Structural evolution and deformation of the Caledonian Highlands, New Brunswick: a preliminary model

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The Caledonian Highlands comprise a deformed continental magmatic arc formed over a period of some 70 million years during the Late Neoproterozoic. The oldest component is the arc itself, which is represented by ca. 620 Ma clastic, volcaniclastic and volcanic rocks of the Broad River Group and co-magmatic plutonic rocks of the Point Wolfe River plutonic suite. These rocks are overlain by volcanic, volcaniclastic, and clastic rocks of the Coldbrook Group, deposited between 560 and 550 Ma, and intruded by a suite of plutonic rocks of similar age. Geochemical studies imply that the Coldbrook Group formed in a post-arc extensional setting. The youngest component of the Caledonian Highlands is the Cambrian-Early Ordovician Saint John Group, a shallow water marine succession of fine- to coarse-grained clastic rocks and minor carbonate rocks. Two regional unconformities separate these three components.

Preliminary studies in a major high-strain zone that crosses the Caledonian Highlands from NE to SW demonstrate a complex history of deformation. Earliest deformation produced augen gneiss and foliated granite in the Point Wolfe River plutonic suite, and textures in these rocks imply fabric development under subsolidus conditions in the cooling plutons. The implication is that earliest deformation began soon after intrusion of these rocks and probably prior to deposition of the Coldbrook Group. Progressive non-coaxial deformation in this high-strain zone, consistent with north-over-south thrusting, affected both the plutonic rocks and the Broad River Group, imposing a strongly transposed 'grain' and obscuring original stratigraphy.

Deformation in the Coldbrook Group imposed a regional fabric that is more heterogeneous in expression than in the older Broad River Group but that shares both overall geometry and the sense of north-over-south thrusting. This deformation generated major overfolds with isoclinal profiles overturned to the south. Cambrian-Ordovician Saint John Group rocks share this history of folding and thrusting.

In the Big Salmon River area the main high-strain zone also contains other fabrics, such as a sporadic shallowly inclined lineation indicating a strike-slip component to deformation. In the same area the zone forms a boundary between a section to the south where a very restricted Coldbrook Group assemblage (only the Seeley Beach, Hosford Brook, and Silver Hill formations) is preserved, and a section to the north where all the Coldbrook Group succession is preserved. The implication is that this high strain zone served as an extensional fault during Coldbrook Group deposition.

Dating this deformation history at present consists of data providing maximum and minimum constraints. The age of the Point Wolfe River plutonic suite (ca. 620 Ma) is the maximum, and if initial deformation of the plutonic rocks was subsolidus, then the actual age of initial deformation cannot be substantially younger than this. The interleaving of Saint John Group with the Coldbrook and Broad River groups by thrusting and isoclinal folding must have been post-Early Ordovician. ⁴⁰Ar/³⁹Ar ages from muscovite at two locations in the highstrain zone indicate cooling after this deformation to be advanced by mid-Devonian time (ca. 390 Ma).