geoconvention
Virtual Event
September 21-23
2020
CSPG • CSEG • CWLS • GAC • MAC • IAH

Complex magmatic arcs and syn-magmatic sedimentation in Cape Breton Island NS; challenges in geological mapping and geochronology of highly compressed accretionary margins.

Deanne van Rooyen
Cape Breton University
Sandra M. Barr
Acadia University
Christopher E. White
Nova Scotia Department of Energy and Mines

Abstract

The northern Appalachian orogen in Atlantic Canada preserves a complex history of amalgamation of terranes with both Laurentian and Gondwanan affinities. The Cape Breton Island segment of the orogen is particularly interesting because it preserves a highly compressed section through the orogen from the Laurentian margin through diverse Gondwanan accreted terranes resulting in the absence of some components but preservation of components which are not well represented elsewhere in the orogen. Recent mapping and extensive geochronology work illustrate the complex challenges associated with highly compressed accretionary margins. The Aspy and Bras d'Or terranes of north-central Cape Breton Island both contain abundant plutons and, in some places, comagmatic volcanic rocks, with ages ranging from Early Ediacaran through Late Devonian. Many of these plutons display wide range in petrological and isotopic characteristics, reflecting differences in tectonic setting and petrogenesis. As the available database of U-Pb zircon ages has grown it has become clear that these plutons are much more complex and varied than previously known. In some cases, plutons that were mapped as single units have U-Pb zircon ages that demonstrate multiple magmatic phases spanning tens of millions of years, in other cases plutons with very different chemical and tectonic signatures have emplacement ages in common. Inherited zircon in both S- and I-type intrusive rocks commonly play a significant role as well and can eclipse the youngest populations of zircons representing emplacement ages. The presence and significance of inherited zircon grains in igneous units can be accurately interpreted only if the ages of surrounding units are well understood. Additional challenges are caused by the juxtaposition of plutons of different ages and origins, some as a result of faulting, and some as a result of overlapping intrusive phases in composite plutonic arc settings. In addition, strain localization in adjacent units can be a misleading factor in determining relative ages if based on relative intensity of deformation and can only be accurately determined by absolute dating. Similar complexity exists in the metasedimentary units that host plutons. In some of these rocks it can be demonstrated that even within continuous sections the detrital zircon populations in adjacent units can be wildly different. This makes interpretation challenging, particularly when

coupled with non-continuous exposure and the need for correlation across different units of variable metamorphic grade. These results have broad implications for equivalent terranes in Newfoundland and elsewhere in the Appalachian-Caledonide orogen, underlining the need for careful, systematic field mapping.