

Stratigraphic Constraints on the Timing of Fault Movements in New Brunswick

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New Brunswick has been divided into several tectonostratigraphic terranes based on the uniqueness of their stratigraphy and structural history. These are from north to south: Elmtree (Ordovician back-arc oceanic crust), Miramichi (Ordovician

Atlantic Geology, August 1988, Volume 24, Number 2

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back-arc intracontinental volcanics), St. Croix (Cambro-Ordovician slope sediments deposited on thinned continental crust), Mascarene (Cambrian? mafic schist overlain by Siluro-Devonian volcanic rocks), and Avalonian (Precambrian basement overlain by Cambro-Ordovician platformal rocks). The movement history along their faulted boundaries and age of overlapping cover rocks demonstrate that these terranes were accreted to the North American craton between the Late Ordovician and Devonian.

The Rocky Brook-Millstream Fault, a prominent dextral transcurrent fault displacing strata as young as Carboniferous, has previously been used as the boundary between the Elmtree and Miramichi terranes. Recent structural studies by the Geological Survey of Canada suggest that this boundary may more accurately be represented as a series of southward-directed thrusts, which accompanied early folding. The age of this thrusting is no younger than Late Silurian since conglomerate of that age unconformably overlies, and contains deformed pebbles derived from Middle Ordovician volcanics of the Tetagouche Group.

The Fredericton Fault, which transects Silurian rocks of the Fredericton cover, has generally been considered to mark the boundary between the Miramichi and St. Croix terranes in New Brunswick. Carboniferous basalt has been downthrown 700 m to the southeast across the trace of this fault. Its extension into Maine, the Norumbega Fault, dextrally displaces Devonian granite with a total offset of no more than 30 km.

A recent seismic survey across southern Maine indicates that extensive earlier southeastward-directed thrusting, involving

Siluro-Devonian cover rocks, occurred prior to granite emplacement in the Devonian. As a consequence, high-grade metamorphic rocks of Miramichi aspect are, locally, found to the southeast of the Norumbega Fault, where they structurally overlie black slates of the St. Croix Terrane. No ancient oceanic crust was found to be present in this region. Vergence of folds in the Fredericton cover rocks in New Brunswick is consistent with southeastern thrusting on the Honeydale Fault, transporting these cover rocks over the St. Croix Terrane.

The Pendar Brook Fault, which defines the northern extent of the Mascarene Terrane, is truncated by the Devonian Saint George Batholith. Seismic evidence suggests that the equivalent Turtle Head Fault in Maine is a steep structure penetrating the lower crust. The Wheaton Brook Fault, which marks the northern exposed limit of the Avalonian Terrane, also pre-dates the Saint George granite, but the parallel Belleisle Fault to the south displaces Carboniferous strata.

The widespread occurrence of southeastward-directed thrusts to the north of the Precambrian Avalonian Terrane, suggests that northwestward-directed subduction was responsible for terrane accretion between the Late Ordovician and Early Devonian. The older thrusts in the north have been related to subduction of back-arc oceanic crust during the latter stage of the Taconian orogeny. The younger thrusts in the south can be related to Acadian subduction of subcontinental lithosphere that generated Late Silurian to Early Devonian calc-alkaline volcanics within the Matapedia cover sequence.