Barkerville Project: Regional Till Geochemistry (93H/4, 5) and Orientation (93A/14) Studies

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KEYWORDS: Till geochemistry, orientation studies, Barkerville Terrane, Slide Mountain Terrane, Cariboo Terrane, Quesnel Terrane, surficial geology, Quaternary, ice-flow, glaciation, mineral exploration, drift prospecting, Ancient Pacific Margin, Ace, VMS, NATMAP.

INTRODUCTION

During the 2000 field season, both regional and detailed till sampling surveys were conducted in the Cariboo region of central British Columbia (Figure 1). These surveys complement the longer term objectives of the NATMAP Ancient Pacific Margin (APM) project (see Nelson, 2000) and provide continuity to the surficial till geochemistry work initiated by Dixon-Warren and Hickin (2000) in 1999 as part of the APM project team. The regional till survey discussed here, represents work in the first of a multi-year, integrated exploration program, hereafter called the Barkerville Project. The Barkerville Project follows a series of previous integrated or focused multi-year Geological Survey Branch initiatives completed throughout the province in areas of high mineral potential (e.g. Northern Vancouver Island 1991-1994; Kerr *et al*., 1992; Bobrowsky and Sibbick, 1996; Nechako/Fraser Plateaus 1991-1995; Levson and Giles, 1997; Eagle Bay 1996-1998; Bobrowsky *et al*., 1997; Dixon-Warren *et al*., 1997; Paulen *et al*., 1998, 1999). In contrast, the Ace Project is a detailed till orientation study, also located in the Cariboo region, that complements previous orientation and property-scale surveys completed in the province which aim to model site specific behaviour of elements in different types of media (*e.g.* Cook and Pass, 2000).

The Barkerville Project is centred primarily over rocks of the Barkerville and Slide Mountain terranes (Figure 2). This first year of work evaluated till geochemistry in the southern half of NTS map sheet 93H/05 (Stony Lake) and the northern half of 93H/04 (Wells), located directly north of the town of Wells (Figure 1). The study covers an area of approximately 1000 square kilometers. A number of factors provide the impetus for this project area: 1) the high mineral potential of the terranes for lode

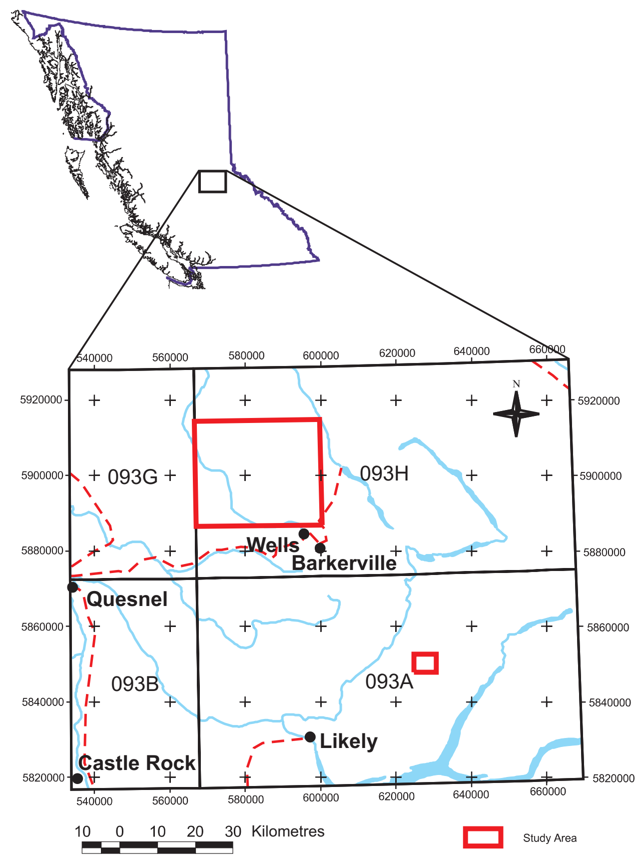

Figure 1. Location of study area for both the Barkerville (large square) and Ace (small square) Projects in the Cariboo region of British Columbia.

gold mineralization and placers; 2) the previous successful industry record for locating new showings using till geochemistry farther south in Eagle Bay rocks (also Barkerville Terrane); and, 3) the increasing industry exploration activity and the need for this type of data in the Cariboo region. In the past, placer and lode gold deposits supported the local mining industry in the region, but with the more recent realization of VMS potential, exciting new mineral prospects including the Lottie, Frank Creek and the Bonanza Ledge Zone have come to light. The primary purpose of the multi-year survey is to provide reconnaissance level till geochemistry data and re-

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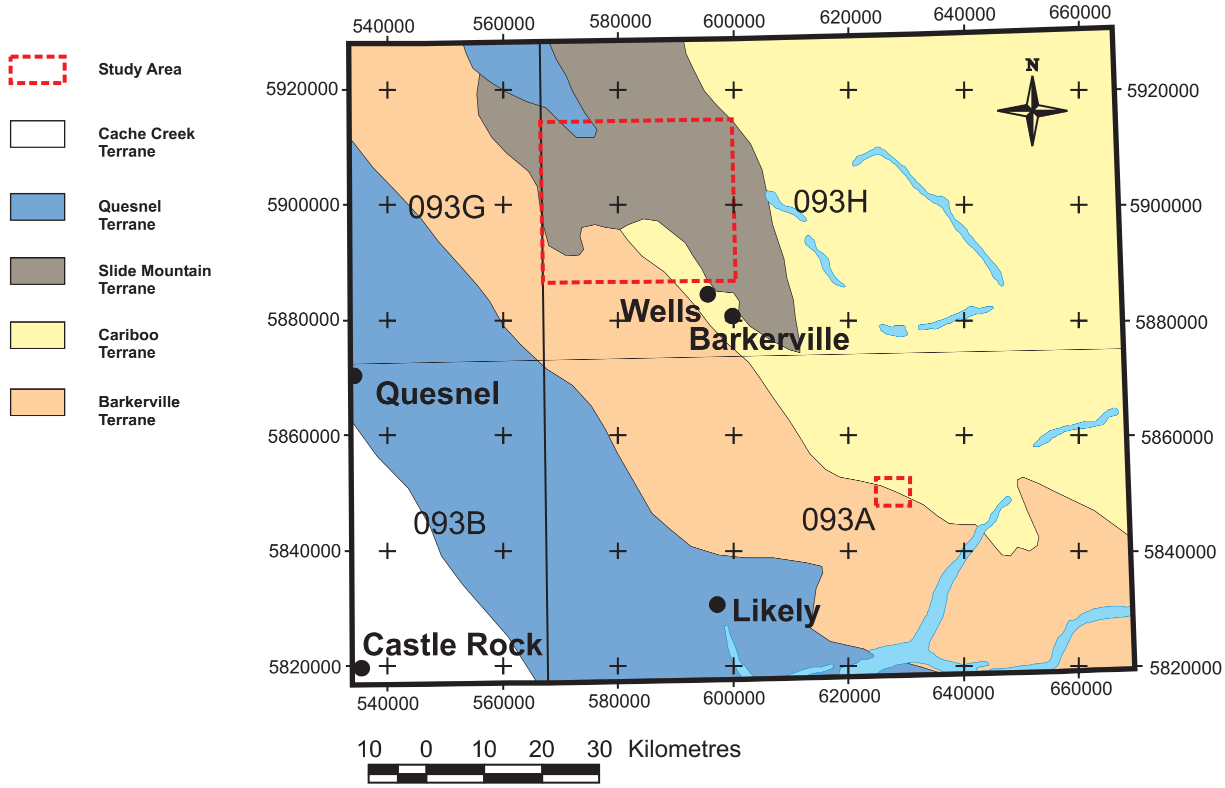

Figure 2. Generalized bedrock geology map showing the distribution of terranes in the vicinity of the Barkerville and Ace Project areas.

gional ice flow pattern information to industry clients as an incentive for further exploration.

The Ace Project is located within NTS map sheet 93A/14 (Caribou Lake) (Figure 1) and covers approximately 30 square kilometers on claims owned by Barker Minerals Ltd. This particular area has been shown to contain abundant mineralized type float thought to be the source of anomalous magnetic and soil survey results (personal communication, Louis Doyle 2000). Speculation thus far suggests that the float and soil data are possibly linked to massive sulphides and gold-quartz veining (MINFILE 093A 142 Ace) located to the northwest. The purpose of this orientation study is to evaluate and model the pattern and behaviour of geochemical dispersion in the vicinity of the anomalous zone. Multi-year, related bedrock mapping and mineral deposit studies are also currently being conducted by other staff in the GSB (*see* Ferri 2001; Ray *et al*., 2001; both in this volume).

The thick cover of surficial sediments in both study areas has hampered the use of more traditional geochemical exploration techniques making both ideal locations for the implementation of a till geochemistry program. The following objectives provide the direction for the Cariboo region projects:

- To further stimulate exploration and economic activity in the Cariboo Mining Division.
- To generate a regional pattern of till geochemistry data to define new anomalies and assist in the discovery of new mineralization.
- To assist the exploration community by demonstrating the use of till geochemistry as a more effective exploration tool in areas of thick overburden compared to conventional geochemical surveys.
- To map ice flow indicators and discern both regional and local ice flow patterns to aid drift prospecting.
- To document the dispersal of pathfinder elements down-ice from known sources of mineralization.
- To further expand the use of drift prospecting as both a reconnaissance and property-scale exploration technique.

This paper summarizes the surficial geology work that was conducted during the 2000 field season and provides background information for industry to use in concert with the final till geochemistry data. Analytical results from the till geochemical sampling program are pending and will be released separately as a GSB Open File.

PHYSIOGRAPHY, CLIMATE AND VEGETATION

Both studies occur within the Interior Plateau physiographic region. The Interior Plateau, in turn, is divided into seven subdivisions, two of which, the Fraser Plateau and the Quesnel Highlands intersect the two project studies. The Ace Project is found entirely within the Quesnel Highlands.

The Quesnel Highlands are situated on the eastern boundary of the Interior Plateau and lie to the west of the Cariboo Mountains (Photo 1). They are bounded to the north and west by the Fraser Plateau and to the south by the Shuswap Highlands. The highlands were once plateaus of moderate relief and have since been dissected, leaving upland regions that rise from approximately 1600 metres asl in the west to 2100 metres asl in the east (Photo 2) (Holland, 1976). The distinction between the Fraser Plateau and the Quesnel Highlands is an arbitrary one, as there is no visible boundary that can be discerned (Holland, 1976). The eastward rise of the dissected Fraser Plateau continues within the Quesnel Highlands.

The highest peak in the Barkerville study area is Two Sisters Mountain, rising to about 2100 metres asl. The lowest elevation is approximately 980 metres asl, in the Willow River Valley. Throughout, the landscape shows abundant evidence of previous glaciations and post-glacial erosion. In contrast, sampling at the Ace Project was concentrated on a glaciated northeast-facing valley slope that rises from 900 to 1920 metres asl.

Both study areas occur mainly within the Sub-Boreal Spruce(SBS) Zone, with minor parts in the Engelmann Spruce-Subalpine Fir (ESSF) Zone. Extending from the valley bottoms up to 1300 metres, the SBS zone is dominated by white spruce and sub-alpine fir with Douglas fir, lodgepole pine and aspen also common (Meidinger and Pojar, 1991). Luvisolic, podzolic and brunisolic soils are typical. Above 1300 metres the Engelmann Spruce-Subalpine Fir Zone is encountered and is dominated by these two species. The climate in the region is characterized by seasonal extremes. Severe snowy winters contrast to relatively warm, moist and short summers with a moderate annual rainfall (Meidinger and Pojar, 1991).

BEDROCK GEOLOGY

The regional bedrock geology of the Cariboo region has been described by Holland (1954), Sutherland Brown (1957, 1963), Tipper (1959, 1961), Campbell *et al*. (1973), Campbell (1978), Struik (1986, 1988), Bloodgood (1989), Panteleyev and Hancock (1989) and more recently Ferri *et al*. (1997), Ferri and Höy (1998a; 1998b) and Ferri (2001; this volume).

Both project areas lie on the western edge of the Omineca tectonic belt, where it abuts the Intermontane Belt. Within the regional project area, there are four terrane units represented: the Cariboo, Slide Mountain, Barkerville and Quesnel terranes. The detailed project area occurs over the Cariboo and Barkerville terranes.

Rocks of the Slide Mountain Terrane underlie the majority of the Barkerville Project area, (~75 per cent),

Photo 1. View from Two Sisters Mountain to the east of the Cariboo Mountains. During the peak of the Fraser Glaciation, thick ice would have advanced westwards from this region overriding the Quesnel Highlands.

Photo 2. View northeast from Slide Mountain showing typical relief in the Quesnel Highlands.

and are found in the eastern and northern portions of the region (Figure 2). Slide Mountain rocks are Mississippian to Permian in age and are characterized by oceanic marginal basin volcanic and sedimentary rocks. The dominant rock types are basalts and chert pelite sequences with some intruded diorite, gabbro and ultramafic rocks. The Slide Mountain Terrane is internally imbricated by small thrust faults, but as a whole, the terrane is thrust on top of the Cariboo and Barkerville terranes along the Pundata Thrust Fault (Struik, 1986, 1988).

The Barkerville Terrane makes up the next largest portion of the study area, comprising some 15 per cent of the area (Figure 2). The terrane is Precambrian to Palaeozoic in age and is an assemblage of pericratonic marine clastic and volcanic rocks, as well as their metamorphic equivalents. Typical rocks of this terrane consist of siliceous argillite, chert and quartzite. In this area, the Barkerville Terrane is generally considered to be the most metamorphosed of the four terranes represented. The Barkerville Terrane is recognized as the northern extension of the Kootenay Terrane found in south-central British Columbia (Struik, 1986, 1988). The northwest trending Pleasant Valley Fault separates the Barkerville and Cariboo terranes.

The remainder of the regional study area is underlain by rocks of the Cariboo and Quesnel terranes and comprise some 10 per cent of the area (9 per cent and 1 per cent; respectively). Cariboo rocks are Precambrian to Permo-Triassic in age, whereas the younger Quesnel Terrane is upper Triassic to lower Jurassic. Rocks of the Cariboo Terrane are found in the south-central portion of the study area and are characterized by clastic sedimentary rocks of an ancient passive continental margin typified by siltstone, sandstone, chert and shale. This differs markedly from the rocks of the Quesnel Terrane, to the north-west (Figure 2), which are related to a volcanic arc origin; primarily andesite, dacite, rhyolite, shale and siltstone.

As previously noted, only the Barkerville and the Cariboo terranes are found within the Ace project area where they are relatively equally distributed. At this location, rocks of the Cariboo Terrane can be found to the northeast, whereas Barkerville rocks occur to the southwest.

MINERAL EXPLORATION

Historically, the Cariboo Mining Division has been a "hotspot" for placer mining and continues to be so today. Within the Barkerville regional study, there are 185 placer claims (Figure 3; Table 1) as of June 2000. Similarly, a total of 181 mineral claims were registered, accounting for ~21 per cent of the area investigated in this project (Figure 3).

Both mineral occurrences (MINFILE) and assessment report (ARIS) sites are shown on Figure 4. As of this report, there are a total of 21 mineral occurrences that fall within the current Barkerville Project boundaries (Table 2), six of which are mineral showings. Table 2 shows the distribution of mineral occurrences based on the highest ranked mineral commodity; gold being the most common represented in 19 sites. Notable gold occurrences within the Barkerville Terrane include Mosquito Creek, Island Mountain, Cariboo Gold Quartz, Cariboo Hudson as well as the Snowshoe and Midas veins (Struik, 1986, 1988). Similarly, silver, tungsten, lead, zinc and copper have also been documented in this region. Proportionately, the Slide Mountain Terrane has been less successful in the past, yielding only one minor copper occurrence (Struik, 1986, 1988).

Of the 57 assessment reports filed within the Barkerville Project area, 11 were completed in the 1990s, whereas the majority (44) were completed in the 1980's (Table 3). Previous to 1980, only two assessment reports were filed in this area. During 2000, the region has experienced a revival in exploration with major projects from companies such as Hudson Bay Mining and Smelting Co. and International Wayside Ltd.

QUATERNARY HISTORY

The Cariboo region contains abundant evidence resulting from at least two episodes of glaciation during the Pleistocene: the penultimate glaciation and the Fraser Glaciation. During these two events, glaciers generally flowed eastward from the Coast Mountains and westward

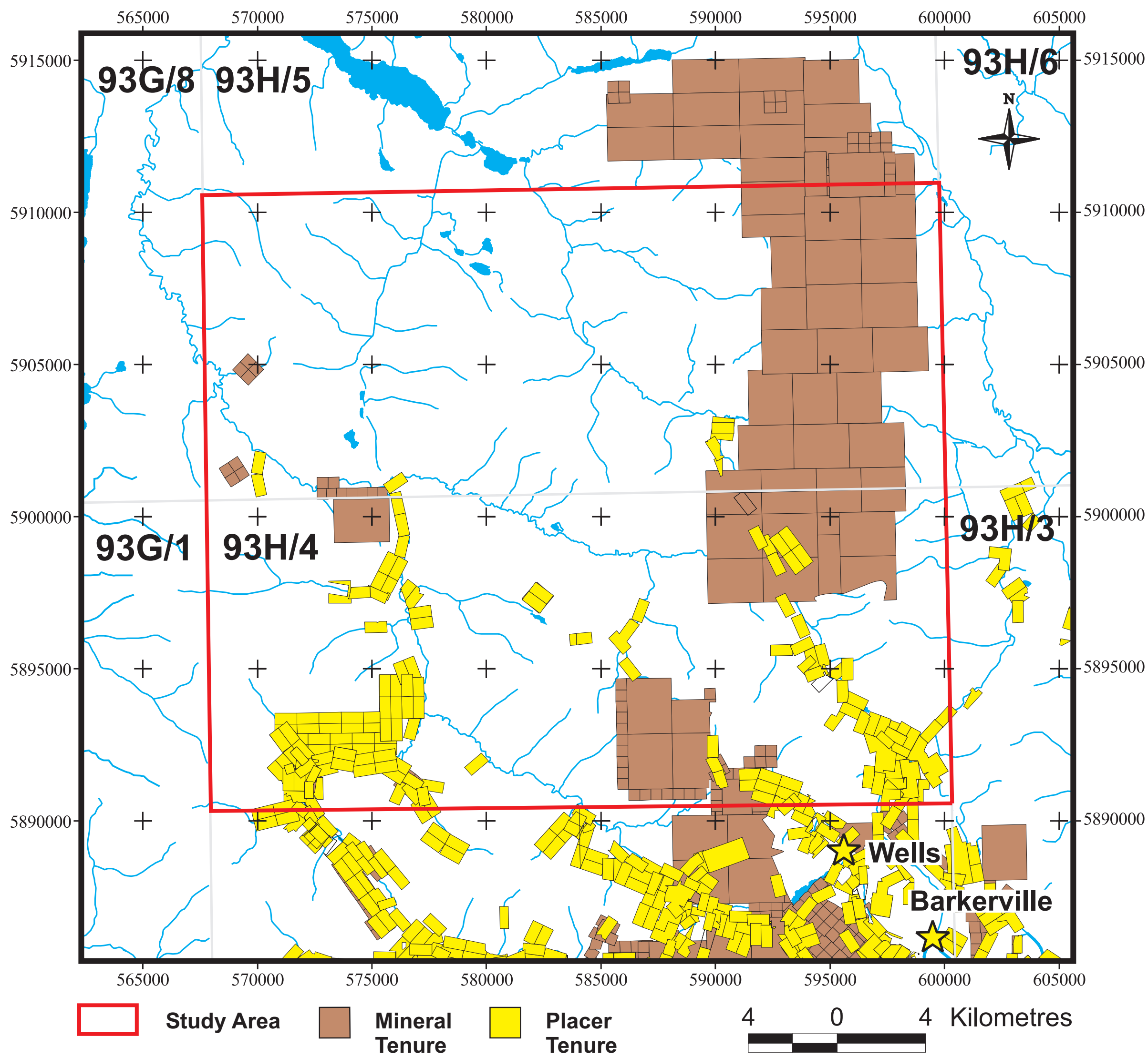

Figure 3. Distribution of mineral and placer claims within the Barkerville study area (summer of 2000 data).

TABLE 1
NUMBER OF MINERAL OCCURRENCES, ASSESSMENT REPORTS AND MINERAL AND PLACER CLAIMS FOR THE BARKERVILLE PROJECT AREA

	Count
Minfile	21
ARIS	57
Claims (Mineral)	181
Claims (Placer)	185

TABLE 2
MINERAL OCCURRENCES FOR THE BARKERVILLE PROJECT AREA, BASED ON THEIR HIGHEST RANKED MINERAL COMMODITY

Commodity	No. of Occurrences
Gold	19
Lead	6
Silver	3
Zinc	4

from the Cariboo Mountains to coalesce over the Interior Plateau (Tipper, 1971; Fulton, 1991).

Tertiary deposits consisting of broad, stable, gravel fluvial deposits are exposed primarily in deeply incised river valleys (Levson and Giles, 1993). Such deposits are often gold bearing and have been a major focus of activity for the placer industry in the area.

Overlying the Tertiary fluvial deposits are younger glaciofluvial and glacial sediments. Most deposits of this age consist of massive and stratified silt, sand and gravel occasionally intercalated with till. Though very rare, the oldest till deposits are from the penultimate glaciation, and are likely pre-Late Wisconsinan in age (Clague, 1988; Levson and Giles, 1993). Such deposits are described as units of diamicton separated by thin sand and gravel beds (Clague, 1988; Clague, 1991). The presence of striated and faceted stones, the texture, and the fabric of the diamictons suggest that in most cases, these are in fact

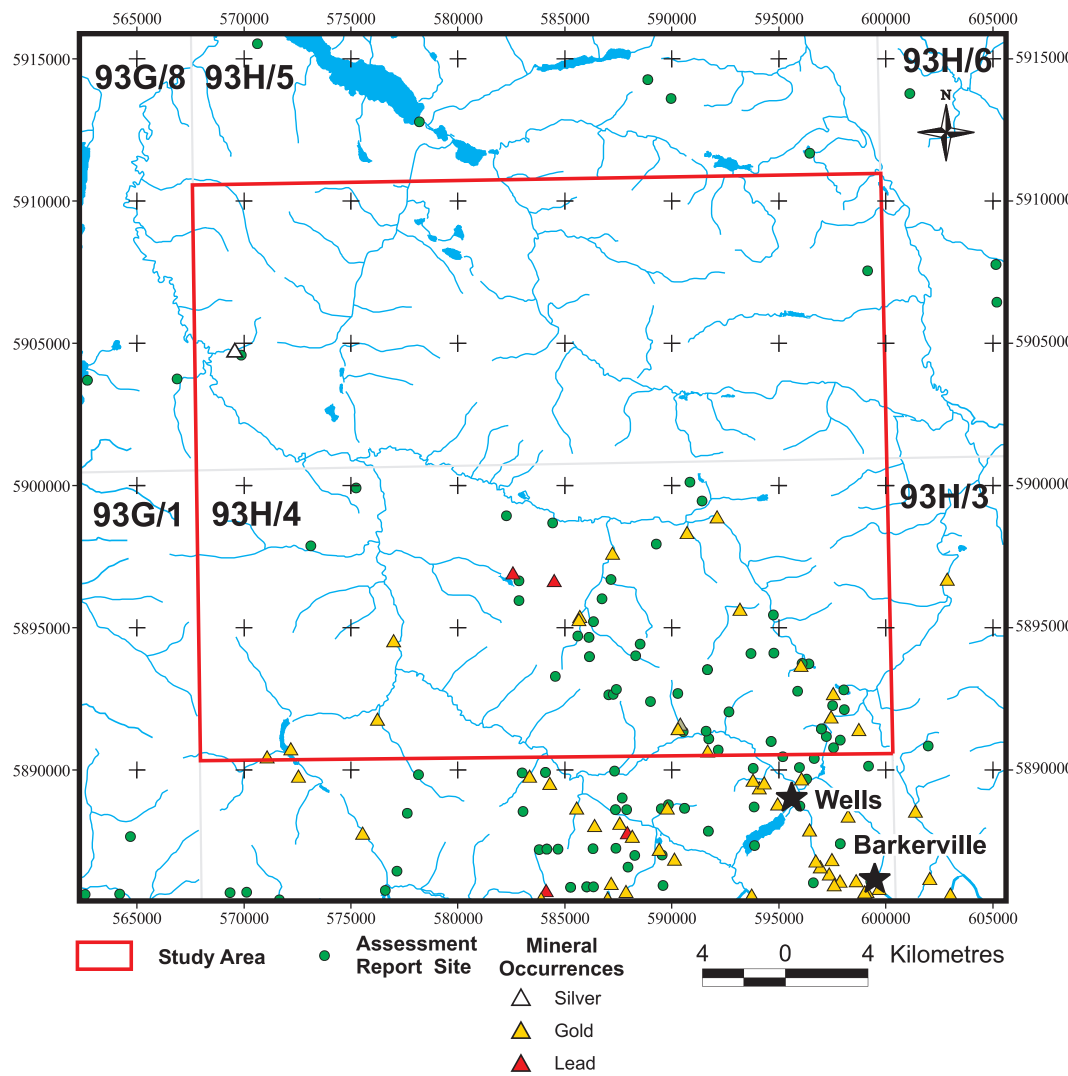

Figure 4. Distribution of exploration assessment report sites and mineral occurrences within the Barkerville study area.

TABLE 3
ASSESSMENT REPORTS WITHIN THE BARKERVILLE PROJECT AREA
(REPORTS ARE GROUPED ACCORDING TO THE YEAR IN WHICH THEY WERE FILED)

Year	Count
1990-1999	11
1980-1989	44
1970-1979	1
<1970	1

tills. No concrete dates have been assigned to this older till unit as they are beyond the limits of radiocarbon dating.

Once the glaciers of the penultimate glaciation had receded, the region remained ice-free from about 51,000 to 40,000 years ago (Clague *et al*., 1990). During this time interval, valleys were incised by ancestral rivers to levels similar to present (Clague, 1991). Following this erosional phase, the deposition of thick units of fluvial and lacustrine sediments directly preceded the Fraser Glaciation.

Evidence for the last glacial advance, the Fraser Glaciation (Late Wisconsinan), is much more pronounced. Glaciers advancing from the Cariboo Mountains, in the east, deposited thick layers of glacial, glaciofluvial and glaciolacustrine sediments over the landscape. This last event contributed most of the landforms presently observed, including U-shaped valleys, terraces, eskers, drumlins, roche moutonnées and whale backs throughout the region.

METHODS

The 2000 field season was divided into two separate field camps. The first, based out of the Barker Minerals Ltd. field camp in the township of Likely, provided access to the Ace Project to the east, where a property-scale till geochemistry orientation program was conducted. The second camp, based out of the Hudson Bay Mining and Smelting Co. field camp in Wells, provided access for the regional till geochemistry sampling program to the north.

Within the regional study area, road coverage is extensive and is serviced by a good network of major logging roads. Active logging in several of the valleys has resulted in regular road maintenance, thereby leaving the roads in relatively good condition. Secondary roads vary in their condition, ranging from excellent to unusable. Some areas proved to be inaccessible except by foot. Most of the fieldwork was conducted using 4-wheel drive vehicles. In extreme cases, where roads were impassable with 4-wheel drive vehicles, all-terrain vehicles were used.

In the vicinity of the Ace project, road access is generally less favourable, but given the objectives of the orientation study and its small area, road coverage proved adequate. Here, the bulk of the sampling was conducted on main access roads that are in relatively good condition and can be driven using a 2 or 4-wheel drive vehicles.

Prior to field work, maps of the study area were compiled using GIS software. Data collected were based on digital TRIM II maps as reference. Information on road access was obtained from Ministry of Forests and West Timber Fraser Ltd., and geological data were provided by Hudson Bay Mining and Smelting Co. (for the Barkerville Project) and from Barker Minerals Ltd. (for the Ace Project). Vertical aerial photographs of the region were also assembled to assist in both navigation and landform interpretation.

For each field station, including geological stops where no till samples were collected, the following data were collected for the site: UTM location; general geomorphology; terrain polygon unit; average slope; orientation of streamlined landforms, striations and grooves; description of bedrock; elevations of post-glacial deposits; and active geological processes.

For the regional till survey, bulk sediment samples for geochemical analysis were collected throughout the study area to generate a sampling density of approximately one sample per 2-3 square kilometres. Sampling was directed, where possible, towards unweathered, C-horizon basal till. This preferred media represents a first derivative product of glacial deposition (as per Shilts, 1993). Basal till was sampled at maximum depth, utilizing natural exposures and hand excavations (Photo 3). Where basal till was unobtainable, ablation till and colluviated till were collected.

At each till sample site, the following information was recorded: type of exposure (gully, road cut, etc.); depth to sample from surface; total thickness of exposure; stratigraphy and thickness of units within exposure; internal structures; clast percentage, angularity, and size; clast lithology; matrix or clast supported diamicton; matrix texture and colour; consolidation; and geologic interpretation (whether the material being sampled was a basal till, ablation till or colluviated till).

Sampling during the Ace Project varied slightly from the above-described method. In this case, a higher sampling density was used over most of the area, with horizontal sampling intervals every 150 to 200 metres along the main roads. At each sampling station, a small back-hoe excavator was used to create a trench approximately one meter wide and several metres deep (Photo 4). Within each trench, a B-horizon, BC-horizon and a C-horizon sample was collected. The sedimentology and stratigraphy of each sampling trench was described.

Once collected, labeled and recorded, samples were shipped to Bondar Clegg Laboratories in North Vancouver for sample preparation. Samples were first air dried and then split and sieved to <63 m. The unsieved split sample, along with the pulps and <63 m samples were then returned to the GSB. The <63 m fraction was then split, with one part subjected to aqua regia digestion and analysed for 30 elements by ICP (inductively coupled plasma emission spectroscopy) and for major oxides by

Photo 3. Hand excavated till pit in the Barkerville Project area, exposing basal till at a road cut.

Photo 4. Till trench excavated using a small back-hoe alongside a road as part of the Ace Project. Trenches were up to a metre wide and up to three metres deep, thereby allowing for samples to be collected from various depths in the sediment profile.

$LiBO_2$ fusion – ICP (11 oxides, loss on ignition and 7 minor elements). The other portion was submitted for INA (thermal neutron activation analysis) for 35 elements.

RESULTS

A total of 368 bulk sediment samples were collected during the regional till geochemistry Barkerville Project, including 42 duplicate samples for quality control. This results in 326 unique sample sites within the full 1:50,000 area, thus yielding a sampling density of ~1 sample per 2.86 km^2 (Figure 5). Table 4 shows the distribution of sample media types collected. Of the 326 samples, 290 represent basal till and account for 89 per cent of the suite, 30 samples (9 per cent) were colluviated till and six samples (2 per cent) were ablation till. Although not as reliable, the 36 non-basal till samples, are still useful for the regional exploration program, but require additional effort in their interpretation. More importantly, was the occurrence of mineralized float at a number of locations scattered over the project area. Although geochemical data have yet to be generated, it is anticipated that exceptional values of several key indicator elements will correspond to the mineralization observed in exposures.

Figure 6 shows the distribution of till samples for the Ace Project. A total of 202 samples were collected in this case, including 22 duplicates. Table 5 summarizes the distribution of sample types, as well as the average depth for each within the suite of 180 non-duplicate samples. At each of the 54 sampling stations, trenches were excavated and samples collected with increasing depth: one sample was taken from the B-soil horizon; one deep within the C-horizon; and one sample in between, either as a shallow C or a BC-horizon. At stations where interval samples were not collected, only C-horizon till samples were ob-

TABLE 4
SAMPLE MEDIUM DISTRIBUTION FOR BARKERVILLE PROJECT

Till Type	No. of Samples	Per cent
Ablation	6	2
Basal	290	89
Colluviated	30	9
Total	326	100

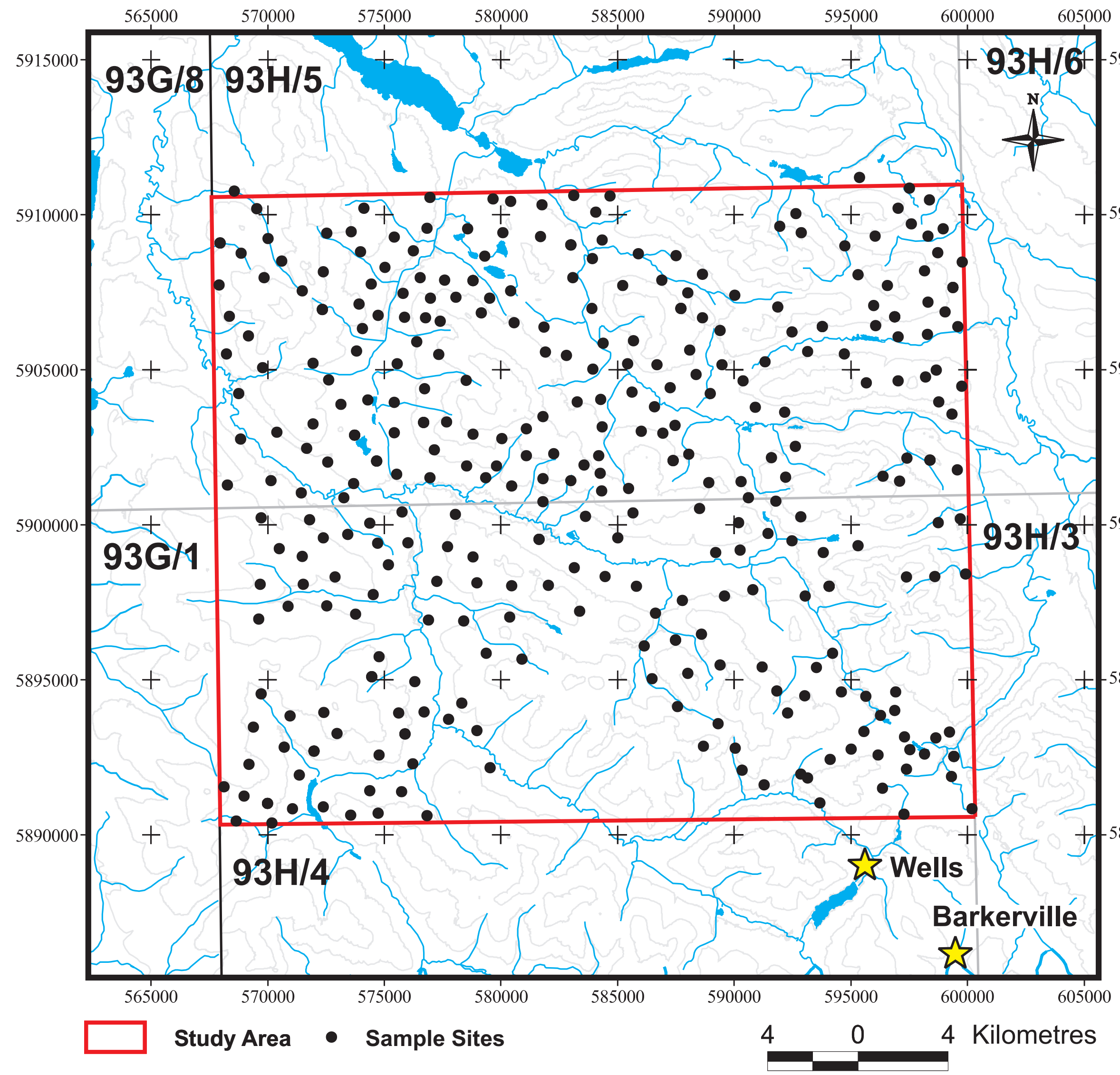

Figure 5. Till geochemistry sample distribution within the Barkerville Project area. There are 326 sample sites that yield a sampling density of approximately one sample per 2.86 square kilometres.

tained. All geochemical samples are currently being analyzed and the final results will appear in a separate publication.

During the regional till survey, a number of ice flow directional indicator features were also encountered and studied (Figure 7). This involved mainly small scale and intermediate scale erosional forms. Most ice flow evidence was derived from the measurement of striations and rat tails, although grooves and gouges also figured prominently (Photos 5 and 6). Minor directional data were collected in the field from roche moutonnées, whale backs, rock drumlins and crag and tail features. All of the evidence compiled thus far comes from the northern half of the regional study area (93H/5 south half). Documented ice flow direction is quite variable, ranging through most cardinal directions. One unique pattern is the unequivocal evidence for flow toward the east in the centre part of the map sheet. A number of sites confirm this ice flow direction. This pattern alone is remarkable given the close proximity of the study area to the mountains located farther east. In this area, one would expect that westward flowing ice from the Cariboo Mountains would have over-shadowed any eastward flowing interior ice. The full appreciation and interpretation of the multiple ice flow directions have yet to be reconciled, however, the implications are significant. Back calculation of ice flow direction is usually a simple up-ice effort. Here, cross-cutting striations over such a broad area will require site specific interpretations when tracing anomalous geochemical results.

A variety of different surficial sediment types were observed in the Barkerville Project area. Till (basal till and less commonly ablation till), colluvial, fluvial, glaciofluvial, glaciolacustrine, organic and anthropogenic sediments are common. In general, fluvial, glaciofluvial and glaciolacustrine sediments are

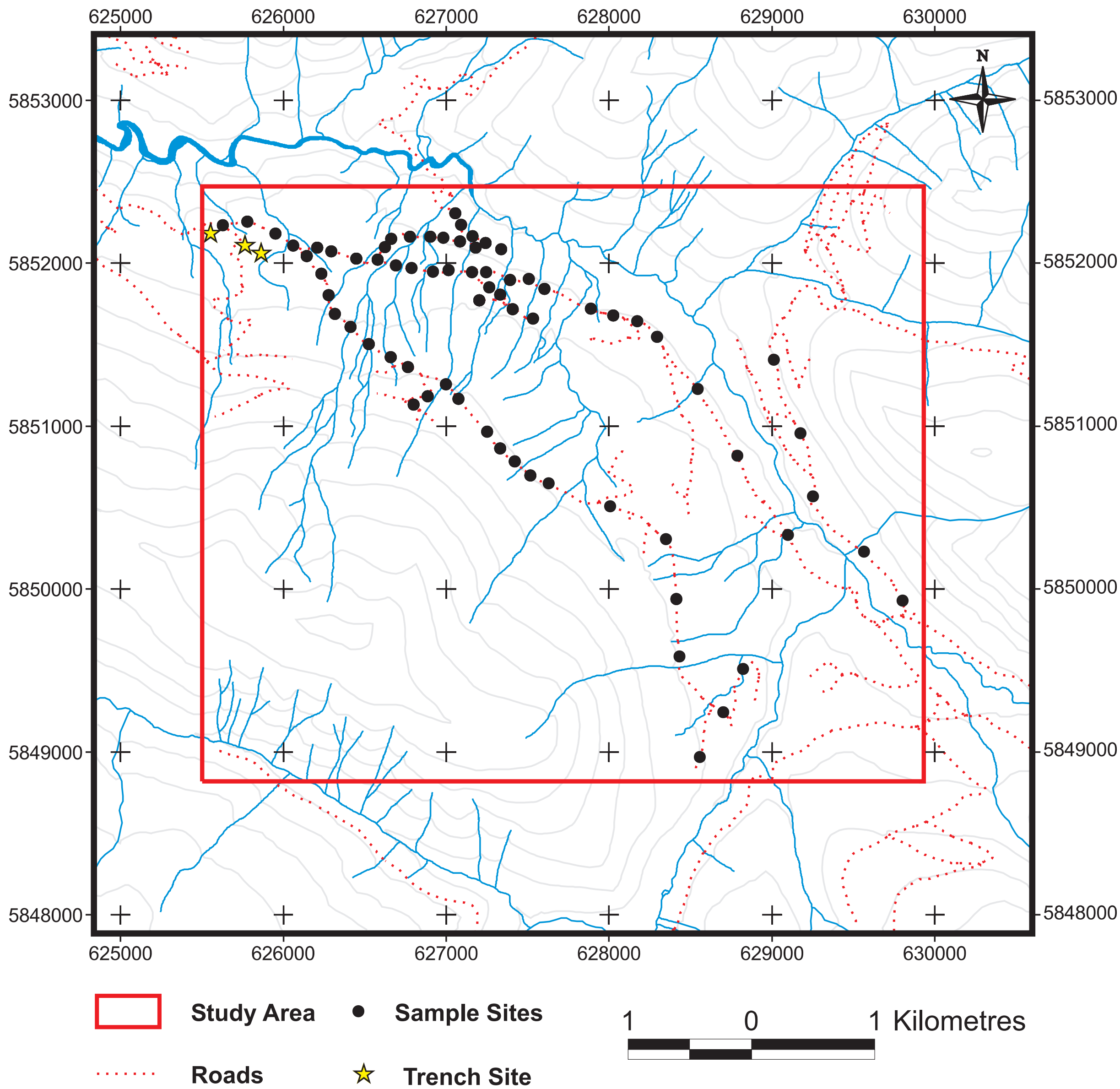

Figure 6. Till geochemistry sample distribution within the Ace Project area. Samples were collected from back-hoe trenches located along roads in an up-ice direction to the mineralized exploration trenches (indicated by stars on the map).

TABLE 5
SAMPLE MEDIUM DISTRIBUTION AND CORRESPONDING AVERAGE SAMPLE DEPTH

Sample Medium	No. of Samples	Per cent	Average Depth (m)
B Soil	55	31	0.27
B-C Soil	26	14	0.64
C Till	99	55	1.38
Total	180	100	

found in the bottom of valleys to elevations of about 1050 metres above sea level. Underlying these sediments at depth, deposits of till and other materials are occasionally present. Above this elevation, ground moraine dominates except where slopes are steep in which case colluvium occurs. Sediments disturbed or derived by anthropogenic activities are found in and around communities, along roads and, in particular, within surface workings such as placer mines. Organic deposits occur locally in all types of terrain.

Basal till deposits are characterized as being very poorly-sorted, matrix-supported diamictons (Photo 7). They occur throughout the study area as variably thick veneers (<1 metre) to blankets (>8 metres) that are primarily massive, although some minor stratification was ob-

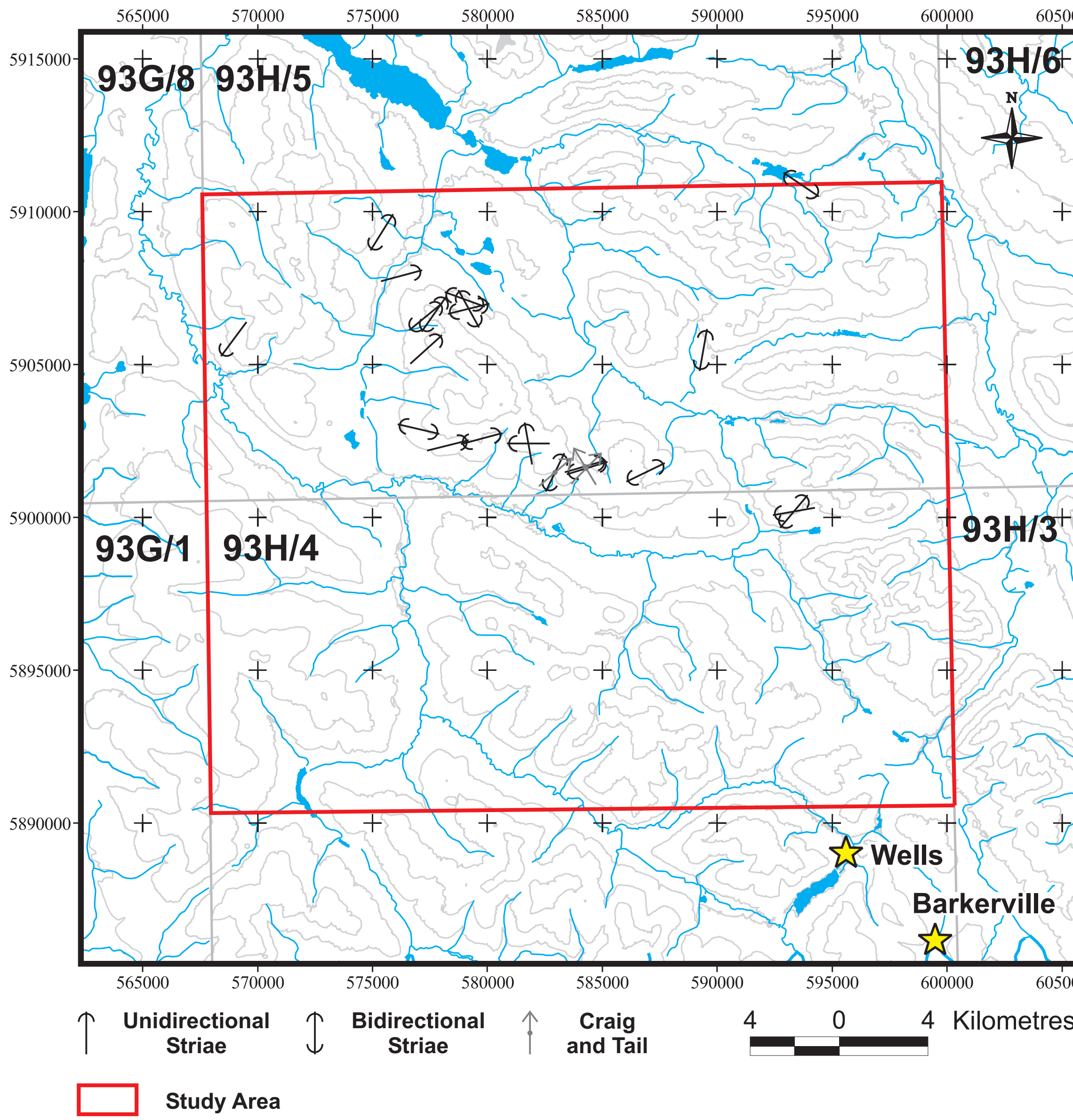

Figure 7. Ice flow map for the Barkerville study area.

served. The tills are moderately to highly consolidated and cohesive. The matrix is generally an olive grey or olive brown colour and has a clayey-silt to silty-sand texture. Clast percentages within the basal till range from 5 to 45 per cent averaging 26 per cent. Clast size ranges from granular to >2 metres with an average of about 1.7 centimetres. The clasts in till are primarily subrounded to subangular in shape and often have faceted and/or striated surfaces.

Deposits of ablation till are massive to crudely-stratified diamictons often occurring as veneers overlying deposits of basal till or bedrock. Such deposits are generally less consolidated compared to a typical basal till accumulation (moderately compact and cohesive). The matrix is also sandier than that of a basal till. The ablation tills sampled have a range of clast percentage from 20 to 70 per cent; averaging 39 per cent. Clast size ranges from granular to ~60 centimetres with a mean of about 4.0 centimetres. The shape of clasts ranges from very angular to subrounded and shows less faceting and striations than those found in a basal till.

As noted earlier, other sediment types were also observed in the two study areas, and their characteristics were noted. However, given that they play no role in our till geochemistry survey, we do not describe their attributes and distribution in this paper.

SUMMARY

During the 2000 field season, two drift prospecting projects were successfully completed in the Cariboo

Photo 5. Striated and grooved bedrock surface found in the north-western part of the Barkerville study area. Ice is interpreted to have flowed from the southwest towards the northeast at this site.

Photo 6. Bullet-shaped boulder found within basal till. The photo was taken from a perspective of looking obliquely down onto the boulder. Ice flow is interpreted as coming out of the page towards the viewer.

Mining Division. The first was a regional study that focused on collecting bulk till samples for geochemical analysis over the Barkerville and Slide Mountain terranes in the vicinity of Wells. This project covered half of two 1:50,000 NTS map sheets with a total of 326 sampling sites. The second project was a detailed orientation program, conducted within an area of known mineral potential near Likely. As part of this latter project, 180 samples were collected from 70 sampling sites. All samples are currently in the process of being analyzed and their results will be published separately at a later date.

The most important implications of the till geochemistry work accomplished to date include:

- the significant mineral potential of the region has been confirmed through our work;
- basal till is a common surficial deposit type in the region and is ideally suited for geochemical drift prospecting;
- evidence for multiple ice flow directions requires additional work for resolution to a satisfactory level that industry can use;
- mineralized float was encountered in a number of locations in the study region;
- significant areas of high mineral potential remain unstaked.

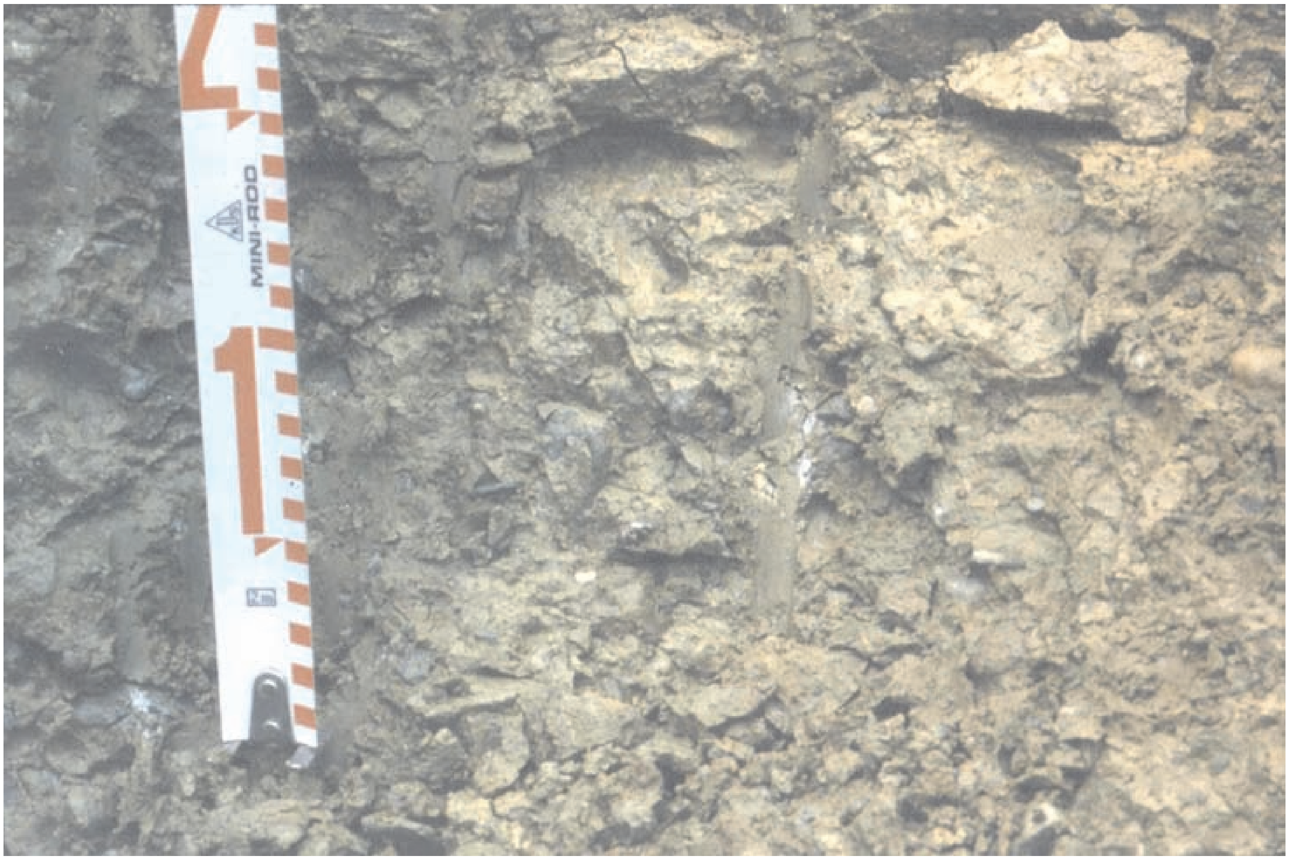

Photo 7. Example of a poorly sorted, basal lodgement till that contains ~15% clasts and has a fine sand, silty matrix. Note the strongly fissile texture.

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REFERENCES

Bloodgood, M.A. (1989): Geology of the Quesnel Terrane in the Spanish Lake Area, central British Columbia, 93A/11; *in* Geological Fieldwork 1987, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1988-1, pages 139-145.

Bobrowsky, P.T. and Sibbick, S.J. (1996): Till Geochemistry of Northern Vancouver Island Area (92L/5, 6W, 11W, 12); *B.C. Ministry of Employment and Investment*, B.C. Geological Survey Branch, Open File 1996-7.

Bobrowsky, P.T., Leboe, E.R., Dixon-Warren, A. and Ledwon, A. (1997): Eagle Bay Project: Till geochemistry of the Adams Plateau (82M/4) and North Barriere Lake (82M/5) map areas; *in* Geological Fieldwork 1996, D.V. Lefebure, W.J. McMillan and G. McArthur, Editors; *B.C. Ministry of Employment and Investment*, Paper 1997-1, pages 413-421.

Campbell, R.B. (1978): Quesnel Lake 93A Map Area; *Geological Survey of Canada*, Open File 574.

Campbell, R.B., Mountjoy, E.W. and Young, F.G. (1973): Geology of the McBride map area, British Columbia; *Geological Survey of Canada*, Paper 72-35, 104 pages.

Clague, J.J. (1988): Quaternary stratigraphy and history, Quesnel, British Columbia; *Geographie physique et Quaternaire*, Volume 42, pages 279-288.

Clague, J.J. (1991): Quaternary stratigraphy and history of Quesnel and Cariboo river valleys, British Columbia: implications for placer gold exploration; *in* Current Research, Part A, *Geological Survey of Canada*, Paper 91-1A, pages 1-5.

Clague, J.J., Hebda, R.J. and Mathewes, R.W. (1990): Stratigraphy and paleoecology of Pleistocene interstadial sediments, central British Columbia; *Quaternary Research*, Volume 34, pages 208-228.

Cook, S.J. and Pass, H.E. (2000): Ancient Pacific Margin Part V: Preliminary results of geochemical studies for VMS deposits in the Big Salmon Complex, Northern British Columbia (104N/9, 16; 104O/11, 12, 13, 14); *in* Geological Fieldwork 1999*; B.C. Ministry of Energy and Mines*, Paper 2000-1, pages 71-105.

Dixon-Warren, A., Bobrowsky, P.T., Leboe, E.R. and Ledwon, A. (1997): Eagle Bay Project: Surficial geology of the Adams Plateau (82M/4) and North Barriere Lake (82M/5) map areas; *in* Geological Fieldwork 1996, D.V. Lefebure, W.J. McMillan and G. McArthur, Editors; *B.C. Ministry of Employment and Investment*, Paper 1997-1, pages 405-411.

Dixon-Warren, A. and Hickin, A. (2000): Ancient Pacific Margin NATMAP Part IV: Surficial mapping and till geochemistry in the Swift River Area, Northwestern British Columbia; *in* Geological Fieldwork 1999, *B.C. Ministry of Energy and Mines*, Paper 2000-1, pages 47-69.

Ferri, F. (2001): Geological setting of the Frank Creek massive sulphide occurrence near Cariboo Lake, east-central British Columbia (93A/11, 14); *in* Geological Fieldwork 2000, *B.C. Ministry of Energy and Mines*, this volume.

Ferri, F., Höy, T. and Friedman, R.M. (1997): Description, U-Pb age and tectonic setting of the Quesnel Lake Gneiss, east-central British Columbia; *in* Geological Fieldwork 1996, D.V. Lefebure, W.J. McMillan and G. McArthur, Editors; *B.C. Ministry of Employment and Investment*, Paper 1997-1, pages 69-80.

Ferri, F. and Höy, T. (1998a): Zn-Pb deposits in the Cariboo Subterrane, central British Columbia (93A/ NW); *in* Geological Fieldwork 1997, D.V. Lefebure and W.J. McMillan, Editors; *B.C. Ministry of Employment and Investment*, Paper 1998-1, pages 14.1-14.9.

Ferri, F. and Höy, T. (1998b): Stratabound base metal deposits of the Barkerville Subterrane, central British Columbia (093A/ NW); *in* Geological Fieldwork 1997, D.V. Lefebure and W.J. McMillan, Editors; *B.C. Ministry of Employment and Investment*, Paper 1998-1, pages 13.1-13.12.

Fulton, R.J. (1991): A conceptual model for growth and decay of the Cordilleran ice sheet; *Geographie physique et Quaternaire*, Volume 45, no. 3, pages 281-286.

Holland, S.S. (1954): Geology of the Yanks Peak-Roundtop Mountain area, Cariboo District, British Columbia; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Bulletin 34, 102 pages.

Holland, S.S. (1976): Landforms of British Columbia, a physiographic outline; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Bulletin 48.

Kerr, D.E., Sibbick, S.J. and Jackaman, W. (1992): Till geochemistry of the Quatsino map area (92L/12); *B.C. Ministry of Energy, Mines and Petroleum Resources*, Open File 1992-21.

Levson, V.M. and Giles, T.R. (1993): Geology of tertiary and quaternary gold-bearing placers in the Cariboo region, British Columbia (93A,B,G,H); *B.C. Ministry of Employment and Investment*, Bulletin 89, 202 pages.

Levson, V.M and Giles, T.R. (1997): Quaternary geology and till geochemistry studies in the Nechako and Fraser Plateaus, Central British Columbia (NTS 93 C/1,8,9,10; F/2,3,7; L/16; M/1); *in* Interior Plateau Geoscience Project: Summary of Geological, Geochemical and Geophysical Studies, L.J. Diakow and J.M. Newell, Editors, *B.C. Ministry of Employment and Investment*, Paper 1997-2, pages 123-146.

Meidinger, D. and Pojar, J. (1991): Ecosystems of British Columbia; *B.C. Ministry of Forests*, Special Report Series, no. 6.

Nelson, J. (2000): Ancient Pacific Margin Part I: BCGS contributions and collaborative activities with GSC and Yukon geology program; *in* Geological Fieldwork 1999; *B.C. Ministry of Energy and Mines*, pages 15-18.

Panteleyev, A. and Hancock, K. (1989): Quesnel mineral belt: Summary of the geology of the Beaver Creek- Horsefly River map area; *in* Geological Fieldwork 1988, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1989-1, pages 159-165.

Paulen, R.C., Bobrowsky, P.T., Little, E.C., Prebble, A.C. and Ledwon, A. (1998): Surficial deposits in the Louis Creek and Chu Chua Creek Area; *in* Geological Fieldwork 1997, D.V. Lefebure and W.J. McMillan, Editors, *B.C. Ministry of Employment and Investment*, Paper 1998-1, pages 16.1-16.12.

Paulen, R.C., Bobrowsky, P.T., Lett, R.E., Bichler, A.J. and Wingerter, C. (1999): Till Geochemistry in the Kootenay, Slide Mountain and Quesnel Terranes; *in* Geological Fieldwork 1998, *B.C. Ministry of Employment and Investment*, Paper 1999-1, pages 307-319.

Ray, G.E., Webster, I., Lane, B., Rhys, D., Ross, K., Hall, R. and Dunne, K.P.E. (2001): Variable geochemistry of the gold mineralization in the Wells-Barkerville Camp; *in* Geological Fieldwork 2000; *B.C. Ministry of Energy and Mines*, this volume.

Shilts, W.W. (1993): Geological Survey of Canada's contributions to understanding the composition of glacial sediments; *Canadian Journal of Earth Sciences*, Volume 30, pages 333-353.

Struik, L.C. (1986): Imbricated terranes of the Cariboo Gold Belt with correlations and implications for tectonics in southeastern British Columbia; *Canadian Journal of Earth Sciences*, Volume 23, pages 1047-1061.

Struik, L.C. (1988): Structural geology of the Cariboo Gold Mining District, east-central British Columbia; *Geological Survey of Canada*, Memoir 421, 100 pages and four 1:50 000 maps.

Sutherland Brown, A. (1957): Geology of the Antler Creek area, Cariboo District, British Columbia; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Bulletin 38, 105 pages.

Sutherland Brown, A. (1963): Geology of the Cariboo River area, British Columbia; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Bulletin 47, pages 60.

Tipper, H.W. (1959): Geology, Quesnel, Cariboo District, British Columbia; *Geological Survey of Canada*, Map 12-1959, 1:250 000.

Tipper, H.W. (1961): Geology, Prince George, British Columbia; *Geological Survey of Canada*, Map 49-1960, 1:250 000.

Tipper, H.W. (1971): Multiple glaciations in central British Columbia; *Canadian Journal of Earth Sciences*, Volume 8, pages 743-752.