BRITISH COLUMBIA Ministry of Energy and Mines
Geoscience BC

British Columbia Geological Survey Open File 2014-06
Geoscience BC Map 2014-06-01

Basal till potential of the Clusko River map area (NTS 093C/09), British Columbia

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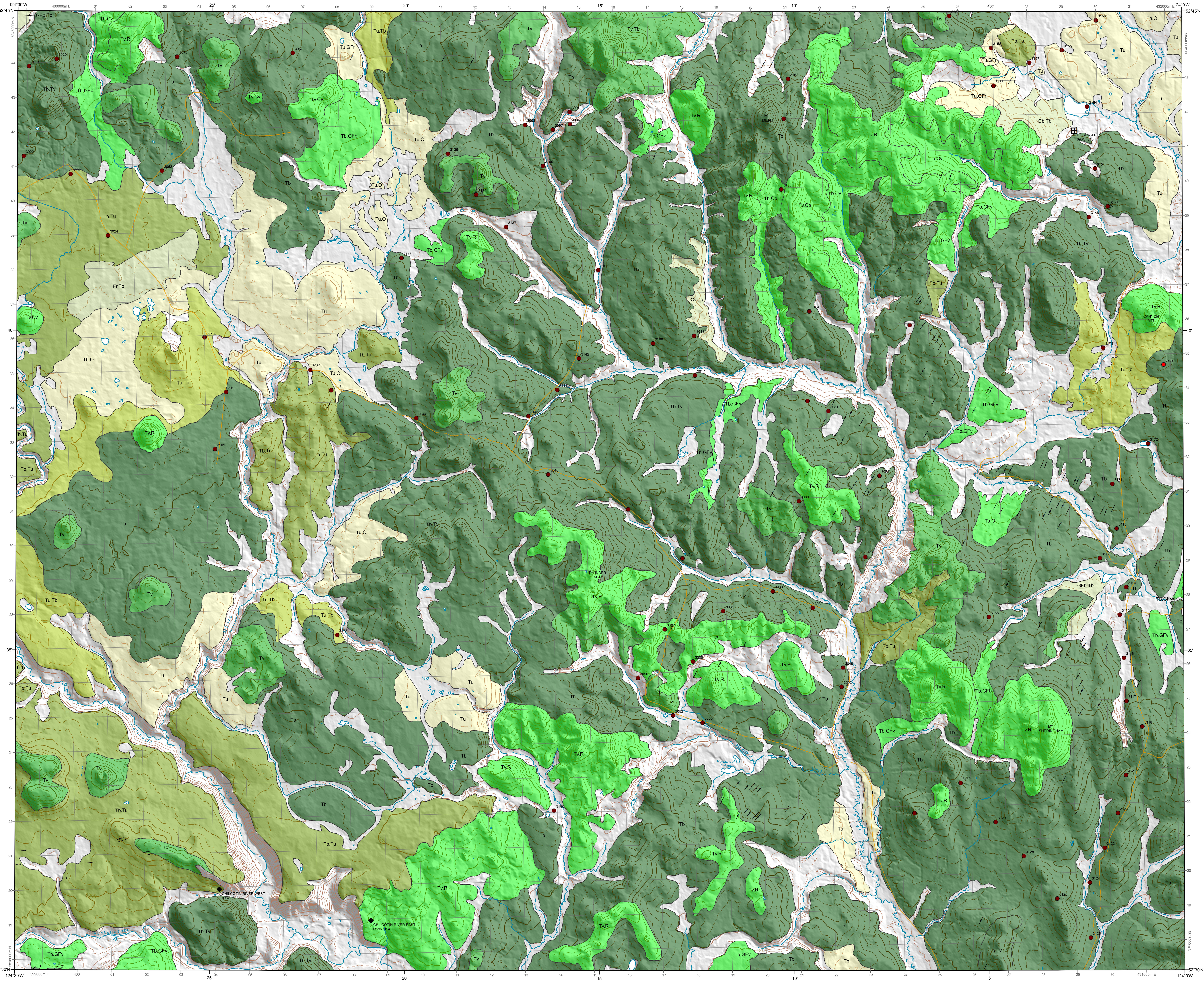


0 1 2 4 6 8 10
Kilometres
Scale 1:50,000

North American Datum 1983
Universal Transverse Mercator Zone 10 North
Shuttle Radar Topography Mission (SRTM) DEM, 3, arcsecond (90 m) resolution
Contour interval 20 metres

Geology by D. Sacco, and D. Proudfoot and R. Allison (1993). Compilation by D. Sacco. Cartography by H. Arnold.

SURFICIAL GEOLOGY

NOTE: Where map units are composed of multiple surficial materials, a compound map unit designator is used, separating more extensive materials from less extensive (e.g., for Tb.Tv, Tb is more extensive than Tv).

ORGANIC DEPOSITS: Largely saturated organic materials, consisting mainly of mosses, sedges, or other hydrophytic vegetation.

O **Undifferentiated organic deposits:** Bogs, fens, and swamps; generally where shallow lakes have been infilled and in depressions along floodplains and abandoned meltwater channels.

EOLIAN DEPOSITS: Well sorted, silt to medium-grained sand deposited by the wind immediately following glaciation.

Er **Dunes:** Barchan or poorly formed dune structures, typically inactive.

COLLUVIAL DEPOSITS: Materials deposited by direct gravity-induced movement; lithologic composition dependent on source material; typically poorly sorted, massive to crudely stratified diamicton.

Cf **Colluvial fan:** Diamicton that spread out from an apex or form as a toe-slope apron with a surface gradient ≤ 15˚.

Cv **Colluvial veneer:** Deposits less than 2 m thick that conform to underlying topography; typically on steep slopes.

Cb **Colluvial blanket:** Deposits greater than 2 m thick that mask subtle variations in substrate surface but generally conform to underlying topography; typically on steep slopes.

GLACIOFLUVIAL DEPOSITS: Poorly sorted to well sorted sand and gravel transported and deposited directly by glacial meltwater.

Gfv **Glaciofluvial veneer:** Deposits less than 2 m thick that conform to underlying topography.

GFb **Glaciofluvial blanket:** Deposits greater than 2 m thick that mask subtle variations in substrate surface but generally conform to underlying topography.

GFr **Eskers:** Sinuous ridges of stratified sand and gravel deposited in subglacial, englacial, or supraglacial channels.

BASAL TILL DEPOSITS: Diamictons eroded, transported and deposited at the base of an active glacier. They are dense, massive and matrix supported. Matrix is typically composed of silt and clay with lesser amounts of sand. Clasts are often subangular to subrounded and can be faceted and striated.

Tv **Till veneer:** Deposits less than 2 m thick that conform to underlying topography; predominantly in upland regions with isolated bedrock exposures.

Tb **Till blanket:** Deposits greater than 2 m thick that mask subtle variations in substrate surface but generally conform to underlying topography; predominantly in areas of low relief.

Ts **Streamlined till:** Flutings, drumlins, and the sediment (down ice) part of crag-and-tails.

ABLATION TILL DEPOSITS: Diamictons deposited by melt out, commonly from stagnant ice, of far-travelled supraglacial and englacial material. These deposits lack the density of basal till and have a high percentage of matrix sand. May be stratified and include sorted sands and gravels.

Tu **Undulating till:** Loose, sandy diamicton commonly representing thinner deposits near the margins of widespread ice stagnation or in depressions where localized ice stagnation occurred. Consist of hillocks and hollows with slopes ≤ 15°.

Th **Hummocky till:** Loose sandy diamicton commonly representing thicker deposits and widespread ice stagnation. Consist of hillocks and hollows with slopes ≥ 15°.

BEDROCK: Lithology varies greatly across the map area and includes sedimentary, metamorphic, volcanic, and intrusive rocks of Permian to Quaternary age. Outcrop is generally limited to areas of high relief.

R **Undifferentiated bedrock:** High-angle slopes in upland areas or in incised meltwater channels; may be susceptible to rock fall; hummocky, or undulating expressions are the result of glacial or meltwater erosion, or preferential erosion due to structural weaknesses; streamlined bedrock is the result of glacial erosion.

TILL SAMPLES (Labeled with sample number)

- Matrix geochemistry and mineralogy (Sacco et al., 2014)
- Matrix geochemistry (Lett et al., 2006)

MINERAL OCCURRENCES

Provincial MINFILE database (Labeled with name and MINFILE number)

- Prospect
- Showing

ICE-FLOW INDICATORS (Ferbey et al., 2013)

Unidirectional indicators

- Drumlin
- Striation

Bidirectional indicators

- Drumlinoid or fluting

Roads

BASAL TILL POTENTIAL

High

1: Only thick basal till (Tb or Ts); may contain lesser amounts of thin basal till (e.g., Tb.Tv).

2: Only thin basal till (Tv); may contain lesser amounts of thick basal till (e.g., Tv.Tb).

3: Basal till with lesser amounts of another surficial material, excluding ablation till (e.g., Tb.Cb; Tv.R).

Moderate

4: Basal till with lesser amounts of ablation till (Tb.Tu).

5: Ablation till with lesser amounts of basal till (Tu.Tb).

Low

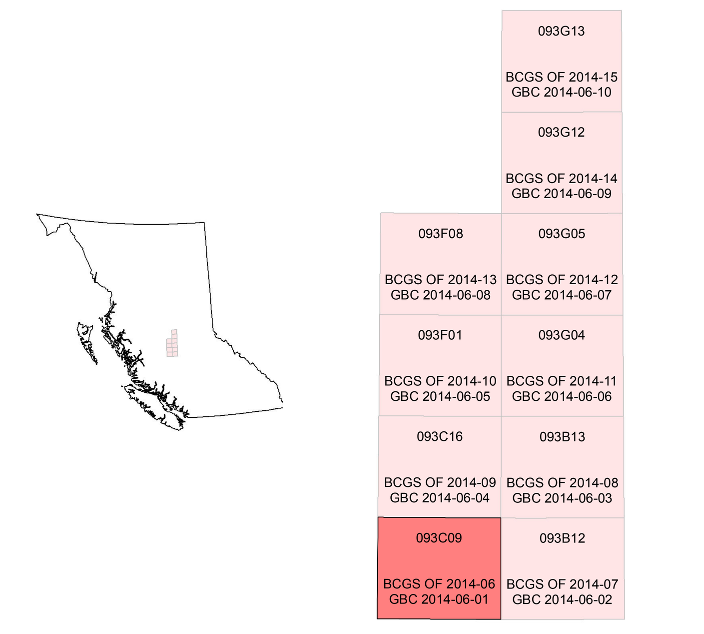
6: Another surficial material with lesser amounts of basal till (e.g., Cb.Tb).

Poor

7: Only ablation till at surface (Th or Tu), or ablation till and another surficial material, excluding basal till (e.g., Th.GFc; GFb.Tu).

None

Surficial material other than till.



Recommended citation:
Sacco, D., Ferbey, T., and Jackaman, W., 2014. Basal till potential of the Clusko River map area (NTS 093C/09), British Columbia. British Columbia Ministry of Energy and Mines, British Columbia Geological Survey Open File 2014-06, Geoscience BC Map 2014-06-01, scale 1:50 000.

DESCRIPTIVE NOTES

The Clusko River map area (NTS 093C/09) is in flat to gently rolling country of the Fraser Plateau, a subdivision of Interior Plateau physiographic region. Mainly drift covered and with sparse outcrop (Holland, 1976), the area remains underexplored despite being underlain by the Stikine terrane island-arc assemblage, which has high potential for mineralization such as calc-alkalic Cu-Mo±Au and alkaline Cu-Au porphyries (Logan, 2013).

The surficial geology of the Clusko River map area was first mapped by Proudfoot and Allison (1993), concurrent with a till geochemical survey to assess mineral potential (Lett et al., 2006). This work was part of a larger project (Levson and Giles, 1997) to better understand the geology and mineral deposits of the Interior Plateau and to develop exploration techniques specific to drift-covered areas (Diakow et al., 1997). Current work in the Clusko River map area is part of Geoscience BC's Targeting Resources for Exploration and Knowledge (TREK) project. Initiated in 2013, this project applies modern geochemical and geophysical methods to build on previous studies (Clifford and Hart, 2014; Sacco et al., 2014).

The basal till potential map presented here is one of a series of 10 maps (see inset map) that were completed for the planning and implementation phases of the TREK geochemical program. Samples shown on these maps were collected for till matrix geochemical and mineralogical analysis; results will be released in future publications.

Surficial sediment geochemical and mineralogical anomalies can be used to locate buried bedrock mineralization. Sediments with a relatively simple transport and depositional history, such as basal tills, are better suited for mineral exploration. Basal till is ideal for assessing mineral potential because: 1) it is a common sediment in glaciated terrain; 2) it can be considered a first derivative of bedrock (Shilts, 1993) and therefore has a similar geochemical signature to its bedrock source; 3) its transport history can be determined by local ice-flow reconstructions; and 4) it produces a geochemical signature that is areally more extensive than the bedrock source (Levson, 2001). Glacial transport and deposition of basal till produces a dispersal train, elongated down ice from its parent rock (Figure 1).

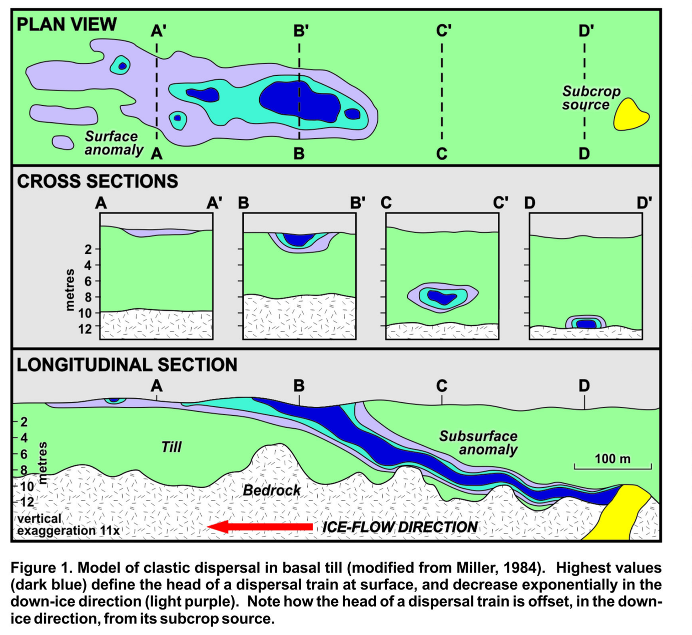


Figure 1. Model of clastic dispersal in basal till (modified from Miller, 1984). Highest values (dark blue) define the head of a dispersal train at surface, and decrease exponentially in the down-ice direction (light purple). Note how the head of a dispersal train is offset, in the down-ice direction, from its subcrop source.

The purpose of this basal till potential map series is to assist in the design of exploration projects, and to guide surficial sediment geochemistry and mineralogy sampling programs, by identifying areas where basal till is most likely to occur. The maps identify areas where basal till samples can likely be collected and areas where sampling will be difficult or require different geochemical sampling protocols. Ice flow indicators compiled by Ferbey et al. (2013) are included in the maps to illustrate the general transport directions of basal till.

This mapping builds on earlier drift exploration potential maps developed by Proudfoot et al. (1995). Map unit definitions are based on conventions outlined by Deblonde et al. (2012). Map unit colours depict the potential occurrence of basal till; map unit labels include surficial materials and their topographic expression.

Existing surficial geology, terrain, or soils and landform mapping data were reviewed and updated using digital air photo stereo-pairs in DAT/EM Summit Evolution photogrammetry software running in tandem with Esri ArcMap. New mapping emphasized the till facies best suited for geochemical and mineralogical analysis. We focused on distinguishing basal till (Figure 2) from ablation till (Figure 3) which, because of a more complex transport and depositional history, is ill-suited for mineral exploration. This differentiation was based largely on interpretations of air photo stereo-pairs supplemented by sparse field data.

Basal till is eroded, transported and deposited at the base of an active glacier. It typically has a subdued surface expression that either follows underlying topography (as a blanket or veneer) or is streamlined in the direction of ice flow. It is a dense, unsorted, massive, matrix-supported diamicton, with a matrix consisting mainly of silt and clay with lesser amounts of sand (Figure 3). Vertical joint and subhorizontal fissility intersections can give basal till a blocky appearance. Clasts are mostly gravel-sized and subangular to subrounded, and are commonly striated. The transport path of basal till is relatively simple and short and can be established by measuring the azimuth of ice-flow indicators, also produced in the subglacial environment. Multiple ice-flow events can, however, create a more complex transport path, highlighting the importance of ice-flow history reconstructions. Compared to basal till, the transport distance of ablation till is longer and the depositional history more complex. Ablation till consists of material transported within and on top of a glacier. It is deposited by passive melt out processes. Deposition of ablation till adjacent to remnant ice-blocks produces an irregular, undulating to hummocky topography. Ablation till is a less compact diamicton. It contains more gravel and has a sandier matrix (Figure 4). It can be massive to crudely stratified and may contain lenses of sorted sand and gravel. Formed by ice downwasting during deglaciation, ablation tills are typically exposed at the surface and can overlie basal tills.

Each mapped till unit is assigned a basal till potential rating. This is assignment is based on the spatial and genetic association of basal till with other surficial materials and their depositional environments. It should be noted that appropriate sample material might be found in low potential areas. For example, windows through an ablation till overlying a basal till, may be smaller than the resolution of current air photos. Basal till, as a primary or secondary surface material, is unlikely to occur at surface in areas designated as 'none'.

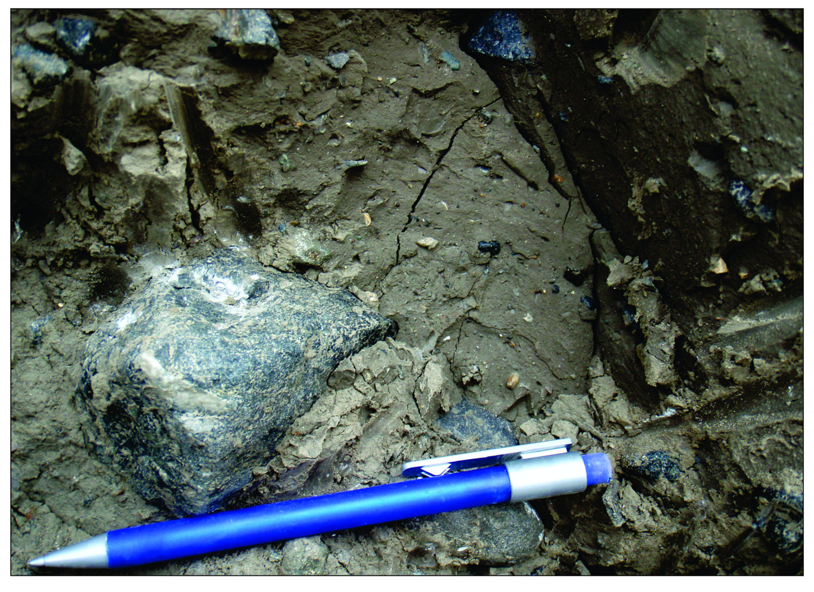


Figure 2. Basal till in vertical exposure. Note blocky appearance. Granule and coarser-sized clasts can be seen floating in a clayey-silt matrix.

Figure 3. Ablation till exposed in road cut (65 cm pick for scale both photos). There is a higher percentage of sand and gravel, compared to a typical basal till (see Figure 2), and lower density.

High potential is assigned to units containing mainly basal till. The highest potential category (1) includes till blankets (>2 m thick) and streamlined till with some till veneer (<2 m thick). In these map units, samples can be collected from most exposures. In the second category of high potential (2), basal till veneers are predominant and likely include some bedrock exposures. In these areas, sample collection may be most productive down-ice from bedrock outcrop, where till might be sufficiently thick to avoid post-depositional surface processes such as pedogenesis. High potential (3) map units are mostly basal till with lesser amounts of another surface material (excluding ablation till). Knowledge of the surface expression of this secondary material, which is provided in the map unit label, will assist in targeting basal till.

Moderate potential is assigned to map units containing varying amounts of basal till and ablation till. These map units typically represent (4) thick basal till deposits in depressions or small valleys where ablation till has been deposited, or (5) near the margins of areally extensive ablation till map units where basal till may be found within a few metres of surface or in areas of higher elevation (i.e., where ablation till thins).

Low potential (6) is assigned to map units that are predominantly another surface material. These areas may include basal till deposits that are too small or discontinuous to resolve at the current map scale. Poor potential (7) is assigned where thick ablation till overlies basal till. These areas typically consist of hummocky ablation till and may include lesser amounts of another surficial material (e.g., ice-contact glaciofluvial deposits). These areas are still mapped as having basal till potential because exposures of sufficient depth could expose underlying basal till deposits.

ACKNOWLEDGEMENTS
L.B. Aspler and A.S. Hickin are thanked for their review of this map.

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