Deciphering the Tectonostratigraphy of a Deformed and Metamorphosed Paleoproterozoic Volcano-sedimentary Sequence: A Study of the Aillik Group, Makkovik Province, Labrador

Alana M. Hinchey
Geological Survey, Department of Natural Resources, Government of Newfoundland and Labrador, P.O. Box 8700, St. John's, NL A1B 4J6, (e-mail: alanahinchey@gov.nl.ca)

The Makkovik Province of Labrador is considered part of a Paleoproterozoic accretionary belt that developed on the southern margin of the North Atlantic craton during the ca. 1.9–1.7 Ga Makkovikian–Ketilidian orogeny. The Aillik domain represents one of three domains that characterize the province. Recent regional bedrock mapping has further defined the lithological units that occur within the Aillik domain. The Aillik domain largely comprises: a) the Aillik Group (previously termed the Upper Aillik Group), a supracrustal assemblage consisting of metasedimentary and bimodal metavolcanic rocks; b) abundant, late- to post-orogenic Paleoproterozoic intrusive suites that have intruded the Aillik Group; and, c) a fault-bound block of Archean gneiss.

The ca. 1883–1856 Ma Aillik Group comprises polydeformed, upper greenschist to lower amphibolite facies, bimodal (rhyolite-dominated) volcanic rocks and sedimentary rocks. The Aillik Group is known to host abundant base-metal and uraniferous deposits and showings. Paleoproterozoic intrusive suites in the Aillik domain include synvolcanic quartz–feldspar-porphyritic granites (ca. 1858 Ma), foliated to massive granitic intrusions (ca. 1805–1795 Ma), non-foliated granitic intrusions (ca. 1720 Ma), and Labradorian intrusions (ca. 1650–1640 Ma). The Aillik domain contains abundant pre- and post-deformational mafic and felsic dykes that outcrop throughout the region.

Detailed bedrock mapping has further constrained the tectonostratigraphy of the Aillik Group. The volcanic rocks of the group consist dominantly of rhyolite and minor felsic tuff, with lesser basalt and minor mafic tuff. Locally preserved pillow selvages are documented within the basalt flows. The sedimentary rocks comprise breccia/conglomerate, tuffaceous sandstone, sandstone and siltstone. Locally, rare cross-bedding and graded bedding are preserved in these rocks and indicate the younging direction. The Aillik Group is cut by porphyritic granites which, based on field

relationships, are interpreted to be high-level intrusive sheets and sills and are, at least in part, coeval with felsic volcanism. Lithological characteristics of the Aillik Group support its formation in a transitional environment, from a shallow marine to a marginal marine or subaqueous environment. Although depositional basement has not been identified, it cannot be coincident with present-day basement, as folding and shearing during Makkovikian orogenesis transported these Aillik Group rocks northwestward. The Aillik Group stratigraphy is complicated by lithological units that are not laterally continuous and locally complex structures which cause repetition of stratigraphy. Regional-scale folding controls the distribution of volcano-sedimentary units in the region and late faulting further complicates the geology.

The degree of deformation and grade of metamorphism are variable throughout the Aillik domain and this further complicates the tectonostratigraphy. The eastern exposures of the Aillik Group comprises a dominantly metasedimentary package of thin-bedded sandstone and lesser conglomerate, marble and rhyolite that has been metamorphosed in the upper greenschist facies and commonly displays primary sedimentary features such as ripple marks and crossbedding. In contrast, the central Aillik domain consists of a dominantly metavolcanic package of felsic tuff, basalt, rhyolite and lesser interbedded conglomerate and sandstones. This package of rocks has been metamorphosed in the amphibolite facies, is highly strained and most primary sedimentary structures are no longer preserved.

Deformation in the Aillik Group is characterized by regional-scale, open to isoclinal, moderately plunging, upright to overturned folds (F_1 in Aillik domain) that were subsequently refolded (F_2). Folding and the development of regional-scale shear zones were contemporaneous with the formation of an axial-planar fabric in the Aillik Group and regional upper greenschist- to lower amphibolite-facies metamorphism, all of which are attributed to compressional tectonic regimes associated with the Makkovikian orogeny. With the exception of the porphyritic, synvolcanic granites, all of the plutonic rocks appear to postdate regional-scale folding in the area. Although some of the ca. 1800 Ma plutons have acquired the regional penetrative fabric, indicating that they were intruded synchronous with deformation, they are not folded.