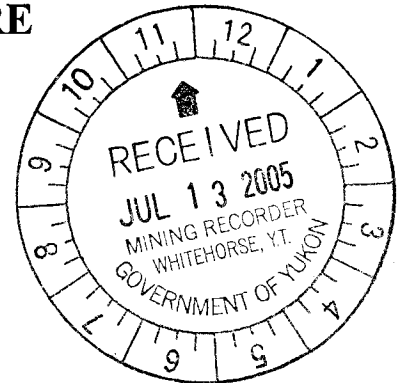


WESTCOAST BIOTECH LTD
2175 Greyllynn Crescent
North Vancouver
B.C. CANADA

**DEVELOPMENT OF WESTCOAST BIOTECH SULPHUR
PROCESS TO CARMACKS ORE**

Prepared for;

**Western Silver Corporation
1550-1185 West Georgia Street
Vancouver, B.C.
V6E 4E6**



Prepared by;

**Westcoast Biotech Ltd
2175 Greyllynn Crescent
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094529

Report Author: A. Bruynesteyn

Report Date: 20 April, 2005

Date Work Performed: 19 July 2004 – 29 March 2005

Claims:

451183	Box 85	115/107
451156	Box 58	115/107
459384	Dun 3	115/107
451154	Box 56	115/107
459383	Dun 2	115/107

Lat. 62° 20' N Long. 136° 43' W

Claim Owner: Western Copper Holdings

Mining District: Williams Creek Area

Costs associated with this report have been
approved in the amount of \$ 38,100.00
for assessment credit under Certificate of Work
No. QW27760

M. Sautter

Mining Recorder
Whitehorse Mining District

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Executive Summary

- 1. These tests proved conclusively that elemental sulphur can produce 93% (33 Kg/T) of all acid required in the leaching process.**
- 2. Only 3.5% (1.25 Kg/T) of the total acid requirement needs to be added during agglomeration, the remaining 3.5% can be added to the leach solution.**
- 3. The 7% (2.5Kg/T) of acid still required can be produced from elemental sulphur in an agitated bio-reactor.**
- 4. Six tests on -1" ore and with 2,5 to 9.0 Kg/T acid added, as well as elemental sulphur, gave extractions, based on head assays, varying between 79.4 and 89.2% of total copper in less then 150 days.**
- 5. The test with only 2.5 Kg/T acid added gave 82.9% total copper extraction (74.3% based on tail assays) and 93.0% acid soluble extraction**
- 6. -2" ore, leached with only 5 Kg/T acid as well as elemental sulphur gave 72.4% total and 81.3% acid soluble extraction after only 195 days**
- 7. The alkaline gangue in pulverized ore consumed 26 Kg/T acid in 24 hours and 34.9 Kg/T after 92 hours.**
- 8. Extractions based on solution and tail assays were 8-10% less then those calculated from solution and head assays**

INTRODUCTION

Westcoast Biotech Ltd. has developed a biological process where common leaching bacteria are used to convert elemental sulphur into sulphuric acid inside heaps and/or dumps. Acid can be produced inside a heap at a rate of 1.8 kg/T/week.

Western Copper Corporation owns the Carmacks ore body containing copper ores of high acid demand. Pulverized ore consumes 37 Kg/T acid in 24 hours and 46 Kg/T in 48 hours. Western Copper is interested to determine if the Carmacks ore can be economically leached using the Westcoast Biotech Sulphur Process.

Westcoast was engaged to design and execute a laboratory column testing and development program

This report discusses the results of this program.

EXPERIMENTAL CONDITIONS

Samples

Approximately 1 tonne of ore samples were received at B.C. Research in early August 2004.. 50 Kg portions were crushed to -3", -2.", -1.5" and -3/4". Then the remainder was crushed to -1". Small samples were removed for head assays.

Bottle roll test

500 grams of pulverized sample was suspended in 1,000 mL of water and 35 Kg/T sulphuric acid and rolled for 92 hours. Samples were removed after 24 and 92 hours. An additional 10 Kg/T acid was added after 24 hours

Column tests

38 Kg of ore was charged to 6 feet high, dia 6" PVC columns. Each column was suspended over a 20 liter capacity solution reservoir, equipped with a peristaltic pump to recirculate the solution at a rate of 3 ml/min (10 l/h/m²)

The ore charged to each column was agglomerated with varying amounts of sulphuric acid as well as with 8 to 10 Kg/T elemental sulphur. The combination of acid added and the acid to be produced from elemental sulphur amounted to 35 Kg/T in all cases.

The leach solutions were assayed regularly for pH, Eh, and Cu

RESULTS

Head assays

The results of the head assays (Table 1) show that the ore contained 0.91% copper and 4.03 % iron.

TABLE 1

Head Assay of Western Silver Carmacks Ore for Copper and Iron

ELEMENT SAMPLES	Cu %	Fe %
W. Silver Column Head	0.90	4
RE W. Silver Column Head	0.91	4.05
Mean	0.91	4.03

ICP analyses showed that the ore does not contain any moitie that could be harmful to the leaching bacteria. The high magnesium, aluminum and calcium content accounts for the high acid consumption of this ore.

TABLE 2

Head Assay of Western Silver Carmacks Ore for Total Metal Analysis by ICP-ES

ELEMENT SAMPLES	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Ni ppm	Co ppm	Mn ppm	Fe %	As ppm
W. Silver Column Head	228	8045	5	74	2.7	7	17	512	3.73	<2

ELEMENT SAMPLES	U ppm	Au ppm	Th ppm	Sr ppm	Cd ppm	Sb ppm	Bi ppm	V ppm	Ca %	P %
W. Silver Column Head	<8	<2	2	22	<.5	<3	6	127	0.54	0.11

ELEMENT SAMPLES	La ppm	Cr ppm	Mg %	Ba ppm	Ti %	B ppm	Al %	Na %	K %	W ppm
W. Silver Column Head	7	40	1.36	481	0.19	<3	1.71	0.03	0.83	<2

Bottle roll test

The results of the bottle roll test (Table 2) show that pulverized ore consumes 37.2 Kg/T acid after 24 hours and as much as 46.1 Kg/T after 92 hours.

Acid Consumption Test of Pulverised Western Silver Carmacks Copper Ore

Head Cu	91% (based on published data)
Sample Wt.	500 g
Acid Consumption at 24 h	37.2 kg H ₂ SO ₄ /tonne
Total Acid Consump. 93 h	46.1 kg H ₂ SO ₄ /tonne
Final pH	2.0
Leachate Filtered + Wash	1.51 L

Solution Cu

2.46 g/L

The 1.51 Liter final leach solution contained 2.46 g/L copper. Thus $1.51 \times 2.46 = 3.71$ grams of copper was extracted from the 500 gram ore sample, equivalent to a 0.743% copper content. Thus, this amount of acid extracted $0.743/0.91 \times 100\% = 81.5\%$ of the copper content of the ore.

The 3.71 grams of copper extracted consumed $3.71 \times 98/65 = 5.59$ grams of acid, or $5.59/0.500 = 11.2$ Kg/T ore. Thus, after 24 hours the gangue had consumed:

$$37.2 - 11.2 = 26 \text{ Kg/T acid}$$

and after 92 hours it consumed;

$$46.1 - 11.2 = 34.9 \text{ Kg/T}$$

This data suggests that the alkaline gangue will continue the consumption of acid for a long time so that the shortest possible leach duration will minimize acid consumption

Column tests

A total of 11 column tests were carried out. The first 6 columns were charged with -1" ore (Table 3).

Cls 1 through 5 had 1.25 Kg/T bio-acid added during agglomeration. This acid was produced from elemental sulphur in a continuously operating bio-reactor, using the bacterium Thiobacillus thiooxidans (T.t.) to oxidize the sulphur to sulphuric acid. Thus, this bio-acid served both as an acid and an inoculum to introduce T.t. to the ore. In addition, 1.25 to 7.75 Kg/T bio-acid, at 25 g/L acid content, was added to the leach solution reservoirs (see column 5 in table 3). These columns had elemental sulphur added during agglomeration to produce from 26 to 32.5 Kg acid per tonne.

Column 6 acted as control and was leached only with sulphuric acid. 380 grams of which was added during agglomeration (10 Kg/T) and 749.8 grams (20 Kg/T) was added to the leach solution reservoir.

TABLE 3

Experimental conditions in Kg/t acid equivalent

Cl#	size	Bio-acid Kg/T	S ⁰ Equiv acid Kg/T	Reserv. bio- acid Kg/T	Reservoir H ₂ SO ₄ Kg/T	Total acid equivalent Kg/T	comments	Total acid added at start Kg/T
1	-1"	1.25	32.5	1.25	0	35		2.5
2	-1"	1.25	30	3.75	0	35		5.0
3	-1"	1.25	28	5.75	0	35		7.0
4	-1"	1.25	26	7.75	0	35		9.0
5	-1"	1.25	26	5.75	76 gram (2 Kg/t)	35		7.0
6	-1"	0	0	0	950 gram (25 Kg/t)	35	380 Gram acid during agglom	
7	- 3/4"	1.25	30	3.75	0	35		5.0
8	-1"	1.25	30	3.75	0	35		5.0
9	- 1.5"	1.25	30	3.75	0	35		5.0
10	-2"	1.25	30	3.75	0	35		5.0
11	+3"	1.25	30	3.75	0	35		5.0

Columns 7 through 11 were set up with ore varying in particle size from -3/4" to -3" (Table3) in order to evaluate the effect of particle size on one set of conditions. Each column had 1.25 Kg/T bio-acid added during agglomeration as well as 3.75 Kg/T added to the leach solution reservoir.

Sulphur Columns

The extraction of the acid soluble copper for the -1" columns (Fig 1), shows that all columns leached faster then did the control column No.6, which was leached conventionally with sulphuric acid.

Cl 1, which had only 2.5 Kg/T acid added during agglomeration and to the leach solution reservoir, leached slower than columns 2,3,4 and 5, which all leached similarly. This suggests that a minimum of 3.75 Kg/T acid must be added to ensure fast kinetics. Some of this acid may be the acid returned from the SX plant. Where these columns reached 80% acid soluble extraction in approximately 87 days, the slower column 1 took about 130 days to reach 80% extraction. This difference in extraction rate would correspond in practice to a much larger pad area and much longer leach time.

In Fig 2 are shown the overall extraction profiles for these 6 columns, which follow the same pattern as they do in Fig 1

At the end of each leach, the residual ore was washed with pH 2 water, causing most of the copper held up in the interstitial waters to be removed. As a result, each curve has a small jump at the end of the leach.

At 50 and 74 days, each column had 50% of the content of its leach solution reservoir removed and replaced with water. To this water was added the acid equivalent of the copper removed in order to simulate the solvent extraction process. This added acid, as well as improved diffusional characteristics, gave rise to small increases in extraction.

At the time of this writing, 5 of the six columns have been terminated. Column 3 is continuing in order to evaluate environmental shut down procedures.

When the pH of the leach solutions is plotted (Fig 3), it can be seen that column 1, with the least amount of acid added, took the longest to develop a pH value below 2.5. The more acid is added, the faster the pH drops to lower values. But after approximately 75 days, all pH values are similar. Upon termination, each column was washed, causing the pH to rise sharply. Column 3 is still going to study environmental parameters and will be reported on separately.

Thus, column 4, with the sulphur equivalent of only 26 Kg/T acid, eventually did as well as the columns with more sulphur added and obtained similar good total extraction.

The Eh of the leach solutions has a similar profile as the pH (Fig 4) The columns with the most acid added, reached high eH values first, indicating that oxidative leaching started there first. This is confirmed by the extraction profiles in Fig 2, where the columns with the most acid added, initially leached faster (Cl's 4 and 5), but after 75 days, all but column 1 leached at the same rate.

The leach solution of column 4 contained only 300 ppm total iron at day 50. The remaining columns showed from 238 to 566 mg/L iron after 148 days. These low values suggest that there are very few iron containing minerals in the ore. However, the Eh chart indicates that most of this iron was in ferric form during the last 50 days of the leach, enabling the oxidation of any chalcocite into covellite. These low iron values may promote the use of direct electro-winning in commercial operations.

Tail assays on the leach residues from columns 1, 2 and 6 showed that the overall extraction were 8-10% less then when calculated based on head assays.

Extractions based on solution and tail assays

Cl	Based on head assay	Based on tail assay
1	82.9%	74.3 %
2	86.4	76.6
6	78.3	67.0
10	72.4	68.3

Particle columns

Columns 7 through 11 were set up to evaluate the effect of particle size on the rate and extent of extraction (Fig 5). Columns 7 and 8, with $-3/4$ and -1 " ore respectively leached fast and similar to the other -1 " columns shown in Fig 2. Columns 9 and 10, with -1.5 and -2 " ore respectively, leached at similar rates, but significantly slower then the -1 " columns.. The -2 " ore reached 70% extraction in approximately 172 days, twice as long as the $-3/4$ " ore in Cl 7, and 68 days longer then the -1 " ore column No.8.

Column 11, with the -3 " ore went relatively so poorly that it was terminated after just 100 days and 48% extraction. Column 10, with the -2 " ore, is being continued after reaching its maximum extraction in order to study the environmental aspects of plant shutdown and will be reported on later.

The acid soluble extractions were significantly higher then the total extractions (Fig 6). The -1.5 " ore and -2 " ore reached 80% acid soluble extraction after 158 and 167 days respectively.

Solution and tail assays on the leach residue from column 10, where -2 "ore was leached, showed that the overall extraction was 68.3%, whereas extraction calculated from solution and head assays showed an extraction of 72.4%

Acid consumption.

Columns 3 and 5 in Table 3 show the amounts of acid added during agglomeration and into the leach solution reservoir at the start of the testing program. The last column shows the total amount of acid added

When solution replacement was practiced during the leaching period, the equivalent acid removed with the copper, was returned to the solution reservoirs, in order to duplicate commercial solvent extraction practices. However, this acid was already produced in the columns from the elemental sulphur.

Column 8 had a total of 7.22 grams of copper extracted per Kg of ore. This is equivalent to $7.22/1000 \times 1000 = 7.22$ Kg per tonne of ore. This amount of ore would require $98/65 \times 7.22 = 10.9$ Kg/T acid. In a commercial operation, this acid is continuously recycled from the SX plant. The Westcoast Sulphur process only has to supply the acid consumed by the gangue. Obviously, the shorter the leach period, the smaller the acid consumption

RECOMMENDATIONS.

These results clearly show that the Carmacks ore can be leached with the Westcoast Sulphur process. However, we have not been able to determine any beneficial effects of the acid return from a solvent extraction plant. Such acid would greatly benefit the rate of the extraction process.

In commercial operations, there is a build up in the leach solution of many metals and salts, some of which may interfere with the biological sulphur oxidation process, particularly if the pH of the SX raffinate is allowed to decrease below a value of 1.5

It is therefore recommended that a pilot sized leach test be carried out in a large diameter column of 30 feet height. Leach solutions will be treated by SX once a week to closely duplicate commercial conditions. Since 30 feet is the average height of commercial copper heap leach operations, the leach solutions used will resemble those obtained in commercial operations. We will evaluate the low iron containing leach solutions for use in direct electro-winning.

We have available large 25 feet tall columns and we propose to fill one with 20 feet of ore and set up the second column in series, with 10 feet of ore. A detailed experimental program for such a test series is available.

Fig 1 Acid sol extraction Cls 1-6

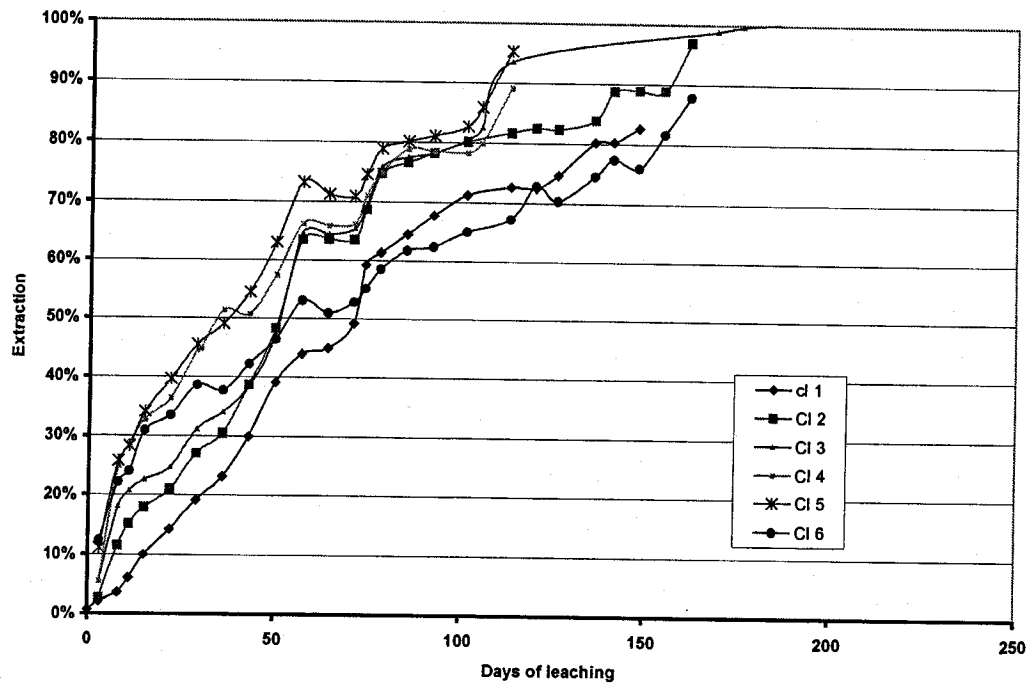


Fig 2 Total extraction CIs 1-6

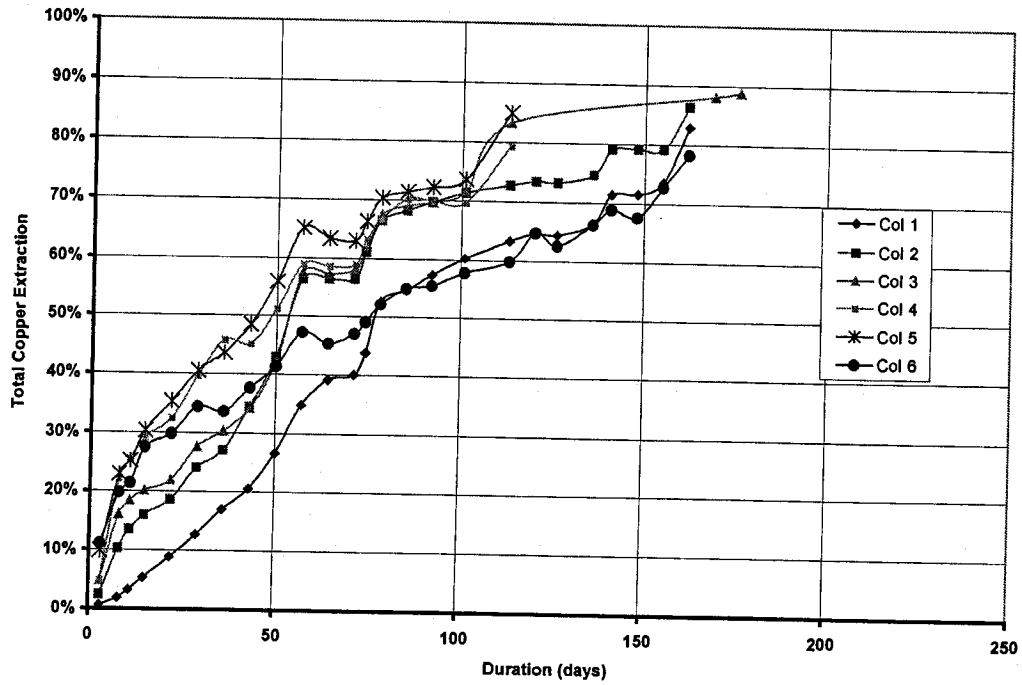


Fig 3 Cls 1-5 solution pH

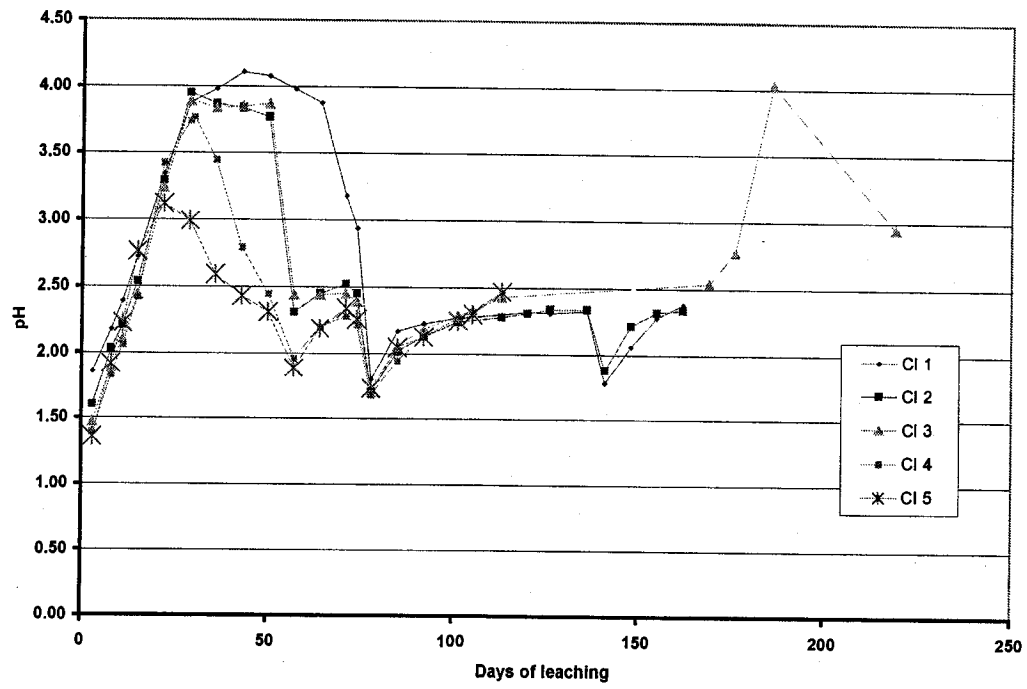


Fig 4 Eh CIs 1-5

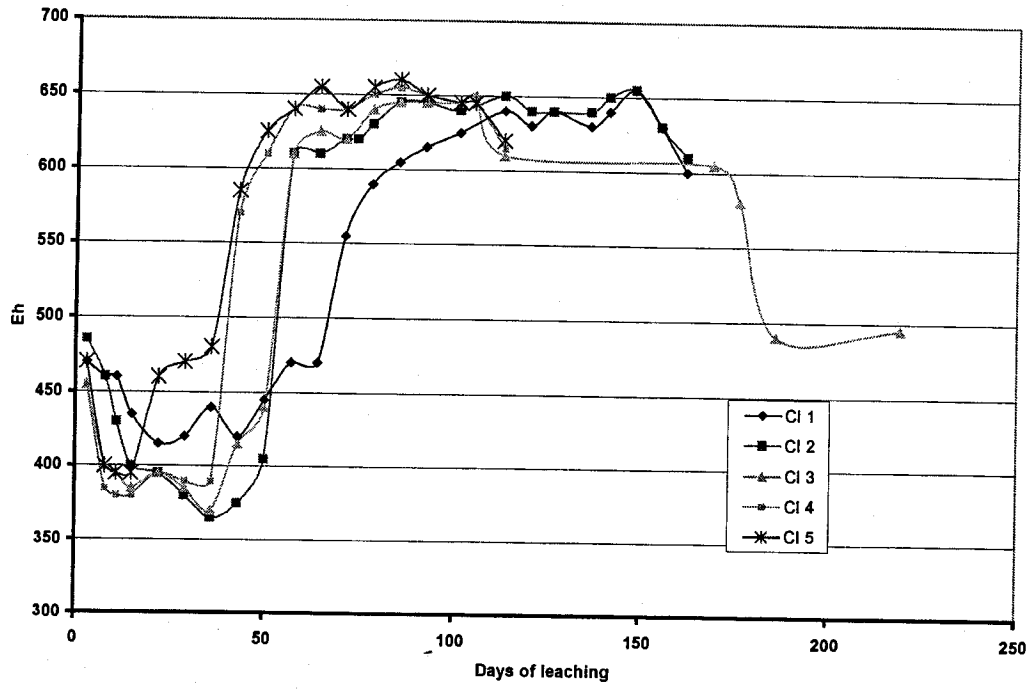


Fig 5 Total extraction particle cls

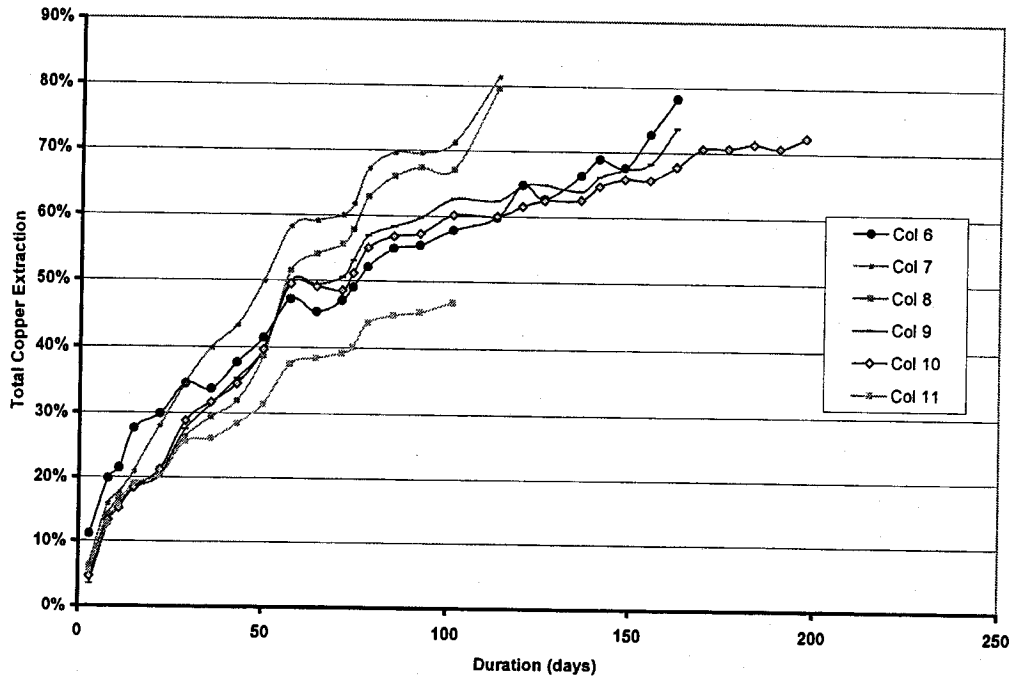
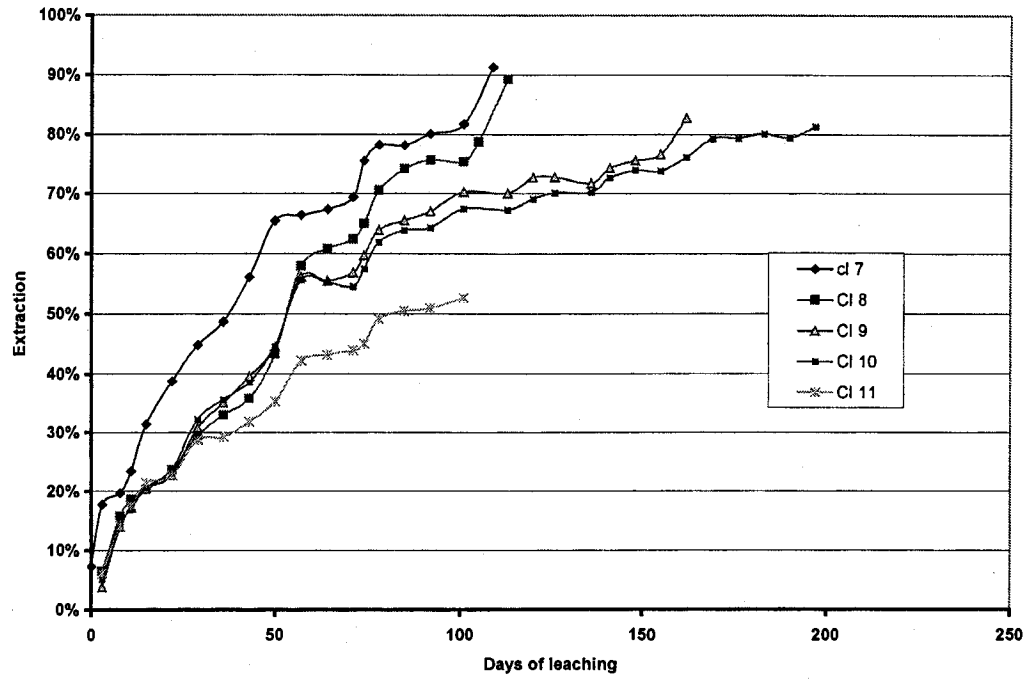


Fig 6 Acid sol extraction CIs 7-11



Appendix A

Table 4 Detail Column Test Results

Table 4 Column 1

Gross Wt. 47.8 kg
Tare Wt. 7.675 kg
Net Wt. 40.13 kg

Charge: 38.0 kg of - 1 inch Western Silver Carmacks Ore
Agglomerated with:
1532 mL of biosulphur solution containing 30g free H₂SO₄/L added with sulphur.
~411.5 g of elemental sulphur with thiobacillus bacteria.

1.53 L of biosulphur leachate containing 31.0 g H₂SO₄/L to reservoir container.
Total Free Acid added = 35 kg free H₂SO₄/ tonne.
Inoculated November 4, 2004 with washed Cu concentrate bioleach culture

Total S = 0.07 %
Non-sulphide Cu = 0.099 %
Total Cu = 0.907 %
Oxide Cu = 0.808 %
Acid soluble Cu

Date	Cumm Days	Reservoir Vol. (L)	pH		Eh (mV)	Temp. (C°)	Flow Rate (mL/min)	Cu		Cu Extracted of Total (%)	Fe (mg/L)
			Solution	Fippings				(mg/L)	(%)		
16-Aug-04	0	20				25	4.1			0%	
19-Aug-04	3	20	1.86	4.88	470			109	0.06	0.6%	0.7
24-Aug-04	8	20	2.18	4.27	460			322	0.17	1.9%	2.1
27-Aug-04	11	20	2.39	4.65	460			559	0.29	3.2%	3.6
31-Aug-04	15	20	2.72	4.65	435			920	0.48	5.3%	6.0
07-Sep-04	22	20	3.34	-	415			1530	0.81	8.9%	10.0
14-Sep-04	29	20	3.88	-	420			2190	1.15	12.7%	14.3
21-Sep-04	36	20	3.98	-	440			2930	1.54	17.0%	19.1
28-Sep-04	43	20	4.11	-	420			3550	1.87	20.6%	23.1
05-Oct-04	50	20	4.08	-	445			4600	2.42	26.7%	30.0
12-Oct-04	57	20	3.98	-	470			6000	3.16	34.8%	39.1
19-Oct-04	64	20	3.88	-	470			6750	3.55	39.2%	44.0
26-Oct-04	71	20	3.18	-	555			6900	3.63	40.0%	44.9
29-Oct-04	74	20	2.94	-	590			7550	3.97	43.8%	49.2
02-Nov-04	78	20	1.80	-	590			5320	4.79	52.8%	59.2
09-Nov-04	85	20	2.17	-	605			5850	4.96	54.7%	61.4
16-Nov-04	92	20	2.23	-	615			6120	5.21	57.4%	64.5
25-Nov-04	101	20	2.27	-	625			6620	5.47	60.3%	67.7
07-Dec-04	113	20	2.30	-	640			7150	5.75	63.4%	71.2
14-Dec-04	120	20	2.32	-	630			7365	5.86	64.6%	72.6
20-Dec-04	126	20	2.31	-	640			7340	5.85	64.5%	72.4
30-Dec-04	136	20	2.33	-	630			7680	6.03	66.5%	74.6
04-Jan-05	141	20	1.78	-	640			4700	6.48	71.5%	80.2
11-Jan-05	148	20	2.06	-	655			4710	6.49	71.5%	80.3
18-Jan-05	155	20	2.28	-	630			5070	6.68	73.6%	82.6
19-Jan-05											
25-Jan-05	162	20	2.38	-	600			1600	7.52	82.9%	93.0
16-Mar-05	214										

Removed 10 litres - added tap water + 95.70g H₂SO_{4 conc.}

Removed 10 litres - added tap water + 118.54g H₂SO_{4 conc.}

Column discontinued
Started 20 L wash
Terminated
Conducted tail assay on column remains

Sample Name Samp S(tot) % S(ele) % S(SO4) % Cu %
Head 1.08
Column 1 Residue Pulp 0.23 0.02 0.19 0.26
% Extraction 98.1% 71.3%

copper removed 7.52 g/Kg
tail 0.26% = 2.6 g/Kg
Total 10.22 g/Kg
Extraction 7.52/10.22 x100= 74.3%

Column 2

Charge: 38.0 kg of - 1 inch Western Silver Carmacks Ore
 Agglomerated with:
 1532 mL of bisulphur solution containing 30g free H₂SO₄/L added with sulphur.
 ~380.0 g of elemental sulphur with thiobacillus bacteria.

Gross Wt. 47.64 kg
 Tare W. 7.495 kg
 Net Wt. 40.145 kg

4.60 L of bisulphur leachate containing 31.0 g H₂SO₄/L to reservoir container.
 Total Free Acid added = 35 kg free H₂SO₄/ tonne.
 Inoculated November 4, 2004 with washed Cu conenstrate bioleach culture

Total S = 0.07 %
 Non-sulphide Cu = 0.099 %
 Total Cu = 0.907 %
 Oxide Cu 0.808 %

Date	Cumm Days	Reservoir Vol. (L)	pH		Eh (mV)	Temp. (C°)	Flow Rate (mL/min)	Cu		Cu Total of (%)	Cu Extracted of Acid Extractable (%)	Fe (mg/L)
			Solutoir	Drippings				(mg/L)	(g/kg)			
16-Aug-04	0	20				25	4.1			0%		
19-Aug-04	3	20	1.60	4.55	485		3.0	408	0.21	2.4%	2.7%	1.4
24-Aug-04	8	20	2.03	4.17	460		"	1770	0.93	10.3%	11.5%	
27-Aug-04	11	20	2.21	4.03	430		"	2330	1.23	13.5%	15.2%	
31-Aug-04	15	20	2.54	4.25	400		"	2750	1.45	16.0%	17.9%	
07-Sep-04	22	20	3.29	-	395		"	3220	1.69	18.7%	21.0%	
14-Sep-04	29	20	3.95	-	380		"	4160	2.19	24.1%	27.1%	
21-Sep-04	36	20	3.87	-	365		"	4680	2.46	27.2%	30.5%	
28-Sep-04	43	20	3.84	-	375		"	5940	3.13	34.5%	38.7%	
05-Oct-04	50	20	3.77	-	405		"	7410	3.90	43.0%	48.3%	
12-Oct-04	57	20	2.31	-	610		"	6040	5.13	56.5%	63.5%	
19-Oct-04	64	20	2.45	-	610		"	6050	5.13	56.6%	63.5%	
26-Oct-04	71	20	2.52	-	620		"	6050	5.13	56.6%	63.5%	
29-Oct-04	74	20	2.45	-	620		"	6850	5.56	61.2%	68.8%	
02-Nov-04	78	20	1.71	-	630		"	4340	6.04	66.6%	74.7%	
09-Nov-04	85	20	2.02	-	645		"	4630	6.19	68.2%	76.6%	
16-Nov-04	92	20	2.13	-	645		"	4880	6.32	69.7%	78.2%	
25-Nov-04	101	20	2.24	-	640		"	5170	6.47	71.4%	80.1%	
07-Dec-04	113	20	2.28	-	650		"	5410	6.60	72.8%	81.7%	
14-Dec-04	120	20	2.31	-	640		"	5540	6.67	73.5%	82.5%	
20-Dec-04	126	20	2.34	-	640		"	5510	6.65	73.3%	82.3%	
30-Dec-04	136	20	2.34	-	640		"	5750	6.78	74.7%	83.9%	
04-Jan-05	141	20	1.88	-	650		"	3620	7.17	79.1%	88.8%	
11-Jan-05	148	20	2.22	-	655		"	3640	7.18	79.2%	88.9%	566
18-Jan-05	155	20	2.32	-	630		"	3640	7.18	79.2%	88.9%	
19-Jan-05												
25-Jan-05	162	20	2.34	-	610		"	1250	7.84	86.4%	97.0%	
16-Mar-05	214											

Removed 10 litres - added tap water + 114.4g H₂SO₄ conc.

Removed 10 litres - added tap water + 93.38g H₂SO₄ conc.

Removed 10 litres - added tap water + 88.75g H₂SO₄ conc.

Column discontinued
 Started 20 L wash
 Terminated
 Conducted tail assay on column remains

Sample SampleTy S(tot) % S(ele) S(SO4) % Cu %
 Head 1.00 0.907
 Column Pulp 0.2 0.01 0.19 0.24
 % Extraction 99.0% 73.5%
 copper removed 7.84 g/Kg
 tail 0.24 = 2.4 g/Kg
 Total 10.24 g/Kg
 extraction 7.84/10.24x100% = 76.6%

Column 3

Charge: 38.0 kg of - 1 inch Western Silver Carmacks Ore
 Agglomerated with:
 1532 mL of biosulphur solution containing 30g free H₂SO₄/L added with sulphur.
 ~354.5 g of elemental sulphur with thiobacillus bacteria.

Gross Wt. 47.64 kg
 Tare Wt. 7.585 kg
 Net Wt.0 40.055 kg

7.05 L of biosulphur leachate containing 31.0 g H₂SO₄/L to reservoir container.
 Total Free Acid added = 35 kg free H₂SO₄/tonne.
 Inoculated November 4, 2004 with washed Cu concentrate bioleach culture

Total S = 0.07 %
 Non-sulphide Cu = 0.099 %
 Total Cu = 0.907 %
 Oxide Cu 0.808 %

Date	Cumm Days	Reservoir Vol. (L)	pH		Eh (mV)	Temp. (C)	Flow Rate (mL/min)	Cu		Fe	
			Solution	Drippings				(mg/L)	(g/kg)	(%)	(mg/L)
16-Aug-04	0	20				25	4.1				
19-Aug-04	3	20	1.47	4.52	455			832	0.44	4.8%	5.4%
24-Aug-04	8	20	1.69	3.93	400			2770	1.46	16.1%	18.0%
27-Aug-04	11	20	2.11	4.08	395			3170	1.67	18.4%	20.6%
31-Aug-04	15	20	2.44	4.12	385			3470	1.83	20.1%	22.6%
07-Sep-04	22	20	3.24	-	395			3780	1.99	21.9%	24.6%
14-Sep-04	29	20	3.89	-	385			4780	2.52	27.7%	31.1%
21-Sep-04	36	20	3.84	-	370			5220	2.75	30.3%	34.0%
28-Sep-04	43	20	3.85	-	415			5900	3.11	34.2%	38.4%
05-Oct-04	50	20	3.87	-	440			7265	3.82	42.2%	47.3%
12-Oct-04	57	20	2.44	-	610			6280	5.22	57.5%	64.6%
19-Oct-04	64	20	2.44	-	625			6250	5.20	57.3%	64.4%
26-Oct-04	71	20	2.45	-	620			6400	5.28	58.2%	65.3%
29-Oct-04	74	20	2.39	-				7000	5.60	61.7%	69.3%
02-Nov-04	78	20	1.70	-	640			4500	6.12	67.5%	75.6%
09-Nov-04	85	20	2.06	-	645			4760	6.26	69.0%	77.5%
16-Nov-04	92	20	2.19	-	645			4880	6.32	69.7%	78.2%
25-Nov-04	101	20	2.29	-	645			5220	6.50	71.7%	80.5%
29-Nov-04	105	20	2.33	-	650			5540	6.67	73.5%	82.5%
03-Dec-04	109	0									
07-Dec-04	113	20	2.43	-	610			1680	7.55	83.3%	93.5%
25-Jan-05	162	0									
07-Feb-05	169	20	2.54	-	605			830	7.99	88.1%	98.9%
08-Feb-05	176	20	2.77	-	580			124	8.06	88.8%	99.7%
09-Feb-05	177	0									
11-Feb-05	179	0									
18-Feb-05	186	0									
18-Feb-05	186	20	4.03	-	490		1.5*	62	8.09	89.2%	100.1%
01-Mar-05	197	0									
08-Mar-05	206	0									
11-Mar-05	209	0									
21-Mar-05	219	11.5	2.95	-	495		0.33	126	8.13	89.6%	100.6%
29-Mar-05	227	16.43	9.99	-	35		3				

Removed 10 litres - added tap water + 112.7 g H₂SO_{4 conc.}

Removed 10 litres - added tap water + 93.78g H₂SO_{4 conc.}

Column discontinued
 Started 20 L wash

Started 20 L wash

Started second 20 L wash

Started third 20 L wash with 1 Kg of Lime (CaO) added (5%)

Measured outflow of lime solution to be 3.9 mL/min at bottom of column
 Measured outflow of lime solution to be 1.82 mL/min at bottom of column

Measured total output to be approximately 13.5 L then diluted with tap water to 20 L prior to sampling
 Started fourth 20 L wash with tap water

Measured outflow of wash to be 0.33 mL/min at bottom of column
 Measured outflow of wash to be 0.34 mL/min at bottom of column
 Measured outflow of wash to be 0.33 mL/min at bottom of column
 see Col 3 Enviro

Column Discontinued

Column 4

Charge: 38.0 kg of - 1 inch Western Silver Carmacks Ore
 Agglomerated with:
 1532 mL of biosulphur solution containing 30g free H₂SO₄/L added with sulphur.
 ~329.5 g of elemental sulphur with thiobacillus bacteria.

Gross Wt. 47.08 kg
 Tare Wt 7.100 kg
 Net Wt. 39.98 kg

9.50 L of biosulphur leachate containing 31.0 g H₂SO₄/L to reservoir container.
 Total Free Acid added = 35 kg free H₂SO₄/ tonne.
 Inoculated November 4, 2004 with washed Cu conertrate bioleach culture

Total S = 0.07 %
 Non-sulphide Cu = 0.099 %
 Total Cu = 0.907 %
 Oxide Cu 0.808 % Acid soluble Cu

Date	Cumm Days	Reservoir Vol. (L)	pH		Eh (mV)	Temp. (C°)	Flow Rate (mL/min)	Cu		Cu Extracted of Total of Acid		Fe	
			Solution	Drippings				(mg/L)	(g/kg)	(%)	Extractable (%)	(mg/L)	(g/kg)
16-Aug-04	0	20				25	4.1			0%			
19-Aug-04	3	20	1.39	4.28	455		3.0	834	0.44	4.8%	5.4%	2.4	0.00
24-Aug-04	8	20	1.83	3.92	385		"	3820	2.01	22.2%	24.9%		
27-Aug-04	11	20	2.06	3.92	380		"	4420	2.33	25.6%	28.8%		
31-Aug-04	15	20	2.42	3.93	380		"	5030	2.65	29.2%	32.8%		
07-Sep-04	22	20	3.42	-	395		"	5590	2.94	32.4%	36.4%		
14-Sep-04	29	20	3.74	-	390		"	6840	3.60	39.7%	44.6%		
15-Sep-04	30	20	3.77	3.81			"	6870	3.62	39.9%	44.7%		
21-Sep-04	36	20	3.45	-	390		"	7890	4.15	45.8%	51.4%		
28-Sep-04	43	20	2.79	-	570		"	7785	4.10	45.2%	50.7%		
05-Oct-04	50	20	2.45	-	610		"	8820	4.64	51.2%	57.5%	300	0.16
12-Oct-04	57	20	1.96	-	640		"	5750	5.35	59.0%	66.2%		
19-Oct-04	64	20	2.20	-	640		"	5700	5.32	58.7%	65.9%		
26-Oct-04	71	20	2.28	-	640		"	5750	5.35	59.0%	66.2%		
29-Oct-04	74	20	2.22	-			"	6500	5.74	63.3%	71.1%		
02-Nov-04	78	20	1.68	-	650		"	3840	6.05	66.7%	74.9%		
09-Nov-04	85	20	1.95	-	655		"	4440	6.37	70.2%	78.8%		
16-Nov-04	92	20	2.13	-	650		"	4400	6.35	70.0%	78.6%		
25-Nov-04	101	20	2.27	-	645		"	4360	6.33	69.7%	78.3%		
29-Nov-04	105	20	2.32	-	645		"	4620	6.46	71.3%	80.0%		
03-Dec-04	109	0											
07-Dec-04	113	20	2.47	-	615		"	1400	7.20	79.4%	89.1%		

Removed 10 litres - added tap water + 136.1 g H₂SO₄ conc.

Removed 10 litres - added tap water + 88.75g H₂SO₄ conc.

Column discontinued
 Started 20 L wash
 Terminated

Column 5

Charge: 38.0 kg of - 1 inch Western Silver Carmacks Ore
 Agglomerated with:
 1532 ml. of biosulphur solution containing 30g free H₂SO₄/L added with sulphur.
 76 g H₂SO₄ conc

Gross Wt. 47.5 kg
 Tare Wt 7.395 kg
 Net Wt. 40.11 kg

~329.5 g of elemental sulphur with thiobacillus bacteria.
 Inoculated November 4, 2004 with washed Cu conetrate bioleach culture

7.05 L of biosulphur leachate containing 31.0 g H₂SO₄/L to reservoir container.
 Total Free Acid added = 35 kg free H₂SO₄/ tonne.

Total S = 0.07 %
 Non-sulphide Cu = 0.099 %
 Total Cu = 0.907 %
 Oxide Cu 0.808 %
 Acid soluble Cu

Date	Cumm Days	Reservoir Vol. (L)	pH		Eh (mV)	Temp. (C°)	Flow Rate (mL/min)	Cu (mg/L)	Cu of Total (%)	Cu Extracted of Acid Extractable (%)	Fe (mg/L)
			Solution	Drippings							
16-Aug-04	0	20				25	4.1		0%		
19-Aug-04	3	20	1.36	4.08	470		3.0	1700	0.89	11.1%	3.6
24-Aug-04	8	20	1.92	3.88	400		"	3950	2.08	22.9%	
27-Aug-04	11	20	2.23	3.86	395		"	4350	2.29	25.2%	
31-Aug-04	15	20	2.76	3.85	395		"	5230	2.75	30.3%	
07-Sep-04	22	20	3.12	-	460		"	6090	3.21	35.3%	
14-Sep-04	29	20	2.99	-	470		"	6980	3.67	40.5%	
21-Sep-04	36	20	2.59	-	480		"	7520	3.96	43.6%	
28-Sep-04	43	20	2.43	-	585		"	8360	4.40	48.5%	
05-Oct-04	50	20	2.31	-	625		"	9660	5.08	56.1%	434
12-Oct-04	57	20	1.89	-	640		"	6400	5.91	65.2%	
19-Oct-04	64	20	2.19	-	655		"	6100	5.75	63.4%	
26-Oct-04	71	20.5	2.34	-	640		"	5900	5.73	63.1%	
29-Oct-04	74	20	2.26	-			"	6600	6.02	66.3%	
02-Nov-04	78	20	1.73	-	655		"	3980	6.37	70.3%	
09-Nov-04	85	20	2.05	-	660		"	4170	6.47	71.4%	
16-Nov-04	92	20	2.13	-	650		"	4320	6.55	72.2%	
25-Nov-04	101	20	2.25	-	645		"	4560	6.68	73.6%	
29-Nov-04	105	20	2.30	-	645		"	5050	6.94	76.5%	
03-Dec-04	109	0									
07-Dec-04	113	20	2.47	-	620		"	1460	7.71	85.0%	

Removed 10 litres - added tap water + 149.1g H₂SO₄ conc.

Removed 10 litres - added tap water + 91.07g H₂SO₄ conc.

Column discontinued
 Started 20 L wash
 Terminated

Column 6

Gross Wt. 47.24 kg
Tare Wt. 7.705 kg
Net Wt. 39.54 kg

Charge: 38.0 kg of - 1 inch Western Silver Carmacks Ore

Agglomerated with:
0 mL of bisulphur solution
0 g of elemental sulphur with thioacillus bacteria.
380 g H₂SO₄ conc + 1300 ml tap water

0 L of bisulphur leachate to reservoir container.

750 g H₂SO₄ conc in gradual addition

Total S = 0.07 %

Non-sulphide Cu = 0.098 %

Total Cu = 0.907 %

Oxide Cu = 0.808 %

Acid soluble Cu

Date	Cummil Reservoir		pH	Eh (mV)	Temp. (C°)	Flow Rate (mL/min)	Cu (mg/L)	Cu Extracted of Total (%)	Fe (mg/L)	H ₂ SO ₄ conc reservoir addition (g)
	Days	Vol. (L)								
16-Aug-04	0	20			25			0%		
17-Aug-04	0	20	3.18	added 75.14 g H ₂ SO ₄ conc to reservoir	4.1					75.14
19-Aug-04	3	20	1.70	3.00	3.0	1910	1.01	11.1%	12.4%	202
24-Aug-04	8	20	2.23	3.07	3.90	3410	1.79	19.8%	22.2%	
25-Aug-04	9	20	1.84							
27-Aug-04	11	20	1.97	3.07	3.85	3690	1.94	21.4%	24.0%	26.05
31-Aug-04	15	20	2.10	2.79	3.80	4750	2.50	27.6%	30.9%	16.28
07-Sep-04	22	20	2.50	3.95	3.95	5140	2.71	29.8%	33.5%	16.16
14-Sep-04	29	20	2.48	N/A	N/A	5935	3.12	34.4%	38.7%	20.24
21-Sep-04	36	20	2.41	4.75	4.75	5800	3.05	33.7%	37.8%	24.54
28-Sep-04	43	20	2.35	5.05	5.05	6490	3.42	37.7%	42.3%	30.46
01-Oct-04	50	20	2.19	5.25	5.25	7130	3.75	41.4%	46.4%	31.35
05-Oct-04	57	20	2.02	5.15	5.15	4580	4.29	47.3%	53.1%	20.13
12-Oct-04	64	20	2.08	6.20	6.20	4250	4.11	45.3%	50.9%	23.83
22-Oct-04	71	20	2.17	6.25	6.25	4550	4.27	47.1%	52.9%	17.37
29-Oct-04	78	20	1.99	6.20	6.20	4900	4.46	49.1%	55.1%	11.45
02-Nov-04	85	20	2.06	6.30	6.30	2980	4.73	52.2%	56.6%	21.78
09-Nov-04	92	20	2.13	6.25	6.25	3470	4.99	55.0%	61.8%	12.82
16-Nov-04	101	20	2.15	6.35	6.35	3560	5.04	55.8%	62.4%	14.08
22-Nov-04	108	20	2.20	6.40	6.40	3960	5.25	57.9%	65.0%	11.83
01-Dec-04	113	20	2.16	6.35	6.35	4300	5.43	59.9%	67.2%	17.28
07-Dec-04	120	20	2.13	6.40	6.40	5160	5.88	64.8%	72.8%	18.62
14-Dec-04	126	20	2.09	6.40	6.40	4790	5.69	62.7%	70.4%	22.62
20-Dec-04	136	20	2.26	6.45	6.45	5420	6.02	66.4%	74.5%	18.01
30-Dec-04	141	20	2.26	6.55	6.55	3150	6.25	68.9%	77.4%	18.75
04-Jan-05	148	20	2.06	6.50	6.50	2930	6.13	67.6%	75.9%	19.66
11-Jan-05	155	20	2.10	6.25	6.25	3810	6.60	72.7%	81.7%	19.79
18-Jan-05	162	20	2.60	6.05	6.05	950	7.10	76.3%	87.8%	32.22
25-Jan-05	214	20								22.77
16-Mar-05	214	20								20.21
							Total H ₂ SO ₄ conc. added to reservoir:			748.79 g

Removed 10 litres - added tap water + H₂SO₄ to adjust pH 1.9

Removed 10 litres - added tap water + H₂SO₄ to adjust pH 1.9

Removed 10 litres - added tap water + 32.22g H₂SO₄ conc.

Pump line clogged and repaired, no pH adjustment required
Column discontinued
Started 20 L wash
Terminated

Conducted fall assay on column remains

Sample No	Sample	S (lot) %	S (ele) %	S (SO ₄) %	Cu %
Head		0.18	1.00	0.17	0.35
Column 6 / Pulp		0.18	0.01	0.17	0.35
Extraction		99.0%	99.0%	61.4%	61.4%

Extraction 7.10/10.6 x 100% = 67.0%

Column 7

Gross Wt. 48.22 kg
Tare Wt. 8.15 kg
Net Wt. 40.07 kg

Charge: 38.0 kg of - 3/4 inch Western Silver Carmacks Ore
Agglomerated with:

1532 mL of biosulphur solution containing 30g free H₂SO₄/L added with sulphur.
~380.0 g of elemental sulphur with thiobacillus bacteria.

Inoculated November 4, 2004 with washed Cu conertrate bioleach culture

4.60 L of biosulphur leachate containing 31.0 g H₂SO₄/L to reservoir container.
Total Free Acid added = 35 kg free H₂SO₄/ tonne.

Total S = 0.07 %
Non-sulphide Cu = 0.099 %
Total Cu = 0.907 %
Oxide Cu 0.808 %
Acid soluble Cu

Date	Cumm Reservoir Days	Reservoir Vol. (L)	pH		Eh (mV)	Temp. (C°)	Flow Rate (mL/min)	Cu		Cu of Total (%)	Cu Extracted of Acid Extractable (%)	Fe (mg/L)	Fe (g/kg)
			Solution	Drippings				(mg/L)	(g/kg)				
16-Aug-04	0	20				25	4.1			0%			
19-Aug-04	3	20	1.61	4.34	450		3.0	1120	0.59	6.5%	7.3%	2.8	0.00
24-Aug-04	8	20	2.16	3.98	380		"	2730	1.44	15.8%	17.8%		
27-Aug-04	11	20	2.40	3.83	380		"	3025	1.59	17.6%	19.7%		
31-Aug-04	15	20	2.81	4.00	390		"	3600	1.89	20.9%	23.4%		
07-Sep-04	22	20	3.76	-	365		"	4820	2.54	28.0%	31.4%		
14-Sep-04	29	20	3.39	-	N/A		"	5960	3.14	34.6%	38.8%		
21-Sep-04	36	20	2.62	-	490		"	6880	3.62	39.9%	44.8%		
28-Sep-04	43	20	2.55	-	580		"	7480	3.94	43.4%	48.7%		
05-Oct-04	50	20	2.45 / 1.88	-	615		"	8610	4.53	50.0%	56.1%	261	0.14
12-Oct-04	57	20	1.81	-	640		"	5750	5.29	58.3%	65.5%		
19-Oct-04	64	20	2.11	-	645		"	5900	5.37	59.2%	66.5%		
26-Oct-04	71	20	2.30	-	640		"	6050	5.45	60.1%	67.5%		
29-Oct-04	74	20	2.25 / 1.65	-			"	6350	5.61	61.8%	69.4%		
02-Nov-04	78	20	1.69	-	645		"	4120	6.11	67.3%	75.6%		
09-Nov-04	85	20	1.98	-	655		"	4530	6.32	69.7%	78.2%		
16-Nov-04	92	20	2.09	-	650		"	4520	6.32	69.6%	78.2%		
25-Nov-04	101	20	2.24	-	645		"	4810	6.47	71.3%	80.1%		
29-Nov-04	105	20	2.29	-	645		"	5060	6.60	72.8%	81.7%		
03-Dec-04	109	0		-			"						
07-Dec-04	113	20	2.49	-	620		"	1480	7.38	81.4%	91.3%		

Removed 10 litres - added tap water + 132.89 g H₂SO₄ conc.

Removed 10 litres - added tap water + 93.38g H₂SO₄ conc.

Column discontinued
Started 20 L wash
Terminated

Column 8

Charge: 38.0 kg of - 1 inch Western Silver Carmacks Ore
 Agglomerated with:
 1532 mL of biosulphur solution containing 30g free H₂SO₄/L added with sulphur.
 ~380.0 g of elemental sulphur with thiobacillus bacteria.

Gross Wt. 48.18 kg
 Tare Wt. 8.13 kg
 Net Wt. 40.05 kg

4.60 L of biosulphur leachate containing 31.0 g H₂SO₄/L to reservoir container.
 Total Free Acid added = 35 kg free H₂SO₄/ tonne.
 Inoculated November 4, 2004 with washed Cu conetrate bioleach culture

Total S = 0.07 %
 Non-sulphide Cu = 0.099 %
 Total Cu = 0.907 %
 Oxide Cu 0.808 %
 Acid soluble Cu

Date	Cummi Days	Reservoir Vol. (L)	pH		Eh (mV)	Temp. (C°)	Flow Rate (mL/min)	Cu		Cu Total of Acid Extractable (%)	Fe	
			Solution	Drippings				(mg/L)	(g/kg)		(mg/L)	(g/kg)
16-Aug-04	0	20				25	4.1			0%		
19-Aug-04	3	20	1.68	4.65	460		3.0	998	0.53	5.8%	1.3	0.00
24-Aug-04	8	20	2.28	4.17	395		"	2420	1.27	14.0%		
27-Aug-04	11	20	2.53	4.17	380		"	2860	1.51	16.6%		
31-Aug-04	15	20	2.97	4.21	380		"	3130	1.65	18.2%		
07-Sep-04	22	20	3.94	-	355		"	3640	1.92	21.1%		
14-Sep-04	29	20	4.02	-	N/A		"	4520	2.38	26.2%		
21-Sep-04	36	20	3.85	-	380		"	5060	2.66	29.4%		
28-Sep-04	43	20	3.89	-	405		"	5500	2.89	31.9%		
05-Oct-04	50	20	2.85 / 1.86	-	535		"	6660	3.51	38.6%		
12-Oct-04	57	20	2.05	-	605		"	5560	4.68	51.6%		
19-Oct-04	64	20	2.31	-	640		"	6000	4.91	54.1%		
26-Oct-04	71	20	2.37	-	635		"	6250	5.04	55.6%		
29-Oct-04	74	20	2.34 / 1.43	-			"	6650	5.25	57.9%		
02-Nov-04	78	20	1.68	-	650		"	4180	5.70	62.9%		
09-Nov-04	85	20	2.05	-	655		"	4730	5.99	66.1%		
16-Nov-04	92	20	2.16	-	650		"	4960	6.11	67.4%		
25-Nov-04	101	20	2.28	-	645		"	4920	6.09	67.2%		
29-Nov-04	105	20	2.30	-	645		"	5440	6.37	70.2%		
03-Dec-04	109	0		-			"					
07-Dec-04	113	20	2.40	-	620		"	1620	7.22	79.6%		

Removed 10 litres - added tap water + 102.8 g H₂SO₄ conc.

Removed 10 litres - added tap water + 96.47g H₂SO₄ conc.

Column discontinued
 Started 20 L wash
 Terminated

Column 9

Gross Wt. 48.2 kg
Tare Wt. 8.14 kg
Net Wt. 40.1 kg

Charge: 38.0 kg of - 1½ inch Western Silver Carmacks Ore

Agglomerated with:

1532 mL of biosulphur solution containing 30g free H₂SO₄/L added with sulphur.

~380.0 g of elemental sulphur with thiobacillus bacteria.

4.60 L of biosulphur leachate containing 31.0 g H₂SO₄/L to reservoir container.

Total Free Acid added = 35 kg free H₂SO₄/tonne.

Inoculated November 4, 2004 with washed Cu concentrate bioleach culture

Total S = 0.07 %
Non-sulphide Cu = 0.099 %
Total Cu = 0.907 %
Oxide Cu 0.808 %

Acid soluble Cu

Date	Cumulative Days	Reservoir Vol. (L)	pH		Eh (mV)	Temp. (C°)	Flow Rate (mL/min)	Cu (mg/L)	Cu of Total (%)	Cu Extracted of Acid Extractable (%)	Fe (mg/L)
			Solution	Drippings							
16-Aug-04	0	20				25	4.1		0%		
19-Aug-04	3	20	1.51	4.29	465		3.0	598	0.31	3.5%	3.9%
24-Aug-04	8	20	2.00	4.02	400		"	2160	1.14	12.5%	14.1%
27-Aug-04	11	20	2.35	4.16	395		"	2640	1.39	15.3%	17.2%
31-Aug-04	15	20	2.87	4.10	395		"	3140	1.65	18.2%	20.5%
07-Sep-04	22	20	3.89	-	380		"	3490	1.84	20.3%	22.7%
14-Sep-04	29	20	3.84	-	N/A		"	4730	2.49	27.4%	30.8%
21-Sep-04	36	20	3.03	-	445		"	5380	2.83	31.2%	35.0%
28-Sep-04	43	20	2.65	-	545		"	6080	3.20	35.3%	39.6%
05-Oct-04	50	20	2.48 / 1.79	-	615		"	6840	3.60	39.7%	44.6%
12-Oct-04	57	20	2.00	-	640		"	5200	4.54	50.0%	56.1%
19-Oct-04	64	20	2.23	-	645		"	5100	4.48	49.4%	55.5%
26-Oct-04	71	20	2.32	-	640		"	5300	4.59	50.6%	56.8%
29-Oct-04	74	20	2.27 / 1.52	-			"	5750	4.83	53.2%	59.7%
02-Nov-04	78	20	1.78	-	650		"	3520	5.17	57.0%	63.9%
09-Nov-04	85	20	2.13	-	650		"	3770	5.30	58.4%	65.6%
16-Nov-04	92	20	2.17	-	650		"	4000	5.42	59.7%	67.1%
25-Nov-04	101	20	2.26	-	650		"	4500	5.68	62.6%	70.3%
07-Dec-04	113	20	2.31	-	645		"	4460	5.66	62.4%	70.1%
14-Dec-04	120	20	2.34	-	640		"	4870	5.88	64.8%	72.7%
20-Dec-04	126	20	2.38	-	635		"	4880	5.88	64.8%	72.8%
30-Dec-04	136	20	2.39	-	640		"	4720	5.80	63.9%	71.7%
04-Jan-05	141	20	1.83	-	650		"	2750	6.00	66.2%	74.3%
11-Jan-05	148	20	2.14	-	650		"	2950	6.11	67.3%	75.6%
18-Jan-05	155	20	2.27	-	630		"	3110	6.19	68.3%	76.6%
19-Jan-05	156	20		-			"				
25-Jan-05	162	20	2.37	-	625		"	930	6.68	73.7%	82.7%
08-Mar-05	206	0		-			"				
15-Mar-05	213	16.38	2.26	-	605		"	727	6.99	77.1%	86.6%
22-Mar-05	220	18.33	2.48	-	550		"	139	7.06	77.9%	87.4%

Removed 10 litres - added tap water + 105.6 g H₂SO₄ conc.

Removed 10 litres - added tap water + 81.81g H₂SO₄ conc.

Removed 10 litres - added tap water + 72.85g H₂SO₄ conc.

Column discontinued

Started 20 L wash

Let stand for 6 weeks

Started 20 L tap water wash

Started second 20 L tap water wash

Started third wash 20 L tap water + 1000 g of Na₂CO₃

Column 10

Charge: 38.0 kg of - 2 inch Western Silver Cammacks Ore
 Agglomerated with:
 1532 mL of bisulphur solution containing 30g free H₂SO₄L added with sulphur.
 ~380.0 g of elemental sulphur with thiobacillus bacteria.
 Gross Wt. 47.14 kg
 Tare Wt. 7.13 kg
 Net Wt. 40.01 Kg
 * - agglomeration tarp washed into reservoir

4.60L of bisulphur leachate containing 31.0 g H₂SO₄L to reservoir container.
 Total Free Acid added = 35 kg free H₂SO₄/tonne.
 Inoculated November 4, 2004 with washed Cu concentrate bioleach culture

Total S = 0.07 %
 Non-sulphide Cu = 0.099 %
 Total Cu = 0.907 %
 Oxide Cu 0.808 %
 Acid soluble Cu

Date	Cumm Days	Reservoir Vol. (L)	pH		Eh (mV)	Temp. (C)	Flow Rate (mL/min)	Cu (g/kg)	Cu Total (%)	Cu Extracted of Acid (%)	Fe (mg/L)	Fe (g/kg)
			Solution	Drippings								
16-Aug-04	0	20				25	4.1		0%			
19-Aug-04	3	20	1.53	4.12	455		3.0	797	0.42	4.6%	5.2%	43
24-Aug-04	8	20	2.04	3.94	405		"	2290	1.21	13.3%	14.9%	
27-Aug-04	11	20	2.36	4.09	395		"	2600	1.37	15.1%	16.9%	
31-Aug-04	15	20	2.84	4.03	390		"	3165	1.67	18.4%	20.6%	
07-Sep-04	22	20	3.61	-	410		"	3650	1.92	21.2%	23.8%	
14-Sep-04	29	20	2.98	-	N/A		"	4950	2.61	28.7%	32.2%	
21-Sep-04	36	20	2.58	-	510		"	5460	2.87	31.7%	35.6%	
28-Sep-04	43	20	2.54	-	555		"	5940	3.13	34.5%	38.7%	
05-Oct-04	50	20	2.38 / 2.00	-	585		"	6840	3.60	39.7%	44.6%	202
12-Oct-04	57	20	2.09	-	615		"	5120	4.49	49.6%	55.6%	
19-Oct-04	64	20	2.29	-	645		"	5050	4.46	49.1%	55.2%	
26-Oct-04	71	20	2.36	-	630		"	4950	4.41	48.5%	54.5%	
29-Oct-04	74	20	2.30 / 1.56	-			"	5400	4.64	51.2%	57.5%	
02-Nov-04	78	20	1.79	-	650		"	3330	5.00	55.1%	61.9%	
09-Nov-04	85	20	2.15	-	630		"	3690	5.16	56.9%	63.9%	
16-Nov-04	92	20	2.17	-	645		"	3760	5.20	57.3%	64.4%	
25-Nov-04	101	20	2.28	-	645		"	4240	5.45	60.1%	67.5%	
07-Dec-04	113	20	2.31	-	640		"	4220	5.44	60.0%	67.4%	
14-Dec-04	120	20	2.34	-	630		"	4490	5.58	61.6%	69.1%	
20-Dec-04	126	20	2.36	-	630		"	4650	5.67	62.5%	70.2%	
30-Dec-04	136	20	2.38	-	645		"	4670	5.68	62.6%	70.3%	
04-Jan-05	141	20	1.85	-	655		"	2700	5.87	64.7%	72.7%	
11-Jan-05	148	20	2.14	-	660		"	2900	5.98	65.9%	74.0%	511
18-Jan-05	155	20	2.27	-	630		"	2880	5.97	65.8%	73.8%	
19-Jan-05	156	20										
25-Jan-05	162	20	2.19	-	645		"	3240	6.18	67.9%	76.2%	
01-Feb-05	169	20	2.02	-	635		"	2700	6.41	70.6%	79.3%	
08-Feb-05	176	20	2.22	-	640		"	2110	6.41	70.7%	79.4%	
15-Feb-05	183	20	2.19	-	625		"	2230	6.48	71.4%	80.2%	
22-Feb-05	190	20	2.17	-	625		"	2120	6.42	70.8%	79.4%	
01-Mar-05	197	20	2.02	-	590		"	1340	6.57	72.4%	81.3%	
08-Mar-05	206	20	2.07	-	570		"	1450	6.62	73.0%	82.0%	
15-Mar-05	213	18.34	2.38	-	600		"	543	6.89	75.9%	85.2%	
16-Mar-05	214											

Removed 10 litres - added tap water + 105.6 g H₂SO₄ conc.

Removed 10 litres - added tap water + 76.40g H₂SO₄ conc.

Removed 10 litres - added tap water + 72.08 g H₂SO₄ conc.

Removed 10 litres - added tap water + 50.01 g H₂SO₄ conc.

Removed 10 litres - added tap water + 33.96 g H₂SO₄ conc.

Discontinued - Started 20 L tap water wash
 Terminated
 Conducted tail assay on column remains

Sample Name S(tot) Sulphide-S % S(ele) S(SO₄) % Cu %

Head 1.0
 Column 10 Tail 0.05
 Extraction (%) 96%
 0.2 0.01
 0.907
 0.32/10.09 x 100% = 68.3%
 copper removed 6.89 g/kg
 total 10.09 g/kg

Column 11

Charge: 38.0 kg of ± 3 inch Western Silver Carmacks Ore
Agglomerated with:

1532 mL of biosulphur solution containing 30g free H₂SO₄/L added with sulphur.
~380.0 g of elemental sulphur with thiobacillus bacteria.

Gross Wt. 46.78 kg
Tare Wt. 6.93 kg
Net Wt. 0 39.86 kg*

* - agglomeration tarp washed into reservoir

4.60 L of biosulphur leachate containing 31.0 g H₂SO₄/L to reservoir container.
Total Free Acid added = 35 kg free H₂SO₄/ tonne.
Inoculated November 4, 2004 with washed Cu conetrate bioleach culture

Total S = 0.07 %

Non-sulphide Cu = 0.099 %

Total Cu = 0.907 %

Oxide Cu 0.808 % Acid soluble Cu

Date	Cumm Days	Reservoir Vol. (L)	pH		Eh (mV)	Temp. (C°)	Flow Rate (mL/min)	Cu		Cu Extracted of Acid Extractable (%)	Fe	
			Solution	Drippings				(mg/L)	(g/kg)		(mg/L)	(g/kg)
16-Aug-04	0	20				25	4.1					
19-Aug-04	3	20	1.52	3.59	455		3.0	939	0.49	6.1%	61	0.03
24-Aug-04	8	20	2.04	3.70	410		"	2180	1.15	12.7%		
27-Aug-04	11	20	2.34	3.48	410		"	2690	1.42	15.6%		
31-Aug-04	15	20	2.69	3.32	420		"	3280	1.73	19.0%		
07-Sep-04	22	20	3.02	-	465		"	3490	1.84	20.3%		
14-Sep-04	29	20	2.80	-	N/A		"	4400	2.32	25.5%		
21-Sep-04	36	20	2.62	-	540		"	4480	2.36	26.0%		
28-Sep-04	43	20	2.61	-	555		"	4890	2.57	28.4%		
05-Oct-04	50	20	2.52 / 1.95	-	580		"	5410	2.85	31.4%		
12-Oct-04	57	20	2.00	-	525		"	3760	3.40	37.5%		
19-Oct-04	64	20	2.24	-	645		"	3920	3.49	38.4%		
26-Oct-04	71	20	2.32	-	630		"	4040	3.55	39.1%		
29-Oct-04	74	20	2.27 / 1.52	-			"	4200	3.63	40.1%		
02-Nov-04	78	20	1.74	-	640		"	2740	3.97	43.8%		
09-Nov-04	85	20	2.04	-	630		"	2940	4.08	44.9%		
16-Nov-04	92	20	2.11	-	645		"	3020	4.12	45.4%		
25-Nov-04	101	20	2.25	-	645		"	3280	4.26	46.9%		
29-Nov-04										52.7%		

* Removed 10 litres - added tap water + 83.5 g H₂SO₄ conc.

** Removed 10 litres - added tap water + 62.36g H₂SO₄ conc.

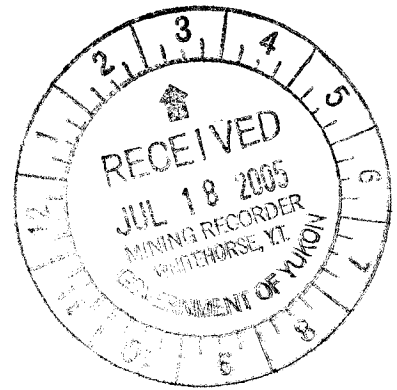
*** Terminated

Appendix B

Statement of Qulifications

RESUME

ALBERT BRUYNESTEYN



WESTCOAST BIOTECH LTD

EDUCATION:

B.A.Sc. and Ph.D. Chemical Engineering

RELEVANT
EXPERIENCE:

1962-1967

Plant Engineer, Plant Superintendent & Plant
Manager, Park & Tilford Distilleries, North
Vancouver, B.C.

1967-1980

Senior Research Engineer and Manager Mineral
Leaching Program, B.C. Research, Vancouver, B.C.

Developed programs to transfer basic scientific and technical knowledge, developed in the laboratories, into practical use. Assisted numerous mining companies, world-wide, in developing and improving heap and dump leach operations.

1980-1984

Head, Division of Extractive Metallurgy, B.C.
Research.

Developed new applications for mineral biotechnology in copper, uranium and precious metal leaching. Designed and executed multi-company sponsored research programs for the development of bacterial copper concentrate leaching processes. Developed bacterial uranium leaching process, since applied underground at Denison Mines, Ontario. Carried out extensive consulting to the mining industry in the application of biological leaching processes, with emphasis on copper dump/heap leaching.

1984-1987

President, Giant Bay Biotech Ltd.

Developed the agitated biological treatment process for refractory gold/silver ores and concentrates. The economic and technical viability of this process was demonstrated with a 10 t/d plant at the Salmita Mine of Giant Yellowknife Mines.

1984-present President, Westcoast Biotech Ltd.

Consultant to the mining industry on mineral biotechnology. Consulted on numerous copper dump leach operations, including those at Gibraltar Mines, Mar Copper, Andacollo Copper, Bald Mountain (Chevron), Cerro Verde (Peru), Toquepalla, Cajone (Chile), Cerro Colorado (Panama), Cananea Copper Corp., Anaconda Copper Butte and many others. Currently (2004/2005) involved with optimising the Zaldivar copper heap leach operations.

Specializing in the production and execution of experimental programs designed to optimize heap and dump leach operations.

Participated and played leading roles in many seminars and workshops, organized by U.N. agencies and individual countries, to transfer mineral biotechnology to developing nations. Given numerous lectures on biological leaching processes at universities and corporate workshops around the world.

PUBLICATIONS:

More than forty publications related to mineral/microbiological leaching processes. See enclosed list.

PATENTS:

- 1 Canadian Patent No. 1,214,043
US patent No. 4,571,387 Feb 18, 1986
The biological-acid leach process for copper sulphide concentrates.
- 2 US Patent 4,888,293, Dec. 19, 1989
Adapting bacteria to low pH and high arsenic concentrations for use in oxidizing sulphide ores
- 3 US Patent No. 4,989,081, Jan 22, 1991
Chemical/biological process to oxidize multi-metallic sulphide ores

- 4 US Patent No. 5,089,412 Feb 18, 1992
Bacteria for oxidizing multi-metallic sulphide ores
- 5 US Patent Application No. 10/723,392 Oct 26, 2003
Process for leaching acid consuming ores.
- 6 Can. Patent Application No. 2,450,525, Nov 26, 2004
Process for leaching acid consuming ores
- 7 Chilean Patent Application No. 1629-2004, June 25, 2004
Process for leaching acid consuming ores

MEMBERSHIPS

Chairman of ISAC, the International Scientific Advisory Committee of UNEP, a United Nations Agency.

Past member of the National Research Council Associate Committee on Biotechnology.

Consultant to the United Nations on Biotechnology since 1975

Associate member of B.C. Research Corporation

Member Canadian Institute of Mining

Member American Institute of Mining and Engineering

Appendix C

List of Claims and Claim Map

Claim Status Report

10 June 2005

Claim Name and Nbr.	Grant No.	Expiry Date	Registered Owner	% Owned	NTS #'s	
AC # 2 - 3	Y 91722 - Y 91723	2019/10/28	Western Copper Holdings Limited	100.00	115107	L
BOY 20	Y 51118	2008/03/09	Western Copper Holdings Limited	100.00	115107	
BOY 22	Y 51120	2019/10/28	Western Copper Holdings Limited	100.00	115107	L
BOY 24	Y 51122	2019/10/28	Western Copper Holdings Limited	100.00	115107	L
BOY 51	Y 51149	2008/03/09	Western Copper Holdings Limited	100.00	115107	
R BOY 52	Y 51150	2010/03/09	Western Copper Holdings Limited	100.00	115107	
BOY 53	Y 51151	2008/03/09	Western Copper Holdings Limited	100.00	115107	
R BOY 54	Y 51152	2010/03/09	Western Copper Holdings Limited	100.00	115107	
BOY 55 - 58	Y 51153 - Y 51156	2019/10/28	Western Copper Holdings Limited	100.00	115107	L
BOY 83	Y 51181	2008/03/09	Western Copper Holdings Limited	100.00	115107	
BOY 85	Y 51183	2019/10/28	Western Copper Holdings Limited	100.00	115107	L
DUN 1	Y 59382	2008/03/09	Western Copper Holdings Limited	100.00	115107	F
DUN 2 - 3	Y 59383 - Y 59384	2019/10/28	Western Copper Holdings Limited	100.00	115107	L F
REM 1	YC39221	2006/04/11	Western Copper Holdings Limited	100.00	115107	
REM 2	YC39222	2006/04/11	Western Copper Holdings Limited	100.00	115107	F
REM 3 - 10	YC39223 - YC39230	2006/04/11	Western Copper Holdings Limited	100.00	115107	
REM 11	YC39231	2006/04/11	Western Copper Holdings Limited	100.00	115107	F
REM 12 - 30	YC39232 - YC39250	2006/04/11	Western Copper Holdings Limited	100.00	115107	
REM 32	YC39251	2006/04/11	Western Copper Holdings Limited	100.00	115107	F
REM 33 - 34	YC39252 - YC39253	2006/04/11	Western Copper Holdings Limited	100.00	115107	
REM 35	YC39254	2006/04/11	Western Copper Holdings Limited	100.00	115107	F
R TT 1	YB97068	2007/03/09	Western Copper Holdings Limited	100.00	115107	
R TT 2	YB97251	2006/03/09	Western Copper Holdings Limited	100.00	115107	
R VW 11	YB96620	2006/03/09	Western Copper Holdings Limited	100.00	115107	
R VW 13	YB96622	2006/03/09	Western Copper Holdings Limited	100.00	115107	
R VW 17 - 18	YB96626 - YB96627	2006/03/09	Western Copper Holdings Limited	100.00	115107	
R VW 19 - 21	YB96628 - YB96630	2008/03/09	Western Copper Holdings Limited	100.00	115107	
R VW 23	YB96632	2007/03/09	Western Copper Holdings Limited	100.00	115107	
R VW 25	YB96634	2007/03/09	Western Copper Holdings Limited	100.00	115107	
R VW 27 - 30	YB96636 - YB96639	2007/03/09	Western Copper Holdings Limited	100.00	115107	
R VW 31 - 34	YB96640 - YB96643	2007/03/09	Western Copper Holdings Limited	100.00	115107	F
R VW 35 - 38	YB96644 - YB96647	2007/03/09	Western Copper Holdings Limited	100.00	115107	
R VW 40 - 49	YB96986 - YB96995	2006/03/09	Western Copper Holdings Limited	100.00	115107	
R VW 50	YB96996	2006/03/09	Western Copper Holdings Limited	100.00	115107	F
R VW 60 - 61	YB96997 - YB96998	2007/03/09	Western Copper Holdings Limited	100.00	115107	
R W 1 - 37	YB26708 - YB26744	2007/03/09	Western Copper Holdings Limited	100.00	115107	

Total claims selected : 240

Left column indicator legend:

R - Indicates the claim is on one or more pending renewal(s).
P - Indicates the claim is pending.

Right column indicator legend:

L - Indicates the Quartz Lease.
F - Indicates Full Quartz fraction (25+ acres)
P - Indicates Partial Quartz fraction (<25 acres)
D - Indicates Placer Discovery
C - Indicates Placer CoDiscovery
B - Indicates Placer Fraction

Claim Name and Nbr.	Grant No.	Expiry Date	Registered Owner	% Owned	NTS #'s	
W 38 - 40	YB26745 - YB26747	2019/10/28	Western Copper Holdings Limited	100.00	115107	L
R W 41 - 43	YB26748 - YB26750	2007/03/09	Western Copper Holdings Limited	100.00	115107	
W 44 - 48	YB26751 - YB26755	2019/10/28	Western Copper Holdings Limited	100.00	115107	L
W 49	YB26756	2025/03/09	Western Copper Holdings Limited	100.00	115107	L
R W 50 - 53	YB36249 - YB36252	2007/03/09	Western Copper Holdings Limited	100.00	115107	
R W 55	YB36254	2007/03/09	Western Copper Holdings Limited	100.00	115107	
R W 57	YB36256	2007/03/09	Western Copper Holdings Limited	100.00	115107	
R W 91 - 93	YB36929 - YB36931	2007/03/09	Western Copper Holdings Limited	100.00	115107	
R W 95	YB36933	2007/03/09	Western Copper Holdings Limited	100.00	115107	
WAR 22	Y 59373	2008/03/09	Western Copper Holdings Limited	100.00	115107	
R WAR 23 - 31	YB36240 - YB36248	2007/03/09	Western Copper Holdings Limited	100.00	115107	
R WAR 32 - 37	YB36446 - YB36451	2007/03/09	Western Copper Holdings Limited	100.00	115107	
R WAR 38 - 50	YB36765 - YB36777	2007/03/09	Western Copper Holdings Limited	100.00	115107	
R WC 5 - 18	YB36693 - YB36706	2008/03/09	Western Copper Holdings Limited	100.00	115107	
R WC 23 - 36	YB36711 - YB36724	2008/03/09	Western Copper Holdings Limited	100.00	115107	
R WC 40	YB36728	2006/03/09	Western Copper Holdings Limited	100.00	115107	
R WC 41 - 54	YB36729 - YB36742	2008/03/09	Western Copper Holdings Limited	100.00	115107	
R WC 57 - 58	YB36745 - YB36746	2006/03/09	Western Copper Holdings Limited	100.00	115107	
R WC 59 - 72	YB36747 - YB36760	2008/03/09	Western Copper Holdings Limited	100.00	115107	
R X 3 - 4	YB36898 - YB36899	2007/03/09	Western Copper Holdings Limited	100.00	115107	
R X 5 - 7	YB36962 - YB36964	2007/03/09	Western Copper Holdings Limited	100.00	115107	F

Criteria(s) used for search:

CLAIM STATUS: ACTIVE & PENDING OWNER(S): WESTERN COPPER HOLDINGS LIMITED REGULATION TYPE: QUARTZ

Left column indicator legend:

R - Indicates the claim is on one or more pending renewal(s).
P - Indicates the claim is pending.

Right column indicator legend:

L - Indicates the Quartz Lease.
F - Indicates Full Quartz fraction (25+ acres)
P - Indicates Partial Quartz fraction (<25 acres)

Total claims selected : 240

D - Indicates Placer Discovery
C - Indicates Placer Codiscovery
B - Indicates Placer Fraction

Appendix D

Certified Statement of Account