

DESCRIPTIVE NOTES

The oldest unconsolidated till in the map area is residuum which is mechanically and chemically weathered bedrock. Areas of the Antigonish Highlands have a veneer of shatterd bedrock. The age of this deposit is not known, but intense chemical weathering in basalt residuum deposits east of the map sheet suggests a pre-Wisconsinan and perhaps a pre-Quaternary age (Rutherford and Blais, 1987). There are large areas designated as rock on the map sheet that are overlain by a thin discontinuous veneer of till. The rock exposed is generally competent and often glacially scoured. Stone trunks marked on the map are often sites of outcrop, especially in the regions southeast of Hopewell. The most complete Quaternary sections are found on the Northumberland Strait shore from Arisaig northeastward. At the base of most of these sections is a sequence of stratified, well-sorted sands and gravels resting on an emergent abrasion platform believed to be a remnant of a Sangamonian high sea level stand (Section 6, Figure 1, Grant, 1986). The height of this rock bench varies from 4-6 meters above mean sea level. Lying above the stratified sands in most of the sections is a distinctive, boundary to gravelly diamict. The clasts are intertidally angular and locally derived. This sediment varies in thickness from 4-20 meters. This material may be a product of mass wasting from glacial rock slopes during proglacial conditions. It is also possible that it represents a supraglacial flow till, deposited by advancing glaciers that deposited the overlying till. Stratigraphically above this diamict are two tills distinguished primarily by their stone content. The lower till (McCarron Brook-East Millford Till) is greyish-red and has a silt matrix. It is relatively stone-free. Fossil fragments of Mammals (sp) are commonly found near the base of this till unit. A date of 10,000 yrs B.P. was obtained on one of the fragments (GSC-4048, D. R. Grant, personal communication, 1984). Thick exposures of this till rest on bedrock surfaces with striations trending 100°-120°. Large elongate boulders at the base of some sections with stony tills and fine lines are oriented parallel to the bedrock striations and have parallel surface striations. This till sheet was probably emplaced from an ice sheet moving to the east and southeast. A peat bed dated at 442,000 years B.P. (GSC-1599) lies under the surface Estoville Till at Adington Forks. This peat bed contains the pollen remains of Birch, Oak, Hornbeam, Hickory and Elm indicating a climate warmer than present, an interglacial interval. Peat inclusions were also found in a weathered till unit beneath the surface Estoville-Lawrencetown Till at section 14 (Fig. 1), near Glen Alpine. These have not been dated or palynologically analyzed. The first Wisconsinan glacial event was an eastward to southeastward ice flow stemming from a centre outside the Province. Figure 2a shows the flow lines of this glacier based on the trend of striations, hummocks and till lobes on the map area. The dotted arrows may represent ice flow during later (south-southwestward or earlier (eastward) flow phases). The McCarron Brook-East Millford Till (MB) Sections 31 and 64 (Figure 1) was deposited during this ice flow event (Olson, 1994; Shea et al., 1985). This till is named after type localities east and south of the map area (Williams et al., 1985; Shea et al., 1985). It is a compact, judgment till found at the base of many sections along the coast and outcropping as small unmappped windows along the sides of east trending valleys in the Antigonish Highlands. Erratic content of the McCarron Brook-East Millford Till in the map area differs with location. Along the Northumberland Strait shore the till has less than 1% granitic erratic content. The next phase of ice flow across the map area was northward and northward (Figure 2b). This flow was funnelled northward through the Baltaton Cap (Fig. 2b) and northward along the Northumberland Strait. Type localities for striations relating to the northward ice flow on the map sheet are: (1) 1 km northeast of Burnside River Station where striations and clog and tail features on metasedimentary bedrock indicate northward flow, and (2) east of Eden Lake where striations and clog and tail features trending 005° are cut by striations trending 220°. The Estoville-Lawrencetown Till north of the St. Marys Graben (Fig. 2b) has been either deposited or reworked by this phase of northward flow. Till lobes in the Estoville-Lawrencetown Till at Willow Point and Meadow Springs (Sections 2, 11, Fig. 1) indicate northward ice flow. Northward dispersal of Antigonish Highland erratics has been noted in samples of Estoville Till north of the Hollow and Chebucto Faults (Fig. 2b). The last phase of ice flow was southwestward out of the St. Marys Graben region. Northward flow features may be covered with this flow if the centre was located in the Eden Lake region (Fig. 2c). Moraine features in the Chatham Harbour area near Pictou indicate a late southwestward glacier. A type locality for striations belonging to this flow phase is 10 kilometers north of Tralorag where striae surfaces are inscribed by a set trending 254°, cutting across an older set at 301°. Stony, locally-derived till (Antigonish Highland and Tony River Till) were probably formed by this glacier or glacier complex. These tills often form ribbed moraine topography that is perpendicular to the southwest phase of ice flow, such as the areas northeast and southeast of Eden Lake. These stony tills also overlay the Estoville-Lawrencetown Till at several localities (Sections 2, 9, 10, 11, 12, 15, Fig. 1). Ages of these ice flows are speculative because none of the tills related to the flows have been dated directly. The McCarron Brook-East Millford Till is believed to be Early Wisconsinan because it overlies peat beds (Shea and Hemsworth, 1979) tentatively assigned to the Sangamonian interglaciation (Grant and King, 1984). It is possible that similar till units found at the base of thick drift sequences in Illinois in age. The subsequent three ice flow phases are believed to span Middle to Late Wisconsinan time (6400 - 10,000 years B.P.).

Deglaciation

Deglaciation is recorded by the detritic glacioluvial and glaciomarine sediments of the Five Islands Formation. Shelf dates on bottomset beds of a delta at Spencer's Island west of the map area range from 14,300 - 15,000 years B.P. (Shea and Wightman, 1987). The pattern of deglaciation in the region is marked by the relationships between proglacial outwash and ice contact stratified drift and accurate patterns of ribbed moraine and alluvial till (AN, TA). These features suggest the recession of an ice mass centered southeast of Antigonish (Fig. 2d).

Economic Geology

Outwash deposits of the Saint's Rest Member provide the best aggregate resources in the map area. These deposits are generally well sorted, have few fines, abundant grad and sand, and consist of rounded, granitic stones. Ice contact stratified drift of the Apple River Member is much more unpredictable in grain size and soundness. The deposits vary from road base grade to asphalt grade. Alluvial or stream deposits can provide a good source of aggregate locally, but limitations include the common use of the areas as prime farmland and the proximity to the residential areas. Residuum deposits have been cited in some areas as sources of aggregate, primarily for road base. The highly weathered nature of the clasts renders them useless for concrete or asphalt.

Drift Thicknesses

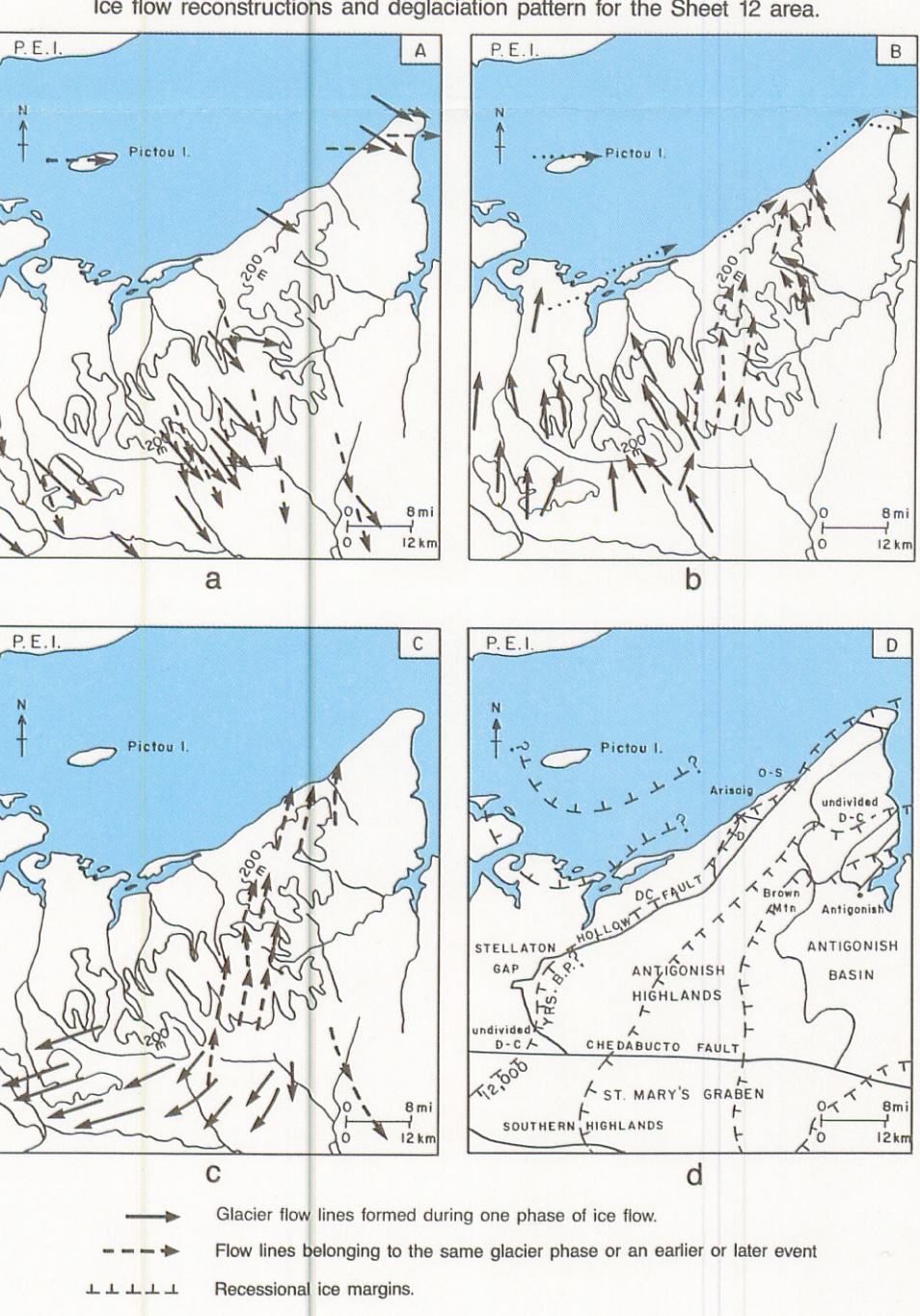
In the legend a range of thicknesses are estimated for each of the surficial units. A relationship exists between drift thickness and topographic elevation. Estimates of drift thickness in uncovered areas can be made by applying the formula: T = 40 - (30NE) T = Average thickness of till cover (feet) E = Topographic elevation (feet)

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FIGURE 2

Ice flow reconstructions and deglaciation pattern for the Sheet 12 area.



LEGEND

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NONGLACIAL ENVIRONMENT
ORGANIC DEPOSITS: C, peat, gyttja, clay, underlies bogs, fens and marshes; generally greater than 1m thick.
COLLUVIAL DEPOSITS: G, gravel, sand, silt, minor clay and organic material; a complex mixture of glacial deposits, weathered and non-weathered rock, formed by periods of downslope creep and/or mass movement along steep valley walls, 1-10m thick.
ALLUVIAL DEPOSITS: A, gravel, sand, silt, minor clay and organic material; forms flood plains, channel and bank deposits; 2-15m thick.
MARINE DEPOSITS: Ma, low sand, silt, clay, locally overlain by peat and organic till matrix; forms intertidal mud flats, 2-15m; Mb, gravel, silt, sand; forms beaches, bars and spits, 2-15 m thick.
NONGLACIAL AND GLACIAL ENVIRONMENT
LATE WISCONSINAN
FIVE ISLANDS FORMATION: glacioluvial, glaciomarine and glaciomarine deposits laid down during the retreat of glaciers and the final fall of sea level.
SAINT'S REST MEMBER: SR, glacioluvial gravel, sand and minor silt; massive to horizontally stratified, channel sequences common; forms outwash plains and upper parts of Gilbert-type deltas, 3-30 m thick.
APPLE RIVER MEMBER: AR, ice contact stratified drift, boulders, gravelly sand, sand and silt; abrupt changes in grain size between beds; bedding common; till may be present locally; forms hummocky and knotted terrain, varies along valley sides, 4-30 m thick.
GLACIAL ENVIRONMENT
STONY LOCAL TILLS: (includes T, AN, G and MG) characterized by an abundance of cobble-boulder sized clasts; sandy matrix, the matrix to clay silt is variable; the 2 m-thick clast fraction averages 20% of the total fill weight; the matrix averages 50% sand, 30% silt and 20% clay; local derivation, removal distance (distance, elevation of a bedrock contact, at which 50% of the clasts incorporated in the till are from the underlying bedrock) is 200-500 m; stony till facies exhibit greater removal distances, up to 10 km.
TONY RIVER TILL: TR, greyish-brown stony sand silt; moderately compact, boulders abundant near surface with upward throughout; inclinations of nodules silt till; subangular to angular clasts; clay lithology 80% grey and red Carboniferous sandstones, 10% crystalline siltstone; surface till areas of conglutinated ribbed moraine; till lobes formed grey loamy sandy till loams, interbedded silt and sand and gravel; large boulders on till surface of local lithology; selected areas of waterlain material; forms hummocky topography with a low-relief landscape; 2-20m thick.
ANTIGONISH HIGHLAND TILL: AN, greyish brown very stony sand silt; loam to moderately compact; boulders throughout; angular clasts; clay lithology 90% local bedrock lithologies, crystalline, volcanic and metasedimentary; 10% Magama Group metasedimentary and foreign clasts; forms ground moraine in areas of granitic bedrock; 3-5 m thick. ANs, locally facies similar to AN but associated with sand and gravel beds; forms moraine and hummocky topography.
GRANITE TILL: G, yellowish brown stony sand silt; loam to moderately compact; boulders throughout till section; washed stony zones around boulders and clay shales on pebbles are common; granitic clasts are angular to subangular; clay lithology 90% of a single granitic lithology; forms ground moraine in areas of granitic bedrock; 3-5 m thick.
MERRIMACK TILL: MG, greenish grey stony sand silt; loam to moderately compact; 90% local bedrock lithology; ground moraine overlying metasedimentary bedrock of the Magama Group.
Note: G and MG are considered lateral equivalents, AN and T are also considered lateral equivalents.
SILTY TILLS: (includes MR, E, and MB) This class of tills is characterized by higher mud/clay ratios than the stony tills; the 2 m-thick fraction averages 25% of the total fill weight; the matrix averages 40% sand, 45% silt and 15% clay; these tills tend to have higher percentages of exotic clasts, and are characterized by removal distances in the order of 10 kilometers.
MOOSE RIVER TILL: MR, greyish brown silt; compact, sandy partings locally; clay lithology 80% grey metasedimentary and secondary rocks; forms hummocky, ribbed and rolling ground moraine; 2-10 m thick.
ESTOVILLE-LAWRENCETOWN TILL: E, reddish brown silt; moderately compact; basal and massive, jointed, MnO2 staining along fissile planes; clay lithology 50-60% Carboniferous and igneous sandstones, 50-60% erratics; surface boulder layer in some regions is restricted in extent (thick); forms flat, diminished and rolling ground moraine, 5m thick. E, (brown sand) formed brown stony sand silt; loam to moderately compact; coarsely fissile, greenish sand and sand nodules, partings and beds; clay lithology contains higher erratic content than the regional localities; forms hummocky and ribbed moraine generally in topographic depressions, locally with a local stratified silt; 3-20 m thick.
Note: Deltas in the areas south of the map sheet have been designated as Lawrencetown Till (Shea and Foster, 1979). This is considered a lateral equivalent of the Estoville Till.
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ROCK
PRE-QUATERNARY
D, RESIDUUM: D, fragmented, mechanically and chemically weathered bedrock, overlain by a discontinuous, thin veneer of till, 1-16 m thick.
R, BEDROCK: R, locally sourced bedrock, small and large scale features of glacial erosion, discontinuous, thin veneer of till.
Reference Sections for Sheet 12
Figure 1
A vertical bar chart showing stratigraphic columns for 15 reference sections. The y-axis represents elevation in meters (0 to 25). The x-axis represents section number (1 to 15). Each column shows the sequence of geological units from top to bottom, with their approximate thicknesses and elevations.
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Till Unit: Solid color
Diamict: Stippled pattern
Gravel-Sand: Dotted pattern
Sand: Horizontal lines
Mud: Vertical lines
Peat/Wood (with dates): Wavy lines
Rock: Solid black
Till Fabric: Solid color with arrows
Alteration: Stippled pattern
Folded Sediments: Wavy lines
For Reference Section locations, refer to map.
SYMBOLS
Geological boundary: Solid line
Structural (dip) ridge: Line with arrows
Glacial striae (ice flow direction known, unknown, 1 indicates older striae): Line with arrows and numbers
Fishes molasse: Wavy lines
Dummocky, ribbed terrain: Stippled pattern
Moraine ridge (map, minor): Line with arrows
Hummocky moraine, hummocks: Wavy lines
Esker (direction of flow known, unknown): Line with arrows
Kettle (large, small): Circle with cross
Sinkhole: Circle with dot
Multistair spillway: Staircase pattern
Terrace scarp: Line with arrows
Location of stratigraphic section of special interest (number refers to section, see figure 1): Circle with number
Radiocarbon date: Circle with number
Contour interval 50 feet: Line with arrows
Date: Circle with number
Material: Circle with number
Elevation: Circle with number
NOVA SCOTIA DEPARTMENT OF MINES AND ENERGY
MAP 90-6
SURFICIAL GEOLOGY OF PARTS OF HALIFAX, PICTOU, ANTIGONISH AND GUYSBOROUGH COUNTIES (SHEET 12)
NOVA SCOTIA
Geology by R.R. Shea and R.A. Myers
Scale 1:100,000
Universal Transverse Mercator Projection



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