Introduction

The Appalachian Mountain chains of Eastern North America were produced by the collisional orogen between the North American Continent (Laurentia) and Gondwana Land resulting in closing of the proto-atlantic at about 270 million year before present. Before the final collision between the two continents, several micro-continents and arcs that existed in between were amalgamated to the Eastern margin of North America during the Taconic Orogeny. This mosaic of amalgamated small terranes are termed as Easter Blue Ridge (EBR). The EBR sequence in the Southern Appalachian is composed of a bimodal sequence of volcanic rocks termed as Pumpkinvine Creek (PVC) Formation that are thought to have been produced by arc volcanism, a thick pile of metasediments formed at the continental margin and numerous plutons intruding the sediments. This study attempts to interpret the tectonic setting of arc building in the southern Appalachian by looking at the Sr and Nd isotopes of the felsic (Galts Ferry Gneiss) and mafic (Pumpkinvine Creek Amphibolite) rocks of the PVC formation. The result is then compared with the arcs of the northern and central Appalachian.

Experiment

Fresh whole rock samples chosen for whole rock analysis of Sr and Nd were powdered in a tungsten carbide mortar and dissolved in a 3:1 mixture of twice distilled HF:HNO3. Separation of Sr and Nd followed standard ion exchange procedures employing 4.5 ml of AG50W-X8 9-cm bed-length ion exchange resin. Nd was separated as a bulk REE fraction and eluted in 6 N HCl. Nd and the REE fraction was further separated on a 1.2 ml, 6 cm bed-length column of Ln resin SPS. Measurements were made on a Finnigan-MAT 262 mass spectrometer at NHMFL. In all cases blank levels are insignificant.

Results and Discussion

The $\varepsilon_{Nd}(460)$ of the mafic rocks range from +3.3 to +7.7 and that of the felsic rocks are +4.6 to –3.2. The initial Sr for the felsic rocks cluster in two groups 0.704 and 0.708. The Nd values indicate that the arc was building on a thinned continental margin or in an oceanic setting with minimal interaction with the old continental crust. The bimodal distribution of the initial Sr ratios for the felsic volcanics indicate that either there was more than one edifice of eruption, and/or the lavas with a higher ratio was mixing with sediments.

The $\varepsilon_{Nd}(460)$ of the felsic rock was compared with those of Northern and Central Appalachian arc volcanics of similar ages (modified after Coler, 2001). The comparison clearly shows that the arc lavas of the Southern Appalachian were interacting to a lesser degree with the older basement than the contemporaneous arcs (Fig 1).

Conclusions

The tectonic model of the Taconic orogeny for the Northern and Central Appalachian might not be applicable for the Southern Appalachian and needs further investigation.

References


Figure. Crust fields and included arc terrane values are modified from Coler et al. (2001) and references therein. The new data from the GFG is compared with the other more northern Appalachian arc terranes and associated units.