

Factors controlling intrusion-related mineralization in Cape Breton Island, Nova Scotia, Canada -- Ganderia vs Avalonia

A Moning¹, SM Barr¹, CE White²

¹Department of Earth and Environmental Science, Acadia University, Wolfville, Nova Scotia;

²Nova Scotia Department of Natural Resources, Halifax, Nova Scotia;

Cape Breton Island, Nova Scotia, is part of the Appalachian orogen and consists of rocks belonging to the Laurentian Blair River Inlier in the north and the Gondwana-derived Aspy, Bras d'Or, and Mira terranes to the south. Aspy and Bras d'Or are part of Ganderia, whereas Mira is part of Avalonia, microcontinental fragments that extend through the Atlantic provinces and into New England, USA. Granitoid plutons of known Devonian age are a major component of both Aspy and Mira terranes in Cape Breton Island. The Gillis Mountain pluton in the Avalonian Mira terrane of southern Cape Breton Island hosts porphyry-style copper-molybdenum mineralization. The pluton consists of three main units: quartz monzodiorite, porphyritic granite and fine-grained granite with minor aplitic, granitic and mafic dykes. It intruded early to middle Cambrian shale and siltstone and has characteristics typical of shallow intrusions. U-Pb (zircon) dating has yielded an age of 370.5 ± 2.4 Ma. Compilation of previous petrological information combined with new data from recent drill core confirmed the calc-alkalic, subduction-related tectonic setting for the pluton, and the presence of elevated metal contents. In contrast, plutons of similar or assumed similar age in the Leonard MacLeod Brook area of the Ganderian Aspy terrane of northern Cape Breton Island are not known to be mineralized or associated with mineralization, although they contain rock types similar to those of Gillis Mountain and were also emplaced at shallow depths, based in part on close association with volcanic rocks. Mapping during the summer of 2017 resulted in division of the plutonic rocks in the area into the Gillis Brook, Leonard MacLeod Brook, Easach Ban, and Bothan Brook plutons. Only the Bothan Brook pluton is confirmed to be Devonian, and preliminary results of dating in progress indicates that some plutonic components are late Silurian, but all of the plutons have characteristics indicative of emplacement in a subduction-related tectonic setting. Comparison of host rocks, depth of emplacement, mineralogy, and chemical and isotopic composition of these plutons may provide insight about factors controlling the presence or absence of porphyry-style mineralization, and the nature of the crust under Ganderia compared to Avalonia. Hence this study has broader implications for plutons of similar age in both Newfoundland and New Brunswick, and for the understanding of mineralizing systems related to granitoid rocks in general.