GENERAL DESCRIPTIVE NOTES

INTRODUCTION

This map results from one part of a multi-component geological and mineral exploration survey of the Fawnie Creek map area conducted in 1993 that includes bedrock geology (Diakow *et al.*, 1994), lake sediment geochemistry (Cook and Jackaman, 1994), till geochemistry and surficial geology (Giles and Levson, 1994) and mineral deposit (Schroeter and Lane, 1994) studies. The general objective of the program is to aid mineral exploration in the region. The objectives of the Quaternary geology and till geochemistry components are as follows:

- gain an understanding of the surficial geology and Quaternary stratigraphy of the area in order to define the glacial history and decipher ice-flow patterns
- evaluate existing terrain mapping in the region and compile field descriptions of terrain units for the purpose of constructing 1:50 000 surficial geology maps and drift prospecting potential maps
- collect till samples for geochemical analyses in order to identify potential buried mineral deposits
- develop and refine methods of drift exploration applicable to the Interior Plateau region.

For more information on the results of these studies please refer to Giles and Levson (1994) and Levson and Giles (1994a, b). Final results of the till and lake sediment geochemical sampling programs will be published at a later date.

PHYSIOGRAPHY AND QUATERNARY GEOLOGY

The Fawnie Creek map area is located in the Nechako Plateau, in the west-central part of the Interior Plateau physiographic region (Holland, 1976). The Fawnie Range dominates the northeast corner of the map sheet, reaching elevations of over 1775 metres. Entiako Spur extends across the northern portion of the region, with elevations dropping westward from 1750 metres to below 1200 metres. Fawnie Creek valley occupies the centre of the map sheet and flows from Top Lake at an elevation of around 1070 metres southwest through Laidman and Johnny Lakes. The Naglico Hills, reaching elevations of 1550 metres, are bounded to the north and south by the Fawnie Creek and Blackwater River valleys, respectively. All valleys in the area are broad with gently inclined sides reflecting glacial modification, except Van Tine Creek which is perpendicular to ice-flow and has a sharp V-shaped valley.

During the last or Late Wisconsinan Fraser glaciation ice moved into the map area from the Coast Mountains (Tipper, 1971). Results of ice flow studies in the area indicate that there was one dominant flow direction during the last glacial period modified by topographic control during both early and late stages of glaciation. At the Late Wisconsinan glacial maximum, ice covered the highest peaks in the region and movement appears to have been unaffected by topography suggesting an ice thickness in excess of 1000 metres. Crag and tail features, drumlins, glacial flutings and bedrock striae throughout the area indicate flow towards the east and northeast during full glacial time. Cross-cutting striae in an easterly (075°) trending valley in the northeast part of the area is an example of topographically influenced ice flow during waning stages of glaciation. Early flow is towards 045° and later flow at 075°. Similarly, in the southwest part of the area the full-glacial ice direction was determined to be 070° - 080° with later flow at 089° - 103°.

During deglaciation, a number of small ice-dammed lakes formed in a few areas in the northern part of the map area and glaciofluvial gravels and sands were deposited in most low lying areas. Meltwater deposits and glacigenic debris flow deposits were deposited in many parts of the map region on or near the ablating glaciers. Several small eskers formed under downwasting ice in the Van Tine Creek and Fawnie Creek valleys and in low-lying areas southwest of Moose Lake. On the southeast margin of Entiako Spur, kame deposits and an extensive series of meltwater channels developed parallel to the ice margin, indicating prolonged ice stagnation.

MAP CONSTRUCTION METHOD

This map is an interpretive product derived from terrain map data produced by Howes (1976) and Ryder (1993) and surficial geology information collected by airphoto interpretation and field studies (Giles and Levson, 1994; Levson and Giles, 1994a). The map was produced using a Geographic Information System (GIS) software package (TerraSoft). A list of field data collected is provided in the following section. Field and map data were used to identify categories of drift exploration potential as defined on the accompanying legend. The terrain units in each category are provided in the table below so that users can derive similar drift exploration potential maps from terrain data available for the surrounding regions (e.g. Howes, 1977). Based on the results of field studies (Giles and Levson, 1994), the criteria listed are considered applicable to geologically similar areas in surrounding parts of the Interior Plateau and, as such, no further field or airphoto studies are required to produce these additional maps. However, we recommend that these studies be conducted, at least periodically, in order to account for subtle regional differences in geology as well as for variations due to factors such as different authors or author experience and evolving mapping practices over time. The following terrain map criteria are used here to categorize drift prospecting potential:

Category		Criteria*
Very High	R:	terrain units in which bedrock is identified as a primary, secondary or tertiary map component (*e.g.* R/Mv, Cv/R)
	C:	colluvial aprons or blankets with no bedrock outcrop (*e.g.* Ca, Cb, Cb/Cv, Ca//Mb).
High	Mv:	terrain units with morainal veneers (Mv) as the primary component and with colluvium or morainal blanket as secondary or tertiary components (*e.g.* Mv/Mb, Mvb, Mv//Cv); commonly with underlying bedrock.
	Mb:	morainal blankets (Mb) or subdued moraine (Mu) as the only component or with colluvium or morainal veneers as secondary or tertiary components (*e.g.* Mb//Mv, Mbu, Mbv, Mb/Cb)
Moderate	M1:	terrain units with hummocky moraine as the primary component (Mh, Mhu, Mu) and all other morainal units with glaciofluvial, organic or fluvial deposits as secondary or tertiary deposits (*e.g.* Mbv//F^GuO, Mu//OvF^Gh, Mb/F^Gh); commonly modified by meltwater channels (-E^G).
Low	F:	all units dominated by glaciofluvial (F^G), fluvial (F), organic (O) or undifferentiated (U) deposits.
Very Low	L:	terrain units with glacial lake sediments (L^G) occurring as primary, secondary or tertiary components; other surficial terrain units such as eolian (E), glaciomarine (W^G) or anthropogenic (A) units (see Howes and Kenk, 1988) were not mapped in the area by Howes (1976) or Ryder (1993) but most such units would be included in this category.

* for further information on terrain maps and terrain symbols please refer to Howes and Kenk (1988)

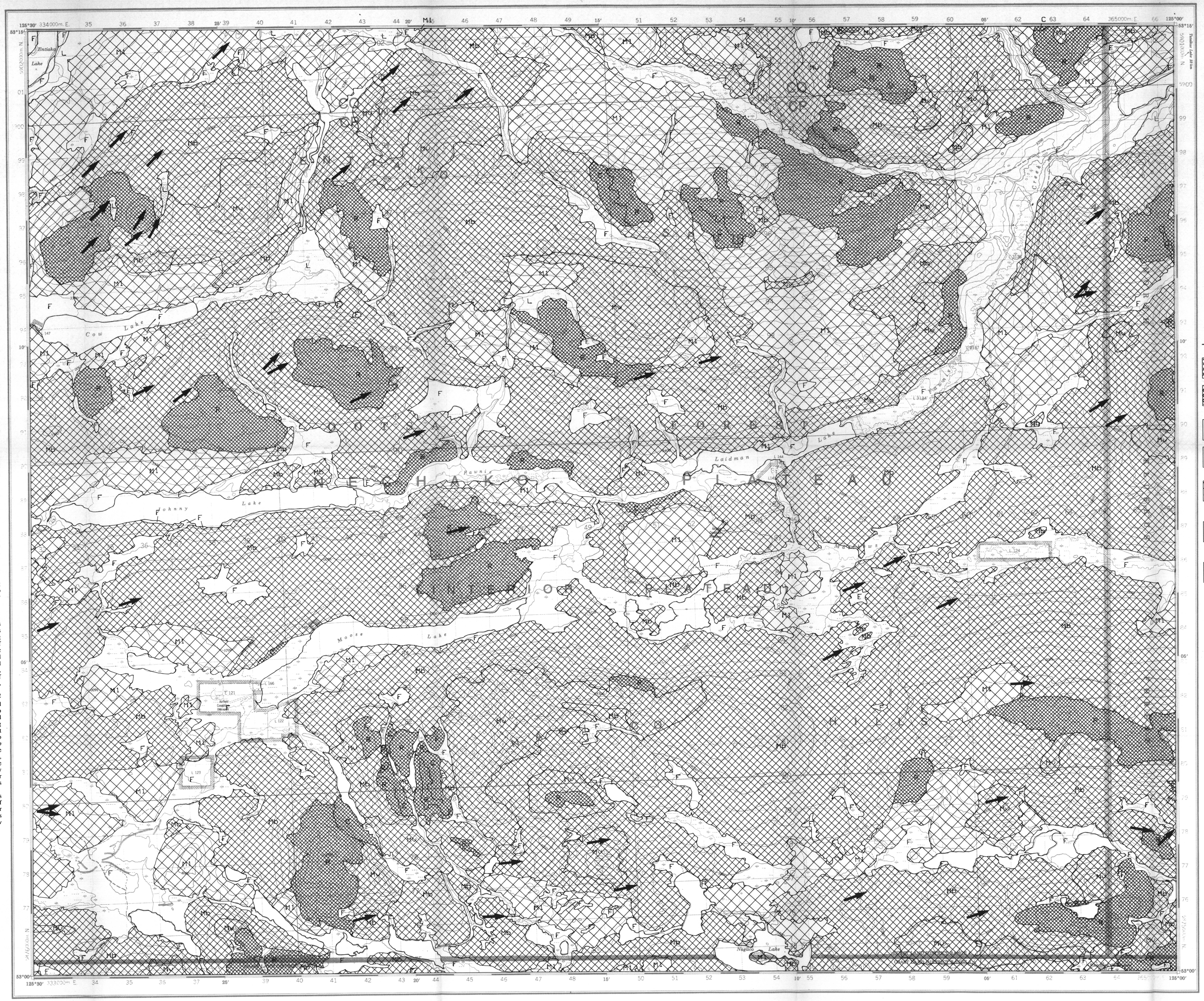
Data on glacial ice-flow direction are summarized on this map to aid in the design of sampling grids and tracing of geochemical anomalies or mineralized clasts ('float'). For the latter purpose it is recommended that reference be made to more detailed information provided on the surficial geology map of the area (Levson and Giles, 1994a). Paleo-flow orientations were compiled from drumlin ridges, crag-and-tail features and striae data.

RECOMMENDED FIELD METHODS

Since this map is intended to aid in the design of drift exploration programs in this area, a few recommendations regarding field methods are provided here. These suggestions generally apply to both property scale and regional surveys and they were followed during the 1993 regional till sampling program (Giles and Levson, 1994). Geochemical sampling programs, indicator clast surveys (boulder tracing) and heavy mineral sampling programs should include collection of stratigraphic, sedimentologic and geomorphic data, wherever possible, in order to aid interpretation of results. Geologic data collected for both surface and subsurface units should include descriptions of sediment type, thickness, primary and secondary sedimentary structures, grain size data (total percentage and modal size of clasts, matrix texture), clast shape and roundness data, abundance of striated and faceted clasts, sediment framework type (matrix- or clast-supported), compactness, fabric data, bedrock striae orientations, imbrication and other paleoflow data, clast lithology, abundance of mineralized erratics and bedrock lithology. Other important data for surficial units includes information on landforms, local slope, vegetation, drainage or water-table data and soil horizon descriptions.

Recommended sample density obviously depends on the scale and purpose of the survey (*e.g.* ~1 sample per 4 km^2 was collected during the regional survey) and will be greatest in areas of prospective high mineral potential (determined on the basis of bedrock geology information or previous geochemical results) but consideration should also be given to the type of surficial material. For example, sample density may be increased in map units where the information gained will most easily lead to identification of source materials (i.e. units with high drift exploration potential). Sampling grids should also be designed after evaluating the surficial deposits in the area of interest in order to account for different types of dispersal patterns. For example, in map units dominated by basal tills, sample sites along traverses parallel to established ice flow direction may be wider spaced than along ice-perpendicular traverses, as glacial dispersal trains tend to be elongated parallel to the dominant glacial paleoflow direction (northeast in this map area). An intermediate sample spacing may be used on traverses oblique to flow. Where mechanical dispersal processes are the main focus of the survey, geochemical samples should collected from within the C mineral horizon, which is comparatively unaffected by the pedogenic processes operative in the A and B soil horizons. Drift prospecting potential can locally be increased for any one map unit by sampling at different depths. For example, basal tills in units Mv or Mb commonly underlie other surficial deposits such as in units M1 or F and they can be readily sampled in existing natural or man made exposures (*e.g.* stream or road cuts) or, at more cost, by excavating or drilling.

Sedimentologic data should be collected at all sample sites in order to distinguish basal tills, glacigenic debris flow deposits, colluvium, glaciofluvial or glaciolacustrine sediments. These sediments have different processes of transportation and deposition which must be recognized in order to understand associated mineral anomaly patterns. For example, local variations will be reflected in some sediments while regional trends may be observed in others. Analyses of these sediments will be useful only if an understanding of their origin is obtained. A basic understanding of ice flow direction, glacial dispersal patterns and transportation distances are required for successful drift exploration programs.



LEGEND AND EXPLANATORY NOTES

DRIFT PROSPECTING POTENTIAL: DEFINITION

Drift prospecting potential, as used here, refers to the ease with which a surficial sediment can be traced back to its original bedrock source using common methods of sampling near-surface sediments. These methods are soil geochemical sampling surveys (commonly using B soil horizons), overburden geochemical surveys (that sample C-horizons, usually in till or colluvium), clast provenance surveys (pebble lithology studies, boulder tracing or other clast indicator surveys) and heavy mineral sampling surveys. The construction of this map is based on mechanical dispersal by glacial, colluvial, fluvial and other sedimentary processes and does not directly include hydromorphic dispersion effects. Factors involved in determining drift prospecting potential include sediment genesis, complexity of erosional and depositional history, sediment thickness, transport distance (proximity to source) and the size, shape and type of dispersal pattern (see below). Drift prospecting 'potential' does not apply to other types of mineral exploration surveys including biogeochemistry, vapour geochemistry, lake and stream sediment geochemistry and geophysical surveys. These types of surveys generally are not primarily influenced by the nature of the surficial sediments at the sample site.

PURPOSE OF MAP

Drift prospecting potential maps are designed to represent the relative potential usefulness of different surficial sediments for geochemical, lithological and heavy mineral exploration programs, particularly those conducted at property scales (~ 1:5 000). They are intended primarily to aid in the planning stages of these surveys. Sampling programs can thus be designed to preferentially select sediment types appropriate to any one level of survey and, likewise, deposit types that will provide less information can be avoided. For example, colluvial deposits typically are composed largely of locally derived materials and therefore they are useful for property-scale surveys; conversely, sampling of glaciofluvial or lacustrine deposits during a property-scale survey generally would provide little information about local mineralization. Using the drift exploration categories on this map, priority sampling areas therefore can be selected. This approach can save time and effort and also yields information of greatest utility. It thus provides a cost-effective means of conducting an exploration program and also has a greater potential for success than do sampling programs that do not discriminate between different surficial sediment types.

EXPLANATION OF SUMMARY LEGEND

Map units are categorized by the dominant surficial materials and ranked according to the relative ease with which each can be traced back to its bedrock source ('traceability'). For example, the potential for tracing the source of thin colluvial deposits derived from bedrock is very good compared to glaciofluvial or glaciolacustrine deposits that are typically derived from other sediments and thus are at least second or third derivatives of bedrock (Shilts, 1976, 1993). 'Transport distance' provides an order of magnitude estimate of the distance that the majority of the sediment in any one deposit type has travelled from its source. 'Probable dispersal pattern' refers to the shape and orientation of dispersal trains produced by erosion, transportation and redeposition of an original source material. Geochemical anomalies in the fine sand, silt and clay fractions and dispersal trains in the gravel fraction may have similar dispersal patterns but transport distances often vary with grain size. 'Applicable survey scale' provides the approximate scales at which sampling of different surficial materials are considered most useful for drift prospecting purposes.

DRIFT PROSPECTING POTENTIAL MAP: SUMMARY LEGEND

Map symbol	Dominant surficial materials	Traceability (to bedrock source)	Transport distance (order of magnitude)	Probable dispersal pattern	Applicable survey scale; and type*
VERY HIGH	**POTENTIAL**				
R	colluvium < 1 m thick with sporadic bedrock outcrops	very good	< 100 m	downslope, linear to fan shaped	1:5 000 (property-scale); S, C
C	colluvial diamicton and rubbly talus deposits > 1 m thick	very good	100 m to 1 km	downslope, fan shaped	1:5 000 (property-scale); S, C
HIGH	**POTENTIAL**				
Mv	Morainal diamicton: mainly basal till deposits < 1 m thick	good	< 2 km	down-ice, linear dispersal train	1:5 000 to 1:50 000; S, C, T, HM
Mb	Morainal diamicton: dominantly basal tills > 1 m thick	good to moderate	< 5 km	narrow, down-ice, elongated fan	1:5 000 to 1:100 000; S, C, T, HM
MODERATE	**POTENTIAL**				
M1	sandy diamicton ('ablation' till); often mantled by < 1 m of glaciofluvial deposits	moderate to poor	> 1 km	broad, down-ice, elongated fans	1:10 000 to 1:100 000; S, C, T, HM
LOW	**POTENTIAL**				
F	glaciofluvial and fluvial gravels and sands; > 1 m thick; includes organics	generally poor	> 5 km	broad, down-flow, fans, discontinuous	1:50 000 to 1:250 000 (mainly regional scale); C, HM
VERY LOW	**POTENTIAL**				
L	glaciolacustrine silt, fine sand and clay; generally > 1 m thick	generally poor	> 5 km	irregular, discontinuous	1:100 000 to 1:250 000 (regional scale): N

* S- soil geochemistry; T - till geochemistry; C - clast provenance surveys (boulder tracing, clast indicator surveys, pebble lithology studies); HM - heavy mineral sampling; N - not recommended for sampling in most cases.

Former glacial flow direction (based on drumlin, crag-and-tail and bedrock striae data)

ACKNOWLEDGMENTS

This map was produced from a prototype drift prospecting map first compiled by Dan Kerr and presented at the 1993 Cordilleran Roundup in Vancouver. The map follows recommendations made by industry explorationists on this original prototype map.

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Province of British Columbia
Ministry of Energy, Mines
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BRITISH COLUMBIA GEOLOGICAL SURVEY

Geological Survey Branch

OPEN FILE 1994-10

DRIFT PROSPECTING POTENTIAL OF THE FAWNIE CREEK AREA

NTS 93 F/3

by Timothy R. Giles and Victor M. Levson

1:50 000

Miles 1 0 1 2 3 Milles

Metres 1000 0 1000 2000 3000 4000 Mètres

For an overview of drift prospecting studies and surficial geology mapping in the Fawnie Creek area please refer to the paper entitled "Surficial Geology and Drift Exploration Studies in the Fawnie Creek Area" by Timothy R. Giles and Victor M. Levson *in* Geological Fieldwork 1993, B.M. Grant and J.M. Newell, Editors, *British Columbia Ministry of Energy, Mines and Petroleum Resources*, Paper 1994-1. Drift prospecting units are derived from surficial geology data compiled by Levson and Giles (1994).

UNIT DESCRIPTIONS

VERY HIGH POTENTIAL

Sediments with very high drift prospecting potential for property-scale surveys include colluvial deposits typically derived from bedrock sources less than 1 kilometre distant and commonly less than 100 metres. They can be traced orthogonally or diagonally upslope along linear to fan-shaped dispersal paths to their original source. These deposits typically consist of unsorted or very poorly sorted diamicton with abundant angular clasts of bedrock. They are differentiated here into those consisting of colluvial deposits, less than 1 metre thick with some exposed bedrock, occurring mainly in upland areas and on steep slopes (R) and colluvium more than 1 metre thick without exposed bedrock (C). The latter include colluvial blankets and rubbly talus deposits that mostly are found at the base of steep rocky slopes in the Fawnie Range and Naglico Hills.

HIGH POTENTIAL

Deposits considered to have high drift prospecting potential for property-scale surveys include basal tills deposited by lodgement or meltout processes (primary tills). These deposits are differentiated here into till veneers less than 1 metre thick occurring mainly on steeper slopes and around bedrock highs (Mv) and till blankets more than 1 metre thick mantling bedrock on gentle slopes (Mb). These deposits can be readily traced to their bedrock sources in an up-glacier direction along linear 'cigar'-shaped or narrow, elongated, fan-shaped dispersal paths. Thin till deposits tend to be closer to source than till blankets. Detected mineralization in both categories, especially till blankets, may be separated or offset from the bedrock source by a region of 'barren' sediment. Also included in this category, but slightly more difficult to trace to source than lodgement or meltout tills, are subglacial debris flow deposits and basal till deposits that have moved downslope since deposition primarily under the influence of gravity (not water). Basal tills may occur locally in other map categories, especially at depth (see recommended field methods).

Dispersal paths in these deposits typically are dominated by a down-ice component modified to various degrees (depending mainly on local relief) by downslope movement. Due to the potential for the development of large dispersal trains, mineral anomalies in basal tills may be detected in regional as well as local surveys. Sampling of basal tills rather than other types of surficial materials is particularly useful in this map area because the dominance of one main regional ice-flow direction throughout much of the last glacial period has resulted in a simple linear, down-ice transport of material (Giles and Levson, 1994; Levson and Giles, 1994b). This makes tracing of basal till anomalies to source relatively easy compared to areas with a more complex ice-flow history.

Morainal deposits typically consist of diamicton with a sandy silt to silty clay matrix. They are unsorted to very poorly sorted, massive or crudely stratified, compact and matrix-supported. Clasts are up to boulder size and often striated. Flutings, drumlinoid ridges, crag-and-tail features and striated bedrock substrates are commonly associated with these deposits, providing a ready means for determining glacial paleoflow direction (shown on map with large arrows). Detailed till fabric measurements, on elongated clasts contained within basal till deposits, can be useful for determining glacial flow direction in the absence of other ice flow indicators or for providing more detailed local information.

MODERATE POTENTIAL

Deposits considered to have moderate drift prospecting potential for property-scale surveys include morainal sediments in areas of hummocky topography and glacial diamictons that have evidence of substantial post-depositional remobilization (secondary morainal deposits) (M1). These deposits are believed to have formed by meltout of debris from glacial ice, as suggested by the hummocky topography, with subsequent remobilization in debris flows. The ubiquitous presence of striated clasts in these deposits suggests that at least some of the sediment was derived from basal or englacial debris. These secondary glacial deposits are more difficult to trace to source than primary tills due to a more complicated sedimentary history. Dispersal paths are similar in primary and secondary glacial deposits, both being dominated by a down-ice movement direction, but secondary dispersal vectors in resedimented glacial deposits are more chaotic and difficult to determine, being related to the position of former ice blocks rather than the present topography. Till fabric analyses, however, can help determine the last direction of debris flow movement. Distance of transport is largely dependent on the original position of transportation within the glacier, more distally derived deposits generally being derived from higher levels in the ice. Supraglacial deposits are typically the most far travelled, sometimes exceeding tens or even hundreds of kilometres. Fortunately, they are not common in the map area. Supraglacial deposits have low drift prospecting potential and need to be differentiated in the field from other resedimented glacial deposits. They can be recognized by characteristics such as abundant, far-travelled erratics, that are commonly angular with few or no glacial abrasion features, and by sedimentologic studies.

Resedimented glacial deposits typically consist of unsorted to poorly sorted, crudely stratified, matrix-supported, sandy diamicton with clasts up to boulder size. Diamicton beds are commonly mantled, interbedded or laterally gradational with glaciofluvial sands and gravels. The latter sediments generally should be avoided in sampling programs as they have a more complicated transport history and usually a longer transport distance from source. Sampling basal tills, that may occur at depths of a few metres or more in this unit, is locally an effective way of increasing drift prospecting potential (see recommended field methods). In upland areas this unit is associated with small regions of exposed bedrock or colluvium and in low areas it occurs with organic, fluvial and glaciofluvial deposits too small to be mapped separately. Small meltwater channels and areas of kettled topography are locally common.

LOW POTENTIAL

Fluvial and glaciofluvial deposits generally have a large component of distally derived material (typically > 5 km from source). Transport distances, however, are highly variable and dependent on paleostream energy, lithology (resistance to abrasion) and grain-size. Processes of entrainment, transportation and redeposition result in discontinuous, irregular, often sinuous dispersal patterns. These deposits are not expected to reflect directly underlying mineralization except in areas where they are less than a few metres thick and erosionally overlie bedrock.

Fluvial deposits typically consist of well stratified and moderately well sorted sand, gravel and some silt. Glaciofluvial deposits are generally more poorly sorted often interbedded with glacial debris flow deposits. Fluvial deposits include floodplain and alluvial (and colluvial) fan sediments and minor modern delta and terrace deposits. In the map area they are most abundant in the Fawnie, Matthews and Van Tine Creek valleys. Several well developed alluvial fans occur in the Fawnie Creek valley between Laidman and Top lakes. Floodplain deposits locally have an organic veneer. Glaciofluvial deposits are most common in valley bottoms where they typically are subdued and overlain or associated with fluvial and organic deposits. (Since drift prospecting potential relates only to mechanical dispersal processes, organic deposits are ranked with the deposits that they overlie, mainly floodplain sediments in this map region; see also below.) Glaciofluvial fans and deltas occur locally along valley sides and at the lower ends of meltwater channels. Kettled outwash, eskers and kame deposits occur locally especially in hummocky terrain in association with morainal deposits.

VERY LOW POTENTIAL

Lacustrine and glaciolacustrine deposits are at least third-derivative sedimentary products of bedrock, invariably having undergone multiple cycles of erosion, transportation and deposition by glaciers, streams and finally in the lacustrine environment. Due to this complex history, locating the original source of any mineralized material that may be discovered in these sediments is very low. In addition, lacustrine and, in particular, glaciolacustrine sediments are often comprised of sediment transported from a wide region and the potential for dilution of mineralized material by barren sediment is therefore much higher. Glacial lake sediments are generally not recommended as a sampling media.

Lacustrine and glaciolacustrine deposits are dominated by well sorted, laminated or thinly bedded, fine to medium sands, silts and clays. Ice-rafted stones, normal faults and slump structures are common. They are invariably overlain by organic materials and also locally by fluvial or glaciofluvial deposits. In the map area they occur mainly in the low areas in the north part of the map sheet in the valleys of Cow, Top, and Entiako lakes and lower Van Tine Creek.