until about 80 per cent was finer than 200 mesh. The pulps were then barrel-amalgamated with new mercury for 1 hour. Gold in both amalgam and amalgamation tailing was then determined for each sample, as follows:

Sample No. 1.

The amalgam from this sample contained 8.42 milligrams of gold, or the equivalent of 0.245 ounce gold per ton of feed.

		Assay, Au, oz./ton
Amalgamation tailing	-	0.02
Amalgam	-	0.245
Feed sample (cal.)	-	0.265

Sample No. 2.

The amalgam from this sample contained 5.23 milligrams of gold, or the equivalent of 0.153 ounce gold per ton of feed.

		Assay, Au, oz./ton
Amalgamation tailing	-	0.02
Amalgam	-	0.153
Feed sample (cal.)	-	0.173

These determinations show that at this grind approximately 90 per cent of the gold is free and recoverable by amalgamation. A blank test showed that the mercury contained no gold.

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EXPERIMENTAL TESTS:

A series of small-scale tests was conducted to find out how much of the gold could be recovered by amalgamation of a gravity concentrate and, as between flotation and cyanidation, which process would be best for further treatment.

Typical tests are described in detail as follows:

Test No. 1. - Sample No. 1.

A sample of the ore was ground 56 per cent through 200 mesh and treated in a jig to remove coarse free gold. The hutch product was amalgamated with new mercury and the gold in the amalgam was determined. The amalgamation tailing was then reunited with the jig overflow. This latter product was sampled for assay and portions of it agitated in cyanide solution, 1.0 pound per ton NaCN, for periods of 24 and 48 hours. The cyanide tailings were assayed for gold.

Summary of Results:

Product	Assay, Au oz./ton	Extraction, per cent total gold	Final titration, lb./ton sol'n NaCN	lb./ton sol'n CaO	Reagents consumed, lb./ton feed NaCN	lb./ton feed CaO
Amalgam	0.1136©	53.2				
Feed to cyanidation	0.10					
Feed sample (cal.)	0.2136					
24-hr. cy. tailing	0.0165	39.1	0.94	0.34	0.84	5.95
48-hr. cy. tailing	0.0101	42.1	0.94	0.20	0.96	5.68

© Amalgam assay is given in terms of ounces per ton of original feed.

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(Test No. 1, cont'd) -

Screen Analysis of Cyanide Tailings:

24-Hour Cyanide Tailing.

Mesh	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent
+100	3.1	0.02	3.8
-100 +150	12.1	0.015	11.0
-150 +200	28.8	0.01	17.4
-200	56.0	0.02	67.8
Cyanide tailing	100.0	0.0165	100.0

48-Hour Cyanide Tailing.

+100	2.72	0.015	4.0
-100 +150	11.88	0.01	11.7
-150 +200	32.12	0.01	31.7
-200	53.28	0.01	52.6
Cyanide tailing	100.00	0.0101	100.0

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Test No. 2. - Sample No. 1.

A sample of the ore was ground 55 per cent through 200 mesh and treated in a jig to remove coarse gold. The hutch product was amalgamated with new mercury and the amalgamation tailing was reunited with the jig overflow as feed to flotation. A concentrate was floated with the following reagents:

Soda ash	-	2.0 lb./ton
Amyl xanthate	-	0.10 "
Pine oil	-	0.10 "

The flotation products and the amalgam were assayed for gold.

(Continued on next page)

(Test No. 2, cont'd) -

Screen Analysis of Flotation Tailing.

Mesh	Weight, per cent	Assay, Au oz./ton
+100	2.9	0.04
-100 +150	11.2	0.03
-150 +200	30.6	0.015
-200	55.3	0.03
Flot. tailing (cal.)	100.0	0.0257

Summary of Results, Test No. 2:

Product	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent content
Concentrate	0.79	8.80	73.2
Tailing	99.21	0.0257	26.8
Flotation feed (cal.)	100.00	0.095	100.0

The amalgam contained gold equivalent to 0.1136 ounce per ton of original feed, which added to the assay of the feed to flotation gives an original feed sample assay of 0.2086 ounce per ton in gold.

Recoveries:

Amalgam	-	54.7 per cent total gold.
Flotation concentrate	-	33.2 " " "
Flotation tailing	-	12.1 " " "

These tests indicate that more than 50 per cent of the gold can be recovered from Sample No. 1 by barrel-amalgamation of a gravity concentrate and that for further treatment cyanidation is more efficient than flotation.

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Test No. 3. - Sample No. 2.

A sample of this ore was ground 57.5 per cent through 200 mesh and treated in a jig to remove coarse gold. The hutch product was amalgamated with new mercury and the gold in the amalgam was determined. The amalgamation tailing and jig overflow were then reunited and sampled for assay and portions of the product were agitated in cyanide solution, 1.0 pound per ton NaCN, for periods of 24 and 48 hours. The cyanide tailings were assayed for gold.

Summary of Results, Test No. 3:

Product	Assay, Au oz./ton	Extraction, per cent total gold	Final titration, lb./ton sol'n: NaCN	CaO	Reagents consumed, lb./ton ore: NaCN	CaO
Amalgam	0.1579©	88.8				
Feed to cyanidation	0.02					
Feed sample (cal.)	0.1779					
24-hr. cy. tailing	0.0096	5.8	0.88	0.20	0.93	4.98
48-hr. cy. tailing	0.0053	8.2	1.04	0.26	1.06	5.85

© Amalgam assay is given in terms of ounces per ton of original feed.

Screen Analysis of Cyanide Tailings:

24-Hour Cyanide Tailing.

Mesh	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent
+ 65	2.1	0.0075	1.6
- 65 +100	6.3	0.005	3.3
-100 +150	13.6	0.01	14.1
-150 +200	18.8	0.01	19.5
-200	59.2	0.01	61.5
Cyanide tailing	100.0	0.0096	100.0

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(Test No. 3, cont'd) -

Screen Analysis, continued --

48-Hour Cyanide Tailing.

Mesh	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent
+100	6.7	0.01	12.5
-100 +150	13.9	0.005	13.0
-150 +200	21.9	0.005	20.5
-200	57.5	0.005	54.0
Cyanide tailing	100.0	0.0053	100.0

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Test No. 4. - Sample No. 2.

A sample of ore was ground 58 per cent through 200 mesh and treated in a jig to remove coarse gold. The hutch product was amalgamated with new mercury and the gold in the amalgam determined. The amalgamation tailing together with the jig overflow was then floated with the following reagents:

Soda ash	-	2.0 lb./ton
Amyl xanthate	-	0.10 "
Pine oil	-	0.10 "

The flotation products were assayed for gold.

Screen Analysis of Flotation Tailing.

Mesh	Weight, per cent	Assay, Au oz./ton
+ 65	2.86	0.02
- 65 +100	7.50	0.01
-100 +150	14.12	0.02
-150 +200	17.32	0.01
-200	58.20	0.015
Flotation tailing (cal.)	100.00	0.0146

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(Test No. 4, cont'd) -

Summary of Results, Test No. 4:

Product	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent content
Concentrate	1.1	1.75	57.1
Tailing	98.9	0.0146	42.9
Flotation feed (cal.)	100.0	0.0337	100.0

The amalgam contained gold equivalent to 0.1089 ounce per ton of original feed. This figure added to the assay of the flotation feed gives an original feed sample assay of 0.1426 ounce per ton in gold.

Recoveries:

Amalgam	-	76.4 per cent total gold.
Flotation concentrate	-	13.5 " " "
Flotation tailing	-	10.1 " " "

These tests indicate that 75 to 80 per cent of the gold can be recovered from Sample No. 2 by barrel-amalgamation of a gravity concentrate and that cyanidation is more efficient than flotation for further treatment.

Test No. 5. - Composite Sample.

This test was conducted on a 50-50 mixture of Samples Nos. 1 and 2, the object being to determine the grade of tailing that can be produced by concentration

(Test No. 5, cont'd) -

along with amalgamation. The ore was ground 58 per cent through 200 mesh and treated in a mineral jig the overflow from which passed over a blanket. The blanket concentrate together with the hutch product was amalgamated with mercury and the amalgamation tailing together with the blanket tailing was floated with the following reagents:

Soda ash	-	2.0 lb./ton
Amyl xanthate	-	0.10 "
Pine oil	-	0.10 "

Summary of Results, Test No. 5:

Product	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent content
Flot. concentrate	0.64	2.84	47.8
Flot. tailing	99.36	0.02	52.2
Feed to flotation (cal.)	100.00	0.038	100.0

The feed used in this test assays 0.1957 ounce per ton in gold, as calculated from the foregoing tests and head sample assays.

Recoveries:

Amalgam	-	80.6 per cent total gold.
Flotation concentrate	-	9.3 " " "
Flotation tailing	-	10.1 " " "

Conclusions:

Tests conducted on these samples of ore show that in each of them the greater part of the gold is free and some of it coarse.

From the foregoing tests it will be seen that

using a jig alone as a gravity concentrator and grinding the ore 55 to 60 per cent through 200 mesh, about 54 per cent of the gold can be recovered as amalgam from Sample No. 1 and about 82 per cent from Sample No. 2. Under the same conditions a composite sample of ore, made up of equal parts, would yield about 68 per cent of its gold.

If the jigging operation should be followed by blanket concentration, as was done in Test No. 5, this figure will be increased to 80 per cent.

The products from this process should be further treated by cyanidation and if this is done blanket concentration would not be needed in addition to treatment in the jig.

Cyanidation for 48 hours after removal of coarse gold will produce a final tailing of 0.01 ounce gold per ton on Sample No. 1 and 0.005 ounce per ton on Sample No. 2, or an average tailing of 0.0075 ounce per ton when a composite sample is being treated.

If flotation is to be used after removal of coarse gold, both jigs and blankets should be used to keep recovery by amalgamation as high as possible. By this method, recovery will not exceed 90 per cent (see Test No. 5) and 9 or 10 per cent of the recovered gold will be in the flotation concentrate which presumably will be sold to a smelter.

Under these conditions cyanidation seems preferable to flotation.

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