QUEST-NORTHWEST REGIONAL GEOCHEMICAL DATA

NORTHWEST BRITISH COLUMBIA

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Table of Contents

INTRODUCTION

The QUEST-Northwest project is part of a series of large-scale regional geochemical studies that have been sponsored by Geoscience BC since 2007. Each of these projects (QUEST, QUEST-West, QUEST-South and QUEST-Northwest) has included a number of important geochemical initiatives such as new surveys and the reanalysis of archived sediment pulps. These types of projects generate a vast array of new information that significantly enhances the utility of the provincial geochemical database (Jackaman, 2012a) and complements other components of the projects, such as airborne geophysical surveys and bedrock mapping (Simpson, 2012). This collection of high-quality geoscience information promotes exploration interest in the project areas and helps guide the development follow-up activities.

As part of the 2011 QUEST-Northwest Project, Geoscience BC funded new infill stream based geochemical surveys plus the reanalysis of over 2400 sample pulps from government funded surveys that were originally completed in NTS map sheets 104F, G and K during the mid-1980s (Figure 1). Geoscience BC Report 2012-07 includes results of the 2011 infill sampling programs. Data generated by the reanalysis work was released in April 2012 (Jackaman, 2012b; Jackaman, 2012c).

Parts of this report include data from previous regional stream surveys completed in the study areas as well as the recently released reanalysis results. 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 maps and maps for individual metals. Raw digital data files used in the production process are included in Microsoft® Excel (XLS) format.

SURVEY DESCRIPTION

QUEST-Northwest infill sampling covered parts of NTS 1:250 000 map areas 104G, H, I and J. To collaborate geochemical sampling with the airborne geophysics

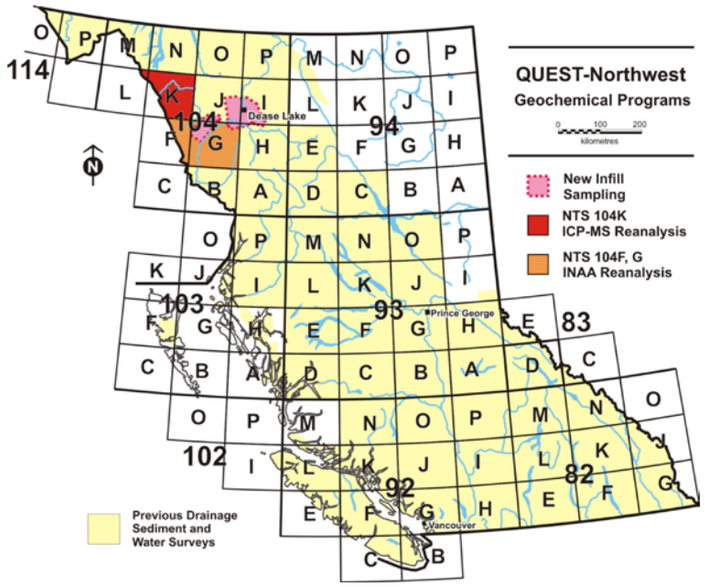

Figure 1. Location of the 2011 QUEST-Northwest regional geochemical survey and sample reanalysis study areas, northwest British Columbia.

programs, the stream sampling was divided into the Telegraph Creek and Dease Lake survey areas (Figure 2).

The Telegraph Creek survey covered an area of more than 3500 km^2 and extends west from the community of Telegraph Creek, straddling the wide and heavily forested Stikine River valley. To the west and south of the valley, the area is characterized by high rugged peaks of the Boundary Ranges, and to the north, the more subdued mountains of the Tahltan Highland. The Dease Lake survey covered more than 5500 km^2 and also includes parts of the Stikine River valley plus the Tanzilla River valley. The area extends east into the Stikine Ranges of the Cassiar Mountains (Holland, 1976).

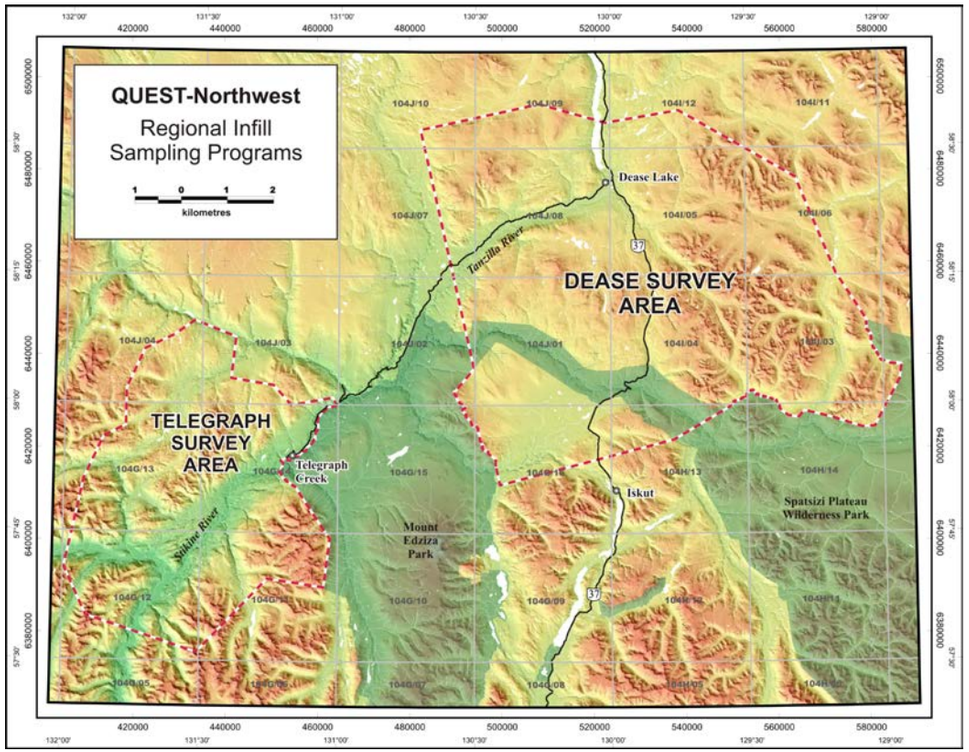

Figure 2. Locations of Telegraph Creek and Dease Lake infill sampling areas (indicated by the dashed red outlines), northwestern British Columbia.

In low-lying regions of the survey areas, access was limited by thick tree cover. In addition, the availability of suitable sample material was often hampered by poorly developed stream drainages associated with extensive wetland cover. Exposed areas at higher elevations provided excellent access to streams and numerous opportunities to improve the overall sample site coverage.

SAMPLE COLLECTION

Using helicopter support, stream-based sample collection was carried out in August 2011. A total of 212 stream sediment and water samples were acquired from 200 sites in the Telegraph Creek study area and 229-stream sediment and water samples were collected from 217 sites located in the Dease Lake study area. Field duplicate samples were routinely collected in each analytical block of 20 samples. Combined with historical survey work, the resulting average sample site density was improved to one site per 7 km^2.

Stream sediment material typically consisted of approximately 2 kilograms of silt to sand sized sediment with varying amounts of coarser gravels and organic constituents. Sediment samples were collected in Hubco® sample bags and water samples were collected in 250 mL high density polyethylene bottles. Field observations describing site location plus sample and site characteristics were recorded for each site. Samples were carefully transported back to field camps located in the community of Telegraph Creek and near Iskut along Highway 37. At the field camps sediment samples were drip-dried in a contaminant free structure and water bottles were stored in a cool, dark location.

Stream sampling work was based on standard geochemical survey strategies and protocols initially developed for the National Geochemical Reconnaissance (NGR) program (Ballantyne 1991; Friske and Hornbrook, 1991) and adopted by the BC Regional Geochemical Survey (RGS) program.

SAMPLE PREPARATION

At the completion of the field program, the samples were shipped to Eco Tech Laboratory Ltd. (Kamloops), where the sediment samples were air-dried at temperatures below 40ºC and sieved to –80 mesh (<177 um). To monitor and assess accuracy and precision of analytical results, control reference material and analytical duplicate samples were inserted in each block of twenty sediment and water samples.

Splits of the processed sediment material were sent to Acme Analytical Laboratories Ltd. (Vancouver, British Columbia) and Becquerel Laboratories Inc. (Mississauga, Ontario) for analysis. Eco Tech Laboratory tested the raw water samples for fluoride. Measurements for pH and conductivity were completed at each sample site using handheld meters.

SAMPLE ANALYSIS

The stream 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 stream water samples. A complete list of elements and analytical detection limits is provided in Tables 1, 2 and 3.

Inductively Coupled Plasma Mass Spectrometry (ICPMS)

For the determination of 53 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, germanium and tantalum were not included as part of this report because of inadequate detection limits and/or precision.

Table 1. List of elements and associated detection levels from ICP-MS analysis using aqua-regia digestion, QUEST-Northwest Project area.
(Abbreviations: ppm, parts per million; ppb, parts per billion; pct, percent)

Element		Detection Levels	Units
Gold	Au	0.2 to 100000	ppb
Silver	Ag	2 to 100000	ppb
Aluminum	Al	0.01 to 10	pct
Arsenic	As	0.1 to 10000	ppm
Boron	B	20 to 2000	ppm
Barium	Ba	0.5 to 10000	ppm
Bismuth	Bi	0.02 to 2000	ppm
Calcium	Ca	0.01 to 40	pct
Cadmium	Cd	0.01 to 2000	ppm
Cobalt	Co	0.1 to 2000	ppm
Chromium	Cr	0.5 to 10000	ppm
Copper	Cu	0.01 to 10000	ppm
Iron	Fe	0.01 to 40	pct
Gallium	Ga	0.1 to 100	ppm
Mercury	Hg	5 to 50000	ppb
Potassium	K	0.01 to 10	pct
Lanthanum	La	0.5 to 10000	ppm
Magnesium	Mg	0.01 to 30	pct
Manganese	Mn	1 to 10000	ppm
Molybdenum	Mo	0.01 to 2000	ppm
Sodium	Na	0.001 to 5	pct
Nickel	Ni	0.1 to 10000	ppm
Phosphorus	P	0.001 to 5	pct
Lead	Pb	0.01 to 10000	ppm
Sulphur	S	0.02 to 5	pct
Antimony	Sb	0.02 to 2000	ppm
Scandium	Sc	0.1 to 100	ppm

Element		Detection Levels	Units
Selenium	Se	0.1 to 100	ppm
Strontium	Sr	0.5 to 10000	ppm
Tellurium	Te	0.02 to 1000	ppm
Thorium	Th	0.1 to 2000	ppm
Titanium	Ti	0.001 to 5	pct
Thallium	Tl	0.02 to 1000	ppm
Uranium	U	0.05 to 2000	ppm
Vanadium	V	2 to 10000	ppm
Tungsten	W	0.05 to 100	ppm
Zinc	Zn	0.1 to 10000	ppm
Beryllium	Be	0.1 to 1000	ppm
Cerium	Ce	0.1 to 2000	ppm
Cesium	Cs	0.02 to 2000	ppm
Germanium	Ge	0.1 to 100	ppm
Hafnium	Hf	0.02 to 1000	ppm
Indium	In	0.02 to 1000	ppm
Lithium	Li	0.1 to 2000	ppm
Niobium	Nb	0.02 to 2000	ppm
Rubidium	Rb	0.1 to 2000	ppm
Rhenium	Re	1 to 1000	ppb
Tin	Sn	0.1 to 100	ppm
Tantalum	Ta	0.05 to 2000	ppm
Yttrium	Y	0.01 to 2000	ppm
Zirconium	Zr	0.1 to 2000	ppm
Platinum	Pt	2 to 100000	ppb
Palladium	Pd	10 to 200000	ppb

Table 2. List of INAA elements and associated detection levels, QUEST-Northwest Project area.
(Abbreviations: ppm, parts per million; ppb, parts per billion; pct, percent; g, gram)

Element		Detection Levels	Units	Element		Detection Levels	Units
Gold	Au	2	ppb	Nickel	Ni	10	ppm
Silver	Ag	2	ppm	Rubidium	Rb	5	ppm
Arsenic	As	0.5	ppm	Antimony	Sb	0.1	ppm
Barium	Ba	50	ppm	Scandium	Sc	0.2	ppm
Bromine	Br	0.5	ppm	Selenium	Se	5	ppm
Cadmium	Cd	5	ppm	Samarium	Sm	0.1	ppm
Cerium	Ce	5	ppm	Tin	Sn	100	ppm
Cobalt	Co	5	ppm	Tantalum	Ta	0.5	ppm
Chromium	Cr	20	ppm	Terbium	Tb	0.5	ppm
Cesium	Cs	0.5	ppm	Tellurium	Te	10	ppm
Europium	Eu	1	ppm	Thorium	Th	0.2	ppm
Iron	Fe	0.2	pct	Titanium	Ti	100	ppm
Hafnium	Hf	1	ppm	Uranium	U	0.2	ppm
Iridium	Ir	50	ppb	Tungsten	W	1	ppm
Lanthanum	La	2	ppm	Ytterbium	Yb	2	ppm
Lutetium	Lu	0.2	ppm	Zinc	Zn	100	ppm
Molybdenum	Mo	1	ppm	Zirconium	Zr	200	ppm
Sodium	Na	1	pct	Weight	Wt	0.01	g

Table 3. Detection levels for F and LOI in sediments plus F, CND and pH in waters, QUEST-Northwest Project area.
(Abbreviations: ppm, parts per million; ppb, parts per billion; pct, percent; uS, microsiemen)

Element		Detection Levels	Units	Element		Detection Levels	Units
Fluorine	F	10	ppm	Fluoride	F	10	ppb
Loss on Ignition	LOI	0.1	pct	Conductivity	CND	0.01	uS
				pH	pH	0.01	

Instrumental Neutron Activation Analysis (INAA)

For the determination of 35 elements listed in Table 2, weighed and encapsulated samples were packaged for irradiation along with internal standards and international reference materials. Samples with an average weight of 26 grams plus 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. Data for silver, cadmium, europium, iridium, nickel, selenium, tin, tellurium, titanium, zinc, and zirconium are not included in this report because of inadequate detection limits and/or precision.

Other Sediment Analysis

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.

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.

Water Analysis

The pH and conductivity of waters was determined using handheld Oakton Multi-parameter TESTR 35 Series instruments. Meters were calibrated using commercial buffer solutions.

Fluoride in waters was determined by specific ion electrode analysis.

DATA PRESENTATION

Information compiled in this report includes field and analytical results from stream samples collected during the 2011 QUEST-Northwest regional geochemical survey. Field observations and analytical results from this work have been determined to be complete and accurate.

To provide complete geochemical data coverage, previously published government funded NGR and BCRGS stream surveys (Lett, 2005) and results from Geoscience BC supported reanalysis initiatives (Jackaman, 2011; Jackaman 2012b,c) have been incorporated into this report (Tables 4 and 5). The data has been subdivided into the Telegraph Creek and Dease Lake study areas and are presented in the following appendices and digital data files:

Appendix A and D:

These sections provide a complete listing of site location information, field observations and analytical results used in this report. Tables preceding the data listings define codes used for field observations.

Appendix B and E:

These sections present summary statistics for individual elements and a more detailed statistical summary of element data that has been subset by the underling geology as determined from Massey et al. (2005). The calculations presented have been determined from the raw data and element determinations reported by the labs at less than method detection limits have been set to the listed method detection limits.

Appendix C and F:

Includes sample location and proportional symbol maps for each element. For most maps the symbol size and colour reflects data ranges that are based on percentiles calculated 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.

Digital Data:

The data summary presented in this package is not considered exhaustive. In order to accommodate more detailed assessments, raw digital data files for each data set used in this package have been included in Microsoft® Excel (XLS) format.

Table 4. Telegraph Creek study area data sets used to produce summary statistics and element maps were selected from the following government surveys.
(Abbreviations: NGR, National Geochemical Reconnaissance; BCRGS, BC Regional Geochemical Survey)

Survey Year	NTS Map Sheet(s)	Survey	Survey Type
2011	Telegraph Creek Area	QUEST NW	GBC Stream Survey
2000	104J	Dease Lake	NGR/BCRGS Stream Survey
1987	104F	Sumdum	NGR/BCRGS Stream Survey/GBC Reanalysis
1987	104G	Telegraph Creek	NGR/BCRGS Stream Survey/GBC Reanalysis
1987	104K	Tulsequah	NGR/BCRGS Stream Survey/GBC Reanalysis

Table 5. Dease Lake study area data sets used to produce summary statistics and element maps were selected from the following government surveys.

Survey Year	NTS Map Sheet(s)	Survey	Survey Type
2011	Dease Lake Area	QUEST NW	GBC Stream Survey
2004	104H	Spatsizi Plateau	NGR/BCRGS Stream Survey
2000	104J	Dease Lake	NGR/BCRGS Stream Survey
1995	104I	Cry Lake	BCRGS Stream Survey/GBC Reanalysis
1987	104G	Telegraph Creek	NGR/BCRGS Stream Survey/GBC Reanalysis

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Preparation:	Eco Tech Laboratory Ltd., Kamloops, BC
Analysis:	ICPMS, F, LOI: Acme Laboratories Ltd., Vancouver, BC INAA: Becquerel Laboratories Ltd., Mississauga, Ont F in Water: Eco Tech Laboratory Ltd., Kamloops, BC

REFERENCES

Ballantyne, S.B. (1991): Stream geochemistry in the Canadian Cordillera: conventional and future applications for exploration; *in* Exploration Geochemistry Workshop, Geological Survey of Canada, Open File 2390, p. 6.1–6.74.

Friske, P.W.B. and Hornbrook, E.H.W. (1991): Canada's National Geochemical Reconnaissance programme; Transactions of the Institution of Mining and Metallurgy, Section B, v. 100, p. 47–56.

Jackaman, W. (2011): Northern BC Sample Reanalysis Project; Geoscience BC, Report 2011-2, 11 p.

Jackaman, W. (2012a): QUEST-Northwest Project: new regional geochemical survey and sample reanalysis data (NTS 104F, G, H, I, J, K), Northern British Columbia; *in* Geoscience BC Summary of Activities 2011, Geoscience BC, Report 2012-1, p. 15-18.

Jackaman, W. (2012b): QUEST-Northwest Sample Reanalysis (ICP-MS); Geoscience BC, Report 2012-05, 9 p.

Jackaman, W. (2012c): QUEST-Northwest Sample Reanalysis (INAA); Geoscience BC, Report 2012-06, 9 p.

Holland, S.S. (1976): Landforms of British Columbia: a physiographic outline; BC Ministry of Energy and Mines, Bulletin 48, 138 p.

Lett, R.E.W. (2005): Regional geochemical survey database on CD; BC Ministry of Energy and Mines, GeoFile 2005-17, CD-ROM.

Massey, N.W.D., MacIntyre, D.G., Desjardins, P.J. and Cooney, R.T. (2005): Digital geology map of British Columbia: whole province, B.C. Ministry of Energy and Mines, Geofile 2005-1.

Simpson, K. (2012): QUEST-Northwest: Geoscience BC's new minerals project in northwestern British Columbia (NTS 104G, J, parts of NTS 104A, B, F, H, I, K, 103O, P); *in* Geoscience BC Summary of Activities 2011, Geoscience BC, Report 2012-1, p. 1–4.

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[1] Geoscience BC - 440 - 890 West Pender Street, Vancouver, British Columbia, Canada, V6C 1J9
http://www.geosciencebc.com/s/Home.asp