A history of the Paleoproterozoic Makkovik Province (Labrador)

Nicholas Culshaw[1], Gavin Sinclair[1], John Ketchum[2] and Sandra Barr[3]
[1]*Department of Earth Sciences, Dalhousie University, Halifax, Nova Scotia B3H 3J5, Canada*
[2]*Memorial University of Newfoundland, St. John's, Newfoundland A1B 3X5, Canada*
[3]*Department of Geology, Acadia University, Wolfville, Nova Scotia B0P 1X0, Canada*

The Makkovik Province was part of a ~1.9-1.75 Ga orogen at the margin of the Archean North Atlantic Craton during assembly of Laurentia–Baltica. Passive margin evolution ended with mafic volcanism at 2178 Ma and the transition to an active margin was signalled 165 m.y. later by foredeep sedimentation (craton + Terrane-I detritus) accompanying oceanward (SE/SW?) subduction. Arrival of Terrane-I resulted in ductile reworking of the craton edge by 1896 Ma and thin-skinned

thrusting with cratonward transport (decreasing deformation towards the craton interior).

A flip to cratonward (NW) subduction established an Andean-type arc within the reworked craton (parautochthon) by 1895 Ma. Arc emplacement accompanied oblique (dextral) convergence as late as 1857 Ma and may have extended outboard (SE) across the postulated accreted Terrane-I. Batholith construction within the parautochthon exploited old structures favourably oriented for extension and thermal softening by the batholith allowed deformation in country rock and parautochthon margins (shear zones) during dextral transpression.

Outboard (SE), bimodal Upper Aillik Group (UAG) volcanism at ~1860 Ma accompanied rifting of arc, parautochthon and (?) Terrane-I. Detritus originating in the arc (granite cobbles) at the rift flanks supplemented epiclastic sedimentation in the UAG basin. Foliated granite xenoliths in late net-veined mafic sills likely represent basement to UAG formed of rifted arc or Terrane-I. Abundant metamorphosed mafic dykes cutting the UAG demonstrate that magmatism during rifting/strike-slip persisted after dated volcanism. The oldest granites (~1840 Ma) in the Cape Harrison domain (Terrane I?) may be related to arc formation continuing on the outboard edge of the rift.

Inversion of the Aillik rift occurred during a hiatus (1860-1810 Ma) in igneous activity in UAG and parautochthon. It resulted from accretion of Terrane-II (Cape Harrison domain?) and caused northwest, cratonward thrusting of high grade gneiss and UAG. Opposed crustal and mantle reflectors are related to these latest events. While definitive thrust-related structures are only locally preserved, most regional UAG structures show evidence of one or more transpressive episodes.

Renewed anatexis and plutonism between ~1810 and 1800 Ma marked the beginning of successive episodes of intra-plate granite plutonism and deformation restricted to narrow belts. An example is dextral strike-slip along the inboard margin of the inverted rift at 1784 Ma and coeval parautochthon plutonism. Widespread 1715 to 1720 Ma plutonism accompanied low-grade dextral transtension at the parautochthon-craton boundary and sinistral-strike slip belts formed during or before empacement of 1650 Ma plutons. These episodes of late, heterogeneneous strike-slip may have decoupled early-Labradorian syn-magmatic extension and compression from the Nain Archean craton. Net-veined mafic sheets, emplaced throughout the parautochthon and UAG between 1720 and 1650 Ma, are postulated to be a by-product of the mantle thermal anomaly that accompanied one episode of intra-plate granitic plutonism. A seismically transparent upper crust (intraplate granites) and a basal high velocity zone (mafic underplate) formed during this time of crustal growth.