British Columbia Geological Survey
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Quaternary Geology Reconnaissance Studies 92I/2 and 7

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INTRODUCTION

During the summer of 2001, the British Columbia Geological Survey Branch undertook a 6-day reconnaissance excursion to the Merritt-Logan Lake area of southern British Columbia to evaluate the potential for future regional till geochemistry exploration projects (Figure 1). Exploration potential in the area is very attractive, given that this region is already known to host several different types of mineralization including stratiform-base-metal, porphyry and vein targets. The record for previous mining activity in this area includes the prominent Highland Valley Copper and Craigmont mines. More recently, the discovery of a high-grade copper-zinc massive sulphide showing on the Fox claims has triggered a minor staking rush in the region. Within a one-year period nearly 1450 claim units had been staked in the vicinity of the Fox claims. Interesting prospects in the proposed study include the LD barite-gold-silver-zinc-lead-copper prospect at Iron Mountain and the Iron King iron prospect south of Nicola Lake.

The Quaternary geology of the region has been subject to periodic attention for the last four decades, primarily during the process of 1:250,000 scale mapping by the Geological Survey of Canada. Unfortunately, much of the surficial geology work is only relevant at the regional scale and provides minimal insight at a more detailed 1:50,000 scale for the exploration community. Given the recent economic attraction of this area of the province and the lack of detailed surficial data that is of direct importance to the exploration community, a reconnaissance surficial study was clearly warranted. The objectives of the present study were to:

- assess the nature and extent of surficial sediments covering an area corresponding to two 1:50,000 map sheets comprising NTS 92I/02 and 92I/07;
- evaluate the potential to undertake a regional till geochemistry survey;
- establish the regional ice-flow pattern of the study area; and
- identify and recognize sites which should be investigated in detail to help resolve the stratigraphic and glacial history for the region.

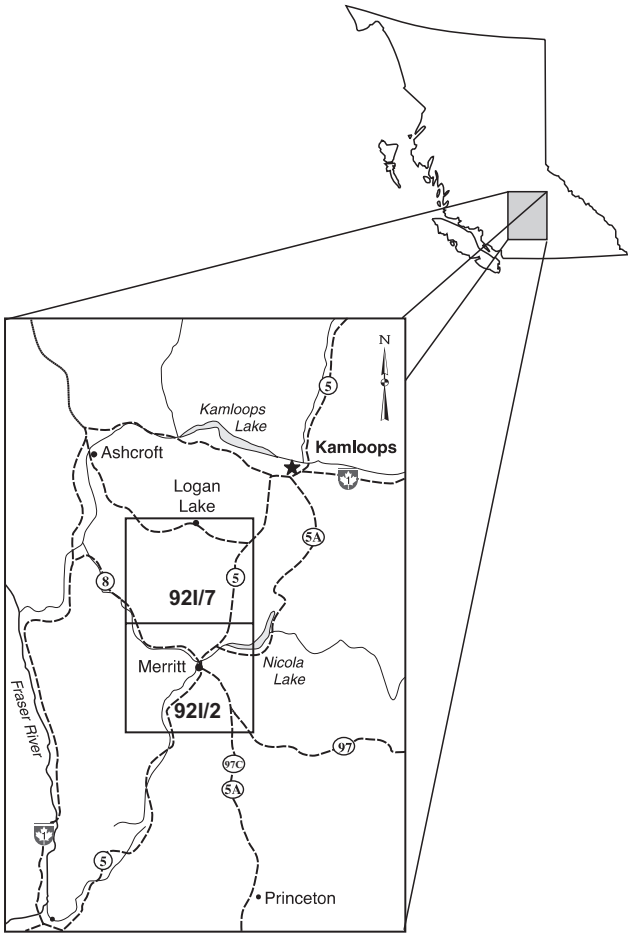

Figure 1. Location map of Quaternary reconnaissance study in the Merritt-Logan Lake area, B.C. (NTS 92 I/2 and 92 I/7).

PREVIOUS WORK

With the exception of work by early geologic explorers working in the Interior Plateau of southern British Columbia, it is the notable mineral deposits in the northwest part of this study (*e.g.* Bethlehem, Highmont, Valley Copper, etc.) that have significantly influenced ongoing geological and mineral exploration study. Previous bedrock geology of the Highland Valley deposit and surrounding area has been detailed in several publications and are well-reviewed by Sutherland Brown (1976) with more recent work by Mon-

ger and McMillan (1989) and Moore *et al*. (1990). The surficial geology work is perhaps less well known but equally important. Significant work by R.J. Fulton (Geological Survey of Canada) during the 1960s and 1970s has allowed a good understanding of the region to be developed. Based on his work (Fulton, 1965, 1968, 1969, 1975a, 1975b, 1984; Fulton and Smith, 1978), the Quaternary stratigraphy for this region can be summarized as follows: the oldest deposits consist of Okanagan Centre Drift sediments (type locality near Okanagan Lake) which are Early Wisconsinan in age (>65 000 years old), overlain by Bessette Sediments (type locality near Lumby) of mid-Wisconsinan age (>20 000 - 65 000 years old), which in turn are overlain by Kamloops Lake Drift deposits (type locality near Kamloops Lake) correlative with the Late Wisconsinan (10 000 to 20 000 years old). Even more interesting are much older sediments that have been discovered by Fulton *et al*. (1992) near Merritt, and that are thought to be >790 000 years old based on reversed magnetic polarity (Matuyama age).

The Quaternary stratigraphy of the Merritt area remains the most detailed and comprehensive for the region and should, theoretically be applicable to the full study region. As summarized in Table 1, the oldest deposits consist of the Coldwater silts that are overlain by Sub-Coutlee sediments and Coutlee sediments. These three sediment packages are all known to be in excess of 790 000 years in age and are, in turn, overlain by Valley Basalts and Brown Drift deposits, covering the period from mid-Wisconsinan to the Matuyama reversal. The youngest deposits consist of Kamloops Lake Drift (proglacial sediments, till and postglacial lake sediments).

Perhaps the greatest attention has been paid to the history of deglaciation of the southern Interior Plateau and surficial deposits associated with this event (Fulton, 1967, 1969, 1991; Church and Ryder, 1972; Ryder 1971). The present day physiography, characterized by rolling uplands, steep-walled, flat-floored valleys, as well as open grassland and pine-forested slopes, is strongly influenced by the style of deglaciation. Most of the major valleys and tributaries in the region supported large ice-dammed lakes as ice retreated northward at the end of the Pleistocene (Ryder *et al*., 1991). Such glaciolacustrine deposits typically consist of rhythmically bedded sand and silt, are of varying thickness and pose considerable hazard to transportation corridors and structures given their tendency to fail (Evans and Buchanan, 1976). From an exploration perspective, glaciolacustrine sediments are a hindrance insofar as they effectively conceal mineral deposits, and are of limited use for geochemical studies. Fortunately, only small parts of the study region comprise valley scenarios and thus much of the area is not affected by such sediments.

Other important fundamental and applied Quaternary research in the region includes that of Bobrowsky *et al*. (1993), Kerr *et al*. (1993), Mathews (1944), Ryder (1976, 1979) and Westgate *et al*. (1975).

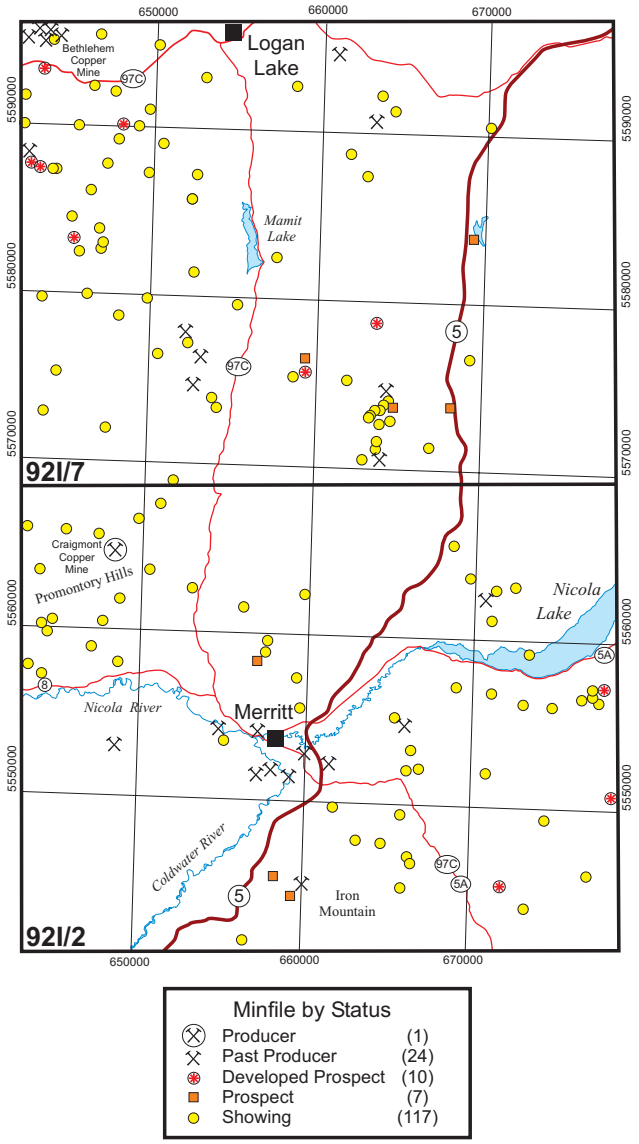

Figure 2. MINFILE occurrence by status in NTS 92I/2 and I/7.

BEDROCK GEOLOGY

The study area (Figure 1) lies within the Intermontane Belt and is part of the Quesnel Terrane. It is primarily underlain by Late Triassic, alkaline to calc-alkaline, predominantly mafic to intermediate but locally felsic, submarine and subaerial volcanic rocks and volcanic-derived sedimentary rocks of the Nicola Group (Preto, 1979). This arc-volcanic package is intruded by large diorite to granite plutons ranging in age from Triassic-Jurassic to early Tertiary (Monger and McMillan, 1989; Moore *et al*., 1990). The largest of these is the Late Triassic to Early Jurassic multiphase Guichon Creek batholith located in the western part of the study.

Clastic and volcanic rocks of Jurassic to Tertiary age (Ashcroft Formation, Spences Bridge Group and Princeton

TABLE 1
QUATERNARY STRATIGRAPHIC UNITS IN THE VICINITY OF MERRITT, BRITISH COLUMBIA

Unit Name	Locality	Interpretation	Age
Merritt silts (Kamloops Lake Drift)	Merritt Lily Lake Road Coldwater	Glacial lake sediments	+/- 11 ka
Till (Kamloops Lake Drift)	Lily Lake Road Coldwater	Glacial deposit	11-20 ka
Proglacial Sediments (Kamloops Lake Drift)	Lily Lake Road	Proglacial deposits	+/- 20-25 ka
Brown Drift	Coldwater River	Glacial deposits	>25 to <790 ka
Valley basalts	Chutter Ranch Quilchena Crk Valley	Volcanic eruption	100 to <790 ka
Coutlee sediments	Lily Lake Road	Interglacial basin fill deposits	>790 ka
Sub-Coutlee sediments	Lily Lake Road	Glacial lake deposits	>790 ka
Coldwater silts	Coldwater	Glacial lake deposits	>790 ka

According to Fulton et al. (1992)
Age is given in thousands of years before present (ka)

Group) unconformably overlie the Nicola Group in local areas. The eastern part of the study area is dominated by the Nicola horst, a fault bounded uplift which comprises metamorphosed Nicola rocks and highly deformed, sedimentary rocks intruded by Triassic, Jurassic and Paleocene plutons (Moore *et al*., 1990). Structurally, there are two predominant fault sets in the area; a northwest striking set of probable Mesozoic age, and a north to northeast striking set of mainly extensional faults of Tertiary age (Moore *et al*., 1990).

The most economically important mineral deposits in the region are the large, calc-alkaline type, porphyry copper-molybdenum-gold-silver deposits hosted by the Guichon Creek Batholith (*e.g.* Highmont, Lornex, Valley, and Bethlehem mines). The study area also includes the past producing Craigmont mine, a large copper skarn in Nicola rocks, and coal mines in Tertiary rocks of the Merritt basin (Figure 2). Throughout its length, the Triassic-Jurassic volcanic and intrusive rocks of the Quesnel terrane host important alkaline-porphyry copper-gold deposits such as Afton mine near Kamloops, and numerous small skarn, vein and stockwork-type base and precious metal occurrences. The recent discovery of the Fox zinc-copper- gold-silver-barite prospect north of Merritt has prompted prospecting for stratiform volcanogenic deposits, particularly in the western volcanic facies of the Nicola Group.

RESULTS

A variety of sediment types were observed within the study area at several sites (Figure 3) including colluvium, glaciolacustrine, lacustrine, fluvial, glaciofluvial, and numerous till facies. Unequivocally, the dominant material encountered throughout the area is basal till. In this case the basal till is characteristically a well-consolidated, massive,

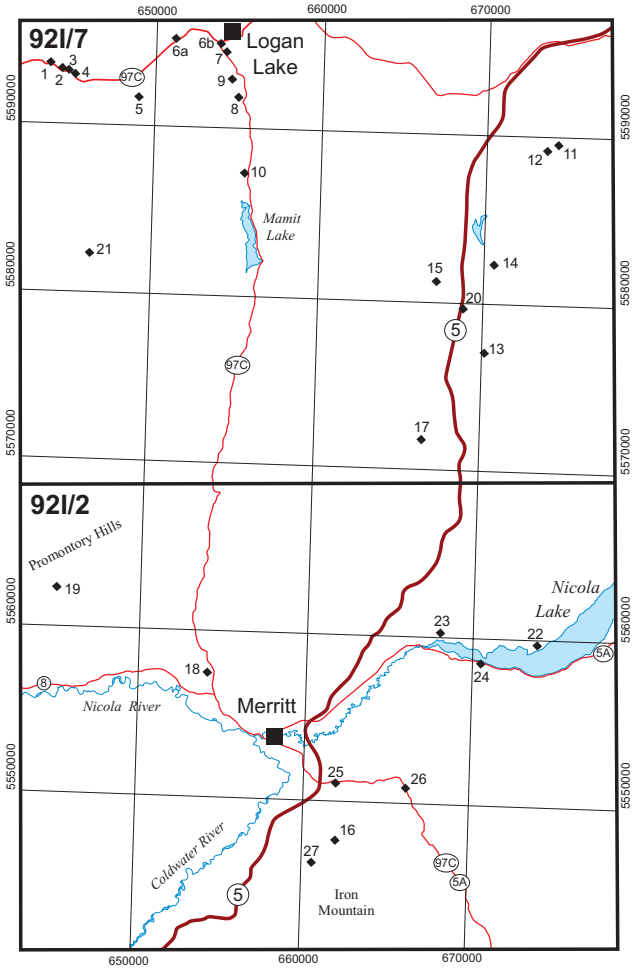

Figure 3. Map showing location of new Quaternary observation points where stratigraphic or ice-flow data were detailed during 2001 reconnaissance study.

moderately stony matrix supported diamicton. Deposits range in thickness from less than a metre to tens of metres, but typically appear to be about 2-5 metres thick. Clast content varies from 5% to 35%, and the majority of stones appear to be subangular in shape. Facets and striae are commonly observed on some of the recovered pebbles. Lithologies reflect the surrounding bedrock geology confirming local provenance sources for the entrained debris.

Bedrock is exposed in small patches throughout the study, thus facilitating an evaluation of the paleo-ice-flow history for the full region. A few dozen locations yielded good evidence for ice flow in the form of striations, rat-tails, grooves, and roche moutonées. Based on the observations conducted in this study it is clear that during the last glaciation ice flowed primarily from the north to the south (Figure 4). Only near the southern margin of the study is there evidence for partial deflection of past ice flow.

Little data are currently available for evaluation regarding the patterns of geochemical distribution in the region. One example of geochemical soil sampling does exist, and is illustrated here to confirm the expected pattern of element dispersion towards the south (Figure 5).

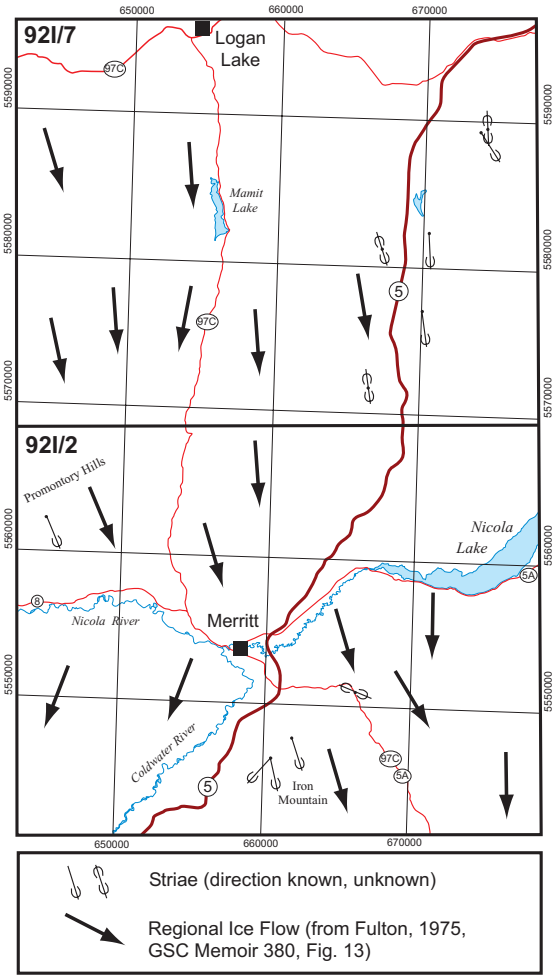

Figure 4. Ice-flow pattern for the study area combining air photographic interpretation by R.J. Fulton and ground based striation evidence from the present study.

CONCLUSIONS

Successful long-term historic mining activity and recently discovered exploration targets suggest that this region contains a high potential mineral exploration framework. From a Quaternary perspective, the predominance of basal till in the area, the relatively thin nature of the surficial overburden cover and the uniform ice-flow direction over the study area all combine to provide an ideal sampling environment for a regional till geochemistry exploration project. During the past few decades expanding ranchland and logging activities have opened previously poorly accessible areas between Merritt and Logan Lake to geological exploration. The improved access, good mineral potential and ideal surficial nature of the region collectively indicate that a reconnaissance level till geochemistry sampling project in NTS 92I/2 and 92I/7 is both feasible and warranted.

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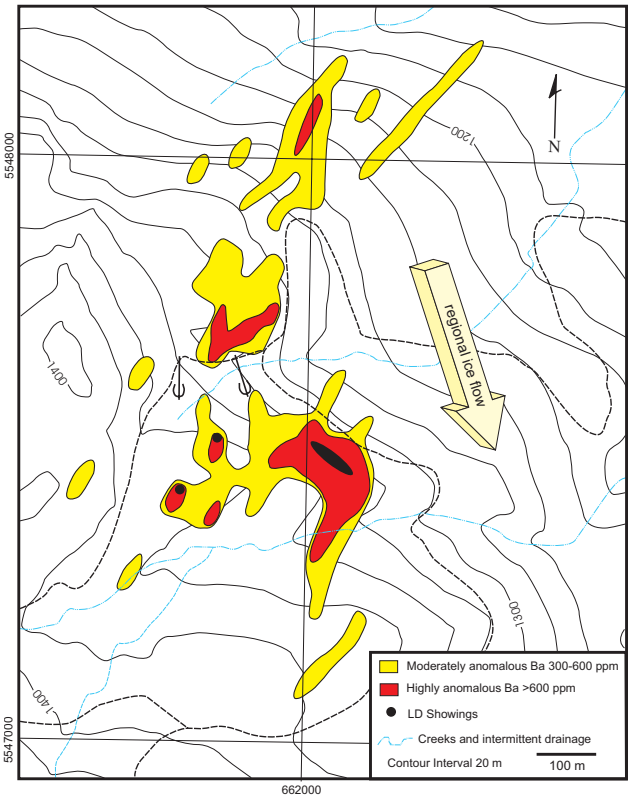

Figure 5. Map showing normalized contour distribution of Ba in soils near the LD showings on the east slope of Iron Mountain. Regional ice flow pattern by GSC compared to site specific detailed ice-flow pattern established at the property scale. Note down ice plume of dispersion of Ba in the sediments.

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