Sediment Routing and Provenance of Shallow to Deep Marine Sandstones in the Late Paleozoic Oquirrh Basin, Utah

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Abstract

The Oquirrh Basin is a Pennsylvanian to early Permian mixed clastic and carbonate basin in northwestern Utah. The basin is the northwestern-most expression of the Ancestral Rocky Mountains (ARM) orogeny, and locally contains up to 9 km of sediment. Depositional facies range from shelf carbonates to deep marine turbidites, debrites, and hybrid flow deposits, with a general deepening from basin initiation to the early Permian; however, the tectonic drivers and sediment source(s) for the basin are poorly constrained. To better understand the subsidence and tectonic history of the Oquirrh Basin, tectonic subsidence analysis was performed on 10 published stratigraphic sections across the basin. Two phases of tectonism are interpreted to have occurred on either side of the basin, forming distinct depocenters during the middle Pennsylvanian and early Permian. Pennsylvanian subsidence is interpreted as a flexural response to a crustal load east of the basin coeval with the ARM, whereas Permian subsidence in the western part of the basin may be related to the uplift and unconformity sequence documented in the Antler Overlap basins of northeastern Nevada. Unlike other ARM basins, no basin-bounding fault or highland has been identified.To test links between sediment provenance and tectonism, 34 thin-sections were analyzed from 8 locations in a northwest to southeast transect across the basin. Gazzi-Dickinson point counting was used to determine composition and provenance. Samples fell into three compositional categories: quartz arenite, sublitharenite, and quartz wacke indicating cratonic interior and recycled orogenic provenances. U-Pb ages for 845 individual detrital zircon grains in six late Paleozoic samples reflect derivation from Paleozoic and Proterozoic crustal terranes across the

Laurentian craton, including the Greater Appalachian orogen. Proterozoic grains are interpreted to have a significant chance of being recycled from the early Paleozoic Cordilleran passive margin, but with an ultimate zircon source in eastern or central Laurentia. Zircon age results suggest the presence of transcontinental sediment transport systems that periodically transported grains from the southeastern part of Laurentia to the coast of western Laurentia from the late Proterozoic to the late Paleozoic. Therefore, sediment transport into the basin appears largely unaffected by local tectonism.

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