O T T A W A August 26th, 1942.

R E P O R T

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1286.

IR 1286

Experimental Tests on Samples of Gold Ore
from Renabie Mines Limited,
at Missanabie, Ontario.

==========

(Copy No.___.)

O T T A W A August 26th, 1942.

R E P O R T

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1286.

Experimental Tests on Samples of Gold Ore
from Renabie Mines Limited,
at Missanabie, Ontario.

========

Shipment:

Six boxes of ore were received on April 27th, 1942. They contained three samples of ore and were submitted by G. A. Howes, Manager, Renabie Mines Limited, Kirkland Lake, Ontario.

Location of Property:

This ore was taken from a property located at the mutual corner of Rennie, Leeson, Stover and Bracken townships in the Sudbury mining division. The claim numbers are S 34794, S 34314-34318. These claims are about 228 miles west of Sudbury on the C.P.R. and then 14 miles northeast to the property.

Character of the Samples:

Six polished sections, two from each sample, were prepared and examined under the ore-microscope for the purpose of determining the character of the ore.

General -

In all three samples metallic minerals are only moderately abundant and are generally coarse in size. Locally they follow fractures or lines of weakness in the gangue and also occur in apparently dense material.

Sample No. 1. -

The gangue consists essentially of clear glassy quartz, slightly fractured and transected by narrow hairlike cracks, some of which are filled with soft rock material that does not appear to be carbonate.

Pyrite predominates as small masses and coarse grains in gangue but a small percentage is disseminated in the finer sizes also. It contains irregular grains and narrow veinlets of gangue as well as rare, small inclusions of chalcopyrite, galena, and sphalerite. A minor amount of chalcopyrite is present in the same modes of occurrence as the pyrite but, in general, its grain sizes are smaller. Sphalerite and galena are visible in practically negligible

(Character of the Samples, cont'd) -

quantities as rare small grains in gangue and in pyrite.

One grain of native gold, about sixty microns (-200+280 Tyler mesh) in size, was observed in the sections. It occurs in gangue between two grains of chalcopyrite and against pyrite.

Sample No. 2. -

The gangue is the same as that in Sample No. 1 but contains more of the soft, rock material as narrow veinlets and small, irregular patches.

The metallic minerals are also the same as those in Sample No. 1 except that no sphalerite was observed, and galena and gold are more abundant. The lead sulphide is common in gangue as small, poorly polished masses and irregular grains often associated with chalcopyrite. The lead and copper minerals are, in many places, interstitial to grains of pyrite.

Ten irregular grains of native gold, ranging from 120 microns (-100+150 Tyler mesh) down to 36 microns (-400 +560 Tyler mesh) in size, were observed and measured. All occur in gangue, five alone and five associated with the sulphides--three with pyrite and one with each of chalcopyrite and galena. The surface appearances of most grains suggest that they are thin and flaky, but this may be due to a poor polish.

Sample No. 3. -

Gangue consists of milky white, somewhat fractured quartz.

In the polished sections metallic minerals are not so abundant as in the two previous samples but they have the

(Character of the Samples, cont'd) -

same modes of occurrence. In their order of abundance, those present are: pyrite, galena, and chalcopyrite. No gold was observed.

Conclusion -

The microscopic examination revealed nothing in the character of the samples that would present any particular difficulty in the treatment of the ore.

Sampling and Assaying:

The samples comprising the shipment were assayed and reported as follows:

	Sample No. 1.	Sample No. 2.	Sample No. 3.
Gold, oz./ton -	0.37	1.94	1.62
Silver, " -	0.28	0.62	0.64
Lead, per cent -	Trace	0.25	0.49
Zinc, " -	0.08	0.07	0.05
Iron, " -	1.63	1.95	2.62
Sulphur, " -	0.76	0.62	1.17

Experimental Tests:

A series of small-scale tests was conducted to determine the most satisfactory method of treating the ore. Owing to the high gold assays of Samples Nos. 2 and 3, the work was largely confined to Sample No. 1.

The tests indicated that the ore contained some very fine gold, of which a considerable quantity was associated with the sulphides. About 30 per cent of the gold in Sample No. 1 is free when the ore is ground 45 per cent finer than 200 mesh. Straight cyanidation will extract about 80 per cent of the gold in 48 hours at the same grind.

Experimental tests conducted on a former shipment of ore from this property are covered in Report of Investigation No. 945, issued in January, 1941.

Details of Test Work:

The tests are described in detail as follows:

Test No. 1. - Amalgamation.

A sample of the ore was ground 45 per cent through 200 mesh and amalgamated with mercury for one hour. The amalgamation tailing was assayed for gold.

Results:

Feed sample	-	0.37 oz./ton gold
Amalgamation tailing	-	0.26 " "
Extraction	-	29.73 per cent

This test was conducted to determine the amount of free gold at this grind.

Tests Nos. 2 and 3. - Straight Cyanidation.

Samples of the ore were ground in cyanide solution, 1.0 pound NaCN per ton, and agitated for periods of 24 and 48 hours. The tailings were assayed for gold.

Screen Analysis, 24-hour Cyanide Tailing -

Mesh		Weight, per cent	Assay, Au oz./ton
+ 65	-	3.94	0.06
- 65 + 100	-	13.24	0.06
- 100 + 150	-	20.08	0.06
- 150 + 200	-	17.30	0.06
- 200	-	45.44	0.11
Cyanide tailing		100.00	0.083

(Continued on next page)

(Tests Nos. 2 and 3, cont'd) -

Screen Analysis, 48-hour Cyanide Tailing.-

Mesh		Weight, per cent	Assay, Au oz./ton
+ 65	-	3.58	0.05
- 65 + 100	-	12.26	0.06
- 100 + 150	-	19.68	0.05
- 150 + 200	-	17.70	0.05
- 200	-	46.78	0.09
Cyanide tailing	-	100.00	0.07

Summary of Results:

(Feed sample, 0.37 oz./ton in gold)

Period of agitation, hours	Tailing assay, Au oz./ton	Extraction, per cent	Final titration, lb./ton soln. NaCN	Final titration, lb./ton soln. CaO	Reagent consumed, lb./ton ore NaCN	Reagent consumed, lb./ton ore CaO
24	0.083	77.57	0.80	0.02	0.40	1.96
48	0.07	81.08	1.0	0.02	0.40	2.06

In the foregoing screen analyses the high assays in the fractions finer than 200 mesh indicate the presence of fine gold, or of fine sulphides containing refractory gold, in these fractions. The need for selective grinding of the sulphides is also suggested.

-

Test No. 4. - Table Concentration and Selective Grinding of Sulphides.

A sample of the ore was ground in cyanide solution and the pulp was treated on a table to produce a low-grade pyrite concentrate. The table concentrate was reground 80 per cent finer than 325 mesh in part of the original cyanide solution. The table concentrate and the table tailing were then agitated separately for 48 hours in cyanide solution,

(Test No. 4, cont'd) -

1.0 pound NaCN per ton. The cyanide tailings were assayed for gold.

Screen Analysis, Cyanide Tailing From Table Tailing.

Mesh		Weight, per cent	Assay, Au oz./ton
+ 65	-	2.00	0.04
- 65 + 100	-	9.22	0.04
- 100 + 150	-	15.60	0.03
- 150 + 200	-	19.60	0.03
- 200	-	53.58	0.05
Cyanide tailing	-	100.00	0.042

Summary of Results:

(Feed sample, 0.37 oz./ton in gold)

Product	Weight, per cent	Assay, Au oz./ton	Extraction of gold, per cent	Final titration, lb./ton soln. NaCN	Final titration, lb./ton soln. CaO	Reagents consumed, lb./ton ore NaCN	Reagents consumed, lb./ton ore CaO
Table concentrate cyanided	15.01	0.095		2.0	0.25		
Table tailing cyanided	84.99	0.042		1.0	0.16		
Average tailing	100.00	0.05	86.49			1.10	3.26

The high assay in the fraction finer than 200 mesh in the foregoing screen analysis indicates the presence of fine gold or of fine sulphides carrying refractory gold. It also indicates that the ore should all be ground finer than 100 mesh and agitated for a longer period of time.

Test No. 5. - Table Concentration and Selective Grinding of Sulphides.

A sample of the ore was ground 72 per cent finer than 200 mesh and treated on a table to concentrate the pyrite. The table concentrate was reground practically all finer than 200 mesh and agitated with the table tailing for 96 hours at 2:1 dilution. The solution was kept at 1.0 pound NaCN per ton. The tailing was assayed for gold.

Results:

Feed sample	-	0.37 oz./ton gold
Cyanide tailing	-	0.03 " "
Extraction	-	91.89 per cent

Reagents -

Final titration, lb./ton solution -

NaCN	-	0.96
CaO	-	0.20

Consumed, lb./ton ore -

NaCN	-	0.88
CaO	-	2.60

Under the foregoing conditions it would seem that the minimum tailing would be somewhere in the neighbourhood of 0.03 ounce per ton in gold.

-

Tests Nos. 6, 7, 8, and 9. - Flotation with Selective Grinding of Sulphides.

Samples of the ore at various grinds were floated to produce a pyrite concentrate, which in turn was reground practically all finer than 325 mesh. The reground concentrate and the flotation tailings were then agitated in cyanide solution, 1.0 pound per ton NaCN, for 96 hours. On Tests Nos. 6 and 9 the concentrates and tailings were

(Tests Nos. 6, 7, 8, and 9, cont'd) -

agitated separately while in Tests Nos. 7 and 8 the concentrates and tailings were reunited and agitated together.

Flotation of the samples was done in a natural pulp with the following reagents:

		Lb./ton
Aerofloat No. 31	-	0.07
Tarol No. 1	-	0.05
No. 301	-	0.05
No. 208	-	0.05
Pine oil	-	0.07

Screen Analysis, Cyanide Tailing from Flotation Tailing, Test No. 6.

Mesh		Weight, per cent	Assay, Au oz./ton
+ 65	-	5.80	0.019
- 65 + 100	-	17.24	0.03
- 100 + 150	-	22.44	0.015
- 150 + 200	-	19.22	0.015
- 200	-	35.30	0.01
Flotation tailing cyanided	-	100.00	0.026

Results of Test No. 6:

Product	Weight, per cent	Assay, Au oz./ton	Extraction of gold, per cent
Flotation conc. cyanided	19.16	0.245	
Flotation tailing cyanided	80.84	0.026	
Average cyanide tailing	100.00	0.068	81.62

(Continued on next page)

Results of Test No. 9: (Grind, -72%-200 mesh)

Product	Weight, per cent	Assays, Au oz./ton	Extraction of gold, per cent
Flotation conc. cyanided	13.16	0.15	
Flotation tailing cyanided	86.84	0.02	
Average cyanide tailing	100.00	0.037	90.00

Summary of Tests Nos. 6 to 9:

(Feed sample assay, 0.37 Au oz./ton).

Test No.	Grind, per cent -200 mesh	Tailing assay, Au oz./ton	Extraction, per cent	Final titration, lb./ton soln.		Reagents consumed, lb./ton ore	
				NaCN	CaO	NaCN	CaO
6	35.30	0.068	81.62			1.55	1.40
7	55.9	0.065	82.43	0.92	0.20	1.16	2.60
8	64.0	0.060	83.78	0.92	0.20	1.16	3.00
9	72.1	0.037	90.0			2.34	3.28

This series of tests showed that the sulphides may be concentrated by flotation as well as tabling. Flotation can be done in a natural pulp, leaving nothing to interfere with subsequent cyanidation of the flotation tailing. The concentrates should be reground all minus 325 mesh before cyanidation. The screen analysis of the cyanide tailing from the flotation tailing of Test No. 6 indicates that the ore should be ground at least all through 100 mesh and that further extraction of gold from the gangue will depend upon still finer grinding.

Preliminary tests have also shown that the concentrate can be roasted to advantage if galena is absent, as is the case with the No. 1 sample, but when galena is present, even in small quantity as in Sample No. 2, roasting forms

(Summary of Tests Nos. 6 to 9, cont'd)

fusible lead sulphate which effectively locks up the gold against further attack by cyanide solution.

Test No. 10. - Sample No. 3.
Flotation and Selective Grinding of Sulphides.

This test was carried out on Sample No. 3 to compare its behaviour with that of Sample No. 1.

The ore was ground 75 per cent finer than 200 mesh and floated in a natural pulp with the following reagents:

		Lb./ton
Aerofloat No. 31	-	0.07
Reagent No. 301	-	0.05
Reagent No. 208	-	0.05
Pine oil	-	0.10

The concentrate was reground practically all minus 325 mesh and agitated in cyanide solution, along with the flotation tailing, for 96 hours at 2:1 dilution. The solution was kept at 1.0 pound NaCN per ton throughout the agitation period. The cyanide tailing was assayed for gold.

Results:

Feed sample	-	1.62 oz./ton gold
Cyanide tailing	-	0.08 " "
Extraction	-	95.06 per cent

Reagents -

Final titration, lb./ton solution -

NaCN	-	1.04
CaO	-	0.24

Consumed, lb./ton ore -

NaCN	-	1.48
CaO	-	3.32

(Continued on next page)

(Test No. 10. - Sample No. 3, cont'd) -

In this sample, about 60 per cent of the gold was free and this may account for higher extraction as compared with Sample No. 1.

Conclusions:

Having reference to Sample No. 1 only, it appears that no more than 90 per cent of the gold can be extracted by cyanidation unless the sulphides are roasted.

Owing to the presence of galena in Samples Nos. 2 and 3, roasting cannot be recommended, since fusible lead sulphate will be formed and will lock up the gold against attack by cyanide solution.

The most practical flowsheet appears to be to grind the ore about 70 per cent finer than 200 mesh, and then concentrate the sulphides either by flotation or by tables and regrind them all finer than 325 mesh.

The reground concentrates could then be given a short period of agitation by themselves and then be returned to the main circuit agitators, where they would rejoin the flotation or table tailing.

With ore of this grade and character about 90 per cent of the gold can be extracted in this way.

oooooooooo
oooooo
oooo

JDJ:HK.