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O T T A W A September 9th, 1940.

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ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 891.

Gold Ore from Lorne Lake,
Rice Lake Mining District,
Manitoba.

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Shipment:

A shipment of 300 pounds of gold ore was received on August 8th, 1940, from the Rockland-Ogama claims, Lorne Lake, Manitoba. The shipment was submitted by A. J. McLaren, Consulting Mining Engineer, 320 Bay Street, Toronto, Ontario.

Location of the Property:

The Rockland-Ogama claims are located in the Rice Lake mining district, in central Manitoba.

Purpose of the Investigation:

The shipment was made for the purpose of determining "the best and most economical flow-sheet for a small mill of from 10 to 25 tons capacity."

Character of the Ore:

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

Gangue -

The gangue consists essentially of translucent white quartz which encloses small streaks and patches of soft, light to dark greenish-grey rock material. It carries a small amount of finely disseminated carbonate and bears local light brown stains of iron oxides.

Metallic Minerals -

The metallic mineral content of the sections is very small. Pyrite preponderates, but small quantities of other metallics are visible, as follows:

Pyrite occurs as small granular masses and coarse to fine grains disseminated unevenly through gangue. It contains numerous inclusions of gangue and is slightly fractured and healed with gangue.

Chalcopyrite and arsenopyrite are visible in small quantity as medium to fine irregular grains in

gangue and in pyrite.

Ilmenite(?), a hard, anisotropic grey mineral, negative to all standard chemical reagents, is present in small amount as tiny irregular grains disseminated in gangue. Under crossed nicols they are seen to be surrounded by a translucent alteration product and probably are ilmenite altering to leucoxene.

Limonite is visible chiefly as rust stains in gangue, rarely as small particles associated with sulphide.

Bornite, chalcocite, and galena are present in practically negligible amounts as rare tiny grains disseminated in gangue.

Native gold is comparatively abundant and occurs largely in gangue. A small percentage, however, is present in pyrite, where it occurs in apparently dense sulphide, as well as along fractures and grain boundaries. Its grain sizes and modes of occurrence are tabulated below:

Grain Analysis of Native Gold:

Finer mesh (approx.)	Alone in gangue, per cent	Associated with pyrite, per cent		TOTALS, per cent
		Along fractures and grain boundaries	In dense pyrite	
+ 200	13.5			13.5
+ 280	36.3			36.3
+ 400	14.5			14.5
+ 560	8.2			8.2
+ 800	16.4			16.4
+1100	1.5	1.1		2.6
+1600	1.8	1.0	1.8	4.6
+2300	1.0	1.6	0.6	3.2
			0.7	0.7
Totals	93.2	3.7	3.1	100.0

Sampling and Analysis:

The shipment was crushed and sampled by standard methods and was found to contain:

Gold	- 6.04	oz./ton
Silver	- 0.68	"
Copper	- None.	

Investigative Procedure:

The ore was treated by concentration, in jigs, on blankets and by flotation. The concentrates from the jig and blankets were amalgamated. The residues from amalgamation together with the blanket tailing were treated by cyanidation and by flotation at various grinds.

Results of Tests:

98.8 per cent of the gold was recovered by amalgamating a jig and blanket concentrate from ore ground 77 per cent minus 200 mesh. Fifty per cent of the remaining gold was recovered by cyanidation within 24 hours. The total recovery was 99.4 per cent of the gold.

84.6 per cent of the gold was recovered by amalgamation at a grind of 55 per cent minus 200 mesh. Flotation of the tailing recovered 65.8 per cent of the remaining gold in a concentrate assaying 34 ounces gold per ton, with a ratio of concentration of 55:1. The flotation tailing contained 0.325 ounce gold per

Details of the Tests:

Test No. 1. - Jig Concentration; Amalgamation of the Concentrate.

A sample of the ore was ground in a ball mill at a dilution of 4 parts solids to 3 parts of water to give a product 55 per cent minus 200 mesh.

The ground ore was jigged in a Denver laboratory mineral jig. The jig concentrate was barrel-amalgamated. After separating the mercury and amalgam from the amalgamated concentrate the products were assayed for gold.

Results:

Product	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent: Jig concentrate	Distribution of gold, per cent: Original feed	Ratio of concentration
Feed	100.00	5.47*		100.00	
Jig conc.	0.43	891.251	100.00	69.99	233:1.
Amalgam	-	884.736	99.27	69.48	
Amalgamation residue	-	6.515	0.73	0.51	
Jig tailing	99.57	1.65		30.01	

* The feed assay was calculated from the products of the test.

Much free gold was recovered in the jig concentrate. Some very fine gold was discovered in the jig tailing. The test shows that 69.99 per cent of the gold was recovered in the jig concentrate, and 99.27 per cent of this was recovered by amalgamation. The overall recovery was 69.48 per cent of the gold.

The results indicate that blanket strakes should follow the jig to recover fine gold from the jig tailing.

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Test No. 2. - Jig and Blanket Concentration; Amalgamation of the Concentrates.

Samples of the ore were ground in ball mills at a dilution of 4 to 3. The grinding time was varied to give products of different degrees of grinding.

Each sample was treated separately by passing it through the jig and over blanket strakes. The concentrates from the jig and blankets were combined and then barrel-amalgamated. After separating the mercury and amalgam, the amalgamated concentrates were returned to their respective blanket tailings, which were filtered and assayed.

Results of Amalgamation:

Test No.	Grind, % -200 mesh	Assays, Au oz./ton Feed	Assays, Au oz./ton Tailing	Recovery of gold, per cent	Ratio of concentration of jig and blanket concentrates
2-A	55.0	6.04	0.92	84.8	Approximately 35:1.
2-B	61.0	6.04	0.69	88.6	
2-C	77.0	6.04	0.07	98.8	

The test indicates that 98 per cent of the gold can be recovered as bullion at a grind of 77 per cent minus 200 mesh.

Test No. 3. - Cyanidation of Blanket Tailings and Amalgamated Concentrates.

This test was made to determine what recovery could be obtained by cyaniding the amalgamated jig and blanket concentrates together with their respective blanket tailings.

After filtering the products of Tests Nos. 2-B and 2-C, portions of the filter cake were repulped in

(Test No. 3, cont'd) -

cyanide solution at a dilution of 1 part solids to 2 parts of solution made up to 1.0 pound NaCN per ton. Lime was added to give protective alkalinity.

The pulps were agitated for various periods of time.

Results of Cyanidation:

Test No.	Agitation, hours	Assays, Au oz./ton: Feed	Tailing	Extraction of gold, per cent	Final titration, lb./ton: solution NaCN	CaO	Reagents consumed, lb./ton ore: NaCN	CaO
(Grind: 61 per cent minus 200 mesh.)								
3-A	16	0.69	0.11	84.1	0.7	0.15	0.60	2.55
3-B	24	0.69	0.075	89.1	1.0	0.15	0.72	2.60
3-C	48	0.69	0.075	89.1	1.0	0.20	0.90	3.50
(Grind: 77 per cent minus 200 mesh.)								
3-D	24	0.07	0.035	50.0	1.0	0.24	0.74	4.85
3-E	48	0.07	0.035	50.0	1.0	0.14	0.87	5.10

The test indicates that finer grinding is required to liberate the remaining gold in the cyanide tailing.

The overall recoveries in these tests are the following:

Test No.	Recovery by amalgamation, per cent	Recovery by cyanidation, in terms of original feed, per cent	Total recovery, per cent
3-A	88.6	9.6	98.2
3-B and 3-C	88.6	10.2	98.8
3-D and 3-E	98.8	0.6	99.4

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Test No. 4. - Flotation of Blanket Tailings and Amalgamated Concentrates.

A sample of ore was ground to 55 per cent minus 200 mesh, passed over the jig and blanket strakes, and the combined concentrates were barrel-amalgamated. The amalgam was separated and the amalgamated concentrates were returned to the blanket tailing, which was then filtered.

The filter cake was repulped in a flotation machine and conditioned for 20 minutes with 1.0 pound of soda ash per ton, then 0.1 pound each of American Cyanamid reagents Nos. 208 and 301 were added per ton as collectors for free gold remaining in the pulp and the sulphide minerals. After 3 minutes' contact, 0.05 pound of pine oil per ton was added and the concentrate was removed.

Results of Flotation:

Product	Weight, per cent	Assay, Au oz./ton	Distribution of gold, per cent: By flotation	Distribution of gold, per cent: In orig. feed	Ratio of concentration
Feed	100.0	0.93⊕	100.0	15.4	
Flot. concentrate	1.8	34.07	65.8	10.1	55.6:1.
Flot. tailing	98.2	0.325	34.2	5.3	

⊕ Calculated from the products.

Summary of Results, Test No. 4:

Recovery by amalgamation -

Feed = Au, 6.04 oz./ton.

Amalgamation tailing = flotation feed = Au, 0.93 oz./ton.

Recovery = 84.6 per cent. (Note Test No. 2-A).

Gold left in flotation feed = 15.4 per cent.

The flotation concentrate contains 34 ounces of gold per ton, with a ratio of concentration of 55:1.

Summary:

The amount of gold recovered in the jig and blanket concentrate appears to depend on the degree of grinding of the ore. At 55 per cent minus 200 mesh the recovery was 85 per cent of the gold. At 77 per cent minus 200 mesh, the recovery was 98 per cent of the gold as bullion.

The cyanidation and flotation tests show the possibilities of additional recoveries by these processes.

Conclusions:

The microscopic examination of the ore indicates that 93 per cent of the gold is found in the gangue. The investigation indicates that the freed gold amalgamates readily and without sickening or fouling of the mercury, as microscopic examination of the panned amalgamated concentrate showed no trace of finely divided mercury or gold.

The investigation indicates that the ore is amenable to amalgamation and a simple flow-sheet, consisting of a ball mill, mineral jig and classifier followed by blanket strakes, should be suitable for the proposed mill. Barrel-amalgamation of the concentrates should not cause trouble with ore of the same character as that submitted for the investigation. As this is exceptionally high-grade ore, the results of this investigation

apply only to the sample submitted. On lower-grade ore entirely different results may be anticipated.

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