

# Crustal Structure Beneath Scotian Margin: New Insight from Gravity Modelling

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## Summary

The continental shelf and slope offshore Nova Scotia are underlain by a classic “Atlantic-style” rifted margin, comprised of stretched and faulted continental crust that is overlain by a series of connected depocentres that together form the Scotian Basin. Rifting was initiated during the late Triassic, and sedimentation was at a maximum rate during the late Jurassic and Cretaceous. Petroleum exploration over the past four decades has led to 23 gas and oil discoveries, primarily in the Sable Island region within the Sable and Abenaki sub-basins.

A close look at the rifted margin reveals considerable variation in rift geometry, basement faulting styles, and depositional patterns. The volcanic-style margin evident along the US Atlantic and southwestern part of the Scotian margin transitions to a non-volcanic style midway along the margin. Wide-angle reflection/ refraction data indicate the presence of serpentinized mantle beneath the easternmost margin, whereas a large volume of igneous material is associated with the much narrower continent to ocean transition zone on the southwestern margin. These variations have considerable implications for heat flow and subsidence along the margin, particularly during the synrift and early stages of post-rift deposition. Images of deeper sedimentary layers and basement are not always clear on multichannel seismic data as salt tectonics have obscured deeper structure on many sections of the margin.

We are using regional gravity data to examine crustal thickness across the region and extend interpretations between and beyond the seismic profile corridors. Constraints on Moho, crust, and sedimentary layers are provided by refraction and deep multichannel reflection data. Three-dimensional models have been developed using the GRAV3D inversion algorithm of Li and Oldenburg, utilizing constraints from bathymetric and sediment thickness data. Initial conditions set background densities and solution ranges, allowing the inversion to solve for crustal and subcrustal geometries plus density variation within the sedimentary column.

The models predict Moho structure beneath the study region, allowing comparison with the seismic interpretations. Several models successfully predict the northward trend toward the thinner crust and broader zone of extension that underlie the Sable subbasin. However, different initial conditions are required to reproduce the crustal profile along the igneous section of margin to the southwest, and future modeling will focus on this area to better resolve the nature of the transition zone.