GEODYNAMIC EVOLUTION OF THE PUMPKINVINE CREEK FORMATION AND ASSOCIATED ROCK ASSEMBLAGES: STRUCTURAL, PETROLOGIC, AND GEOCHEMICAL EVIDENCE OF A PALEOZOIC ACCRETED ARC TERRANE IN THE SOUTHERN APPALACHIANS

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Introduction

The Pumpkinvine Creek Formation (PCF) is a bimodal meta-volcanic sequence containing fine-grained amphibolite, felsic gneiss, and minor pelitic schist (likely background sedimentation) associated with a linear, dominantly meta-volcanic belt starting near the AL-GA state border and continuing for about 100 km to northern Georgia along strike of the Appalachian mountains. This terrane is loosely termed the Dahlonega Gold Belt because of the occurrence of economically important minerals found throughout, and may be associated with the Ashland-Wedowee belt that continues southwest into Alabama. The importance of this terrane is that it occurs structurally adjacent to the eastern margin of the Laurentian portion of the Appalachian metamorphic core, making it the most inboard accreted terrane in this region of the southern Appalachians. Total thickness of the PCF and associated units is unknown due to lack of facing criteria, complex folding, and terrane bounding faults on either side.

Results, Discussion & Conclusions

Recent reports of zircon (IMP) U-Pb ages (felsic meta-volcanics) suggest an Ordovician age of crystallization (460-480 Ma). New geochemical data shows evidence for petrogenesis of the PCF as volcanic arc basalts and rhyolites, possibly in a back-arc setting. Nd isotopic evolution values show that these rocks likely have little or no contribution from Mesoproterozoic crust as the age corrected (~460 Ma) epsilon Nd values of the felsic meta-volcanics are –3.3 to 4.7 and the mafics have values of 3.3 to ~7, which shows generation from a depleted mantle source. Sm/Nd isotope systematics shows evidence of a mixing line for the felsic meta-volcanics that may define a range between basalt and average shale composition. 87/86 Sr is heterogeneous among the felsic samples and is either a result of some disturbance or is primary in that these rocks were sampled from different parent magmas. A poorly constrained Rb/Sr isochron (or ‘scatter-chron’) yields an ‘age’ of 386 +/- 140 Ma. This may represent a metamorphic disturbance age, but the age of crystallization falls well within the error. Most Appalachian arc-terranes show evidence of interaction with older, Mesoproterozoic (Grenville) crust, while the PCF appears to have formed as an island arc related to B-type subduction, and shows (Nd isotopic) similarities to the northern Appalachian Exploits Arc that developed in the middle of the Iapetus Ocean.