

Early Permian Erg Deposits, Paradox Basin, Utah: A Large-Volume Sink for Sediment Delivered to Western Pangea by Transcontinental Rivers

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Abstract

Permian eolian deposits of the Ancestral Rocky Mountains and the Colorado Plateau of the Four Corners region, USA, constituted a regional sink for sediment transported westward by transcontinental rivers that crossed Pangea. During the Early Permian, transcontinental drainage systems delivered large volumes of compositionally mature sand to the margin of an epicontinental seaway (modified by Ancestral Rocky Mountain depocenters), along the margin of which the sand was transferred southwestward by longshore drift and then inland to the southeast by dominant Pangean northwesterly winds. The sediment accumulated in extensive ergs along the northwestern flank of the transcontinental arch.

An excellent example of this sedimentologic scenario is the Cutler Formation, which consists of intercalated fluvial arkose and eolian quartz arenite-subarkose, and represents the principal clastic fill of the Pennsylvanian-Permian Paradox Basin. The eolian facies of the Cutler Formation is termed the White Rim Sandstone. Detrital zircon analysis indicates that feldspathic fluvial sediment was derived exclusively from basement rocks of the adjacent Uncompahgre uplift.

In contrast, intercalated eolian strata, deposited in salt minibasins of the proximal basin and forming an extensive sand sea in the distal basin, constitute a mix of sediment derived from local Ancestral Rocky Mountain and Appalachian sources, or completely lack evidence of local basement sources. Large volumes of compositionally mature sand from distal sources thus form important sedimentary accumulations influenced by local salt tectonics.

The Permian eolianites represent an alternative to the standard “source-to-sink” model, in which a submarine fan constitutes the ultimate sediment sink at the terminus of a continent-scale drainage basin. In the Permian example, sediment was not transported all the way to the continental margin, but rather was intercepted by a shallow seaway on the western edge of Pangea and was redistributed along the flank of that seaway by effective eolian transport in an arid climatic setting.