

T3.4 TERRESTRIAL GLACIAL DEPOSITS AND LANDSCAPE FEATURES

Glaciations during the Quaternary Period have had a profound effect upon the landscapes of Nova Scotia. Glaciers changed narrow V-shaped tributaries to broad U-shaped valleys, such as the St. Marys River, and blanketed the province with a veneer of glacial deposits of varying thickness and form, in some areas up to 300 metres thick. The deposits were generated by the action of the ice as it scoured, abraded and plucked at the bedrock during its advances across country. Glaciers do not always erode earlier deposits. They can modify them or leave them alone. Glaciers have been described as “fickle” erosional agents.

The texture of the glacial material (its clay, sand and stone content) reflects the physical properties of the parent bedrock, particularly hardness. Slate, for instance, is fairly easily reduced to clay, and sandstone is reduced to sand, but granite, quartzite and other hard crystalline rocks tend to remain as pebbles and angular stones.

The spatial relationship of the deposit to the parent rock and also its form are determined by several factors: the direction of ice movement, the position of the material underneath or within the ice, the flow characteristics of the ice mass, the agent of deposition (i.e., the ice itself), meltwater or wind.

In this Topic, the character and distribution of terrestrial glacial deposits are covered in some detail, in order to provide a basis for later topics and habitat descriptions. Offshore glacial deposits are discussed in T3.6.

STRIAE

Evidence of ice movement is provided by grooves and scratch marks (striae) made by hard rocks as they were dragged across the surface of softer strata. Each phase of ice movement produces its own set of markings, and occasionally striae pointing in different directions can be found on the same rock surface. Glacial striae are common on exposed rock ledges, but particularly good examples can be seen

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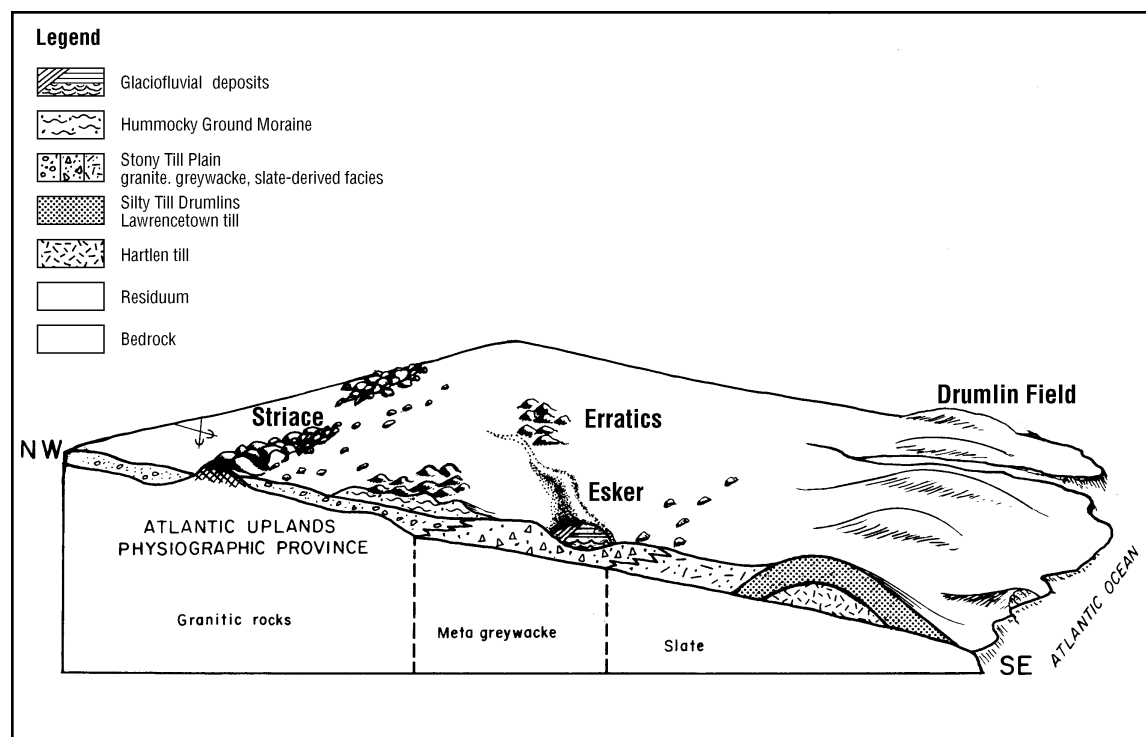


Figure T3.4.1: Cross section of the Quaternary deposits of the Atlantic coast of Nova Scotia.¹

in Point Pleasant Park (Unit 851), at the Ovens Natural Park on the west side of Lunenburg Harbour (Unit 832), and on the south side of Lake Kejimikujik (Unit 412a).

ICE-FORMED DEPOSITS

Materials deposited directly by the glacier are known as till. They can be of many sediment sizes and are characteristically unsorted. Tills that relate to the four phases of ice flow not only overlie striated bedrock surface but at many locations they overlie older nonglacial and glacial deposits^{1,2} (see Figure T3.4.1).

Ground Moraine or Till

Till is the general name given to the material scraped off or ground down from the bedrock. Glacial till is usually divided into a compact bottom or basal till, with a platy type of structure, and an upper, looser ablation till. Ground moraine is the till at the base of the ice that is left behind, more or less in place, like a mantle over the previously ice-covered landscape. It is often a structureless, unstratified deposit, but in some places consists of a lower compacted, smeared

and relatively impervious layer of basal till. Basal tills derived from sedimentary or metamorphic rocks generally have a larger fraction of illite and smectite (swelling clays) than is found in granitic rocks. These clay minerals, which are derived from mica, will absorb more moisture than the clay minerals in granitic rocks, improving moisture and nutrient storage. Above the basal till, looser (sometimes sorted) ablation till is found.

Ground moraine usually reflects the character of the underlying rocks more directly than other glacial deposits. It is, for instance, likely to be fairly thin and with a high clay content over slates, very stony and often absent altogether over granite, and thick and loamy over soft lowland strata. The stone content is generally high, but variable.

The thickness of the ground moraine cover varies considerably across the province. In general, the thinnest deposits are found on high ground and over resistant rocks, whereas the thickest are in lowland areas and local depressions. The upper surfaces of the Cobequid Mountains (District 310) and Cape Breton Highlands (Region 100 and District 210) have very little glacial cover, while Cumberland County,

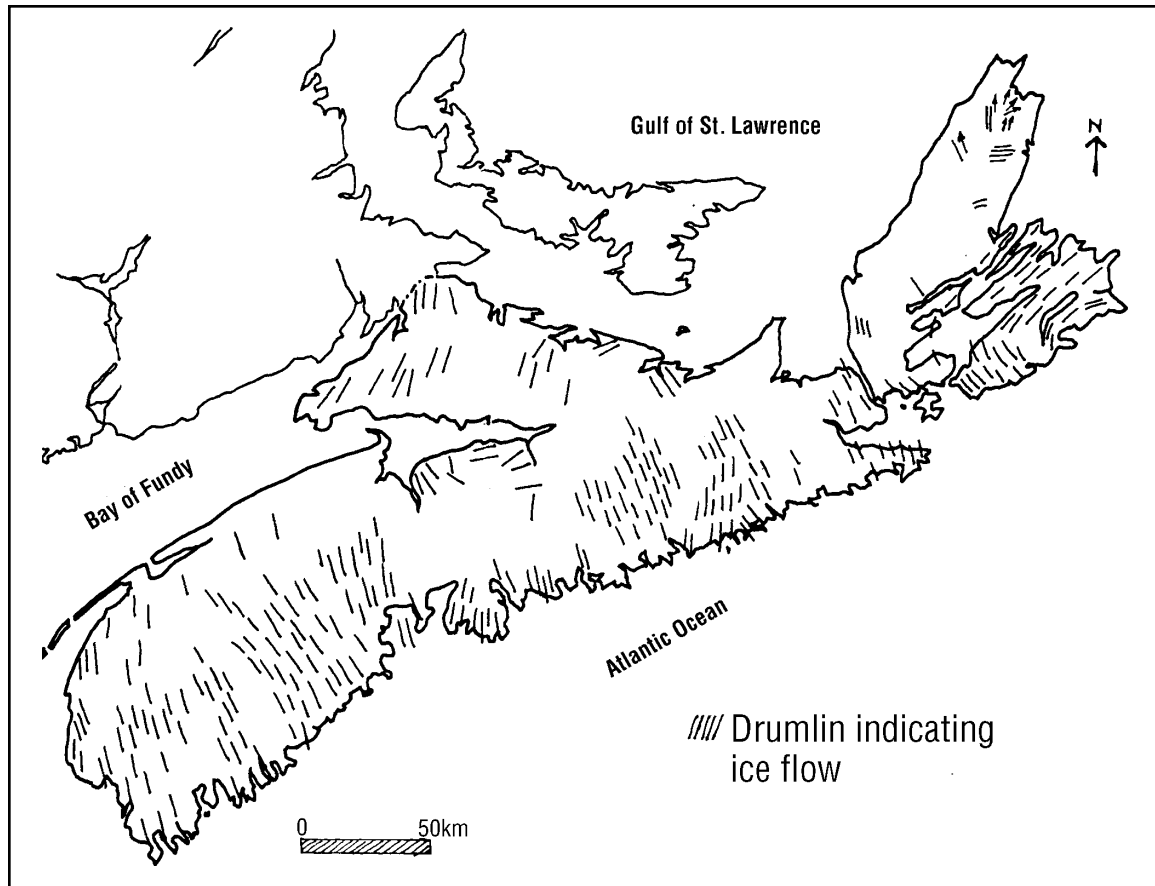


Figure T3.4.2: Orientation of drumlins in Nova Scotia.³

Hants County and the lowlands of Cape Breton have deposits tens of metres thick (Region 500). On the mainland, glacial deposits tend to thicken southwards, and coastal sections frequently show deposits which are 10 m or more in thickness.

At a smaller scale, the distribution of moraine reflects the way an ice mass responds to the underlying morphology. Local high areas may be swept clear, for example, Mount Uniacke and Halifax Airport, and the surrounding low spots filled in, for example, Miller Lake area (Districts 410, 430).

The drainage characteristics of ground moraine are determined by its thickness, its clay/sand/stone composition and the permeability of the underlying bedrock.

Drumlins

Drumlins were formed in Nova Scotia during the ice-flow Phases 1, 2 and 3 (see T3.3). The vast majority were formed during Phase 1, and later modified by Phase 2. Glacial till is often moulded into specially shaped hills called drumlins. These are frequently 15 to 30 m high, and may be more than a kilometre in length. Seen from above, they are generally egg-shaped and aligned parallel to the axis of ice movement, with the pointed end indicating the downstream direction of flow (see Figure T3.4.2).

Texturally, drumlin deposits range from sand to clay loam. They are not usually stratified in the strict sense, but may show a colour and textural variation from bottom to top as locally derived material is overlain by other material carried at a higher level in the ice. Drumlins typically contain scattered stones and boulders of various sizes; the deposits are generally uncompacted, well drained and easily eroded.

Drumlins seem to have a relatively high buffering capacity, which may result from the inclusion of sediment from the carbonate-rich rocks of the Carboniferous Lowlands (Region 500).

Drumlins are typically found in swarms in the Atlantic interior and coast (Districts 430, 830) and Cape Breton (District 870), where the heavily laden ice moved across level areas or down slopes. Most drumlins are associated with slate strata and are generally scarce once a granite or quartzite boundary has been crossed. In areas where slates and quartzites are interbanded, drumlin fields may cross the quartzite area but do not seem to incorporate much new material. The association of drumlins with slate areas is less clearly marked in the Halifax–Guysborough area than in southwestern Nova Scotia.

“Red” drumlins are found throughout the Atlantic interior and along the Atlantic coast. These distinctive landscape features are formed from materi-

als carried from the Carboniferous Lowlands to the north. Red drumlins often occur together; the greatest concentration is in Lunenburg County, but they may also be seen north and east of Halifax Harbour and in isolated localities in Halifax and Guysborough Counties. On soil maps, these red drumlins are Wolfville soils. By contrast, drumlins formed from local slates are “grey” in appearance. A few isolated drumlins, composed of predominantly granite or quartzite rocks, are found in southwest Nova Scotia. Drumlins in Nova Scotia have been extensively farmed and settled.

Erratics

In a glacial landscape it is common to find large rocks or boulders resting in areas far distant from their source. The direction in which these lie relative to their parent rocks provides valuable evidence of the direction of movement of ice masses. Cobequid-type stones, for instance, are rarely found in the Carboniferous Lowlands but are common further south and form a large proportion of the rocks in the bed of the Salmon River at Truro, near Pictou and on Pictou Island. Similarly, igneous rocks from the Creignish Hills in Cape Breton are found to the east near Sydney. In western Nova Scotia granite and basalt are found in a wide area south of their respective outcrops on South Mountain and North Mountain.

WATER-LAIN DEPOSITS

As the ice melted, immense quantities of sands and gravel were released and sorted by the seasonal streams and rivers issuing from the front of the glacier or flowing across its surface. Eskers were formed by streams beneath or within the ice; kames formed in low areas on the ice surface; alluvial fans were built up where streams entered temporary lakes; and outwash plains developed in front of the glacier as the heavily burdened streams carried sand and gravel from the retreating ice front.

Eskers

Eskers are steep-sided ridges up to 30 m high, composed of poorly sorted sands, gravels and rounded cobblestones. They run across country for up to 10 km, sometimes at an angle to the existing water courses, but more often along rivers or natural drainage channels. Those eskers that seem to be superimposed on the topography probably formed within the ice and later slumped down; those that follow natural drainage channels formed at the base of the ice.

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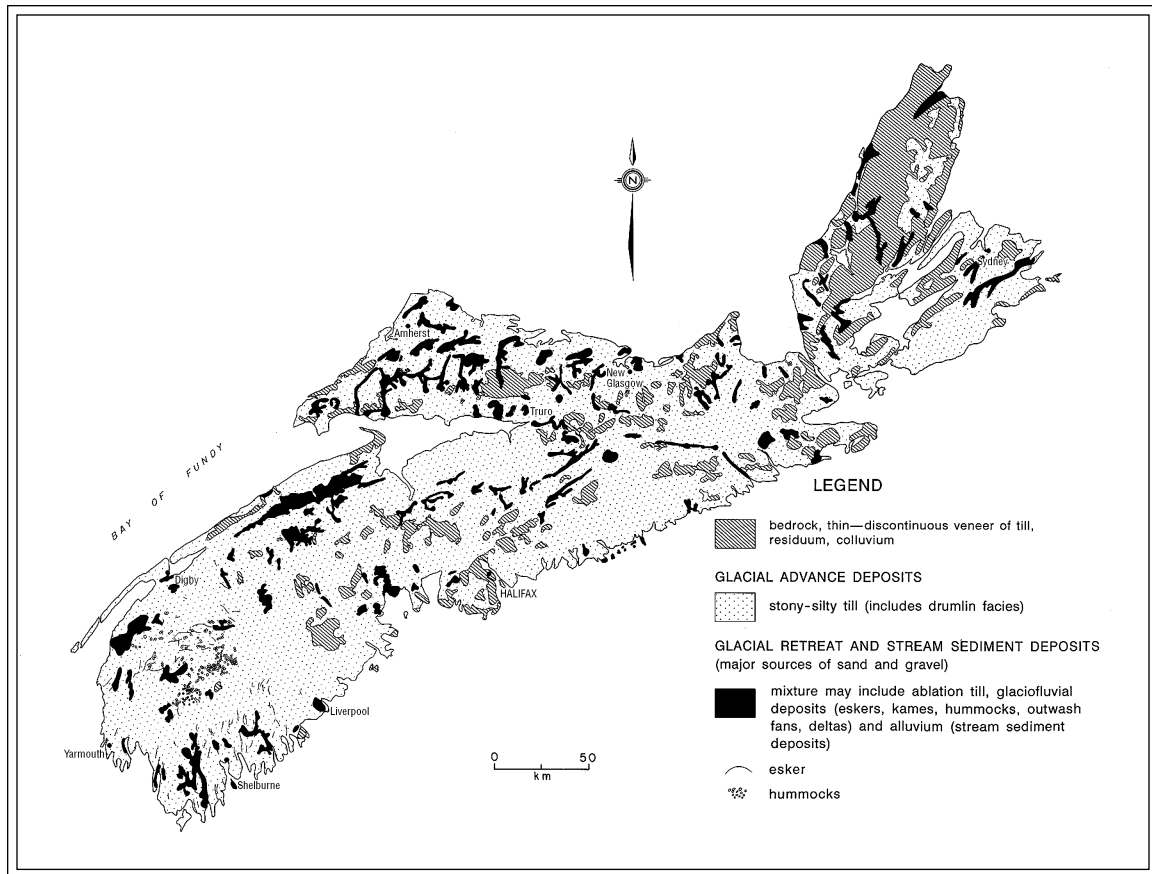


Figure T3.4.3: The simplified surficial geology map is divided into three groups or units. Pre-glacial material includes exposed or nearly exposed bedrock, residuum (weathered bedrock) and minor amounts of colluvium (a mixture of soil and rock derived from slope failure and creep). Glacial advance deposits consist of stony-silty till and includes the various drumlin-related facies.⁴ Compiled by Nova Scotia Department of Natural Resources.

Eskers are rare in northern Nova Scotia but are common in the southwestern counties. One of the best known is the “Boar’s Back,” which runs for nearly 20 km from Halfway River along the west side of River Hebert in Cumberland County (Units 581, 532). The Sable, Jordan and Clyde rivers (Unit 412) in southwestern Nova Scotia each have eskers along some part of their courses. Eskers are also found inland, particularly near the edges of lakes. The maps listed in the references should be consulted for localities.

Kames and Kame Terraces

Kames are mounds of stratified sand, gravel and water-worn cobble stones which were deposited in pools and holes within the ice and along its margin. If the material is dropped from melting water flowing along the surface of the ice at the side of a valley, a kame terrace may be formed.

Kames and kame terraces are very common throughout the province; the terraces are particularly conspicuous along valleys and in water gaps. In northern Nova Scotia, good examples of kame de-

posits can be found in the Parrsboro Gap, the Folly Gap, Wentworth Valley, and along the divide between the Parrsboro River and River Hebert (Unit 311). Kame terraces are also found along the Gaspereau River in Kings County (Unit 422a) and south of Berwick and Aylesford (District 610). In Cape Breton, they occur along the Sydney River (Unit 585b). Most valleys in southern Nova Scotia have examples of kame deposits and many can be seen from the highways.

Outwash Deposits

The material carried away from the front of the glacier by streams is sorted and deposited over a wide area as fans, deltas and plains. The texture depends upon the ratio of sand to cobble stone, and the material is generally well drained. Thickness may vary within a fairly small area.

Outwash deposits are particularly thick where glacial meltwater was channelled through passes and down river valleys. Good examples are found south of the Parrsboro and Folly gaps and at the

mouths of all the rivers between Truro and Parrsboro. They were also formed in the Stewiacke River valley and near the James River south of Antigonish. In Guysborough County, the river valleys were almost filled with sand and gravel. Indian Harbour River has deposits along most of its length, and Indian Harbour Lake has been cut off by a wide alluvial bar. Country Harbour and Isaac's Harbour have extensive deposits on their margins, while at New Harbour the inlet is divided into sandy bars by outwash material. In Cape Breton, outwash deposits can be seen in many valleys but are particularly well developed in the northern part of the Mira Valley and in most of the Margaree Valley.

Water-lain and Wind-sorted Sand

In the northwestern part of the province, the Annapolis–Cornwallis valley (District 610) is covered with fine sands. Some were deposited by streams, some in glacial lakes, and some were carried by the wind and deposited as dunes; the latter can be found in the area around Kingston. Loess, a fine wind-blown silt, is also found on the slopes of the South Mountain between Middleton and Nicholsville and in the vicinity of Debert. Farther west, deltas were formed near Bear River and at Sandy Cove on Digby Neck.

Water-sorted glacial deposits provide potential reserves of sand and gravel and have been mapped as such by the Nova Scotia Department of Natural Resources, though not always with their morphological name attached (an example of sand and gravel extraction is shown in Plate T12.4.1).

KARST TOPOGRAPHY

Karst topography is a landscape feature characteristic of highly soluble bedrocks (such as limestone) and evaporite deposits (such as gypsum and anhydrite). In the Carboniferous Lowlands, gypsum underwent erosion during the Tertiary and planation during glaciation. Glacial tills covered much of the eroded gypsum, but sinkholes and disappearing streams reveal the presence of ancient karst topography. Karst features are very visible wherever gypsum is mined, and where streams and rivers have removed surficial sediments to expose gypsum, for example, at St. Croix, where erosion on the bluff has revealed the gypsum.

Karst surface conditions are characterized by conspicuously pitted topography. This uneven surface impedes forestry and has contributed to the fact that some very old coniferous forests still grow at places like Dutch Settlement and Hayes Cave. The ground

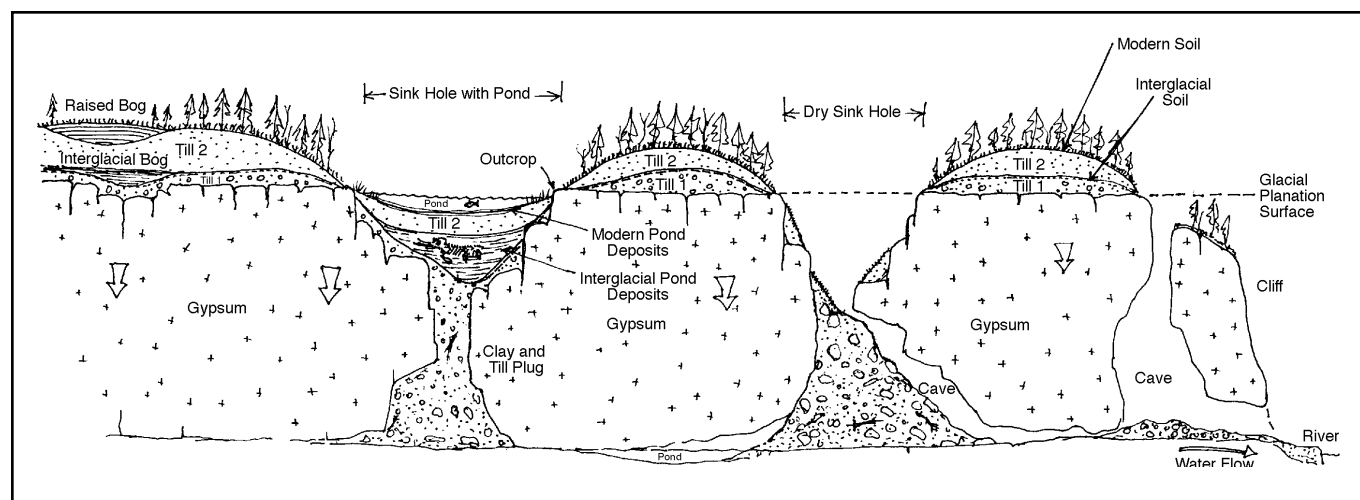


Figure T3.4.4: Diagrammatic cross section of karst features on gypsum in Nova Scotia, based upon examples at South Maitland, Hants Co., and Dutch Settlement, Halifax Co. (Unit 511a).

flora and fauna associated with karst is characterized by calcium-loving plants and various species of land snail.

The Hayes Cave site at South Maitland (Unit 511a) has several typical karst features, such as the cave itself, sinkholes and a collapsed cave system. Groundwater solution contributed to the erosion of the gypsum, creating sinkholes. The ancient stream channels and sinkholes were subsequently infilled and have been preserved as solution-collapse and cavity-fill structures.⁵ Caves are important hibernacula for bats and other mammals (see Figure T3.4.3).



Associated Topics

T3.3 Glaciation, Deglaciation and Sea-level Change, T3.5 Offshore Bottom Characteristics, T9.1–T9.3 Soils, T10.12 Rare and Endangered Plants, T11.16 Land and Freshwater Invertebrates, T12.4 Glacial Deposits and Resources

Associated Habitats

H5.3 Cliff and Bank, H5.5 Cave

References

- 1 Stea, R.R., R.J. Mott, D.F. Belknap and U. Radtke (1992) "The pre-Late Wisconsin chronology of Nova Scotia, Canada." In *The Last Interglaciation/Glaciation Transition in North America*, edited by P.U. Clark and P.D. Lea. Geological Society of America. (*Special Paper* 270).
- 2 Mott, R.J., and D.R. Grant (1985) "Pre-Late Wisconsinan paleoenvironments in Atlantic Canada." *Geographie Physique et Quaternaire* 39: 239–54.
- 3 Cameron H.L. (1966) *Glacial Landforms in Nova Scotia*. Nova Scotia Research Foundation. (Map).
- 4 Stea, R.R., H. Conley and Y. Brown (compilers) (1992) *Surficial Geology of the Province of Nova Scotia*. Nova Scotia Department of Natural Resources. (*Map* 92–3), Scale 1:500 000.
- 5 Morris, L., ed. (1985) *The Hayes Cave Site, South Maitland, Nova Scotia*. Nova Scotia Museum. (*Curatorial Report* No. 50).

Additional Reading

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- References in T3.3 Glaciation.