The rapakivi-bearing Margaree pluton, Aspy terrane, Cape Breton Island, Nova Scotia, Canada: inherited geochemical signature in an extension-related intrusion

GABRIEL SOMBINI DOS SANTOS[1], SANDRA M. BARR[2], CHRIS E. WHITE[3], AND DEANNE VAN ROOYEN[4]

1. Department of Earth and Environmental Science, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada <gabriel.santos@uwaterloo.ca>

2. Department of Earth and Environmental Science, Acadia University, Wolfville, Nova Scotia B4P 2R6, Canada

3. Nova Scotia Department of Energy and Mines, Nova Scotia B3J 2T9, Canada

4. Department of Mathematics, Physics, and Geology, Cape Breton University, Sydney, Nova Scotia B1P 6L2, Canada

The Margaree pluton extends for approximately 40 km along the NNE-SSW axis of the Ganderian Aspy terrane of northern Cape Breton Island. Typically described in the literature as rapakivi-textured megacrystic syenogranite, detailed mapping has shown that the pluton can be subdivided into mappable units of (1) megacrystic syenogranite; (2) medium-grained, equigranular, biotite syenogranite; and (3) microgranite porphyry, all locally displaying rapakivi texture. The equigranular syenogranite intruded megacrystic syenogranite, and the porphyry intruded both granites. The units are locally mingled, consistent with similar U–Pb (zircon) ages of 363.0 ± 1.6 Ma from a megacrystic syenogranite sample, 364.8 ± 1.6 Ma from an equigranular syenogranite sample, and 365.5 ± 3.3 Ma from a microgranite porphyry sample. Although the pluton displays wide textural variation, chemical data from 50 samples collected throughout the pluton show similar trends. The Margaree pluton is peraluminous and ferroan, with an alkalic to calc-alkalic signature. The REE patterns for the three units that compose the pluton are virtually identical, with parallel trends characterized by enrichment in the LREE (La 20 to 100 times chondritic values), flat HREE, and moderate negative Eu anomalies. The observed variability in major element composition and textural features can be explained by the interaction of felsic and mafic magmas in the magma chamber, followed by fractionation of alkali feldspar, plagioclase, and quartz. The geochemical signature suggests that the pluton is an evolved I-type granite, a surprising signature given the ca. 365 Ma age and its location in an area presumed to be in an extensional regime since ca. 375 Ma. This apparent conundrum can be untangled by a combination of geochemistry and field relations. The Margaree pluton is highly enriched in heat-producing elements (HPE). Combined with the intrusion of mafic magmas in the Aspy terrane at the time, as evidenced by the textural features of the Margaree pluton and characteristics of coeval supracrustal units, the enrichment in HPE provides the engine for anatexis. The isotopic (Sm-Nd, Pb, Hf, and O systematics) signature of the Margaree pluton is consistent with melting of pre-existing igneous rocks from the continental crust. This magma produced by crustal recycling migrated to high crustal levels in the area where the Aspy Fault intersected the Western Highlands Shear Zone, as indicated by the *en-cornue* geometry of the pluton, with tails at the intersection point of both structures, during Late Devonian extension in the Aspy terrane.

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