Chronology and Provenance of Late Mississippian-Early Pennsylvanian Clastic Influx to the Hugoton Embayment and Arkoma Shelf, Constraints on Transcontinental Sediment Transport and Regional Tectonics

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ABSTRACT

The Late Mississippian to Early Pennsylvanian is a critical time interval across the globe, with major changes in tectonics, climate, and eustacy. Transcontinental sediment transport in North America, from the Appalachians to Great Canyon, has been proposed to initiate at this time (Gehrels et al., 2011). In the midcontinent, clastic influx to the Hugoton Embayment and Arkoma Shelf, during this period of widespread carbonate platform deposition, may record evidence for this model, but the limited number of studies on the provenance of sandstones has hindered interpretations. To test this model and further constrain sediment dispersal and source-to-sink systems in the midcontinent, we evaluate the provenance of upper Mississippian to middle Pennsylvanian siliciclastic intervals, in two areas, using sandstone component analysis and detrital zircon U-Pb-He double dating. (1) In the Hugoton Embayment, we are analyzing sandstone intervals deposited in two clastic valley-filling systems, the Chester and Morrow. We are analyzing 15 core samples, 9 from Chester and 6 from Morrow, from 7 oil fields in the southwestern Kansas. Preliminary analysis suggests that the Morrow sandstone is more broadly distributed and is coarser grained than the Chester, and may support changing regional tectonics and provenance during the early Pennsylvanian. (2) For the Arkoma shelf, we are analyzing 11 samples, collected from outcrops in northwest Arkansas, covering 9 clastic intervals, that capture the transition from the Late Mississippian stable shelf to the Middle Pennsylvanian foreland basin. The detrital zircon U-Pb crystallization age spectra and (U-Th)/He cooling ages will provide new constraints on the age and depositional lag time of these units, and cooling history of sediment source regions. The results may also have implications for the distribution and quality of reservoirs in the prolific hydrocarbon-bearing Anadarko and Arkoma basins, located to the south.