The Youngest (~48 Ma) Magmatic Event in Eastern North America

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The Eastern North American Margin (ENAM) can provide important clues to the long-term evolution of rifted continental margins. An Eocene (ca. 47-49 Ma) volcanic swarm exposed in the Appalachian Valley and Ridge Province of Virginia and West Virginia, contains the youngest known igneous rocks in the ENAM. These magmas are the only window into the most recent deep processes contributing to the post-rift evolution of this margin. Modeling of the melting conditions using primitive basalts yielded an average temperature and pressure of 1412 °C and 2.3 GPa, respectively; corresponding to a mantle potential temperature of ~1400°C, suggesting melting conditions slightly higher than ambient mantle but not as high as expected from plume activity. When compared with magmas from Atlantic hotspots, the Eocene ENAM samples share isotopic and trace-element signatures with the Azores and Cape Verde. This similarity suggests the possibility of a large-scale dissemination of similar sources in the upper mantle left over from the opening of the Atlantic. Asthenosphere upwelling related to localized lithospheric delamination is a possible process that can explain the intraplate signature of these magmas that lack evidence of a thermal anomaly. This process can also explain the Cenozoic dynamic topography and potential links to rejuvenation of the Central Appalachians. New P- and S-wave tomography using data from EarthScope's USArray suggests that a low-velocity anomaly persists in the upper mantle beneath the Eocene volcanic swarm, indicating that the magmatic event substantially modified regional lithospheric structure. Our goal is to integrate the geochemical and petrologic constraints with the geophysical data emerging from EarthScope to elucidate the post-rift evolution of ENAM.

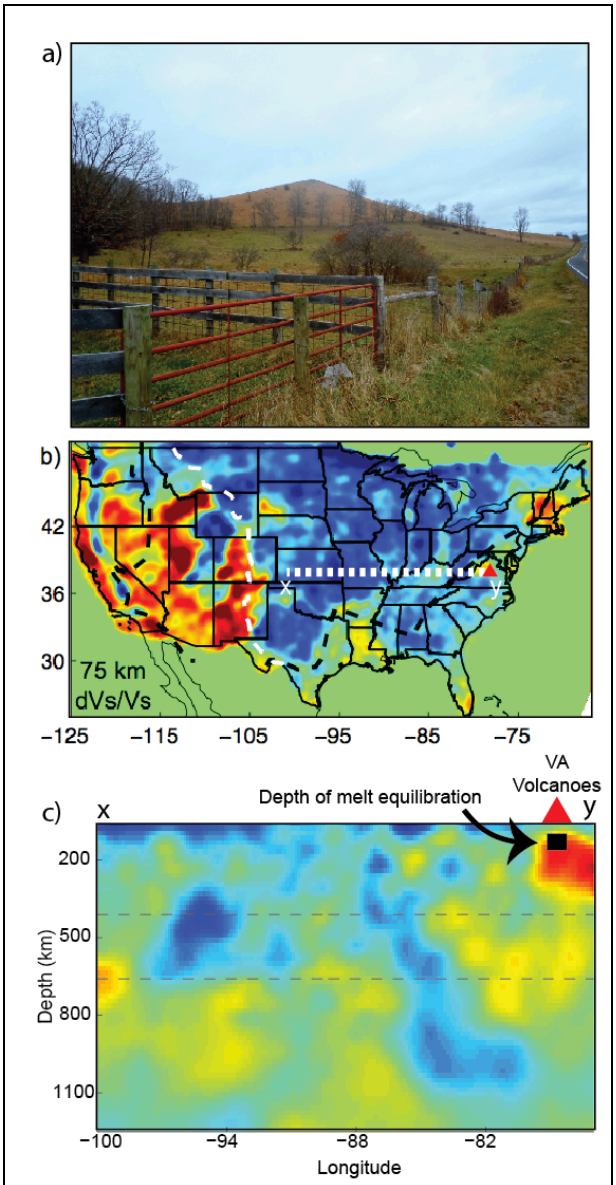

Fig 1. a) Trimble Knob in VA. b) dVs/Vs results at 75 km from (Schmand and Lin, 2014) c) Cross-section and results of pressure of equilibration from the Eocene volcanoes.