

T7.1 MODIFYING FORCES

The coast is a place of constant change. Winds, waves, tides and ice are continually at work, eroding, transporting and depositing the rock, gravel, sand and mud of the shore (see Plate T7.1.1). On the Atlantic Coast (Region 800), waves are the most important environmental agent of change, while in the Bay of Fundy (Regions 600 and 700), tides, and the currents generated by them, are of greater significance. Sea-level rise can also contribute to morphological changes on the coast. Organisms can influence the modifying effects of the physical forces.

TOPOGRAPHY

Landforms that result from these forces depend very much on the bedrock geology, unconsolidated surficial materials remaining from the last glaciation, and sea-level changes in the post-glacial period. For purposes of this description, bedrock can be grouped into resistant and unresistant types. Resistant rocks dominate the Atlantic Coast, except in southern Cape Breton Island, the Bay of Fundy coast west of Cape Split (District 720) and the Antigonish-western Cape Breton Island section of the Gulf of St. Lawrence (Districts 220, 310).

Beaches and marshes in these areas are derived exclusively from reworked surficial sediments, including eroded drumlins, glacial outwash and marine deposits. These beaches and marshes are therefore of limited extent and size. Unconsolidated bedrock outcrops in the Northumberland Strait (District 520), southern Cape Breton Island (Districts 530,

870) and the upper reaches of the Bay of Fundy (District 620) are sources of relatively abundant coastal sediment. Surficial deposits also tend to be more plentiful in these areas. As a direct result, the largest beaches and marshes are found on these coasts.

WAVES

Ocean swells from the south and east dominate the Atlantic Coast. This high-energy environment is more pronounced in winter. In the fall, remnants of hurricanes often cross the province and its coastal waters from the southwest. Significant wave height occurring for a 12-hour period once a year varies from 6 m in the Gulf of Maine to 8 m off Halifax and Cape Breton Island.¹

Waves due to offshore winds have no erosive effect on the shoreline, but even off Halifax (which experiences predominantly northwest and northerly offshore winds in the winter) easterly storm-wind events produce onshore waves which rework exposed glacial deposits along the Atlantic Coast at Hartlen Point (Unit 833) at a rate of 2 m annually. Waves along the Eastern Shore are responsible for reworking sediments varying in size from sand particles to cobbles.²

The Atlantic Coast is also exposed to long ocean swells originating from storms at great distance. Swells from the open ocean are not very significant in the Bay of Fundy, nor in the Gulf of St. Lawrence.

Summer winds from the southwest and especially winter winds from the northwest generate waves in the Bay of Fundy. These have combined with the tides to erode wave-cut platforms on west-facing coasts. In the Gulf of St. Lawrence, northeast storm winds generate waves of sufficient energy to erode unresistant bedrock outcrops at 1 m annually.

A noticeable seasonal cycle in wave energy is observed in the Atlantic Ocean, Bay of Fundy and Gulf of St. Lawrence (although the Gulf is protected by ice from December to April). The increased winter wave energy, especially in storm episodes, combs down beaches, removing sand and gravel offshore and destroying the characteristic series of parallel offshore bars. Persistent, but gentler, onshore winds in the summer move the same material shorewards, rebuilding the beaches and bars.

T7.1 Modifying Forces

In the late 1970s, winter storm waves were breaking down the primary sand dune at Rissers Beach, Lunenburg County (Unit 832). Deterioration of the jetty at the west end of the beach by the river was found to be the root cause. The jetty had functioned to support the beach in a configuration which faced the direction of greatest wave energy. When the jetty developed gaps, sand washed into the river at an increasing rate, leaving the beach sand-starved and eroding. The beach was restored by repairing the jetty, in-filling the breaks in the dune with Christmas trees as sand traps, and planting beach grass to help hold the sand in place.

TIDES

With the rapid increase in tidal range and height within the Bay of Fundy, stronger tidal currents are established and the capacity to move sediments increases. Large tides have ranges of 5.1 m at Yarmouth (District 920), 9.3 m at Digby (District 720), 12.6 m at Advocate (District 710) and 16.0 m at Burntcoat Head in Minas Basin (District 620). Currents have been reported in excess of 5 m/s in the Minas Channel.

River estuaries in the Bay are virtually dry at low tide. Stronger currents generated by the flood tide carry fine sediment into these estuaries, which the weaker ebb-tidal currents are unable to remove. This is the origin of sediments which have built, and are building, the marshes at the heads of Chignecto and Cobequid bays. The strongest currents in the main channels carry and deposit sand, forming gigantic sand bodies characterized by sand waves. Particularly conspicuous sand bodies are found in the Avon estuary off Hantsport (Unit 511a), and off Economy Point and in Cobequid Bay west of the Shubenacadie estuary (Unit 913a). This sand is exposed only at low tide.

Tidal range is only 1–2 m in the Northumberland Strait, and at certain times only one tide occurs (see T6.1). In summer, the low tide occurs during the day, exposing beaches and sand bars to the sun's radiation. The incoming tide is warmed as it moves over these sand flats, raising water temperatures to the highest values achieved in Nova Scotia. In winter, the reverse situation occurs: the sand flats are exposed at night and the incoming tidal water is chilled, greatly aggravating the ice conditions.

Tidal ranges of large tides increase westward on the Atlantic Coast from a large tide of 1.4 m at Ingonish (Unit 522b) to 1.95 m at the Guysborough (District 860) and 2.1 m at Halifax (Unit 833). Narrow entrances restrict the tidal influence in Bras d'Or Lake (Unit 916). However, strong tidal currents and barometric tides result in the mixing of fresh and salt water. The largest tidal-current velocities are generated within inlet throats and estuarine tidal channels, and here provide the mechanism for landward transport of sand- and mud-sized sediments into embayments.²

ICE

Only in the Gulf of St. Lawrence does sea ice cover large areas of water. Shore ice begins forming in December and by late January covers much of the Northumberland Strait. Not until late March or April does this ice break up and move through the Cabot

Strait to the Atlantic. The ice cover is moved by strong winds and, in piling up on windward shores, protects the coast from wave attack, although the ice itself may "raft" material from beaches and marshes. During break-up, strong currents moving ice along the Atlantic coast of Cape Breton Island cause ice scour, removing sediments, vegetation and animals southwards and offshore.

Ice forms in the Upper Bay of Fundy (Unit 913a) from December to April. Drift ice moves with the strong current and transports material which becomes frozen into the flows but may strand with the ebb tide.

Ice forming on mud flats in the Bay of Fundy may protect the coast from erosion by waves and tidal currents. However, the mud flats themselves are heavily scoured by ice, which causes erosion and mortality of benthic organisms.

Local ice forms in bays on the Atlantic Coast but does not produce major changes in coastal landforms.

SEA-LEVEL RISE

All coastlines in Nova Scotia are changing. Rising sea level over the last 15,000 years (see T3.3) has caused the coast to retreat inland, flooding the lower reaches of river valleys, eroding unresistant bedrock and unconsolidated materials to create marine platforms, raising marsh levels, and pushing beaches landwards.

Tide-gauging records for Nova Scotia indicate that the relative sea level has been rising over the past century. Records at Halifax show an average 35-cm rise since 1896. The projected relative rise by 2070 is one metre per century.³

The impact of accelerating sea-level rise on the coast of Nova Scotia is extrapolated from evidence of post-glacial coastal changes and from observations of coastline retreat over the last century. Past and current sea-level changes have contributed to the erosion of bedrock shorelines and bluffs, beach retreat and subsequent sediment increase in sheltered inlets and estuaries.

Coastal dunes on Sable Island (District 890) are constantly being reworked, and increased sea-level rise is expected to accelerate this process.³ The cyclic phases of progradation, stability and retreat, resulting from sea-level changes, waves and tides, have been changing the shoreline of Nova Scotia since the last glacial retreat. If the predictions on sea-level change in the future are right, these processes will continue to modify the coast, possibly at an accelerated rate.³

BIOLOGICAL COMPONENT

Biological communities have a significant impact on the form and development of the coastline. When salt-marsh grasses and Eel Grass colonize muddy shores, they reduce the wave and current action, leading to the deposition of sediment and the building of more extensive muddy environments. Kelp beds can have a similarly moderating effect in areas exposed to high waves.

Growth of thin films of unicellular algae on the surface of muds can make them more resistant to erosion by slowing the rate of change over what would occur in the absence of organisms. Some seabottom invertebrates, such as the amphipod *Ampelisca* and the polychaete *Clymenella torquata*, build tubes out of sediment, and the combined effect can stabilize the sediment. Organisms that feed on sediment sometimes make the bottom more stable by depositing feces, which are more compact and stable than the sediment was before it was ingested.

Rock-boring organisms, such as the clams *Zirphaea crispata* and *Petricola pholadiformis*, tunnel in soft rocks in shallow water and help to break them apart. The shells of clams in some coastal environments form a distinctive feature, and the crushed remains of shells and the skeletons of barnacles can form a distinctive type of sediment called shell hash.

CULTURAL FACTORS

Agricultural and forestry practices have led to significant loads of sediment entering the ocean and resulting in pronounced coastline change, usually in sheltered coastal estuaries. Humans have also had an impact by excavating or in-filling marine areas (the former Halifax City Dump) and by dyking practices begun by the Acadians and continued to the present. The construction of causeways, breakwaters and jetties alters the normal pattern of water movement and sediments transported by water and can create or destroy coastal features such as beaches and tidal marshes (see T12.9).



Associated Topics

T3.3 Glaciation, Deglaciation and Sea-level Changes, T6.1 Ocean Currents, T6.3 Coastal Aquatic Environments, T6.4 Estuaries, T7.2 Coastal Environments, T7.3 Coastal Landforms, T10.9 Algae, T11.17 Marine Invertebrates, T12.7 The Coast and Resources

Associated Habitats

H2 Coastal

References

- 1 Walker, R.E. (1976) Wave Statistics for the North Atlantic—1970. Bedford Institute of Oceanography, Dartmouth, N.S. (*Data Series* BI-D-76-3).
- 2 Boyd, R., A.J. Bowen and R.K. Hall (1987) "An evolutionary model for transgressive sedimentation on the Eastern Shore of Nova Scotia." In *Glaciated Coasts*, edited by D.M. Fitzgerald and P.S. Rosen. Academic Press, San Diego.
- 3 Shaw, J., R.B. Taylor and D.L. Forbes (1991) "Impact of accelerated sea level rise on the coast of Nova Scotia, Canada." In *The Climate of Nova Scotia; Proceedings from a Symposium, November 19, 1991*. Atmospheric Environment Service, Environment Canada, Dartmouth, N.S.

Additional Reading

- Forbes, D.L., and R.B. Taylor (1987) "Coarse-grained Beach Sedimentation under Paraglacial Conditions, Canadian Atlantic Coast." In *Glaciated Coasts*, edited by D.M. Fitzgerald and P.S. Rosen. Academic Press, San Diego.



Plate T7.1.1: Eroding drumlin at Lawrencetown Head, Halifax County (Unit 833). The till is eroded and sand transported and deposited in the sand beach/dune system of Conrod Island in the distance. Photo: D. Davis

T7.2 COASTAL ENVIRONMENTS

Like terrestrial and freshwater environments, the coastal environment may be subdivided using biophysical classifications that provide a hierarchical categorization. Coastal landforms (see T7.3) are the smallest of these divisions and have not been systematically identified in Nova Scotia. Regional divisions are distinct and widely recognized as follows:

1. Atlantic Coast: exposed, high wave energy
2. Bay of Fundy: large tidal range, semi-enclosed, more sheltered to wave exposure
3. Southern Gulf of St. Lawrence: micro-tidal, seasonally wave dominated, winter sea ice
4. Sable Island: open shelf environments, exposed high wave energy

Coastal environments have been further subdivided by Owens and Bowen.¹ The following subdivisions are made on the basis of geomorphic and process characteristics:

1. Atlantic Coast

- Northeast Cape Breton Island (Districts 550 and 210)
- East Cape Breton Island (District 530)
- Southeast Cape Breton Island (District 870)

- North Chedabucto Bay (District 860)
- South Chedabucto Bay (District 850 in part)
- Eastern Shore (Districts 830, 840 and 850 in part)
- Western Shore (District 820)

2. Bay of Fundy

- South Shore (District 720)
- Head of the Bay (District 710 in part)
- Minas Basin (District 620)
- Chignecto Bay (Units 532 and 523)

3. Southern Gulf of St. Lawrence

- Northumberland Strait (District 520 in part)
- Antigonish-West Cape Breton Island (Districts 550, 220, 310 and 580)
- St. Georges Bay (District 520 in part)

4. Sable Island (District 890)

Tables T7.2.1–T7.2.3 identify the main characteristics of the first three subdivisions. This approach most closely approximates the land-district level of biophysical classification, characterised by a “distinctive pattern of relief in geology, geomorphology and associated regional vegetation”.¹

T7.2
Coastal
Environments

SUBDIVISION	GEOLOGICAL CHARACTER	BACKSHORE RELIEF	BEACH CHARACTER	FETCH AND WAVE EXPOSURE	MEAN TIDAL RANGE	SEDIMENT AVAILABILITY
Northeastern Cape Breton Island	Resistant metamorphic and igneous rocks; thin till cover	Upland cliffed coast (5–100 m)	Absent or narrow; coarse sediments	Exposed open ocean coast; ice-free 8 to 9 months	1 m	Very scarce
Eastern Cape Breton Island	Carboniferous sandstone or shale; thin till cover	Rocky cliffs (5–20 m)	Occasional spits and barriers	Exposed 500 km; ice-free 8 to 9 months	1 m	Scarce
Southeastern Cape Breton Island	Carboniferous sedimentary and metasedimentary rocks; thick till and drumlins	Low rock and till cliffs (10–20 m)	Barrier beaches	Exposed open ocean coast; ice in sheltered areas up to 3 months	1 m	Scarce, but locally abundant
Northern Chedabucto Bay	Carboniferous sedimentary rocks, some resistant volcanics, abundant till	Low rock and till cliffs up to 20 m	Spits and barrier; coarse sediments	Exposed in northeast; elsewhere sheltered (50 km) ice-free 8 to 9 months	1.5 m	Abundant
Southern Chedabucto Bay	Resistant metasedimentary and igneous rocks; fault-line coast; very thin till	Rocky cliffs (3–10 m)	Absent or narrow; coarse sediments	Sheltered (50 km) ice-free 8 to 9 months	1.5 m	Very scarce
Eastern Shore	Resistant metasedimentary and granitic rocks; variable-thickness tills and drumlins	Indented low rocky coast, some eroded drumlins (30 m)	Absent or barriers or pocket beaches in re-entrants; coarse	Exposed open ocean coast, embayments sheltered; ice in sheltered areas 2 to 3 months	1 to 2 m	Very scarce
Western Shore	Resistant sedimentary and metamorphic rocks; thin till deposits	Till or rock cliffs (3–30 m)	Narrow or coarse-sediment barriers	Variable locally very exposed; local ice up to 2 months	4 m	Scarce, but locally abundant

Table T7.2.1: Coastal environments of the Atlantic Coast of Nova Scotia.

SUBDIVISION	GEOLOGICAL CHARACTER	BACKSHORE RELIEF	BEACH CHARACTER	FETCH AND WAVE EXPOSURE	MEAN TIDAL RANGE	SEDIMENT AVAILABILITY
South Shore	Resistant Triassic basalt dyke; parallels coast	Low rocky coast or cliffs, up to 30 m	Absent or narrow cobble beach at high-water mark, with wide intertidal platform	Sheltered (50 km)	6 to 10 m	Very scarce
Head of the Bay	Resistant conglomerates, basalts or granites	Cliffed coast, up to 200 m	Absent or large pocket beaches, pebble/cobble on beachface and mud overlying coarse sediment in intertidal zone	Exposed (50-100 km)	10 m	Scarce, but locally abundant
Minas Basin	Triassic sandstone and shales, or unconsolidated glacial deposits	Cliffs, up to 30 m	Wide, intertidal mud or sand flats on rock platform, pebble-cobble beach at high-water mark, marshes in sheltered areas	Very sheltered (<50 km)	>10 m	Abundant
Chignecto Bay	Permo-Carboniferous sandstone and shale	Cliffs, up to 20 m	Wide, intertidal mud flats on rock platform, pebble/cobble beach at high-water mark, extensive marshes in sheltered areas	Very sheltered (<50 km)	>10 m	Abundant

Table T7.2.2: Coastal environments of the Bay of Fundy, Nova Scotia.

SUBDIVISION	GEOLOGICAL CHARACTER	BACKSHORE RELIEF	BEACH CHARACTER	FETCH AND WAVE EXPOSURE	MEAN TIDAL RANGE	SEDIMENT AVAILABILITY
Northumberland Strait	Sandstone and shale	Unresistant low relief; till, rock cliffs (3-10 m)	Barriers, spits and intertidal bars; mixed or fine-grained sediments	Very sheltered (<50 km) ice-free 7 to 8 months	1 to 2 m	Scarce
Antigonish	Deformed sedimentary, metasedimentary and igneous rocks	Resistant rocky upland cliffed coast (5-100 m)	Absent, or narrow gravel-boulder beaches	Very exposed (>300 km) ice-free 7 to 8 months	<1 m	Very scarce
St. Georges Bay	Metasedimentary and sedimentary rocks	Low relief; till, rock cliffs (2-10 m)	Narrow, or spits and barriers; mixed sand-gravel beaches	Sheltered (50 km) ice-free 7 to 8 months	1 m	Scarce, but locally abundant

Table T7.2.3: Coastal environments of the Southern Gulf of St. Lawrence, Nova Scotia.

The Atlantic Coast of mainland Nova Scotia has been further subdivided by Munroe.² He identified twelve morpho-dynamic units. One distinctive unit included the large salt marshes of Lobster Bay, Little River and Cheboque harbours along southwest Nova Scotia (in Unit 831). In these long, shallow estuaries, large tides penetrate the gently sloping valleys of rivers such as the Tusket, Annis, Chebogue and Argyle. Drowned drumlins and rock outcrops dot the outer parts of these bays. Another distinctive area is the Baymouth barrier-beach system east of Halifax Harbour to Owl's Head (west of Ship Harbour, Unit 833). Drumlins in this area provide an important anchor for the barriers, as well as an important source of sediment for beach formation.



Associated Topics

T2 Geology, T6.2 Oceanic Environments, T6.3 Coastal Aquatic Environments, T6.4 Estuaries, T7.1 Modifying Forces, T7.3 Coastal Landforms

References

- Owens, E.H., and A.J. Bowen (1977) "Coastal environments of the Maritime Provinces." *Maritime Sediments* 13.
- Munroe, H.D. (1982) *Regional Variability, Physical Shoreline Types and Morphodynamic Units of the Atlantic Coast of Mainland Nova Scotia*, edited by R.B. Taylor, D.J.W. Piper and C.F.M. Lewis. Geological Survey of Canada. (*Open File 725*).

T7.3 COASTAL LANDFORMS

Nova Scotia has a great variety of coastal landforms. Erosional features are predominant, but the landforms produced vary according to the geology and glacial history. Depositional landforms, beaches and marshes, are being formed as a result of erosion and transportation of unconsolidated material. But many of these deposits are, in turn, being eroded and submerged by the rising sea level. These descriptions of coastal landforms should be read in conjunction with the habitat descriptions.

ANCIENT SHORELINES

Parts of Nova Scotia's coastline are remnants of ancient shorelines formed as sea level changed during and since the last glaciation (see T3.3). Some of these features are exposed, while others are now under water; they provide clues to the development of the province over the last 10,000 years or more. In the Northumberland Strait, for instance, a series of submerged terraces cut into the less-resistant rocks document successive sea levels of the post-glacial period.¹

In the western and northern extremities of Nova Scotia, an elevated shoreline is found. This terrace, or

bench, cut in the bedrock is a distinctive landscape feature in St. Marys Bay (District 820) and on the east and west of northern Cape Breton Island (Districts 550, 590). In St. Marys Bay it is assumed to be 125,000 years old and to have been formed in a warmer, interglacial period (Sangamon). This age is assumed because extensively weathered glacial tills are found on the bench, as shown in Figure T7.3.1.² Elevation of this ancient bench above present sea level is only slight, averaging 4–6 m. Gravel beds, sea stacks² and striated potholes³ have also been found on the surface.

By inference, the ancient wave-cut terrace north of St. Margaret Village (Unit 592c), which is at a similar elevation to the bench, is the same age. Remnants of what is probably the same platform are found around Cape George, Antigonish County (Unit 312).

MARINE LIMIT

The maximum inland penetration of the post-glacial sea level is marked by relict coastal features similar to those now found at the shoreline. These features are confined to the north and west of a line joining Yarmouth, Windsor, Truro and Northport. The marine

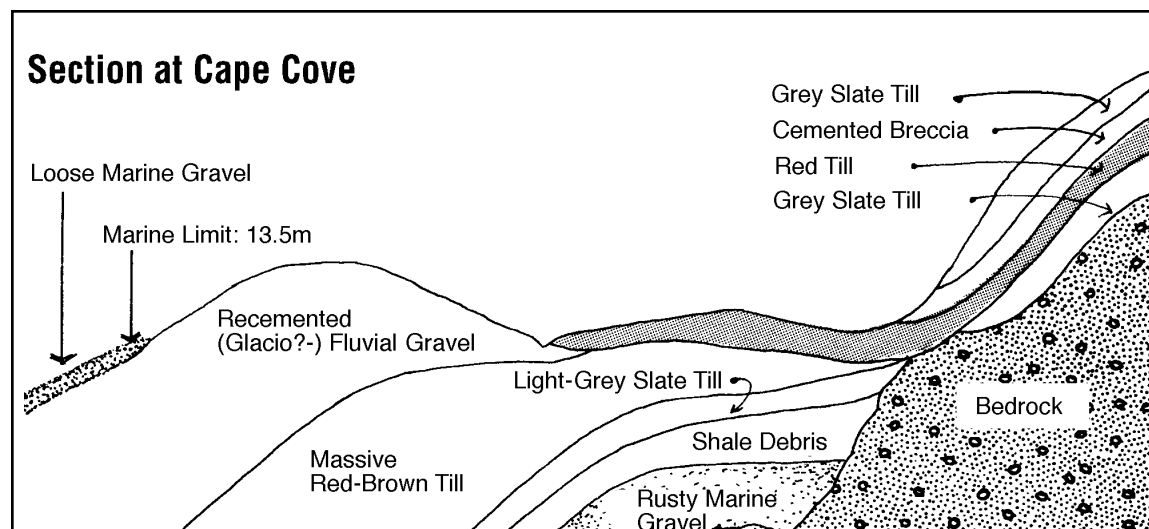


Figure T7.3.1: Section at Cape Cove, Digby County. A record of the Acadian glaciation.² Marine gravel: deposited in immediate post-glacial time, higher sea level. • Cemented fluvial gravel: outwash materials deposited during glaciation. • Red-brown till: glacial till from New Brunswick, regional advance, 100,000 years ago • Light-grey slate till: locally derived till, indicating early and late local ice caps. • Debris: angular fragments from periglacial conditions prior to ice advance. • Marine gravel (rusty): deposited prior to last glacial advance. • Marine platform: fossil wave-cut platform, just above present sea level, backed by fossil cliff, 120,000 years ago and earlier.

limit is highest on Digby Neck and at Brier Island. Well-preserved beaches are found at 36 m above mean sea level (District 810). At Sandy Cove a wave-cut cliff exposes 40 m of stratified sand and gravel, the top of which has been levelled by wave erosion. To the south and east the limit declines in altitude.

A delta on the Sissiboo River at Weymouth (Unit 411) is 25 m high. At Smith Cove in the Annapolis Valley (District 610), stratified materials reach 33 m. Raised beaches near Woodside are 25 m high and 5.5 km inland from the present coast. At the same times as these beaches were being formed, low-lying areas of the modern Annapolis Valley were submerged. Marine clays were deposited in these submarine basins. Near Bridgetown and Lawrencetown, these clays are now exposed and have been mapped as Lawrencetown and Fash soils in Annapolis County.

On the Cobequid shore, a series of conspicuous raised beaches reaches a maximum height of 40 m above present sea level at Advocate (District 710), where a replica of the present harbour deposits is found on the hillside behind the village. In the same District, at Parrsboro, the raised beaches are 22 m high. The marine limit declines to present sea level at Truro.

It is assumed that south and east of the line joining Yarmouth, Truro and Northport, post-glacial sea levels have never been higher than they are at present. This tilting of the land mass is evidence for a greater glacial depression of the land in the Bay of Fundy area than in eastern Nova Scotia.

BURIED VALLEYS

Lower sea levels from 15,000 to 8000 years ago, and probably from earlier periods, caused the rivers to extend well beyond the present estuaries. In some cases where the rivers flow over easily eroded rocks, especially the Triassic sandstones of the Bay of Fundy, the river valleys were cut down deeply into the bedrock. Buried valleys in the bedrock have been found at Truro and Brookfield and in the Annapolis Valley. Both the North and Salmon rivers at Truro have similar buried valleys, extending 6 km and 8 km respectively under the present floodplain north of Truro. In places, the channel of the Salmon River reaches 40 m below the present land surface. Buried channels in the Truro and Kentville areas are filled with glacial outwash sands and gravels.

SUBMERGENCE

Sometime before 8000 years ago in the Bay of Fundy, and before 15,000 years ago elsewhere in Nova Scotia, the sea once again began to encroach upon the land. Forests had developed on the exposed sea floor, which was probably a maximum of 37 m below present sea levels in the Bay of Fundy.

The submerged forests to be found on the Atlantic and Bay of Fundy coasts are probably the most dramatic evidence of sea-level change. Examples occur in Chignecto Bay at Fort Lawrence in Unit 423 (which can only be viewed off Fort Beausejour in

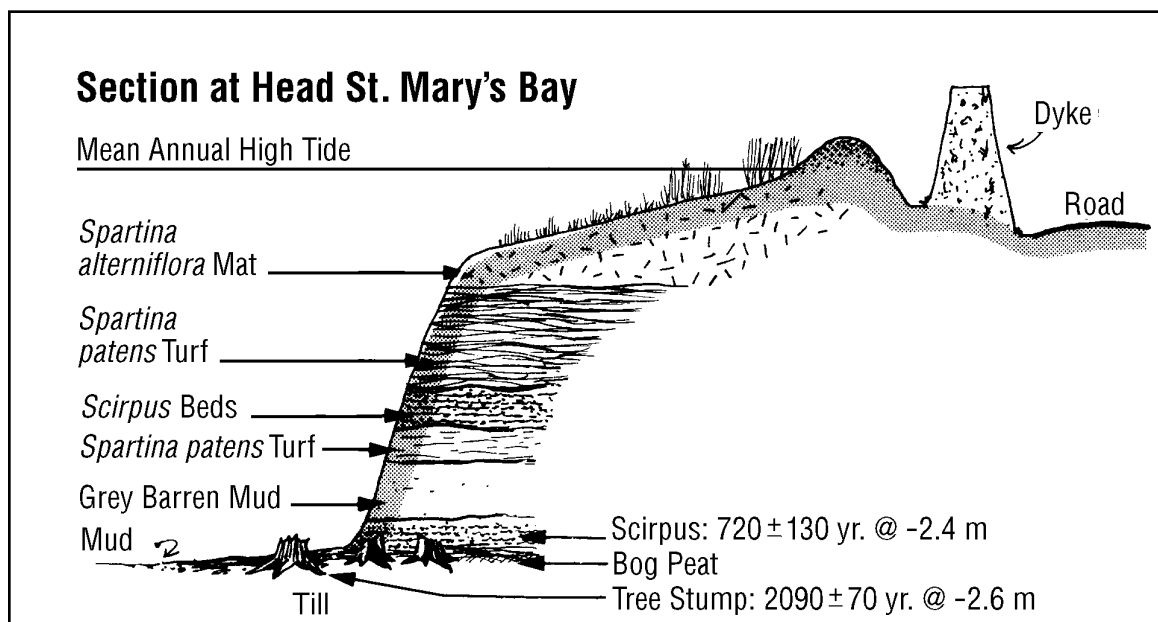


Figure T7.3.2: Relationships of submerged forests to recent salt-marsh deposits, Bay of Fundy.²

New Brunswick) and at Boot Island in Minas Basin (District 610). Pine and Beech stumps more than a metre in diameter occur at these sites and are well rooted in Podzol soils resembling those of the surrounding uplands. On the soil surface a forest-floor humus of partly decomposed leaves, twigs and cones can still be found. A typical site is illustrated in Figure T7.3.2.²

Many scattered examples of these forests occur along the Atlantic Coast (Region 800), extending in places well beyond the low-tide level. Well-known examples are Yarmouth Harbour, Sunday Point, Cape Sable Island, Lunenburg, McNabs Island in Halifax Harbour and Bon Portage in Yarmouth County. Most of these stumps are between 5000 and 3000 years old. It has been deduced that their submergence was due largely to recent crustal subsidence, which over the last 4000 years has averaged 30 cm per century.⁴

ROCKY SHORES

Where resistant rocks occur, there are insufficient unconsolidated deposits to build beaches and marshes. The only significant physical process in such circumstances is the hydraulic “quarrying” of large blocks by storm waves, any glacial till overburden having been simply swept off the shore by large waves. Two types of rocky shores without cliffs can be recognized: granitic rocks and Meguma rocks, principally quartzite. Both are part of the gently seaward dipping surface of the Atlantic upland. Only where less-resistant volcanic rocks occur at Louisbourg (District 870) and Fourchu (District 820) are sea cliffs formed.

The granite headlands of the Atlantic Coast have changed little despite their submergence and exposure to waves. The thin cover of glacial till, however, has been removed to expose the glacially smoothed bedrock. The gradual seaward slope of the land continues under the ocean without interruption. Where the granite is more heavily jointed, waves have been more effective in excavating large blocks.

In the quartzites of the Meguma rocks, joints are more closely spaced. As a result “quarrying” has been more effective. Modification of these rocks has not been sufficient to produce cliffs, but tide pools are more numerous, especially where the rocks outcrop parallel to the coast, as on much of the Eastern Shore.

CLIFFS

Cliffs are being formed in less-resistant rocks, such as sandstones, shales and basalt, and in unconsolidated materials, especially drumlins. Ancient cliffs, especially in northern Nova Scotia, were formed over long periods before the last ice advances and often relate to structural weaknesses, such as fault lines. This feature can be attributed to the general tilting of the province to the southeast.

Notable ancient cliffs are found in Cape Breton north of the Margaree Valley on the west coast (District 220). On the mainland, Cape George (District 310) is a southerly extension of this same geological structure. Northern limits of the southern upland Meguma rocks form seacliffs on the south side of Chedabucto Bay (Unit 862), which is a fault-line scarp, and the south side of St. Mary’s Bay, where the strike parallels the coast (District 820).

The most rapidly eroding cliffs are those in partially submerged drumlins on the Atlantic Coast (District 830) and in unresistant horizontal sandstones of the Bay of Fundy (Region 600), Northumberland Strait (District 520) and the Sydney Coalfield (Unit 531). Maximum rates of retreat have been reported as follows:

Five Islands (District 710)	1.5 m/year ¹⁰
Minas Basin (Region 700)	2.0 m/year ⁵
Glace Bay (Unit 531)	2.6 m/year ¹¹
Cape LaHave (Unit 832)	2.5 m/year ¹²
Hartlen Point (Unit 833)	2.3 m/year ¹³

More recent information on cliff erosion is available through the Atlantic Geoscience Centre, based at the Bedford Institute of Oceanography.

Mean rates for the Bay of Fundy are about 0.5 m/year and for exposed Atlantic Coast drumlins are about 1.0 m/year. Eroded drumlins are marked by a lag deposit, just below low-tide level, of the larger boulders. All other material has been winnowed from the drumlin and redistributed. As long ago as 1929, Johnson attempted to recreate a map of the former drumlin field in Mahone Bay (District 460) from hydrographic charts of shoals. He mapped nearly sixty shoals or lag deposits which must have been drumlins within the past 10,000 years, and there are many other bars and small islands which may at one time have been drumlins.

Observations of a drumlin recently exposed to wave attack at Chezzetcook Inlet (Unit 833) recorded rates of erosion averaging 5.4 m/year.⁹

In contrast, the erosion of bedrock cliffs in the Bay of Fundy, Northumberland Strait and Cabot Strait creates a wave-cut platform in the bedrock as the cliff recedes. (Wave-cut intertidal platforms are considered in more detail in the following section.) The nature of the cliff face and the platform both depend on the dip of the rocks. Predominantly horizontal sedimentary strata in Cobequid Bay, Cumberland Basin, Northumberland Strait and Cabot Strait result in near-vertical cliffs and smoothly sculptured intertidal platforms. Where the structure is vertical, as in Bay of Fundy basalts or sedimentary strata west of Parrsboro, vertical cliffs may again be formed, but with a more irregular platform. Inclined strata may produce overhanging cliffs if the dip is landwards, as in northwest Cape Breton or in some Meguma-group slates on the Atlantic Coast.

Features such as caves, arches and stacks are not common. Where erosion is rapid, small variations in resistance produce such features but, by definition, they are short-lived. Conditions necessary for the formation of these erosional features are best developed in Cobequid Bay, where a dramatic arch is found at Salter Head (District 620) and a series of stacks at Five Islands (District 710). Other stacks, "The Three Sisters," can be seen 10 km north of Cape Chignecto, at Eatonville (Unit 311). Caves eroded in the Halifax formation can be seen at "The Ovens" in Lunenburg County (Unit 832).

Many of the cliffs are unstable. In the glacial-till cliffs that border the Northumberland Strait (Dis-

trict 520), slumping, especially in the spring thaw, is the predominant destructive process. Where sedimentary rocks dip seawards, seepage may produce slides, as in Horton shales in northeast Cape Breton (District 550). The large-scale slides can also be seen in the schists north of Cap Rouge on the Cabot Trail in Cape Breton Highlands National Park (District 220). Large blocks detach themselves from the horizontally bedded cliffs of southeast Cape Breton (District 530) and in the Bay of Fundy. Huge masses of rubble accumulate at cliff feet in Triassic basalt as frost shatters the vertical structure.

The highest actively eroding cliffs in Nova Scotia, in Advocate Bay at Cape Chignecto, are 210 m in height (District 310). Other high cliffs are on Cape Split, 80 m, and Cape Blomidon, 180 m (District 720).

INTERTIDAL WAVE-CUT PLATFORMS

As cliffs recede, a gently upward-sloping bench is cut into the bedrock. Waves cut this bench by removing cliff-foot debris, scouring fragments against the cliff foot and across the platform, through wave "quarrying" in storms, and by chemical disintegration in the spray zone. Since wave attack is controlled by the limits of tidal action, it is clear that the landward and seaward limits of the platform must also be determined by tidal heights. Wide platforms are found on more-exposed coasts with high-energy waves and on coasts with a large tidal range. However, in Nova Scotia the highest-energy coast, the

T7.3 Coastal Landforms

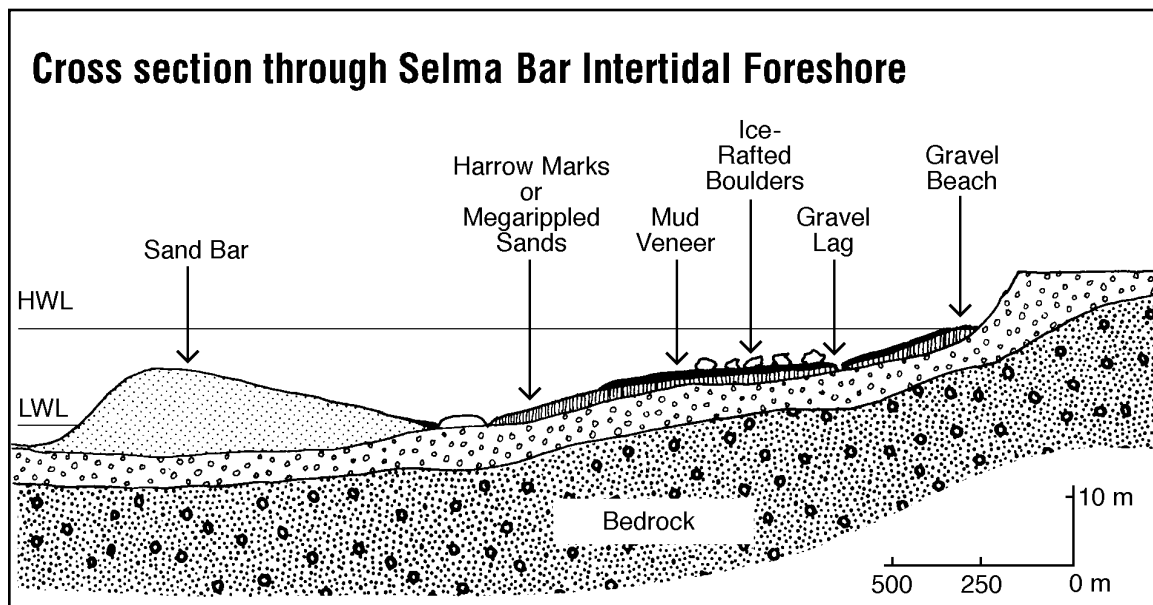


Figure T7.3.3: Intertidal sediments, Bay of Fundy; section on Selma Bar.⁵

Atlantic Coast, is dominated by highly resistant rocks. For much of the Atlantic Coast, there is no marine platform and no cliffs.

In contrast, the entire Bay of Fundy coast exhibits a wide wave-cut platform cut into both basalts and the less-resistant sedimentary rocks. East of Digby Gut, a wide, continuous platform has been cut into the basalts that form near-vertical cliffs at the landward edge of the platform, up to 30 m in height (District 720). In Cobequid Bay, the platform is even wider, reaching a maximum 6000 m at Lower Economy (District 620). The narrowest section in the Bay is 900 m at Burntcoat Head, presumably because the sandstone is more resistant in this area.

The great width and extreme rapidity with which this platform has been created, and is still being extended, are due to the large tidal amplitude. In most areas, the platform is partially obscured by sediments, which typically show the following sequence: gravel beach, mud veneer over gravel lag, exposed gravel lag, sand bars. These sediments (see Figure T7.3.3³) are predominantly thin, less than 0.5 m. Gravel at the cliff foot forms a steep beach, which in places is being driven inland over salt marshes by the rising sea level. The mud veneer, in Cobequid Bay, is thin on the rock platforms and appears to thicken during the summer and to be thinned by winter ice. Near the low-water level, the mud becomes coarser and more extensive. Sometimes deep sand deposits obscure the platform. A gravel-lag deposit, from which the finer sediments have been washed out, underlies this entire sequence in some sections.

Wide intertidal platforms also dominate the Northumberland Strait coast from Merigomish to Baie Verte (N.B.). Little research has been conducted on the formation of these platforms. Their presence is attributed to the unresistant bedrock. Sand bars are frequently found on these platforms, which have an almost imperceptible gradient.

BEACHES

Beaches are wave-dominated deposits composed of a mixture of sand, gravel and other sizes of sediments. Sand beaches occur in sediment "sinks," in which all available material from a stretch of coast known as a "cell" is concentrated. Sand beaches often contain a significant gravel element at the higher levels. Very large particles in the boulder/cobble range are generally found close to their source, usually an eroding glacial-till cliff.

Concentrations of sand and gravel are formed under a great variety of circumstances and are the

basis for the following beach classifications:

1. Barrier beaches and baymouth bars
2. Spits
3. Tombolos
4. Pocket beaches

Barrier Beaches and Baymouth Bars

These beaches are found only in areas with abundant unconsolidated sediments. Rising sea level erodes the beach and adjacent headlands, forcing a landward retreat of the beach. The adjacent headlands anchor the extremities of barrier beaches. Barrier beaches are well developed in eastern Cape Breton. The sandy beaches of Bridgeport Basin and Big Glace Bay Lake (District 530) are sand-and-gravel barriers (often segregated gravel on the upper beach and sand on the lower beach). The barrier beaches at Belfry and Fourchu on the Atlantic Coast (District 870) are formed of pebbles, cobbles and sand. Large barrier beaches are found at Clam Bay, Martinique and Lawrencetown (Unit 833), at St. Catherines River Bay (Cadden Bay in Unit 841) and elsewhere on the Atlantic Coast. These are all composed largely of relict sands accumulated during deglaciation, rather than sands which are actively accumulating at present. Barrier beaches are largely absent from the Bay of Fundy and are found only in pronounced sediment traps in Northumberland Strait at, for example, Oak Island, Caribou Island and Merigomish Island (Unit 521).

On the more exposed Gulf of St. Lawrence coast, barriers are again well developed, especially at Antigonish and Pomquet (Unit 521b) and at Inverness and Pleasant Bay (Units 551a and 592b).

As a result of their continuing landward migration, all these beaches undergo a constant cycle of erosion, failure and rebuilding. All stages of this process may be observed at various places in the province.

The Cadden Bay barrier beach has failed twice in storms during the last fifty years, a fact confirmed by aerial photography and indicated by the flat profile, absence of dunes and restricted vegetation on the beach at present. Inverness Beach (Unit 551a), by contrast, is well developed, with high, stable dunes and no evidence of overwash. Martinique (Unit 833) is about to fail, with recent establishment of washovers, a high erosion face in the dunes, and invasion of dune vegetation by blowing sand, resulting in a reduction in diversity of shrubs and grasses in favour of dune grass.

The low wave energy of Northumberland Strait has not allowed the incipient barrier beaches to build above high-tide level, but has maintained an almost horizontal subtidal profile over large areas,

as at Oak Island. At the eastern end of the Strait, which is more exposed, higher wave energy has allowed the emergence of the barrier beaches. The best example, at Merigomish, is also failing, with washover occurring in most major storms (Unit 521a).

Spits

Spits are created by the movement of sediments along the shore by waves and, in the Bay of Fundy and Bras d'Or Lake, tidal currents. At points where there is an abrupt change of shoreline orientation or the currents diminish, sediment is deposited. Many of the barrier beaches have been initially formed by the coalescing of spits forming from opposite directions, or by the complete closure of a bay by material moving in one direction. Coalescing spits have formed the beaches at Advocate Harbour (District 710) and West Apple River (Unit 532), Cole Harbour (Unit 833), and South Harbour, Ingonish (Unit 522c), while materials moving from one direction have formed barriers such as Merigomish Island, Mabou Harbour (Unit 584) and Martinique Beach.

Beaches forming on spits, including the recurved downdrift extremity, are uncommon. One of the best is at St. Anns Bay (Unit 522c) and another is in Barrington Bay (Unit 841). St. Anns is a good example of a spit that grew as a series of recurved beach ridges that are now drowned by the present beach. Probably the best classic examples of spits are on the north shore of Minas Channel and the supratidal elements of the barrier-bar system at Oak Island on the Northumberland Strait. The two spits extending westward from the island fail to form a permanent connection with another southward-extending spit on the mainland.

Where currents meet on straight shorelines, spits may coalesce to form a triangular beach enclosing a small lagoon. These "barachois" ponds are especially common in Bras d'Or Lake (District 560, Unit 916) where the incoming and outgoing tidal currents interact.

Tombolos

Tombolos are beaches formed in the lee of islands, where wave action is reduced. Frequently tombolos extend from the mainland shore to the island, forming a permanent connection. Many of the larger and better-known beaches are of this type: Partridge Island at Parrsboro (District 710), the former beach at Port Hood (Unit 522), and the double tombolo at Point Michaud (District 870).

Pocket Beaches

On coasts with cliffs and where sediment is scarce, limited amounts of sand, gravel or cobbles may accumulate in indentations in the coastline. These beaches are always small and generally become smaller as the sea level rises. The fine sand beaches on Pennant Head in Halifax County (Unit 851) are of this type, as well as many of the steep cobble beaches on the Atlantic Coast; for example, on Flying Point, Martinique. Beaches of this type are also common in northern Cape Breton; for example, Fishing Cove and Pigeon Point Cove in the national park (District 520).

General

While most of the beaches are eroding, retreating landwards and losing sand, there are some examples of accreting beaches. Where accretion is most rapid, a series of beach ridges may be built parallel to shoreline. The best example is at Pomquet Beach, which appears to be still growing despite rising sea level. Conrod Island (Unit 833) is also composed entirely of recently constructed beach ridges but is now eroding. Just to the west, Cole Harbour beach is also accumulating both sand and gravel at a rapid rate.

Changes in exposure to wave attack by erosion of offshore drumlins may result in changes to the orientation of beaches. This occurs in two main areas: Mahone Bay (District 460a) and Lobster Bay (Unit 831). One of the best-known examples is Yarmouth Bar (District 820), described by Goldthwait, "...here ...are three groups of concentric beaches, intersecting one another in such a way as to show they were built by shore drift coming first from one side and then from the other..."¹⁰ The beach is currently being pushed landwards over the salt marshes earlier developed in its protection.

Artificial changes to the shoreline are usually the most likely reason for modern beach construction (see T12.7).

DUNES

Nowhere in mainland Nova Scotia are sand dunes exceptionally well developed, compared with areas surrounding the southern Gulf of St. Lawrence in P.E.I. and Newfoundland. This may be attributed to a scarcity of sand on the higher-energy coasts and to lower-energy environments in areas where sediment is abundant. Sable Island is discussed below.



Plate T7.3.1: Offshore islands near Prospect, Halifax County (Unit 851). The granite outcrops of the island in the foreground has been denuded of vegetation as a result of constant exposure to salt spray, wind and seabird guano. Photo: O. Maass.

Probably the largest mainland dunes are those at South-West Port Mouton, reportedly 15 m high. Elsewhere on the high-energy Atlantic Coast, dunes are found at Rissers Beach (Unit 832) and in Barrington Bay (Unit 841). On many other beaches, low ridges colonized by Marram Grass are commonly referred to as dunes, but many of these backshore ridges have been thrown up by the waves with only minor additions of windblown sand. Only a few, very low dunes are found in the Bay of Fundy, and in the Northumberland Strait sand dunes are restricted to the more exposed easterly sections. Features referred to as dunes at Caribou Island, Merigomish Harbour, Antigonish and Pomquet are more properly classified as wave-created beach ridges. True sand dunes are found at Mabou Harbour, Port Hood, Aspy Bay and Inverness, where copious sand supply coincides with strong on-shore winds.

Large sand dunes are associated with the beaches near Mavillette, such as at Bartletts Beach (Unit 820).

ISLANDS

Islands, areas of land surrounded by water, are characteristic of submerging coastlines. There are many hundreds of islands around the coast of Nova Scotia, particularly along the Atlantic Coast (Region 800, Unit 911). They range in size from large (e.g., Long Island, District 720 and Sable Island, District 890) to small reefs exposed only at low tide. Islands may be composed of bedrock, glacial till or sand. Bedrock islands are most common, particularly in areas of resistant rock, such as the granite and quartzite of the Atlantic Coast (Unit 911), but also of softer sedimentary rocks and basalt in the Northumberland Strait (District 520, Unit 914) and Bay of Fundy (e.g., Isle Haute, District 810, Unit 912).

Glacial-till islands occur where drumlin fields have been drowned by rising sea level. This particularly occurs in Mahone Bay and St. Margarets Bay (District 460, Unit 911) and east of Halifax Harbour (Units 833 and 911). Drumlins erode more rapidly than

bedrock, gradually being reduced to boulder reefs. The eroding till provides ample sediment supply for the development of sandy beaches and cobble-shore habitats.

Islands of sand are generally low lying and change their shape as a result of water currents and storms. Larger islands, such as Pomquet Beach (Units 521b and 914) and Sable Island (Districts 890 and 930), are more stable and have developed sand-dune and coastal-forest vegetation.

Islands have a high value as wildlife habitat, particularly for breeding seabirds and waterfowl but also for breeding seals. The value is enhanced by the degree of isolation (distance from shore) and the state of residual vegetation. Vegetation is characteristically sparse on sand-dune habitats, but on large islands includes White Spruce coastal forest. Bedrock islands are most suitable for Eider Ducks, terns, gulls, and also Blue Heron, osprey and cormorants if there are sufficient trees and the site is not too far offshore. Some of Nova Scotia's bedrock islands are also suitable for nesting Black Guillemot (see T11.6). Drumlin islands and bedrock islands with sufficient soil provide habitat for Puffins and petrels, which build their nests in burrows. Sand islands are important for shorebirds such as the endangered Piping Plover. There are relatively few islands with cliffs suitable for alcid nesting, the most important being Bird Islands in Units 531 and 915 (which also support Puffins and Razorbills) and St. Paul Island (District 880, Unit 923).

Another important biological feature of islands is the isolation and adaptation of species of plants and animals that have been separated from other populations by rising sea level. Classic studies of "island ecology" have provided important insights into the mechanisms of adaptation and evolution. Species of interest on islands of the coast of Nova Scotia include *Geumpeckii* (Brier Island), land snails *Cepaea hortensis*, Redback Salamanders, Garter Snakes (including melanistic forms) and small mammals.

The importance of islands to wildlife is reflected in the establishment of several protected areas of islands, e.g., Eastern Shore Islands Wildlife Management Area (Units 834, 911), and single islands, e.g., Pearl Island Wildlife Management Area (Units 832, 911). Islands that are significant as wildlife habitat are shown in the *Atlas of Important Freshwater Wetlands and Coastal Wildlife Habitats for Nova Scotia*.¹¹ Other land uses have included sites for lighthouses, sheep grazing, farming/fishing stations or communities and, more recently, vacation cottage or resort development.

SABLE ISLAND

In sharp contrast to the mainland, Sable Island (District 890) has an abundance of sand and strong winds. As a result, dunes over 25 m in height are found and continue to be formed. Most dunes are 5–15 m in height and occur in two ridges oriented east–west, parallel to the shoreline. These two ridges are gradually moving together, obliterating the once-continuous pond between them. The northern ridge is higher and probably older than the southern ridge, which is less than 10 m high. Materials are entirely sand; no native pebbles have ever been found. It appears that the central part of the island is essentially stable, but the spits at either end are very mobile and move back and forth with storm activity.

Controversy surrounds the question of the ultimate survival of the island. Some think that storms will reduce the island to a submarine bar. However, recent investigation indicates that while the island has been becoming narrower through loss of sand from the south side, it has been increasing in height relative to rising sea level.

Perpetual movement of the sand dunes by the persistent strong winds has prevented the establishment of shrubs. Roland¹² records that the 80,000 shrubs planted in 1901 had dwindled to 77 in 1913 and one in 1952. The contribution of the Sable Island horses to this loss of shrubs and increased mobility of sand is also a matter of some controversy.

TIDAL DELTAS

In inlets to lagoons, and in estuaries characterized by strong tidal currents, reworked marine sediments are commonly found on both the seaward and landward sides of the inlet where tidal currents abruptly lose velocity.

Inlets in barrier beaches, where sediments are plentiful, usually exhibit tidal deltas, particularly on the landward side. Cole Harbour has almost been filled with sands in a very large flood-tidal delta. On the seaward side, the ebb-tidal delta is much smaller, as the sediments are continually removed by wave action. Changes to the channel immediately result in current changes, which are soon reflected in the form of the tidal delta. Tidal deltas rarely emerge above the highest high tide, as their deposition is dependent on tidal currents.

While tidal deltas are a normal feature of breached barrier beaches, they are best developed in Cobequid Bay (District 620), where exceptionally strong tidal currents occur. Flood-tidal currents are strongest along the shorelines, while the ebb tide dominates

the central channel in the Bay. The entire sand body reaches 5 km in width and is up to 25 m thick. Particle size decreases towards the head of the Bay, but fine sand remains the dominant sediment well into the Salmon River and Shubenacadie River estuaries. Sand is abruptly replaced by mud in embayments and in the estuaries. Six main sand bars constitute the tidal delta in Cobequid Bay and five in the Avon River estuary. The sand bars are elongated, up to 15 km in length, approximately aligned with the tidal currents. Sand waves and megaripples dominate the surfaces of these bars.

RIVER DELTAS

The very limited amount of sediment carried by rivers and a large tidal range preclude the development of deltas in the estuaries of most Nova Scotia rivers. In Bras d'Or Lake (District 560, Unit 916), the small tidal range has permitted the development of small deltas at the mouths of the larger rivers, particularly in Nyanza Bay and Whycommagh Bay. These river deltas show the typical features: levees lining the main channel, which extends beyond the distributory channels; little emergence above the lake level; and emergent vegetation over the entire delta.

MUD FLATS

Mud flats (see also H2.4) are composed of predominantly clay-sized particles and water, and are distinguished from salt marshes by a lack of vegetation. A more accurate sediment description in the Bay of Fundy, where the largest mud flats occur, would be muddy, sandy silt-flats. The lower mud flats contain more sand and silt and less water than the upper mud flats. Newly deposited flats, such as that north of the Windsor causeway (Unit 511a), are more fluid (containing 80 per cent water) than more stable flats, which contain only about 20 per cent water, and have virtually no shear strength.

In some circumstances the mud flats are a veneer over intertidal rock platforms, but in sheltered bays and inlets, deep deposits are found, up to 25 m deep in places. Vegetation is able to colonize only the mud flats near the higher tide levels. When this happens, further fine sediments are trapped by the vegetation, building the marsh up to within a metre of the higher high-tide level. The mud flat proper forms below, about 4 or 5 m above the mean tide level in the Bay of Fundy. Large mud flats are found in the southern Minas Basin both east and west of the Avon River estuary and in Cumberland Basin.

It has been shown that the activities, especially secretions, of marine organisms, help to stabilize the mud flats. Such activity may influence the mud flat to a depth of 30 cm.

Fine sediments composing the mud flat are derived from eroding cliffs and carried in to the upper Bay by flood-tidal currents. The ebb-tide current is unable to carry out the same amount of sediment. Concentrations of sediment in the water have been measured at up to 10 g/litre in Cumberland Basin and up to 40 g/litre in tidal rivers.

SALT MARSHES

Bay of Fundy salt marshes (see H2.5) can be distinguished from salt marshes on other coasts by their height, sediment distribution and organic matter. The Bay of Fundy salt marshes are mud flats raised and stabilized by the effects of colonizing vegetation. The marsh surface is almost horizontal, slightly more than a metre below the highest high-tide levels. As the tidal height is elevated in the estuaries, the salt marshes may be formed as high as 4.5 m above chart datum. Reclaimed marshes in the Annapolis, Salmon, Shubenacadie, Avon, Minas Basin and Cumberland Basin areas vary in height from 8.0 m to 14.6 m, depending on local tidal conditions. The relationship between tidal heights and marsh levels is shown in Table 7.3.1.

T7.3
Coastal
Landforms

	DIGBY/ANNAPOLIS	BURNCOAT HEAD	HANTSPORT
Large Tide	9.33	15.79	15.29
Mean Tide	7.99	13.56	13.19
Mean Sea Level	4.54	7.53	7.07
Tidal Marsh	8.13	14.59	14.04

Table T7.3.1: Relationships of tidal heights and marsh levels (in metres) in selected Bay of Fundy marshes.

Organic matter is a small component of these marshes, which are composed of fine sands, silt and clay-sized particles. The colour of the marsh soils indicates the type of sediments. Bay of Fundy marshes can be classified as “red,” with better drained, coarser sediments, and “blue,” with finer, poorly drained sediments.

Formation of the marshes has been likened to a river in reverse. The tide flows in through the main channel and then spills over and branches into a series of smaller channels. Levees of coarser, sandy sediment are built on the channel margins, while the fine material is deposited further from the channels. On the larger marshes, fresh water may be trapped at the lower marsh elevations, adjacent to the upland on the landward side of the marsh. Rising sea level has accentuated this elevation difference, often forming a plug at the entrance to a river valley, damming fresh water inland and allowing the formation of peat deposits. Such situations are found in the Cornwallis River valley and on the Chignecto marshes (Unit 523).

The large Bay of Fundy marshes are unusual in that the source of the sediments is chiefly marine; elsewhere, large salt marshes are usually formed from river-borne sediments. A copious supply of marine sediment derived from eroding drumlins in Lobster Bay, together with a large tidal range, has also caused the formation of extensive marshes in the Pubnico area (Unit 831).

Marshes on the Atlantic Coast and Northumberland Strait are smaller, have accumulated more slowly, and usually contain much greater amounts of organic matter. Rising sea level is driving beaches inland over the marshes at numerous locations, and in places compressed peat deposits outcrop seaward of the beach. At the inland limit, the coastal spruce–fir forest is characteristically being inundated by the sea, and organic deposits are slowly spreading into the forest. A fringe of bleached coniferous tree trunks killed by salt water is a common backdrop to Nova Scotia salt marshes.



Associated Topics

T2.1-T2.9 Geology, T3.3 Glaciation, Deglaciation and Sea-level Change, T3.4 Terrestrial Glacial Deposits and Landscape Features, T6.1 Ocean Currents, T6.3 Coastal Aquatic Environments, T6.4 Estuaries, T7.1 Modifying Forces, T7.2 Coastal Environments, T8.2 Freshwater Environments, T12.7 The Coast and Resources

Associated Habitats

H2 Coastal, H5.3 Cliff and Banks, H5.4 Talus Slope

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