

Regional Tectonic Control on Leonardian Sediment Dispersal and Stratigraphic Patterns in the Permian Basin and Texas Panhandle

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Abstract

Late Paleozoic continent-continent collision had a significant influence on regional uplift and basin evolution in southwestern Laurentia. The controls on Leonardian stage sediment dispersal in the Permian Basin and Texas Panhandle, including the Delaware, Midland, and Palo Duro basins, are poorly constrained. The epeirogeny in southwestern Laurentia that resulted from late Paleozoic Gondwana-Laurentia collision are thought to have significantly impacted sediment dispersal and depositional system evolution. We test our hypothesis by using new detrital zircon data, core description, wireline-log correlation and published seismic and detrital zircon (DZ) data and paleogeographic maps. Detrital zircon data of the Red Cave sandstone in the Palo Duro Basin are similar with those of the Tubb and Dean sandstones in the Northern Shelf and floor of the Midland basin, respectively, and we interpret these units as time equivalent. Moreover, Red Cave, Tubb, and Dean sandstones have a much less Grenvillian age (ca. 900–1300 Ma) DZ component than published DZ data of Permian Basin in the Wolfcamp D Formation, Spraberry Formation, and Delaware Mountain Group and have more dominant Paleozoic (ca. 250–500 Ma) and Pan African (ca. 500–750 Ma) DZ age components. High-angle cross bedding, absence of marine fossils, and widespread anhydrite in the Red Cave sandstone suggest wadi plain and sabkha depositional systems, and these characteristics combined with previous depositional system studies of the Pennsylvanian period of Palo Duro Basin indicates that the

basin transitioned from a marine to terrestrial setting from Pennsylvanian to Leonardian time. This depositional environment transition likely resulted from basin uplift and/or rapid sedimentation. The combined evidence of depositional system and DZ data of Red Cave, Dean, and Tubb sandstones suggest the Red Cave sand acted as an intermediate source to feed the Tubb and Dean sands from north to south. Subsurface correlations indicate significant progradation of the shelf margin in the Texas Panhandle and north of Midland Basin during Wolfcampian and Leonardian stages. The shelf-to-basin correlation of Leonardian strata in the northern Midland Basin show offlapping stratigraphic patterns, consistent with published seismic-reflection data. This offlapping stratigraphic pattern probably resulted from regional uplift and increased sediment supply from the source region.