DEPARTMENT OF MINES AND RESOURCES

BUREAU OF MINES

CANADA

Ottawa, November 14, 1946.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 2127.

Concentration and Cyanidation Tests on a Shipment of Gold Ore from Beaulieu Yellowknife Mines Limited, Yellowknife District, Northwest Territories.

9p

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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. 10.)

1947

BUREAU OF MINES
DIVISION OF METALLIC MINERALS
ORE DRESSING AND
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Shipment:

A shipment of one bag of ore, of a net weight of 98 pounds, was received from Nepheline Products Limited, Lakefield, Ontario, on September 25, 1946. It was noted on the shipping tag that this was a representative sample of a 16-hundredweight shipment of ore from Beaulieu Yellowknife Mines Limited.

A letter dated September 19, 1946, from E. Schnee, Beaulieu Yellowknife Mines Limited, Room 1024, 85 Richmond St. W., Toronto, Ontario, relative to this shipment, requested gravity concentration and cyanidation tests and a recommended flow sheet.

Mr. Schnee's letter stated that a 35-ton gravity concentration mill was being installed at the present time.

Location of Property:

The property of Beaulieu Yellowknife Mines Limited from which the sample of ore originated is in the Beaulieu River section of the Yellowknife district, Great Slave Lake, Northwest Territories.

Sampling and Analysis:

The ore sample as received was already crushed to approximately ¼ inch mesh. Although this was not entirely suitable for microscopic examination, a sample was taken for this purpose.

The ore was then crushed to approximately 20 mesh and a head sample was cut out for assay and analysis.

The remainder was screened and further crushed to minus 20 mesh and bagged for investigative purposes.

The analysis made on the head sample gave the following results:

Gold	-	1.63 oz./ton
Silver	-	0.40 "
Iron	-	4.16 per cent
Arsenic	-	None.
Sulphur	-	1.07 per cent
Insoluble	-	87.16 "

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

Mesh	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	19.7	1.19	4.16	0.95	16.7	20.7	18.3
+ 35	19.5	1.39	4.00	0.99	19.3	20.0	19.1
+ 48	10.6	1.47	3.74	1.00	11.1	10.0	10.2
+ 65	10.6	1.53	3.74	0.95	11.5	10.0	10.2
+100	8.0	1.97	3.85	0.94	11.2	7.8	7.4
+150	7.9	1.64	2.91	1.01	9.3	5.8	7.5
+200	5.8	1.85	3.43	1.05	7.6	5.0	6.0
-200	17.9	1.04	4.58	1.21	13.3	20.7	21.3
Total	100.0	1.40	3.95	1.02	100.0	100.0	100.0

(Continued on next page)

Microscopic Examination:

Four polished sections were prepared and examined microscopically for the purpose of determining the character of the ore. The sample was crushed when received and each of the four polished surfaces is composed of four to six pieces of ore which average about one-half inch in size.

Gangue -

As exhibited in the four polished sections, gangue material varies in character and appears to be an assemblage of vitreous quartz and soft, light to dark greenish grey rock. In several places the latter constituent displays a distinct schistosity and probably represents a silicified chloritic schist.

Metallic Minerals -

Metallic mineralization is very light in the four polished surfaces and is represented by pyrite, marcasite, chalcopyrite, pyrrhotite and gold. None of these minerals is abundant; all are sparsely and finely disseminated through gangue.

Pyrite predominates as small irregular grains and parallel shreds with the long dimension conforming to the schistosity of the rock. The longest shred observed is a little over 1 mm. in length with an average width of about 84 microns (0.084 mm.). The irregular but more or less equant grains are smaller and would average 74 microns (200 Tyler mesh) or less in size. Small amounts of marcasite, chalcopyrite and pyrrhotite are visible as small scattered grains in gangue. The latter mineral occurs also as rare tiny inclusions in pyrite.

Twenty-eight irregular particles of native gold were observed and measured. All occur in one piece of ore in which chalcopyrite is the preponderant metallic mineral. In

(Microscopic Examination, cont'd) -

size they range from 108 microns (-100+150 Tyler mesh) down to 4 microns in diameter, but the finer sizes (-280 Tyler mesh or less) predominate. Three of the twenty-eight grains of gold are against chalcopyrite, the remainder are alone (free) in gangue. (See Figure 1.)

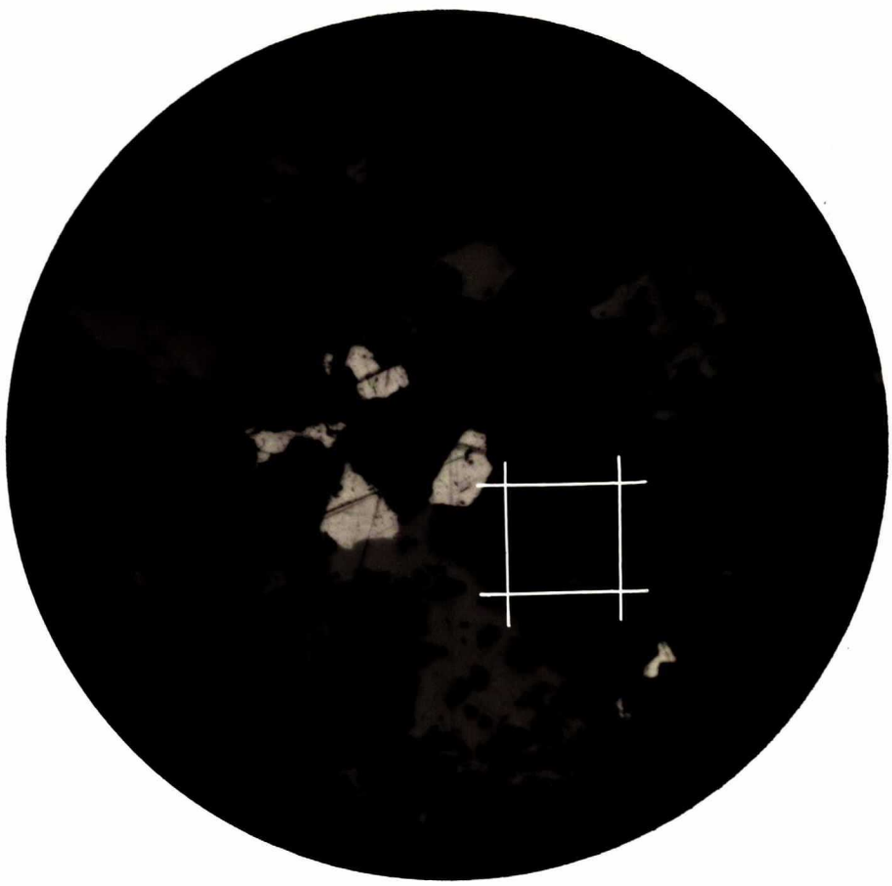
Conclusion from Microscopic Examination -

The fact that all the gold was seen in one of the half-inch pieces of ore in which chalcopyrite preponderates may indicate that the occurrence of gold is spotty, and that it probably has some association with the copper mineral.

(Figure 1 follows, on Page 5.)

(Microscopic Examination, cont'd) -

Figure 1.



PHOTOMICROGRAPH OF POLISHED SECTION SHOWING NATIVE GOLD (WHITE) ALONE IN GANGUE (BLACK) AND AGAINST CHALCOPYRITE (GREY).

Pits and scratches are black, and a 200-mesh Tyler screen opening is outlined in white.

X200 magnification.

Conclusions:

Straight cyanidation of the ore appeared to give the highest extraction of gold, and considering the grade of the head sample some satisfactory tailings were obtained from these tests, as in Test No. 1. Fine grinding did not appear necessary, and a high extraction of gold was obtained at less than 70 per cent minus 200 mesh.

Considerable of the gold would seem to be "free milling" as the high extraction from amalgamation would indicate.

Gravity concentration on blankets or on tables gave comparatively good results with a high-grade concentrate from tabling being obtained, as in Test No. 3, which could be shipped direct to the smelter if this was considered advisable. In Test No. 6, results confirm these tabling results and the adaptability of the ore to cyanidation, inasmuch as a very high extraction was obtained from cyaniding the table concentrates. As an alternative the concentrate could be barrel amalgamated and a bullion recovered for easy shipment of the gold. This would open the way for comparatively low cost plant installation and low shipment costs on the gold if high overall extraction were not considered paramount and if some future treatment could be considered for the table tailings.

It can be said that the gold in the ore yields itself to good recovery by all the tests which were carried out. As mentioned previously, plant layout should include cyanidation in some form for greatest efficiency.

The results obtained are applicable to the gold as represented by the sample received. Any change in the grade of ore or the mineral association might alter partially

(Conclusions, cont'd) -

or completely the method of treatment.

DETAILS OF INVESTIGATIVE TESTS:

Test No. 1.

Two lots of ore of 1,000 grams each were ground in a jar mill to 67.6 per cent minus 200 mesh (1A) and to 89.0 per cent minus 200 mesh (1B) and cyanided for 47 hours.

Results	Lot 1A	Lot 1B
Cyanide heads, Au oz./ton	= 1.63	1.63
Cyanide tailings, Au oz./ton	= 0.02	0.015
Extraction of gold, per cent	= 98.80	99.08
NaCN consumed, lb./ton ore	= 1.32	1.24
CaO " " "	= 3.28	3.48

Reducing power of solution, 1A and 1B combined, in c.c. N/10 $KMnO_4$ per 1000 c.c. solution = 86.7

NaCNS of solution, 1A and 1B combined, per cent = 0.005

Test No. 2.

2,000 grams of ore ground to 77.2 per cent minus 200 mesh.

Run over a blanket table at 3 to 1 dilution with a slope of 3 inches per foot on the table.

Results:

Products	Weight, per cent	Assay, Au, oz./ton	Distribution of gold, per cent
Blanket table conc.	5.5	15.82	79.3
Blanket table tailing	94.5	0.24	20.7
Total	100.0	1.10	100.0

Test No. 3.

2,000 grams of ore ground to 77.2 per cent minus 200 mesh and run over a laboratory Wilfley table.

(Continued on next page)

(Details of Investigative Tests, cont'd) -

Results:

Products	Weight, per cent	Assays Au, oz./ton	Distribution of gold, per cent
Table conc.	2.2	37.01 ($1,295.35)*	78.8
Table middlings	27.8	0.26	7.0
Table tailings	70.0	0.21	14.2
Total	100.0	1.03	100.0

* Gold at $35.00 per ounce.

Test No. 4.

1,000 grams of ore ground to 77 per cent minus 200 mesh and amalgamated for 1 hour with 7 c.c. mercury, 0.5 gram CaO, 1,000 c.c. water, and 6 small pebbles. Mercury recovered.

Results:

Assay heads, Au oz./ton = 1.63
Amalgamation tailings, Au oz./ton = 0.29
Extraction of gold, per cent = 82.2

Test No. 5.

1,000 grams of ore ground to 65 per cent minus 200 mesh and transferred to a flotation cell.

Reagents Added:

		Lb./ton	
To Grinding -			
Soda ash	-	0.5	
No. 301	-	0.1	
No. 208	-	0.1	
Pot. amyl xanthate	-	0.1	
To Conditioning -			
Pot. amyl xanthate	-	0.1	3 mins.
To Flotation -			
Pine oil	-	0.05	5 mins. pH, 9.2.

(Details of Investigative Tests, cont'd) -

Results:

Products	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
Flotation conc.	8.79	12.96	12.7	10.96	80.1	31.2	88.1
Flotation tailing	91.21	0.31	2.7	0.13	19.9	68.8	10.9
Totals	100.00	1.42	3.58	1.08	100.0	100.0	100.0

Test No. 6.

4,000 grams of ore ground to 78 per cent minus 200 mesh and run over a laboratory Wilfley table.

Results:

Products	Weight, per cent	Assays, Au, oz./ton	Distribution of gold, per cent
Table conc.	3.25	29.64 ($1,037,40)@	84.3
Table tailing	96.75	0.185	15.7
Total	100.00	1.14	100.0

@ Gold at $35.00 per ounce.

90 grams of table concentrate ground for 25 minutes and cyanided for 48 hours.

Results:

Concentrate heads, Au oz./ton = 29.64
Cyanide residue, " " = 0.015
Extraction of gold, per cent = 99.50

NaCN consumed, lb./ton conc. = 34.0
CaO " " " = 30.4

Reducing power of solution, in

c.c. $\frac{N}{10}$ $KMnO_4$ per 1000 c.c. solution = 264
NaCNS, per cent = 0.021

Overall recovery from tabling and cyaniding concentrate, per cent = 83.98

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