LEGEND

SURFICIAL DEPOSITS

QUATERNARY

HOLOCENE - LATE WISCONSINAN

A-OW — **UNDIFFERENTIATED ALLUVIAL AND OUTWASH DEPOSITS (A-OW):** A; silt, sand and gravel; forms alluvial floodplains and alluvial channel deposits. OW; silt, sand and gravel; massive to horizontally bedded; channel sequences common; forms flat plains and terraced deposits.

IC — **ICE-CONTACT DEPOSITS (IC):** silty sand, gravel and boulders, abrupt grain size transition from shallow- to steeply-dipping beds; faulting is common; clasts reflect provenance of surrounding till; may be interstratified with till; forms kames and thin gravel deposits near lakes; thickness 1-6 m.

LATE - MIDDLE WISCONSINAN

* — **SHELBURNE RIVER TILL:** *Occurs as granite (GSRT) and greywacke/slate (MSRT) lithological facies; loose, texture varies from a sandy matrix-rich to a stony, clast supported till; colour varies from white (10YR8/1)** to very pale brown (10YR7/3); nonweathered appearance; occurs as hummocks, ridges and a rolling ground moraine; deposits are crudely stratified; spatially associated with kames and eskers; exhibits extensive onlap of clasts down-ice onto adjacent bedrock units; renewal distances*** vary from 0.1 km to > 5 km; matrix may be derived from up-ice lithologies and may not reflect the composition of the pebble fraction; thickness varies from 1-3 m in areas of ground moraine to 10-15 m on hummocks and ridges; the major transport direction is toward the southeast with lesser transport toward the south and west.

BEAVER RIVER TILL: Divided into ablation, ground moraine and drumlin-derived units.

GTC — Ablation moraine: May occur as granite (GTC), greywacke (GWC) and slate (SLC) lithological facies; loose, matrix supported till containing intrabeds of silt, sand and gravel; colour varies from very pale brown (10YR7/4) to yellowish-brown (10YR5/4); forms hummocks and ridges with associated ice-contact deposits; locally derived or may exhibit extensive onlap of clasts and matrix down-ice onto adjacent rock types; renewal distances vary from 0.1 to 6 km; thickness 1-10 m; glacial transport is toward the southeast and south.

GTB / GWB / SLB — Ground moraine: Subdivided into granite (GTB) and greywacke-slate (GWB)-(SLB) lithological facies; structureless stony matrix, though sandier varieties with minor washed zones around boulders are common; colour varies from light yellowish-brown (10YR6/4) to dark yellowish-brown (10YR4/4) in the granitic facies, light olive-brown (2.5Y5/4) in the greywacke and slate facies; generally forms a featureless ground moraine; exhibits rapid lithological change down-ice of bedrock contacts, > 90% of clasts are transported less than 1 km; renewal distances vary from tens to hundreds of metres; thickness 1-6 m; glacial transport directions are difficult to determine due to short renewal distance, it is southeastward across most of the South Mountain Batholith (SMB); however, northward, northwestward and westward dispersal was mapped in the northern and western margins of the SMB.

GTB(D) — Drumlin-derived moraine (GTB(D)): Loose, medium- to coarse-grained, sandy matrix, moderately stony, minor washing; colour is brown (10YR5/3) to dark yellowish-brown (10YR4/4); till mantles and forms a ground moraine between drumlins; nongranitic lithologies are incorporated from stratigraphically older tills; matrix composition is in part dependent on composition of reworked older till; thickness 1-4 m; actual glacial transport directions are the same as those of the ground moraine unit; however, a strong southeast transport was inherited from older, reworked southeast-transported till(s).

LT — **LAWRENCETOWN TILL (LT):** Muddy to sandy till, moderately compact, jointed, greenish mottling in the weathered zone; colour varies from dark reddish-brown (2.5YR3/4) to strong brown (7.5YR4/6); occurs as a ground moraine and drumlins; clast lithologies vary from 10-90% local bedrock to 10-90% non-granitic clasts derived from as far as 90 km, distal sources are the metasedimentary/volcanic massif complex of the Cobequid Highlands, Meguma Group, metasedimentary and volcanic rocks of the White Rock, New Canaan, Kentville and Torbrook formations, and North Mountain basalt; renewal distances vary from hundreds of metres to tens of kilometres; thickness is 1-2 m as a ground moraine and 4-30 m as drumlins; dispersal direction varies from southward to southeastward.

PRE-QUATERNARY

EARLY WISCONSINAN (?)

* — **HARTLEN TILL (HT):** *Occurs as granite (GTA) and slate (STA) lithological facies; sandy, compact till, clast-rich, fissile; colour varies from strong brown (7.5YR4/6) in granite facies to olive (5Y5/3) in slate facies; generally forms or cores drumlins; cast lithology dominated by local bedrock lithologies; 10-35 percent of clasts transported 20-25 km; thickness 1-10 m; glacial transport is toward the southeast with lesser transport toward the east-southeast(?).

R — **RESIDUUM (R):** Chemically-weathered bedrock; commonly develops a soil-like consistency due to in situ weathering followed by glacial mixing; may retain hypidiomorphic granular texture of parent granite, preservation of K-feldspar megacrysts and hydrothermally altered fracture zones; restricted to the topographically higher regions of the Southern Uplands; thickness varies from a veneer to > 3 m.

D — **BEDROCK (D):** Glacially-scoured bedrock; areas of discontinuous till veneer and B-horizon soil developed to bedrock; bedrock structure and large scale features of glacial erosion are easily discernible on aerial photographs.

* Shelburne River and Hartlen Till do not occur on this map sheet.
** All colours from Munsell Soil Colour Chart.
*** Renewal distance is the distance required by a given rock type (measured from the proximal contact of the up-ice lithology) to increase its proportion in till from 0% to 50% (Peltoniemi, 1985).

LEGEND

TILL CLAST LITHOLOGIES

Biotite granodiorite (1a) / monzogranite (1): grey; texture varies: fine- to coarse-grained, medium-grained equigranular and medium- to coarse-grained; contains megacrysts of K-feldspar; 10-15% biotite; bedrock sources are the Scrag Lake Granodiorite, Salmontail Monzogranite, Little Round Lake Monzogranite, Whale Lake Monzogranite and Walden Monzogranite.

Biotite ± muscovite ± cordierite leucomonzogranite: colour varies: light grey; buff and pink; medium- to coarse-grained; contains megacrysts of K-feldspar; 3-5% biotite; 0-2% muscovite; commonly hematized; bedrock sources are the New Ross Leucomonzogranite and Lake George Leucomonzogranite.

Porphyry: grey; fine- to medium-grained inequigranular texture; 3-10% biotite; 1-2% muscovite in porphyry having minor biotite (3-5%) content; bedrock sources are the Little Round Lake Monzogranite, small unnamed porphyry intrusives and textural variations of the Salmontail Monzogranite.

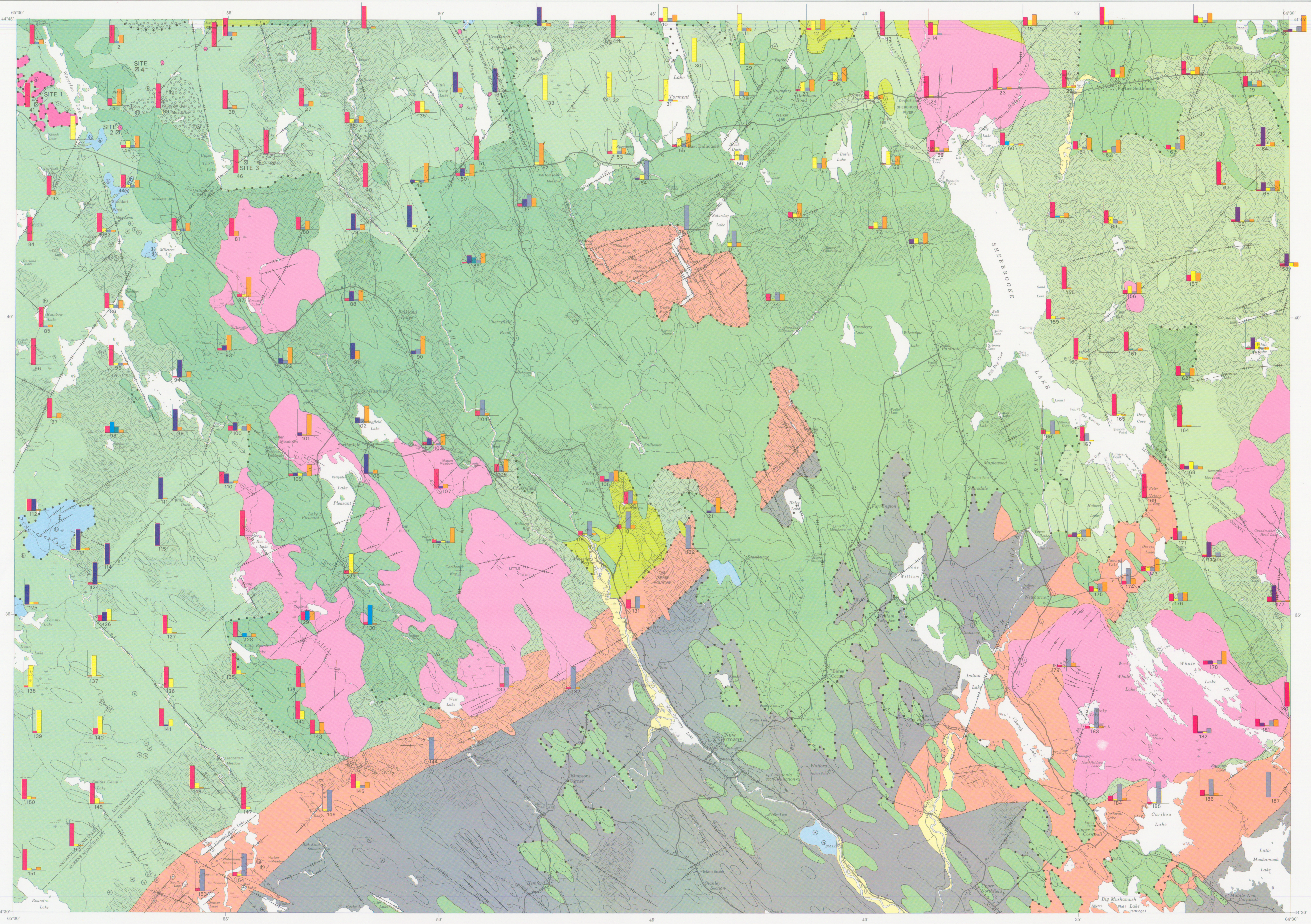
Biotite muscovite leucomonzogranite: colour varies: white, grey, buff, pink and red; texture varies: fine-grained equigranular and fine- to medium-grained; may contain quartz and K-feldspar megacrysts; 3-5% biotite; 0-2% muscovite; commonly hematized; bedrock sources are the Panuke Lake Leucomonzogranite, East Dalhousie Leucomonzogranite and fine-grained dyke rocks.

Leucocratic rocks: colour varies: white, pink; texture varies: fine-grained equigranular and pegmatitic; trace biotite; 0-2% muscovite; bedrock sources are the Keddy-Reeves Leucogranite and pegmatitic intrusives.

Meguma Group: grey-green wacke; grey to greyish-black slate; clasts are derived predominantly from the Meguma Group but include Torbrook and Kentville Formation lithologies.

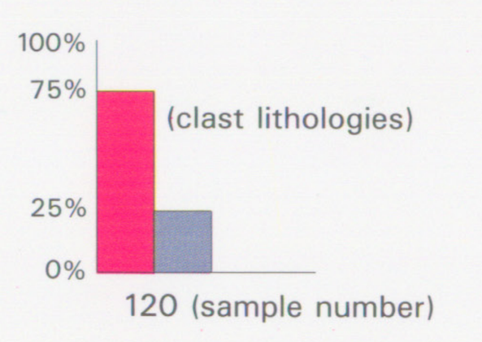
Foreign: slate; quartzite; amygdaloidal and non-amygdaloidal basalt; indurated sandstone; volcanic breccia, mafic intrusives, rhyolite and rhyolitic tuff; bedrock sources are the North Mountain basalt, White Rock Formation, mafic dyke rocks, and Triassic sedimentary basins.

*All granite bedrock units after Horne (1987).



SYMBOLS

Striations; sense of ice flow (known, unknown, 1 is oldest, 2 is youngest, from MacNeill)
Contact between surficial units (abrupt, gradational, assumed)
Contact between surficial units inferred from bedrock geology
Lineaments; may or may not be structurally controlled, possible ice scour along structurally weakened zones
Bedrock ridges (linear, strike)
Till veneer
Drumlin
Ablation mound
Esker, flow direction unknown
Moraine (minor)
Kettle
Escarpment in unconsolidated sediment



This illustration shows the system of lithological representation used on the map. Each bar represents a clast lithology, the height denoting its percentage in the pebble fraction of the till. Clast lithologies on histograms are keyed to the Till Clast Legend. The axis of a histogram defines the sample.

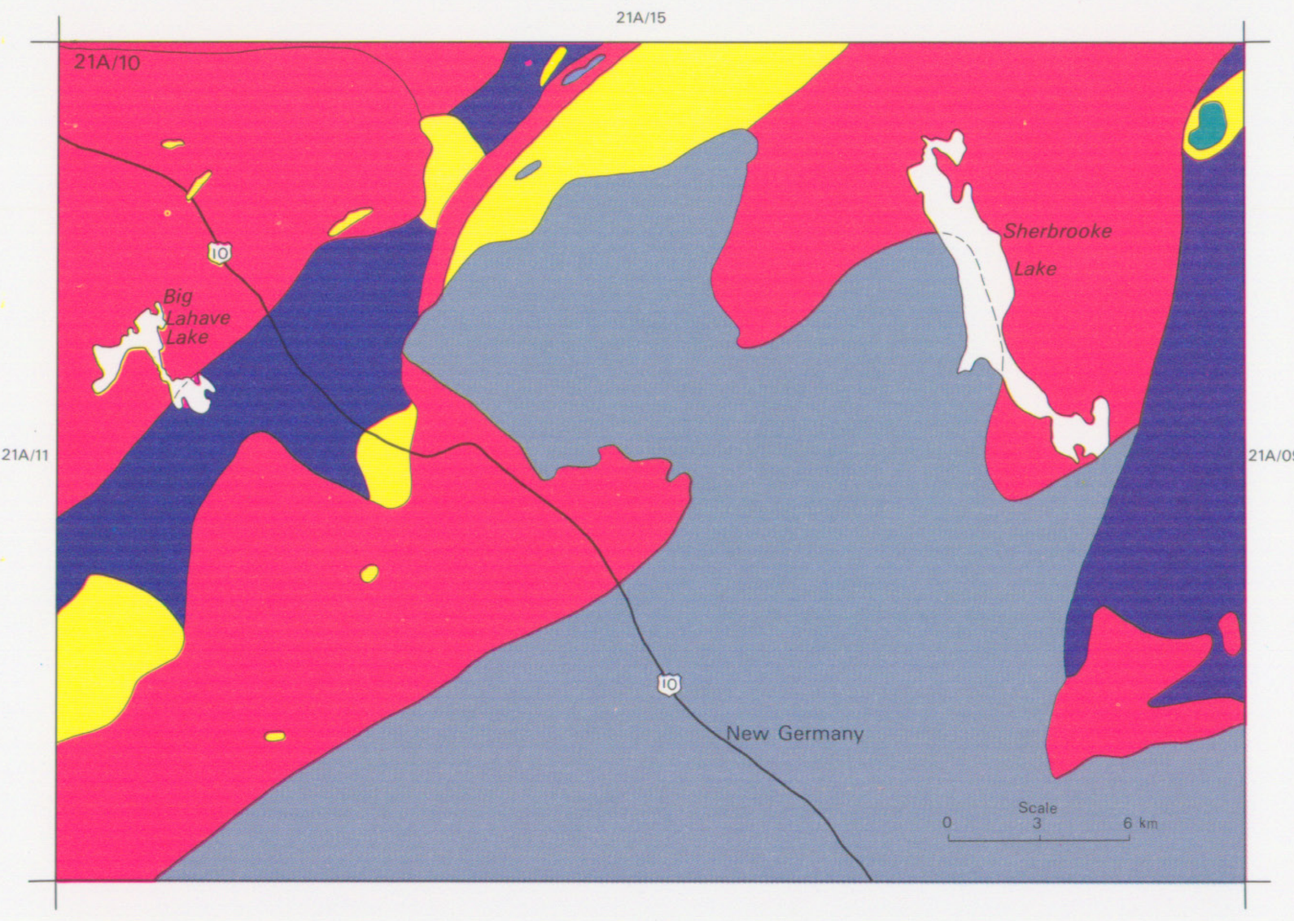


FIGURE 1: Simplified bedrock geology of the New Germany map sheet (21A/10) modified after Horne (1987). Bedrock units are keyed to the till clast legend and histograms on the glacial geology map.

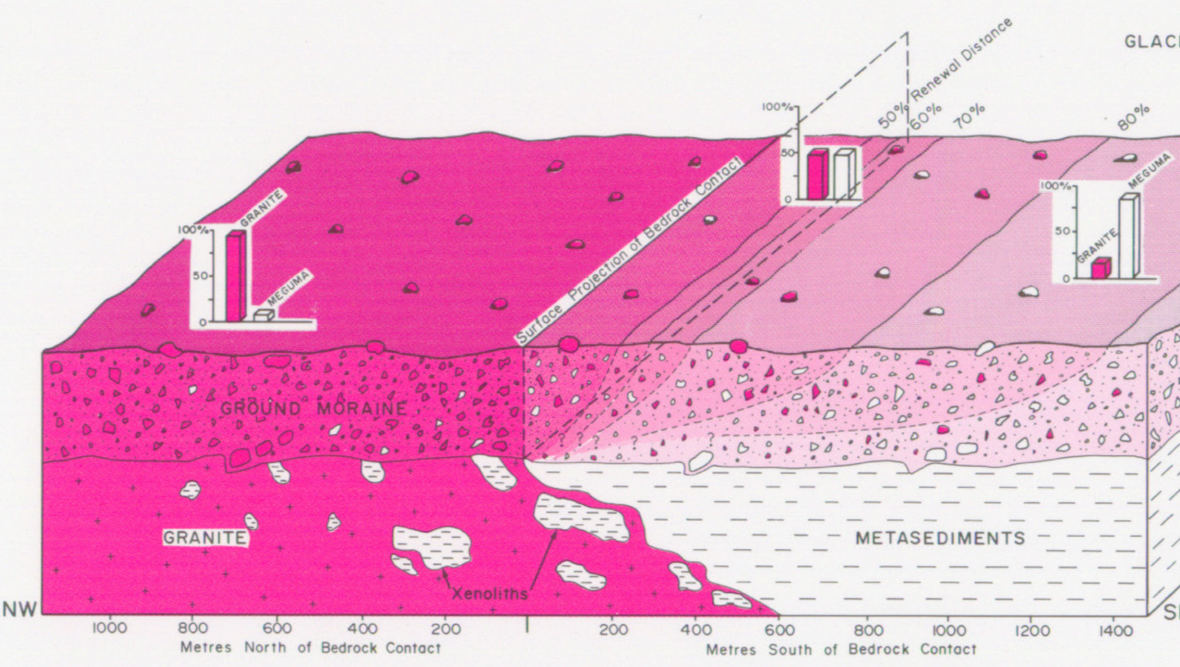


FIGURE 2: Dispersal characteristics of the Beaver River Till ground moraine, Pleasant River Lake, Lunenburg County.

Planimetric base provided by SURVEYS AND MAPPING BRANCH, DEPARTMENT OF ENERGY, MINES AND RESOURCES. Updated from aerial photographs taken in 1972 and 1973. Culture check 1974. Published 1976.

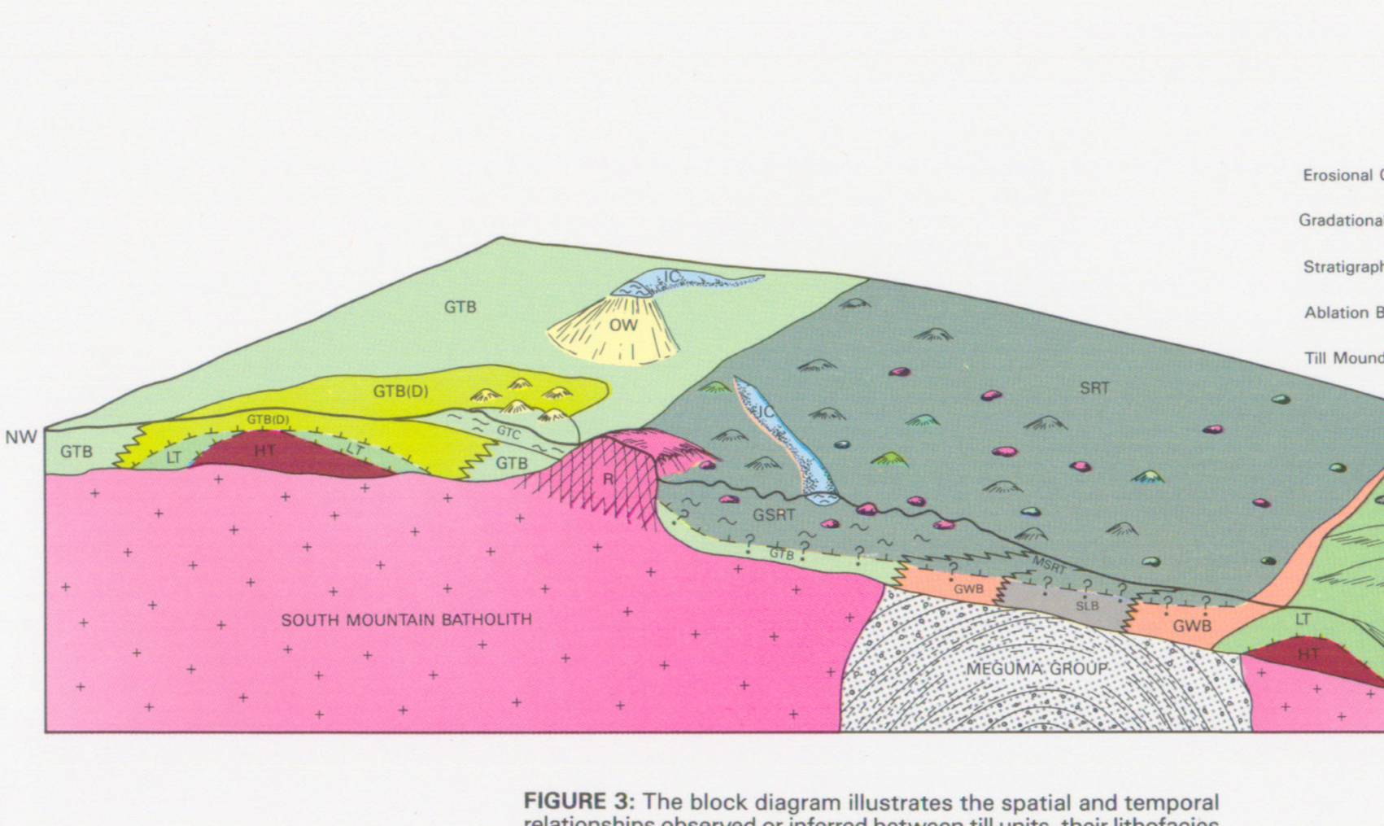
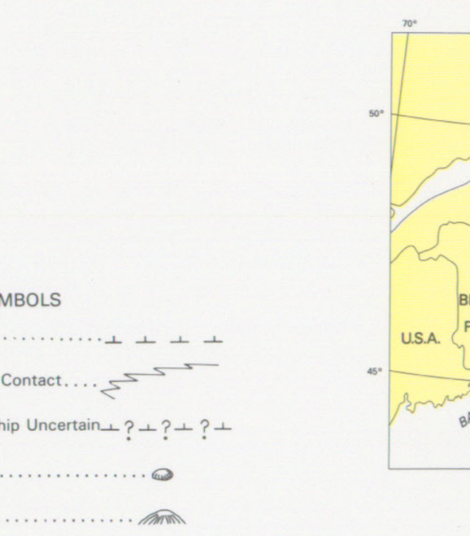
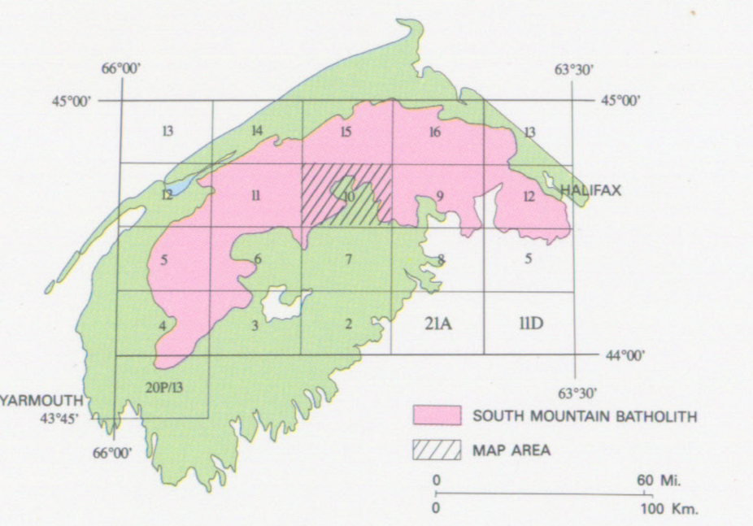


FIGURE 3: The block diagram illustrates the spatial and temporal relationships observed or inferred between till units, their lithofacies and the relationships between till and underlying bedrock geology on the South Mountain Batholith. The horizontal and vertical scales are schematic.





PREVIOUS WORK

As part of the Nova Scotia Soil Survey, Cann et al. (1958; 1965) and MacDougall et al. (1969) mapped the soils of Lunenburg, Kings and Annapolis Counties and produced 1:126 720 scale maps. Mapping of the soil catenas included a reference to the parent material from which the underlying Quaternary deposit may be inferred. This work assisted the present survey in determining till unit boundaries over the granitic terrain and was the primary source of information used to deduce the type of drift cover blanketing Meguma Group bedrock. In addition to the soil mapping of Cann and MacDougal, MacNeill (1956) produced 1:50 000 scale surficial geology maps that showed the distribution of drumlins, ice-contact and glaciofluvial deposits.

Although mineral exploration companies have utilized soils and tills over the South Mountain Batholith (SMB) as geochemical sampling media, little mapping of the tills and no separation of geochemically and lithologically distinct till units were attempted. Exploration concentrated on the Sn, W and U potential of the Falkland Ridge-East Dalhousie area. The most significant discovery was at Lake Torment where Shell Canada Resources Limited (MacGillivray, 1982) and Esso Resources Canada Limited (MacLeod, 1982; 1983) reported tin anomalies in the soil and till. Tin-bearing boulders were also discovered; however, the bedrock source of the geochemical anomalies and metalliferous float was not located.

INTERPRETIVE NOTES

Map Units

BEDROCK (D)

Ten per cent of the study area was mapped as bedrock. Although this unit is not a surficial deposit, its occurrence and distribution is largely dependent on glacial processes. Bedrock as a map unit includes barren rock outcrop, regions of thin till and large wooded areas where B-soil horizon has developed to bedrock. Over this unit all tills occur locally. In the Lake Pleasant and Sherbrooke Lake bedrock areas a veneer of Lawrencetown Till is the most common deposit whereas at Whale Lake a thin covering of Beaver River Till predominates.

The general relief and configuration of the land surface results from the effects of glacial erosion and bedrock structure. Large strike ridges west of Meiseners Section and at Whale Lake were formed by glacial smoothing and plucking by ice as it flowed parallel to the major joint system in the area. These regions, as well as an area north of Sherbrooke Lake, were scoured by very erosive, southeastward-flowing ice.

Surfaces of bedrock outcrops are commonly weathered or frost-shattered, destroying glacial striations. Where till has been removed during road construction, striations are preserved on the underlying polished outcrop. Striations reveal two major directions of glacier flow and a third minor flow. The earliest flow was toward the east-southeast with an average direction of 120°. A younger flow was also southeastward with an average direction of 148°. The age relationship between these two sets of striations was determined on an outcrop east of Pleasant River Lake. Nailhead striations trending 112° are crosscut by younger 150° striations and grooves whose flow direction is defined on the basis of well-developed crag and tail. One striation site indicating ice flow toward the northwest (345°) was mapped near Wild Duck Lake. It crosscuts striations of the oldest east-southeast (120°) ice flow. The presence of northwestward-trending striations near Wild Duck Lake indicates that ice flow originated to the south and that the SMB ice cap or divide of Stea (1988) was situated south of this region.

RESIDUUM (R)

Less than one per cent of the study area was mapped as residuum. It was noted in gravel pits and hand-dug holes in the northwest part of the map sheet, varies in thickness from < 0.5 m to > 3 m, and is commonly greyish-brown or pale grey. MacNeill (1954) clearly documented the presence of residuum on the SMB by describing ten occurrences of unconsolidated granite bedrock that he believed were formed by intense weathering. Mahogany and dark salmon-coloured, weathered granite bedrock described in some instances by MacNeill (1954) probably represents intensive hydrothermal (hematitic) alteration of bedrock. Residuum, as observed by the authors, is commonly greyish-brown or locally pale grey.

One kilometre west of Waterloo Lake (site 1) > 3 m of grey residual granite are exposed in a road cut. In situ weathering of the granite has produced a loose material with the original hypidiomorphic granular texture of the parent granodiorite bedrock. The residuum is easily excavated with a pick and shovel. Grey bands of silty material containing non-granitic clasts were observed in the residuum. The bands generally strike northeast and dip to the southeast. The bands are believed to be till wedges developed by the opening of tension fractures in the down-glacier direction during continued glacial drag and subsequent infilling with till (Dreimanis, 1969).

Greyish-brown residuum mixed and transported by ice is also preserved in a small gravel pit east of Waterloo Lake (site 2). The original texture of the parent bedrock is completely destroyed leaving a loose, disaggregated mass called grus. It overlies bedrock inscribed with striations trending 120°. The direction of ice flow indicated by the striations is in agreement with the orientation of the till wedges west of Waterloo Lake.

Residuum is overlain by Beaver River Till (GTB) along a logging road (site 3) separating Upper and Lower Thirty Lakes. The granodiorite clasts in the till are strongly weathered and were eroded from the underlying residual granite. Residuum exposed in a gravel pit 2 km east of Waterloo Lake (site 4) was incorporated into overlying Lawrencetown Till. The transition zone between the two units is approximately 0.5 m in width and contains allochthonous clasts mixed into the residuum during reworking by the overriding glacier.

Pavich (1986) calculated a rate for saprolite (residuum) development of 1 m per 250 000 years in a granite gneiss of the Virginia Piedmont. Based on this information and the observed thickness of residuum on this map sheet and elsewhere on the SMB (4-6 m) a pre-Pleistocene age is suggested for the residuum on map sheet 21A/10. This is in agreement with a pre-Pleistocene age suggested by MacNeill (1954) and also postulated for weathered bedrock in New Brunswick (Wang et al., 1981) and Cape Breton (McKeague et al., 1983).

LAWRENCETOWN TILL (LT)

Forty per cent of the map area is covered by Lawrencetown Till. It occurs as drumlins and ground moraine extending from Dalhousie road in the north to Barss Corner in the south and primarily overlies Meguma Group bedrock. It is bordered on the east by Sherbrooke Lake and extends westward past Springfield. This area of Lawrencetown Till is a northwesterly extension of the Lunenburg drumlin field of Grant (1963).

Drumlins are scattered throughout the Lawrencetown Till; however, the greatest concentration occurs near Springfield and New Germany where individual drumlins reach heights of 30 m. The orientation of the drumlins is generally northwest-southeast though some drumlins have a southward alignment suggesting deposition or more likely reorientation by a younger south-trending ice movement (Stea and Brown, 1989). Lawrencetown Till ground moraine, varying from <1 m to 3 m in thickness, occurs between the drumlins. Bedrock exposure is primarily restricted to the areas of ground moraine.

Clasts in the Lawrencetown Till were eroded from the SMB and bedrock sources 35-50 km to the north in the basaltic lavas of the North Mountain, metasedimentary and metavolcanic rocks of the White Rock Formation, and grey-black slate derived from the Meguma Group, Torbrook and Kentville formations. The ratio of SMB to non-granitic lithologies varies depending on the facies of Lawrencetown Till. The drumlin facies is consistently dominated by 50-90% allochthonous rock types. The Lawrencetown Till ground moraine has a non-granitic clast component varying from 30-50%. Non-granitic lithologies in drumlins near Springfield are grey, pink and purple quartzite, dark grey to black rhyolitic tuff, grey-black slate and basalt. In the New Ross drumlin field, east of Sherbrooke Lake, the White Rock lithologies are absent and the dominant non-granitic rocks are grey-black slate and basalt. The preponderance of White Rock clasts in the Springfield area results from the large area of subcropping up-ice metasedimentary and metavolcanic rocks to the northwest.

The presence of non-granitic clasts in Lawrencetown Till on the New Germany map sheet, with bedrock sources within the Fundy, Horton and Meguma groups near Digby, indicates large-scale southeast glacial dispersion across the SMB. However the SMB granite clast component in Lawrencetown Till on map sheet 21A/10 only reflects underlying and/or immediately up-ice bedrock sources within a maximum distance of 12 km.

Most Lawrencetown Till in the study area shows limited dispersion of immediately up-ice granite bodies. For example, within Lawrencetown Till ground moraine near Springfield, up-ice Scrag Lake Granodiorite clasts show limited dispersion of approximately 2 km down-ice across the Lake George Leucomonzogranite with a concommitent increase in the proportion of leucomonzogranite in the till. Similarly, in the Butler Lake area there is significant onlap of East Dalhousie Leucomonzogranite southeastward onto the Salmontail Monzogranite (Fig. 1). However, there is only a 20-25% incorporation of locally-derived Salmontail Monzogranite at a distance 5-6 km southeast of its most northerly contact with the East Dalhousie Leucomonzogranite. Near Springfield drumlins overlap a bedrock contact between the Scrag Lake Granodiorite and the Lake George Leucomonzogranite of Horne (1987). The Lawrencetown Till contains granite clasts eroded from the underlying bedrock; however, there is virtually no clast dispersion of Scrag Lake Granodiorite southeastward onto the Lake George Leucomonzogranite.

In all three examples there is a total absence of granite clasts whose source areas can be easily traced to bedrock units mapped over a distance of 12-35 km up-ice to the northwest by MacDonald and Ham (1988), Corey and Horne (1989) and Ham (1989). There is in effect an approximately 20 km skip zone where bedrock lithologies are not represented in the clast geology of the Lawrencetown Till deposited on the New Germany map sheet.

A model is presented for erosion, incorporation, transportation and deposition of material within Lawrencetown Till. A large proportion of the material in Lawrencetown Till was eroded and incorporated into a basal ice position by southeast- to south-flowing ice north of the SMB over rocks of the Fundy, Horton and Meguma groups. As the ice impinged on the north flank of the SMB subglacial debris was sheared into an englacial position, effectively removing Lawrencetown Till from any further input of granitic material as ice flowed across the SMB. Prior to and/or at the time of deposition locally-derived granitic lithologies were incorporated as Lawrencetown Till was deposited by a process of basal melting, suggested by Nielson (1976). The amount of locally-derived granitic debris and the amount of dispersion are proportional to the resonance time of the Lawrencetown Till in a basal ice position prior to deposition. Thus, drumlins contain very little local material while ground moraine contains more granite clasts and shows greater dispersion.

BEAVER RIVER TILL (BRT)

The Beaver River Till is divided into ablation, ground moraine and drumlin-derived units after Finck et al., 1992.

Ground Moraine: This unit is subdivided into granite (GTB), greywacke (GWB) and slate (STB) lithological facies. Greywacke and slate ground moraine cover 18% of the map sheet, occurring in the central and southern part of the map area overlying Meguma Group bedrock. Mapping by the authors was restricted to the SMB and the immediate exocontact. The distribution of greywacke and slate ground moraine is based primarily on Nova Scotia Soil Survey maps (Cann et al., 1958; 1965; MacDougall et al., 1969). This work was slightly modified to accommodate our airphotograph interpretation and the minor amount of mapping performed along the SMB-Meguma Group contact during this survey. It is interpretative in nature and should be viewed accordingly. Granite ground moraine covers 31% of the map area. It is restricted to the east, north and west margins of the map sheet.

Beaver River ground moraine forms a flat, featureless to rolling topography. Drumlins are less common in this unit than in areas of Lawrencetown Till. Where drumlins occur the ground moraine usually forms a mantle till overlying stratigraphically older tills. The till composition of drumlins in areas of limited access was based on airphotograph interpretation and regional mapping. As such, the surface till on some of these drumlins may actually be Beaver River drumlin-derived moraine or older Lawrencetown Till.

Clasts in ground moraine tills are locally derived and can be used to infer underlying bedrock geology. A* comparison of the clast geology of the Beaver River Till with the bedrock geology of the area (Fig. 3) shows that the distribution of granite and Meguma Group till clasts closely mirrors the known bedrock geology. The accurate representation of bedrock lithologies in the clast geology of the overlying ground moraine is due to the short (200 m) renewal distances in the till (Fig. 4). In areas of thin till (<1 m), such as overlying the East Dalhousie Leucomonzogranite in the north-central portion of the map sheet and overlying small porphyry and leucomonzogranite bodies south of Springfield Lake, the renewal distance in the till is a few tens of metres.

The short transport distance of clasts in the ground moraine makes it difficult to determine the direction of glacial transport using clast dispersal evidence. However, the bulk of the ground moraine appears to have been transported southeastward with minor dispersal toward the northwest during late-stage ice flow reversal.

Drumlin-Derived Moraine (GTB(D)): Approximately 1% of the map area is covered by drumlin-derived moraine. It occurs along the north edge of the map sheet and near Meiseners Section. This till is a laterally equivalent facies of the Beaver River granite ground moraine enriched in non-granitic lithologies due to its proximity to the Lawrencetown Till. At Meiseners Section, the area is extensively drumlinized and the enrichment of Meguma Group greywacke in this till results from inheritance of clasts from the Lawrencetown Till (Finck and Stea, 1990).

Mapping of the drumlin-derived moraine near Meiseners Section is problematical. In this area bedrock was mapped as Little Round Lake Monzogranite by Horne (1987). Tills in the area generally appear to be drumlin-derived moraine; however, some samples containing up to 72% Meguma Group greywacke appear to be Beaver River Till ground moraine. This inconsistency might be explained by the presence of unmapped subcropping inliers of Meguma Group rocks.

Ablation Moraine (GTC): Approximately 1% of the map area is covered by granitic ablation moraine. It forms a poorly developed hummocky moraine restricted to the northwest corner of the map sheet. Till exposure is limited with its distribution based mainly on airphotograph interpretation and its spatial relationship to more extensive ablation deposits on map sheet 21A/15. The ablation moraine will be discussed more fully in marginal notes on the map sheet immediately to the north, 21A/15.

ICE-CONTACT DEPOSITS (IC)

Approximately 1% of the map area is covered by ice-contact deposits that form an esker and small kames near Tommy Lake and small kames southeast of Waterloo Lake. Esker and kame sediments are derived primarily from glacial debris by the washing and sorting action of meltwater. The clast geology of the ice-contact deposits will reflect the provenance of the englacial and subglacial load. In areas of Beaver River ground moraine, clasts of the ice-contact deposits are derived from the clast geology of the till and hence reflect local bedrock geology. Direct field evidence occurs north of Tommy Lake where kame gravel is composed predominantly of Lake George Leucomonzogranite. The till is Beaver River ground moraine and the underlying bedrock is Lake George Leucomonzogranite. Ice-contact deposits also have a lithologic content representative of the surrounding Lawrencetown Till. Southeast of Waterloo Lake, the Lawrencetown Till hosts 10-54% granite believed to be Scrag Lake Granodiorite, 6-32% Joe Simon Leucomonzogranite and 40-70% allochthonous clasts. In this area kame gravel at two sites has a similar lithologic composition of 25% Scrag Lake Granodiorite, 5% Joe Simon Leucomonzogranite and 70% allochthonous clasts.

* Renewal distance is the distance required by a given rock type (measured from the proximal contact of the up-ice lithology) to increase its proportion in till from 0% to 50% (Peltoniemi, 1985).

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NOVA SCOTIA DEPARTMENT OF NATURAL RESOURCES

MINES AND ENERGY BRANCHES

MAP 93-02

GLACIAL AND TILL CLAST GEOLOGY OF NEW GERMANY

(N.T.S. SHEET 21A/10)

NOVA SCOTIA

P. W. FINCK, R. M. GRAVES and F. J. BONER

SCALE 1 : 50 000

kilometres 1 0 1 2 3 4 kilometres

miles 1 0 1 2 miles

NOVA SCOTIA DEPARTMENT OF NATURAL RESOURCES

Hon. John G. Leefe — MINISTER
John Mullally — DEPUTY MINISTER

HALIFAX, NOVA SCOTIA
1992

Nova Scotia Department of Natural Resources

Canada-Nova Scotia Mineral Development Agreement