Deglaciation of the inner Scotian Shelf, Nova Scotia: correlation of land-sea events

R.R. Stea[1], D.B. Scott[2] and G.B.J. Fader[3]
[1]*Nova Scotia Department of Natural Resources, Halifax, Nova Scotia B3J 2T9, Canada*
[2]*Centre of Marine Geology, Dalhousie University, Halifax, Nova Scotia B3H 3J5, Canada*
[3]*Geological Survey of Canada, Dartmouth, Nova Scotia B2Y 4A2, Canada*

The continental shelf off Nova Scotia, located between the deep ocean and the land, is a critical region for land-sea correlation. Glacial and nonglacial sediments of the last glacial cycle are preserved in eastern Canada across the land-deep sea boundary to the edge of the continental shelf. The inner shelf has been recently mapped and subdivided into five coast-parallel terrain zones which record glaciation, ice retreats and readvances, and sea-level rise and fall during the Late-glacial period.

A major morainal system termed the Scotian Shelf End Moraine Complex lies at the seaward margin of the inner Scotian Shelf. These moraines formed at the margin of the Scotian Ice Divide located across the axis of the Nova Scotia peninsula. The divide evolved in response to removal of ice from the Laurentian Channel and its associated feeder tributaries. Ice flow from the Scotian Ice Divide changed from northward, directed into the Lauentian Channel to northwestward into the Bay of Fundy as ice receded from the Gulf of Maine. The formation of the Scotian End Moraines is coeval with abundant iceberg production in the Emerald Basin to the southwest, dated between 17 and 15 (^{14}C) ka.

Landward of the end moraines is a linear depositional ba-

sin termed the Basin Zone. Seven sequences have been identified from acoustic profiles. A piston core (91018-53) from this basin was analyzed for foraminiferal content and grain size variations and was radiocarbon-dated. Core lithofacies and biofacies were correlated to the seismic sequences in the Basin Zone. Interpreted together, these records provide a unique history of Late-glacial climatic change. Core 91018-53 did not penetrate the lowest depositional sequences (1+2) within the Basin Zone. They are characterized by high amplitude, coherent reflections (Emerald Silt facies A) and are interpreted to be ice proximal sediment, deposited by overflow and interflow meltwater plumes emanating from a tidewater ice margin.

The Chedabucto Bay glacier in northern Mainland Nova Scotia evolved from the Scotian Ice Divide after landward retreat of this glacier out of the Basin Zone (*ca.* 14-13 ka). A readvanced *ca.* 13 ka formed terminal moraines on land and DeGeer moraines in the marine realm. Sequence 2 in the Basin Zone (Emerald Silt facies A) was deposited during this re-advance. From 14 to 13 ka, sea level dropped rapidly, due to general isostatic recovery. As the margin of the Chedabucto Bay glacier emerged above sea level, wave turbulence and meltwater plumes from the retreating, tidewater glacier suspended and transported very large amounts of sediment. Iceberg rafting was also an important sediment delivery mechanism. This sediment was carried out into the Basin Zone, forming Sequence 3, characterized by low amplitude reflections and dropstone diffractions (Emerald Silt facies B). Enhanced current erosion during a sea-level lowstand *ca.* 11.6 ka was recorded in the inner Scotian Shelf basins by erosional truncation of Sequence 3. After this erosional event sea level rose rapidly concomitant with climatic warming, as indicated by foraminiferal fauna within the Basin Zone and increase in spruce pollen in Nova Scotia terrestrial lake records. In the Basin Zone a seismic sequence characterized by indistinct, low amplitude reflections (Sequence 4) was deposited.

Sequence 5 was deposited during the period from 11 to 10.0 ka. It is characterized in the core by increased sand content and sandy layers and seismically by a return to high amplitude, coherent reflections (Emerald Silt facies A). Sequence 5 is correlative with the Younger Dryas clay layer in lakes and the glacigenic sediments that overlie peat in land sections. Both land and sea records demonstrate an oscillation from organic-rich sediments to an inorganic sedimentation event initiated at around 10.8 ka. Climatic cooling and snowfield/glacier buildup on land, with increased sea-ice/icebergs in the marine realm, are the principal causes of these sedimentation events. The land and ocean sedimentation events appear synchronous.