The Torngat Orogen of northern Labrador and its role in the evolution of northeast Laurentia

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The development of northern Labrador in the period 1.9 to 1.74 Ga was controlled by the oblique collision of the Archean Nain craton with an Archean–Paleoproterozoic block, known as the core zone, to form the Torngat Orogen. The collision of the two Archean blocks sandwiched a narrow, axial belt of juvenile metasedimentary crust (the Tasiuyak gneiss, probably representing the remnants of an accretionary complex) and calk-alkalic, arc-related plutonic rocks. As such, the orogen represents a deeply eroded, ancient analog for modern small-scale transpressional orogens such as the California Coast Ranges and Pyrenees.

Development of the Torngat Orogen followed the sequence: (1) rifting of the Nain craton ca. 2.2 to 2.1 Ga in association with generation of granite-anorthosite suites and mafic dyke swarms; (2) ocean closure and arc magmatism ca. 1.91 Ga; (3) initial deformation (arc/Nain collision?) ca. 1.86 Ga; (4) Nain–Core zone collision and overriding of core zone ca. 1.84 to 1.83 Ga, followed and accompanied by intense sinistral shearing 1.845 to 1.82 Ga; and (5) renewed outward vergent thrusting, probably related to more distal collisions in the evolving orogenic plexus of northeast Laurentia between 1.82 and 1.74 Ga.

A structural cross-section across the northern Torngat Orogen reveals a doubly vergent profile, centered on the Abloviak shear zone, that was constructed through multistage thrusting and sinistral ductile shearing between 1.86 and 1.74 Ga. Comparisons with geodynamic model templates suggest that this may have been achieved by a combination of plug uplift due to frontal continental collision, and flower-structure development as the result of transcurrent motion on the Abloviak shear zone. A recent refraction seismic profile across the northern part of the orogen has revealed a pronounced crustal root beneath the orogen, possibly representing the remnants of thickened and partially subducted (core zone?) continental crust. As the Torngat Orogen is traced to the south, the Abloviak zone dies out, as does the Tasiuyak gneiss, and sinistral shearing steps southwestwards into the core zone as a number of en echelon shear zones. The suture in the far south is marked only by a rather cryptic juxtaposition of Nain craton and core zone Archean gneisses that probably represents the initial character of the suture prior to Abloviak overprint. The sinistral shearing, therefore, postdated initial collision and accretion on the Nain margin but may have been synchronous with core zone collision. Whilst the sinistral shear zones are impressive in size, their en echelon character and limited strike length suggests that they probably do not represent very large-scale lateral translations.

A noteworthy feature of Torngat Orogen (and other Paleoproterozoic orogens of NE Laurentia), is the lack of the late- to post-orogenic granites that predominate in many other orogens. A possible explanation is that Torngat Orogen and its neighbours are largely underlain at depth by (refractory?) Archean lithosphere that may have inhibited the melting effects of the delamination and asthenospheric upwelling processes that are generally thought to initiate post-collision magmatism.

The Torngat Orogen may be traced north into Baffin Island where it appears to separate the Trans–Hudson Orogen of Baffin Island from the Nagssugtoqidian Orogen of west Greenland. There are, however, several problems of correlation which will be discussed, foremost among which is the degree to which juvenile Trans–Hudson crust of Baffin Island extends into Labrador/Quebec.