Geofile 2007-5

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Contents

This document outlines the contents of Geofile 2007-5, which includes 9 files:

Geofile2007-5MihalynukEtAl.pdf (this document)

Geofile2007-5aMihalynukEtAl.pdf	(Part A -1)	39,942 KB
Geofile2007-5aMihalynukEtAl.map	(Part A -2)	21,267 KB
Geofile2007-5aMihalynukEtAl.grd	(Part A -3)	1,163 KB
Geofile2007-5aMihalynukEtAl.xml	(Part A -4)	2 KB
Geofile2007-5aMihalynukEtAl.prj	(Part A -5)	1 KB
Geofile2007-5bMihalynukEtAl.xls	(Part B -1 to 5)	244 KB
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Geofile 2007-5 Part A

Part A includes five files corresponding with the edited version of a poster presentation publicly released January 2007, at the Mineral Exploration Roundup, in Vancouver, BC.

1. Portable Document File (*Geofile2007-5aMihalynukEtAl.pdf*) containing all information on the poster.
2. Manifold® map file containing all of the information used to create the preliminary thickness model for the Chilcotin Group in NTS092O&P and 093C&B. For more information on the technique used see (Mihalynuk, 2007a) and for implications of the model see the aforementioned plus (Andrews and Russell, 2007; Gordee *et al.*, 2007).
3. Interchange format (ESRI grid file) *Geofile2007-5aMihalynukEtAl.grd* for the preliminary Chilcotin Group thickness model.
4. Projection and location information for the preliminary Chilcotin Group thickness model is contained in *Geofile2007-5aMihalynukEtAl.xml*.
5. Projection information in a format that may be required by non-Manifold GIS products to correctly load *Geofile2007-5aMihalynukEtAl.grd.*

Note: References cited in Part A-1 can be found at the end of this document.

Geofile 2007-5 Part B

Results summarized in the poster (Part A of this Geofile) are only one aspect of a multi-pronged investigation into how geoscientific information can best benefit the areas of British Columbia adversely affected by the Mountain Pine Beetle. Analytical results from other parts of the 2006 program are summarized here in Part B together with annotations (see also (Mihalynuk, 2007b).

Part B of Geofile 2007-5 is a series of data tables presented as sheets within a single Microsoft Excel™ format workbook file (*Geofile2007-5bMihalynukEtAl.xls*) as well as location figures within a Portable Document Format file (*Geofile2007-5bMihalynukEtAl.pdf*).

Data presented in Part B are from samples collected during our reconnaissance survey of the Beetle Infested Zone (BIZ) in 2006. Four data tables are included here.

1. **RGS**
   -combined Inductively Coupled Plasma Mass Spectroscopy (ICP-MS) and Instrumental Neutron Activation Analysis (INAA) data from analysis of stream sediment samples collected from in and around the BIZ. Detection limits, and determinations from standards and blanks are included along with a comparison of analyzed and accepted values for each standard.
2. **Lithogeochem**
   -lithogeochemical data (ICP-MS and INAA) from rock samples collected from in and around the BIZ
3. **CuPrep&Assay**
   -ICP-MS and INAA analytical data from samples prepared using variable grinding times and digestion techniques (for ICP-MS) with the aim of accurate determination of copper content in samples containing native copper.
4. **EskerGeochem**
   -an esker field northwest of Nazko is interpreted as the product of easterly subglacial flow. Heavy mineral samples were collected from four sites, sieved and processed for magnetic separates (see details below). Analysis was by ICP-MS following aqua regia digestion.
5. **Mag Sus**
   -magnetic susceptibility data measured on a variety of lithologies within and around the BIZ. Recorded measurements include the maximum, minimum and mean of readings taken at each station. Typically, ten readings are taken, with the minimum, maximum and mean values recorded. This table contains the magnetic susceptibility data together with the latitude and longitude information of each field collection site.

Notes to accompany tables

List of Figures:

Fig. 1. Regional distribution of RGS samples collected as part of this study.
Fig. 2. Location of RGS samples collected as part of this study and contoured Au results (using data reported by Matysek et al., 1992) from the Riske Creek area.

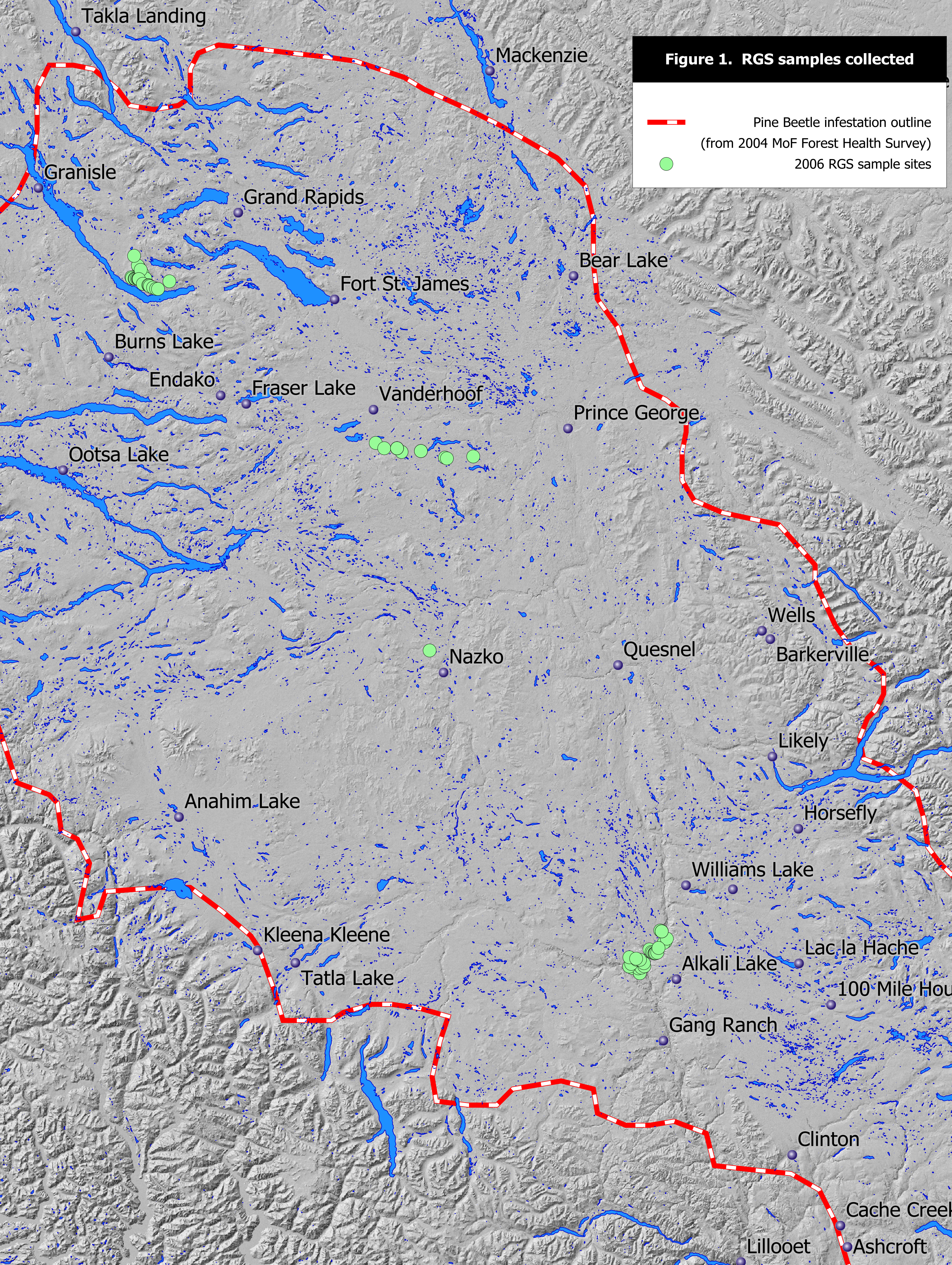
Figure 1. RGS samples collected
Pine Beetle infestation outline
(from 2004 MoF Forest Health Survey)
2006 RGS sample sites
Takla Landing
Mackenzie
Granisle
Grand Rapids
Bear Lake
Fort St. James
Burns Lake
Endako
Fraser Lake
Vanderhoof
Prince George
Ootsa Lake
Wells
Barkerville
Nazko
Quesnel
Likely
Anahim Lake
Horsefly
Williams Lake
Kleena Kleene
Tatla Lake
Lac la Hache
Alkali Lake
Gang Ranch
Clinton
Lillooet
Ashcroft

Fig. 3. Location of RGS samples collected as part of this study and contoured Cu*P results from the Babine Lake area (using data reported by Friske et al., 2003).

Fig. 4. RGS sample locations and U results from between Prince George and Vanderhoof (BCMEMPR-GSC, 1985).

RGS

Stream sediment collection was by standard techniques e.g. (Lett and Jackaman, 2004). However, sample collection from dry stream beds was necessary at many sites, especially in the Riske Creek area (Fig. 1).

Riske Creek area

RGS samples previously collected in the Riske Creek area and reanalyzed (Matysek *et al.*, 1992) revealed elevated metal and indicator elements. With respect to ~50,000 other samples collected province-wide, the results are: arsenic (80th percentile), copper (94th percentile), zinc (96th percentile), mercury (99th percentile), and gold (>99th percentile, sample 92O795414; Fig. 2). Unfortunately, we were not able to duplicate these results, but one sample did return elevated levels of multiple elements. In addition, we discovered mineralized boulders within till down-ice of the RGS sample site see (Mihalynuk and Harker, 2007) for details.

Babine Lake

RGS sample collection in the Babine Lake area as part of this study focused on an area of coincident elevated copper and phosphorous; a signature of alkaline copper-gold porphyry environments. Samples were taken from the upstream side of culverts along logging roads north of eastern Babine Lake (Fig. 3). Where possible, samples collected along roads were from beyond the dust plume zone and outside of areas of logging disturbance. Samples were collected both from creeks sampled as part of the previous RGS survey (Friske *et al.*, 2003), as well as other streams. Results of our RGS sampling are comparable with those of the 2003 survey (see also *Lithogeochem* below).

Vanderhoof area

We were drawn to the area adjacent and south of the highway between Prince George and Vanderhoof because of elevated RGS geochemical results, especially gold, mercury, and uranium (Fig. 4). Our rationale was that enrichments of uranium, which is mobile in a near-surface, oxidizing environment, could point to buried intrusions. Since U is enriched in evolved and alkaline intrusions, elevated RGS values could point to the suite of plutons which include the host to the Endako molybdenum deposit, or Cu-Au porphyry deposits. We confirmed the existence of a source of elevated Cu-Au-U in boulders within glacial till (see *Lithogeochem* below).

Analysis of samples containing native copper

Accurate determination of copper content in samples containing native copper is a problem reported at several porphyry copper (±Au, Ag, Mo) deposits in the province. Copper porphyry deposits that contain a supergene zone with native (elemental) copper are a principal exploration target within the BIZ. Accurate determination of copper grades in the near surface environment may be particularly important to early evaluation of copper porphyry deposits.

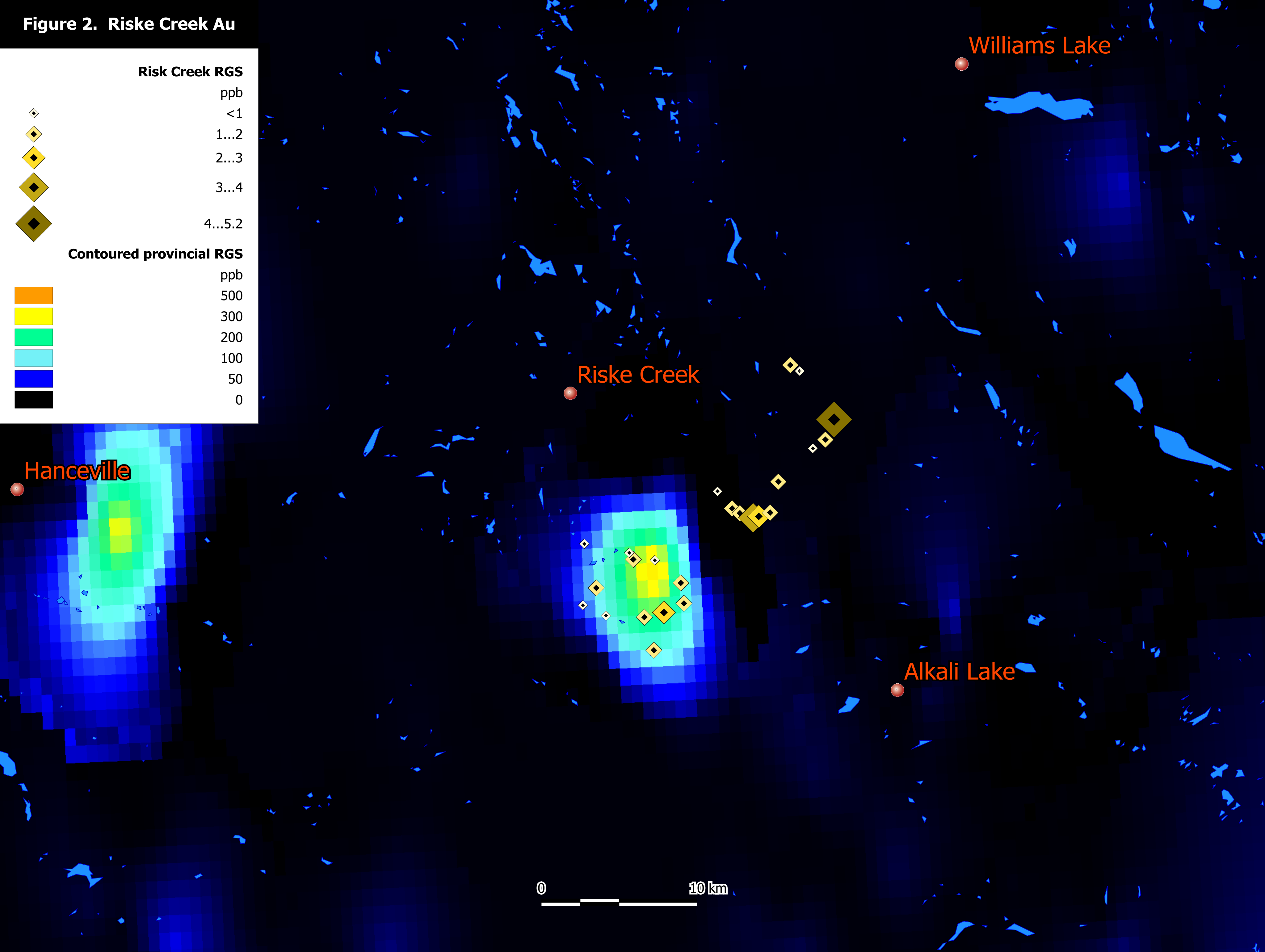
Figure 2. Riske Creek Au
Risk Creek RGS
ppb
<1
1...2
2...3
3...4
4...5.2
Contoured provincial RGS
ppb
500
300
200
100
50
0
Williams Lake
Riske Creek
Hanceville
Alkali Lake
0
10 km

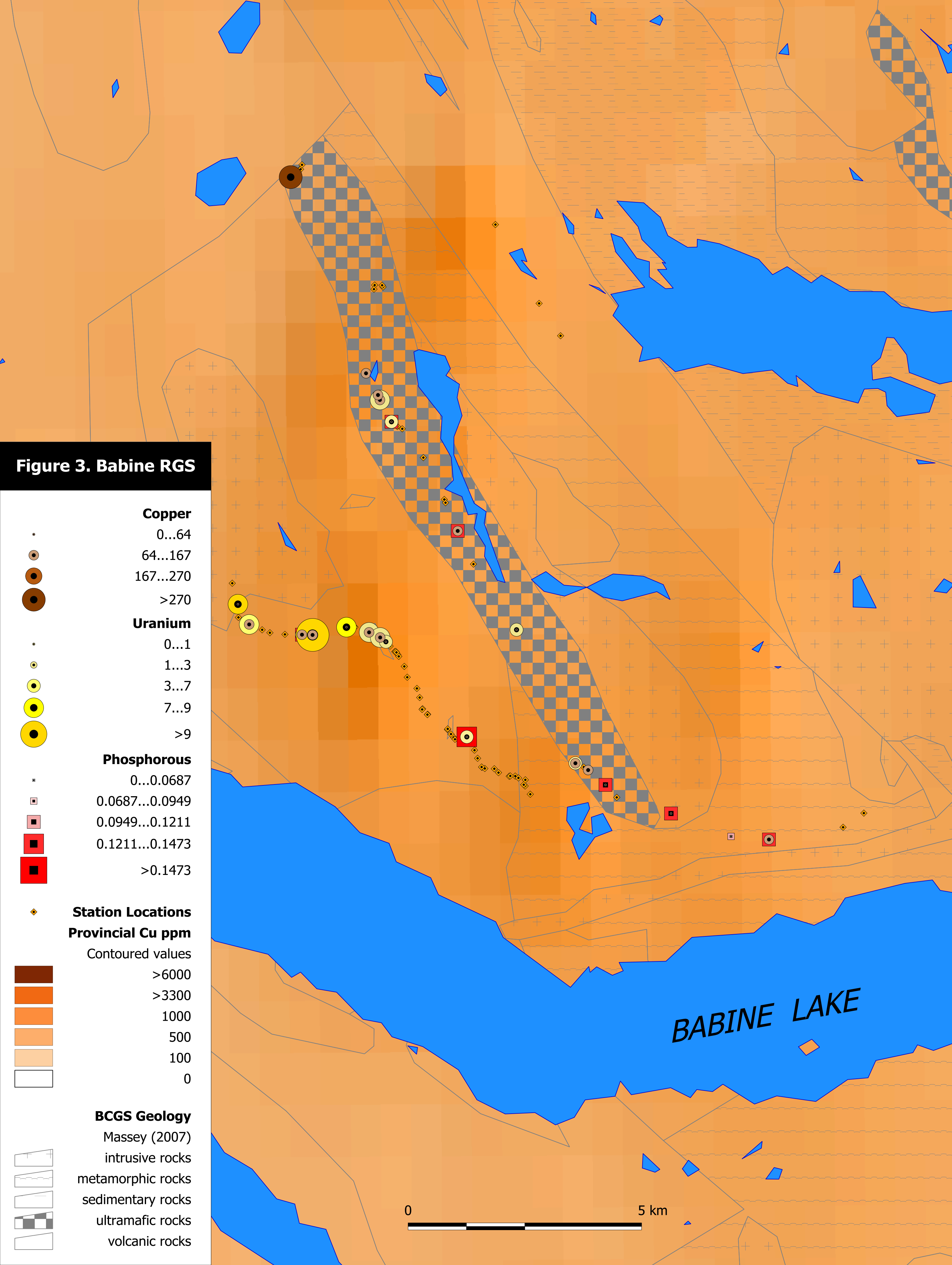
Figure 3. Babine RGS
Copper
0...64
64...167
167...270
>270
Uranium
0...1
1...3
3...7
7...9
>9
Phosphorous
0...0.0687
0.0687...0.0949
0.0949...0.1211
0.1211...0.1473
>0.1473
Station Locations
Provincial Cu ppm
Contoured values
>6000
>3300
1000
500
100
0
BCGS Geology
Massey (2007)
intrusive rocks
metamorphic rocks
sedimentary rocks
ultramafic rocks
volcanic rocks
BABINE LAKE
0
5 km

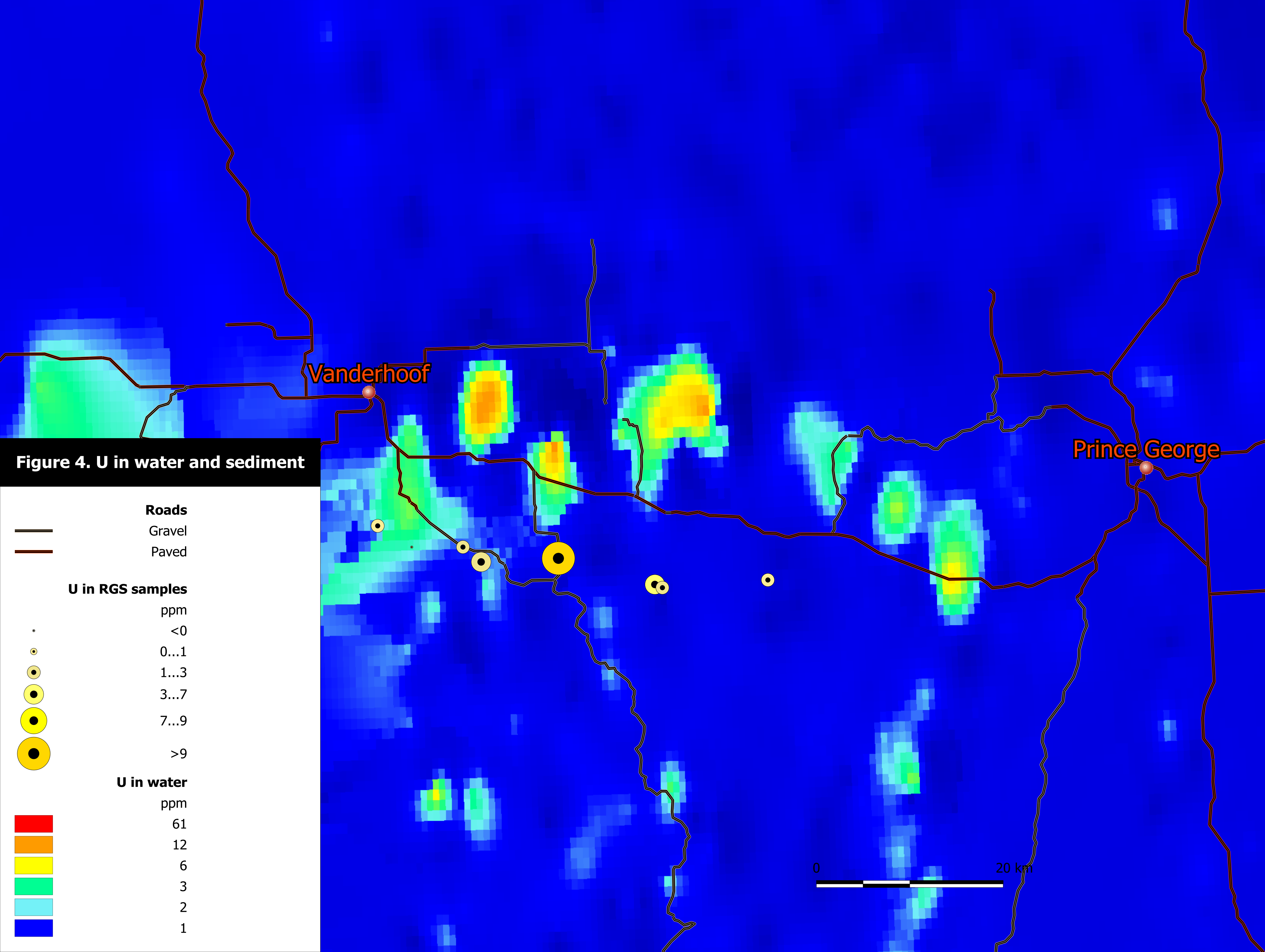

Figure 4. U in water and sediment
Roads
Gravel
Paved
U in RGS samples
ppm
<0
0...1
1...3
3...7
7...9
>9
U in water
ppm
61
12
6
3
2
1
Vanderhoof
Prince George
0
20 km

Data presented here that bear on this problem are part of an on-going study under the direction of Ray Lett. These data show that neither grinding time nor the choice of conventional digestion technique result in significant variation in the analytically determined copper values reported. Yet such values can be an order of magnitude less than values determined by visual estimation of the amount of leaf or wire copper seen on broken rock surfaces. Our preliminary investigation into using image analysis to estimate the native copper content on CUT rock surfaces suggest that observations of the broken rock surfaces tend to OVER-estimate the copper content because the rocks are susceptible to braking along pre-existing fractures that tend to also be the site of native copper deposition. Nevertheless, further investigation into the use of other sample digestion techniques is warranted.

Lithogeochemistry

Rock samples were collected for analysis wherever ore-forming minerals were identified or suspected. Both bedrock and glacial boulders are represented in the data table. An example of each is highlighted here:

Babine Lake

Analysis samples from new mineral occurrences in the Babine Lake area included 9 of the 10 most elevated Cu analyses obtained during the 2006 project season (004 – 0.4 % Cu; except for one sample collected near Vanderhoof – see next section). Included in these 9 samples is the one with the highest copper content analyzed (0.4%), which is from a metamorphosed mafic arc unit. Mineralization is focused in tensional quartz-orthoclase-chalcopyrite veins (up to 3 cm thick) and along foliation surfaces (Photo 1). Protoliths for most of the metamorphic section are coarsely augite-porphyritic flows; but the best mineralization is from a unit that contains a higher proportion of tabular feldspar than is typical, and could have a hypabyssal intrusion protolith.

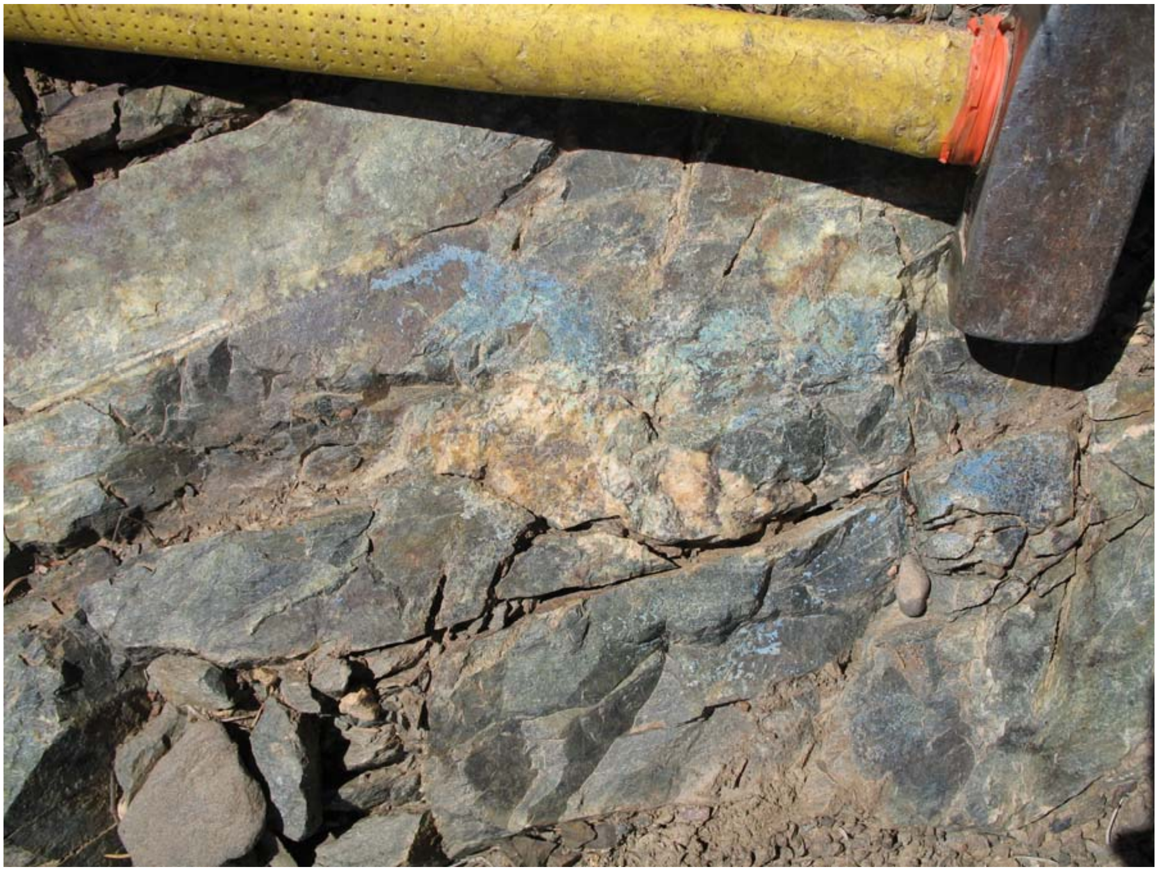

Photo 1. Mineralization in the mafic arc succession near Babine Lake. A new mineral occurrence from which a grab sample returned 0.4% Cu (MMI06-8-7).

Vanderhoof

In this area of sparse outcrops we focused on boulders within glacial deposits as an indicator of bedrock. In one logging clear-cut we encountered sparse boulders of quartz-eye porphyry (Photo 2). One boulder contained finely disseminated sulphides as well as epidote-chalcopyrite (>pyrite) veinlets. Propylitic ateration minerals were well developed within the porphyry boulder. Distinctive, dark grey quartz eyes comprised about 10% of the porphyry which was too altered to permit visual identification of feldspars. A sample of the boulder was taken and analyzed (MMI06-22-6), and revealed the highest Au, Ag and U contents of any samples collected by the project team in 2006 (Au: 185 ppb – ICP-MS; Ag: 2300 ppb ICP-MS; and U: 13.3 ppm INAA / 3.8 ppm ICP-MS). In addition, analysis returned 0.1% Cu (ICP-MS).

Photo 2. Drift prospecting near Vanderhoof, site of quartz-eye porphyry boulders with elevated Au, Ag and U (MMI06-22-6).

Esker (heavy mineral geochemistry)

We collected 19 samples from four sites within the esker complex along lower Baesaeko River valley. These eskers are interpreted to have been constructed beneath an ice mass that flowed out of the west. Today, part of this area is within the Kluskoil Lake Park, and includes drainages from which RGS samples were collected. Analyses of the RGS samples show several instances of elevated copper and gold contents.

Sample Collection

Sample sites were selected near, but not on, the esker tops. Game trails were avoided. Five pits spaced ~5m apart were dug along the esker at each site (Photo 3; except for site MMI06-18-6, which comprises 4 pits). Each pit was dug to a depth of between 0.5 and 1.0 m. Material from the bottom of each pit was processed by sieving to less than 2mm (Photo 4), until approximately 2 kg of sieved material was obtained. The five samples from each site were combined into two large sample bags (double thickness) labeled inside and out, and sealed with tamper-proof closures (Photo 5). All but a representative collection of the coarse fraction (~1 kg) was discarded. Pits were back-filled, and both soil and vegetation were replaced.

Photo 3. (above) Sampling esker material off of the esker axis. A composite sample is collected from the bottom of the pits. Note dead and dying pine trees.

Photo 4. (left) Material screened at the site to -2mm.

Photo 5. Approximately 2kg of dry sieved sample from the bottom of each of the five pits are combined, stirred and poured into tamper-proofed bags. These are reinforced by placing them into a second bag. The two doubly-bagged parts of the sample are placed into clean plastic buckets, which are capped and taped for shipping.

Magnetic Separation

Samples were shipped to the BC Geological Survey Branch laboratory facility where they were dried and sieved to produce 3 size fractions: <0.5 mm, 0.5-1.0 mm and >1.0 mm. The 0.5 – 1.0 mm size (35 and 18 mesh) fraction was passed through the Carpco magnetic separator. Operating conditions were 0.5 Amps and 60 rpm. Magnetic, paramagnetic and non-magnetic fractions were collected and sent to Acme Analytical laboratories for multi-element determination by ICP-MS.

Results

None of the samples revealed notably elevated metal contents in the magnetic, paramagnetic or non-magnetic fractions. Elemental abundances are comparable from all fractions with the exception of iron, which is elevated in the magnetic fraction, as expected.

Two of the samples were processed to concentrate the heavy fraction in a Morfee spiral concentrator. Gold flakes were found in both of the samples thus processed. Approximately 2 ml of heavy concentrate from samples MMI06-19-1 and MMI06-19-2 were examined under a microscope and 25 gold grains were picked from each. These range between 0.1 and 0.5 mm, and are subequant to hackly. They are typically deep brassy coloured to iron-oxide-stained, but one elongate grain is silvery butter-coloured, and is probably electrum. About 10 % of the flakes were tested for malleability by piercing them with pointed tweezers.

Given the mundane analytical Au RGS results (Table "*Esker*"), the abundance of gold flakes is surprising and points to a significant "nugget effect".

Provincial contoured RGS: Au, Mo, Th, U, U_W

We used provincial-scale, contoured Regional Stream Sediment (RGS) data to help focus our reconnaissance field investigations in 2006. We present these very preliminary compilations here on an "as-is" basis. Error-checking for data integrity has been minimally applied. Data-leveling by simple statistical standardization has been applied only to the Mo plot, and this has been done primarily to integrate lake sediment analyses with the RGS data set. Nevertheless, persons attempting to focus exploration efforts in the vastness of the Interior Plateau will find them helpful, and for this reason they are included here. Please be mindful of the limitations and potential aberrations of these preliminary plots.

Contoured surfaces were generated by standard kridging technique using a 0.01 to 0.05 degree cell (Lat/Long) and 10 nearest neighbours. Results are presented in both Portable Document (*Geofile2007-5bMihalynukEtAl.pdf*) and Manifold (*Geofile2007-5bMihalynukEtAl.map*) formats. On-going work by Lett et al. at the BC Geological Survey Branch will produce similar plots for all elements analyzed as part of the RGS programs.

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