85-246-14602

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Ministry of Energy, Mines and Petroleum Resources

ASSESSMENT REPORT
TITLE PAGE AND SUMMARY

TYPE OF REPORT/SURVEY(S)	TOTAL COST
Metallurgical	$

AUTHOR(S) A. Clark
B.C. Research
SIGNATURE(S)

DATE STATEMENT OF EXPLORATION AND DEVELOPMENT FILED 19 March/85; 30 April/85 YEAR OF WORK 85

PROPERTY NAME(S) Edeye Pass Mine
Surf Point Mine

COMMODITIES PRESENT Gold, Silver, copper

B.C. MINERAL INVENTORY NUMBER(S), IF KNOWN 103-J #1; 2; changed to 103J-15

MINING DIVISION

NTS 103-J/2W

LATITUDE 54° 01.5'

LONGITUDE 130° 35'

NAMES and NUMBERS of all mineral tenures in good standing (when work was done) that form the property [Examples: TAX 1-4, FIRE 2 (12 units); PHOENIX (Lot 1706); Mineral Lease M 123; Mining or Certified Mining Lease ML 12 (claims involved)]:

Edeye Pass; Tippy, Toby, Kerry

OWNER(S)

(1) Porcher Island Gold Mines Ltd.

(2)

FILMED

MAILING ADDRESS

1131 Jackson Way
Delta, B.C.

GEOLOGICAL BRANCH
ASSESSMENT REPORT

OPERATOR(S) (that is, Company paying for the work)

(1) Imperial Metals Corporation

(2)

14,602

MAILING ADDRESS

#1300 - 409 Granville Street
Vancouver, B.C.
V6C 1T2

SUMMARY GEOLOGY (lithology, age, structure, alteration, mineralization, size, and attitude):

Gold in pyrite, associated with quartz veins and shear-zones cutting hornblende diorite.

REFERENCES TO PREVIOUS WORK

Gold & Silver Recovery, B.C. Research, November 1984

(over)

TABLE OF CONTENTS

POCHER ISLAND PROJECT

HISTORY

The property was first worked in 1916, and has been worked intermittantly by various optionees since then. A total of about 78,000 tons ore has been mined at a reported grade of 0.29 oz Au/t, of which about 38,000 tons were milled or smelted. Last production was in 1939 and total recovery was about 22,500 oz gold. In 1979 the predecessors to Imperial Metals Corporton optioned the property from Banwan Gold Mines and in 1980 mined 1,600 tons of ore for tests purposes which was stock piled at the portal, at tide-water.

ACCESS

The property is accessible by boat from Prince Rupert.

GEOLOGY

Gold mineralization occurs in pyrite in quartz veins, which infill shear zones. The shear zones cut through a Cretaceous quartz diorite which intrudes the Jurassic Prince Rupert Schists.

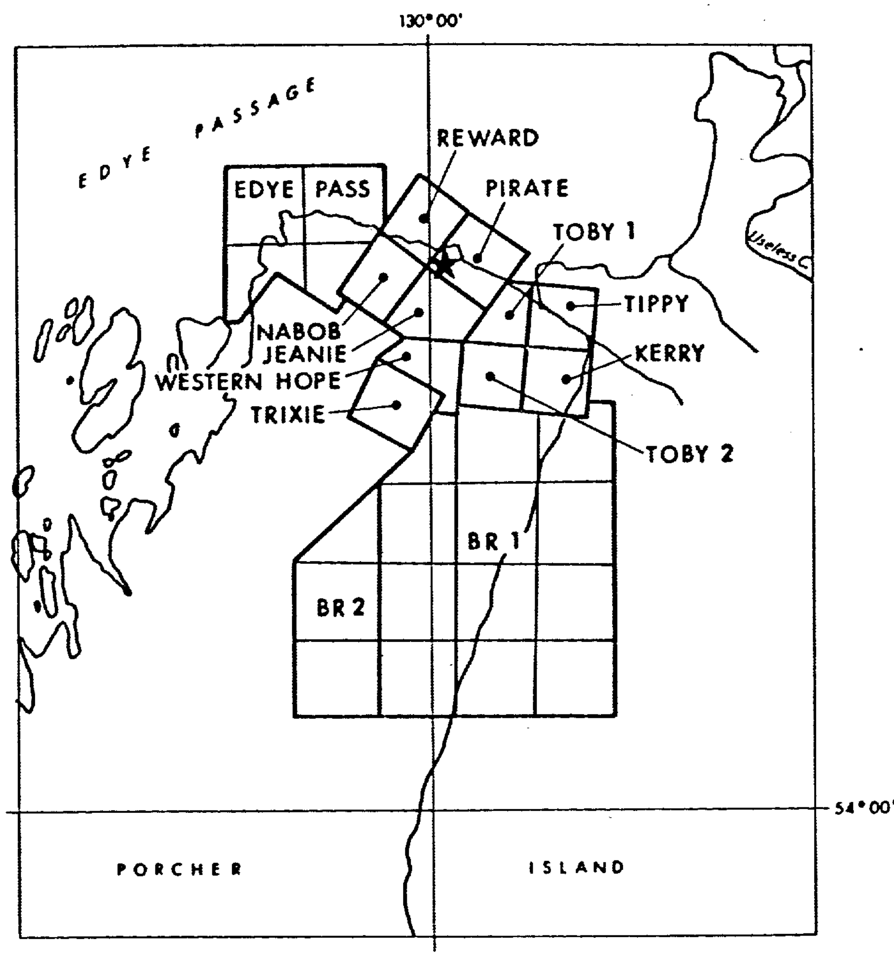
SAMPLINGS

A bulk sample (several hundred kilograms) was collected by digging into the ore stock-pile at various locations. This material has since been crushed and split at B.C. Research, and used for various metallurgical tests.

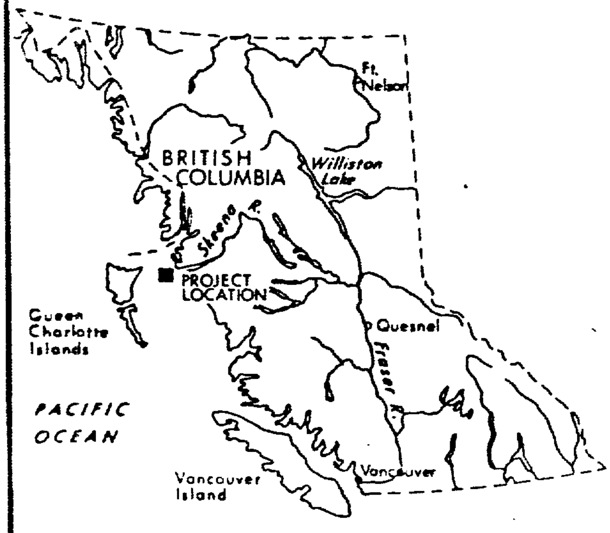
A.M.S. CLARK
VANCOUVER, B.C.

MAY 26, 1986

AMSC:bc
D1GCGeology



★ Ore Stockpile at Portal



E&B Explorations Ltd.

PROJECT # 1007-00

MINERAL DISPOSITION MAP OF PORCHER ISLAND PROJECT CLAIMS SHOWN ON MAP NTS 103-J

SCALE 1:50,000

1 0 1 2 Kilo

MAY 1986

INTRODUCTION

OBJECTIVES

- To perform biological leach tests on an ore sample supplied by Imperial Metals Corporation.
- To produce bioleach residues at partial and extensive oxidation for cyanidation.
- To perform cyanide leach tests on a sample of untreated, finely ground ore and the bioleach residues.

BACKGROUND

Microbiological leaching research studies at B.C. Research have led to the development of process concepts for the treatment of refractory gold and silver ores. The results from tests on a wide range of pyritic, arsenopyritic and other sulphide ores and concentrates have shown that a biological preleach can liberate precious metals for recovery by standard cyanidation procedures.

B.C. Research has been contracted by Imperial Metals Corporation to assess the amenability of a sample of ore to the biological oxidation leach and to determine the effect of two degrees of oxidation on gold and silver recovery by cyanidation. The ore was known to be refractory to gold and silver recovery by cyanide even after flotation concentration of a minus 200 mesh sample. This report represents the results of the experimental and biological oxidation leach assessment.

SUMMARY

- A study on the effect of biological oxidation as a preleach for gold and silver recovery by cyanidation on finely ground ore has been carried out.
- Two biological oxidation leach tests were performed, resulting in 5.9% and 9.3% iron dissolution achieved in 261 h and 595 h respectively. The sulphur breakdown in the first leach represents 70% oxidation and in the later leach 80% oxidation.

- The table below shows the results obtained by cyanidation of the untreated and biologically leached material.

Cyanidation of:	Recovery (%) Gold	Recovery (%) Silver
Untreated ore	68.5	50.4
Bioleach 1 (70% S breakdown)	89.7	80.6
Bioleach 2 (80% S breakdown)	96.1	85.9

- A study on the effect of Vat biological oxidation of cone crushed ore is presently in progress. The Vat bioleach rate is much longer than for finely ground ore. The results of this investigation will be forwarded as an addenda when completed.

EXPERIMENTAL PROCEDURES

SAMPLE

About 300 kg of run of the mine ore sample from Imperial Metals Corporation was received at B.C. Research on September 1, 1984.

Approximately 20 kg of sample was taken randomly from the 300 kg material and was Jaw and Cone crushed. The crushed portion was then split out to a 1.2 kg sample for fine grinding by a vibratory-ring pulverizer.

BIOLOGICAL LEACH TEST

The biological leach tests were performed in 4 L turbine agitated baffled tanks at 35°C with CO_2-enriched air sparging. For each test, a 4 L solution containing nutrient salts* for the bacteria was charged with 400g of finely ground ore. The pulp was adjusted to a stable pH of ~2.2 with sulphuric acid prior to inoculation with an active culture of *Thiobacillus ferrooxidans* previously grown on a pyrite concentrate.

The leach test was sampled periodically for soluble iron and pH measurements and was terminated at a predetermined degree of oxidation. The pulp was filtered and the solid residue washed and dried for cyanidation.

---

* Silverman, M.P. and Lundgren, D.G. J. Bacteriol. 77 (1959), 642-647.

CYANIDE LEACH TESTS

The biological leach residues and an untreated finely ground ore sample (for comparison) were subjected to standard 24h bottle roll cyanide leach procedures.

Lime was used to maintain protective alkalinity and sodium cyanide was used in excess during the cyanidation.

ANALYTICAL

Solution samples were assayed for iron, copper, gold and silver by atomic absorption spectrophotometry (AA).

Solid samples were digested with bromine and aqua regia. The digestion solutions were analyzed for iron, copper by AA and for sulphur by the barium sulphate precipitation method.

Excess cyanide was determined by silver nitrate titration. Gold and silver in the ore and the biological leach residues were determined by fire assay.

RESULTS AND DISCUSSION

SAMPLE ASSAY

The head assay of Imperial finely ground ore sample was as follows:

Fe	Cu	S	Au		Ag	
	(%)		(oz/st)	(g/tonne)	(oz/st)	(g/tonne)
3.13	0.19	6.34	0.288	9.874	0.18	6.17

BIOLOGICAL OXIDATION (Preleach)

Two biological leaching tests were carried out. An overview of the bioleach results are given in Table 1.

The first leach test was terminated after 261h retention time. The iron was only partially solubilized to 5.9% dissolution although subsequent residue assays showed that the sulphur breakdown reached approximately 70%. The pH dropped slightly from an initial value of 2.2 to 1.84. The Eh rose from 470 (mv) to 660 (mv) which indicates biological oxidation activity.

The second leach test was terminated after 595h retention time. Only slightly more iron dissolution (9.3%) was evident, but again, sulphide conversion was high (80%). A pH change to 1.77 and an Eh rise to 660 (mv) were observed as a result of extending the bioleach retention time.

The sulphuric acid addition required to bring down the pulp pH to below 3.0 was high (58.8 kg/tonne) due to the alkaline content of the ore. (The optimum pH required to start biological oxidation is between ~2.2 to 2.5).

CYANIDE LEACH TESTS

The results of the cyanide leach tests are given in Tables 2 and 3.

Gold and silver recovery from the finely ground untreated material was 68.5% and 50.4% respectively. Following a biological pretreatment leach to 70% S breakdown, gold and silver recovery was increased to 89.7% and 80.6% respectively. Extended biological pretreatment leaching 80% S breakdown, further increased gold and silver recovery to 96.1% and 85.9% respectively.

The corresponding gold tailings assay was decreased from 2.743 g/tonne (0.020 oz/st) for cyanidation of the untreated material to 1.296 g/tonne (0.037 oz/st) and 0.377 g/tonne (0.011 oz/st). The corresponding silver tailings assay was decreased from 3.77 g/tonne (0.11 oz/st) for cyanidation of the untreated ore to 1.71 g/tonne (0.05 oz/st) and 1.37 g/tonne (0.04 oz/st).

Cyanide consumptions for both the untreated head and the biological pretreatments were moderate at around 8 to 10 kg/tonne, indicating some cyanicide content in the ore. Optimum reagent consumption was not investigated.

Alkali consumption was somewhat higher following both biological leaches, indicating incomplete washing of the biological residues but substantial increases in alkali requirement was not needed.

CONCLUSIONS AND RECOMMENDATIONS

The Imperial Metals Corporation ore sample was amenable to biological oxidation and a high degree of sulphide breakdown was achieved.

Utilizing a biological oxidation leach prior to cyanidation enhanced gold recovery from 68.5% for untreated finely ground ore to 89.7% and 96.1%. Comparative silver recovery was increased from 50.4% for untreated material to 80.6% and 85.9%.

The significant improvements in gold and silver recovery from finely ground ore indicates that a viable preleach treatment followed by a cyanide leach process could be developed. We recommend that further investigations are warranted to determine the potential for process development.

The next phase of work should include a study of the various process scheme options. These include the treatment of ore by heap leaching or by controlled stirred-tank leaching; and the preparation of a flotation concentrate for stirred-tank leaching. In this case, the head grade of the ore may be high enough to allow treatment by the preferred stirred-tank leaching route without making a concentrate. However, if a good concentrate can be made (high recovery, low weight), treatment of the concentrate may provide more favourable economics.

We would like to discuss these possibilities with you so that a suitable test program can be devised. Such a program will have the objective of studying the various process parameters (particle size, pulp density, retention time, degree of sulphide oxidation required, etc.) to enable some preliminary engineering cost estimates to be made. Decisions can then be made whether further study would be warranted.

Clinton G. Rule
Extractive Technologist
Division of Extractive Metallurgy

ON BEHALF OF B.C. RESEARCH

R.W. Lawrence, Ph.D.
Head
Division of Extractive Metallurgy

TABLE 1

BIOLEACH OVERVIEW

Leach (1)

Retention time:	261 h
pH	1.84
Eh (mv)	660
Added H_2SO_4	58.8 kg H_2SO_4/tonne
Dissolved Fe	5.9%
Oxidized S	70%

Leach (2)

Retention time:	595 h
pH	1.77
Eh (mv)	660
Added H_2SO_4	58.8 kg H_2SO_4/tonne
Dissolved Fe	9.3%
Oxidized S	80%

TABLE 2

CYANIDATION OF AN ORE SUPPLIED BY IMPERIAL METALS CORPORATION AND BIOLEACH RESIDUES - MATERIAL BALANCES

FEED	PRODUCT	QUANTITY (mL or g)	ASSAY (ppm) Au	ASSAY (ppm) Ag	UNITS (mg) Au	UNITS (mg) Ag	DISTRIBUTION (%) Au	DISTRIBUTION (%) Ag
Untreated Finely Ground Ore	CN Head	200.0	9.874	6.17	1.975	1.23	100.0	100.0
	CN Solution	194.0	4.944	3.17	0.959	0.61	68.5	50.4
	Wash Solution	176.0	1.363	0.89	0.240	0.16		
	CN Residue	200.8	2.743	3.77	0.551	0.76	31.5	49.6
	Calc. Head	200.0	8.750	7.65	1.750	1.53	100.0	100.0
Tank 1 Bioleach Residue	CN Solution	174.0	7.784	5.03	1.354	0.86	89.7	80.6
	Wash Solution	294.0	2.968	1.93	0.873	0.57		
	CN Residue	201.8	1.269	1.71	0.256	0.35	10.3	19.4
Tank 2 Bioleach Residue	CN Solution	162.0	7.661	6.85	1.241	1.11	96.1	85.9
	Wash Solution	202.0	3.215	2.92	0.649	0.59		
	CN Residue	201.6	0.337	1.37	0.076	0.28	3.9	14.1
	Calc. Head	200.0	9.83	9.90	1.966	1.98	100.0	100.0

*CN Head Assays for bioleach residues calculated to allow for weight change in bioleach.

TABLE 3

CYANIDATION TESTS ON UNTREATED ORE AND BIOLEACH RESIDUES

		UNTREATED ORE	TANK 1 BIOLEACH RESIDUE	TANK 2 BIOLEACH RESIDUE
Initial Weight	(g)	200.0	202.0	200.0
CaO addition	(g)	0.96	1.20	1.60
	(kg/t)	4.80	5.94	8.00
Initial Ph		11.0	11.0	11.0
NaCN addition	(g)	3.0	3.0	3.0
	kg/t)	15.00	14.85	15.00
Excess CN	(g)	1.45	1.19	1.07
NaCN Consumption	(g)	1.55	1.81	1.93
	(kg/t)	7.75	8.96	9.65
Final pH		11.0	11.0	11.0
Final weight	(g)	200.8	201.8	201.6
Residue Assays	(g/t)			
	Au	2.743	1.269	0.377
	Ag	3.77	1.71	1.37
Extractions (%)	Au	68.5	89.7	96.1
	Ag	50.4	80.6	85.9

BC
RESEARCH

3650 Wesbrook Mall,
Vancouver, B.C.,
Canada V6S 2L2
Phone (604) 224-4331
Cable RESEARCHBC
Telex 04-507748

March 5th, 1985
Our File: 5-41-419

Dr. A.M.S. Clark
Imperial Metals Corporation
Suite 1300, 409 Granville Street
Vancouver, B.C.
V6C 1T2

Dear Dr. Clark,

Please find enclosed an Addendum to our Report 1-41-419 of November 1984 concerned with biological preoxidation of your refractory gold ore. The addendum gives the results of vat leach tests and cyanidation tests on cone crushed ore.

As you will see the cone crushed ore did not respond well in our tests with only 13.0% oxidation achieved in 126 days at 18-20°C compared with the 80% achieved for the finely ground ore. Consequently gold and silver recoveries were low at 23.7% and 35.5% respectively compared with 96.1% and 85.9% obtained for the biologically treated ground ore.

We would welcome the opportunity to discuss the results of the overall test program and the possibilities for process development with you. Thank you again for using our services. I look forward to hearing from you.

Yours very truly,

R.W. Lawrence, Ph.D.
Head
Division of Extractive Metallurgy

RWL/dlt
Encl.

BC RESEARCH

GOLD AND SILVER RECOVERY FROM ORE SUPPLIED BY IMPERIAL METALS CORPORATION

Addendum to Report 1-41-419, November 1984

The 20 kg of jaw and cone crushed material (see Report p. 2) was riffled down to give two 5 kg portions for vat leach tests.

The vat leaches were carried out by percolating leach solution through a bed of the crushed ore laid over a perforated plastic sheet (34 x 44 cm) covered with filter cloth supported inside rectangular plastic containers (vats).

10 L of leach solution which was first acidified to pH 2.3 was pumped from the bottom sump of the vat to the top of the ore bed following inoculation of the ore with a *T. ferrooxidans* culture. Recirculation of solution in the two vat tests were continued for 72 and 126 days. The results of the biological oxidation tests is summarized in Table 1.

After the termination of the bioleach tests (72 and 126 days) the leached orebeds were washed with water to ∿pH 3.0. Fresh solution containing lime was then recirculated. When the pH stabilized at 11 - 11.5, sodium cyanide was added and the solutions recirculated for 48h. The results of the cyanide leaches are given in Table 2.

Comments and Conclusions

The results show that the coarse, cone-crushed ore responded poorly to the bioleach with only 13% oxidation achieved in 126 days.

The cyanidation of the two bioleach residues (76 and 126 days) resulted in 15.2% and 23.7% Au extraction and 27.8 and 35.5% Ag extraction respectively.

In comparison, direct cyanidation of finely ground ore gave Au and Ag recoveries of 68.5% and 50.4% respectively. Bioleaching of the finely ground ore resulted in an improvement in the gold and silver extractions at 96.1% and 85.9% respectively.

We suggest that the recommendations put forward in our report for further testwork to develop a process for the ground ore be given consideration.

R.W. Lawrence, Ph.D.
Head
Division of Extractive Metallurgy

March, 1985

TABLE 1

Summary of Bioleach Results

	Vat 1	Vat 2
Retention Time (days)	72	126
Final pH	1.90	1.71
Final Eh (SCE) mV	480	480
H_2SO_4 addition (kg/t)	52.8	56.4
Dissolved Fe (%)	11.9	13.0

TABLE 2

Summary of Cyanide Leach Tests

		Vat 1	Vat 2
Initial pH		11.2	11.0
Final pH		10.3	11.0
CaO added	(g)	14.50	16.50
	(kg/t)	2.89	3.28
NaCN added	(g)	10.00	20.00
excess	(g)	5.65	1.28
consumed	(g)	4.35	18.72
	(kg/t)	0.87	3.72
Residue Assays	(g/t)		
	Au	9.600	8.469
	Ag	5.14	4.11
Extractions	(%)		
	Au	15.2	23.7
	Ag	27.8	35.5

ITEMIZED COST STATEMENT

Sample Collection and Sorting (August 14th - 28th, 1984)	
1 man @ $175/d for 13 days	$ 2,275.00
Board & Lodging @ $80/man-day for 7 days	560.00
Truck @ $100/day for 10 days	1,000.00
Truck gas, insurance, maintenance @ $15/d	150.00
Barge, Prince Rupert/Porcher Island	375.00
Contract Metallurgy (Report Date November 1984)	$ 3,500.00
TOTAL	$ 7,860.00

BC
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Telex 04-507748

May 7th, 1985
Our File: 5-41-585

Dr. A.M.S. Clark
Imperial Metals Corporation
Suite 1300 - 409 Granville Street
Vancouver, B.C.
V6C 1T2

Dear Dr. Clark,

In November 1984 we submitted our report (1-41-419) which compared the extraction of gold and silver from your ore before and after a biological preoxidation leach. The results showed the following recoveries:

Untreated ore	68.5% Au	50.4% Ag
Bioleach 1 (70% oxidation)	89.7	80.6
Bioleach 2 (80% oxidation)	96.1	85.9

At your request we have carried out and completed further testwork on the untreated ore to determine recoveries and reagent consumptions at 24, 48 and 72h to see whether improvement in recoveries can be achieved by extended cyanidation. The results of this testwork are given below.

Sample

A 20 kg sample was taken from the 300 kg of run-of-mine ore. The sample was jaw and cone crushed, then a 1 kg sub-sample was pulverized in a vibratory ring pulverizer. The pulverized material was ball-milled to obtain 90% minus 325 mesh material for testing.

Cyanidation

The finely ground ore sample was subjected to a 72h bottle roll cyanidation test. Samples were taken and reagent strengths adjusted at 24h and 48h.

Analytical

Solutions were assayed for Au and Ag by atomic absorption spectrophotometry (AA). Solids (head and tails) were assayed for Au and Ag by fire assay.

NaCN consumption was determined by silver nitrate titration using the Liebig-Deniges method.

Results

The results (Tables 1 and 2) show that direct cyanidation of the finely ground ore (98% minus 325 mesh) produces a quick release of gold and silver. No improvement in recoveries was achieved by extending the retention time after 24h.

The recoveries obtained (based on fire assays of head and tails) were 78.8% and 49.2% after 72h. Recoveries based on calculated heads (solid and solution assays) were slightly higher at around 83% Au and 61% for all samples taken. These are not considered as reliable as the results based on fire assay only.

Andrew Vizsolyi

A. Vizsolyi
Senior Hydrometallurgist
Div. of Extractive Metallurgy

BC RESEARCH

TABLE 1

Cyanidation Test Results

			Initial	24h	48h	72h
Input wt		g	500	500	500	500
Final wt		g				507.7
CaO addition		g	5.0	5.0	5.0	5.0
		kg/t	10.0	10.0	10.0	10.0
pH			11.0	11.1	11.1	11.3
NaCN addition		g	5.0	5.0	7.01	8.58
		kg/t	10.0	10.0	14.02	17.16
NaCN excess		g		2.99	3.43	3.43
		kg/t		5.98	6.86	6.86
NaCN adjustment[1]		g		(2.01)	(1.57)	-
		kg/t		(4.02)	(3.14)	-
NaCN consumption		g		2.01	3.58	5.15
		kg/t		4.02	7.16	10.30
Head	Au	oz/st	0.216			
	Ag	oz/st	0.16			
Residue	Au	oz/st				0.045
	Ag	oz/st				0.08
Extraction	Au	%				78.8
	Ag	%				49.2
Extraction[2]	Au	%		82.4	86.8	82.6
	Ag	%		60.9	61.7	60.6

1. Adjusted for continuation at maintained cyanide level.

2. Progression based on solution (AA) assays.

TABLE 2

Material Balance

Feed/Product	Quantity ml or g	Assays Au oz/st	(ppm)	Ag oz/st	(ppm)	Units (mg) Au	Ag	Distribution (%) Au	Ag
Head	500 g	0.216	7.405	0.16	5.49	3.702	2.74	(100)	(100)
Solution	375 ml		6.4		2.40	2.40	1.42	82.6	60.6
Wash/Repulp	380 ml		3.5		1.33	1.33	0.72		
Residue	507.7 g	0.045	1.543	0.08	2.74	0.783	1.39	17.4	39.4
Total[1]			9.03		7.06	4.51	3.53	(100)	(100)
Head	500 g	0.216	7.405	0.16	5.49	3.702	2.74	78.8	49.2
Residue	507.7g	0.045	1.543	0.08	2.74	0.783	1.39	21.1	50.8

1. or calculated head based on solution and tail assays.

CERTIFICATE OF ASSAY

Date: May 1, 1985
File: 8504-2452

SGS SUPERVISION SERVICES INC.
General Testing Laboratories Division
1001 East Pender Street,
Vancouver, B.C., Canada. V6A 1W2
Telephone: (604) 254-1647
Telex: 04-507514

TO: B.C. RESEARCH
3650 Wesbrook Mall
Vancouver, B.C.
V6S 2L2

We hereby certify that the following are the results of assays on: Pulps (Control)

MARKED	GOLD oz/st	SILVER oz/st	xxx	xxx	xxx	xxx	xxx	xxx
Standing Order No. 8467								
Req. No. R16045								
Project 5-41-585								
Imp. Metals Head	0.216	0.16						
Imp. Metals CN residue	0.045	0.08						

NOTE: REJECTS RETAINED ONE MONTH. PULPS RETAINED THREE MONTHS ON REQUEST PULPS AND AND REJECTS WILL BE STORE FOR A MAXIMUM OF ONE YEAR.

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L. Wong
PROVINCIAL ASSAYER

TESTWORK ON PORCHER ISLAND
MINE ORE

Background

In November 1984 we submitted our report (1-41-419) which compared the cyanide extraction of gold and silver from Porcher Island mine ore before and after a biological preoxidation leach. As the testwork showed promising results on direct cyanidation, further investigation was carried out on 90% -325 mesh material and the results were reported in May 1985 (1-41-585). This report presents testwork of the direct cyanidation approach using the same experimental conditions and methods on different grind sizes, viz. -200 mesh, -100 mesh, -65 mesh and -10 mesh.

Sample Preparation

A 20 kg sample was taken from the ~300 kg of run-of-mine ore previously supplied. The sample was jaw and cone crushed. Part of this sample was used in the previous experiment for cyanidation after fine grinding. In this study, we took part of this jaw and cone crushed sample and rod milled it. At discharge, the fines were washed out through a -325 mesh screen and the dried material was screened through a sieve deck comprising 10 mesh, 65 mesh, 100 mesh, 200 mesh screens (Tyler).

Cyanidation

Each fraction passing the above screen set was subjected to a 72 h bottle roll cyanidation test. At 24 h and 48 h retention samples were taken to determine gold extraction (cyanidation) progress and reagent consumption. If it was necessary at these intervals additional sodium cyanide was added to adjust the reagent to its original strength to compensate for consumption.

Analytical Methods

Solutions were assayed for Au and Ag by atomic absorption spectrophotometry (AA). Solids (head and tails) were assayed for Au and Ag by fire assay.

NaCN consumption was determined by silver nitrate titration using the Liebig-Deniges method.

Results

The results in Table 1 show the progression of gold extraction by cyanidation at 24 h, 48 h and at final 72 h retention.

The material balance and reagent consumption data are given in Tables 1 and 2.

For comparison, the earlier data on 90% -325 mesh material are also included in both tables.

Figure 1 shows the relationship between grind size and cyanide extractive gold.

The grade of varius grind fractions and discrepancies between head assays, calculated head values and corresponding extractions can be overviewed in Table 4.

Conclusion

As the results and final graph show, fine grinding is necessary on Porcher Island mine ore to deliver above 80% gold extraction. Grinding to 200 mesh would establish a possible 60% gold recovery.

Silver extractions were less affected by the grind size. A 40-60% silver recovery could be expected for -65 mesh material.

Longer retentions (72 h) on the coarser fractions were helpful as expected; on the finer grinds, 24 h and 48 h seems to be sufficient for carrying out the cyanidation.

Lime requirement on -10 mesh, -65 mesh and -100 mesh size material was 5.7 kg/t and on -200 mesh and -375 mesh 10 kg/t; sodium cyanide consumption was between 8-14 kg/t regardless of grind size or gold extraction.

A. Vizsolyi
Senior Metallurgist
Division of Extractive Metallurgy

R.W. Lawrence
Head
Division of Extractive Metallurgy

TABLE 1

Effect of Leaching Time on Gold Recovery

GRIND SIZE (mesh)	CUMULATIVE LEACH TIME (h)	NaCN kg/t				Au extracted	
		pH	Residual	Added	Consumed (cum)	kg/t[1]	%[2]
-10 + 65	0	11.1	-	10.0	-	-	-
	24	11.0	8.9	1.1	1.1	1.29	9.1
	48	11.0	6.9	3.1	4.2	1.90	19.0
	72	11.1	6.3	-	7.9	1.80	17.4
-65 + 100	0	11.3	-	10.0	-	-	-
	24	10.9	8.5	1.5	1.5	3.58	29.0
	48	10.9	6.4	3.6	5.1	3.90	31.6
	72	11.0	6.2	-	8.9	4.10	33.2
-100 + 200	0	11.3	-	10.0	-	-	-
	24	10.9	6.5	3.5	3.5	5.01	39.1
	48	10.9	6.2	3.8	7.3	5.40	42.1
	72	11.0	5.6	-	12.9	5.40	42.1
-200 + 325	0	11.3	-	10.0	-	-	-
	24	11.0	7.0	3.0	3.0	6.38	54.4
	48	10.9	4.9	5.1	8.1	6.90	58.8
	72	11.0	4.1	-	14.0	6.30	53.8
-325	0	11.0	-	10	-	-	-
	24	11.1	6.0	4.0	4.0	7.96	82.4
	48	11.1	6.8	3.2	7.2	8.39	86.8
	72	11.3	6.9	-	10.3	7.98	82.6

(1) kg/t values calculated from solution analyses by AA measurement

(2) percent of total gold extracted obtained from calculated head (see Table 2)

TABLE 2

Cyanidation Tests - Summary
(72 h leaching time)

		-10 + 65 mesh	-65 + 100 mesh	-100 + 200 mesh	-200 + 325 mesh	-325 mesh
Initial wt,	g	350	350	350	220	500
CaO addition,	g	2.0	2.0	2.0	2.0	5.0
	kg/t	5.7	5.7	5.7	10.0	10.0
Initial pH		11.1	11.3	11.3	11.3	11.0
NaCN addition,	g	4.96	5.28	6.05	3.98	2.58
	kg/t	14.2	15.1	17.3	18.1	17.2
Excess NaCN,	g	2.20	2.16	1.96	0.90	3.43
	kg/t	6.3	6.2	5.6	4.1	6.9
NaCN consumption,	g	2.76	3.12	4.09	3.08	5.15
	kg/t	7.9	8.9	11.7	14.0	10.3
Final pH		11.2	11.0	11.0	11.0	11.3
Final wt,	g	353.5	352.7	352.2	222.6	507.7
Head, Au	g/t	12.86	14.81	12.89	11.04	7.406
Ag		5.49	6.51	5.83	5.83	5.49
Residue, Au	g/t	8.26	8.57	7.51	4.77	1.543
Ag		3.97	3.43	3.77	4.11	2.74
Extraction[1], Au	%	35.1	41.7	41.4	56.3	78.8
Ag	%	30.7	46.9	34.9	28.7	49.3

[1] Calculated on solid/solid weight basis

TABLE 3

Material Balance (72 h cyanidation)

FEED/PRODUCT	QUANTITY mL or g	ASSAY (ppm) Au	Ag	UNITS (mg) Au	Ag	DISTRIBUTION % Au	Ag
-10 + 65 mesh							
Head (input)	350	12.86	5.49	4.50	1.92	(100)	(100)
Solution	265	1.9	1.3	0.50	0.34	16.6	23.1
Wash/repulp	130	0.6	0.5	0.08	0.06		
Residue	353.5	8.26	3.77	2.92	1.33	83.4	76.9
Total (Calculated head)				3.50	1.73	100	100
-65 + 100 mesh							
Head (input)	350	14.81	6.51	5.18	2.28	(100)	(100)
Solution	183	4.5	3.1	0.82	0.57	30.1	43.4
Wash/repulp	149	3.2	2.4	0.48	0.36		
Residue	352.7	8.57	3.43	3.02	1.21	69.9	56.5
Total (Calculated head)				4.32	2.14	100	100
-100 + 200 mesh							
Head (input)	350	12.89	5.83	4.50	2.04	(100)	(100)
Solution	198	5.9	3.5	1.17	0.69	41.0	46.2
Wash/repulp	197	3.4	2.3	0.67	0.45		
Residue	352.2	7.51	3.77	2.65	1.33	59.0	53.8
Total (Calculated head)				4.49	2.47	100	100
-200 + 325 mesh							
Head (input)	220	11.04	5.83	2.43	1.28	(100)	(100
Solution	135	7.3	3.3	0.99	0.45	58.8	44.5
Wash/repulp	173	3.0	1.6	0.52	0.28		
Residue	222.6	4.77	4.11	1.06	0.91	41.2	55.5
Total (Calculated head)				2.57	1.64	100	100
-325 mesh							
Head (input)	500	7.405	5.49	3.702	2.74	(100)	(100
Solution	375	6.4	2.40	2.40	1.42	82.6	60.6
Wash/repulp	380	3.5	1.33	1.33	0.72		
Residue	507.7	1.543	2.74	0.783	1.39	17.4	39.4
Total (Calculated head)				4.51	3.53	100	100

TABLE 4

Overview of Extraction and Grades

GRIND SIZE (mesh)	HEAD GRADE (g/t)		RESIDUE GRADE (g/t)		EXTRACTION (%)[1]	
	Au	Ag	Au	Ag	Au	Ag
-10 + 65	12.86	5.49	4.50	1.92	35.1	30.7
-65 + 100	14.81	6.51	5.18	2.28	41.7	46.9
-100 + 200	12.89	5.83	4.50	2.04	41.4	34.9
-200 + 325	11.04	5.83	2.43	1.28	56.3	28.7
-325	7.405	5.49	3.702	2.74	78.8	49.3

GRIND SIZE (mesh)	CALCULATED HEAD (g/t)		EXTRACTION (%)[2]	
	Au	Ag	Au	Ag
-10 + 65	10.00	4.94	16.6	23.1
-65 + 100	12.34	6.11	30.1	43.4
-100 + 200	12.83	7.06	41.0	46.2
-200 + 325	11.68	7.45	58.8	44.5
-325	9.02	7.06	82.6	60.6

1 Calculated on solid/solid weight basis
2 Obtained from material balances.

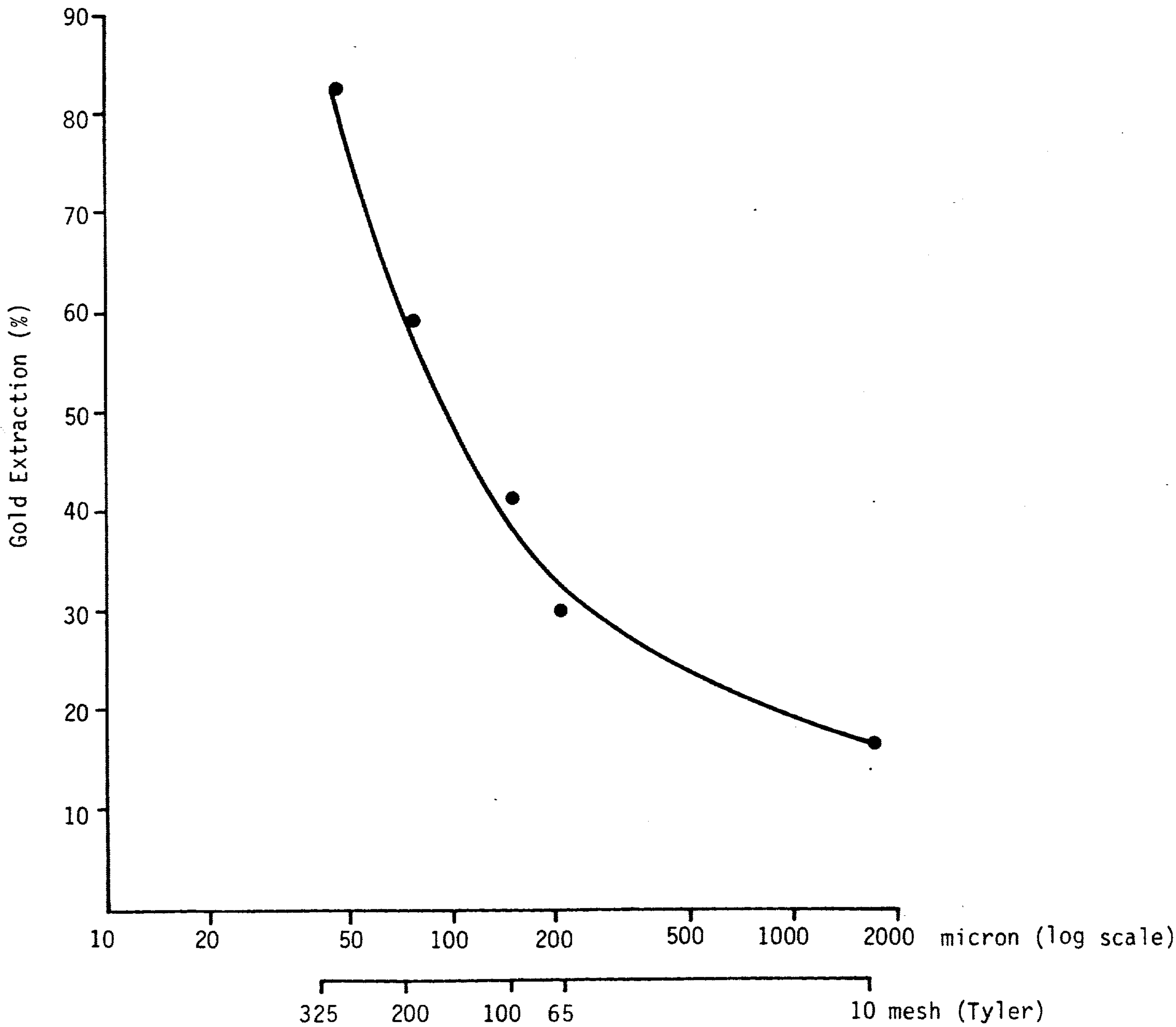

FIGURE 1

Effect of Grindsize on Gold Extraction
by Direct Cyanidation