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to: Kent Morton
fax #: (867)920-2627
re: Arsenic Project - Progress Report #4
date: May 15, 1998
pages: 12, including this cover sheet

I will send the report in three parts

Regards,

Mary

From the desk of

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ROYAL OAK MINES Inc.
ARSENIC TRIOXIDE LEACHING AND CRYSTALLIZATION TESTWORK

Progress Report #4

Mary Goldman
April 1998

Dissolution of As_2O_3 from Giant's baghouse dust

Executive Summary

Testwork was conducted on Giant's baghouse dust to establish the effect of leaching temperature on arsenic, antimony and iron dissolution. Tests were conducted at 5.3% solids and 60 minutes of residence time. Arsenic recovery and concentration in the pregnant solution increase with temperature. The same trends were observed for antimony. Iron recovery and concentration decrease with temperature. At 95°C, fitted recoveries were 90.8% arsenic, 17.0% antimony and 0.6% iron; fitted concentrations were 30.5 g/L arsenic, 86.8 ppm antimony and 4.4 ppm iron.

Four tests have been conducted to evaluate the dissolution of baghouse dust, at 3°C. Tests were conducted for one hour, at 38.5% solids. On average, 2.0% of the arsenic, 0.19% of the antimony and 2.2% of the iron were dissolved. The pregnant solution assayed, on average, 8.91 g/L arsenic, 7.5 ppm antimony and 175 ppm iron.

Results compiled for 47 tests conducted at various temperatures, residence times and %solids showed an increase in arsenic and antimony concentration and a decrease in iron concentration in the pregnant solution, with temperature. A good fit was obtained despite the wide range of %solids. Iron concentration in the pregnant solution decreases with an increase in arsenic concentration.

The low arsenic concentrations in solution, achieved in this work may be attributed to improper wetting of the dust or removal of arsenic from solution by iron, calcium or aluminum. Hot water leach tests using wetting agents should be conducted. X-ray analyses of head samples and selected residues are recommended.

Two stage tests were conducted to establish the maximum arsenic recovery from Giant's baghouse dust. Average overall recoveries 99.5% arsenic, 50.2% antimony and 1.2% iron.

Crystallization testwork was conducted on pregnant solutions from leach tests conducted at 25, 30, 60, 70, 80 and 95°C. Crystal weight increased with leaching temperature. A fitted arsenic assay of 75.74% was calculated for crystals obtained from pregnant solutions of leach tests conducted at 60°C or higher. Antimony assay in the crystal is independent of the leaching temperature. Average antimony assay was 0.17%. Iron assay decreases with crystal weight. For crystal weight equal or higher than 0.3 g, the fitted iron assay is 0.072%.

Feed Material

The testwork presented on this report was conducted on BHD Composite September 97, a composite sample obtained by sampling baghouse dust for a period of four weeks (September 1 to 26, 1997) or BHD Composite January 98, a composite sample obtained by sampling baghouse

dust from December 10, 1997 to January 12, 1998. Average assays for these composites, taking into account all assays conducted to date were:

	<u>September 97</u>	<u>January 98</u>
Arsenic	67.71%	69.73%
Antimony	1.04%	0.90%
Iron	1.68%	0.93%
Gold	0.132 oz/ton	0.112 oz/ton

Hot Water Leach Tests

Testwork has been conducted to investigate the effect of temperature on the recovery of arsenic, antimony and iron from Giant's baghouse dust. Tests were conducted at 60 minutes of residence time, 5.3% solids and at the following temperatures: 25, 30, 60, 70, 80 and 95°C. Results for tests conducted at 95 °C have been presented on previous reports. Heating times are presented on Table 1, below. Time zero was the time when the slurry reached the temperature selected for testing.

Table 1 - Heating time as a function of temperature

Temperature (°C)	Heating time (min)
25	3
60	16
70	20
80	24
95	30

Arsenic recovery as a function of temperature is presented on Table 2 and Graph 1. The assayed arsenic concentration in the pregnant solution was corrected for dilution. Table 2 presents the assayed and corrected concentrations. Graph 1 presents the corrected arsenic concentration as a function of temperature. Arsenic recovery and concentration increase with temperature. The highest arsenic recovery was achieved at 95°C (88.0% on average). Average arsenic concentration at 95°C was 32.14 g/L. Fitted arsenic recovery and concentration, at 95°C, were 90.8% and 30.5 g/L, respectively.

Antimony recovery as a function of temperature is presented on Table 3 and Graph 2. Table 3 also presents assayed and corrected antimony concentrations as a function of temperature. Graph 2 presents corrected antimony concentration versus temperature. Both antimony recovery and

Table 2 **Arsenic recovery and concentration vs Temperature**
Test conditions: 60 minutes, distilled water, 5.3% solids

Test #	Temperature (C)	Arsenic				Head	
		Recovery (%)	Av. Rec. (%)	Concentration (g/L)	Corr. Conc. (g/L)	Backcalc. (%)	Assayed (%)
98-035	25	15.1	16.1	5.07	5.07	64.59	67.36
98-034	25	17.0		5.32	5.32	62.83	67.36
98-036	30	21.0	20.8	6.96	6.96	65.40	67.36
98-033	30	20.6		6.71	6.71	63.75	67.22
98-037	60	58.5	60.0	18.50	18.50	66.04	68.25
98-031	60	61.4		20.94	20.94	68.68	67.08
98-032	70	62.4	66.8	20.24	20.24	67.04	67.08
98-030	70	71.2		22.30	22.30	66.87	67.08
98-028	80	88.0	82.6	26.81	26.81	65.95	67.88
98-038	80	77.1		24.30	24.30	65.00	68.25
97-013	95	91.9	88.0	33.66	33.66	65.36	67.29
97-020	95	92.4		29.35	32.39	67.33	67.90
97-016	95	79.8		29.13	30.37	67.26	68.06

Graph 1 **Arsenic recovery and concentration vs Temperature**

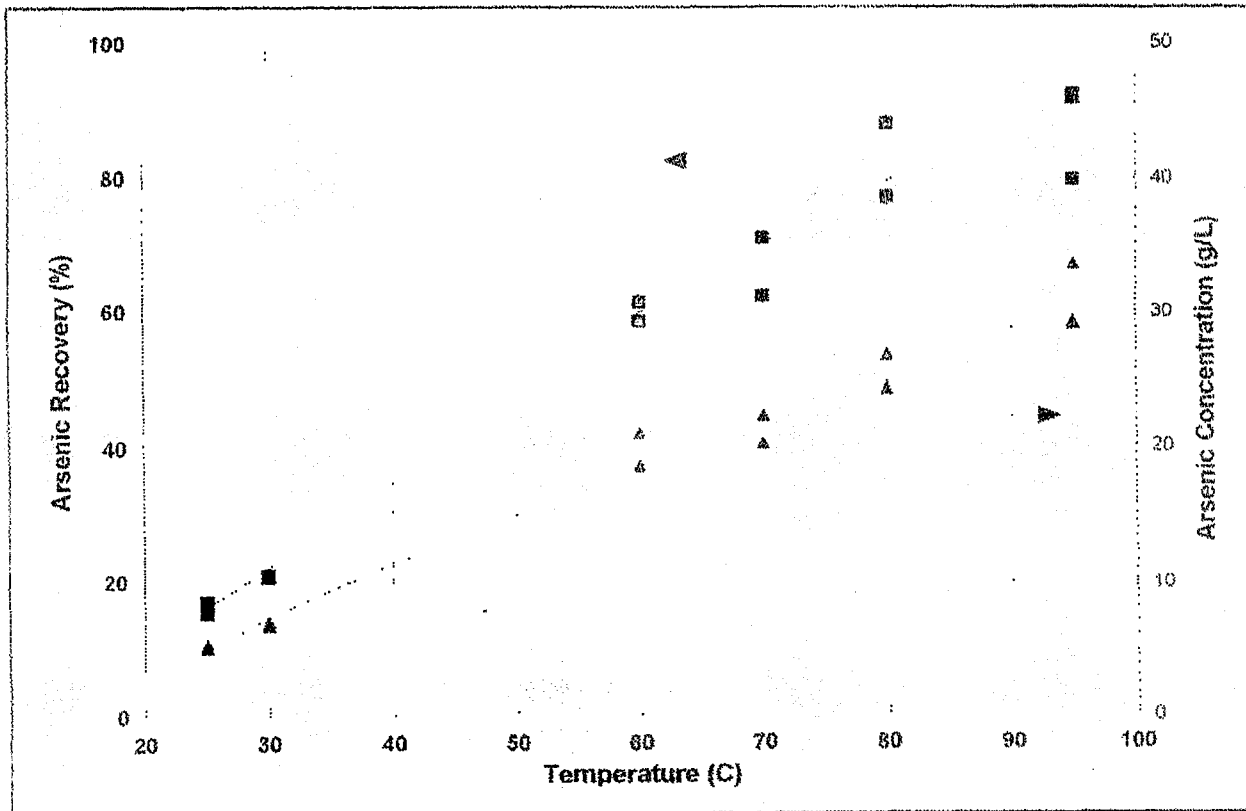


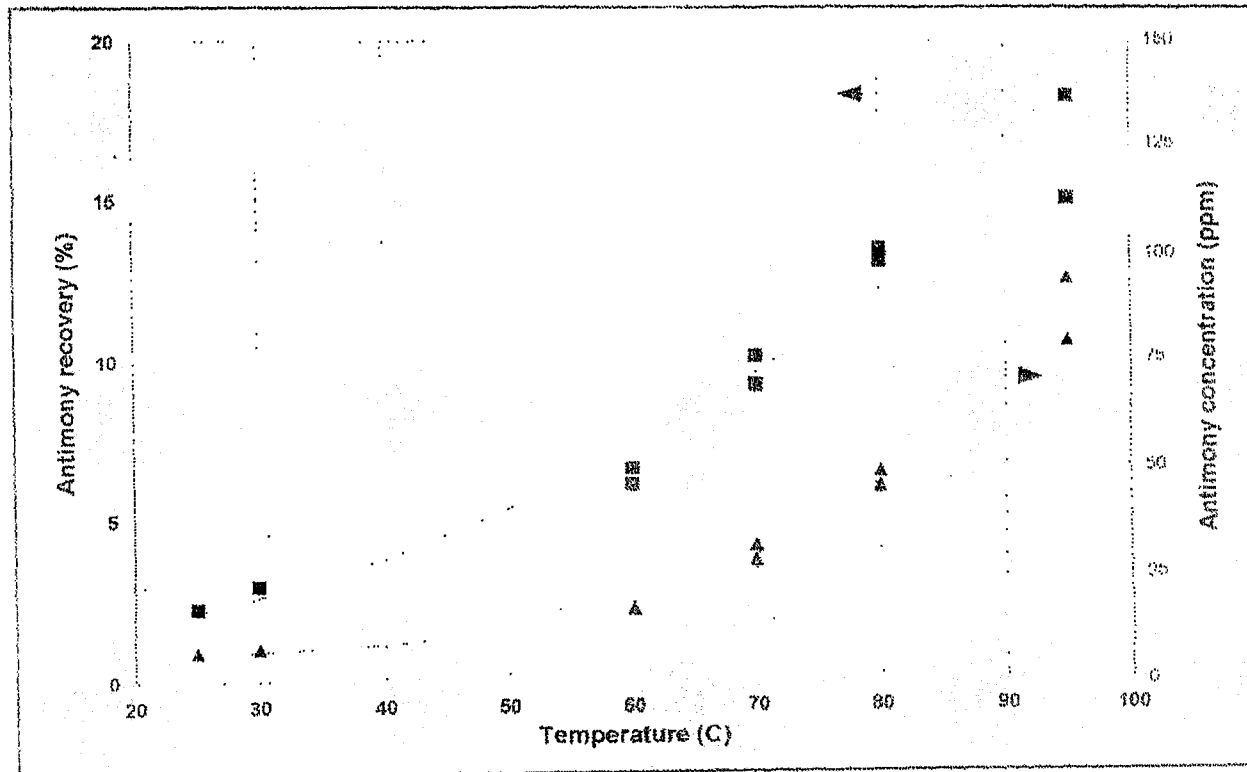
Table 3

Antimony recovery and concentration vs Temperature
Test conditions: 60 minutes, distilled water, 5.3% solids

Test #	Temperature (C)	Antimony				Head	
		Recovery (%)	Av. Rec. (%)	Concentration (ppm)	Corr. Conc. (ppm)	Backcalc. (%)	Assayed (%)
98-035	25	2.3	2.3	7.2	7.2	0.91	1.03
98-034	25						
98-036	30	3.0	3.0	8.0	8.0	0.95	1.03
98-033	30						
98-037	60	6.6	6.4	17.2	17.2	0.94	0.99
98-031	60	6.1		16.8	16.8	1.00	1.08
98-032	70	9.2	9.7	31.6	31.6	0.98	1.08
98-030	70	10.1		28.0	28.0	1.04	1.08
98-028	80	13.1	13.3	45.2	45.2	1.00	1.04
98-038	80	13.5		48.8	48.8	0.96	0.99
97-013	95	15.0	16.6	79	79	1.05	1.13
97-020	95						
97-016	95	18.2		94	98	1.05	1.18

Graph 2

Antimony recovery and concentration vs Temperature



concentration increase with temperature. The highest recoveries and concentrations were achieved at 95°C (on average, 16.6% and 88.5 ppm respectively). Fitted antimony recovery and concentration, at 95°C, were 17.0% and 86.8 ppm, respectively.

Antimony recovery as a function of arsenic recovery is presented on Graph 3. Antimony concentration as a function arsenic concentration is presented on Graph 4. Antimony recovery increases with arsenic recovery. The same trend was observed for antimony and arsenic concentrations.

Iron recovery decreases with an increase in temperature, as shown on Table 4 and Graph 5. The highest recoveries were achieved at 25°C (4.5% on average). Table 4 also presents assayed and corrected iron concentrations. Corrected iron concentration decreases with temperature, as shown on Graph 6. Highest concentration was achieved at 25°C (41.2 ppm, on average). At 95°C, average iron recovery and concentration were 0.9% and 7.3 ppm, respectively. Fitted iron recovery and concentration, at 95°C were 0.6% and 4.4 ppm, respectively.

Iron recovery decreases with an increase in arsenic concentration, as shown in Graph 7. The same trend is observed for iron and arsenic concentrations (iron concentration decreases with an increase in arsenic concentration), as shown in Graph 8.

Leach Tests at 3°C

Two additional tests have been conducted to evaluate the dissolution of baghouse dust in water, at 3°C. Tests were conducted for one hour, at 38.5% solids. Results for all tests conducted to date are presented on Table 5.

On average, 2.0% of the arsenic, 0.19% of the antimony and 2.2% of the iron contained in BHD were dissolved. Average corrected concentrations were: 10.19 g/L arsenic, 8.5 ppm antimony and 198.6 ppm iron. The residue contained, on average, 97.7% of the original weight.

Summary of water leach tests

Table 6 presents a summary of results for 47 tests. Four tests were conducted at a cold temperature (3°C), four tests were conducted at ambient temperature (25 and 30°C) and the remainder at hot temperature (60, 70, 80 and 95°C). The tests are presented by increased order of arsenic concentration (corrected for dilution).

Arsenic concentration as a function of temperature is presented on Graph 9. Arsenic concentration increases with temperature. A good fit was obtained even though tests were conducted at different %solids. A weight of only 0.1 was given to Test 98-014 (3°C, 38.5% solids), as the arsenic concentration obtained for this test (31.24 g/L) was very high when compared to all other results. All other tests were given a weight of 1. At 95°C, the fitted arsenic concentration is 33.39 g/L (44.09 g/L As_2O_3).

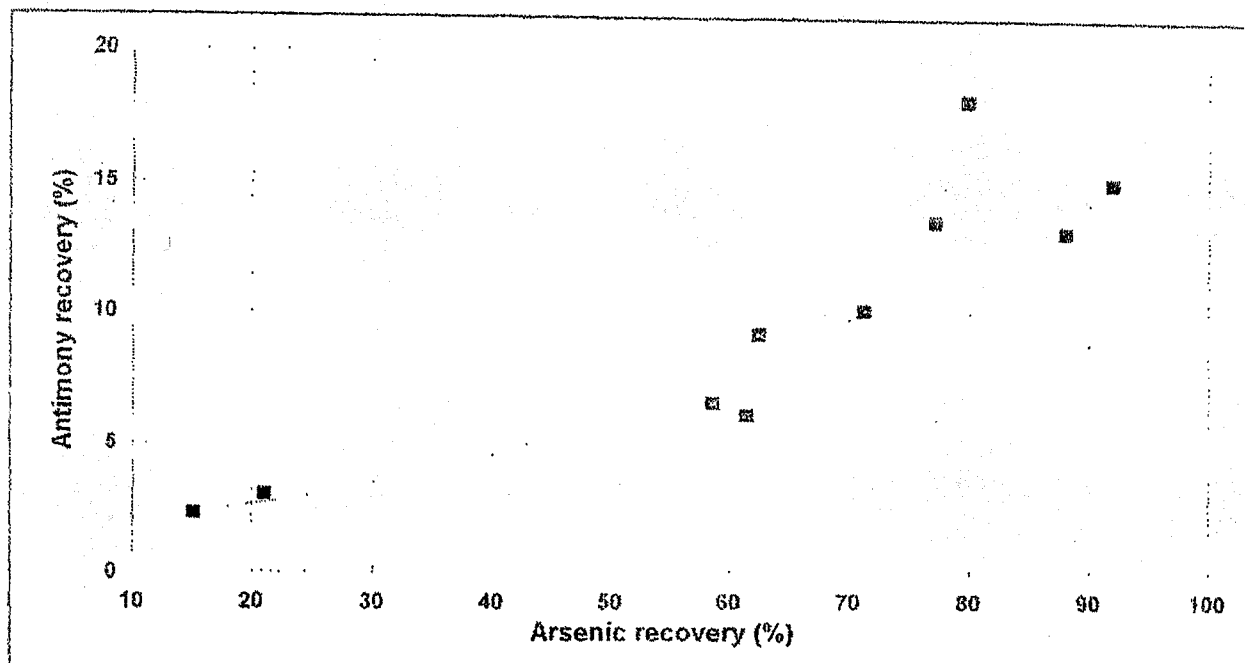
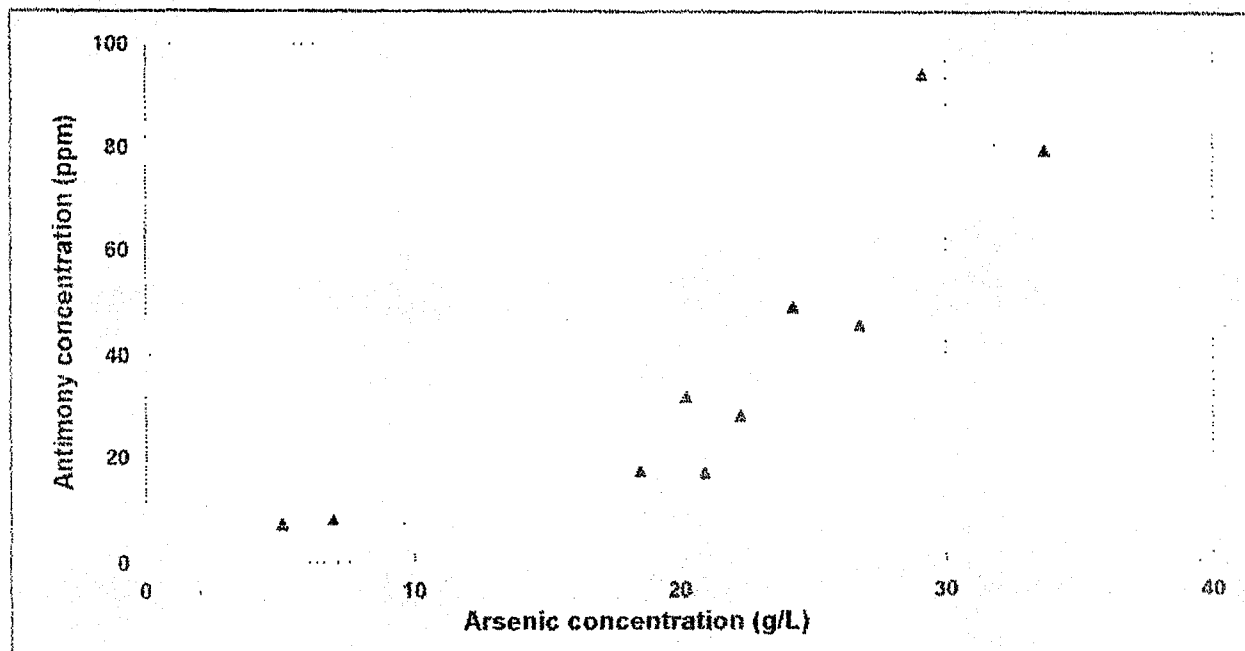
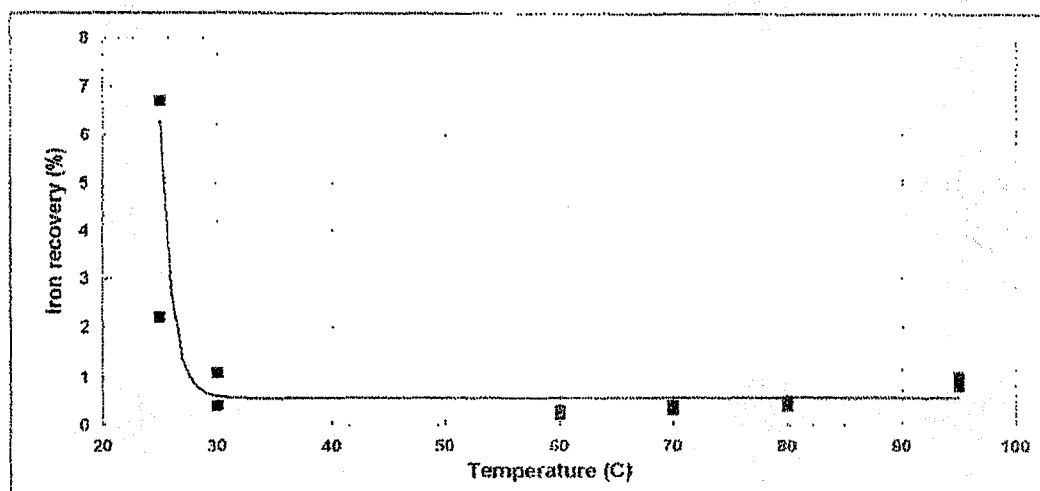
Graph 3 Antimony recovery vs arsenic recovery**Graph 4** Antimony concentration vs arsenic concentration

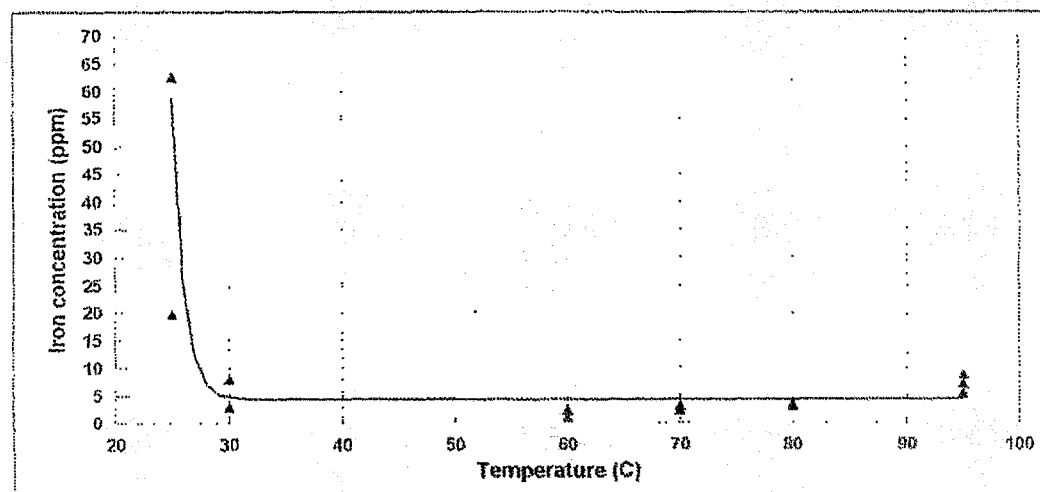
Table 4 Iron concentration vs Temperature
Test conditions: 60 minutes, distilled water, 5.3% solids

Test #	Temperature (C)	Iron				Head	
		Recovery (%)	Av. Rec. (%)	Concentration (ppm)	Corr. Conc. (ppm)	Backcalc. (%)	Assayed (%)
98-035	25	2.2	4.5	19.2	19.7	1.67	1.50
98-034	25	6.7		61.0	62.7	1.67	1.50
98-036	30	1.1	0.8	8.0	8.0	1.56	1.50
98-033	30	0.4		2.8	2.9	1.62	1.50
98-037	60	0.2	0.3	1.2	1.2	1.65	1.50
98-031	60	0.3		2.4	2.4	1.66	1.50
98-032	70	0.3	0.4	2.4	2.4	1.58	1.50
98-030	70	0.4		3.2	3.2	1.75	1.50
98-028	80	0.4	0.5	3.2	3.2	1.87	1.50
98-038	80	0.5		3.6	3.6	1.45	1.50
97-013	95	1.0	0.9	9.0	9.0	1.67	1.63
97-020	95	0.8		5.0	5.5	1.58	1.61
97-016	95	0.9		7.0	7.3	1.54	1.67

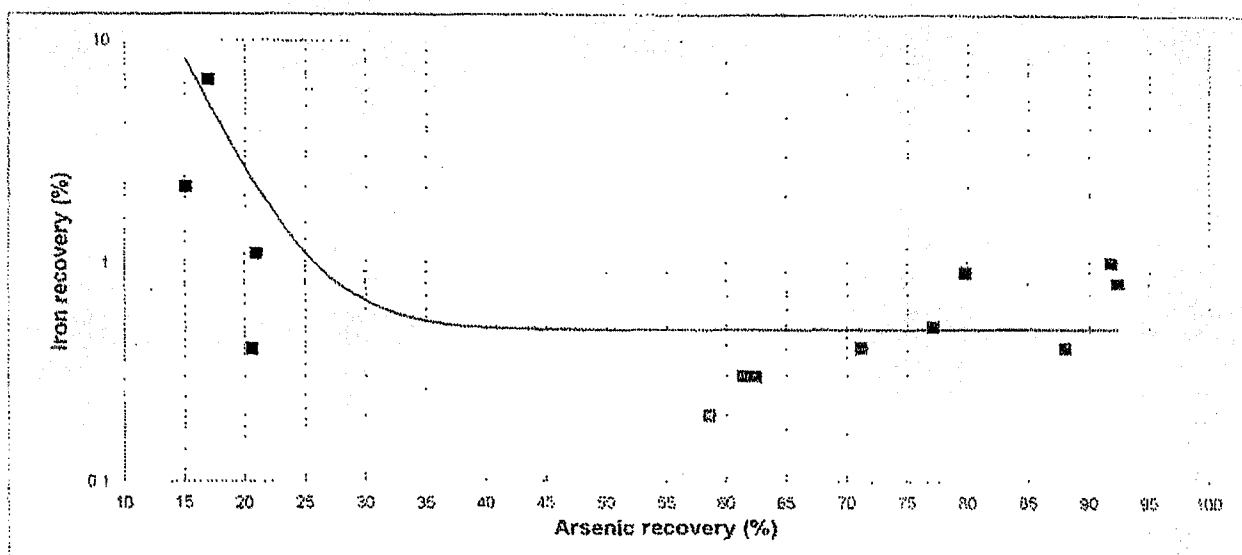
Graph 5 Iron recovery vs Temperature



Graph 6 Iron concentration vs Temperature



Graph 7 Iron recovery vs arsenic recovery



Graph 8 Iron concentration vs arsenic concentration

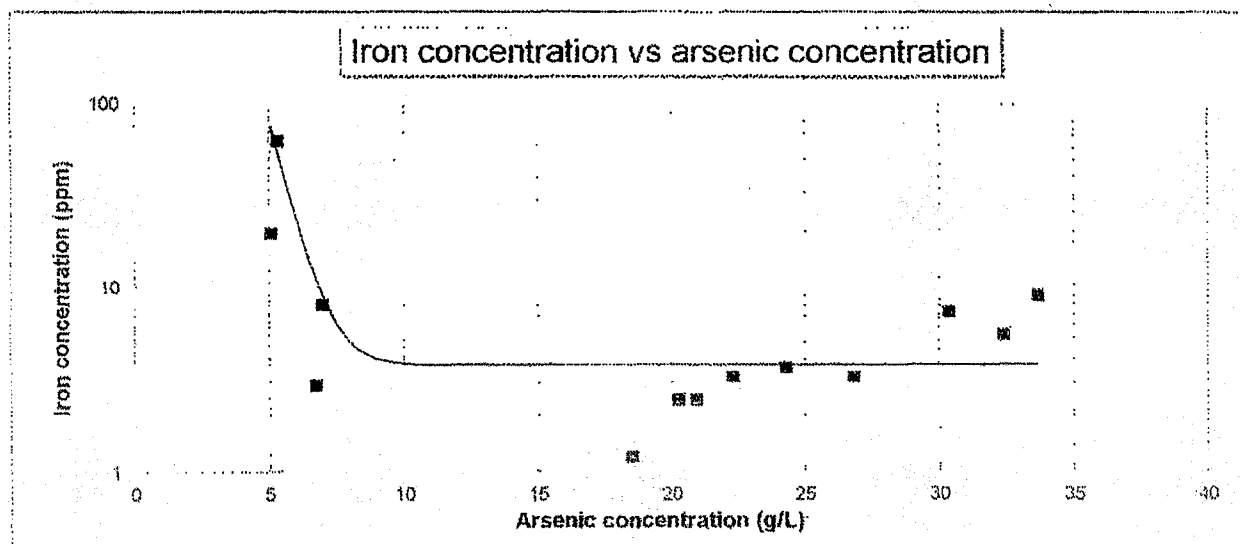


Table 5 Cold water leach tests
Test conditions: 60 minutes, 38.5% solids, 3 C

Arsenic

Test #	Recovery (%)	Concentration (g/L)	Corr	Head (%)	
			Concentration (g/L)	Backcalc.	Assayed
98-014	5.0	27.20	31.24	71.23	68.43
98-018	0.9	2.88	3.27	66.08	68.19
98-041	1.1	3.22	3.65	66.44	64.38
98-044	0.8	2.35	2.62	68.48	68.52
Average	2.0	8.91	10.19	68.06	67.38

Antimony

Test #	Recovery (%)	Concentration (ppm)	corr	Head (%)	
			Concentration (ppm)	Backcalc.	Assayed
98-014	0.30	2.4	2.8	1.00	1.00
98-018	0.40	25.9	29.4	1.00	1.05
98-041	0.04	0.5	0.6	0.95	0.91
98-044	0.03	1.1	1.2	0.94	0.93
Average	0.19	7.5	8.5	0.97	0.97

Iron

Test #	Recovery (%)	Concentration (ppm)	corr	Head (%)	
			Concentration (ppm)	Backcalc.	Assayed
98-014	3.4	290.0	333.1	1.68	1.57
98-018	2.2	160.0	181.4	1.47	1.50
98-041	0.2	20.3	23.0	1.57	3.25
98-044	2.9	230.0	256.7	1.67	1.50
Average	2.2	175.1	198.6	1.60	1.96

Table 6 Summary of baghouse dust leach tests

Test #	%solids	Residence Time (min)	Temperature (C)	corr Arsenic concentration (g/L)	corr Antimony concentration (ppm)	corr Iron concentration (ppm)
98-044	38.5	60	3	2.62	1	257
98-018	38.5	60	3	3.27	29	181
98-041	38.5	60	3	3.65	1	23
98-035	5.3	60	25	5.07	7	20
98-034	5.3	60	25	5.32		63
98-033	5.3	60	30	6.71		3
98-036	5.3	60	30	6.96	8	8
98-037	5.3	60	60	18.50	17	1
98-032	5.3	60	70	20.24	32	2
98-031	5.3	60	60	20.94	17	2
98-030	5.3	60	70	22.30	28	3
98-038	5.3	60	80	24.30	49	4
98-028	5.3	60	80	26.81	45	3
97-061	6.0	30	95	29.04	82	3
97-059	5.3	30	95	29.53	71	1
97-063	6.6	30	95	30.02	80	3
98-002	6.9	60	95	30.07	82	4
98-005	6.0	60	95	30.21	83	3
97-016	5.3	60	95	30.37	98	7
98-001	6.0	60	95	30.84	85	5
98-014	38.5	60	3	31.24	3	333
97-051	6.6	30	95	31.76	96	3
97-049	5.3	30	95	31.81	97	2
98-006	8.2	60	95	32.05	83	4
97-047	6.9	30	95	32.22	98	4
97-020	5.3	60	95	32.39		6
97-026	5.3	30	95	32.40	96	4
97-050	6.3	30	95	32.72	90	3
97-053	6.0	30	95	32.98	84	4
97-048	6.0	30	95	33.24	102	3
97-024	5.3	30	95	33.61		7
97-013	5.3	60	95	33.66	79	9
98-010	6.9	60	95	34.18	87	4
97-054	6.9	30	95	34.24	83	2
98-003	8.2	60	95	34.43	76	3
97-064	6.9	30	95	34.46	70	3
97-060	6.6	30	95	34.49	72	1
97-046	8.2	30	95	34.89	95	5
97-062	6.3	30	95	35.38	55	63
98-008	10.1	60	95	36.32	78	4
97-072	8.2	30	95	36.40	65	3
97-055	8.1	30	95	36.75	77	2
97-057	6.3	30	95	36.96	105	5
98-004	10.1	60	95	37.60	71	3
97-071	10.1	30	95	37.79	72	3
97-045	10.1	30	95	37.92	111	4
97-056	10.1	30	95	41.08	65	7

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PART 2

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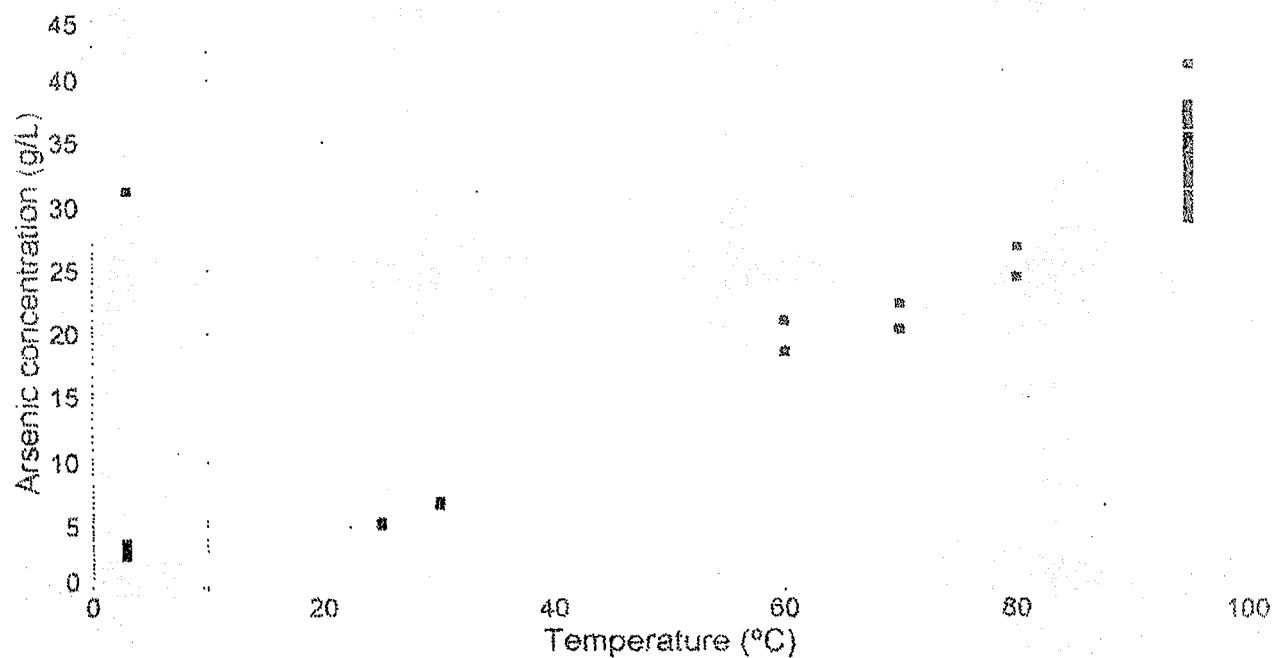
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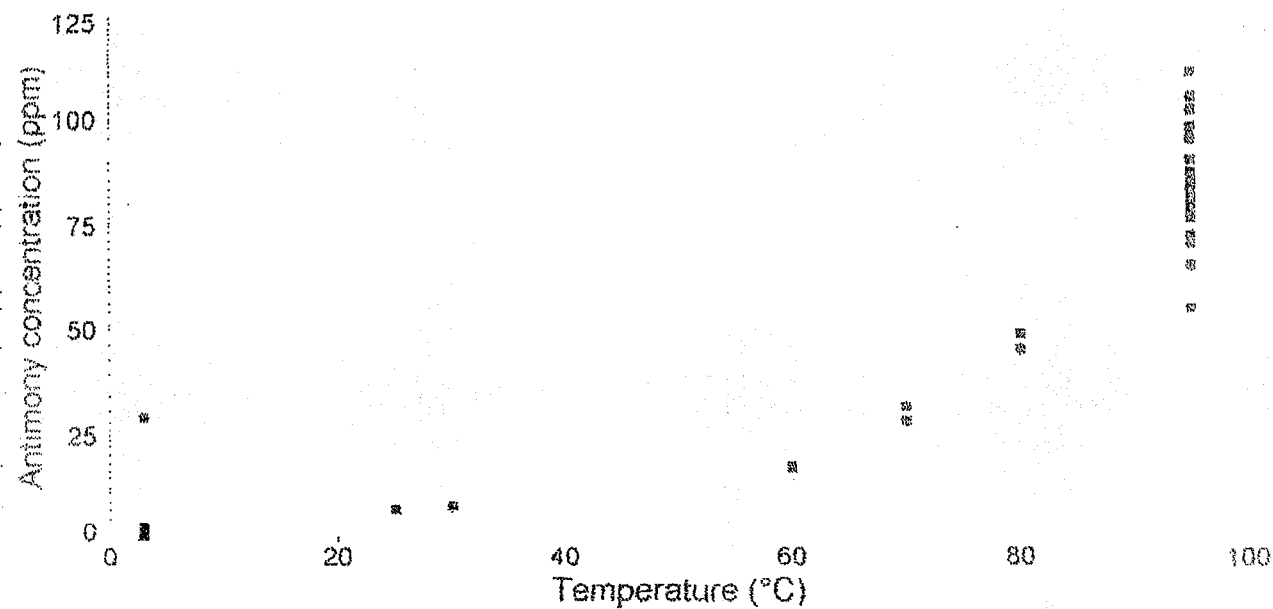
Graph 9

Arsenic concentration vs Temperature



Graph 10

Antimony concentration vs Temperature



There is conflicting information regarding the solubility of arsenic trioxide¹. According to the CRC Handbook of Chemistry and Physics, solubility of amorphous As_2O_3 is 101.4 g/L and solubility of crystalline As_2O_3 is 114.6 g/L at 100°C. At 25°C, arsenic trioxide has a solubility of 12 g/L. Debekaussen et al² reported a solubility of 88 g/L for As_2O_3 at 95°C.

The arsenic concentrations achieved in this testwork program were lower than anticipated, taking into consideration results presented in the literature. These low arsenic concentrations may be attributed to the following:

1. Improper wetting of the dust. Debekaussen et al² used additives to ensure the wetting and dissolution of an industrial arsenic trioxide material. Hot water leach tests using wetting agents are recommended.
2. Removal of arsenic from solution by iron, calcium or aluminum. Several papers³ have dealt with arsenic chemistry and removal from solutions. Ferguson and Anderson³ proposed the following mechanisms for arsenic removal from solution by calcium, iron or aluminum salts:

- *Precipitation*
formation of a stoichiometric phase
- *Occlusion*
incorporation into the interior of a solid either in lattice sites or in interstices
- *Adsorption*
association with the surface of the precipitate

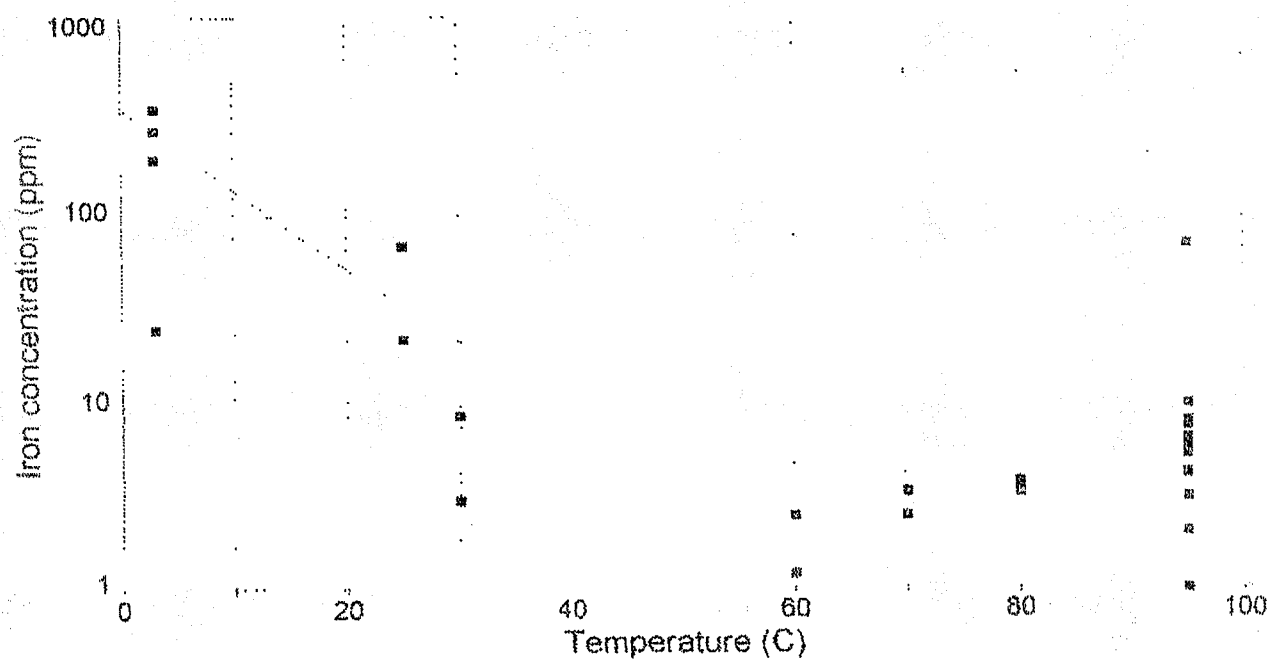
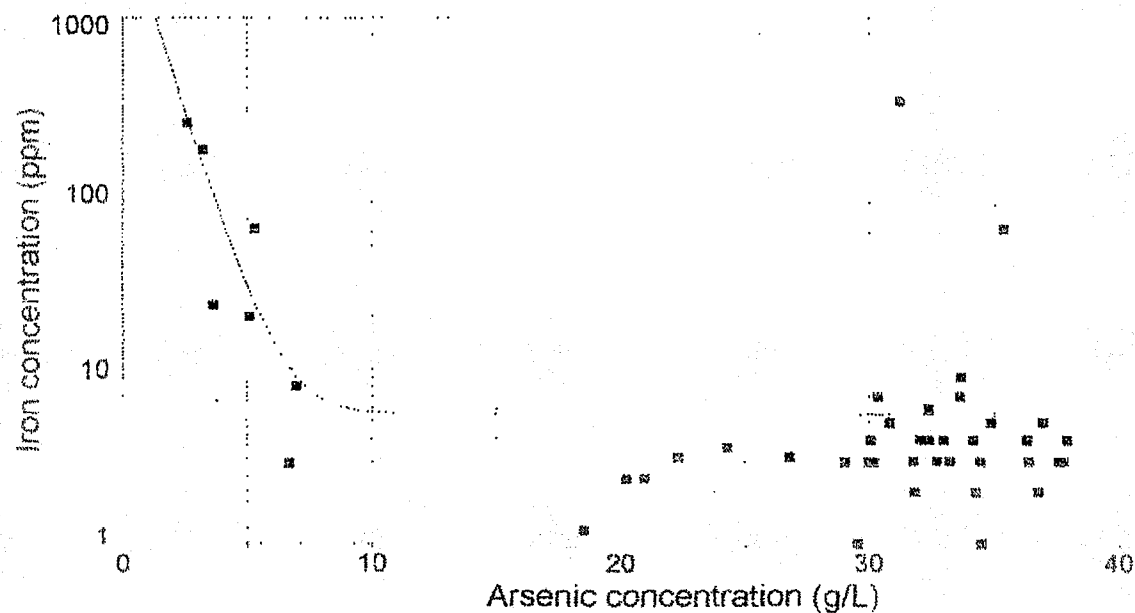
This possibility should be further investigated by conducting X-ray analyses on head samples of baghouse dust as well as residues, for selected tests

Note: Average assays for baghouse dust (Lakefield Research and Maxxam Laboratories) were: aluminum 4020 g/t, calcium 3720 g/t

Antimony concentration increases with temperature, as shown on Graph 10. At 95°C, the fitted antimony concentration is 83.06 ppm.

Iron concentration as a function of temperature is presented on Graph 11. Tests As-98-041 and As-97-062 were assigned a weight of 0.1, all other tests had a weight of 1. Temperature has a dramatic impact on iron concentration, which decreases with an increase in temperature. This trend is opposite to those observed for arsenic and antimony, which increased with temperature. At 95°C, the fitted iron concentration is 3.7 ppm.

Graph 12 presents iron concentration as a function of arsenic concentration. Low arsenic concentrations (< 6 g/L) are associated with high iron concentrations (20 - 257 ppm). As the

Graph 11 Iron concentration vs Temperature**Graph 12 Iron concentration vs arsenic concentration**

arsenic concentration increases, the iron concentration decreases. At arsenic concentrations equal or greater than 20 g/L, the fitted iron concentration is 5.5 ppm.

Two stage hot water leach tests

Tests As-98-053 and As-98-054

Figures 1 and 2 present the flowsheets for two stage leach tests As-98-053 and As-98-057. The first stage was conducted at 95°C, 5.3% solids and 60 minutes of residence time. At the end of the first stage, the slurry was filtered and the residue was recovered, dried, weighed and submitted to the second hot water leach test. The second stage was conducted at 95°C, 60 minutes of residence time, 0.9% solids (As-98-053) and 1.0% solids (As-98-057).

A summary of results for test As-98-053 is presented on Table 7. Table 8 presents a summary of results for test As-98-057. Average overall recoveries taking into consideration the two stages, were 99.5% arsenic, 50.2% antimony and 1.2% iron. Adding a second stage has a dramatic impact on overall arsenic and antimony recoveries: on average, an additional 11.7% of the arsenic and 23.5% of the antimony were recovered. The final residue contained, on average, 5.2% of the initial weight and assayed 6.62% arsenic, 6.75% antimony and 14.38% iron.

The back calculated head for iron, on test As-98-053, was considerably lower than the assayed head (0.70% and 1.00%, respectively).

FIGURE 1

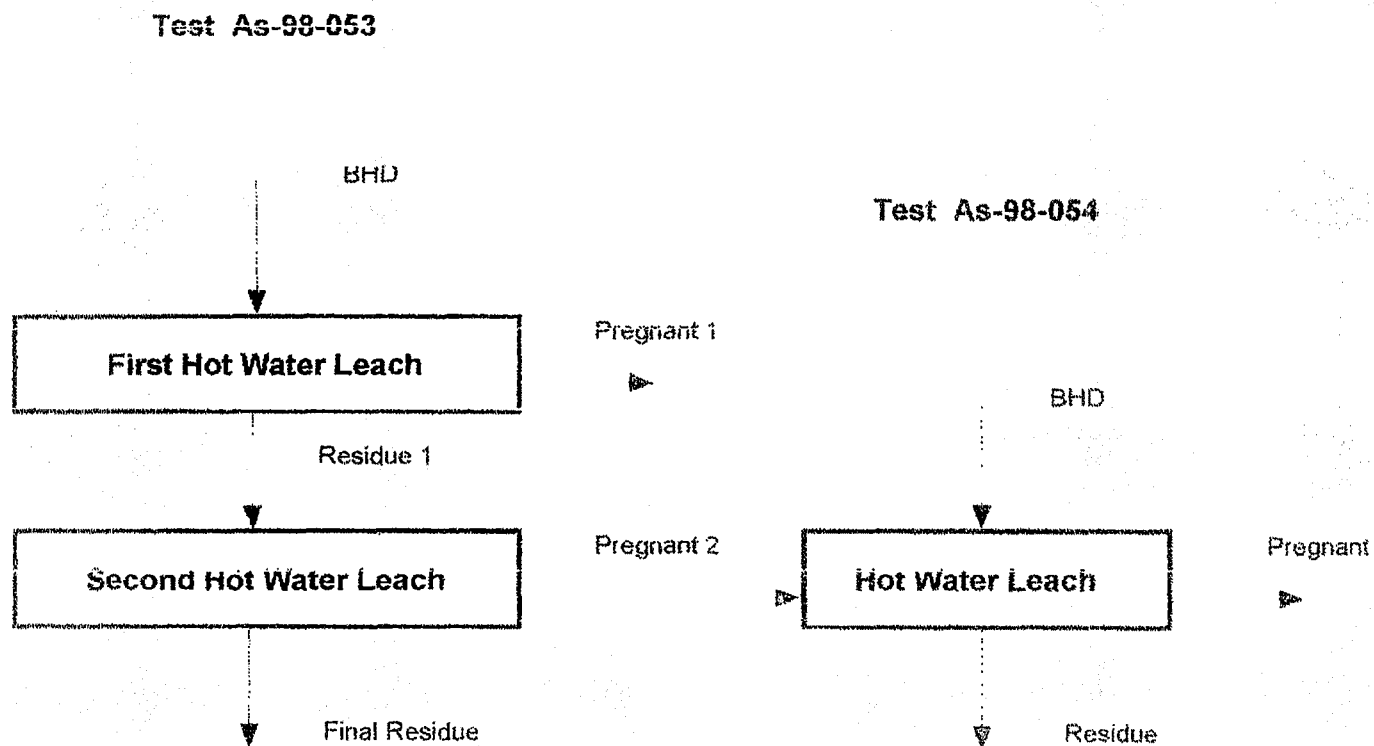


FIGURE 2

Test As-98-057

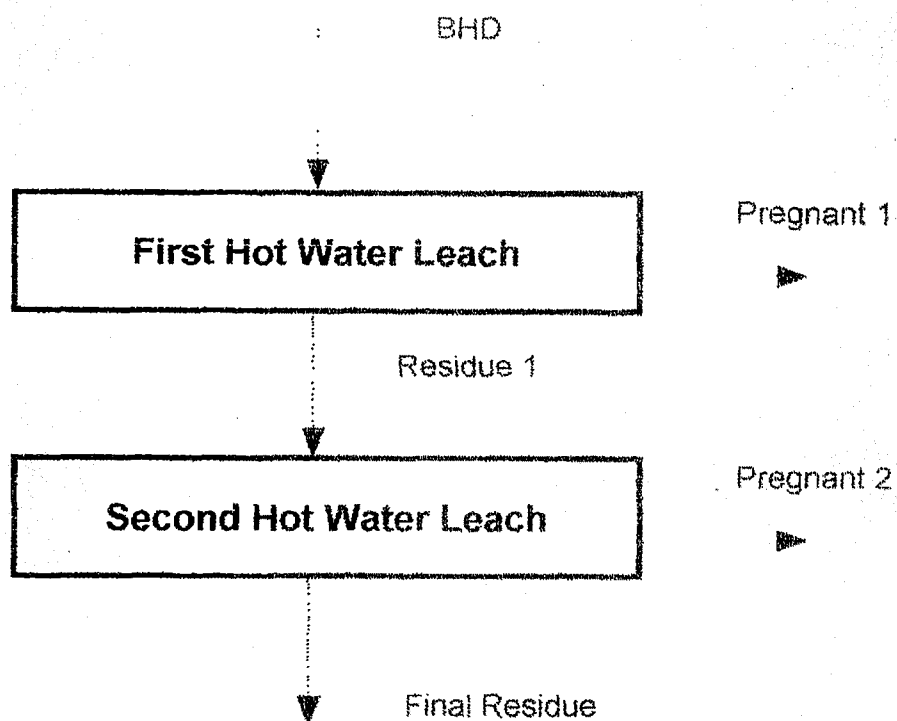


Table 7 - Summary of results for Test As-98-053

	Weight		As (%)	Sb (%)	Fe (%)
	(g)	(%)			
Initial weight	41.9	100	69.53	0.80	1.00
Residue 1 (backcalc)	6.7	16	45.63	2.92	4.33
Final Residue	2.1	5	6.17	6.25	13.75

	As (g/L)	corr. As (g/L)	Sb (ppm)	corr. Sb (ppm)	Fe (ppm)	corr. Fe (ppm)
Pregnant 1	27.44	29.65	67.2	72.6	3.1	3.4
Pregnant 2	3.75	3.75	61.2	61.2	0.8	0.8

	As recovery (%)	Sb recovery (%)	Fe recovery (%)
Stage 1	89.2	28.6	1.0
Stage 2	10.4	23.4	0.2
Overall	99.5	52.0	1.2

	Head	
	Back calculated (%)	Assayed (%)
Arsenic	67.35	69.53
Antimony	0.65	0.80
Iron	0.70	1.00

Table 8 - Summary of results for Test As-98-057

	Weight		As (%)	Sb (%)	Fe (%)
	(g)	(%)			
Initial weight	41.9	100	69.72	0.89	0.75
Residue 1 (backcalc)	7.7	18.4	49.61	3.02	4.29
Final Residue	2.2	5.3	7.07	7.25	15.00

	As (g/L)	corr. As (g/L)	Sb (ppm)	corr. Sb (ppm)	Fe (ppm)	corr. Fe (ppm)
Pregnant 1	27.75	30.06	67.6	73.2	2.8	3.0
Pregnant 2	4.8	4.8	64.0	64.0	1.0	1.0

	As recovery (%)	Sb recovery (%)	Fe recovery (%)
Stage 1	86.6	24.9	0.96
Stage 2	12.9	23.5	0.17
Overall	99.5	48.4	1.1

	Head	
	Back calculated	Assayed
Arsenic	68.01	69.72
Antimony	0.74	0.89
Iron	0.80	0.75

Test As-98-054

Pregnant solution from stage 2 of Test As-98-053 (Pregnant 2) was recycled in the dissolution stage of test As-98-054. The feed solution contained 615 mL of Pregnant 2 and 135 mL of distilled water. The test was run for 60 minutes, at 5.3% solids and 95°C. A summary of results is presented on Tables 9A to 9C. Arsenic recovery with recycled solution was lower than the average for tests with distilled water, but still within the

range of results. Antimony and iron recovery were lower than any of the results obtained for tests run with distilled water: less than half of the average, for antimony and approximately half for iron.

Table 9 A - Summary of arsenic results for hot water leach tests conducted at 5.3% solids, 95° C and 60 minutes of residence time

Test #	Arsenic					
	Recovery (%)	Av. Rec. (%)	Conc. (g/L)	Corr. Conc. (g/L)	Head (%)	
					Backcalc	Assayed
97-013	91.9	88.0	33.66	33.66	65.36	67.29
97-020	92.4		29.35	32.39	67.33	67.90
97-016	79.8		29.13	30.37	67.26	68.06
98-053 (first stage)	89.2		27.44	29.65	67.35	69.53
98-057 (first stage)	86.6		27.57	30.06	68.01	69.72
98-054	81.8	81.8	28.35	30.76	67.12	69.73

Table 9 B - Summary of antimony results for hot water leach tests conducted at 5.3% solids, 95°C and 60 minutes of residence time

Test #	Antimony					
	Recovery (%)	Av. Rec. (%)	Conc. (ppm)	Corr. Conc. (ppm)	Head (%)	
					Backcalc	Assayed
97-013	15.0	21.6	79	79	1.05	1.13
97-020						
97-016	18.2		94	98	1.05	1.18
98-053 (first stage)	28.6		67	73	0.65	0.80
98-057 (first stage)	24.9		68	73	0.74	0.89
98-054	7.2	7.2	67	73	0.98	0.90

Table 9 C - Summary of iron results for hot water leach tests conducted at 5.3% solids, 95°C and 60 minutes of residence time

Test #	Iron					
	Recovery (%)	Av. Rec. (%)	Conc. (ppm)	Corr. Conc. (ppm)	Head (%)	
					Backcalc	Assayed
97-013	1.0	0.9	9.0	9.0	1.67	1.63
97-020	0.8		5.0	5.5	1.58	1.61
97-016	0.9		7.0	7.3	1.54	1.67
98-053 (first stage)	1.0		3.1	3.4	0.70	1.00
98-057 (first stage)	1.0		2.8	3.0	0.80	0.75
98-054	0.5	0.5	2.7	2.9	1.03	0.93

Crystallization Testwork

Table 10 presents results for crystallization tests conducted with pregnant solutions from leach tests conducted on baghouse dust. Leach tests were conducted at 5.3% solids, 60 minutes of residence time and at the following temperatures: 25, 30, 60, 70, 80 and 95°C. In all tests, the volume of the pregnant solution used as feed was reduced by boiling off the excess, in order to induce crystallization. The ratio of reduction is reported on Table 10 as *Filtrate/Feed*. The solution was then left standing overnight. The crystals were recovered by filtration, dried and submitted for assay. The filtrate volume was measured and assayed.

In general, there was good agreement between back calculated and assayed arsenic concentration in the feed solution. The agreement between back calculated and assayed concentration of iron and antimony in the feed solution was generally poor.

The weight of crystals obtained in the crystallization stage increases with the leaching temperature, as shown in Graph 13. All tests were fitted by a single curve, even though different rates of reduction (filtrate/feed) were used. Test As-98-030A (70°C) was given a weight of 0.1. All other tests had a weight of 1. Graph 14 presents arsenic assay in the crystal as a function of leaching temperature. There is a rapid increase in the arsenic assay from 25 to 30°C; between 30 and 60°C, the arsenic content in the crystals approaches 75.74%, the fitted arsenic assay for leaching temperatures equal to or higher than 60°C.

Crystal antimony assay is independent of the leaching temperature or crystal weight, as shown on Graphs 15 and 16. Average antimony assay was 0.17%

Graph 17 presents crystal iron assay as a function of crystal weight. Iron assay decreases with crystal weight. For crystal weight higher or equal to 0.3 g, the fitted iron assay value is 0.072%.

facsimile
TRANSMITTAL

to: Kent Morton
fax #: (867)920-2627
re: Arsenic Project - Progress Report #4
date: May 15, 1998
pages: 12, including this cover sheet

PART 2/3

5 PAGES

I will send the report in three parts

Regards,

Mary

From the desk of

Mary Goldman
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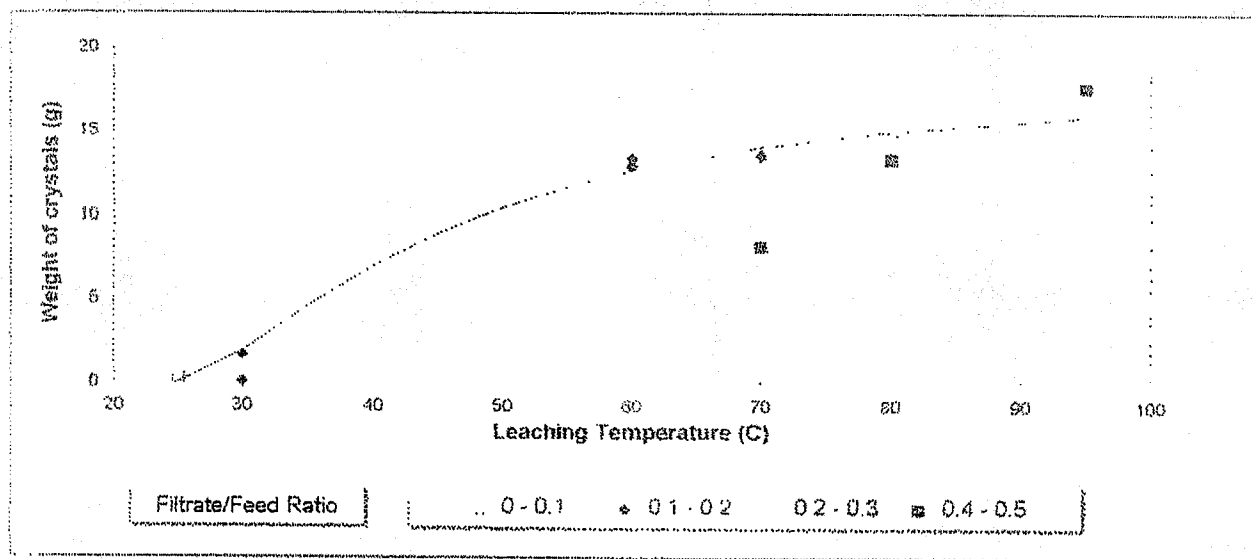
Table 10 Summary of crystallization testwork

Test #	Leaching temp. (C)	Crystallization Final temp. (C)	Time (hours)	Weight (g)	%As	Crystal %As ₂ O ₃	%Sb	%Fe
98-034A	25	26	21	0.025	n/a		0.08	5.80
98-035A	25	22	22	0.3	66.17	87.36	0.32	0.10
98-033A	30	25	23	0.033	n/a		0.32	4.36
98-036A	30	27	16	1.64	73.84	97.49	0.11	0.11
98-037A	60	22	24	12.9	75.64	99.87	0.04	0.05
98-031A	60	26	31	13.4	75.72	99.97	0.08	0.04
98-032A	70	26	31	13.6	75.76	100.03	0.14	0.05
98-030A	70	31	21	8.1	75.53	99.72	0.21	0.04
98-038A	80	25	15	14.7	75.82	100.11	0.04	0.05
98-028A	80	28	19	13.3	75.38	99.52	0.21	0.13
97-078	95	9	13	17.7	76.30	100.74	0.33	0.08
Average							0.17	

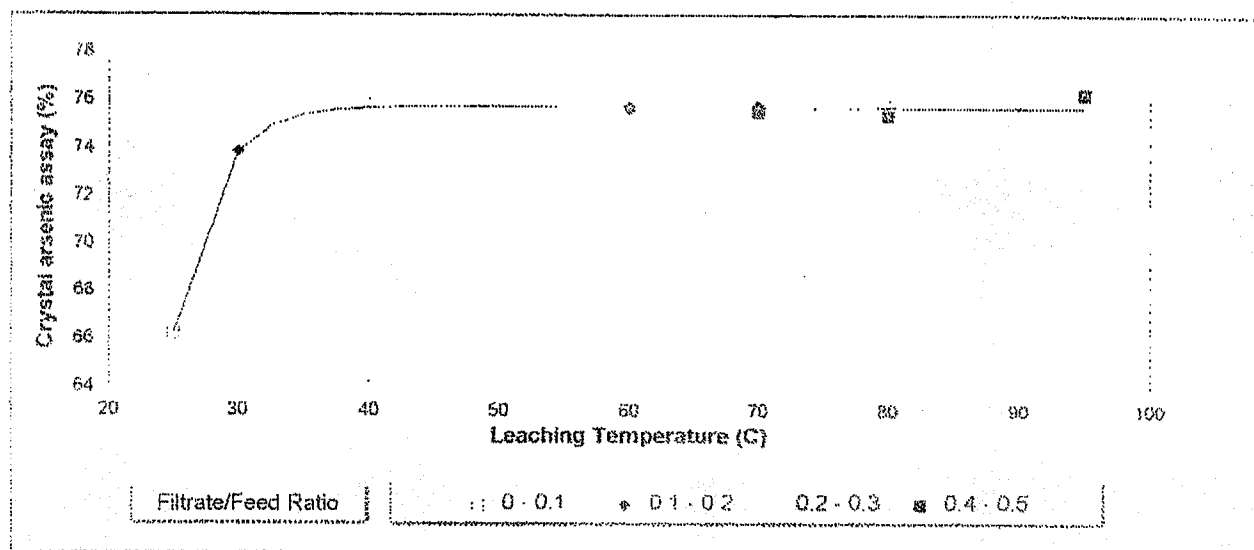
Test #	Feed Solution (mL)	Volume (mL)	Filtrate/Feed	As (g/L)	Sb (ppm)	Fe (ppm)
98-034A	680	150	0.22	24.91	11.2	252.0
98-035A	662	66	0.10	40.94		160.0
98-033A	680	128	0.19	37.55	27.0	4.0
98-036A	680	78	0.11	42.83	13.2	48.0
98-037A	690	102	0.15	21.61	18.8	2.0
98-031A	690	116	0.17	25.96	20.0	1.2
98-032A	690	93	0.13	24.15	21.6	1.6
98-030A	685	290	0.42	29.73	10.8	1.2
98-038A	705	158	0.22		14.4	2.0
98-028A	690	285	0.41	24.65	7.2	1.6
97-078	715	318	0.44	22.33	7.0	1.6

Test #	Arsenic (g/L)		Antimony (ppm)		Iron (ppm)	
	Backcalc.	Assayed	Backcalc.	Assayed	Backcalc.	Assayed
98-034A	5.50	5.32			55.6	61.0
98-035A	4.38	5.07	1	7	16.0	19.2
98-033A	7.07	6.71	5	3	0.8	2.8
98-036A	6.69	6.96	2	8	5.5	8.0
98-037A	17.33	18.50	3	17	0.3	1.2
98-031A	19.04	20.94	3	17	0.2	2.4
98-032A	18.26	20.24	3	32	0.2	2.4
98-030A	21.55	22.30	5	28	0.5	3.2
98-038A			3	49	0.5	3.6
98-028A	24.71	26.81	3	45	0.7	3.2
97-078	28.81	30.10	85	73	20.6	3.0

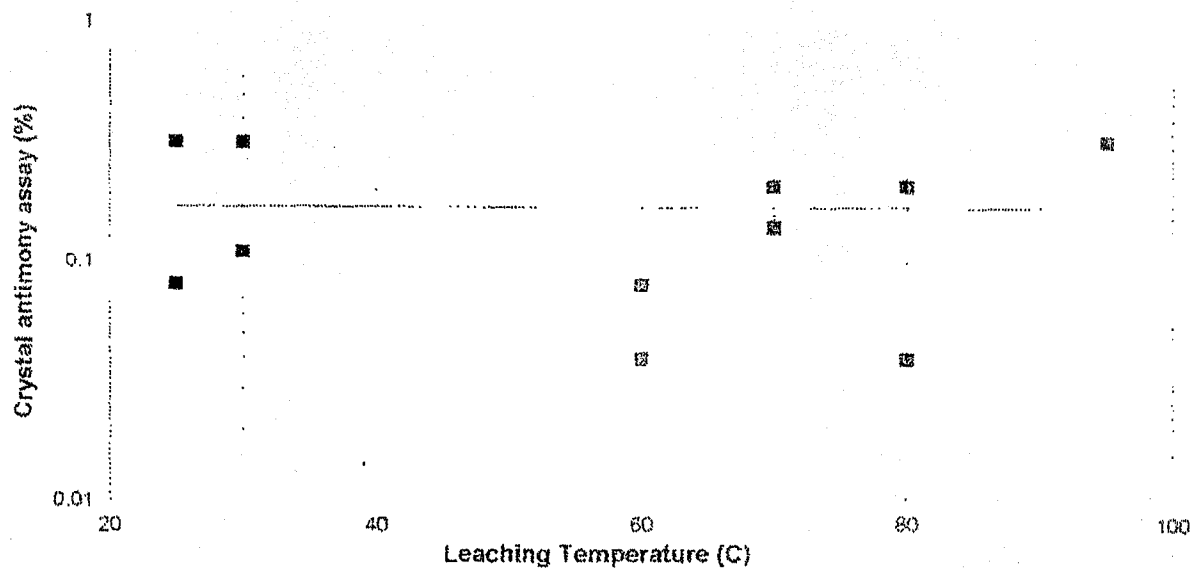
Graph 13 Weight of crystals vs Leaching Temperature



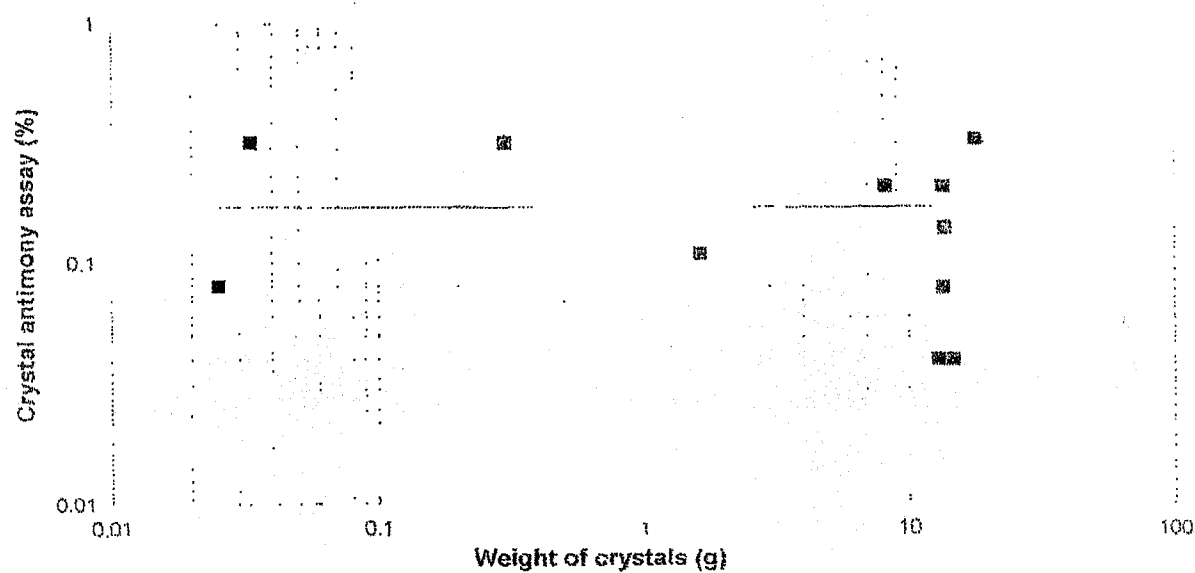
Graph 14 Crystal arsenic assay vs Leaching Temperature

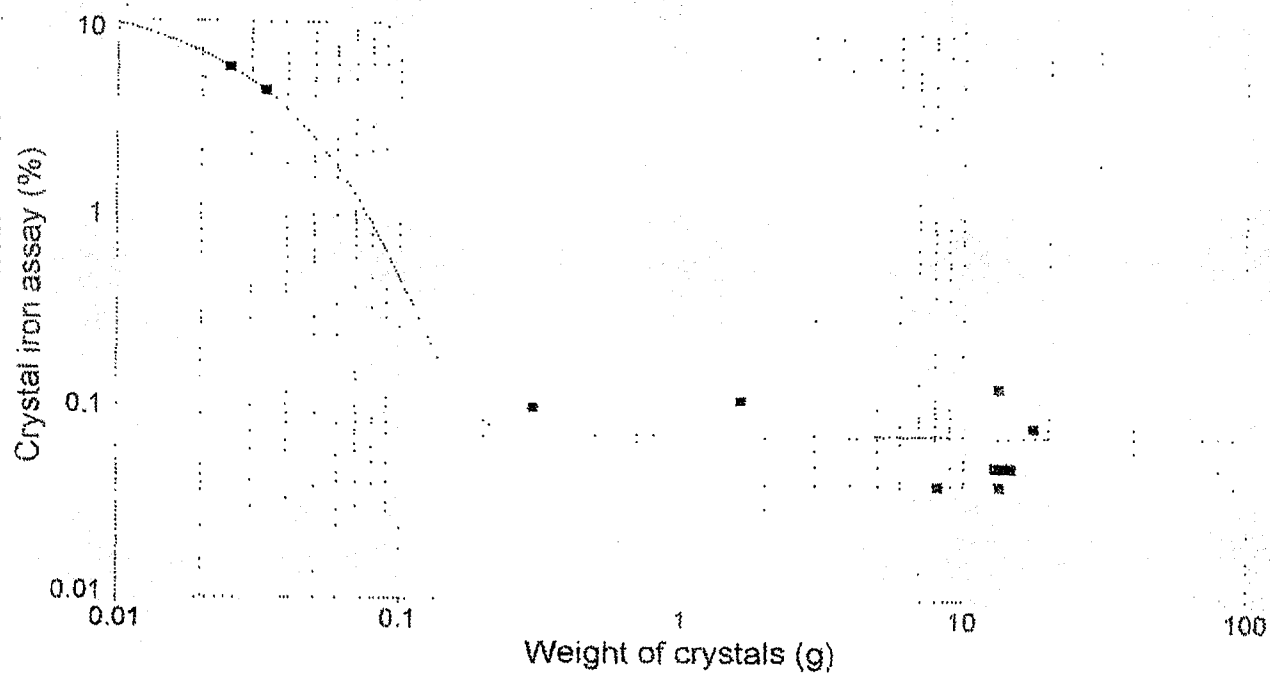


Graph 15 Antimony assay vs Leaching Temperature



Graph 16 Antimony assay vs crystal weight



Graph 17 **Iron assay vs crystal weight**

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