

Anomalous RGS Survey Results West of Dease Lake - New Massive Sulphide Targets

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KEYWORDS: *Geochemical survey, silt sample, RGS, volcanogenic massive sulphide, porphyry, intrusion-related gold, Dease Lake.*

INTRODUCTION

The first government regional geochemical survey (RGS) data for the Dease Lake map sheet (104J) in north-western British Columbia (Figure 1) was released on July 5th, 2001. Stream sediment samples were analysed for more than 40 elements, including precious and base metals (Jackaman and Friske, 2001; Jackaman *et al.*, 2002). The survey results include samples with anomalously high values in drainages with no known mineral occurrences. Some of these anomalous values are for elements that are characteristic of polymetallic volcanogenic massive sulphide (VMS), copper-gold porphyry, and intrusive-related gold deposits. The VMS potential of the region is particularly interesting given the number of zinc, copper and barium anomalies associated with a package of poorly known volcanic rocks that includes ferruginous cherts. There are also samples with intriguing, multi-element anomalies, including high tantalum values that are underlain by Level Mountain volcanics, an area that has been generally discounted for its mineral values.

For this preliminary evaluation of the RGS data it was decided to identify only the most highly anomalous element values. Therefore, only samples with an element of interest whose value exceeded the 90th percentile for the 104J data set were used and are shown on the plots in this article. These anomalous samples were assigned scores from a low of 1 to a high of 4 if they exceeded the 90th, 95th, 98th or 99th percentile respectively. Different combinations of indicator elements were chosen to target different styles of mineralization as shown in Table 1.

VOLCANOGENIC MASSIVE SULPHIDE TARGETS

A broad zone of coincident zinc, copper and barium anomalies with associated silver, antimony, selenium and cadmium values extends from Killarney Lake to north of Nuthinaw Mountain in the northeast corner of the Dease Lake map area (Figure 2). Many of the zinc values exceed 145 ppm and are higher than the 90th percentile value of 135 ppm for all 46,591 British Columbia RGS samples. Thirty-six sites from the 104J RGS survey exceed the 95th percentile for zinc values for the province.

TABLE 1
INDICATOR ELEMENTS USED TO IDENTIFY PROSPECTIVE AREAS FOR MINERALIZATION

Main Elements	Subsidiary Elements	Target Mineralization Type
Cu, Zn	Ba, Se	volcanogenic massive sulphide
Au, Cu		porphyry copper-gold
Au, Bi, As	Mo, W	intrusive-related gold
La, Ta, Zn		rare metals
Au, Ag, As, Sb, Hg		epithermal veins
Cr, Ni		ultramafic-related

These anomalies are found in silts from streams draining little known volcanic rocks of the Cache Creek Terrane, including areas with exposures of the mid-Permian French Range Formation (Gabrielse, 1994, 1998). This formation consists primarily of basaltic volcanic rocks, including pillowed sections, with associated argillite and chert. The presence of pillows and sedimentary rocks show that the French Range Formation was deposited in a largely submarine environment.

The French Range was the subject of a preliminary investigation by the British Columbia Geological Survey in

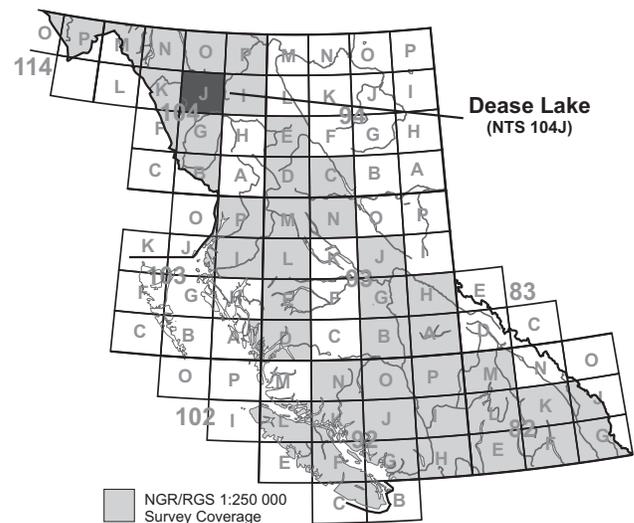


Figure 1. Index map showing the location of the Dease Lake (NTS 104J) map area.

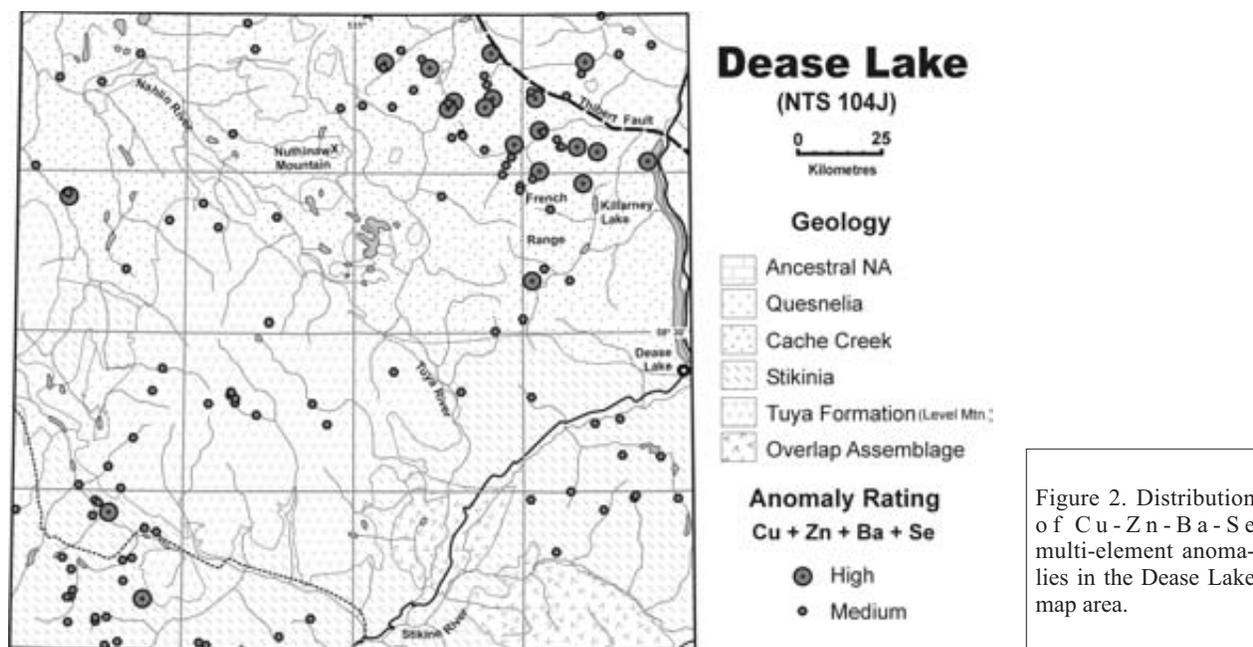


Figure 2. Distribution of Cu - Zn - Ba - Se multi-element anomalies in the Dease Lake map area.

the late 1990s (Mihalynuk and Cordey, 1997). In all, two weeks of 1:50 000 scale mapping were completed during the summers of 1996, 1999 and 2000 to examine the area's potential for the presence of volcanic stratigraphy equivalent to the rocks that host Kutcho Creek deposit (Minfile 104I060). The mapping identified for the first time a felsic volcanic unit and bright red ferruginous cherts, both features associated with some VMS deposits. Recent dating has shown that the Kutcho felsic volcanic rocks at 242 to 246 Ma (Childe and Thompson, 1997) are younger than the only dated volcanic unit from the French Range Formation, which is a felsic tuff that yielded a 263 Ma age (Mihalynuk *et al.*, 1999). Therefore, there is no evidence yet of a temporal correlation between the French Range Formation and Kutcho Creek volcanic rocks, although both may be relics of the same intraoceanic arc.

At present, most of the Dease Lake map area has only been covered at 1:250 000 scale (Gabrielse, 1998). Given the lack of detailed geological mapping and the presence of rocks at least as young as Lower Jurassic along strike to the northeast in the Cache Creek terrane (Cordey *et al.*, 1991); there is potential south of the Thibert Fault (Figure 2) for Mesozoic volcanic sequences correlative with packages that are known to host VMS deposits. For example, stratigraphy that is age-equivalent to the rocks that host the precious metal-rich Eskay Creek deposit may occur in the area. Several anomalous RGS samples from areas underlain by Cache Creek rocks just south of the Thibert Fault warrant mention as possible indicators of precious metal-rich VMS deposits. Site 1167 just northwest of Vowell Mtn. contains 17 ppb Au (> 90th %tile) and 544 ppb Ag (< 99th %tile) plus significant Cu, Zn, Ba, Se, As and Sb (*see* Jackaman and Friske, 2001 for location of specific sample sites). Sample 1172, at the headwaters of Mosquito Creek northeast of Vowell Mtn, has the highest selenium value (13.4 ppm) encountered during the survey and also contains 2598 ppb Ag. Two other samples, 1152 and 1170, contain elevated gold

(250 and 96 ppb), arsenic, antimony, barium and selenium values. Repeat analyses of these samples for gold returned values of 606 and 5 and 8 and 259 ppb Au respectively which suggests a possible nugget effect. The area south of the Thibert Fault has anomalous values for a suite of elements characteristic of epithermal deposits (Au-Ag-As-Sb-Hg, Figure 3) that could be due to Eskay Creek or subaqueous hot spring-type mineralization. Eskay Creek is well known for its high values of contained arsenic, antimony and mercury, as well as gold and silver (Roth *et al.*, 1999).

COPPER±GOLD PORPHYRY POTENTIAL

The porphyry potential of the ancient island arcs of this part of the Cordillera is well known. The prospective Stikine and Quesnelia terranes occur in the southern half and north-east corners of the map sheet respectively (Figure 3). These terranes host many of the larger porphyry copper (± gold) deposits in the province, such as Galore Creek, Shaft Creek, Kemess, Bell, Mount Polley and Highland Valley (McMillan *et al.*, 1995).

A number of RGS samples with copper-gold anomalies were collected from parts of the Dease Lake map area that are underlain by the Stikine Terrane. The most anomalous area is along the Hackett River near its junction with the Shesley River and east of Kaketsa Mountain. The anomalous drainages extend nearly 15 kilometres east-southeast along the Hackett River valley almost to Kennicott Lake. The anomalous RGS values are close to a number of copper and gold prospects that are related to the differentiated granite of the Triassic Kaketsa stock and related outlying intrusions.

Another set of RGS copper-gold anomalies within the Stikine Terrane are located south of the Hackett River valley (Figure 4). They are near Triassic intrusions (Gabrielse,

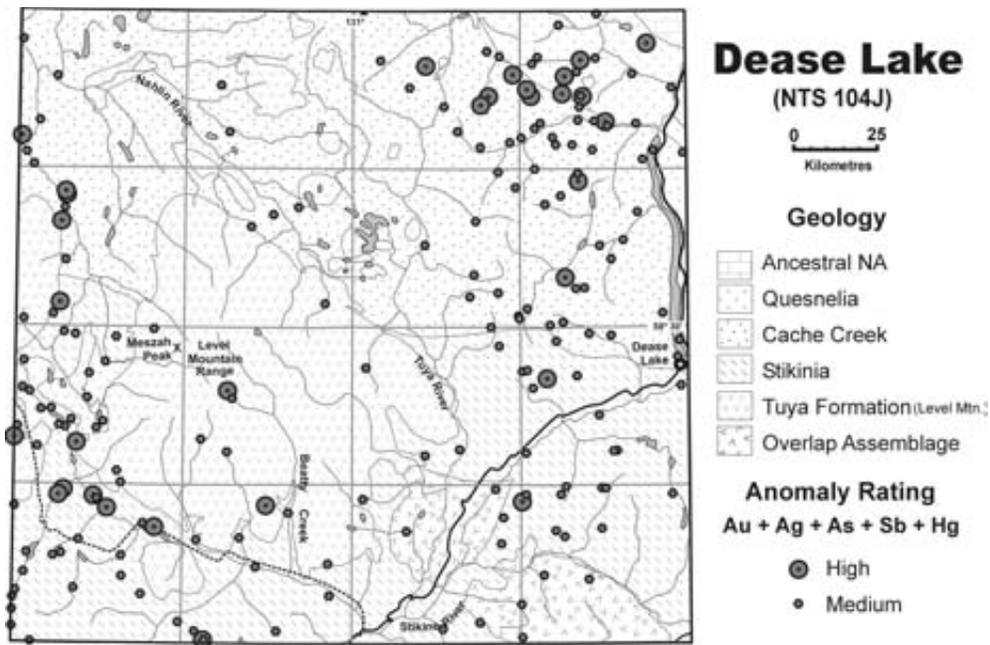


Figure 3. Distribution of Au - Ag - As - Sb - Hg multi-element anomalies in the Dease Lake map area.

1998), but there is no known mineralization in the drainage basins sampled. These anomalies warrant consideration as possible indicators of porphyry-style mineralization. As well, there are a number of unexplained copper-gold anomalies in the Stikine Terrane in the southeast corner of the Dease Lake map sheet in the Hotailuh Range (Figure 4).

Only a small portion of the Quesnel Terrane underlies the Dease Lake map area. Known porphyry mineralization occurs within and near Mesozoic intrusions on Slough Mountain; it is associated with the several Cu-Au RGS anomalies. Another Cu-Au anomaly is near Northwest Mountain and the Anki copper showing (Minfile 104J048).

INTRUSIVE-RELATED GOLD POTENTIAL RELATED TO CRETACEOUS STOCKS

Moderately anomalous gold values (up to 47 ppb) together with elevated molybdenum, tungsten and bismuth occur in drainages around the Cretaceous Snow Peak pluton (Figure 5). These are well known geochemical indicators of plutonic-related gold systems, like the Fort Knox mine in Alaska (Logan *et al.*, 2000), associated with differentiated Cretaceous granitic rocks. The Mack (Minfile 104J014) is the only showing hosted by the Snow Peak Pluton. It consists of molybdenite and/or pyrite quartz stringers in slightly porphyritic granodiorite. Surface samples from a trench and

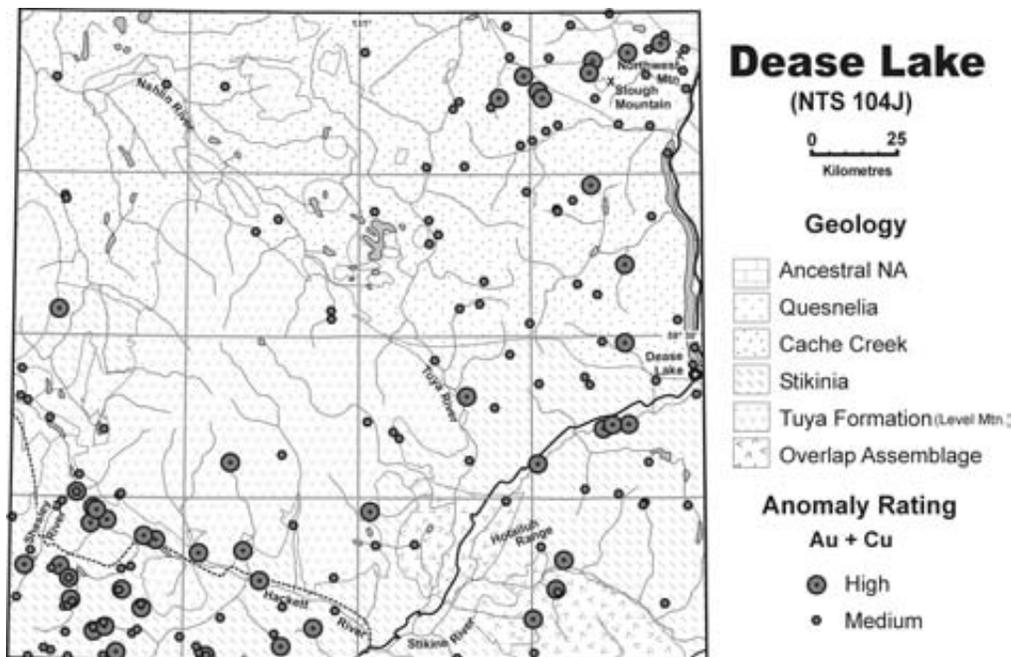


Figure 4. Distribution of Au-Cu multi-element anomalies in the Dease Lake map area.

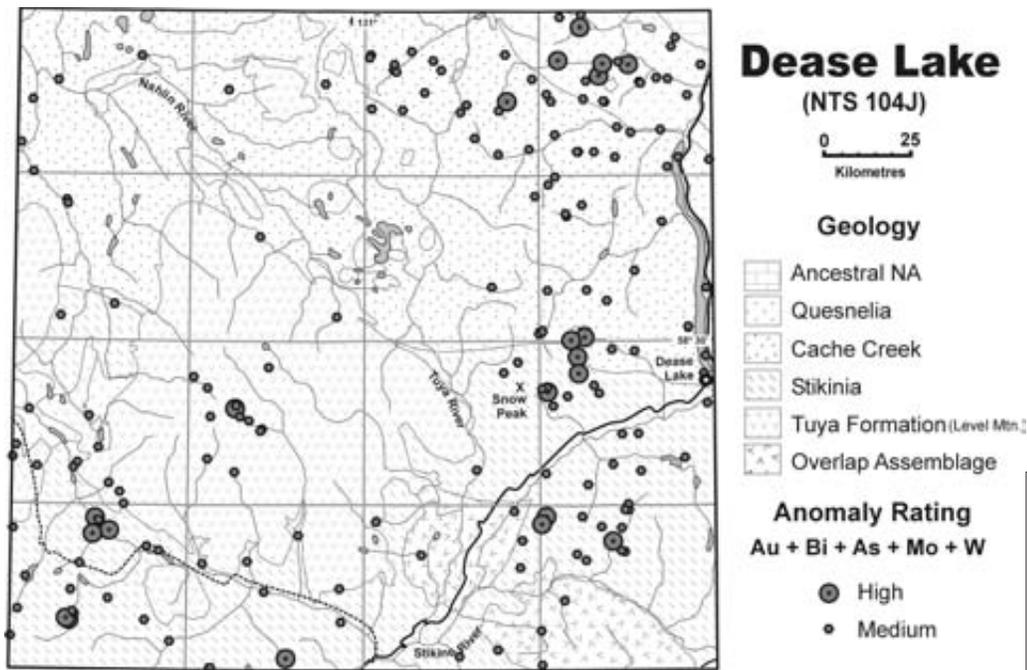


Figure 5. Distribution of Au - Bi - As - Mo - W multi-element anomalies in the Dease Lake map area.

pits yielded up to 0.13% molybdenum, 0.39 % WO₃ and 1.6 grams per tonne gold (Sadler-Brown and Nevin, 1976).

ANOMALIES AT LEVEL MOUNTAIN RANGE

Highly anomalous levels of zinc, tantalum (values up to 10 ppm) and lanthanum with elevated values of tungsten, cadmium and lead are found in RGS samples from the Level Mountain Range (Figure 6). The Level Mountain Complex is a bimodal assemblage of Miocene to Pleistocene alkaline volcanic rocks. Given the cospatial extent of the drainage basins sampled and the Level Mountain Complex, it appears

that these alkaline rocks have high Zn, W, Cd and La background values in contrast with rock types in the map area. There are no previous reports of high Ta values in this area; however, minerals containing tantalum are known to be associated with more differentiated alkaline rocks.

The area southeast of Meszah Peak has attracted some exploration interest because there is a large colour anomaly along the main ridges due to alteration of the highly peralkaline extrusive Level Mountain Complex. The alteration zones are associated with iron- and manganese-stained, weakly brecciated, silicified and kaolinized rhyolites and trachytes (Daly, 1983). There is only one documented showing hosted by Level Mountain rocks, the

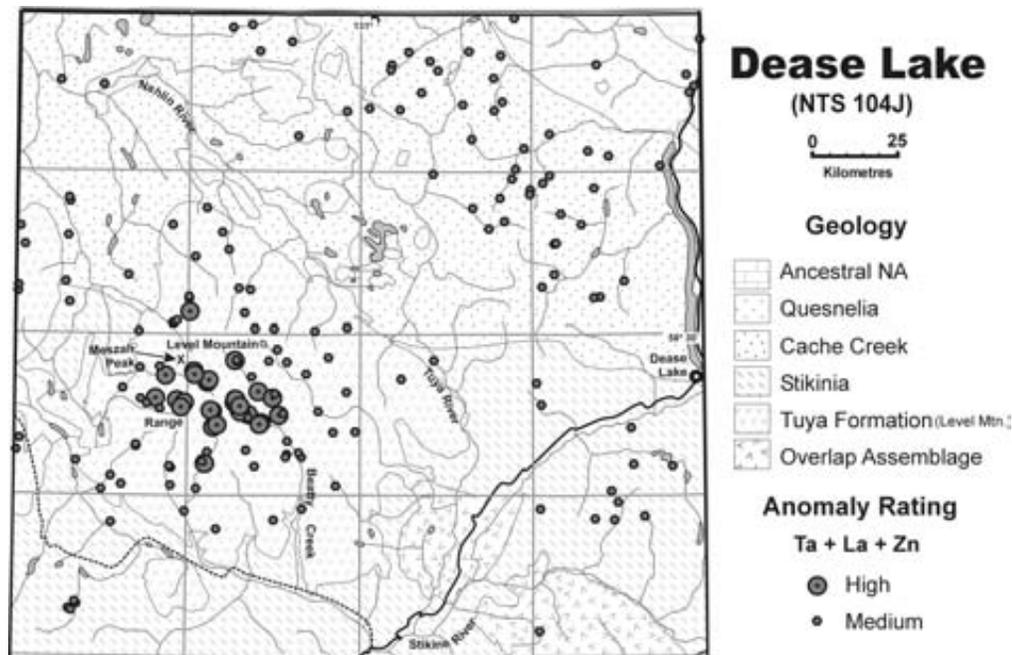


Figure 6. Distribution of La-Ta-Zn multi-element anomalies in the Dease Lake map area.

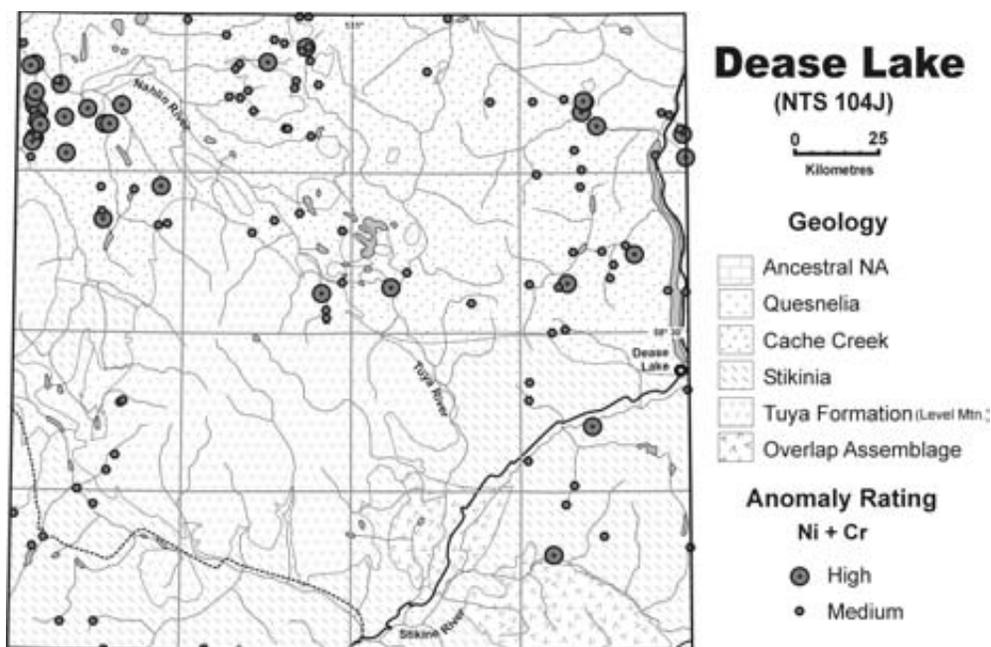


Figure 7. Distribution of Cr-Ni multi-element anomalies in the Dease Lake map area.

Golden Shower Hg occurrence (104J062), which is associated with the colour anomaly. Daley (1983) reports lithogeochemical values of up to 6000 ppb mercury in a brecciated, weakly silicified, limonitic-stained felsite. Many of the 9 stream sediment samples in the same valley, the northern tributary for Beatty Creek, have elevated antimony, mercury and arsenic values. These elements can be indicators of epithermal mineralization which is consistent with the alteration style and geological setting. Unfortunately silver values are only slightly above background and gold contents are not anomalous. When compared to other anomalous RGS samples for Au-Ag-As-Sb-Hg values in the Dease Lake map area (Figure 3), Beatty Creek does not appear to be particularly significant.

NAHLIN RIVER CHROMIUM AND NICKEL ANOMALIES

There are a number of silt samples with anomalous chromium and nickel values from tributaries along the Nahlin River along the northwest edge of the Dease Lake map area (Figure 7). These creeks are draining basins with exposures of the Nahlin ultramafic bodies that may have potential for platinum group elements. Unfortunately there was no sampling for PGEs in the survey.

SUMMARY

The recent release of RGS results for the Dease Lake map area reveal drainage basin areas containing sediment with anomalously high contents of a variety of elements. Elemental suites can be chosen to identify prospective areas for different styles of mineralization. In some areas no mineralization has been reported, and the RGS anomalies remain unexplained. The most interesting exploration targets are:

- volcanogenic massive sulphide deposits in the Cache Creek rocks;
- copper-gold porphyry deposits in the Stikine and Quesnel terranes;
- intrusive-related gold near granitic Cretaceous stocks; and
- an unexplained RGS anomaly with elevated As, Sb and Hg values in the Level Mountain Range.

Anomalously high values of Zn, Ta, La and several other elements are associated with the Level Mountain Complex alkaline volcanic rocks.

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