QUATERNARY GEOLOGY NOTES

INTRODUCTION

This map results from one part of a multi-component geological and mineral exploration survey of the Fawnie Creek map area 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. Final results of the till and lake sediment geochemical sampling programs will be published at a later date. A total of 229 till samples (~1 sample per 4 km^2) were collected for geochemical analyses in order to locate glacially dispersed mineralization present in the region. The map area is approximately 150 kilometers from Vanderhoof and is accessed by the Kluskus-Ootsa forestry road. Logging road access within the north half and southeast quarter of the map area is good but much of the west and southwest are accessible only by trails. Terrain mapping in the area was conducted by Howes (1976, 1977) and Ryder (1993).

PHYSIOGRAPHY

The Fawnie Creek map area lies within 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.

QUATERNARY STRATIGRAPHY

Pre-Late Wisconsinan Deposits

Quaternary sediments underlying till are rarely exposed in the map area. They were observed at one site on the south side of Entiako Spur within a bedrock channel cut oblique to ice flow (Section 93-7). Horizontally stratified sands and crudely imbricated gravels, interpreted as proglacial, glaciofluvial deposits, are unconformably overlain by till at this site.

Late Wisconsinan Glacial Deposits

Morainal sediments of the last glaciation occur throughout the map area and include compact, matrix-supported, silty diamictons interpreted as lodgement and meltout tills. Also common are loose, massive to stratified, sandy diamictons of inferred debris flow origin. These diamictons are often interbedded with stratified silt, sand or gravel. Basal tills usually unconformably overlie bedrock or rarely, glaciofluvial deposits (Section 93-7). They seldom occur at the surface, usually being overlain by glacigenic debris flow deposits (*e.g.* Sections 93-1 and 93-2), glaciofluvial deposits (*e.g.* Sections 93-9, 93-15 and 93-26) and on steep slopes by resedimented diamictons of colluvial origin (*e.g.* Section 93-10). Till thickness varies from a few to several metres in low-lying areas to less than a metre along bedrock ridges and steep slopes. Thin till and glacial debris flow deposits exposed in numerous exploration trenches on the Wolf property (Sections 93-11 to 93-14) at the west end of the Entiako Spur are typical of most upland areas. Till thicknesses on bedrock ridges are much less than in the lee of bedrock highs (compare, for example, Sections 93-11 with Sections 93-1). Thick exposures of till (up to 10 m) also occur locally in narrow valleys oriented perpendicular to the regional ice-flow direction (Section 93-9) and in main valleys (Section 93-26). In Fawnie Creek and Matthews Creek valleys, morainal sediments are largely buried by glaciofluvial, fluvial and organic sediments. Morainal sediments throughout the region were assigned by Tipper (1971) to the Fraser glaciation which is dated in several parts of British Columbia as Late Wisconsinan (Ryder and Clague, 1989).

Late Wisconsinan Deglacial Deposits

Deposits formed during deglaciation of the area include both glaciofluvial and glaciolacustrine sediments. Exposures of glaciolacustrine sediments occur near Top Lake (Section 93-8), in two valleys on the south side of the Entiako Spur (Sections 93-5 and 93-6) and on the east side of the Wolf prospect (Section 93-3). They can be divided into two facies based on grain size and structure: horizontally bedded and trough cross-laminated fine to coarse sands, and rhythmically bedded fine sands, silts and clays. A shallow-water fan-delta origin is proposed for the sand-dominated facies and the finer grained sediments are interpreted to be deeper water glaciolacustrine deposits. Dropstones, load structures, faults, deformed beds and fluid escape structures are common in both facies. Beds commonly fine upwards from glaciofluvial gravels below to fine sands, silts and clays above (Section 93-6). High angle intraformational faulting is locally common, with displacements up to 10 centimetres (Section 93-3).

Glaciofluvial sediments consist mainly of poorly to well sorted, stratified, pebble and cobble gravels and sands. Exposures of glaciofluvial sands and gravels up to 10 metres thick occur in large valleys like Fawnie, Matthews and Van Tine Creek valleys (Sections 93-9, 93-16/17 and 93-26). Clasts are rounded to well rounded, vary in size from small pebbles to cobbles with rare boulders. In upland areas around Entiako Spur, the Naglico Hills and the Fawnie Range, glaciofluvial sands and gravels occur as a veneer or thin blanket, up to 2 metres thick, on top of till (*e.g.* Section 93-15). Many of these deposits are interbedded with gravelly diamictons suggesting a proximal outwash origin.

Holocene Deposits

Holocene fluvial sediments in the map area are dominated by floodplain silts, fine sands and organics and channel gravels in meandering streams. In upland areas small gravelly creeks have reworked glacial, glaciofluvial and colluvial sediments and locally are incised into bedrock. A thin veneer of weathered and broken bedrock clasts in a loose sandy matrix occurs on steep slopes throughout the area. These deposits grade downhill into a thicker cover of colluvial diamicton derived from both local bedrock and till (*e.g.* Section 93-25). Colluvial veneers commonly overlie thin tills on steep slopes (*e.g.* Section 93-4).

Several postglacial alluvial fans occur in the area, the largest and most active of which is located at the west end of Top Lake. This fan has prograded across the valley at the southwest end of Top Lake and has constrained the outlet stream to the southeast side of the valley. Coarse cobble to boulder gravels are actively transported in the main fan channel. Flooding during 1993 caused a major shift in the channel and evidence for many such events on this and other fans in the area is indicated by numerous channel scars on the fan surfaces.

QUATERNARY HISTORY

Prior to glaciation, regional drainage in the map area was probably similar to present, westwards from Top Lake and Mount Davidson through the Fawnie valley into the Entiako River system. During the last or Late Wisconsinan Fraser glaciation ice moved into the Fawnie Creek map area from the Coast Mountains before flowing north, northeast and east onto the Interior Plateau (Tipper, 1971). Glaciers advancing into the map area from the southwest caused the regional drainage to reverse and flow to the east and north through the Top Lake valley. The first lobes of ice advancing into the area were probably confined to major valleys. Topographic control of ice-flow direction during early glacial phases is indicated by valley-parallel striae on bedrock surfaces that are buried by thick till sequences. Drumlins, crag and tails, flutings and striations all concur that, when the glaciers were thick enough to be relatively unaffected by topography during full-glacial times, ice flow was east-northeasterly. At the Late Wisconsinan glacial maximum, ice covered the highest peaks in the region. As glaciers thinned during later stages of the last glacial period, ice flow was again modified by topographic control as indicated by striae studies. For example, striae indicating ice flow towards 045° in the northeast part of the area are cross-cut by younger valley-parallel striae trending 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, stagnant ice northeast of the map area, dammed meltwaters and caused formation of a glacial lake in the Top Lake region. A glaciofluvial delta complex formed where sediment-laden meltwaters entered the western margin of the lake at an elevation of around 1100 metres. Kettled topography indicates the presence of ice blocks within the deltaic sediments. Ten metres of rhythmically bedded sand and silt (*e.g.* Section 93-8) occur along the margin of Fawnie Creek valley suggesting sustained glaciolacustrine sedimentation. The Top Lake valley was the only outlet through the Fawnie Range for meltwaters from ice retreating south of the Entiako Spur. 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 and indicate prolonged ice stagnation. Moderately sorted, crudely bedded gravel and sand terraces high on the eastern margin of Fawnie valley are deposits of high-level ice-marginal channels formed during ice retreat and ablation. Gravelly outwash plains formed in the main valley bottoms as large volumes of sediment and water were removed from the ice margin.

Several small glacial lakes formed locally along the margins of the retreating ice. For example, in the Wolf area, glaciolacustrine sediments occur 75 metres above the base of a north-south trending valley indicating local ice damming (Section 93-3). In addition, meltwaters flowing south off the Entiako Spur into the Fawnie valley were dammed by stagnant ice creating short-lived glacial lakes in the side valleys. A sequence of cobble-boulder gravel, fining upwards to stratified fine-sand, silt and clay, exposed in one of these valleys (Section 93-6), records the change from a glaciofluvial to a glaciolacustrine environment. In another valley, a thick section of well sorted, well bedded, rippled, fine to coarse sand is exposed in a coarsening upward sequence (Section 93-5) which is suggestive of fan-delta progradation.

During postglacial times surficial geology of the area was modified mainly by fluvial activity and the local development of alluvial fans in the valley bottoms as well as by colluvial reworking of glacial deposits along the valley sides.

REFERENCES

Diakow, L.J., Webster, I.C.L., Levson, V.M. and Giles, T.R. (1994): Bedrock and Surficial geology of the Fawnie Creek Area (NTS 93 F/3). *British Columbia Ministry of Energy, Mines and Petroleum Resources*, Open File 1994-2.

Cook, S.J. and Jackaman, W. (1994): Regional Lake-Sediment and Water Geochemistry Surveys in the Northern Interior Plateau, B.C. (NTS 93 F/2,3,6,11,12,13,14). *in* Geological Fieldwork 1993, B. Grant and J.M. Newell, Editors, *British Columbia Ministry of Energy, Mines and Petroleum Resources*, Paper 1994-1, pages 39-44.

Giles, T.R. and Levson, V.M. (1994): Surficial Geology and Drift Exploration Studies in the Fawnie Creek Region (93 F/3). *in* Geological Fieldwork 1993, B. Grant and J.M. Newell, Editors, *British Columbia Ministry of Energy, Mines and Petroleum Resources*, Paper 1994-1, pages 27-38.

Giles, T.R. and Levson, V.M. (1994): Drift Prospecting Potential of the Fawnie Creek Area (NTS 93 F/3). *British Columbia Ministry of Energy, Mines and Petroleum Resources*, Open File Map 1994-10.

Holland, S.S. (1976): Landforms of British Columbia, A Physiographic Outline; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Bulletin 48, 138 pages.

Howes, D.E. (1976): Fawnie Creek Terrain Map, *B.C. Ministry of Environment*.

Howes, D.E. (1977): Terrain Inventory and Late Pleistocene History of the Southern Part of the Nechako Plateau; *B.C. Ministry of Environment*, RAB Bulletin 1, 29 pages.

Ryder, J.M. and Clague, J.J. (1989): British Columbia Quaternary Stratigraphy and History, Cordilleran Ice Sheet; *in* Quaternary Geology of Canada and Greenland, R.J. Fulton, Editor, *Geological Survey of Canada*, Geology of Canada, Number 1, pages 48-58.

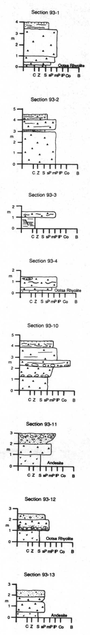
Ryder, J.M. (1993): Terrain Analysis for the Wolf-Capoose and AOK-Moondust Areas. *University of British Columbia*, Department of Geological Sciences, Mineral Deposits Research Unit Technical Report MT-3, 24 pages.

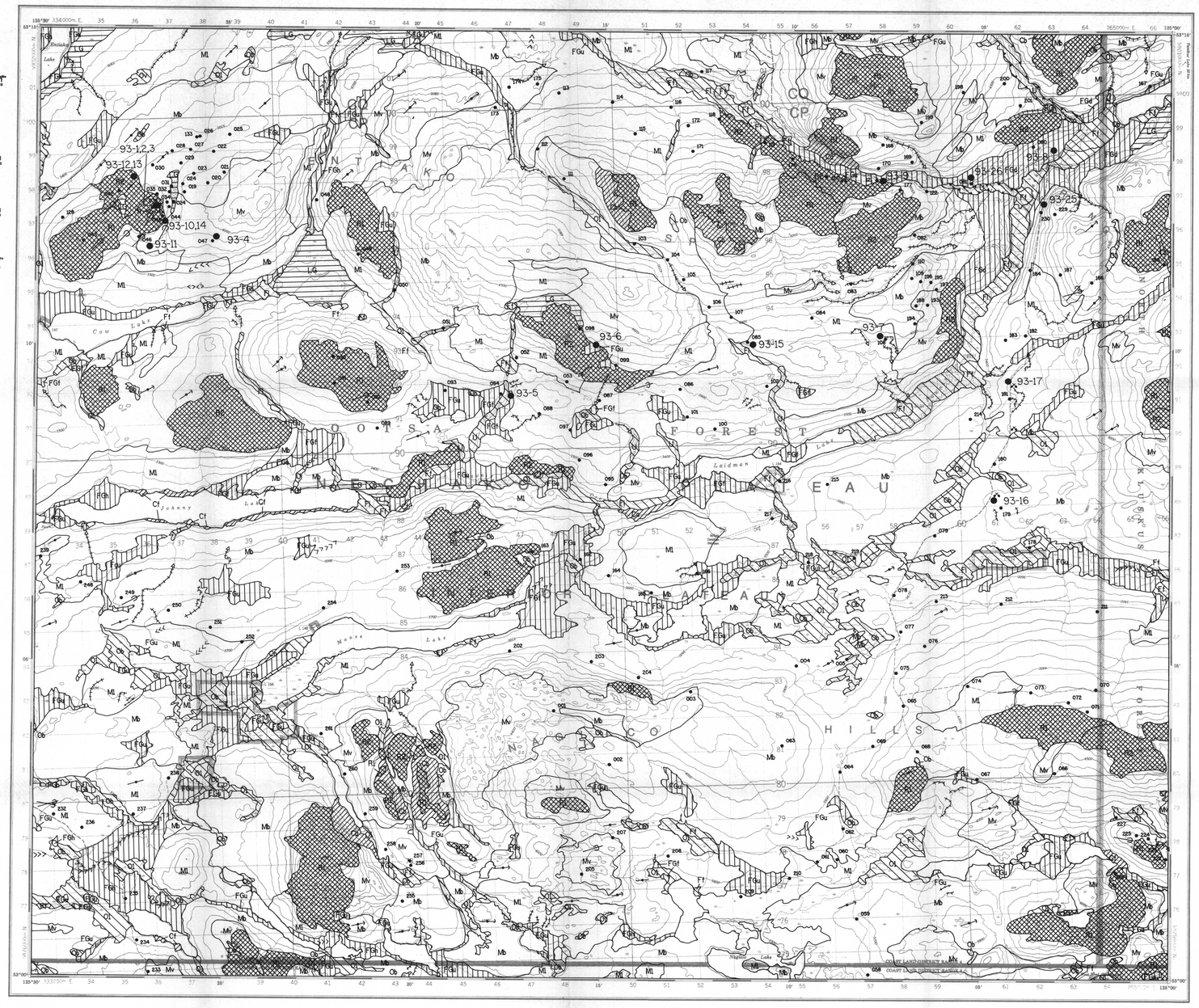
Schroeter, T.G. and Lane, R.A. (1994): Mineral Resources (93F/3 and parts of 93F/2,6, and 7); *in* Geological Fieldwork 1993, B. Grant and J.M. Newell, Editors, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1994-1, pages 45-56.

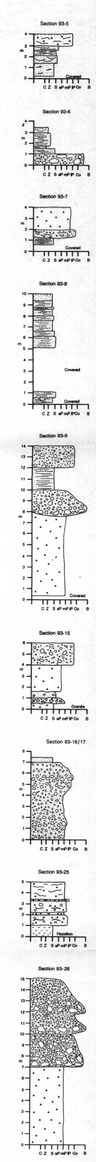
Tipper, H.W. (1963): Nechako River Map-Area, British Columbia; *Geological Survey of Canada*, Memoir 324, 59 pages.

Tipper, H.W. (1954): Geology of Nechako River British Columbia (93F); *Geological Survey of Canada*, Map 1131A.

Tipper, H.W. (1971): Glacial Geomorphology and Pleistocene History of Central British Columbia; *Geological Survey of Canada*, Bulletin 196, 89 pages.







BC

Province of British Columbia
Ministry of Energy, Mines
and Petroleum Resources

Geological Survey Branch

OPEN FILE 1994-9

SURFICIAL GEOLOGY AND QUATERNARY STRATIGRAPHY OF THE FAWNIE CREEK AREA

NTS 93 F/3

by Victor M. Levson and Timothy R. Giles

1:50 000

For an overview of the surficial geology of 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. Surficial geology based on existing terrain map data (Howes, 1976; Ryder, 1993), interpretation of air photographs followed by field verification, and stratigraphic and sedimentologic studies of Quaternary exposures. Fieldwork completed in 1993.

LEGEND

QUATERNARY SEDIMENTS

HOLOCENE

Fl **Fluvial deposits:** sand, pebble-gravel and silt; typically stratified and moderately well sorted; includes minor modern delta and terrace deposits.

Ff **Alluvial fans:** mainly pebble to cobble gravels; up to tens of metres thick; several well developed alluvial fans occur in the Fawnie Creek valley between Laidman and Top lakes.

Fl **Floodplains:** silt, clay and fine sands; shallow water tables common; most abundant in the Fawnie, Matthews and Van Tine Creek valleys; commonly veneered by organic deposits.

Cb **Colluvium:** unsorted or very poorly sorted diamicton with abundant angular clasts of bedrock; occurs mainly as veneers over bedrock (see unit R1) in upland areas and on steep slopes.

Cb **Colluvial blanket:** diamicton more than 1 metre thick; occurs mainly around bedrock highs in the Fawnie Range and Naglico Hills.

Cf **Colluvial fans:** diamicton more than several metres thick; typically small, debris-flow dominated fans; occurs along steep lake shores such as on the south side of Johnny Lake.

Ca **Talus deposits:** angular to subangular coarse gravel; uncommon; occurs at the base of steep slopes in the Fawnie Range.

Organic deposits: accumulations of decayed vegetative material; locally includes small areas of fluvial, glaciofluvial, morainal or colluvial deposits too small to be mapped individually.

Ob **Organic blanket:** peat bog and swamp deposits more than 1 metre thick.

Ol **Discontinuous organic deposits:** small swamp and marsh deposits spatially associated with glaciofluvial, morainal or fluvial deposits in hummocky or undulating terrain; locally includes organic veneers less than 1 metre thick.

LATE PLEISTOCENE

M **Morainal deposits:** unsorted to very poorly sorted diamicton; dominantly basal tills and glacially-derived debris flow deposits; compact; massive or crudely stratified; matrix sandy silt to silty clay; clasts up to boulder size and often striated; in upland areas, unit includes small regions of exposed rock or colluvium.

Mb **Till blanket:** diamicton more than 1 metre thick; mainly basal tills; common on lower valley slopes; often mantles bedrock; flutings and drumlinoid ridges typical.

Mv **Till veneer:** diamicton less than a metre thick; dominantly basal tills; typically occurs on upper valley slopes and around bedrock highs; crag-and-tail features common.

M1 **Resedimented glacial debris:** sandy diamicton; dominantly glacially-derived debris flow deposits and interbedded sands and gravels that accumulated on or near the margins of melting glaciers; discontinuously mantled by 1 or 2 metres of glaciofluvial deposits; small meltwater channels and local areas of hummocky or kettled topography common; in low areas, often occurs with small organic, fluvial and glaciofluvial deposits.

FGc **Glaciofluvial deposits:** mainly pebble to boulder gravels and sands; poorly to well sorted and well stratified; often interbedded with glacial debris flow deposits.

FGh **Eskers and kames:** coarse gravels and sands, typically several metres thick; steeply dipping strata and collapse structures common; hummocky or ridged topography typical; locally includes kettled outwash; common outside of valleys and often associated small morainal deposits.

FGd **Raised deltas:** well bedded sands and gravels; map unit is mainly associated with a large glaciofluvial delta complex in the northeast corner of the map area; locally includes sandy glaciolacustrine deposits.

FGf **Glaciofluvial fans:** interbedded sand, gravel and diamicton; common along valley sides and at the lower ends of meltwater channels.

FGu **Glaciofluvial outwash plains:** sands and gravels; horizontal bedding typical; subdued topography; common in valley bottoms and often underlies or is associated with fluvial and organic deposits.

LG **Glaciolacustrine sediments:** dominantly fine to medium sands, silts and clays; well sorted, laminated or thinly bedded; ice-rafted stones, normal faults and slump structures common; locally kettled; invariably overlain by organic materials and locally by fluvial or glaciofluvial deposits; unit occurs mainly in the north part of the map sheet in the valleys of Cow, Top, and Entiako lakes and lower Van Tine Creek.

TERTIARY AND OLDER

R **Bedrock:** rock at or near the surface; exposures are most common along the Entiako Spur, Fawnie Range and Naglico Hills.

R1 **Bedrock with surficial veneer:** rock outcrops generally discontinuous and commonly veneered by less than 1 metre of colluvial or morainal sediment.

R2 **Bedrock with surficial blanket:** rock mostly covered by one or more metres of surficial sediment but surface expression still reflects the underlying bedrock topography.

UNDIFFERENTIATED

Includes areas where 3 or more map units occur in close proximity and can not be mapped individually; mainly in steep narrow gullies and meltwater channels.

LEGEND FOR STRATIGRAPHIC SECTIONS

Clay, Silt, Sand, Granules, Pebbles, Cobbles, Boulders; Lower Fluvial Regime, Upper Fluvial Regime

- Diamicton
- Gravelly Diamicton
- Gravel
- Breccia
- Sand
- Soil
- Horizontal Laminations
- Wavy Laminations
- Trough Cross-Beds
- Climbing Ripples
- Fault
- Colluvium

GEOLOGIC MAP SYMBOLS

- Drumlin, crag and tail
- Fluting
- Striae, glacial grooves (ice flow direction known; unknown)
- Esker (flow direction known; unknown)
- Meltwater channel (major; minor)
- Till sample site — 144
- Stratigraphic section — 93-12
- Gravel pit