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O T T A W A May 22nd, 1942.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1231.

Gold Ore from Prosperous Lake,
Yellowknife District, Northwest Territories.

(Copy No. 20.)

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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Gold Ore from Prosperous Lake, Yellowknife District, Northwest Territories.

Shipment:

A shipment of 4 sacks of ore, net weight 330 pounds, was received on March 17th, 1942. The shipment was submitted by A. S. Hodgson Limited, Revillon Building, Edmonton, Alberta.

Location of Property:

The property from which the ore was taken was stated to be the Tin Group, Claims 5-11 on the south end of Prosperous lake, which is about 9 miles south of the Yellowknife settlement, Yellowknife district, Northwest Territories.

Character of the Ore:

Selected specimens of the ore were subjected to microscopic examination of polished sections.

Gangue -

Gangue material consists essentially of light to dark grey, impure quartz which, in places, shows a distinct schistose structure and may represent a highly silicified schist.

Metallic Minerals -

Metallic mineralization is not heavy and gangue forms the major portion of the polished sections. In their approximate order of decreasing abundance, the metallic minerals present are: sphalerite, pyrrhotite, marcasite, chalcopyrite, galena, and hematite(?). No gold is visible in the six polished sections.

Sphalerite and pyrrhotite, the two most abundant metallics, occur as small masses and irregular grains, coarse to fine in size, disseminated through gangue. Each contains numerous inclusions of gangue and grains of the other sulphides. Marcasite is locally common as small disseminated grains and fine granular masses usually intimately associated with pyrrhotite, sometimes with sphalerite.

Chalcopyrite and galena are each present in small quantity as occasional, small, irregular grains in gangue. The former is also visible in places as numerous, tiny inclusions in sphalerite and the latter is usually associated with zinc sulphide. An almost negligible amount of a hard,

(Character of the Ore, cont'd) -

light grey, anistropic mineral regarded as hematite occurs in one section as occasional, medium to small irregular grains in gangue.

Purpose of the Investigation:

The investigation was made to determine the value of the ore and a method of treatment.

Sampling and Analysis:

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

Gold (Au)	-	0.53 oz./ton.
Silver (Ag)	-	0.26 "
Copper (Cu)	-	0.015 per cent
Zinc (Zn)	-	1.32 "
Lead (Pb)	-	0.12 "
Sulphur (S)	-	1.93 "
Iron (Fe)	-	2.49 "
Arsenic (As)	-	None detected.
Tin (Sn)	-	" "
Tungsten trioxide (WO_3)	-	" "

Investigative Procedure:

The ore was treated by straight cyanidation, amalgamation, and concentration by jigging and flotation.

Results of the Test Work:

97 per cent of the gold was recovered by straight cyanidation at a grind of 86 per cent minus 200 mesh.

64 per cent of the gold was recovered by amalgamation at a grind of 78 per cent minus 200 mesh.

61.8 per cent of the gold was recovered in a flotation concentrate assaying 5.72 ounces gold and 33.5 per cent zinc per ton. The ratio of concentration was 25:1.

Details of Tests:

Tests Nos. 1 and 2. - Straight Cyanidation.

Samples of the ore were ground in ball mills at a dilution of 4 parts solids to 3 parts of cyanide solution containing 1.0 pound NaCN per ton.

The ground pulps were agitated for 24 hours in a 1.0 pound NaCN per ton solution at a dilution of one part solids to 1½ parts of solution.

The tailings were sampled and a screen test was made on each to show the degree of grinding.

Results:

Grind, per cent -200 mesh	Assays, Au oz./ton: Feed	Tailing	Extraction, per cent	Final titration, lb./ton solution: NaCN	CaO	Reagents consumed, lb./ton ore: NaCN	CaO
77.9	0.53	0.035	93.4	0.70	0.15	1.00	5.75
86.2	0.53	0.015	97.2	0.70	0.15	1.00	5.75

The reducing power of the solution was 230.0 ml. of N/10 $KMnO_4$ per litre in Test No. 2.

Screen Tests on Cyanide Tailings.

Mesh No.	Weight, per cent: Test No. 1	Test No. 2
- 48 + 65	0.2	-
- 65 +100	2.0	0.4
-100 +150	8.2	4.7
-150 +200	11.7	8.7
-200	77.9	86.2
	100.0	100.0

Test No. 3. - Flotation.

A sample of the ore was prepared for flotation by grinding in a ball mill to 78 per cent minus 200 mesh at a dilution of 4 to 3 with water.

(Continued on next page)

(Test No. 3, cont'd) -

Reagents:

To ball mill -	Lb./ton
Soda ash -	2.0
Potassium amyl xanthate -	0.2

To flotation cell - (pH of pulp in cell, 8.6)

Pine oil -	0.10

A concentrate was floated in 7 minutes.

Additional Reagents to the Flotation Cell:

	Lb./ton
Copper sulphate -	1.0
Amyl xanthate -	0.1
Pine oil -	0.05

A small additional amount of concentrate was recovered within 3 minutes.

Both concentrates were recleaned together with 2.0 pounds of lime per ton. This was done to note the grade of zinc concentrate that might result. The cleaner tailing was designated middling.

Results of Flotation:

Product	Weight, per cent	Assays Au, oz./ton	Assays Zn, per cent	Distribution of gold, per cent	Ratio of concentration
Feed	100.0	0.43		100.0	
Concentrate	4.5	5.28	30.0	55.9	22:1.
Middling	3.7	3.92		33.4	27:1.
Flotation tailing	91.8	0.05		10.7	

The rougher concentrate had a calculated value of 4.67 ounces gold per ton and a ratio of concentration of 12:1.

The lime added to the cleaner cell has a depressing effect on the gold and gold-bearing minerals. Flakes of free gold were observed microscopically in the flotation tailing.

The percentage of zinc in this concentrate is below that of commercial grade.

(Details of Tests, cont'd) -

Test No. 4. - Flotation.

This test was similar to Test No. 3.

Reagents Added to the Ball Mill:

		Lb./ton
Soda ash	-	3.0
Sodium cyanide	-	0.10

Grind 78 per cent minus 200 mesh. pH, 9.0.

Reagents Added to the Flotation Cell:

		Lb./ton
Copper sulphate	-	0.2
Potassium ethyl xanthate	-	0.1
Pine oil	-	0.1

Flotation period 7 minutes.

The rougher concentrate was recleaned with 3.0 pounds of lime per ton.

Results of Flotation:

Product	Weight, per cent	Assays Au, oz./ton	Assays Zn, per cent	Distribution of gold, per cent	Ratio of concentration
Feed	100.0	0.37		100.0	
Concentrate	4.0	5.72	33.5	61.8	25:1.
Middling	2.0	2.36		12.7	50:1.
Tailing	94.0	0.10		25.5	

The rougher concentrate had a calculated assay of 4.60 ounces of gold per ton, with a recovery of 74.5 per cent of the values.

Gold was observed microscopically as flakes in the tailing.

A zinc concentrate of commercial grade was not obtained.

(Details of Tests, cont'd) -

Test No. 5. - Jig Concentration; Amalgamation of Jig Concentrate; and Flotation of Jig Tailing and Amalgamated Jig Concentrate.

This test was made to determine the recovery by jigging and amalgamating a jig concentrate.

A sample of ore was ground 78 per cent minus 200 mesh and jigged in a Denver laboratory mineral jig.

The jig concentrate was barrel-amalgamated. After separating the mercury and amalgam, the amalgamated concentrate was returned to the jig tailing and filtered.

The jig tailing was treated by flotation.

Flotation.

The filtered tailing was repulped in the flotation cell, dilution 22 per cent solids.

Reagents to the Flotation Cell:

		Lb./ton
Lime	-	2.0

Conditioned for 20 minutes, pH 11.2.

Copper sulphate	-	0.2
Potassium ethyl xanthate	-	0.03
Pine oil	-	0.10

Zinc concentrate recovered.

Further Addition of Reagents:

		Lb./ton
Copper sulphate	-	1.0
Amyl xanthate	-	0.1
Pine oil	-	0.05

Pyrite concentrate recovered.

The concentrates were recleaned separately.

Recovery by Amalgamation:

Feed	-	Au, 0.53 oz./ton.
Tailing	-	Au, 0.19 "
Recovery	-	64.2 per cent.

(Continued on next page)

(Test No. 5, cont'd) -

Flotation.

Product	Weight, per cent	Assays Au, oz./ton	Assays Zn, per cent	Distribution of gold, per cent In test	Distribution of gold, per cent In orig. feed	Ratio of concentration
Feed	100.0	0.19		100.0	35.8	
Zinc conc.	3.0	3.50	39.8	54.2	19.4	33:1.
Zinc middling	2.7	1.32		18.4	6.6	37:1.
Pyrite conc.	1.2	0.93		5.8	2.1	83:1.
Pyrite middling	2.3	0.24		2.8	1.0	44:1.
Flot. tailing	90.8	0.04		18.8	6.7	

The results indicate that a finer grind than 78 per cent minus 200 mesh should be used.

The flotation tailing compares closely with that of Test No. 1, which was cyanided at the same grind.

Summary of Results, Test No. 5:

		Per cent
Gold recovery by amalgamation	=	64.2
" " in zinc concentrate	=	19.4
" " in pyrite concentrate	=	2.1
Overall recovery	=	85.7
Gold in middling	=	7.6
Gold in flotation tailing	=	6.7
Total	=	100.0

Summary and Conclusions:

The results of the investigation show that 64 per cent of the gold can be recovered by amalgamation at a grind of 78 per cent minus 200 mesh.

Straight cyanidation extracted 93 per cent of the gold at the same grind. Grinding to 86 per cent minus 200 mesh resulted in an extraction of 97 per cent of the gold by straight cyanidation. Some fouling of the solution is

(Summary and Conclusions, cont'd) -

indicated by the reducing power of 230.0 ml. of N/10 $KMnO_4$ per litre.

Straight flotation recovered 73.5 per cent of the gold. 12.7 per cent of this gold reported in the middling when lime was added to the cleaner cell in an attempt to raise the grade of zinc concentrate.

These results indicate that free gold should be recovered by jigs or traps prior to flotation. A jig located between the ball mill and the classifier would recover the gold freed in the ball mill and help to maintain a uniform feed to flotation. The jig concentrates would be barrel-amalgamated and the residues returned to the classifier. The concentrates would have to be treated by a smelter.

Since the location of the property would probably make the shipment of concentrates undesirable, cyanidation would be an alternative method of treatment of the ore. The ore could be ground in cyanide solution, jigged, and the jig concentrates barrel-amalgamated. The classifier overflow would be cyanided. The residue from amalgamation would be returned to the classifier. The results in practice would depend on the character of the ore used as mill feed.

The results obtained apply only to ore of a grade and character similar to that submitted for this investigation.

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