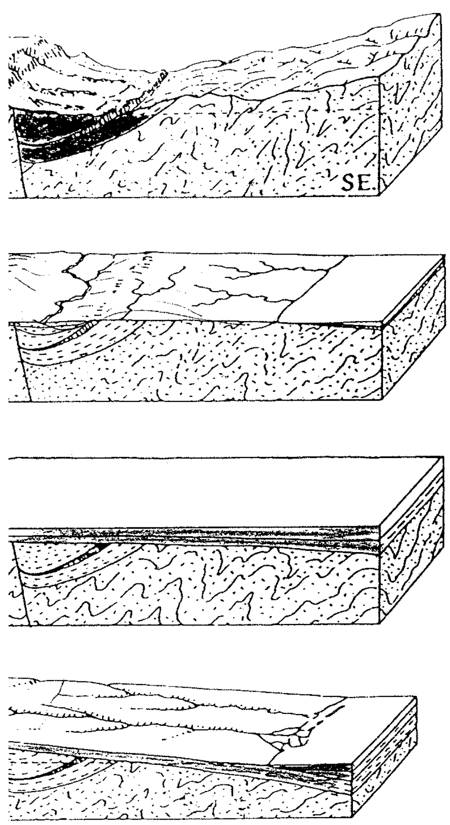
T3.1 DEVELOPMENT OF THE ANCIENT LANDSCAPE

The following summary of landscape development in Nova Scotia is based on Stea *et al.*[1] The evolution of Nova Scotia after the Triassic rifting episode has been debated over the last century. The arguments centre on two basic theories of landform development: the time-dependent, evolutionary concepts of the geomorphic cycle[2] and steady-state landscape hypotheses.[3] Goldthwait[4] and Roland[5] interpreted the geomorphic evolution of Nova Scotia in the light of Davisian concepts. They suggest that the entire region had been infilled after the Triassic and then planed off.

Welsted, on the other hand, argued that the trough of the Bay of Fundy had been in existence since the Triassic.[6] He maintained that there is little evidence for an extensive post-Triassic cover of rocks and superposition of streams. Welsted explained the flat uplands as exhumed surfaces of great antiquity. The Nova Scotia landscape, in this equilibrium model, has not changed substantially since the Triassic rifting episode.

Other studies have supported or diffused these two basic theories.[7–14] It is currently supposed that upland planation may have occurred during several cycles of uplift and erosion from pre-Carboniferous times to the present (see Figure T3.1.1). During the Cretaceous it seems likely that the area was part of a low-relief plain analogous to the Mississippi delta region. Uplift and erosion after the Lower Cretaceous is indicated by valleys cut into Cretaceous rocks and infilled with Tertiary sediments offshore, and by faulting and folding of Lower Cretaceous sediments on land. After the Tertiary, glacial erosion modified the landscape onshore and offshore but did not erode substantial quantities of rock.



1 **Post-Triassic:** rejuvenation, uplift and folding due to rifting.

2 **Jurassic to Early Cretaceous:** formation of the Atlantic Uplands peneplain.

3 **Lower Cretaceous:** marine-basin sediments onlap and cover.

4 **Tertiary** upwarping of the Atlantic Uplands and covering sediments, drainage pattern superimposed on the older surface.

Figure T3.1.1: Evolution of Nova Scotia since the Triassic. according to the cyclic mode.

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The physical landscape is the product of the geology and structure of the terrain, the erosive processes acting upon it, and the length of time over which they act. The memory of past events recorded in the landscape of Nova Scotia is brief, in geological time scales. The last prominent event recorded was the split-up of Pangea and the opening of the present-day Atlantic Ocean in the Triassic Period. The Bay of Fundy (Unit 912), a rift valley, is the remnant of that split-up.

In Nova Scotia there is a variety of igneous, metamorphic and sedimentary formations which have been exposed to desert, temperate and glacial conditions over 140 million years. This long erosive history can be divided into three parts: the development of a planation surface (essentially complete by the Cretaceous Period); uplift, tilting and redissection of this plain during the Tertiary; and glaciation during the Pleistocene. Glacial activity in the province is described in T3.3; elements of the physiography attributable to the other two periods are described below.

THE CRETACEOUS PENEPLAIN

The first phase in the formation of the landscape was the development of a lowland plain during the period prior to the Early Tertiary, about 60 million years ago. At that time, Nova Scotia may have looked like a relatively uniform, flat plain almost at sea level. To the north, the plain extended well into New Brunswick; to the south, it stretched beyond the present coastline and out over at least part of today's continental shelf. The climate at that time was predominantly hot, and the formation of kaolinites in the Nova Scotia Cretaceous sediments implies that it was also moist.[15] Erosion was generally subaerial, with wind abrasion, flash flooding and diurnal expansion and contraction of exposed surfaces being the principal weathering agents.

The surface of the plain cut across some very resistant rocks: the granite and quartzite of the Atlantic Interior (Region 400) and the old metamorphic rocks of the Cobequid Hills, Pictou–Antigonish Highlands (District 310) and the Cape Breton Highlands (Region 200). Although the surface was broadly even, part of the northern plateau of Cape Breton (Region 100), the granite knolls south of Kentville, and Mount Aspotogan in Lunenburg County all stood above the erosion surface.

The planation surface was uplifted during Tertiary times and has since been dissected, so that little remains of its original uniformity. Nonetheless, it still contributes a great deal to the character of the Nova Scotian landscape. The even horizon line and relatively modest maximum elevations can both be attributed to this early levelling.

THE TERTIARY UPLIFT

During the Cretaceous period, the continental shelf subsided and thick sedimentary deposits began to accumulate offshore. At that time, erosion on land was very slow, and only very fine sediments were removed from the flat surface.

During the Late Tertiary, the crustal block of which Nova Scotia was a part was uplifted and tilted; sea level dropped to at least 200 m below the present level, and much of the continental shelf was exposed once again. Vigorous erosion commenced. The soft, unmetamorphosed post-Devonian sediments were stripped off, exposing an ancient landscape of resistant ridges (for example, the Rawdon Hills and Wittenburg Mountain, in District 420); old, hard blocks such as the Creignish Mountains of Cape Breton (Region 300); and old, buried river valleys (for example, parts of the Musquodoboit Valley and the East River Valley). Drainage systems which had formed on the tilted surface were further excavated and entrenched. The Bras d'Or Lake was deepened, and the Gulf of St. Lawrence shelf area became dissected by river valleys. Old coastal features which originally formed during the Carboniferous Period were re-exposed: for example, the coastal embayments of Mahone Bay and St. Margarets Bay (District 460). The river system which had formed west of Cape Split in the Bay of Fundy became further enlarged at this time, and the Minas Basin and Chignecto embayments began to develop. On the Scotian Shelf, a relatively level plain was dissected into hills and valleys, which became banks and channels during the subsequent rise of sea level.

The rate at which this erosion took place was closely controlled by the geology. The hard igneous and metamorphic rocks of northern mainland Nova Scotia, Cape Breton and the Southern Uplands were not worn down appreciably and became more prominent in the landscape as the surrounding soft sediments were removed around them. Lowlands formed from the Carboniferous strata of limestone, gypsum, shales and coal measures. The soluble deposits of the Windsor Sea were eroded, forming karst topography in the Carboniferous Lowlands (Unit

511). The coarse, gritty Horton sands were left as resistant shoulders against older, hard blocks such as the Pictou–Antigonish Highlands (Unit 312). The soft, Early Triassic deposits south of North Mountain were easily washed out by rivers flowing through the Annapolis Valley (District 610) and St. Marys Bay (Districts 810, 820, 910).

Where hard and soft rocks came into contact through faulting, differential erosion left steep escarpments, such as those on the west face of Aspy Bay and Cape North and on the north side of the Minas Basin.

MARINE INCURSION

Sometime in the late Tertiary, the sea level rose relative to the land, and the old coastline was drowned. Distinctive coastal features, such as the Bay of Fundy, Bras d'Or Lake, Canso Strait and St. Marys Bay, were inundated, together with other, smaller river estuaries and coastal embayments. The essential character of the landscape and coastline of Nova Scotia, reflecting its geological and erosional history, was established at this point and was modified only by the glaciation that came later.

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Associated Topics

T2.1 Introduction to the Geological History of Nova Scotia, T2.3 Granite in Nova Scotia, T2.4 The Carboniferous Basin, T2.6 The Triassic Basalts and Continental Rifting, T2.7 Offshore Geology, T3.2 Ancient Drainage Patterns, T3.3 Glaciation, Deglaciation and Sea-level Changes, T3.4 Terrestrial Glacial Deposits and Landscape Features, T3.5 Offshore Bottom Characteristics

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Additional Reading

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