

QUEST-West Project Geochemistry: Field Survey and Data Reanalysis, Central British Columbia (parts of NTS 093E, F, J, K, L, M, N)

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Jackaman, W., Balfour, J.S. and Reichheld, S.A. (2009): QUEST-West Project geochemistry: field survey and data reanalysis, central British Columbia (parts of NTS 093E, F, J, K, L, M, N); in Geoscience BC Summary of Activities 2008, Geoscience BC, Report 2009-1, p. 7–14.

Introduction

As recently as the early 1990s, large portions of central British Columbia have had limited to no regional geochemical coverage. Although a number of provincial and federal government-funded, reconnaissance-scale stream sediment and water surveys had been completed in the area prior to 1990, the regional coverage was sparse and original analytical results are now considered inadequate. Recognizing these deficiencies, efforts were initiated in 1993 by the BC Geological Survey (BCGS) and Geological Survey of Canada (GSC) to improve the geochemical database of the region. The primary objective of those efforts was to provide high quality data that could be used to better assess the mineral potential and increase the opportunity for new discoveries (Cook, 1997). The subsequent mountain pine beetle infestation further supported the importance of acquiring and developing up-to-date information for this area. From 1993 to 2002, a total of 2122 drainage sediment and water samples were collected as well as samples from other geochemical sampling methods, such as till and biogeochemical surveys (Kerr and Levson, 1997; Jackaman, 2007b). Starting in 2005, Geoscience BC-funded initiatives have added another 6822 new samples to the database and have also supported the reanalysis of 7769 previously collected stream sample pulps using modern analytical methods (Jackaman, 2006a; Jackaman and Balfour, 2007, 2008). In 2009, the collection will be further augmented with the release of data from over 950 new sites and the reanalysis of 3629 samples compiled as part of the 2008 QUEST-West Project (Figure 1).

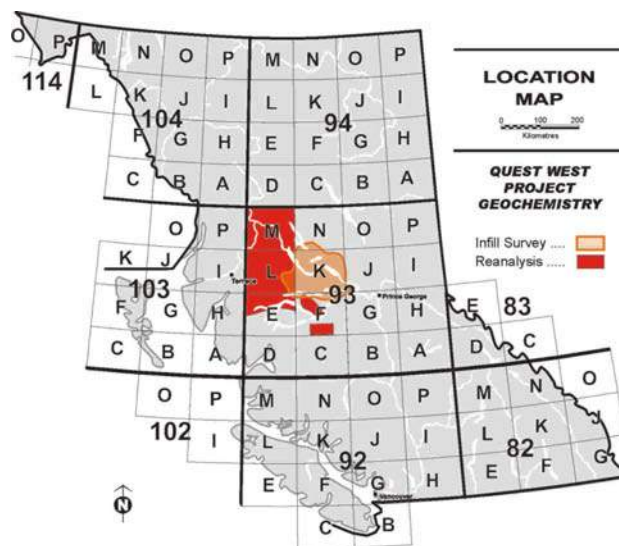


Figure 1. Location of the 2008 QUEST-West drainage sediment survey and sample reanalysis study areas, British Columbia.

QUEST-West 2008 Geochemistry Programs

Although a number of reconnaissance-scale stream surveys have been completed within the more mountainous regions of central BC, much of the flat-lying plateau areas had not been sampled until relatively recently. Characterized by a subdued landscape that includes a large number of potential lake sites (Figure 2), it was determined that lake bottom sediments could be considered an appropriate sample media (Cook, 1993). Used sparingly in other parts of BC but more routinely in central and eastern Canada, the technique has been shown to be effective in identifying regional geochemical patterns as well as anomalous metal concentrations related to mineral deposits (Hoffman, 1976; Coker et al., 1979; Friske, 1991). Supported by the results of this research, lake-based geochemical sampling of BC's central interior proceeded in 1993. The initial phase consisted of several detailed lake sediment surveys in parts of the Nechako River map area (Cook and Jackaman, 1994), the northeast corner of the Fort Fraser map area (Cook et al., 1997) and the Babine porphyry belt (Cook et al., 1998).

Keywords: *Nechako Plateau, Fraser Plateau, mineral exploration, geochemistry, multi-element, reanalysis, stream sediment, lake sediment*

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

More recently, Geoscience BC has funded several large-scale surveys (Jackaman, 2006b, 2007a) covering parts of the Nechako and Fraser plateaus as well as the reanalysis of archived stream and lake sediment samples (Geoscience BC, 2008). In 2008, the QUEST-West Project included a 955 site infill survey in the northern Nechako Plateau (Figure 3) and 3629 archived samples were selected for reanalysis (Figure 4). Table 1 provides a complete list of drainage sediment geochemical survey work completed in central BC since 1993.

Infill Drainage Sediment Survey

The 2008 QUEST-West Project geochemical survey covers 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

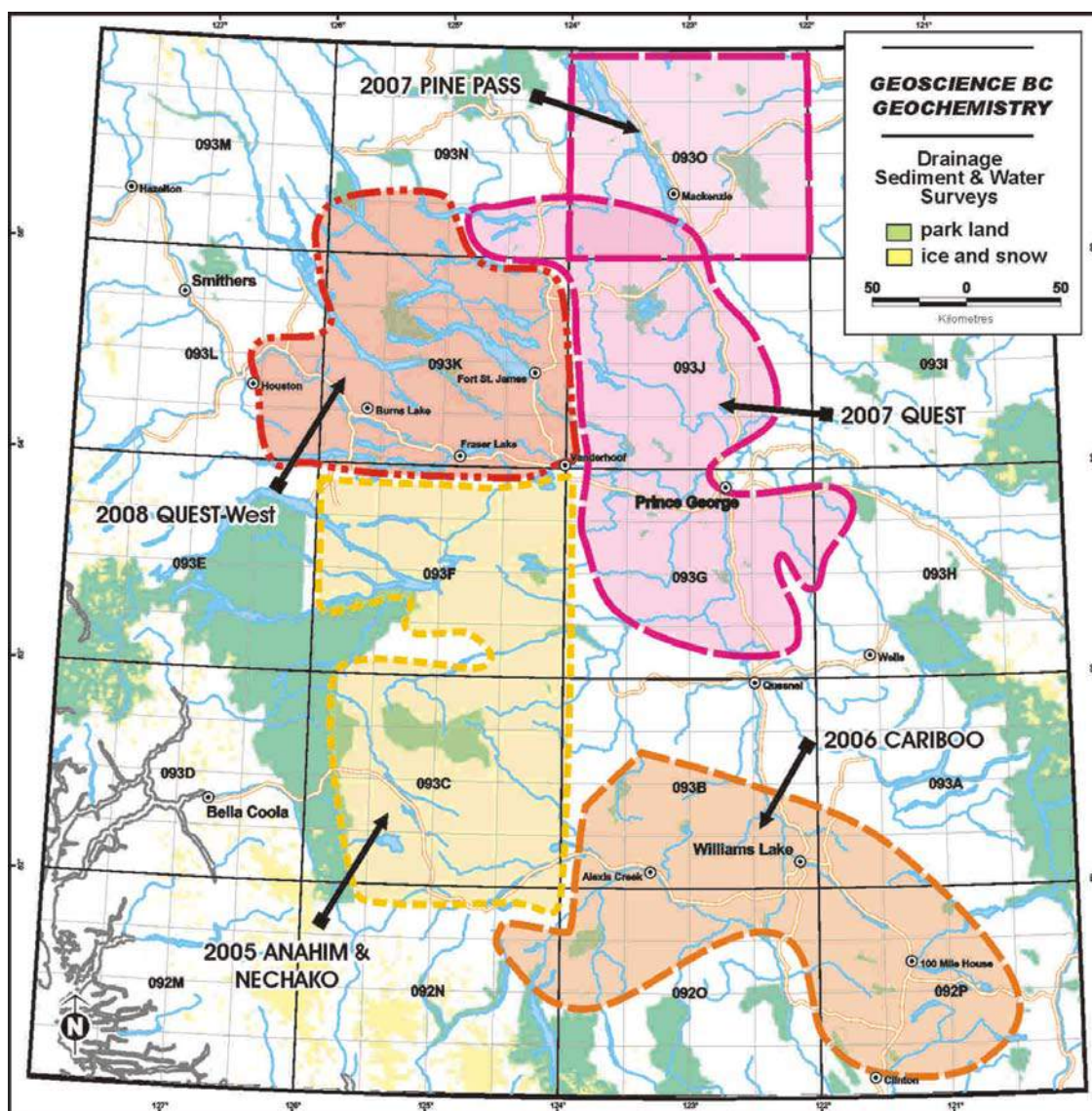


Figure 3. Detailed location map showing the areas where drainage sediment and water surveys have been completed by Geoscience BC in central British Columbia since 2005.

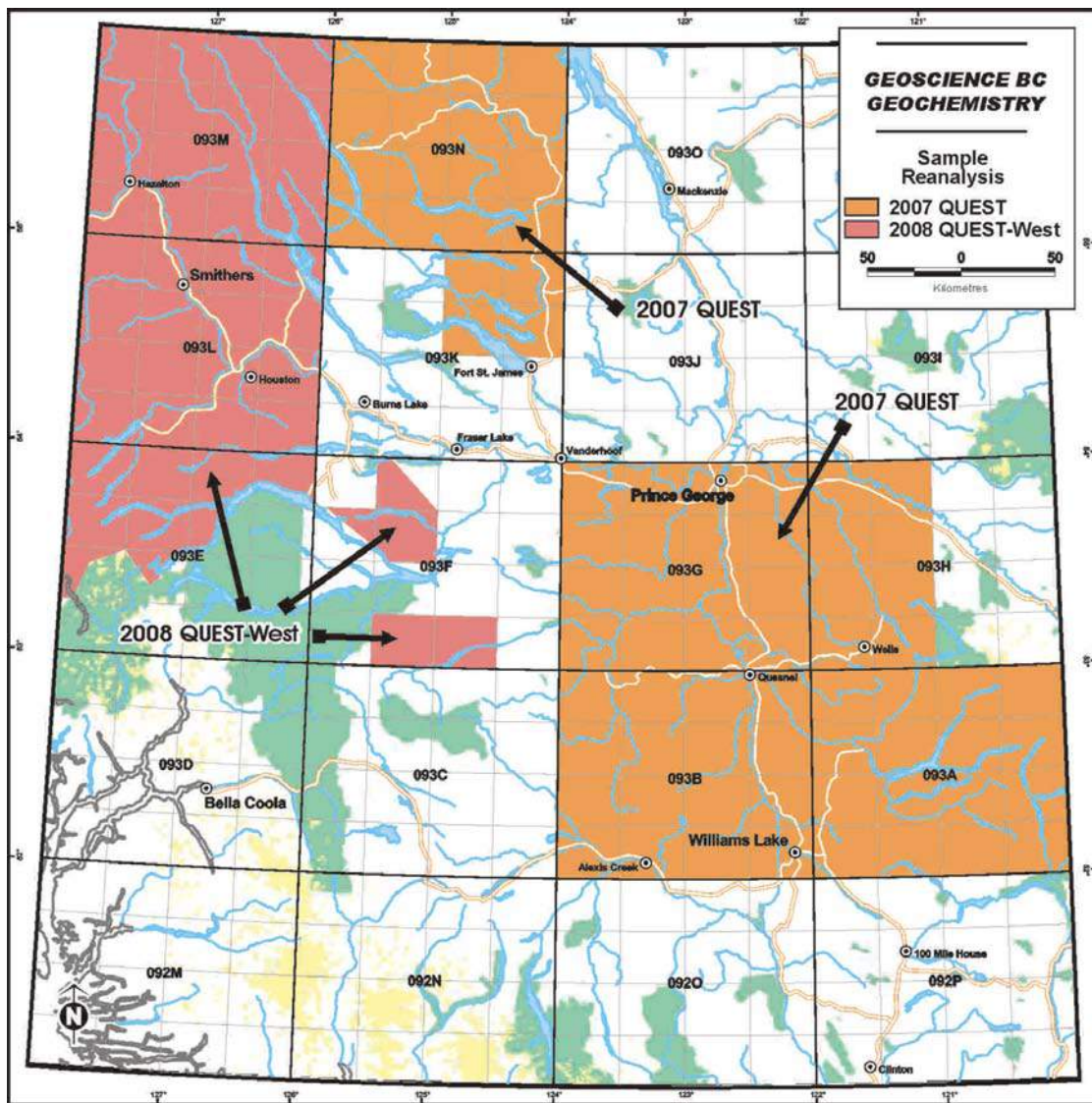


Figure 4. Detailed location map showing the areas of survey sample reanalysis completed by Geoscience BC in central British Columbia since 2005.

Table 1. Drainage sediment geochemical survey areas for work completed in central British Columbia since 1993.

Year	Name	Type	NTS map sheet	Agency	Sites	Samples
1993	Fawnie/Ootsa	Lake survey	093F	BCGS	461	489
1995	Pinchi	Lake survey	093K	BCGS/GSC	413	438
1996	Babine	Lake survey	093L, M	BCGS	332	352
2002	Fort Fraser	Stream survey	093K	BCGS/GSC	795	843
2005	McLeod Lake	Sample reanalysis	093J	BCGS/GSC	1088	1152
2005	Anahim/Nechako	Lake/stream survey	092N, 093C, F	Geoscience BC	1953	2068
2006	Cariboo	Lake survey	092N, O, P, 093A, B	Geoscience BC	1370	1451
2007	QUEST	Lake survey	093G, H, J, N, O	Geoscience BC	2264	2397
2007	Pine Pass	Stream survey	093O	Geoscience BC	854	906
2007	QUEST	Sample reanalysis	093A, B, G, H, K, N	Geoscience BC	5208	5516
2008	Terrace/Prince Rupert	Sample reanalysis	103I, J	Geoscience BC	2128	2253
2008	QUEST-West	Lake/stream survey	093K, L, N	Geoscience BC	952	988
2008	QUEST-West	Sample reanalysis	093E, F, L, M	Geoscience BC	3428	3629

Abbreviations: BCGS, British Columbia Geological Survey; GSC, Geological Survey of Canada

number of new sample sites. In addition, the lake-based work will link a number of lake surveys previously completed in surrounding areas.

Based on standards set by the National Geochemical Reconnaissance (NGR) and BC Regional Geochemical Survey (RGS) programs, helicopter- and truck-supported sample collection was carried out in August and September 2008. A total of 905 lake sediment and water samples and 100 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 km² over the 14 500 km² survey area.

Lake sites were accessed using a float-equipped Bell Jet Ranger helicopter (Figure 5) from Interior Helicopter 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.

At Eco Tech Laboratory Ltd. (Kamloops), dried lake sediment samples were pulverized in a ceramic ring mill to approximately -150 mesh (100 μm) and stream sediment samples were sieved to -80 mesh (177 μm). To monitor and assess accuracy and precision of analytical results, control reference material and analytical duplicate samples were inserted into each block of 20 sediment samples. The sediment samples will be analyzed for base and precious met-

als, pathfinder elements and rare earth elements by inductively coupled plasma mass spectrometry (ICP-MS) and instrumental neutron activation analysis (INAA). Loss-on-ignition and fluorine content will also be determined for sediment material. Fluoride content, conductivity and pH will be determined for the water samples.

Sample Reanalysis

The reanalysis of archived drainage sediment samples by ICP-MS has been found to be a cost-effective means of obtaining new and improved regional geochemical information. The technique provides a significant upgrade from the atomic absorption spectrometry (AAS) method, routinely used for older federal and provincial government-funded geochemical surveys, by making available a wide range of new analytical information at improved detection limits. The work also offers greater data compatibility with laboratory methods currently being employed as well as with other reanalysis initiatives.

Similar to work completed as part of the 2007 QUEST Project, the QUEST-West Project identified a total of 3629 archived survey samples. The samples originated from previous federal government NGR and BC RGS projects. Conducted prior to 1996, the stream- and lake-based surveys covered areas in NTS map sheets 093E, F, L and M (2008 QUEST-West, Figure 4).

Access to government storage facilities located in both Ottawa and Victoria was arranged by GSC and BCGS collection custodians. At the sites, a portion of 1 to 2 g of each archived stream sediment sample was carefully extracted from storage containers (Figure 6). Material from each vial was independently split and transferred to a Ziploc® bag labelled with the sample's original unique identification number. Once secured for shipping, the recovered material was delivered to Acme Analytical Laboratories Ltd. (Van-



Figure 5. Interior Helicopter Ltd.'s helicopter equipped with floats, northern Nechako Plateau, central British Columbia.



Figure 6. Sample recovery at the Geological Survey of Canada sample storage facility in Ottawa.

cover). At the lab, each sample was tested for 37 elements by ICP-MS analysis using an aqua regia digestion.

Project Summary

For the past 30 years, developing and maintaining the provincial drainage sediment geochemical database has been an ongoing task for the GSC and the BCGS. These programs have successfully compiled data for over 65 000 sample sites covering 70% of BC (Lett, 2005). The results of the work are considered an important mineral exploration tool. Surveys have helped stimulate follow-up mineral exploration that is valued in the millions of dollars and has been credited with the discovery of numerous mineral prospects. Recent contributions associated with a number of

Geoscience BC initiatives have also been significant in adding value to this important exploration resource. This is particularly true in BC's central interior where new geochemical data has been collected for close to 17 000 samples at an average sample density of one sample every 8 km². Figures 7 and 8 illustrate the significant improvement made to overall sample coverage since 2005. As a result of these efforts, central BC now has one of the country's most comprehensive collections of drainage sediment geochemical information. Compiled to established standards, released in a timely fashion and presented in usable formats, data from the Geoscience BC projects will make an important contribution in stimulating mineral exploration as well as complement other geoscience research and data mining activities for an area that is considered to have a

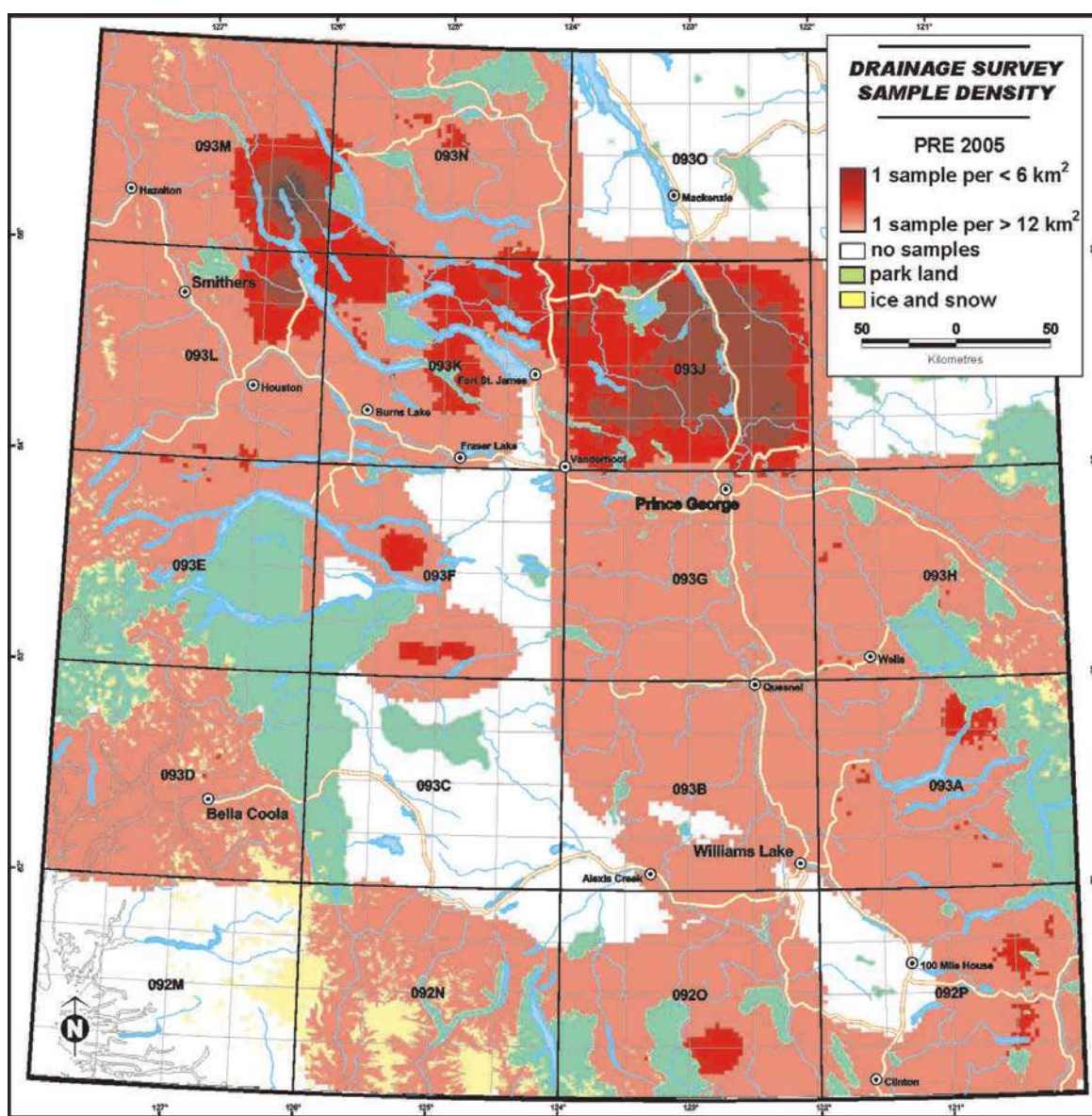


Figure 7. The contour image map shows the overall drainage sediment sample density for central British Columbia prior to 2005.

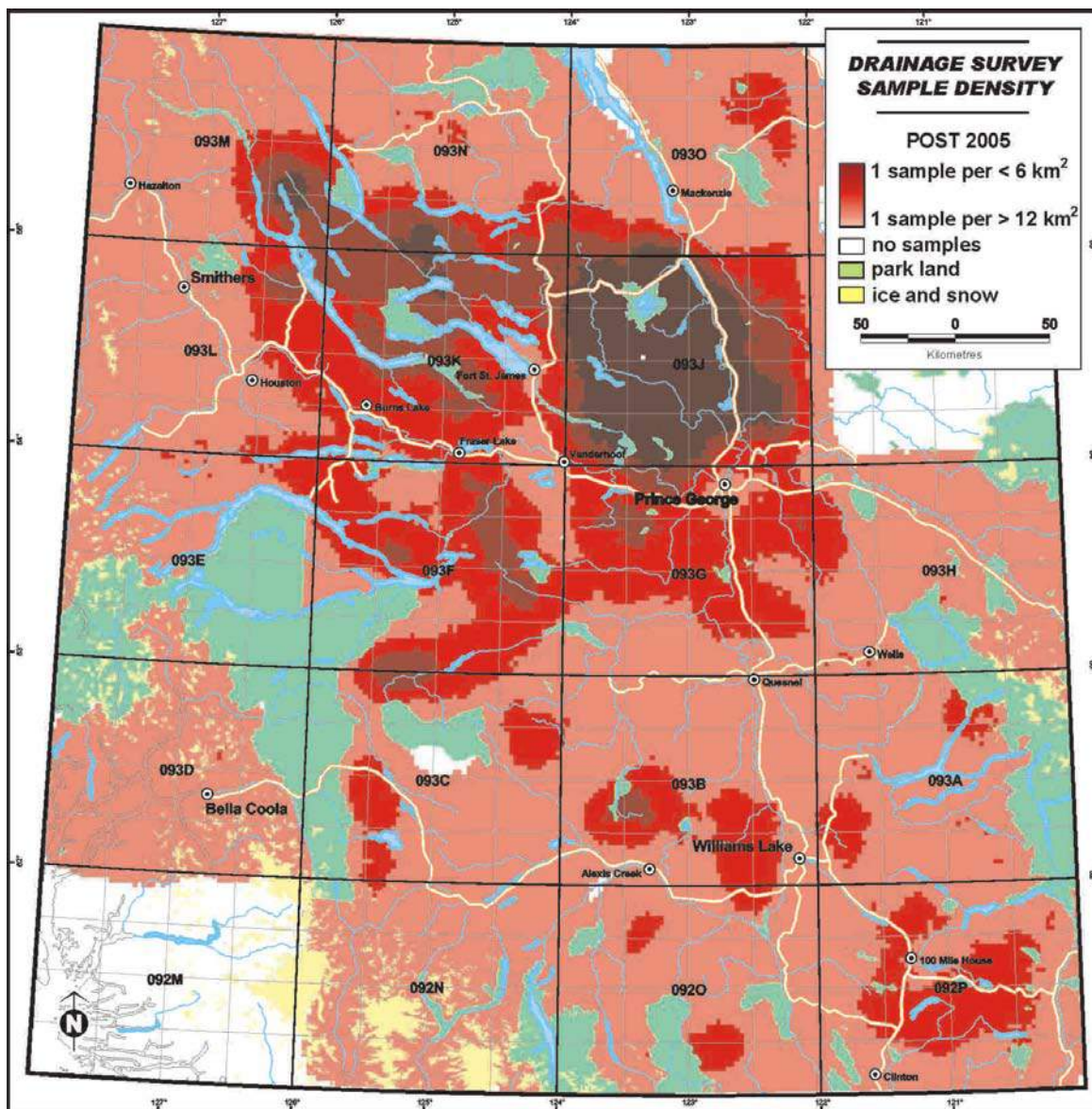


Figure 8. The contour image map shows the significant improvement to overall drainage sediment sample density as a result of new field surveys completed from 2005 to 2008, central British Columbia.

great potential for future discoveries of base- and precious-metal deposits, such as those found at the Endako, Equity Silver, Gibraltar, Huckleberry, Mount Polley, QR and Mount Milligan mining properties.

Acknowledgments

The authors acknowledge P. Friske and M. McCurdy of NRCan and D. Lefebure and R. Lett of the BCGS for their assistance with the reanalysis work; Interior Helicopters Ltd. for their air support; J. Faulkner for his excellent helicopter flying abilities; S. Webb, E.M. Jackaman and E.S. Jackaman for their contributions both on the ground and in the air; the many services located in the communities of Burns Lake, Fraser Lake and Fort St. James. This project was funded by Geoscience BC in partnership with the

Northern Development Initiative Trust and the Regional District of Bulkley-Nechako.

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