ROCK LEACH RESULTS

Prepared for:

George Lake Joint Venture

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1.0 INTRODUCTION

Trigg, Woollett, Olson Consulting Ltd. are conducting mineral exploration studies at the George Lake Property, Northwest Territories, on behalf of Homestake Minerals Ltd. and Kerr McGee Inc. An environmental data collection program was initiated in 1988 and continued by Norecol Environmental Consultants Ltd. from 1989 to the present. As part of the ongoing studies, Norecol was requested to determine the leachate quality from representative rock types from the George Lake deposits. This information will be used to predict water quality discharged from underground exploration workings, should the project proceed to this stage. Mine water quality prediction is part of the requirements for an exploration water licence, required to proceed with underground exploration in Northwest Territories.

2.0 SAMPLES

Typical rock samples were selected from 17 diamond drill core composite samples which had been collected for an acid base accounting study that was conducted in late 1989 (Norecol, 1989). Prior to testing the crushed rock was stored in plastic bags under cover. Seven samples were selected to represent the major rock types encountered at the property, including greywacke (two samples), iron formation containing variable sulphide concentrations (four samples) and mudstone (one sample) (Table 1). Samples 102B, 102E, and 102F are from Locale 1 North. The remainder are from Locale 2.

3.0 METHODS

The samples were tested by CanTest Ltd using a modified version of the British Columbia Ministry of Environment Special Waste Extraction Procedure (SWEP). The test was modified by replacing the acetic acid, normally used to leach the samples, with deionized water. De-ionized water is preferred because it provides a better approximation to rainwater percolating through a rock mass. Since rock will buffer the pH of percolating water, the pH was not adjusted as required in the conventional procedure. The initial and final pHs of the leachate were recorded. After leaching for 24 hours the leachates were analyzed for 30 elements by ICP.

All tests were performed in duplicate.

4.0 RESULTS

Averaged results from duplicate tests are summarized in Table 1. The initial pH for all tests was greater than 9.1 and, in all but one case (415G, mudstone), the pH decreased during the test. The lowest final pH was shown by the high sulphide (401C) and moderate sulphide (102E) ironstone samples.

Only the major rock forming metals (Al, Ba, B, Ca, Fe, Mg, K, Si, Na, Sr) yielded detectable concentrations in the leachates. Greywacke and mudstone leachates yielded the higher concentrations of Al. Leachates from ironstone yielded the greater concentrations of Ba, Ca and Na. Higher concentrations of calcium and to a lesser extent magnesium are positively correlated to sulphide quantity in ironstone.

5.0 INTERPRETATION AND COMPARISON WITH CRITERIA

The overall high pH of the leachates before and after testing indicates a high natural rock buffering capacity probably resulting from hydrolysis of silicates. The decrease in pH observed in the two most sulphidic samples (401C, 102E) is probably indicative of dissolution of minor weathering products of sulphide minerals accumulated during storage. Weathering of these minerals may also have occurred during the period of the test.

As a result of the high pH, most metals were not dissolved to detectable levels. Detectable metal concentrations represent abundant minerals (K, Si, Na, Sr, Mg, Ba, Al), readily soluble alkali earth carbonates (Ca, Mg), and metals which are soluble at alkaline pH (Al). The highest concentrations of calcium (and to a lesser extent Mg) from the two sulphidic samples appears to indicate dissolution of carbonates following dissolution of minor sulphide weathering products. Other variations observed between rock types are the result of differences in overall metal abundance (for example, Al is more concentrated in leachates from mudstone and greywacke due to the greater abundance of fine-grained alumino-silicates in these rocks).

Metal concentrations in leachates were compared to SWEP criteria, and Federal and British Columbian Mine Effluent Guidelines (Table 1). Concentrations did not exceed the SWEP criteria, and only one metal exceeded the lower limit of the mine effluent guideline (Al for 415G). The detection limit of the analytical method is greater than the lower limit of the mine effluent guideline for Cd, and Se.

6.0 CONCLUSIONS

The leach tests indicate a high natural short term buffering capacity. Provided that pH is maintained at these levels, detrimental concentrations of the metals tested in this study are unlikely to be released.

The tests indicate a potential for release of acidic products from highly to moderately sulphidic iron formation, confirming the results of acid-base accounting. In the short term, these products will be neutralized by dissolution of magnesium and calcium-bearing carbonates, thereby buffering leachate pH at near neutral levels.

7.0 REFERENCES

Norecol Environmental Consultants ltd. (1989). Letter report on acid-base accounting prepared for the George Lake Joint Venture.

TABLE 1

GEORGE LAKE JOINT VENTURE
LEACH TEST RESULTS (AVERAGES) COMPARED TO CRITERIA

Metals in mg/l and pH	102B Grey-wacke	102E Mod. sulph. iron form.	102F Non-sulph. iron form.	401C High sulph. iron form.	401D Low sulph. iron form.	415A Grey-wacke	415G Mud-stone	DETECTION LIMIT (mg/l)	SWEP CRITERIA (mg/l)	MINE EFFLUENT LOWER (mg/l)	MINE EFFLUENT UPPER (mg/l)
pH Initial	9.8	9.4	9.8	9.3	9.9	9.5	9.1				
pH Final	9.4	9.0	9.8	8.8	9.7	9.4	9.3				
Al	0.39				0.29	0.44	0.59	0.15		0.5	1
Sb								0.15		0.25	1
As								0.3	5	0.5	1
Ba		0.022	0.004	0.007	0.005	0.001		0.001	100		
Be								0.003			
Bi								0.5			
B	0.012				0.015			0.01			
Cd								0.025	500	0.01	1
Ca	7.62	13.5	4.05	22.6	4.96	7.64	6.24	0.01			
Cr								0.03	5	0.05	0.3
Co								0.02		0.5	1
Cu								0.015		0.3	0.3
Fe			0.11					0.03	0.03	0.3	1

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Pb								0.08	5	0.3	0.2
Mg	1.11	0.42	0.18	0.85	0.26	0.33	0.69	0.001			
Mn								0.003		0.1	1
Hg								0.00005	0.1	0	0.005
Mo								0.04		0.5	5
Ni								0.025		0.5	1
PO_4								0.4			
K	2.7	2.21	1.04	1.25	0.78	1.97	2.78	0.01			
Se								0.25	1	0.05	0.5
SiO_2	1.49	1.48	2.74	0.75	1.6	1.59	1.7	0.08			
Ag								0.03	5	0.05	0.5
Na	3.4	5.22	11.5	9.69	11.5	1.22	0.33	0.1			
Sr	0.03	0.1	0.031	0.11	0.023	0.026	0.017	0.001			
Sn								0.03			
Ti								0.006			

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V								0.01			
Zn								0.015		0.5	1

Notes:

1. A blank for a leach result indicates that the value was less than the detection limit (see detection limit column).

2. A blank in the criteria column indicates that a criterion has not been established for that parameter.

3. Mine effluent guidelines are for British Columbia, except guidelines for As, Cu, Pb, Ni and Zn which are maximum authorized monthly arithmetic mean concentrations appended to the Federal Fisheries Act (1977). The above named elements are the only metals regulated under Federal Mine Effluent Guidelines.