DEPARTMENT OF MINES AND RESOURCES

BUREAU OF MINES

CANADA

Ottawa, January 23, 1947.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 2168.

Laboratory Tests on a Low-Grade Gold Ore from the Properties of Colomac Yellowknife Mines Limited and Indian Lake Gold Mines Limited in the Yellowknife District, Great Slave Lake Area, Northwest Territories.

IR 2168

97

Note:
This report relates essentially to the samples as received. It shall not, nor any correspondence connected therewith, be used in part or in full as publicity or advertising matter for the sale of shares in any promotion.

(Copy No. 11.)

1940

Bureau of Mines

Mineral Dressing and
Metallurgy Division

CANADA

DEPARTMENT
OF
MINES AND RESOURCES

Mines and Geology Branch

O T T A W A January 23, 1947.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 2168.

Laboratory Tests on a Low-Grade Gold Ore from the Properties of Colomac Yellowknife Mines Limited and Indian Lake Gold Mines Limited in the Yellowknife District, Great Slave Lake Area, Northwest Territories.

==========

Shipment and Instructions:

A shipment of 45 sacks of ore, of a net weight of 1,593 pounds, was received on November 23, 1946, from the above-named properties under instructions from Harry W. Darling, of Central Mining Services Limited, Suite 310, Concourse Building, 100 Adelaide Street West, Toronto, Ontario.

After some exchange of correspondence between Mr. Darling and the Department, Mr. Darling's final instructions were to consider the samples from both properties as one operation and to make four groups of the samples. One group carrying our test number 1 was of samples numbered 51 to 55; number 2, of samples numbered 101 to 110; number 3,

(Shipment and Instructions, cont'd) -

of samples numbered 301 to 315; and number 4, of samples numbered 501 to 515. Each group was to be sampled and assayed separately and then were to be combined for assay and test purposes in proportion to the widths of the ore bodies, these widths being given in Mr. Darling's letter of November 28, 1946.

Location of Properties:

The properties of the Colomac Yellowknife Mines Limited and the Indian Lake Gold Mines Limited from which the samples originated are in the Indian Lake section of the Yellowknife district, Great Slave Lake area, Northwest Territories.

Sampling and Analysis:

The samples were arranged into four groups according to their numbering as explained above, and the ore in each group was individually crushed to approximately 20 mesh. A sample was cut out from each group and sent for assay.

The ore from each group was then proportionately combined in the following manner:

Department's Sample No.	Company's Sample No.	Width of X-cut, ft.	Weight Taken, in pounds
1	51-55	75	50
2	101-110	175	116.5
3	301-315	140	93.0
4	501-515	92	61.0
			320.5

The total weight of the combined sample was then made to pass a 20-mesh screen and a head sample was taken for assay and analysis.

(Continued on next page)

(Sampling and Analysis, cont'd) -

The remainder of the combined ore sample was bagged for investigative purposes.

Some ore samples were taken, before the ore was crushed, for microscopic examination. These specimens were taken from samples 513, 305 and 309. These samples appeared to have ore particles more suitable in size for this work.

Assays made on the samples from the individual groups gave the following results:

Department's No.

1	- Au, 0.1325	oz./ton
	- Ag, 0.15	"
2	- Au, 0.06	"
	- Ag, 0.05	"
3	- Au, 0.06	"
	- Ag, 0.04	"
4	- Au, 0.065	"
	- Ag, 0.045	"

The assay and analysis of the combined head sample gave the following results:

Gold	- 0.0825	oz./ton
Silver	- 0.07	"
Iron	- 5.13	per cent
Arsenic	- None detected.	
Sulphur	- 0.74	per cent
Nickel	- None detected.	
Antimony	- None detected.	
Insoluble	- 84.26	per cent

A screen analysis on the ore showed the values, association and distribution of the gold in the various mesh sizes to be as follows:

Mesh Size	Weight, per cent	Assays Oz./ton Au	Assays Per Cent Fe	Assays Per Cent S	Distribution, per cent Au	Distribution, per cent Fe	Distribution, per cent S
+28	11.5	0.08	4.28	0.61	8.2	10.8	9.1
+35	21.3	0.055	4.12	0.60	10.4	19.5	16.5
+48	12.5	0.085	3.97	0.62	9.4	11.0	10.1
+65	13.2	0.27	3.92	0.62	31.7	11.4	10.5
+100	9.1	0.14	3.97	0.71	11.3	8.1	8.4
+150	7.9	0.105	4.58	0.99	7.4	8.1	10.0
+200	5.6	0.15	4.68	1.11	7.4	5.8	8.1
-200	18.9	0.085	6.04	1.12	14.2	25.3	27.3
Total	100.0	0.1126	4.51	0.77	100.0	100.0	100.0

Microscopic Examination:

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

Gangue -

In the polished sections gangue material is a mixture of light to dark greenish grey to almost black rock and grey to milky white quartz. The rock component of this assemblage carries rather abundant finely disseminated carbonate (calcite) and in two or three sections it shows a slight schistose texture. In a few places the gangue bears small, local, light brown stains of iron oxides.

Metallic Minerals -

Metallic mineralization is very sparse in the twelve polished surfaces and is represented by pyrrhotite, pyrite, ilmenite, chalcopyrite, and sphalerite. While those minerals are named in their approximate order of decreasing abundance, none is really abundant, the last two in particular being present only in negligible amounts. All of them are sparingly and sporadically scattered through gangue as occasional to rare, medium coarse to very fine irregular grains. The largest seen is about 0.75 mm. (-20 +28 Tyler mesh) in size but the majority of them are much smaller.

No gold mineral or native metal was found in the twelve polished sections, but this is not surprising since there is so little gold in the sample.

Conclusions:

The ore as represented by the sample received was of a grade lower than anticipated and, at 0.0825 oz./ton in gold ($2.89 at $35.00 per ounce), it must be considered as distinctly marginal from the standpoint of profitable

(Conclusions, cont'd) -

operation, at least under normal tonnage and conditions.

Cyanidation of the ore proved to be the most efficient method of recovering the gold and, as in Test No. 1, an extraction of nearly 94 per cent of the gold with a tailing loss of 0.005 oz./ton was obtained. Fine grinding does not appear to be necessary, as the same results were obtained at a grind of 61 per cent minus 200 mesh as at 88 per cent minus 200 mesh. These extractions must be considered good on an ore of this gold content.

Naturally, straight cyanidation would involve the greatest expenditure for plant installation and would also involve the highest cost per ton in milling operation.

The ore does not respond to flotation as easily as it does to cyanidation, and in Tests Nos. 2 and 6 lower extractions and higher tailings loss resulted.

Straight amalgamation of the ore, as in Test No. 5, gave rather satisfactory results for this process, with an extraction of nearly 85 per cent and a tailing loss of 0.0125 oz./ton in gold at a comparatively coarse grind. From the standpoint of plant installation and cost of operation, amalgamation of the ore must be considered, though cost of operation plus tailing loss in this case would have to be balanced against these factors in the case of straight cyanidation.

While blanket table procedure would be simple, the extraction from this method would be low, as in Tests Nos. 7 and 8.

The ore presents no difficulty from a settling standpoint, as may be deduced from Test No. 4.

DETAILS OF INVESTIGATIVE TESTS:

Test No. 1.

Two lots of ore of 1,000 grams each were ground to 61 per cent minus 200 mesh (A) and to 88.4 per cent minus 200 mesh (B) and agitated individually for 48 hours at 2 to 1 dilution with cyanide and lime.

Pulp filtered, washed, and sent for assay.

Results:

		A	B
Assay heads, Au oz./ton	-	0.0825	0.0825
Assay residue " "	-	0.005	0.005
Per cent extraction, Au	-	93.94	93.94
NaCN consumed, lb./ton ore	-	0.6	0.48
CaO " " "	-	3.08	3.04

Reducing power (c.c. $\frac{N}{10}$ $KMnO_4$ for 1000 c.c. solution) - 96

NaCNS, per cent - 0.007

Test No. 2.

1,000 grams ore ground to 77.4 per cent minus 200 mesh and pulp transferred to a flotation cell.

Reagents Added:

To Grinding -		Lb./ton	
Soda ash	-	0.5	
Reagent No. 301	-	0.1	
" No. 208	-	0.1	
Pot. amyl xanthate	-	0.1	
Aerofloat No. 25	-	0.035	
To Conditioning			
Pot. amyl xanthate	-	0.1	pH, 8.5.
$CuSO_4$	-	1.0	(5 mins.)
To Flotation			
Pine oil	-	0.05	(4 mins.)

(Continued on next page)

(Details of Investigative Tests, cont'd) -

Results:

Product	Weight, per cent	Assays Oz./ton Au	Assays Per Cent Fe	As	S	Distribution, per cent Au	Fe	As	S
Flot. conc.	6.25	1.0	16.75	0.08	10.16	87.0	26.0	6.2	64.1
Flot. tailing	93.75	0.01	3.18	0.08	0.38	13.0	74.0	93.8	35.9
Total	100.00	0.072	4.03	0.08	0.99	100.0	100.0	100.0	100.0

Test No. 3A.

500 c.c. of pregnant solution from Tests Nos. 1A and 1B (combined) was deoxidized for 30 minutes with 0.1 gram $PbNO_3$ added. Precipitated while under vacuum for 5 minutes with 0.3 gram zinc dust. Filtrate recovered.

Results:

Assay of pregnant solution, Au oz./ton = 0.044
Assay of barren " " " = 0.0055

Test No. 3B.

500 c.c. of pregnant solution from Tests Nos. 1A and 1B (combined) deoxidized for 30 minutes with 0.1 gram $PbNO_3$ added. Precipitated while under vacuum for 5 minutes with 0.3 gram aluminium dust and 0.35 gram NaOH.

Results:

Assay of pregnant solution, Au oz./ton = 0.044
Assay of barren " " " = 0.0035

Test No. 4.

500 grams of ore was ground to 79.1 per cent minus 200 mesh with 1.0 pound NaCN and 1.0 pound CaO per ton. Dilution brought up to 4 to 1 and pulp transferred to a cylinder. Settling rate was noted every minute for 10 minutes.

Enough clear solution decanted to bring dilution to 3 to 1, and settlement noted for 10 minutes.

(Continued on next page)

(Details of Investigative Tests, cont'd) -

Enough clear solution decanted to bring dilution to 2 to 1, and settlement noted for 10 minutes.

Results:

4 to 1 dilution, settlement 7 inches in 10 mins. = 3.5 ft./hr.
3 to 1 " " 4⅝ " " 10 " = 2.37 "
2 to 1 " " 2-5/8 " " 10 " = 1.31 "

Settling area required can be ascertained from the formula

$$A = \frac{1.333\,(F-D)}{R}, \text{ in which}$$

A = thickener area,
F = initial density (parts solution),
D = final density of thickener discharge (parts solution),
R = settling rate in feet per hour.

Test No. 5.

1,000 grams of ore ground to 67.2 per cent minus 200 mesh.

Amalgamated for 1 hour with 7 c.c. mercury, 0.5 gram CaO, and 6 pebbles.

Assay heads, Au oz./ton = 0.0825
Assay tailings, " " = 0.0125
Per cent extraction Au = 84.9

Test No. 6.

Conditions of this test were the same as for Test No. 2 with exception of the pH of the pulp at 8.0 and flotation time 6½ minutes.

Results:

Products	Weight, per cent	Assays			Distribution, per cent		
		Oz./ton	Per Cent				
		Au	Fe	S	Au	Fe	S
Flot. conc.	8.62	0.54	13.16	6.19	67.0	28.2	60.6
Flot. tailing	91.38	0.025	3.12	0.38	33.0	71.8	39.4
Total	100.00	0.0695	3.98	0.88	100.0	100.0	100.0

(Details of Investigative Tests, cont'd) -

Test No. 7.

1,000 grams of ore ground to 72.6 per cent minus 200 mesh and run over a corduroy blanket table at a slope of 5 inches per foot. Dilution of the pulp was 3 to 1.

Results:

Products	Weight, per cent	Assays			Distribution, per cent		
		Oz./ton	Per Cent				
		Au	Fe	S	Au	Fe	S
Blanket conc.	8.25	0.72	7.20	2.58	76.5	13.4	25.4
Blanket tailing	91.75	0.02	4.2	0.68	23.5	86.6	74.6
Total	100.00	0.0777	4.44	0.83	100.0	100.0	100.0

Test No. 8.

Same procedure as in Test No. 7, except that two blankets in series were used.

Results:

Products	Weight, per cent	Assays			Distribution, per cent		
		Oz./ton	Per Cent				
		Au	Fe	S	Au	Fe	S
Blanket conc.	10.7	0.64	7.53	2.54	81.4	19.3	55.6
Blanket tailing	89.3	0.0175	3.78	0.54	18.6	81.7	64.4
Total	100.0	0.084	4.18	0.76	100.0	100.0	100.0

oooooooooooo
oooooooo
oo

JH:LB.