Western Copper
Corporation

Project Proposal

Carmacks Copper Project
Yukon Territory

Appendix E3

Detoxification and Rinsing
Testwork Report
(January 2006)

Western Silver Corporation
Carmacks Copper Project

Detoxification and Rinsing Testwork Report

January 2006

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ALEXCO

Carmacks Copper Project
Detoxification and Rinsing Testwork Report

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1. INTRODUCTION

1.1. SUMMARY

Additional information has been requested by the Responsible Authorities as part of the environmental assessment for the Carmacks Copper Project. In particular, additional information and evidence to support the technical feasibility of detoxification of the Carmacks Copper heap is required. This report summarizes additional test work data collected by Western Silver as part of the environmental assessment and optimization of the project. The information presented in this report includes detailed column testwork data, ABA testwork on column residues, mineralogical assessment and recommended additional studies.

1.2. PREVIOUS WORK

Neutralization and detoxification of the spent heap for the Carmacks Copper project is a key component of the final decommissioning of the operation. Previous work on rinsing and neutralization of Carmacks ore samples has been reported by Beattie Consulting Ltd (Beattie 2001) and the results of this work can be found in Volume II, Appendix E of the Project Description and Environmental Assessment Report. This previous work and the test results have been thoroughly reported by Beattie 2001. Previous column rinsing test work consisted of various rinsing approaches using fresh water and base additions including lime, sodium hydroxide and sodium carbonate. Previous work indicated plugging problems using lime as a base addition as well as solution buffering at a pH of approximately 4 when using fresh water.

One of the recommendations made in the Beattie 2001 report is a procedure that uses more fresh water rinsing at the front end of the program prior to rinsing with a base additive. This procedure is designed to flush more of the sulfate out of the spent ore prior to pH adjustment with a base additive such as sodium carbonate.

Beattie recommended additional test work using fresh water pulsing to allow diffusion of copper and sulfate to more effectively rinse the spent ore and reducing the rebound effect of constituents that can be observed in neutralized systems.

The additional column rinse tests conducted by Western Silver Corp. have been designed to take advantage of the lessons learned and recommendations made by Beattie as a result of the previous detoxification testwork.

2. COLUMN NEUTRALIZATION TESTS

Additional column acid leach tests on Carmacks Copper ore samples were completed at the Vancouver, BC laboratories of Vizon Sci Tek. over the period August 2004 – January 2005. Traditional sulfuric acid leaching was tested and compared against alternative acid sources using elemental sulfur and "bio-acid" as the copper lixiviant. The use of elemental sulfur and subsequent biological oxidation to free H_2SO_4 was investigated as an alternative acid source for the Carmacks Copper project. From a copper recovery perspective, the agglomeration of elemental sulfur and bio-acid into the ore samples proved to be as effective as using sulfuric acid solution for leaching copper. Based on the positive results of this recent column leaching program, additional column rinsing and neutralization work was carried out on select columns. These additional column leach tests were performed under the direction of Ab Bruynesteyn with Westcoast Biotech Ltd. Dr. Bruynesteyn also supervised the rinsing and environmental testing program.

The eleven column leach tests described used various crush sizes including - ¾", 1", 1 ½", 2", 3" and +3". Additional column rinsing test work was carried out on four of the 1" and 1 ½" columns. The 1" and 1 ½" columns were selected as they are the optimal and most likely crush size for the Carmacks Copper ore. The procedure for each of the columns varied slightly in order to understand the mechanisms of the detoxification process as well as simulate the actual conditions of neutralization of a commercial heap at Carmacks Copper. A picture of the columns during the leaching phase is shown in Figure 1.

Figure 1. Columns in Operation

2.1. COLUMN DESCRIPTION

A summary of the leaching parameters used in the columns is shown in Table 1.

Table 1
Leaching Parameters Summary

PARAMETER	COLUMN 3	COLUMN 9	COLUMN 5	COLUMN 8
Material Wt. (kg.)	40.05	40.06	40.10	40.05
Crush size (P_{80})	- 1”	- 1 ½”	- 1”	- 1”
Elemental S added (kg/tonne)	8.85	9.48	8.21	9.49
Biosulfur solution added (l/tonne)	7	5	7	5
Conc. H2SO4 added (kg/tonne)	-	-	1.89	-
Total free H2SO4 added (kg/tonne)	35	35	35	35

The ore for the column leach tests was stored at the Vancouver, BC laboratories of Process Research Associates and shipped to the laboratory of Vizon Sci Tek. Previous leaching testwork (Beattie 2001) completed on Carmacks Copper ore samples indicated acid consumption and addition rates ranging from 22 – 34 kg/tonne free H_2SO_4. The free acid addition in the leaching columns used for this most recent decommissioning testwork is 35 kg/tonne, consistent with past acid addition levels.

2.2. COLUMN RINSING PROCEDURE

As previously noted, the procedures used for each of the four columns varied slightly to provide as much information as possible into the mechanisms of spent ore rinsing. A description of the column rinsing procedures is summarized below.

Column 3

The washing procedure for Column 3 was similar to past rinsing test work in the fact that it used the same base additive (lime) and was designed to confirm previous results. The general procedure followed for Column 3 included:

- Immediately following cessation of leaching and column draindown, begin rinsing spent ore with fresh water at an application rate of 10 $l/h/m^2$.
- Following initial fresh water rinse, rinse with 5% lime solution (pH=11.0) at a target application rate of 10 l/h/m2.
- Following lime solution rinse, resume fresh water pulsing.
- Record volumes, pH, conductivity and Cu values during the fresh water rinse phase

Column 9

The rinsing procedure for Column 9 was similar to Column 3 but was modified to use sodium carbonate (Na_2CO3) as the alkaline addition rather than lime. The general procedure for Column 9 was as follows:

- Immediately following cessation of leaching and column draindown, begin rinsing spent ore with fresh water at an application rate of 10 $l/h/m^2$.
- Following initial fresh water rinse, rinse with a 5% sodium carbonate (Na_2CO_3) solution at a target application rate of 10 $l/h/m^2$.
- Following rinsing with sodium carbonate, resume fresh water rinsing.
- Record volumes, pH, conductivity and Cu values during the fresh water rinse phase

The procedure for Column 9 is designed to assess the effectiveness of sodium carbonate as the base addition rather than lime.

Column 5

The procedure for Column 5 was designed to determine if letting the spent ore "rest" prior to pulse rinsing was beneficial. Columns 3 and 9 both began rinsing immediately after acid leaching and draindown was complete. The general procedure for Column 5 was as follows:

- After leaching and draindown is complete, let column rest for 6 months prior to beginning fresh water addition.
- Following rest period, pulse the column with approximately 3 pore volumes of fresh water.
- Record volumes, pH, conductivity and Cu values during the fresh water rinse phase.
- After fresh water pulse, rinse both columns with 50 g/L sodium carbonate solution (pH=11.0 +).
- After the alkaline rinse, continue fresh water rinsing.
- After the second fresh water pulse, perform a second alkaline rinse with sodium carbonate.
- Let the column rest for 6 months.
- Continue fresh water pulse.
- Record volumes, pH, conductivity and Cu values during the alkaline and fresh water rinse phase.

Column 8

The procedure for Column 8 was identical to Column 5 with the exception of adding molasses to the spent ore to determine the effectiveness of carbon addition in fixing or immobilizing metals, particularly copper, during the rinsing process. The molasses addition was made in conjunction with the second alkaline rinse. 200 ppm of molasses was added to 13.7 liters of alkaline rinse solution. The total amount of molasses added to the column was approximately 8 kg/tonne.

The rinsing application rate used for all of the columns was targeted at 3 ml/min which equates to 10 $l/h/m^2$ (0.004 gpm/ft^2). This rate is consistent with practice at most commercial heap operations, both for leaching as well as neutralization and rinsing.

2.3. DISCUSSION OF RESULTS

Table 2 summarizes the key parameters for the column rinse tests including the column effluent analysis for the last sampling period. The operating parameters and detailed analytical results for all of the columns are attached as Tables 3-6. Graphical representations for pH, Cu, SO_4 are included in Figures 2-10. The results of effluent are compared against the Metal Mining Effluent Regulations as a guide for assessing overall neutralization effectiveness.

Table 2
Column Effluent Metal Concentrations

PARAMETER (MG/L)	COLUMN 3	COLUMN 9	COLUMN 5	COLUMN 8	MMER *
Total Rinse Days	319	272	122	122	
pH	9.63	8.48	9.98	9.70	6.0 - 9.5
Cu	0.48	0.24	1.41	2.5	0.30
As	0.34	<0.30	<0.30	<0.30	0.50
Pb	0.10	0.10	<0.10	<0.10	0.20
Ni	0.05	<0.05	<0.05	<0.05	0.50
Zn	<0.05	<0.05	<0.05	<0.05	0.50
SO_4	71	884			

Note: The detection levels for As, Pb, Ni and Zn were reported at different levels by the laboratory. The highest detection limit reported for these parameters is shown above for consistent comparison.

Key indicators to assess the effectiveness of rinsing spent ore primarily include pH and copper.

Western Silver
Carmacks Copper Project
Column Detoxification Testwork
Column 5

Table 3

Days	Date	Operating Parameter	Volume (L)		liters/kg Input	pH	Cond.	Eh	Copper	Ag	Al	As	B	Ba	Be	Bi	Ca
			Input	Output			(umhos/cm)	(mv)	(mg/L)	(ppb)	(ppm)	(ppb)	(ppb)	(ppb)	(ppb)	(ppb)	(ppm)
	16-Aug-04					1.36											
3	19-Aug-04	Column acid leaching phase				1.92		470	1700								
8	24-Aug-04	Column acid leaching phase				2.23		400	3950								
11	27-Aug-04	Column acid leaching phase				2.76		395	4350								
15	31-Aug-04	Column acid leaching phase				3.12		395	5230								
22	7-Sep-04	Column acid leaching phase				2.99		460	6090								
29	14-Sep-04	Column acid leaching phase				2.59			6980								
36	21-Sep-04	Column acid leaching phase				2.43		480	7520								
43	28-Sep-04	Column acid leaching phase				2.31		585	8360								
50	5-Oct-04	Column acid leaching phase				1.89		625	9660								
57	12-Oct-04	Column acid leaching phase				2.19		640	6400								
64	19-Oct-04	Column acid leaching phase				2.34		655	6100								
71	26-Oct-04	Column acid leaching phase				2.26		640	5900								
74	29-Oct-04	Column acid leaching phase				1.73			6600								
78	2-Nov-04	Column acid leaching phase				2.05		655	3980								
85	9-Nov-04	Column acid leaching phase				2.13		660	4170								
92	16-Nov-04	Column acid leaching phase				2.25		650	4320								
101	25-Nov-04	Column acid leaching phase				2.30		645	4560								
105	29-Nov-04	Column leaching shutdown						645	5050								
109	3-Dec-04					2.47											
113	7-Dec-04							620	1460								
0	03-Jun-05	1st fresh water rinse	13.70	10.69	0.36	3.02	5750	540	971								
4	07-Jun-05	1st alkaline rinse (0.05 kg/l Na2CO3)	12.68	1.87	0.33	3.03	5120		582								
5	08-Jun-05			3.85		3.31	8860		536								
6	09-Jun-05			8.32		9.42	37200		43								
7	10-Jun-05			9.74		8.68	23800		313								
7	10-Jun-05	2nd fresh water rinse	13.70		0.36												
11	14-Jun-05			12.41		10.01	17970		7.70								
12	15-Jun-05	2nd 50 g/L Na2CO3 wash	13.70		0.36												
13	16-Jun-05			3.08		10.11	26500		2.90								
14	17-Jun-05			6.58		10.41	41400		4.20								
15	18-Jun-05					10.43	51800		7.10								
17	20-Jun-05			12.33		10.43	35500		3.20								
35	08-Jul-05		13.70		0.36												
39	12-Jul-05	fresh water rinse		11.35		10.25	19270		1.82	52	<1	<300	256	<200	<20	<200	1.8
122	3-Oct-05	fresh water rinse	9.11	9.98			3820		1.41	334	3.3	<300	901	<200	<20	<200	2

Western Silver
Carmacks Copper Project
Column Detoxification Testwork
Column 5

Table 3

Date	Cd (ppb)	Ce (ppb)	Co (ppb)	Cr (ppb)	Cu (ppb)	Fe (ppm)	K (ppm)	Li (ppm)	Mg (ppm)	Mn (ppm)	Mo (ppb)	Na (ppm)	Ni (ppb)	P (ppm)	Pb (ppb)	S (ppm)	Sb (ppb)	Se (ppb)	Si (ppm)	Te (ppb)	Ti (ppb)	Tl (ppb)	U (ppm)	V (ppb)	W (ppb)	Zn (ppb)
16-Aug-04																										
19-Aug-04						3.6																				
24-Aug-04																										
27-Aug-04																										
31-Aug-04																										
7-Sep-04																										
14-Sep-04																										
21-Sep-04																										
28-Sep-04																										
5-Oct-04						434																				
12-Oct-04																										
19-Oct-04																										
26-Oct-04																										
29-Oct-04																										
2-Nov-04																										
9-Nov-04																										
16-Nov-04																										
25-Nov-04																										
29-Nov-04																										
3-Dec-04																										
7-Dec-04																										
03-Jun-05																										
07-Jun-05																										
08-Jun-05																										
09-Jun-05																										
10-Jun-05																										
10-Jun-05																										
14-Jun-05																										
15-Jun-05																										
16-Jun-05																										
17-Jun-05																										
18-Jun-05																										
20-Jun-05																										
08-Jul-05																										
12-Jul-05	<20	<300	<50	<200	1816	0.53	8.2	<.5	<1	<.1	15341	4388	<50	36.93	<100	249	<100	273	132.64	<100	181	<100	<.5	2249	109	<50
3-Oct-05	<20	<300	<50	<200	1408	5.15	3.8	<.5	<1	<.1	23835	1186	<50	27.66	<100	173	<100	218	65	<100	263	<100	<.5	1599	127	<50

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Carmacks Copper Project
Column Detoxification Testwork
Column 8

Table 4

Days	Date		Volume (L)		pH	Cond.	Eh	Copper	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Ce	Co
			Input	Output		(umhos/cm)	(mv)	(mg/L)	(ppb)	(ppm)	(ppb)	(ppb)	(ppb)	(ppb)	(ppb)	(ppm)	(ppb)	(ppb)	(ppb)
	16-Aug-04	Acid Leaching Phase																	
3	19-Aug-04	Acid Leaching Phase			1.68		460	998											
8	24-Aug-04	Acid Leaching Phase			2.28		395	2420											
11	27-Aug-04	Acid Leaching Phase			2.53		380	2860											
15	31-Aug-04	Acid Leaching Phase			2.97		380	3130											
22	7-Sep-04	Acid Leaching Phase			3.94		355	3640											
29	14-Sep-04	Acid Leaching Phase			4.02			4520											
36	21-Sep-04	Acid Leaching Phase			3.85		380	5060											
43	28-Sep-04	Acid Leaching Phase			3.89		405	5500											
50	5-Oct-04	Acid Leaching Phase			2.85		535	6660											
57	12-Oct-04	Acid Leaching Phase			2.05		605	5560											
64	19-Oct-04	Acid Leaching Phase			2.31		640	6000											
71	26-Oct-04	Acid Leaching Phase			2.37		635	6250											
74	29-Oct-04	Acid Leaching Phase			2.34			6650											
78	2-Nov-04	Acid Leaching Phase			1.68		650	4180											
85	9-Nov-04	Acid Leaching Phase			2.05		655	4730											
92	16-Nov-04	Acid Leaching Phase			2.16		650	4960											
101	25-Nov-04	Acid Leach stop, column rest			2.28		645	4920											
105	29-Nov-04				2.30		645	5440											
109	3-Dec-04																		
113	7-Dec-04						620	1620											
0	03-Jun-05	fresh water pulse	13.7	10.99	3.0	6610	555	1460											
4	07-Jun-05	alkaline rinse (0.05 kg/l Na2CO3)	8.32	2.31	4.1	7180		651											
5	08-Jun-05			4.72	8.21	20000		18											
6	09-Jun-05			6.01															
7	10-Jun-05			6.12	7.29	10600		502											
7	10-Jun-05	fresh water pulse	13.7																
11	14-Jun-05			11.62	8.82	9210		50.6											
12	15-Jun-05	alkaline rinse (0.05 kg/l Na2CO3) + 200 ppm molasses	13.7																
13	16-Jun-05			3.02	10.09	30200		24.0											
14	17-Jun-05			6.52	10.3	38500		13.7											
15	18-Jun-05				10.26	51900		14.2											
17	20-Jun-05			12.28	10.28	35300		19.6											
35	8-Jul-05																		
39	12-Jul-05	fresh water pulse	13.7	10.99	10.01	15300		5.7	<50	<1	<300	<200	<200	<20	<200	5.7	<20	<300	<50
122	3-Oct-05	fresh water pulse	13.7		9.7			2.5	<50	1.6	<300	568	<200	<20	<200	11.1	<20	<300	<50

Western Silver
Carmacks Copper Project
Column Detoxification Testwork
Column 8

Table 4

Date	Cr (ppb)	Cu (ppb)	Fe (ppm)	K (ppm)	Li (ppm)	Mg (ppm)	Mn (ppm)	Mo (ppb)	Na (ppm)	Ni (ppb)	P (ppm)	Pb (ppb)	S (ppm)	Sb (ppb)	Se (ppb)	Si (ppm)	Te (ppb)	Ti (ppb)	Tl (ppb)	U (ppm)	V (ppb)	W (ppb)	Zn (ppb)
16-Aug-04																							
19-Aug-04			1.3																				
24-Aug-04																							
27-Aug-04																							
31-Aug-04																							
7-Sep-04																							
14-Sep-04																							
21-Sep-04																							
28-Sep-04																							
5-Oct-04																							
12-Oct-04																							
19-Oct-04																							
26-Oct-04																							
29-Oct-04																							
2-Nov-04																							
9-Nov-04																							
16-Nov-04																							
25-Nov-04																							
29-Nov-04																							
3-Dec-04																							
7-Dec-04																							
03-Jun-05																							
07-Jun-05																							
08-Jun-05																							
09-Jun-05																							
10-Jun-05																							
10-Jun-05																							
14-Jun-05																							
15-Jun-05																							
16-Jun-05																							
17-Jun-05																							
18-Jun-05																							
20-Jun-05																							
8-Jul-05																							
12-Jul-05	<200	5703	0.35	5.9	<.5	12.3	0.11	18185	3407.2	<50	25.45	<100	558	<100	251	41.91	<100	106	<100	<.5	1360	100	<50
3-Oct-05	<200	2521	1.96	3.2	<.5	5.3	<.1	30490	1444	<50	22.45	<100	473	<100	274	31.63	<100	118	<100	<.5	1063	113	<50

Western Silver
Carmacks Copper Project
Column Detoxification Testwork
Column 3

Table 5

Days	Date	Operating Parameter	Volume (L)		pH	Cond.	Eh	Copper	Sulphate	Alkalinity	Ag	Al	As	B	Ba	Be
			Input	Output		(umhos/cm)	(mv)	(mg/l)	(mg/L)	(mg CaCO3/L)	ppb	ppm	ppb	ppb	ppb	ppb
	16-Aug-04	Acid Leaching Phase			1.47		455	832								
3	19-Aug-04	Acid Leaching Phase			1.89		400	2770								
8	24-Aug-04	Acid Leaching Phase			2.11		395	3170								
11	27-Aug-04	Acid Leaching Phase			2.44		385	3470								
15	31-Aug-04	Acid Leaching Phase			3.24		395	3780								
22	7-Sep-04	Acid Leaching Phase			3.89			4780								
29	14-Sep-04	Acid Leaching Phase			3.84		370	5220								
36	21-Sep-04	Acid Leaching Phase			3.85		415	5900								
43	28-Sep-04	Acid Leaching Phase			3.87		440	7265								
50	5-Oct-04	Acid Leaching Phase			2.44		610	6280								
57	12-Oct-04	Acid Leaching Phase			2.44		625	6250								
64	19-Oct-04	Acid Leaching Phase			2.45		620	6400								
71	26-Oct-04	Acid Leaching Phase			2.39			7000								
74	29-Oct-04	Acid Leaching Phase			1.70		640	4500								
78	2-Nov-04	Acid Leaching Phase			2.06		645	4760								
85	9-Nov-04	Acid Leaching Phase			2.19		645	4880								
92	16-Nov-04	Acid Leaching Phase			2.29		645	5220								
101	25-Nov-04	Acid Leaching Phase			2.33		650	5540								
105	29-Nov-04	Acid Leach Stop, Column Rest														
0	3-Dec-04	Fresh water pulse		20	2.43		610	1680								
4	7-Dec-04															
53	25-Jan-05	Fresh water pulse		20	2.54		605	830								
60	1-Feb-05				2.77		580	124								
67	8-Feb-05	1st alkaline rinse (0.05 kg/l CaO)		20												
68	9-Feb-05															
70	11-Feb-05															
77	18-Feb-05	Column exhibited plugging problems, reduce flow		20	4.03	1777	490	55	1350	<1	<5	10.2	<30	27	<20	2
95	08-Mar-05															
98	11-Mar-05															
108	21-Mar-05			11.5	2.95	3080	495	121		<1	<5	40.5	<30	188	30	5
109	22-Mar-05	2nd alkaline rinse (0.05 kg/l Na_2CO_3)														
116	29-Mar-05	No plugging concern after Na_2CO_3 rinse		16.4	9.99	3670	35									
123	05-Apr-05	Fresh water pulse			9.95											
151	03-May-05	Fresh water pulse		16.7	10.22	15800	-20	2.54	465	7680	157	1.2	176	499	<20	<2
179	31-May-05	Fresh water pulse		17.4	10.28	2770	65	0.76	93	1020	475	1.196	141.6	342	14.5	<.05
207	28-Jun-05	Fresh water pulse		16.5	10.06	1950	80	0.45	48	784	8	1	49	180	<20	<2
235	26-Jul-05	Fresh water pulse		16.8	9.72	1790	52	0.39	59	670	21	0.8	32	114	<20	<2
319	18-Oct-05	Fresh water pulse		15.4	9.63	1322	70	0.48	71	600	7	1.6	34	99	<20	<2

Western Silver
Carmacks Copper Project
Column Detoxification Testwork
Column 3

Table 5

Date	Bi	Ca	Cd	Ce	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Se	Si	Te	Ti	Tl	U	V	W	Zn
	ppb	ppm	ppb	ppb	ppb	ppb	ppb	ppm	ppm	ppm	ppm	ppm	ppb	ppm	ppb	ppm	ppb	ppm	ppb	ppb	ppm	ppb	ppb	ppb	ppm	ppb	ppb	ppb
16-Aug-04																												
19-Aug-04																												
24-Aug-04																												
27-Aug-04																												
31-Aug-04																												
7-Sep-04																												
14-Sep-04																												
21-Sep-04																												
28-Sep-04																												
5-Oct-04																												
12-Oct-04																												
19-Oct-04																												
26-Oct-04																												
29-Oct-04																												
2-Nov-04																												
9-Nov-04																												
16-Nov-04																												
25-Nov-04																												
29-Nov-04																												
3-Dec-04																												
7-Dec-04																												
25-Jan-05																												
1-Feb-05																												
8-Feb-05																												
9-Feb-05																												
11-Feb-05																												
18-Feb-05	<20	384.4	2	32	40	<20	55029	1.02	6.3	<.05	20.9	1.1	<5	5	19	0.02	12	360	<10	<20	34.51	<10	12	<10	<.05	<10	<10	275
08-Mar-05																												
11-Mar-05																												
21-Mar-05	<20	606.3	6	65	130	<20	121102	3.9	17.4	0.11	57.5	3.17	12	12.3	34	0.13	12	757	<10	<20	97.93	<10	21	<10	<.05	<10	<10	696
22-Mar-05																												
29-Mar-05																												
05-Apr-05																												
03-May-05	<20	1.9	8	<30	<5	20	2543	1.67	11.2	<.05	0.3	0.01	41099	3917.8	<5	53.14	<10	154	<10	555	34.32	<10	202	<10	<.05	2067	134	16
31-May-05	1.45	1.701	2.39	5.13	0.41	26.1	763.6	1.858	2.715	0.00	0.256	0.007	13673	690.34	<.2	29.708	2.6	43	2.02	387.1	42.24	0.8	163	0.03	0.00	1133	69.42	14.8
28-Jun-05	<20	1.3	<2	<30	<5	<20	447	1.98	1.5	<.05	0.2	0.01	4745	427.9	<5	13.11	<10	16	<10	110	55.36	<10	99	<10	<.05	786	32	6
26-Jul-05	<20	1.2	<2	<30	<5	<20	389	1.92	1.3	<.05	0.1	<.01	4819	330.7	<5	9.35	<10	28	<10	70	32.56	<10	83	<10	<.05	528	29	<5
18-Oct-05	<20	1	<2	<30	<5	<20	478	2.62	1.4	<.05	0.2	0.01	5320	335.9	<5	8.5	<10	33	<10	76	32.54	<10	57	<10	<.05	487	32	7

Western Silver
Carmacks Copper Project
Column Detoxification Testwork
Column 9

Table 6

Days	Date	Operating Parameter	Volume (L)		pH	Cond.	Eh	Copper	Sulphate	Alkalinity	Ag	Al	As	B	Ba	Be	Bi
			Input	Output		(umhos/cm)	(mv)	(mg/l)	(mg/L)	(mg CaCO3/L)	ppb	ppm	ppb	ppb	ppb	ppb	ppb
	16-Aug-04	Acid Leaching Phase			1.51	465		598									
3	19-Aug-04	Acid Leaching Phase			2.00	400		2160									
8	24-Aug-04	Acid Leaching Phase			2.35	395		2640									
11	27-Aug-04	Acid Leaching Phase			2.87	395		3140									
15	31-Aug-04	Acid Leaching Phase			3.89	380		3490									
22	7-Sep-04	Acid Leaching Phase			3.84	N/A		4730									
29	14-Sep-04	Acid Leaching Phase			3.03	445		5380									
36	21-Sep-04	Acid Leaching Phase			2.65	545		6080									
43	28-Sep-04	Acid Leaching Phase			2.48	615		6840									
50	5-Oct-04	Acid Leaching Phase			2.00	640		5200									
57	12-Oct-04	Acid Leaching Phase			2.23	645		5100									
64	19-Oct-04	Acid Leaching Phase			2.32	640		5300									
71	26-Oct-04	Acid Leaching Phase			2.27			5750									
74	29-Oct-04	Acid Leaching Phase			1.78	650		3520									
78	2-Nov-04	Acid Leaching Phase			2.13	650		3770									
85	9-Nov-04	Acid Leaching Phase			2.17	650		4000									
92	16-Nov-04	Acid Leaching Phase			2.26	650		4500									
101	25-Nov-04	Acid Leaching Phase			2.31	645		4460									
113	7-Dec-04	Acid Leaching Phase			2.34	640		4870									
120	14-Dec-04	Acid Leaching Phase			2.38	635		4880									
126	20-Dec-04	Acid Leaching Phase			2.39	640		4720									
136	30-Dec-04	Acid Leaching Phase			1.83	650		2750									
141	4-Jan-05	Acid Leaching Phase			2.14	650		2950									
148	11-Jan-05	Acid Leaching Phase			2.27	630		3110									
155	18-Jan-05	Acid Leach Stop, Column Rest															
0	19-Jan-05	fresh water pulse	13.7		2.37	625		930									
6	25-Jan-05																
48	08-Mar-05	fresh water pulse	13.7														
62	22-Mar-05	alkaline rinse (0.05 kg/l Na_2CO_3)	13.7														
69	29-Mar-05	fresh water pulse	13.7	17.9	9.87	3650	30										
76	05-Apr-05			18.3	10.11	14680	-20	1.85			154	1.2	257	126	<20	<2	<20
104	03-May-05	fresh water pulse	13.7	16.9	9.65	3360	15	0.85	500	840	61	1.5	70	137	35	<2	<20
132	31-May-05	fresh water pulse	13.7	17.6	9.72	1312	80	0.43	142	340	23	0.594	49.1	131	11.18	<.05	3.01
160	28-Jun-05	fresh water pulse	13.7	17.1	9.36	1353	100	0.38	146	326	70	0.6	30	104	<20	<2	<20
188	26-Jul-05	fresh water pulse	13.7	16.5	8.73	1340	90	0.26	236	245	33	0.4	30	98	<20	<2	<20
272	18-Oct-05	fresh water pulse	13.7	15.7	8.48	2430	120	0.24	884	188	<50	<1	30	<200	<200	<20	<200

Western Silver
Carmacks Copper Project
Column Detoxification Testwork
Column 9

Table 6

Date	Ca	Cd	Ce	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Se	Si	Te	Ti	Tl	U	V	W	Zn
	ppm	ppb	ppb	ppb	ppb	ppb	ppm	ppm	ppm	ppm	ppm	ppb	ppm	ppb	ppm	ppb	ppm	ppb	ppb	ppm	ppb	ppb	ppb	ppm	ppb	ppb	ppb
16-Aug-04																											
19-Aug-04																											
24-Aug-04																											
27-Aug-04																											
31-Aug-04																											
7-Sep-04																											
14-Sep-04																											
21-Sep-04																											
28-Sep-04																											
5-Oct-04																											
12-Oct-04																											
19-Oct-04																											
26-Oct-04																											
29-Oct-04																											
2-Nov-04																											
9-Nov-04																											
16-Nov-04																											
25-Nov-04																											
7-Dec-04																											
14-Dec-04																											
20-Dec-04																											
30-Dec-04																											
4-Jan-05																											
11-Jan-05																											
18-Jan-05																											
19-Jan-05																											
25-Jan-05																											
08-Mar-05																											
22-Mar-05																											
29-Mar-05																											
05-Apr-05	2.2	<2	<30	<5	209	1846	2.1	10.9	<.05	0.4	0.01	27624	4655.8	<5	36.59	<10	215	<10	574	110.2	<10	302	<10	<.05	1961	100	25
03-May-05	2.2	5	<30	<5	<20	846	3.19	2	<.05	0.4	0.01	15289	689	<5	12.38	<10	179	<10	112	52.23	<10	168	<10	<.05	832	30	20
31-May-05	1.227	1.16	3.77	0.16	6.3	427.6	1.7	1.088	1E-04	0.174	0.004	7393.9	319.95	0.2	7.668	1.8	58	1.59	75.8	43.95	0.57	101	0.01	2E-04	483.1	23.88	16
28-Jun-05	1.4	<2	<30	<5	<20	376	1.52	0.8	<.05	0.2	<.01	4115	255.1	<5	4.25	<10	46	<10	37	40.48	<10	64	<10	<.05	321	14	6
26-Jul-05	1.9	<2	<30	<5	<20	261	1.11	0.9	<.05	0.1	<.01	3529	230.5	<5	3.04	<10	91	<10	<20	23.33	<10	51	<10	<.05	166	12	5
18-Oct-05	33.8	<20	<300	<50	<200	241	0.69	2.4	<.5	1.3	<.1	1742	573.6	<50	1.57	<100	306	<100	<200	34.12	<100	<100	<100	<.5	<100	<100	<50

2.3.1. Initial Fresh Water Rinse

Graphical presentation of the pH response from rinsing is included in Figures 2-5.

A significant result of the column rinsing testwork is the achievement of acceptable effluent pH in all four of the columns. Previous testwork demonstrated a buffering mechanism that made it difficult to achieve pH levels acceptable for direct discharge and the column effluent pH consistently flattened in the pH 4.5 range. The common procedure used in all four of these recent rinse columns included rinsing with fresh water prior to addition of an alkaline solution, followed by additional fresh water pulses. In the case of Columns 3 and 9, fresh water rinsing began almost immediately after leaching and column draindown was complete. For Columns 5 and 8, a rest period of approximately 6 months was used in the procedure prior to initial rinsing with fresh water. Similar to previous testwork, the fresh water rinse alone achieved only marginal increases in pH which remained below 4.0 in all four of the columns. The amount of the initial fresh water rinse was increased from previous testwork and was closer to a level of 3 pore volumes (PV) rather than 1/3 PV as was used previously. The primary benefit of the initial fresh water rinse is speculated to be a flushing mechanism for constituents such as sulfate and free acidity.

There may be a minor benefit in allowing the spent ore to "rest" prior to initial fresh water rinsing. The effluent pH of the first effluent solution from the column after the first fresh water rinse was slightly over 3.0 in Columns 5 and 8. These columns had a rest period of 6 months prior to rinsing with fresh water. In the case of Columns 3 and 9 where the initial fresh water pulse occurred immediately after column draindown, the pH of the first solution from this pulse was slightly lower and averaged approximately 2.4.

The rest period in Columns 5 and 8 is consistent with expected field conditions in a commercial heap. From a practical point of view, the dynamics of an operating large scale heap are such that there will likely be a lag time or rest period between active leaching and rinsing. Practical constraints on effectively separating leach and rinse solutions in a large commercial heap require a buffer zone of spent ore between the two active areas of leaching and rinsing. Because of this operational reality, there will likely be a rest period in an active heap, consistent with the procedure used in Columns 5 and 8.

Figure 2
Carmacks Copper Column Detox Results
Column 3
Parameter - pH

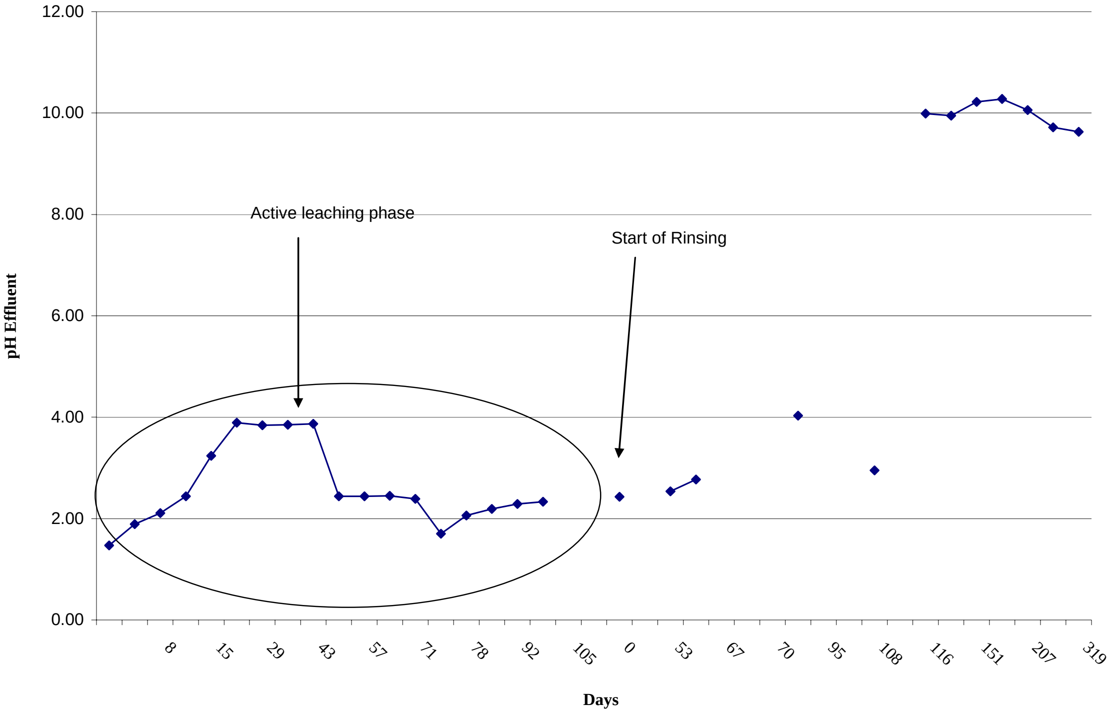


Figure 3
Carmacks Copper Column Detox Results
Column 9
Parameter - pH

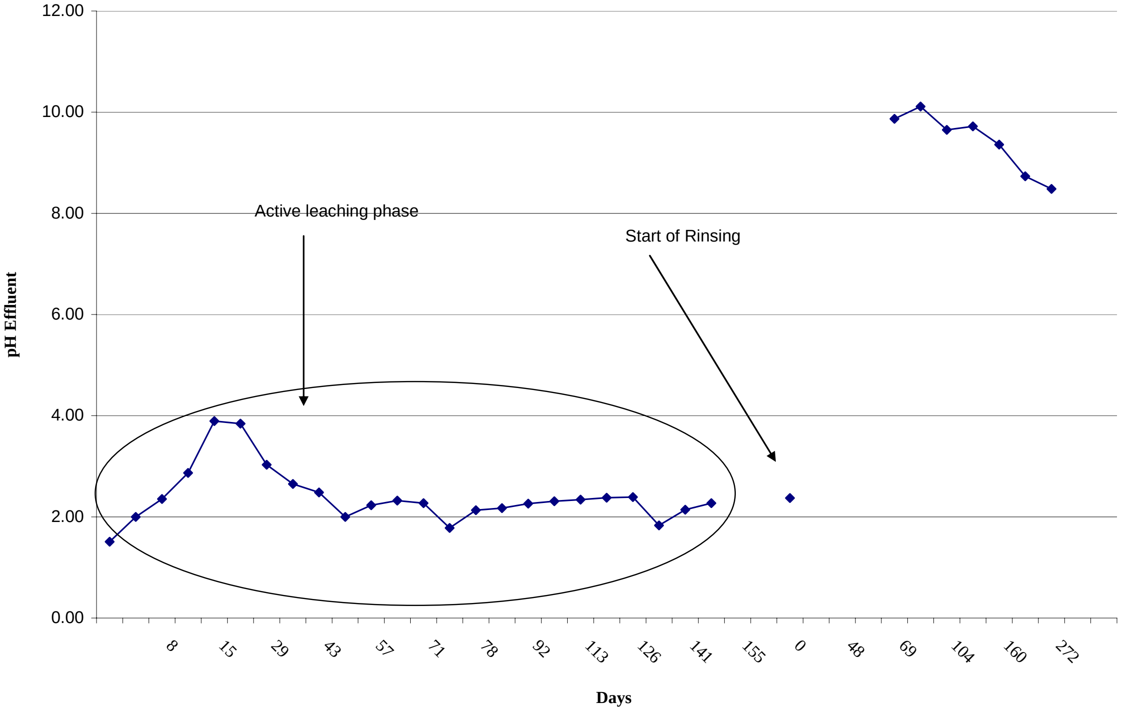


Figure 4
Carmacks Copper Column Detox Results
Column 5
Parameter - pH

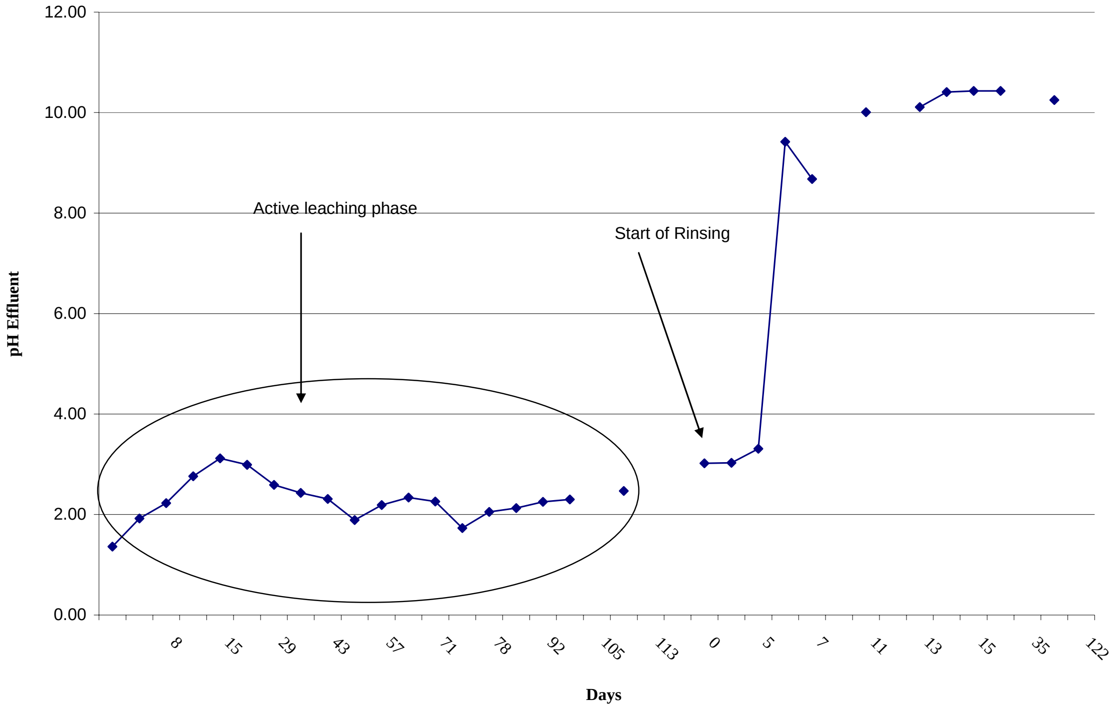
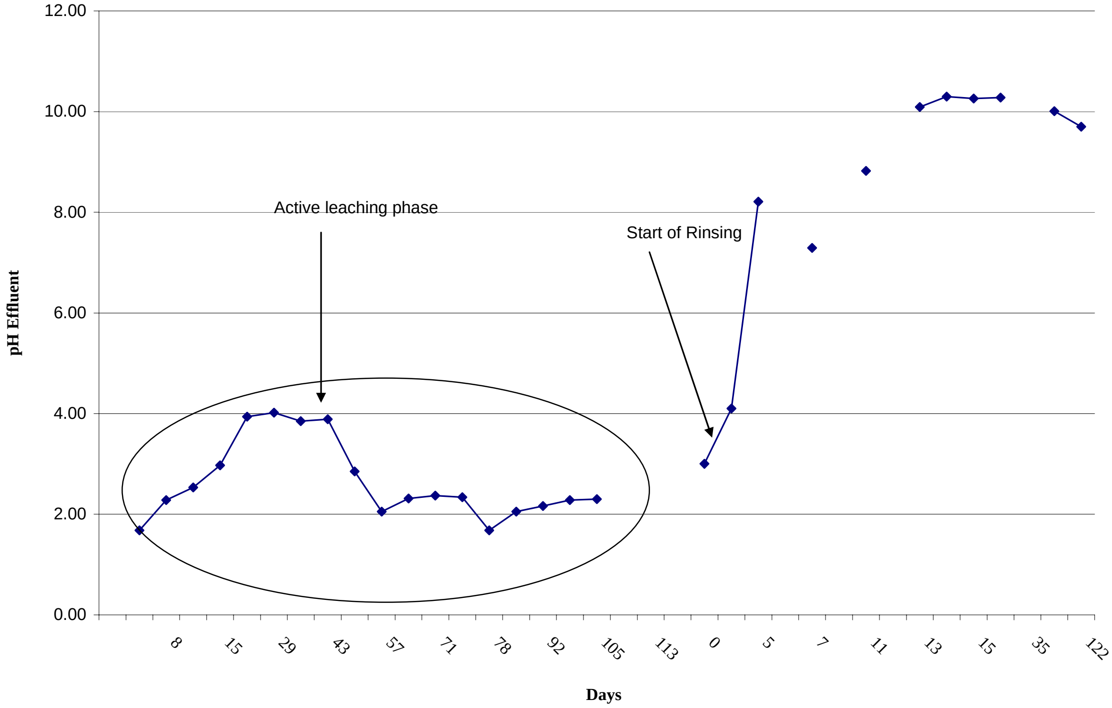


Figure 5
Carmacks Copper Column Detox Results
Column 8
Parameter - pH



2.3.2. Columns 3 and 9 Alkaline Rinse

Following the initial fresh water rinse, all four of the columns underwent a rinse with an alkaline solution to further increase the effluent and pore water pH. Previous work demonstrated plugging concerns when a lime solution was used as the base addition. A 5% lime solution was purposefully chosen as the alkaline rinse solution for Column 3 to determine if this phenomenon continued in the latest round of testwork. As a comparison, the alkaline solution rinse for Column 9 used a 5% sodium carbonate solution initially.

Consistent with past experience, Column 3 exhibited plugging problems and reduced solution infiltration following the addition of a lime solution. The effluent pH of Column 3 increased only marginally to pH 4.03 after the addition of a lime solution. This likely indicates that the highly alkaline solution did not penetrate throughout the entire column height and only limited contact with the spent ore occurred. This also suggests that the plugging occurred relatively early in the alkaline rinse phase and occurred in the top section of the ore column. Additional fresh water rinsing in Column 3 alleviated some of the plugging concerns. An additional alkaline rinse was completed using a 5% sodium carbonate solution, resulting in substantially increased infiltration rates similar to those found in Column 3 prior to the lime rinse. Following the lime and sodium carbonate rinses in Column 3, the effluent pH was approximately 9.99, indicating highly effective rinsing and contact with the spent ore. The alkaline rinse phase for Column 3 reaffirm previous results and indicate that sodium carbonate is more effective than lime in providing alkalinity to the spent ore and does not create plugging concerns.

To further demonstrate this conclusion, the alkaline rinse for Column 9 used a 5% sodium carbonate solution at the onset in lieu of lime solution. There were no plugging problems exhibited in Column 9 during this alkaline rinse phase. The effluent pH of Column 9 following the alkaline rinse was approximately 9.87, again demonstrating effective contact with the spent ore and reaffirming the use of sodium carbonate over lime as the preferred alkaline solution.

2.3.3. Columns 5 and 8 Alkaline Rinse

Immediately following the fresh water rinse, Columns 5 and 8 received an alkaline rinse using a 5% sodium carbonate solution. The effluent pH of Column 5 following the alkaline rinse increased to 9.42 and then decreased to 8.68. No plugging problems were exhibited in Column 5 using Na_2CO_3. A nearly identical result was shown for Column 8 during the alkaline rinse. The pH after the base addition was approximately 8.21 and then decreased to a value of 7.3.

An addition of molasses was made in conjunction with the second alkaline rinse for Column 8. This procedure is the initial assessment for potentially using a biological process in conjunction with conventional rinsing for overall heap detoxification and stabilization. The addition of molasses provides a carbon source to promote reduction of metals to elemental states and usually sulfate reduction and the dissolution of the elemental metals into a sulfide or sulfur phase (Green World Science process). The GWS process has been used successfully at a number of cold weather heap leach operations using cyanide for gold recovery. There are primary differences between a copper oxide acid heap leach and a gold cyanide operation. However once the copper acid heap has been flushed and the pH maintained to near neutral conditions, the process of biological reduction of metals is similar. This is the basis for investigating the initial effectiveness of using the GWS process in Column 8.

The 200 ppm of molasses was added to 13.7 liters of alkaline rinse solution. The total amount of molasses added to the column was approximately 8 kg/tonne.

2.3.4. Fresh Water Pulses

Following the alkaline rinse, all four of the columns were put on a fresh water pulse cycle for the duration of the test. Results of previous work indicated that pulsing the fresh water addition appeared to be of benefit to the overall rinsing effectiveness. The fresh water pulsing represents additional rinsing after the alkaline pH adjustment from both active rinsing as well as precipitation. Fresh water was pulsed through Columns 3 and 9 at a nominal rate of 10 $l/h/m^2$ (3.1 ml/min) for a total duration of 4 days. Columns 3 and 9 were then rested for 17 days for a total cycle time of 3 weeks.

In the case of Columns 3 and 9, the pH of the column effluent remained stable after 6 pulses. The final pH in Column 3 was 9.63 compared to a starting pH of 9.99 prior to the fresh water pulses. The final pH in Column 9 was 8.48 compared to a starting pH of 9.87 prior to the fresh water pulses.

In the case of Column 5 and 8, the fresh water pulse cycles were modified. Similar to Columns 3 and 9, the first pulse was completed immediately after the alkaline rinse followed by a second fresh water pulse 3 weeks later. The major change was an additional fresh water pulse 12 weeks later rather than the 3 week cycle used in Columns 3 and 9. This significantly delayed pulse was designed to determine if there was any rebound (i.e. reduction in pH) if the spent ore is rested for a significantly longer period. The procedure also was used to determine if increased fresh water rinsing benefits the pH after rinsing with an alkaline solution. After the second fresh water pulse conducted 15 weeks after the alkaline rinse, the pH of Column 5 effluent was approximately 9.87 compared to a pH of 10.43 prior to the fresh water pulses. For Column 8, the pH after the second fresh water pulse was 9.7 compared to a pH of 10.28 prior to the fresh water pulses.

2.3.5. Copper

Graphical presentation of the copper response from rinsing is included in Figures 6-9. The concentration of copper in the column effluent is shown in log scale to reflect the high starting point of the copper values immediately after cessation of active acid leaching.

Given the high levels of soluble copper in the pore solution caused by acid leaching, reduction of copper levels close to discharge values is a primary objective of heap detoxification and stabilization.

Copper levels in the column effluent were reduced significantly (order of magnitude) from the initial fresh water and alkaline rinse levels. Copper in Column 3 decreased from a starting point of 5540 mg/l to <100 mg/l after the first alkaline rinse. Column 9 showed a similar decrease as well. In the case of Column 5, copper reduced from a starting point of 5050 mg/l to approximately 500 mg/l after the first alkaline rinse. Column 8 showed copper reductions from 4920 mg/l to 651 mg/l after the first alkaline rinse. Given these comparisons, there appears to be some benefit in reducing the initial copper levels in the spent ore from commencing fresh water rinsing immediately after cessation of leaching rather than letting the spent ore rest before fresh water rinsing begins. This is likely because continued leaching of copper will occur from the acid even when the heap is at rest and no recirculation of solution is occurring. The first fresh water and alkaline rinse steps do not reach acceptable discharge levels for copper but the significant majority of the mass loading of copper is removed in these initial rinsing steps.

Figure 6
Carmacks Copper Column Detox Results
Column 3
Parameter - Copper

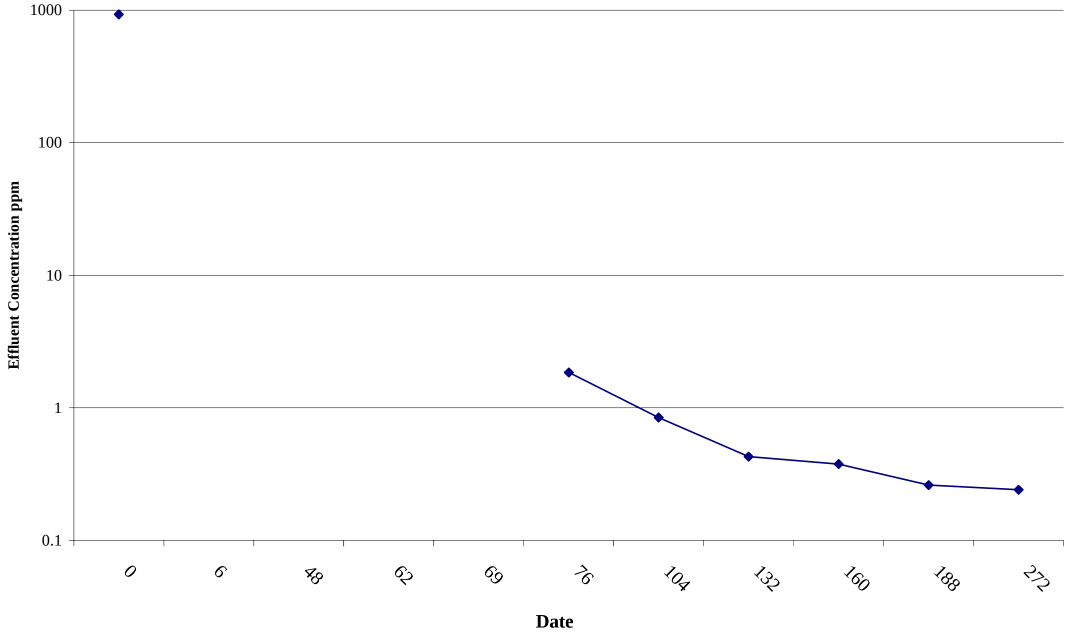
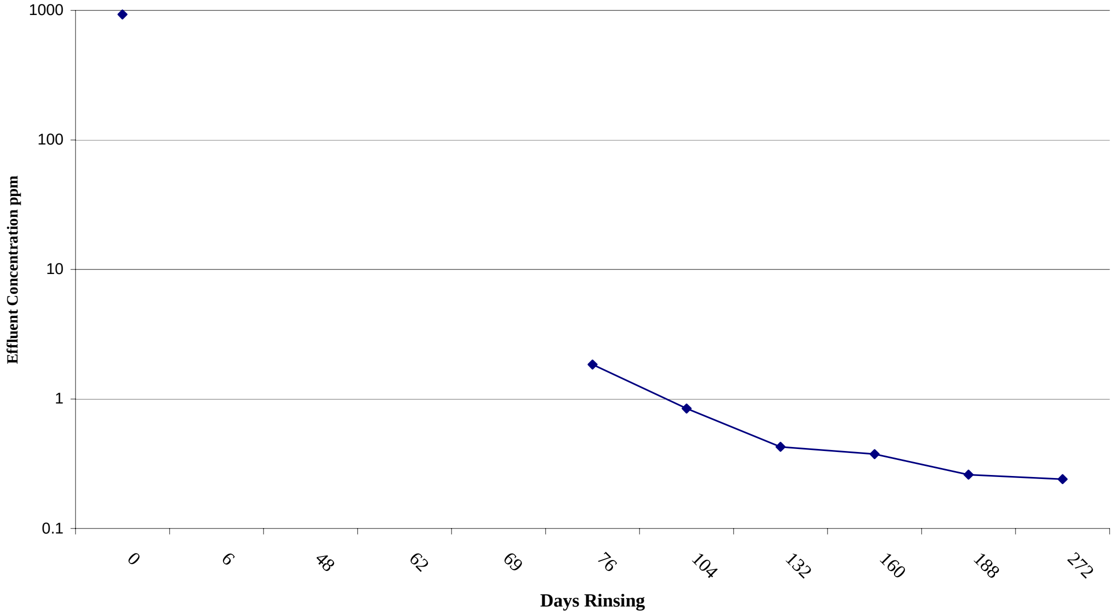


Figure 7
Carmacks Copper Column Detox Results
Column 9
Parameter - Copper



Subsequent fresh water pulsing in Columns 3 and 9 resulted in nearly linear reduction of copper levels in the column effluent to a point of meeting direct discharge standards (MMER). After 6 pulses of fresh water over a period of 196 days, the copper in the effluent of Column 3 decreased from over 3 mg/l to 0.478 mg/l. For Column 9, 5 pulses of fresh water over a period of 196 days decreased the copper from 1.85 mg/l to 0.24 mg/l.

Copper concentrations in Columns 5 and 8 decreased significantly as well during the fresh water pulses but remained higher than MMER standards. After 2 fresh water pulses over a period of 109 days, copper decreased from 2.9 mg/l to 1.41 mg/l in Column 5. In the case of Column 8, copper decreased from 19.6 mg/l to 2.5 mg/l over a period of 105 days from 2 pulses. The significant difference between Columns 3 and 9 versus 5 and 8 is the number of fresh water pulses and time lapse. Columns 3 and 9 reached MMER discharge levels within a period of 200 days compared to only 100 days and 2 pulses for Columns 5 and 8.

Figure 8
Carmacks Copper Column Detox Results
Column 5
Parameter - Copper

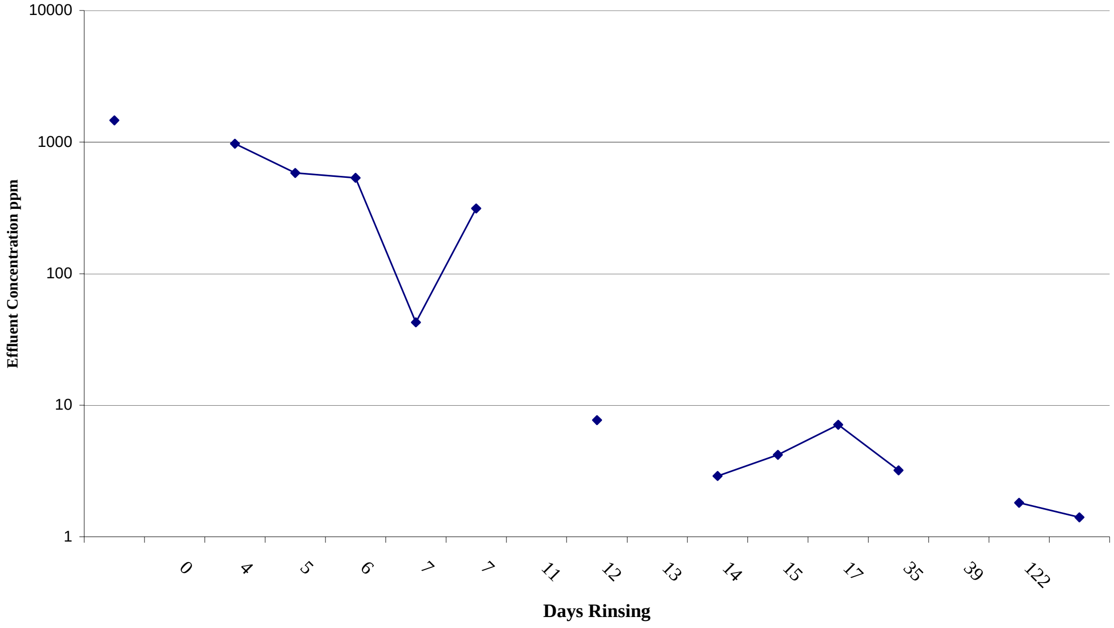
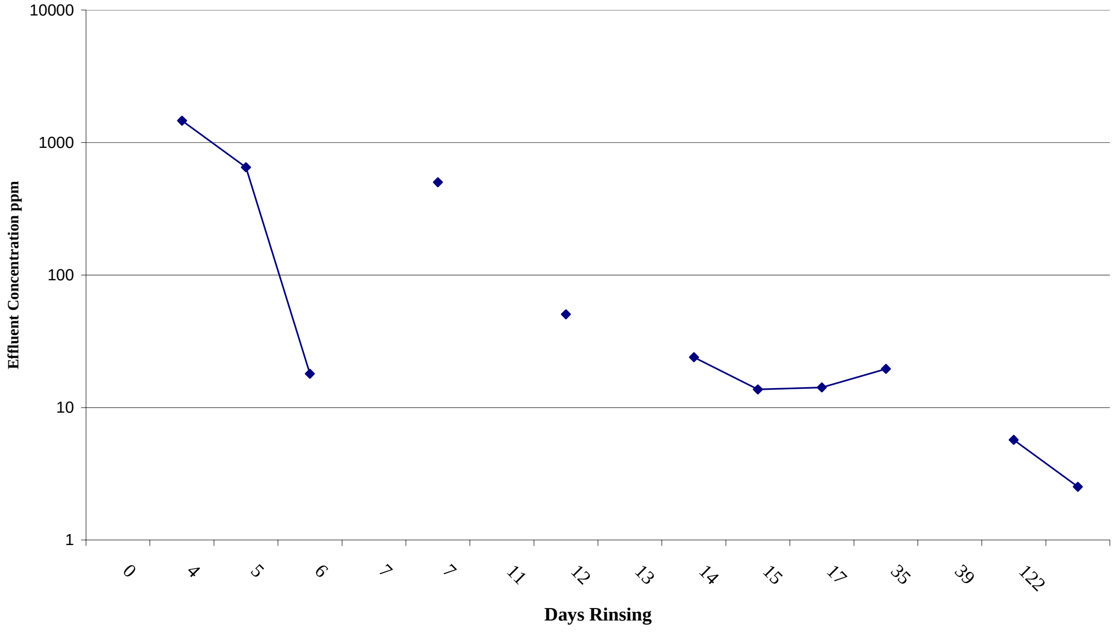


Figure 9
Carmacks Copper Column Detox Results
Column 8
Parameter - Copper



2.3.6. Sulfate

Sulfate was analyzed during the rinsing phase on Columns 3 and 9. Figures 10 and 11 show the progression of sulfate in the column discharge.

Figure 10
Carmacks Copper Column Detox Results
Column 3
Parameter - SO4

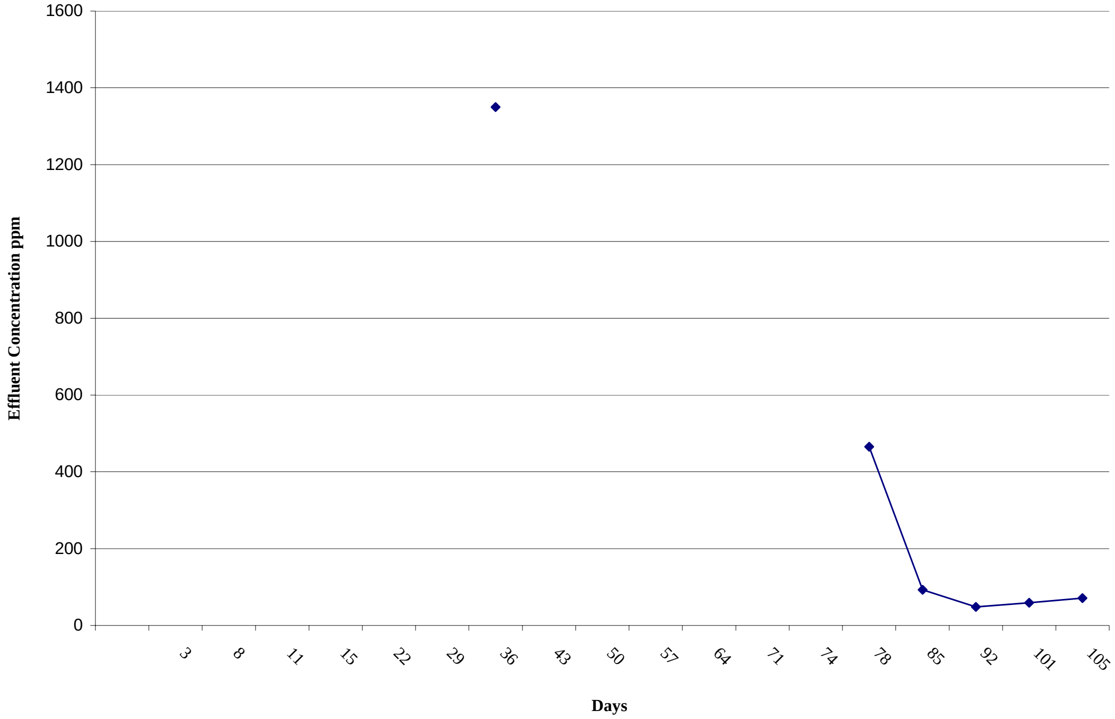
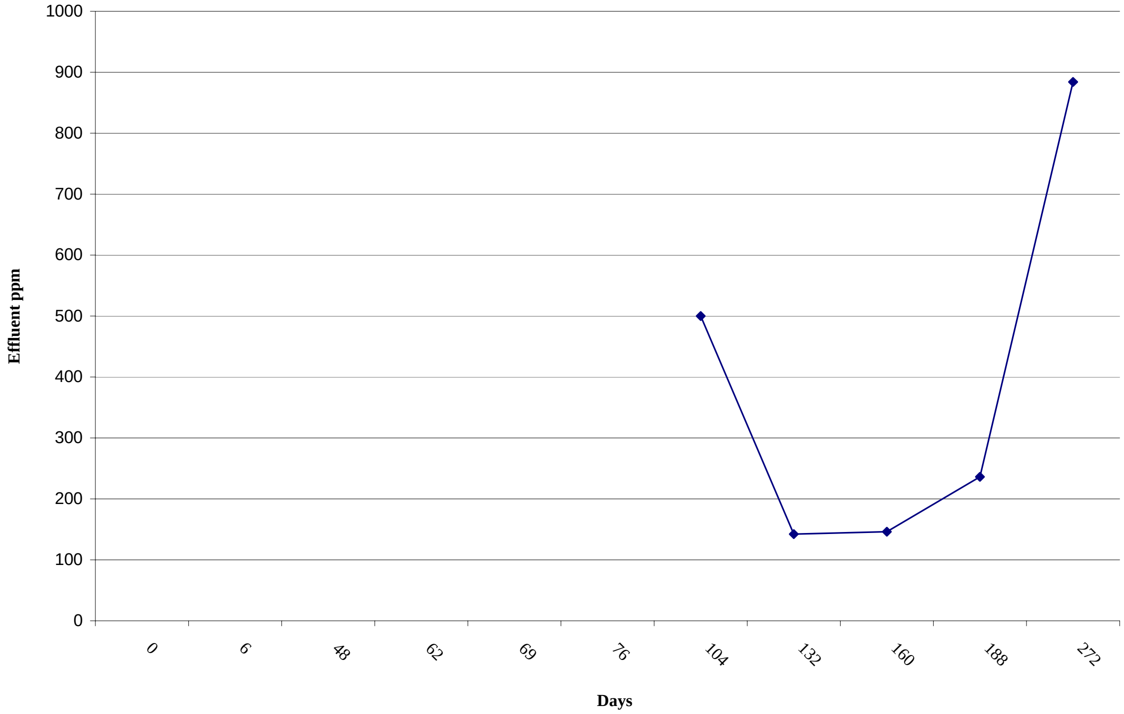


Figure 11
Carmacks Copper Column Detox Results
Column 9
Parameter - SO4



Sulfate in Column 3 showed a steadily decreasing trend starting at nearly 1400 mg/l down to a steady state level of approximately 70 mg/l. In contrast, a spike in sulfate was exhibited in Column 9 at over the half way point of the rinsing process. Sulfate in Column 9 decreased to approximately 140 mg/l, consistent with the values seen in Column 3. However, a spike of sulfate occurred and the final level was well over 800 mg/l. The pH of Column 9 showed a steadily decreasing trend during the end of the test period, but was still within an acceptable range at 8.5. There is likely a correlation between the spike in sulfate and the decreasing trend in pH for Column 9. Flushing of residual acid during the rinsing procedure may have resulted in increases in sulfate and a decrease in pH. The pulsing effect of the procedure used in all of the columns may result in new solution pathways being developed during each successive pulse and therefore rinsing additional acid each time. This is one of the reasons pulsing may be a more effective rinsing process than continued recirculation.

2.4. MINERALOGICAL ASSESSMENT

Once the rinsing phase of the columns was completed, all of the columns were dismantled and sampled for additional mineralogical assessment and ABA testwork. Samples from Columns 3 and 9 were sent to Vancouver Petrographics for mineralogical assessment. The final report is attached as Appendix A. The column dismantling and sampling was conducted under the supervision of Dr. Bruynesteyn with WestCoast Biotech.

Visual observations noted during the dismantling of the columns indicated a minor iron staining on the rock surfaces (Personal communication, Dr. Bruynesteyn).

Figure 12 is a picture of the column residue for Column 3 after dismantling.

Figure 12 – Column 3 Residue

2.5. ENVIRONMENTAL TESTWORK

Additional environmental testwork on the residue of Column 3 and 9 was completed at the laboratory of Vizon Scitec. This work consisted of paste pH and acid base accounting (ABA). The results of the ABA and paste pH are summarized in Tables 7-9.

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F: 604-224-0540 3650 Wesbrook Mall
info@vizonscitec.com Vancouver, BC
www.vizonscitec.com Canada V6S 2L2
VIZON SCITEC

Table 7
ABA and Paste pH Summary

ABA Results for Column 3 & 9 Residues - December, 2005

Sample	Paste pH	Total Sulphur (Wt.%)	Sulphate Sulphur (Wt.%)	Sulphide Sulphur* (Wt.%)	Maximum Potential Acidity** (Kg CaCO3/Tonne)	Neutralization Potential (Kg CaCO3/Tonne)	Net Neutralization Potential (Kg CaCO3/Tonne)	Fizz
Column 3 Residue	9.32	0.08	0.06	0.02	0.6	13.3	12.6	none
Column 9 Residue	6.97	0.12	0.10	0.02	0.6	7.6	7.0	none
Detection Limits	*0.1*	*0.02*	*0.01*					
Vizon Method Number	7160	7400.00	7410	Calculation	Calculation	7150	Calculation	7150

*Based on difference between total sulphur and sulphate-sulphur
**Based on sulphide-sulphur

NP method used: Mod. ABA method (1989)

Table 8a: QA/QC for NP Determination (Modified ABA Method)

Sample	**Neutralisation Potential (kgCaCO3/Tonne)**	**Neutralisation Potential (kgCaCO3/Tonne)**
Duplicates - NP		
Column 3 Residue	13.3	13.3
NBM-1 Reference (NP = 42)	41.8	-

Table 8b: QA/QC for Sulphur Speciation

Sample	**Sulphur (Wt.%)**	**Sulphur (Wt.%)**
Total Sulphur		
Column 9 Residue	0.12	0.10
Vizon Ref. (0.11% TS)	0.10	-
Std. CSB (5.3% TS)	5.26	-
Sulphate-sulphur		
Column 3 Residue	0.06	0.06
Vizon Ref. (0.27% SO4-S)	0.27	-

Table 9: Particle Size Analysis for Column 3 & 9 Residues - December, 2005

Col. # 3				
Screen (mm)	**Mass** (g)	**% Retained**		**% Passing**
		Interval	Cumulative	
50.8	0	0.0	0.0	100.0
25.4	0	0.0	0.0	100.0
13.33	298.2	24.4	24.4	75.6
9.50	98.6	8.1	32.5	67.5
6.30	110.6	9.0	41.5	58.5
4.00	100.1	8.2	49.7	50.3
2.00	133.9	11.0	60.7	39.3
1.00	122.6	10.0	70.7	29.3
0.500	128.6	10.5	81.2	18.8
< 0.500	229.6	18.8	100.0	0.0
Total	1222.2	100.0		

Col. # 9				
Screen (mm)	**Mass** (g)	**% Retained**		**% Passing**
		Interval	Cumulative	
50.8	0	0.0	0.0	100.0
25.4	880.9	55.7	55.7	44.3
13.33	206.3	13.0	68.7	31.3
9.50	31.3	2.0	70.7	29.3
6.30	60.2	3.8	74.5	25.5
4.00	50.6	3.2	77.7	22.3
2.00	61.4	3.9	81.6	18.4
1.00	53.6	3.4	84.9	15.1
0.500	72.2	4.6	89.5	10.5
< 0.500	166	10.5	100.0	0.0
Total	1583	100.0		

2.5.1. Paste pH

Paste pH is a measure of the sample's immediate acidity or alkalinity and reflects current geochemical conditions. The high paste pH for both column residues indicates that most if not all of the residual acid from the leaching phase has been effectively rinsed.

2.5.2. Sulphide Concentrations

The spent ore residue has very low sulphide sulfur concentrations (0.02%). This is consistent with the oxide nature of the orebody where low amounts of sulfide are expected. Any sulfide that may have been in the ore prior to leaching has been largely oxidized during the leaching phase. Given the very low sulfide sulfur concentration of the residue, the spent ore has very low or no acid generating potential.

2.5.3. Maximum Potential Acidity

The maximum potential acidity (MPA) is calculated from the sulphide content, assuming it is all converted into sulfuric acid and is reported as kg $CaCO_3$ per tonne. This calculated value represents the maximum or worst case condition of acid production. The low MPA for both column residues indicates effective rinsing as well as very low potential for additional acid production.

2.5.4. Neutralization Potential

The neutralization potential (NP) is a measure of the amount of neutralizing compounds such as calcium carbonate in the material. The neutralization potential ratio of the material is calculated by dividing the NP by the MPA. The net neutralization potential (NNP) is calculated by subtracting the NP from the MPA. For column residues 3 and 9, the NPR was 22.1 and 12.7, respectively. The high NP ratios for both columns again indicate very low or no acid generating potential of the spent ore.

3. TEST WORK CONCLUSIONS

The test results presented provide proof of significant progress and demonstration on the ability to effectively rinse and neutralize the Carmacks Copper spent ore material. Most significantly are the results of Column 9 demonstrating all the parameters in the MMER list of standards were met for direct discharge. The main conclusions of the test results indicate:

1. The use of sodium carbonate over lime is superior for alkaline addition and no plugging problems are observed with Na_2CO_3 as is the case with CaO.
2. Letting the spent ore rest after leaching is complete and before initial fresh water rinsing provides a higher initial pH compared to commencing fresh water rinsing immediately.
3. Additional fresh water pulses continue to reduce soluble copper levels to the point where MMER standards are met.
4. Acceptable copper and pH standards are met within reasonable timelines of 200 column days.
5. Pulsing of fresh water appears to be more effective, likely due to some diffusion controlled mechanism of copper as well as the creation of new solution pathways and more effective overall rinsing;
6. The addition of a carbon source did not provide any obvious benefit for stabilization of copper. However the assessment of this part of the program was not optimized and it should be further investigated;
7. The optimum rinsing process at this point appears to consist of:
    a. Initial fresh water pulse to flush residual acidity;
    b. Adjustment of pH by pulsing an alkaline solution of 5% sodium carbonate;
    c. Continued pulsing of fresh water followed by rest periods until copper has reached acceptable levels;
8. The environmental testwork indicates the residual acid from leaching was effectively rinsed and the spent ore has very low or no acid generating potential which is consistent with the oxide nature of the material.
9. It has been demonstrated to be technically feasible to rinse the free acidity and reduce metals to acceptable standards.

4. SCALE UP

The data from the column rinsing test work can be used to estimate the time to rinse a commercial heap at Carmacks Copper. By applying the application rate used in the column test work and the number of column days to rinse the spent ore, an estimated time for a commercial heap to be rinsed can be determined. Table 10 summarizes the scale-up data for Column 9 since it was the column that achieved the best results.

Using the column application rate of 10 $l/h/m^2$ (0.004 gpm/ft^2) and a fresh water pumping rate of 400 m^3/hr, approximately 13% of the surface of the heap could be rinsed at a time. This requires approximately 8 passes of fresh water rinsing to cover the entire area of the heap. Using the column timeframe of 200 days, it would take approximately 1,600 days (4.4 years) to rinse the Carmacks heap. This assumes that rinsing did not commence until the end of the mine life, rinsing was conducted year round and there was no concurrent rinsing conducted during active leaching.

The scale-up calculations show that the availability of fresh water for rinsing is important in the amount of time required to rinse the heap. Figure 13 shows the time required for fresh water rinsing compared with the amount of fresh water available.

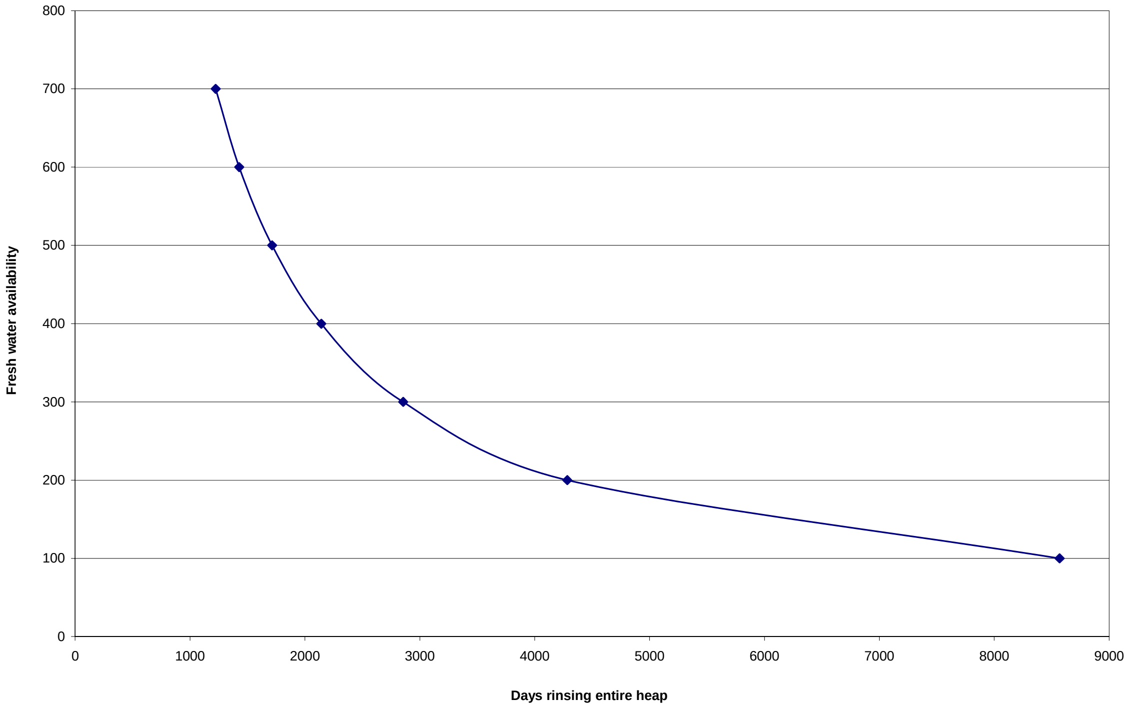
The scale-up exercise suggests that concurrent rinsing should be considered to reduce the overall heap neutralization period down to a reasonable timeframe. At the fresh water capacity assumption of 400 m^3/hr, approximately 1,600,000 tonnes of spent ore could be rinsed each year. Using a concurrent rinsing process, the majority of the heap could be rinsed by the end of the mine life when the heap is fully loaded. Assuming rinsing begins in Year 3 and continues annually during operations, approximately 8,000,000 tonnes (1,600,000 x 5 years) would be rinsed at the end of active mining. The remaining 5,300,000 tonnes of spent ore would then be rinsed within a 3 year period following completion of economic leaching.

Table 10
Western Silver Corporation
Carmacks Copper Project

Column Detoxification Test Results
Column Results Scale-Up

Parameter	Unit	Column 9	Commercial Heap
Solution Application Rate	$l/h/m^2$	10.00	
	gpm/ft^2	0.0041	
Total ore on leach pad	tonnes		13,300,000
Total area of heap	ha		31.5
Stacked ore density	t/m^3		1.6
Average ore height	m		26.4
Available fresh water rinse	m^3/hr		400
	gpm		1760
Total area under fresh water rinse	m^2		40,000
Total tonnes under fresh water rinse	tonnes		1,688,889
Total days fresh water rinsing	days	200	
Total # passes around heap	#		7.875
Total estimated days fresh water rinse	days		2142

Figure 13
Rinse days vs available fresh water



4.1. RINSING CRITERIA

For conservative sake, the estimated time for rinsing and detoxification is estimated at 4.5 years, based on the assumption that no concurrent rinsing occurs during the active leaching phase and the entire heap is rinsed and detoxified at the end of the mine life. A summary of the key parameters for the rinsing and detoxification are summarized below.

Total tonnes spent ore:	13,300,000
Total duration of rinsing:	4.5 years
Total volume of fresh water:	15,520,000 m^3
Design rinsing rate	400 m^3/hr

5. ONGOING STUDIES

Ongoing studies should be completed to optimize the heap detoxification and decommissioning plan. The column testwork results discussed in this report present and demonstrate the technical feasibility of the heap detoxification process. Additional studies will provide data for optimization of the process.

Western Silver has commissioned a further large scale column leach program. This leaching program is intended to optimize the leaching performance and design criteria for the project. The large scale column to be used in this latest optimization testwork is 0.3 m diameter (12") by 9.1 m high (30 foot). This column will hold in excess of 1 tonne of material. Once the column leaching phase of the program is complete, additional rinsing and detoxification testwork will be conducted on this large scale column. The results of the smaller columns will be used to guide and develop the specific procedure for the large scale column.

This approach to optimization is consistent with the assessment of the Brewery Creek Mine heap detoxification process. Small columns were used during the assessment process to demonstrate the technical feasibility of the proposed detoxification approach and larger column testing was completed during active operations to optimize the process.

Appendix A

Petrographic Report

PETROGRAPHIC REPORT ON 4 SAMPLES FROM PROJECT 2 21 0912

Report for:	Doug Warkentin	Invoice 060018
	VIZON SCITEC	Project 2 21 0912
	3650 Wesbrook Mall	
	Vancouver, B.C. V6S 2L2. (604) 224-4331(Ext. 270)	Jan. 15, 2006.

SUMMARY:

This suite of 4 samples comprises variably oxidized, partly foliated, biotite-hornblende diorite intrusive (accessory sphene, apatite, magnetite oxidized to hematite). The copper mineralization principally reflects a low total-sulfur system characterized by chalcopyrite (only trace pyrite), oxidized to "pitch" limonite characteristic of direct, in situ oxidation of chalcopyrite, and minor malachite. Capsule descriptions are as follows:

2 21 912 Col 3: biotite-hornblende diorite (accessory sphene, apatite, hematite possibly in part after magnetite (?) and mineralized with patches of "pitch" limonite and minor malachite after chalcopyrite (traces remain), associated with minor sericite-epidote-zoisite-chlorite alteration.

2 21 912 Col 9-1/2: hornblende-biotite diorite (weak to locally moderate alteration to clay-sericite) with accessory quartz and minor magnetite (oxidized to hematite), sphene, apatite and chalcopyrite (partly to completely oxidized to limonite and minor hematite, some of which is further transported by weathering, forming amorphous stains).

2 21 912 Col 9+1: weakly foliated biotite diorite (slight alteration to clay-sericite) with accessory quartz, magnetite (oxidized to hematite), apatite, and chalcopyrite oxidized to concentric rims of "pitch" limonite and minor hematite.

2 21 912 Col 9+1.5: foliated intermediate gneiss of about biotite-hornblende diorite composition (accessory sphene, magnetite partly oxidized to hematite, apatite, epidote and monazite?), mineralized with disseminated chalcopyrite (trace pyrite) partly oxidized to "pitch" limonite.

Detailed petrographic descriptions and photomicrographs are appended. If you have any questions regarding the petrography, please do not hesitate to contact me.

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2 21 912 Col 3: BIOTITE-HORNBLENDE DIORITE (ACCESSORY SPHENE, APATITE) WITH CHALCOPYRITE COMPLETELY OXIDIZED TO "PITCH" LIMONITE-HEMATITE-MINOR MALACHITE

Sample consists of small flat slabby chips of rock mostly <3 cm in diameter, covered with a pale ochre coating of mud and dirt. The rock is not magnetic, shows minor reaction to cold dilute HCl where malachite occurs, and no stain for K-feldspar in the etched offcut. The etched offcut shows a dark grey, relatively fine-grained, intermediate to mafic intrusive rock of about diorite composition, with several patches of collomorphic-textured, possible "pitch" limonite associated with the malachite, likely after former chalcopyrite). Modal mineralogy in polished thin section is approximately:

Plagioclase (andesine?)	55%
Amphibole (hornblende?)	25%
Biotite (ferriferous?)	15%
"Pitch" limonite (after chalcopyrite)	2-3%
Clay-sericite	1-2%
Sphene	1%
Carbonate (malachite)	<1%
Apatite	<1%
Hematite (partly after magnetite?)	<1%
Chlorite	<1%
Epidote, zoisite	<1%
Quartz	<1%
Chalcopyrite (relict)	trace

This sample is composed of interlocking plagioclase, amphibole and biotite with accessory sphene, apatite, magnetite (largely oxidized to hematite), and mineralized by "pitch" limonite (after chalcopyrite, traces of which remain), associated with malachite and minor sericite.

Plagioclase forms somewhat rounded, sub- to euhedral crystals mostly <1 mm in diameter, with very minor compositional zoning typical of metamorphism (composition near andesine, An37, based on extinction Y^010 of 20 degrees, Z^001 of 23 degrees) The crystals are generally slightly to locally weakly altered along twin planes and cleavages to clay-sericite as subhedral to ragged flakes rarely over 20 microns in diameter.

Amphibole forms ragged to irregular subhedra locally up to 2.5 mm in maximum dimension, with medium sea-green pleochroism and extinction angle about 20 degrees, suggesting an actinolitic hornblende. Intergrown biotite forms ragged subhedral flakes rarely over 1 mm in diameter, with greenish brown pleochroism indicative of possibly ferriferous composition. The mafic minerals are rarely altered to minor chlorite as pale green subhedral flakes to 0.25 mm in diameter, zoisite (Fe-poor epidote) as subhedra to 0.3 mm (both with anomalous blue interference colours), and epidote to 0.25 mm (with normal birefringence).

Accessory sphene forms subhedral crystals up to 0.5 mm in diameter; apatite forms small stubby prisms mostly<0.15 mm long. Small patches of hematite with euhedral outlines <0.1 mm across may mark the sites of possible former accessory magnetite (?) crystals.

The copper mineralogy is dominated by irregular-shaped patches up to 3.5 mm long of brilliant red-brown, collomorphic and botryoidal-textured "pitch" limonite, generally considered to have formed directly in situ by oxidation of chalcopyrite (minute traces of which remain, <0.1 mm across, at the core). Minor hematite occurs at the margins as subhedral flakes to 0.1 mm. Further oxidation has produced small patches of malachite as radiating sprays of pale green, euhedral acicular crystals mostly <0.1 mm long, associated with patches of sericite as flakes <25 microns in diameter.

In summary, this is a biotite-hornblende diorite (accessory sphene, apatite, hematite possibly in part after magnetite (?) and mineralized with patches of "pitch" limonite and minor malachite after chalcopyrite (traces remain), associated with minor sericite-epidote-zoisite-chlorite alteration.

2 21 912 Col 9-1/2: HORNBLENDE BIOTITE DIORITE; ACCESSORY QUARTZ-SPHENE-APATITE-MAGNETITE/CHALCOPYRITE (OXIDIZED TO HEMATITE/LIMONITE)

Sample consists of small angular chips of medium- to coarse-grained granitic or dioritic rock, mostly <2 cm in diameter, and coated with pale ochre-coloured mud and dirt. The rock is locally slightly magnetic, but shows no reaction to cold dilute HCl; minor yellow stain in the etched offcut is likely due to biotite. Modal mineralogy in polished thin section is approximately:

Plagioclase (oligoclase?)	70%
Biotite (partly ferriferous?), locally oxidized	15%
Amphibole (hornblende?)	5%
Quartz	3-5%
Clay-sericite (after plagioclase)	2-3%
Limonite (partly transported)	1-2%
Magnetite (partly to largely oxidized to hematite)	1%
Chalcopyrite	<1%
Pitch limonite (after chalcopyrite)	<1%
Sphene	<1%
Apatite	<1%
Carbonate	<1%

This sample consists of small chips <1 cm in diameter of partly oxidized intrusive rock composed mainly of plagioclase and variable proportions of biotite and hornblende, containing minor magnetite largely oxidized to hematite and relatively minor chalcopyrite (rare pyrite). The chips are locally variably stained by orange-brown transported limonite, possibly derived by weathering of bright red-brown limonite probably after formerly more extensive chalcopyrite.

Plagioclase forms ragged, subhedral to irregular, anhedral crystals up to 5 mm in diameter, commonly incipiently to locally moderately altered (especially along twin planes, cleavages and fractures) to very fine-grained clay-sericite as flakes up to about 25 microns in diameter. Composition appears to be about oligoclase, An20, based on extinction on 010 close to zero degrees. Accessory quartz, forming ragged subhedra in aggregates up to 2.5 mm in size, is locally abundant, interstitial to the plagioclase crystals. The quartz exhibits strong undulose extinction, sub-grain development, and minor suturing of grain boundaries, indicating it is strongly deformed. Traces of carbonate (subhedra mostly <0.1 mm in diameter) occur with the quartz.

Biotite is widespread as somewhat ragged subhedral to locally euhedral flakes up to 2 mm in diameter. The crystals are mainly deep greenish brown, suggesting a ferriferous composition, but locally are pale to deep brown, or oxidized (interleaved with or stained by amorphous red-brown limonite), and are commonly bent, suggesting deformation. Amphibole is only present in certain chips, forming stubby subhedral crystals mostly <0.7 mm long with weak, pale sea-green pleochroism and small extinction angle (<10 degrees) suggestive of actinolitic hornblende (?).

Accessory magnetite is only locally present, forming mainly euhedral crystals <0.3 mm in diameter (locally aggregating to 0.6 mm) that are almost completely pseudomorphed by hematite, forming “martite”. Minor sphene and apatite are associated with biotite, forming subhedral crystals to 0.5 and 0.2 mm in diameter, respectively.

Chalcopyrite is only present in only one chip, forming irregular-shaped crystals/aggregates up to about 1 mm across, slightly oxidized along fractures and rims to limonite (pale orange-brown), locally associated with bladed hematite as euhedral crystals mostly <50 microns in diameter, particularly around the margins of the oxidized chalcopyrite relics. Rare pyrite is present in one chip, forming euhedral crystals <0.1 mm in diameter, slightly oxidized to limonite at the rims.

In summary, this appears to be mostly hornblende-biotite diorite (weak to locally moderate alteration to clay-sericite) with accessory quartz and minor magnetite (oxidized to hematite), sphene, apatite and chalcopyrite (partly to completely oxidized to limonite and minor hematite, some of which is further transported by weathering, forming amorphous stains).

2 21 912 Col 9+1: WEAKLY FOLIATED BIOTITE DIORITE, ACCESSORY QUARTZ, APATITE, MAGNETITE AND CHALCOPYRITE (OXIDIZED TO HEMATITE AND “PITCH” LIMONITE RESPECTIVELY)

Sample consists of very weakly foliated, granitic or dioritic-looking rock fragments coated with pale ochre-coloured mud and dirt. The rock is weakly magnetic, but shows no reaction to cold dilute HCl, and only trace stain for K-feldspar in the etched offcut. Minor sulfides appear to be mostly chalcopyrite, slightly oxidized to limonite around the margins. Modal mineralogy in polished thin section is approximately:

Plagioclase (oligoclase?)	75%
Biotite (ferriferous?)	15%
Quartz	2-3%
Magnetite (partly to largely oxidized to hematite)	2-3%
Chalcopyrite	2-3%
Clay-sericite (after plagioclase)	1-2%
Pitch limonite (after chalcopyrite)	<1%
Apatite	<1%
K-feldspar	<1%

This sample consists of intermediate plagioclase and biotite, with accessory quartz, magnetite oxidized to hematite, chalcopyrite oxidized to limonite, apatite and trace K-feldspar.

Plagioclase forms ragged, subhedral to irregular, anhedral crystals as much as 4.5 mm in diameter, commonly incipiently to slightly altered along fractures and cleavages to very fine-grained clay-sericite as flakes mostly<15 microns in diameter. Composition appears to be about oligoclase, An20, based on extinction on 010 close to zero degrees. Minor accessory quartz, forming ragged subhedra up to 0.5 mm in size, and traces of K-feldspar as subhedra mostly <0.1 mm in diameter, is locally interstitial to the plagioclase crystals.

Biotite forms somewhat ragged subhedral to locally euhedral flakes rarely over 1.5 mm in diameter, but commonly in bent, curving aggregates up to almost 5 mm long. Dark greenish brown pleochroism may suggest a ferriferous composition. Accessory oxides and sulfides are generally closely associated with the biotite aggregates.

Accessory magnetite forms mainly euhedral crystals <0.5 mm in diameter (locally aggregating to almost 1 mm). Some crystals are almost completely pseudomorphed by hematite, forming “martite”.

Chalcopyrite, originally forming subhedral crystals up to about 0.5 mm in diameter, is rimmed by botryoidal, collomorphic, bright red limonite (“pitch” limonite), formed directly in situ from the chalcopyrite, locally associated with bladed hematite as euhedral crystals mostly <0.1 mm in diameter, particularly around the margins of the oxidized chalcopyrite relics. The hematite appears to contain rare traces of chalcopyrite (?), mainly <5 microns in diameter.

In summary, this is a weakly foliated biotite diorite (slight alteration to clay-sericite) with accessory quartz, magnetite (oxidized to hematite), apatite and chalcopyrite oxidized to concentric rims of “pitch” limonite and minor hematite.

2 21 912 Col 9+1.5: FOLIATED, GNEISSIC BIOTITE-HORNBLENDE DIORITE (ACCESSORY SPHENE-MAGNETITE/HEMATITE-APATITE-EPIDOTE-MONAZITE?), MINERALIZED WITH CHALCOPYRITE (±PYRITE) OXIDIZED TO "PITCH" LIMONITE

Sample consists of slabby pieces of dark grey-green foliated, gneissic rock coated on weathered surfaces with pale ochre-brown mud and dirt. The rock is weakly to locally strongly magnetic, shows no reaction to cold dilute HCl, and no stain for K-feldspar in the etched offcut. Minor sulfides (chalcopyrite), rimmed by limonite, is visible in the etched offcut. Modal mineralogy in polished thin section is approximately:

Feldspar (plagioclase, andesine?)	60%
Amphibole (hornblende?)	30%
Quartz	2-3%
Biotite (green, ferriferous?)	2-3%
Sphene	1-2%
Magnetite (partly oxidized to hematite)	1-2%
Limonite (amorphous, goethitic?)	1%
Pitch limonite (?), after chalcopyrite	<1%
Chalcopyrite	<1%
Pyrite	<1%
Epidote/clinozoisite (?)	<1%
Clay/sericite (after feldspar)	<1%
Apatite	<1%
Monazite (?)	<1%

This sample consists of alternating laminae, mostly 1-2 mm thick, richer in plagioclase or amphibole (locally also with biotite and partly oxidized sulfides, or with magnetite partly oxidized to hematite). Plagioclase as interlocking subhedra mostly <0.4 mm in diameter is intermediate, probably about sodic andesine (An30-35) in composition based on extinction on 010 up to 16 degrees, and relief about the same as very minor quartz that forms interstitial, rounded subhedra mostly <0.15 mm in size. Traces of clay-sericite (flakes <20 microns in size) replace plagioclase in places. Amphibole with dark olive-green pleochroism (likely hornblende) forms ragged subhedra up to about 1.5 mm in diameter, although locally skeletal or sieve-like aggregates are up to 3 mm across. Biotite forms irregular to ragged subhedral flakes up to 2 mm in diameter with dark greenish brown pleochroism suggestive of ferriferous composition. Accessory sphene (rounded subhedral aggregates mostly <0.1 mm), magnetite (euhedra mostly <0.15 mm in diameter, locally rimmed/replaced by hematite) and apatite (rounded stubby prisms <75 microns long) are common. Locally, minor colourless epidote (Fe-poor, clinozoisite) and possible monazite (?) form euhedral crystals mostly <50 microns in size.

The primary copper mineral is chalcopyrite, originally forming subhedral to irregular-shaped, but commonly elongate, crystals or blebs up to 0.75 mm long (aligned with the lamination/foliation). The chalcopyrite is locally associated with minor pyrite as euhedral crystals mostly <0.25 mm in size. Both are surrounded, rimmed and locally entirely replaced by a distinctive limonite with bright red internal reflections or colour, relatively high reflectance (15-20%; not high enough for cuprite) and botryoidal, collomorphic texture, known informally as "pitch" limonite, formed directly after and commonly pseudomorphing, chalcopyrite. The aggregates are locally partly rimmed by lepidocrocite or hematite (R=25%). Adjacent aggregates of limonite up to 1.2 mm long, with much lower reflectance (R=5-10%) and central voids (filled with epoxy), likely reflect amorphous, transported goethitic limonite derived by weathering of sulfides elsewhere in the sample.

In summary, this is a foliated, intermediate gneiss of about biotite-hornblende diorite composition (accessory sphene, magnetite partly oxidized to hematite, apatite, epidote and monazite?), mineralized with disseminated chalcopyrite (trace pyrite) that has been partly oxidized to "pitch" limonite.

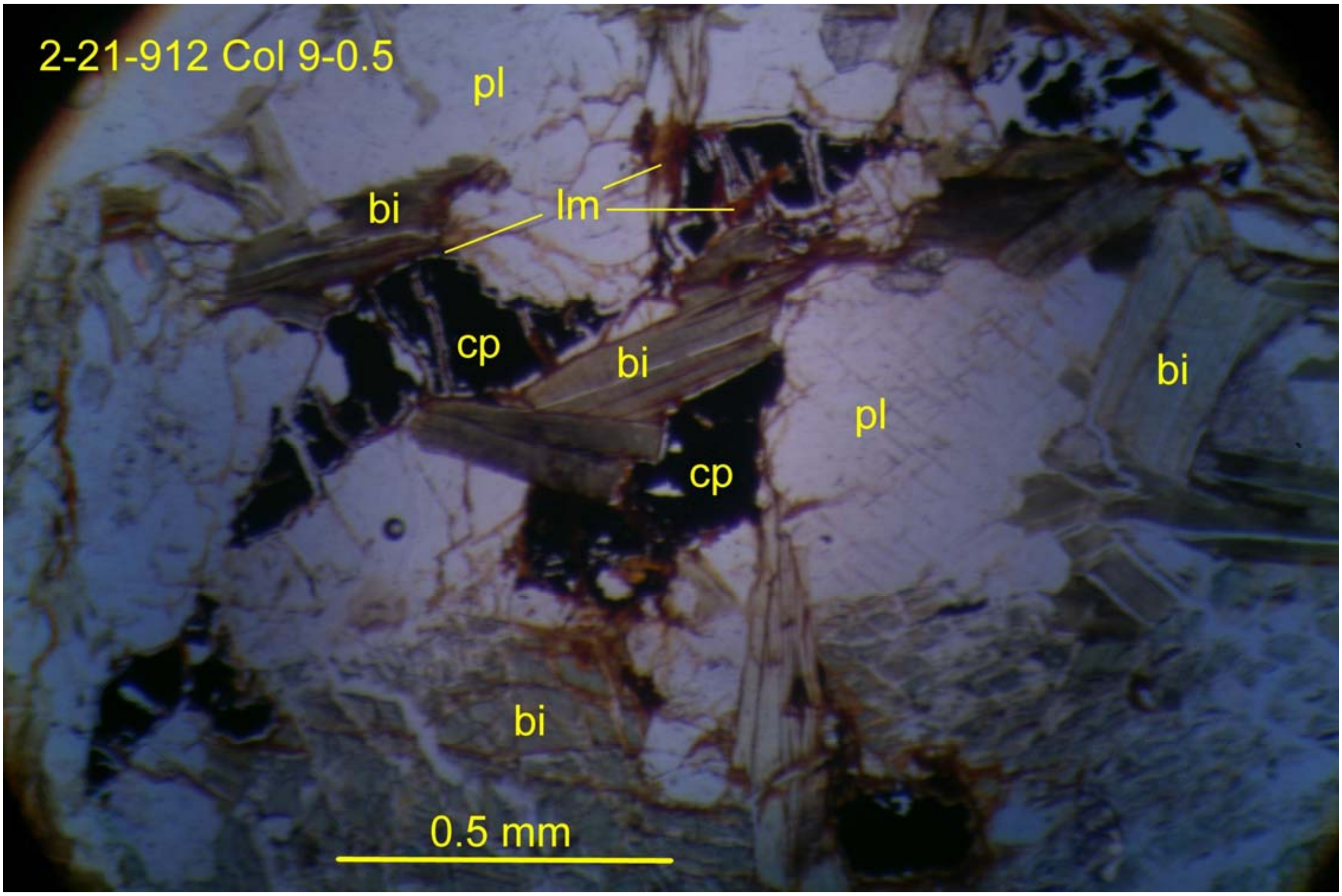
PHOTO CAPTIONS

2 21 912 Col 3: Patch of bright red “pitch” limonite, locally associated at the margins with minor malachite (mal), sericite (ser), epidote (ep) alteration of plagioclase (pl) and amphibole (am) and green biotite (bi). Note small remnant of chalcopyrite (opaque) at core of limonite. Transmitted plane light, field of view 2.7 mm wide.

2 21 912 Col 9-1/2: Chalcopyrite (opaque) oxidized at rims and along narrow fractures to red-brown limonite, and associated with green biotite (bi) flakes in slightly sericitized plagioclase crystals (clear). Transmitted plane light, field of view 2.25 mm wide.

2 21 912 Col 9+1: Remnant chalcopyrite (cp) at the cores of collomorphic, concentrically zoned aggregates of “pitch” limonite (lm) locally rimmed by bladed hematite (hm), associated with magnetite largely oxidized to hematite and to limonite, associated with biotite (bi) and accessory apatite (ap) in matrix of plagioclase (pl). Reflected light, uncrossed polars, field of view 2.25 mm wide.

2 21 912 Col 9+1.5: Remnant chalcopyrite (cp), minor pyrite at the cores of collomorphic, botryoidal-textured aggregates of “pitch” limonite (lm) locally rimmed by hematite (hm), probably formed directly from the chalcopyrite. Adjacent aggregates of transported limonite (go), associated with voids, have much lower reflectance. In silicate matrix of plagioclase (pl), amphibole (am), accessory sphene (sp). Reflected light, uncrossed polars, field of view 2.7 mm wide.


2-21-912 Col 9-0.5
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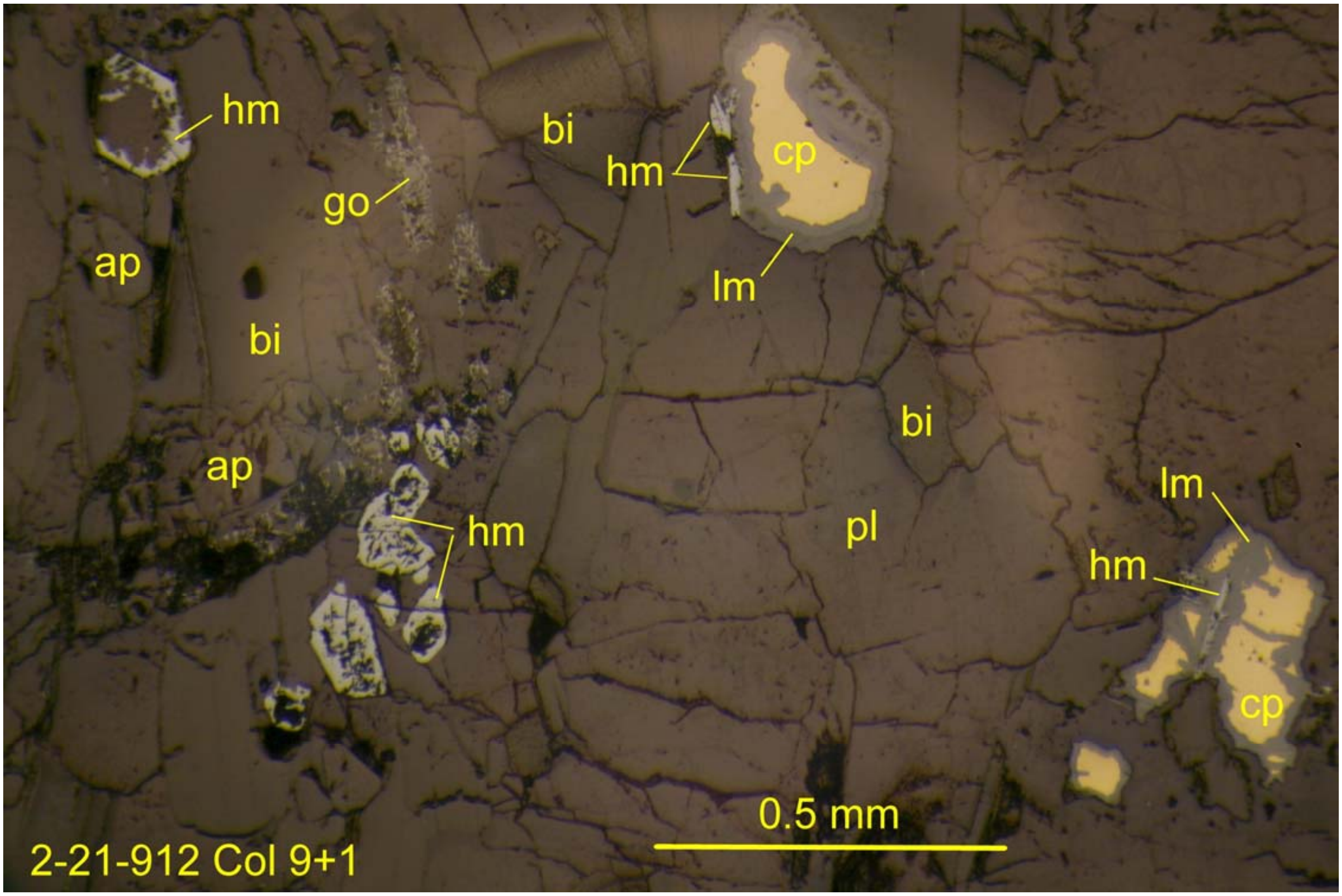
lm
bi
cp
bi
bi
pl
cp
bi
0.5 mm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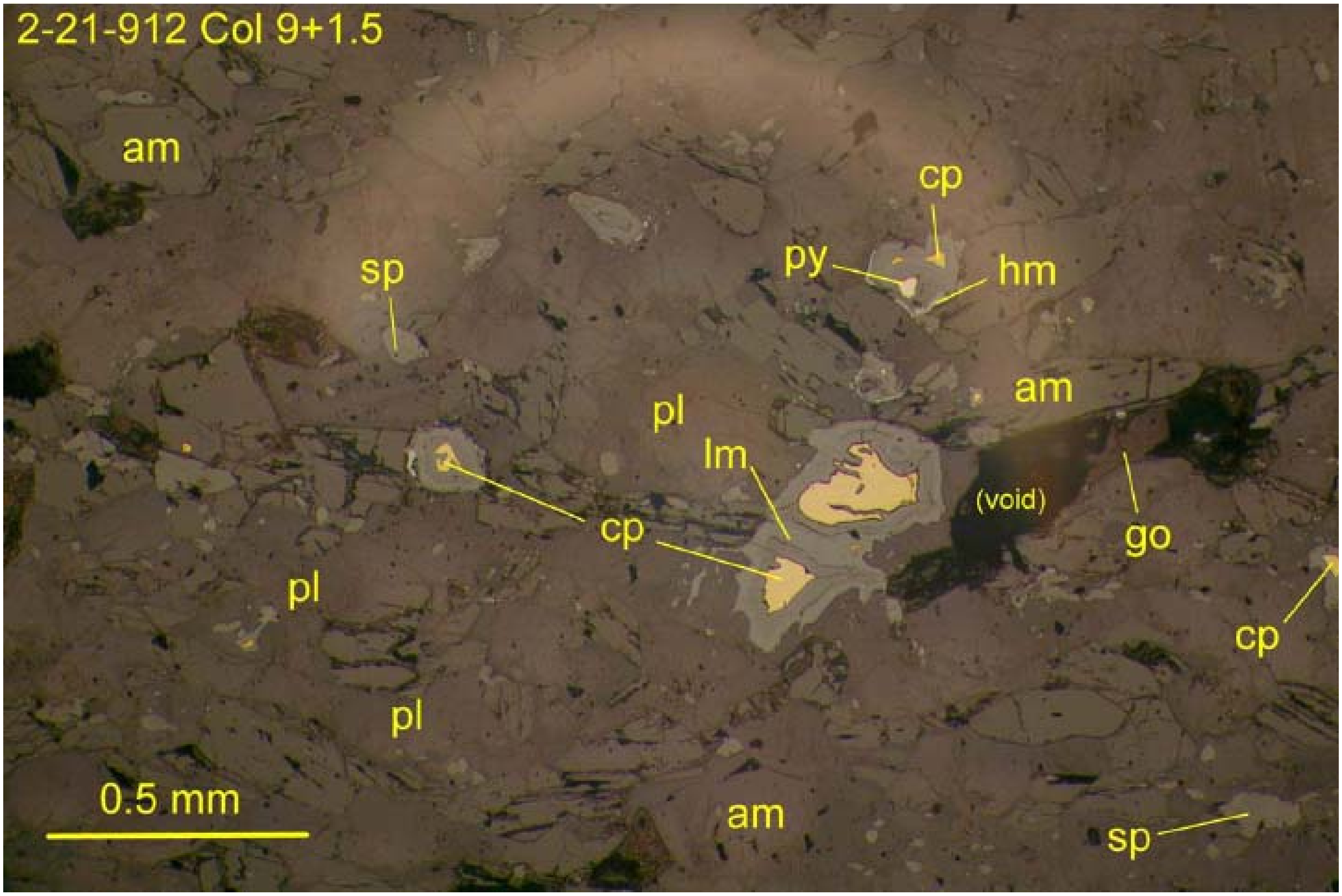
2-21-912 Col 9+1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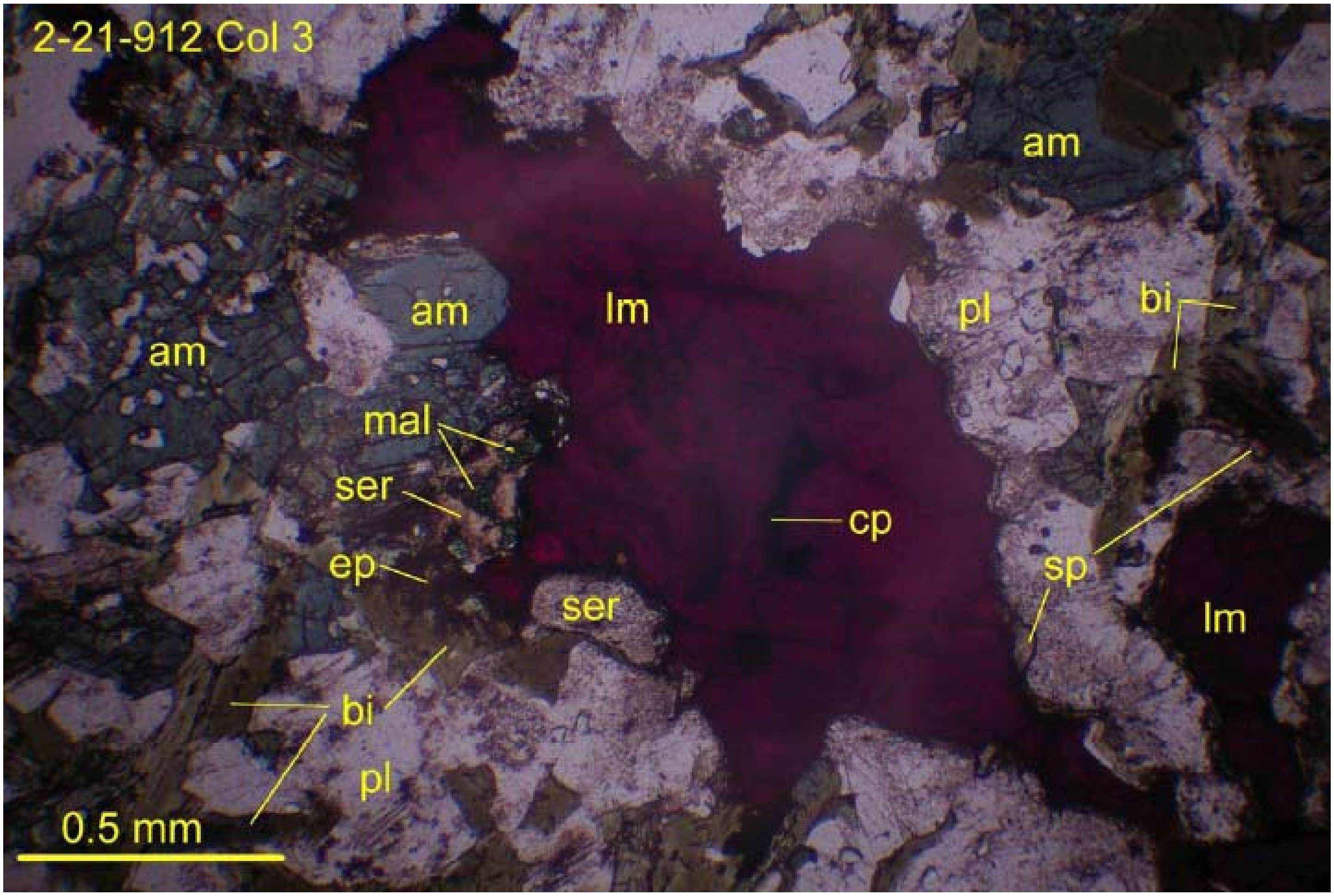
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am
lm
pl
bi
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mal
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0.5 mm