REGIONAL DRAINAGE SEDIMENT AND WATER GEOCHEMICAL DATA

CENTRAL BRITISH COLUMBIA

(PARTS OF NTS 93E, F, G, J, K, L, M, N & O)

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CENTRAL BRITISH COLUMBIA

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INTRODUCTION

As part of the 2008 QUEST-West Project (Figure 1), Geoscience BC in partnership with the Northern Development Initiative Trust and the Regional District of Bulkley-Nechako funded an infill drainage sediment and water survey conducted in central British Columbia. The QUEST-West Project also included the reanalysis of over 3475 sample pulps from previous government funded surveys. Results from this work were released in January 2009 (Jackaman *et al.*, 2009[1]; Geoscience BC, 2009[2]).

Geoscience BC Report 2009-11 contains results of the 2008 infill survey and parts of this package incorporate data from a number of previous lake and stream based surveys completed in the study area as well as the new reanalysis data. This information has been provided in a variety of digital formats. PDF files include survey descriptions and details regarding methods, field and analytical data listings, summary statistics, sample location map, geology map and maps for individual metals. Raw digital data files used in the production process are included in XLS and DBF formats.

These types of initiatives contribute to the geochemical coverage of the province, complement existing private and publicly available geoscience data sets and provide the mining and exploration community with new, high-quality geochemical information.

SURVEY DESCRIPTION

The 2008 infill survey covered parts of the northern portion of the Nechako Plateau. Although much of the area was the site of previous stream and lake sediment projects, the target area included a large number of new sample sites. In addition, the lake-based work will connect lake surveys previously completed in surrounding areas.

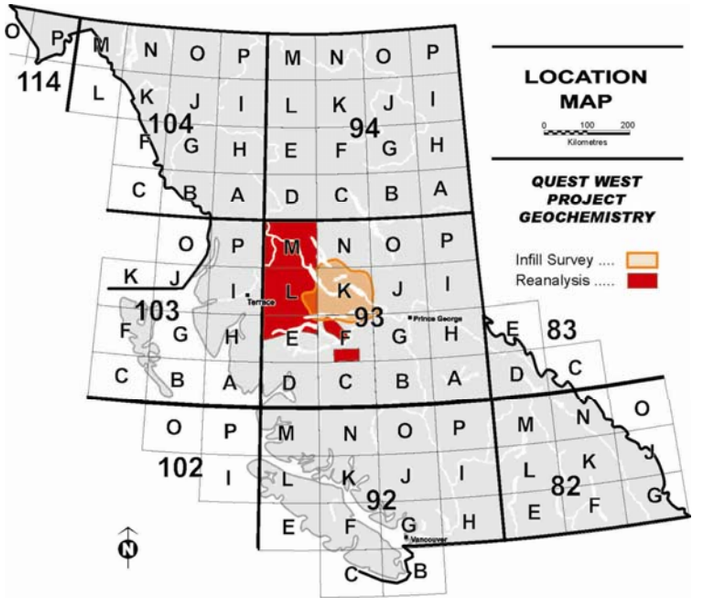

Figure 1. Location of the 2008 QUEST-West drainage sediment survey and sample reanalysis study areas, central British Columbia.

Based on standard lake sediment geochemical survey strategies used elsewhere in Canada for the National Geochemical Reconnaissance (NGR) program (Friske, 1991[3]), as well as prior orientation studies and regional lake sediment surveys completed in BC (Cook, 1997[4]; Jackaman, 2007[5]; Jackaman, 2008[6]), helicopter- and

[1] Jackaman, W., Balfour, J.S. and Reichheld, S.A. (2009): QUEST-West Project geochemistry: field survey and data reanalysis (parts of NTS 093E, F, J, K, L, M, N), central British Columbia; *in* Geoscience BC Summary of Activities 2008, Geoscience BC, Report 2009-1.

[2] Geoscience BC (2009): Geoscience BC's QUEST-West Project, geochemical sample reanalysis; Geoscience BC, Report 2009-5.

[3] Friske, P.W.B. (1991): The application of lake sediment geochemistry; *in* mineral exploration; in Exploration Geochemistry Workshop, Geological Survey of Canada, Open File 2390.

[4] Cook, S.J. (1993a): Preliminary report on lake sediment geochemistry in the northern Interior Plateau, Central British Columbia; *in* geological fieldwork 1992, *BC EMPR*, Paper 1993-1.

[5] Jackaman, W. (2007): Regional drainage sediment and water geochemical data, South Nechako Basin and Cariboo Basin, central British Columbia (parts of NTS 92N, O, P, 93A, B); Geoscience BC, Report 2007-6.

[6] Jackaman, W. (2008): Regional lake sediment and water geochemical data, Northern Fraser Basin, central British Columbia (parts of NTS 93G, H, J, K, N, O); Geoscience BC, Report 2008-5.

Figure 2. Typical lake sample site found in the flat topography of the Nechako Plateau, central British Columbia.

truck-supported sample collection was carried out in August and September 2008. A total of 905 lake sediment and water samples and 102 stream sediment and water samples were systematically acquired. Field duplicate sediment and water samples were routinely collected in each analytical block of 20 samples. Combined with the previous survey work, the resulting average sample site density is one site per 7 km^2 over the 14 500 km^2 survey area.

SAMPLE COLLECTION

Lake sites were accessed using a float-equipped Bell Jet Ranger helicopter supplied by Interior Helicopters Ltd. (Fort St. James). The sampling crews collected sediment material with a torpedo-style sampler and water samples were saved in 250 mL bottles. Samples were successfully collected from most of the lakes targeted in the survey area. However, some of the smaller ponds and very large, deep lakes were not sampled due to poor sampling conditions.

Stream sampling was supported by both truck and helicopter. Approximately 2 kg of fine-grained sediment and 250 mL of clean flowing water was collected at each site. Field observations and site locations were recorded for all sample sites.

SAMPLE PREPARATION

The bags containing the sediment samples were catalogued and drip-dried at a field camp set up in Fraser Lake. At the end of the field program, samples were shipped to a commercial lab, where they were air-dried at temperatures below 40ºC. After drying, lake sediment samples were pulverized to approximately minus 150 mesh (100 μm) in a ceramic ring mill and stream sediment samples were dry sieved to –80 mesh (177 μm). To monitor and assess accuracy and precision of analytical results, control reference material and analytical duplicate samples were routinely inserted into each block of twenty sediment samples.

SAMPLE ANALYSIS

The sediment samples were analyzed for base and precious metals, pathfinder elements and rare earth elements by inductively coupled plasma mass spectrometry (ICPMS) and instrumental neutron activation analysis (INAA). Loss-on-ignition and fluorine were also determined for sediment material. Fluoride, conductivity and pH were determined for the water samples. A complete list of elements and analytical detection limits is provided in Tables 1 and 2.

Inductively Coupled Plasma Mass Spectrometry (ICPMS)

For the determination of 35 elements listed in Table 1, a 0.5-gram sample was leached with 3 ml of a mixture of HCl, HNO_3, and distilled, deionized water (3:1:2 v/v) at 95°C for one hour. The sample solution was diluted to 10 ml and analyzed by inductively coupled plasma mass spectroscopy on a Thermo-Electron X-series II instrument. Data for boron was not published because of inadequate detection limits and/or precision.

Table 1. Detection Limits: ICPMS.

Element		D.L.	Unit	Method	Element		D.L.	Unit	Method
Aluminum	Al	0.01	%	ICPMS	Molybdenum	Mo	0.01	ppm	ICPMS
Antimony	Sb	0.02	ppm	ICPMS	Nickel	Ni	0.1	ppm	ICPMS
Arsenic	As	0.1	ppm	ICPMS	Phosphorus	P	0.001	%	ICPMS
Barium	Ba	0.5	ppm	ICPMS	Potassium	K	0.01	%	ICPMS
Bismuth	Bi	0.02	ppm	ICPMS	Scandium	Sc	0.1	ppm	ICPMS
Cadmium	Cd	0.01	ppm	ICPMS	Selenium	Se	0.1	ppm	ICPMS
Calcium	Ca	0.01	%	ICPMS	Silver	Ag	2	ppb	ICPMS
Chromium	Cr	0.5	ppm	ICPMS	Sodium	Na	0.001	%	ICPMS
Cobalt	Co	0.1	ppm	ICPMS	Strontium	Sr	0.5	ppm	ICPMS
Copper	Cu	0.01	ppm	ICPMS	Sulphur	S	0.01	%	ICPMS
Gallium	Ga	0.1	ppm	ICPMS	Tellurium	Te	0.02	ppm	ICPMS
Gold	Au	0.2	ppb	ICPMS	Thallium	Tl	0.02	ppm	ICPMS
Iron	Fe	0.01	%	ICPMS	Thorium	Th	0.1	ppm	ICPMS
Lanthanum	La	0.5	ppm	ICPMS	Titanium	Ti	0.001	%	ICPMS
Lead	Pb	0.01	ppm	ICPMS	Tungsten	W	0.1	ppm	ICPMS
Magnesium	Mg	0.01	%	ICPMS	Uranium	U	0.1	ppm	ICPMS
Manganese	Mn	1	ppm	ICPMS	Vanadium	V	2	ppm	ICPMS
Mercury	Hg	5	ppb	ICPMS	Zinc	Zn	0.1	ppm	ICPMS

Table 2. Detection Limits: INAA, F, LOI and Waters.

Element		D.L.	Unit	Method	Element		D.L.	Unit	Method
Antimony	Sb	0.1	ppm	INAA	Samarium	Sm	0.1	ppm	INAA
Arsenic	As	0.5	ppm	INAA	Scandium	Sc	0.2	ppm	INAA
Barium	Ba	50	ppm	INAA	Sodium	Na	0.02	%	INAA
Bromine	Br	0.5	ppm	INAA	Tantalum	Ta	0.5	ppm	INAA
Cerium	Ce	5	ppm	INAA	Terbium	Tb	0.5	ppm	INAA
Cesium	Cs	0.5	ppm	INAA	Thorium	Th	0.2	ppm	INAA
Chromium	Cr	20	ppm	INAA	Tungsten	W	1	ppm	INAA
Cobalt	Co	5	ppm	INAA	Uranium	U	0.2	ppm	INAA
Europium	Eu	1	ppm	INAA	Ytterbium	Yb	2	ppm	INAA
Gold	Au	2	ppb	INAA	Sample Weight	Wt	0.01	gm	GRAV
Hafnium	Hf	1	ppm	INAA	Fluorine	F	10	ppm	ION
Iron	Fe	0.2	%	INAA	Loss on Ignition	LOI	0.1	%	GRAV
Lanthanum	La	2	ppm	INAA					
Lutetium	Lu	0.2	ppm	INAA	pH	pH			ISE
molybdenum	Mo	1	ppm	INAA	Fluoride	FW	10	ppb	ION
Rubidium	Rb	5	ppm	INAA	Conductivity	CND	0.01	uS	ISE

Instrumental Neutron Activation Analysis (INAA)

Weighed and encapsulated samples were packaged for irradiation along with internal standards and international reference materials. Samples and standards were irradiated together with neutron flux monitors in a two-megawatt pool type reactor. After a seven-day decay period, samples were measured with a high-resolution germanium detector. Typical counting times were 500 seconds. Elements determined by INAA are listed in Table 2. Data for silver, cadmium, iridium, nickel, selenium, tin, tellurium, titanium, zinc, and zirconium are not published because of inadequate detection limits and/or precision.

Other Sediment Analysis

Loss-on-ignition was determined using a 1-gram sample. The sample, weighed into a crucible, was placed into a 1000ºC muffle furnace for one hour. The crucibles were removed from the oven and cooled to 100ºC and then transferred to a desiccator for cooling to room temperature. The crucibles were re-weighed, and the difference was reported as loss-on-ignition (GRAV).

To measure fluorine, a 0.25-gram sample was fused with 1-gram of sodium carbonate-sodium nitrate. After being leached with metal free water for 1 hour, 10 ml of 10% citric acid solution is added. Fluoride was measured using specific ion electrode analysis (ION).

Water Analysis

The pH of waters was determined using a Hanna Instruments 991001 pH/temperature metre with automatic temperature compensation, a range of 0.00 to +14.0 pH, resolution of 0.01 pH and an accuracy of ±0.01 pH. Meters were calibrated using commercial buffer solutions with pH values of 4.0, 7.0 and 10.0.

Conductivity of waters was determined using a Hanna Instruments pH/EC/TDS meter with automatic temperature compensation and a range of 4000 µS/cm, a resolution of 1 µS/cm and a full-scale accuracy of ±1%. Meters were calibrated using commercial conductivity standards.

Fluoride in waters was determined by specific ion electrode analysis (ION).

DATA PRESENTATION

Geochemical information compiled in this report includes field and analytical results from samples collected during a regional lake survey conducted in 2008 (N = 1007). Results from the survey have been determined to be accurate and complete. The data package has been prepared as a PDF document and presents survey results in three appendices that are described as follows:

Appendix 'A': Is a complete listing of site location information, field observations and analytical results for the 2008 survey. Tables preceding the data listings define codes used for field observations and underlying geology.

Appendix 'B': Presents summary statistics for individual elements and a more detailed summary based on the underlying bedrock geology determined at each sample site. This summary includes the 2008 results plus data from previous BC Ministry of Energy, Mines and Petroleum Resources (MEMPR) and Geoscience BC (GEOBC) surveys listed in Table 3. The calculations have been determined from raw data and values reported by the labs at less then detection limit have been set to the listed detection limit.

Table 3. Data used to produce summary statistics and element maps was selected from the following surveys.

Year	NTS Map Sheet(s)	Map Area	Survey Type	Report Number
1983	093M	Hazelton	stream survey	MEMPR GeoFile 2005-17
1983	093N	Manson River	stream survey	MEMPR GeoFile 2005-17
1984/85	093G	Prince George	stream survey	MEMPR GeoFile 2005-17
1985	093J	McLeod Lake	stream survey	MEMPR GeoFile 2005-17
1993	093F	Nechako River	lake survey	MEMPR OF 1994-19
1995	093K	Pinchi Lake	lake survey	MEMPR OF 1996-15
1996	093L/M	Babine	lake survey	MEMPR OF 1997-17
2002	093K	Fort Fraser	stream survey	MEMPR GeoFile 2005-17
2005	093C/F	Anahim/Nechako	lake/stream survey	GEOBC 2006-04
2005	093J	McLeod Lake	sample reanalysis	MEMPR GeoFile 2006-09
2007	093G/J/N/O	QUEST	lake survey	GEOBC 2008-05
2007	093O	Pine Pass	stream survey	GEOBC 2008-07
2007	093A/B/G/H/K/N	QUEST	sample reanalysis	GEOBC 2008-03
2008	093K/L/N	QUEST West	lake/stream survey	GEOBC 2009-11
2008	093F/E/L/M	QUEST West	sample reanalysis	GEOBC 2009-05

Appendix 'C': Includes a sample location map, simplified geology and mineral occurrence map and proportional symbol maps for each element. Element maps incorporate the 2008 results with data from the previous surveys listed in table 3. For most maps the symbol size and colour reflects data ranges that are based on percentile ranges as determined from the raw data. Maximum symbol size is assigned to highest values. Portraying high values with large, bold symbols, with background values represented by relatively smaller dots, helps highlight regional trends and anomalous sample sites.

The data summary presented in this package is not considered exhaustive. In order to accommodate more detailed assessments, raw digital data files have been included in XLS and DBF formats. Original data files can be downloaded from the Geoscience BC and BC Ministry of Energy, Mines and Petroleum Resources web sites.

ACKNOWLEDGMENTS

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Collection:	Noble Exploration Services Ltd., Sooke, BC
Preparation:	Eco Tech Laboratory Ltd., Kamloops, BC
Analysis:	Eco Tech Laboratory Ltd., Kamloops, BC Becquerel Laboratories Ltd., Mississauga, Ont

* * *

[7] Geoscience BC - 410 - 890 West Pender Street, Vancouver, British Columbia, Canada, V6C 1J9 http://www.geosciencebc.com/s/Home.asp