Geochemical and Isotopic constraints on the Avalon Composite Terrane during the Early Silurian

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The age and nature of the accretion of the Avalon Terrane to North America are pivotal to our understanding of the Appalachian Orogeny. The Lower Silurian to Middle Devonian Arisaig Group, Northumberland Strait, Nova Scotia, provides a continuous Avalonian stratigraphic record during accretionary and post-accretionary events. The Arisaig Group is composed of Lower Silurian, bimodal, basalt-rhyolite volcanic rocks overlain by a thick succession of marine, fossiliferous, siliciclastic rocks. Although the geochemistry of the volcanics indicates a local intracontinental setting, its regional tectonic significance is unclear. Recently, it has been proposed that the geochemical signature of turbidite sediments may help identify tectonic settings. The Lower Silurian Beechill Cove sedimentary rocks, the lowermost shallow marine sequence in the Arisaig Group, were selected for geochemical and isotopic analysis.

The geochemistry of the Beechill Cove Formation cannot simply be attributed to Avalonian basement, and therefore may have a significant chemical contribution from other adjacent land-masses in the Early Silurian. Major elements reveal elevated K_2O/Na_2O and $Al_2O_3/CaO+Na_2O$ and low $FeO+MgO$, TiO_2 and Al_2O_3/SiO_2 relative to Avalonian crust. Trace elements record an increase in Rb/Sr ratios relative to the less differentiated Avalonian material, and samples normalized to chondrite give a distinctive pattern with elevated light rare earth elements over heavy rare earth elements and a pronounced Eu anomaly.

Silurian palaeographic reconstructions suggest many possible sources for the detritus, including the Caledonide Orogenic Belt of western Europe. If the isotopic analysis of Beechill Cove sediments helps constrain the chemical contribution of old continental crust, this has exciting implications for palaeographic reconstructions and the accretionary history of the Appalachian Orogeny.