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U-Pb Detrital Zircon Signatures of Mississippian Clastic Rocks and their Tectonic Implications, Southern Mid-continent, United States

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The Mississippian succession in the southern mid-continent, United States, is characterized by shallow marine limestones and deeper marine shales interbedded with paralic and non-marine sandstones and siltstones. Provenance and potential dispersal paths of these terrigenous clastics remain a subject of debate. Two models, local sources driven by base level changes and/or distal sources related to regional tectonics, have been proposed based on field and petrographic evidence. In this study, twelve Mississippian sandstones were sampled along the northwestern Arkansas outcrop belt, and analyzed using LA-ICP-MS U-Pb detrital zircon geochronology. Results document mixed contributions by five distinct age groups: 0.4-0.6 Ga, 0.9-1.2 Ga, 1.3-1.5 Ga, 1.6-1.8 Ga, and >2.5 Ga. The youngest age group, 0.4-0.6 Ga, was likely derived from the Acadian and Taconic orogenic terrane. The majority of the Grenville age grains (0.9-1.2 Ga) was likely inherited and experienced recycling. The three oldest age groups, 1.3-1.5 Ga, 1.6-1.8 Ga, and >2.5 Ga, were sourced from the Granite-Rhyolite province and Yavapai-Mazatzal province comprising the North American mid-continent, and the Superior Province, respectively. Early Mississippian sandstone shows one major Superior Province age peak (~2.6 Ga), two minor Grenville (~1.0 Ga) and Yavapai-Mazatzal province (~1.8 Ga) peaks, and no grains younger than ~1.0 Ga. In contrast, all late Mississippian sandstones show all five age groups with a concentration of Grenville age, and minor peaks of the Acadian-Taconic, and mid-continent age groups. Age distributions preserved in southern mid-continent Mississippian clastic rocks indicate a change in source area from a broad Laurentia passive margin to the Appalachian-Ouachita tectonic belts. Early Mississippian intervals were derived from a northern cratonic source, whereas late Mississippian intervals reflect mainly recycled Appalachian sources from the north and northeast, but with a modest contribution from the mid-continent. There is no evidence for an exhumed Ozark Dome during the Mississippian.