Tectonic Significance and Petrogenesis of Igneous Intrusions in Central Arkansas: Implications for Mississippi Embayment Evolution

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Abstract

The Mississippi Embayment (ME) is a south-plunging basin extending from Southern Illinois toLouisiana and containing 1.5 km of Mesozoic to Cenozoic sediments unconformably overlying normally-faulted Paleozoic rocks. Bordered to the West by the Ouachita fold and thrust belt and the ArkomaBasin, the ME serves as a northward extension of the Gulf of Mexico coastal plain. This study aims toprovide insight into the ME's evolution in the context of Mesozoic extensional tectonics by providingnew thermochronometric age data from a) volcanic rocks overlying Late Paleozoic units and b) dykes that cut through these units in east-central Arkansas. Radiometric age-dating from large igneous intrusions of the Arkansas Alkaline Province (AAP) has been used to study evolution of the ME. Most of these studies present age data from larger igneous provinces within the AAP, including Granite Mountain, Saline County, Dare Mine Knob, Magnet Cove,and Potash Sulfur Springs. Based on these ages, it has been suggested that westward movement of the North American plate over the Bermuda hotspot led to regional uplift followed by subsidence, which allowed coastal sediments to fill the basin. Evolution of the ME has also been linked to extensional tectonics of the region, focusing on the reactivation of basement faults known as the Mississippi Valley Graben (MVG), which formed during the breakup of Pangea. In this study, we focused on an E-W sampling route from Little Rock, AR, westward into the Ouachita fold and thrust belt. We collected samples from exposures of igneous dykes and sills at 12

locations. Previously, these locations have not been systematically sampled, due to dense vegetation and thus sparse rock exposures. Thermochronology (Ar-Ar and U-Th/He) of these samples, combined with previous age data, will allow us to limit the timing and rates of these intrusions, how they relate to the unconformity between Paleozoic and Mesozoic units, and the extensional evolution of the ME. The samples contain abundant primary zircons originated during a regional transition from rhyolitic to basaltic magma in the early stages of extension in the ME. Our detailed radiometric age-dating will provide the timing of this transition. Understanding this transition will also have implications for sediment provenance in the Gulf of Mexico and the bordering Arkoma Basin.