Reconnaissance Biogeochemical Survey using Spruce Tops in the West Road (Blackwater) River Area, Fraser Plateau, Central British Columbia (parts of NTS 093C/14, /15, 093F/02, /03)

W. Jackaman, Noble Exploration Services Ltd., Jordan River, BC, wjackaman@shaw.ca

D.A. Sacco, Palmer Environmental Consulting Group Inc., Vancouver, BC

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Introduction

The fundamental objective of the TREK project is to promote mineral exploration in underexplored parts of the Interior Plateau, British Columbia. This is accomplished through the production of high-quality integrated geoscience data that can be used to advance the understanding of the economic geology in a region with potential to host porphyry copper, porphyry molybdenum and epithermal gold deposits. Historically, exploration activities within the region have been hindered by Neogene Chilcotin Group basalt flows and extensive glacial drift that obscure the underlying, and potentially prospective, bedrock units. To address these difficulties, the TREK project combines information from ground geochemical, airborne geophysical, and geological initiatives to provide a foundation for more advanced resource development in this important region (Clifford and Hart, 2014).

The surficial geochemistry component of the TREK project began in 2013 and includes a collection of 1233 subglacial till samples and 281 lake sediment samples. In addition, 1711 archived till samples have been reanalyzed and geochemical data from previous geochemical surveys have been compiled. This has resulted in one of the highest quality and most comprehensive geochemical datasets available (Jackaman et al., 2015a; Sacco and Jackaman, 2015). Although a total of more than 4500 geochemical samples for geochemical analysis have been collected from lake- and stream-sediment, water, till and biological media in the region since the 1990s, several key tracts of prospective ground still have limited or no geochemical coverage. This lack of data is largely due to thick vegetation cover, few lakes and limited road networks (Figure 1), which significantly limits the types of survey techniques that can be applied. To address this problem, a helicopter-supported, spruce-top twig-and-needle survey was conducted in a selected area to generate geochemical information to assist in locating hidden mineralization.

Figure 1. Biogeochemical survey area, Fraser Plateau, British Columbia.

Biogeochemical Survey Area

The 2015 biogeochemical survey area is located 40 km north of Anahim Lake within the Fraser Plateau and extends north from the Itcha and Ilgachuz mountain ranges to the West Road (Blackwater) River Basin (Figure 2). This area is characterized by gentle north-facing slopes that are blanketed with glacial drift and dissected by streams that flow into the flat-floored valley. Interspersed throughout the 1000 km^2 survey area are stands of lodgepole pine (*Pinus contorta*), white spruce (*Picea glauca*) and Engelmann spruce (*Picea engelmannii*). A hybrid species of white and Engelmann spruce (known as Interior spruce) is also common in the central Interior. Fortunately, these spruce species have very similar chemical characteristics (C. Dunn, pers. comm., 2015). Wetland features and sedge grass meadows are common. Evidence of beetle-killed pine, recent forest fires and regeneration from previous forest fires was also observed. Access roads do not currently extend into the survey area, but forest service roads are located immediately to the east and north.

The survey area is underlain by Hazelton Group and Ootsa Lake Group rocks, and Chilcotin Group volcanic rocks.

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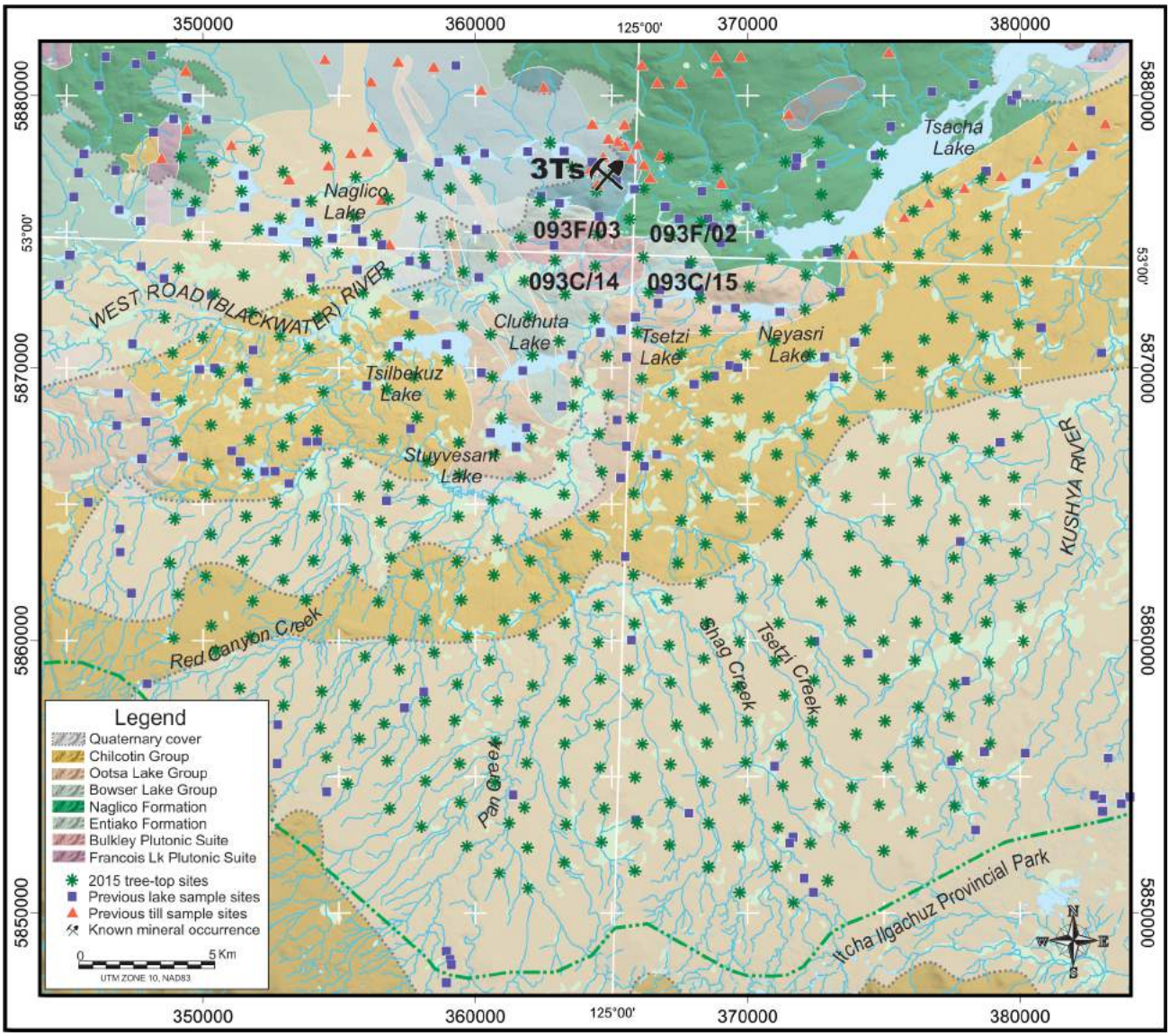

Figure 2. Generalized bedrock geology (after Angen et al., 2015), generalized Quaternary cover (after Massey et al., 2005), 3Ts mineral occurrence (MINFILE 093F 068; BC Geological Survey, 2015), archived lake-sample sites (Cook and Jackaman, 1994; Jackaman, 2006) and archived till-sample sites (Levson et al., 1994; Jackaman et al., 2015b). Digital elevation model from Canadian digital elevation data (GeoBase®, 2015).

Several developed prospects that contain Au, Ag, Zn, Pb and Cu mineralization are located in the region. The Blackwater-Davidson intermediate sulphidation epithermal Au-Ag deposit (NTS 093F/02; MINFILE 093F 037; BC Geological Survey, 2015) is located 15 km north of the survey area, and the 3Ts polymetallic Ag–Pb–Zn±Au deposit (NTS 093F/03; MINFILE 093F 068) is situated on the northern survey boundary. No recorded mineral occurrences exist within the survey area south of the West Road (Blackwater) River.

Historical Geochemical Data

Previous vegetation sampling has not been attempted in the 2015 biogeochemical survey area; however, several regional biogeochemical surveys and research programs have been conducted in other parts of the TREK project area. To the north of the current study, ground-based regional surveys were completed using lodgepole-pine bark (Dunn and Hastings, 1998, 1999, 2000), and to the south, a helicopter-supported reconnaissance survey was conducted over the Fish Lake property (NTS 092O/05E; MINFILE 092O 041) using lodgepole-pine tops (Dunn et al., 1994). In addition, several research programs have investigated the application of biogeochemical techniques in areas of thick glacial sedimentary rocks and Neogene Chilcotin Group basalt flows (Dunn, 1995; Dunn and Levson, 2010; Heberlein et al., 2013).

2015 Spruce-Top Biogeochemical Survey

Field Methods

Field survey methods and sample preparation and analysis protocols in the 2015 biogeochemical survey were based on previous field surveys, orientation investigations and detailed research (Dunn, 1995, 2007). During a six-day period in June 2015, a 1000 km^2 area was surveyed using predetermined flight-lines along an offset grid with 1500 m spacing. A total of 421 side-branch samples, comprising 1 kg of twigs, needles and cones, were systematically collected near the tops of 401 healthy spruce trees (Figure 3). Location co-ordinates were carefully recorded at each site.

The target spruce trees were healthy, 80–100 years old, 20–25 m tall and commonly extended 2–3 m above a lower canopy of lodgepole pine, which typically showed effects of the mountain pine beetle infestation. A recent forest fire in the northern part of the survey area and several immature patches of forest regeneration limited the availability of spruce for a small number of the predetermined sites.

Sample Preparation and Analysis

After collection, each 1 kg sample was systematically processed in the field prior to shipment to the commercial laboratory. Cones were removed and the branches were trimmed to include only 5–7 years of growth. Each of the field-processed samples weighed approximately 500 g and was delivered to the Bureau Veritas Commodities laboratory (Vancouver, BC). After the samples were oven dried at 60°C, the needles and twigs were separated. The twigs were macerated to 1 mm and analyzed for 53 elements by inductively coupled plasma–mass spectrometry (ICP-MS) following aqua-regia digestion. Needles were reduced to ash at 475°C and 0.5 g of ash material was analyzed for 53 elements plus rare-earth elements by ICP-MS following aqua-regia digestion.

Quality Control

In addition to the in-house quality-control procedures of the commercial lab, quality control for analytical determinations included the use of field duplicates, analytical duplicates and control reference standards. Duplicate samples determine sampling and analytical variability, and reference standards measure the accuracy and precision of the analytical methods. For each batch of 20 sequential samples, one field duplicate (taken at a randomly selected sample site), one analytical duplicate (a sample split during the lab preparation process) and one reference standard are included in the geochemical analyses. Certified reference standards for plant materials are not readily available; however, ash and spruce twig control samples with known element concentrations were included to monitor the precision of the analytical results (C. Dunn, pers. comm., 2015).

Figure 3. Helicopter-supported spruce-top collecting of distal side-branch samples consisting of twigs, needles and cones.

Summary

Generating a comprehensive collection of high-quality, regional geochemical analytical data and field information is a primary objective of the geochemical component of the TREK project. Maximizing geochemical coverage for the entire TREK project area has required innovative approaches to access and collect data in challenging locations. Ongoing research supports the effectiveness of biogeochemistry, and combined with advances in analytical methods, establishes biogeochemical surveys as a valid exploration option for generating valuable geochemical information. The TREK biogeochemical survey helps complete the coverage of surface geochemical data in the TREK project area, and generates geochemical results that are complementary to existing geoscience datasets, providing a comprehensive collection of information that supports the search for potential mineral deposits in the Interior Plateau, British Columbia.

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