

Regional Tectonic Implications of the Lithoprobe East Marine Deep Seismic Reflection Line Across the Northern Canadian Appalachians

G. Stockmal, Geological Survey of Canada, Atlantic Geoscience Centre, Bedford Institute of Oceanography, P.O. Box 1006 Dartmouth, Nova Scotia B2Y 4A2, and The Lithoprobe East Group

In the fall of 1984, as the initial stage of a presently ongoing program, over 450 km of marine deep seismic reflection data were recorded to 15 seconds two-way travel time across the Appalachian Orogen, northeast of Newfoundland. The seismic line, which crosses all of the major geological zones of the northern Canadian Appalachians, was positioned with the aim of relating deep crustal structure to surface geology. A preliminary geological interpretation of the seismic data is currently in press.

The preliminary interpretation, which tentatively established the underthrust eastern limit of the stretched Grenville continental craton, the allochthonous nature of at least part of the Dunnage zone, and a tectonically disrupted Moho, has major regional tectonic implications. In light of recent near surface geological interpretations, we have considered possible plate tectonic configurations for the evolution of the orogen, which will satisfy the seismic observations and simultaneously explain the major regional change in structural geometry and sense of vergence between Newfoundland and the Gaspé Peninsula as

well as the development of the arcuate Anticosti foreland basin.

Our preferred interpretation involves initial continent/arc collision between the offset Grenville craton (Precambrian rifting is known to have produced a 300–400 km right-lateral offset in the margin, which is preserved as the Quebec Reentrant and the St. Lawrence Promontory) and a relatively straight eastward dipping subduction zone to produce the Taconian Orogeny. Acadian shortening in Newfoundland was then accommodated by lithospheric delamination of the lower lithosphere beneath the Grenville of the St. Lawrence Promontory with simultaneous tectonic wedging of the lower lithosphere which formerly underlaid the Dunnage back-arc basin. To the south, in New Brunswick and Quebec, further Acadian emplacement of the overthrust wedge onto the craton occurred. Major Acadian overthrusting in the northwestern Maritimes is supported by recent geological and geophysical observations, although the relative partitioning of Taconian versus Acadian shortening remains a problem.