

Ultramafic rocks in a Neoproterozoic arc, Antigonish Highlands, Nova Scotia

Dan MacNeil

Department of Geology, St. Francis Xavier University, Antigonish, NS B2G 2W5

Typical continental arc magmas are calc-alkaline and range from andesitic to felsic compositions. The ca. 610 Ma Neoproterozoic Greendale complex, in the Antigonish Highlands, Nova Scotia is a local example of regional arc-related magmatism that typifies the Avalon terrane. The dominant rocks of the complex exhibit calc-alkaline trends and have continental arc magmatic affinities that range from andesitic to felsic in composition. However, they also contain an important ultramafic component that is atypical of Neoproterozoic Avalonian magmatism. Petrographic examination and microprobe analyses of the ultramafic rocks within the Greendale complex show that they contain tschermakitic hornblende which poikilitically encloses olivine, hypersthene, augite, and chrome spinel, and minor amounts of interstitial phlogopite and plagioclase (<5 %) as well as late magnetite-apatite veins. The mafic minerals have high magnesium numbers (78–80), that are typical of ultramafic rock compositions. The Greendale complex was emplaced during the final stages of coeval dextral motion between the

Hollow and Greendale faults associated with subduction along the northeastern margin of Gondwana. Geochemical analyses, phase equilibria and field relationships indicate a two-stage process for emplacement of the ultramafic rocks. Early crystallizing mafic minerals (olivine, augite, and hypersthene) probably formed as cumulus minerals in a basaltic parental magma chamber at depth. Large, poikilitic hornblende crystals are believed to have formed after this magma (with its entrained mafic minerals) was injected into a shallower water-rich environment near the roof of the Greendale complex. This process would account for large poikilitic hornblende crystals that enclose the early mafic minerals.

The origin of magma within the Greendale complex is related to Neoproterozoic intra-arc rifting. The range of rock compositions within the Greendale complex, including the ultramafic component offers insights into Neoproterozoic tectonic processes which contributed to the formation of the Avalon terrane in Atlantic Canada.