

Dakota Group Fluvial Systems of the Colorado Front Range: Provenance, Geochronology, and Paleogeographic Significance

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Abstract

Bob Weimer made first-order contributions to understanding of Cretaceous rocks of the Colorado Front Range and, more broadly throughout the Laramide Rockies. In this presentation we build on his timeless work by summarizing new detrital-zircon (DZ) U-Pb provenance and geochronology data from the Cretaceous Dakota Group, and outline the significance of Dakota Group strata to Cretaceous sediment routing.

The Front Range Dakota Group rests on the sub-Cretaceous unconformity, and represents fluvial, deltaic, and shallow-marine strata deposited in the Sevier foreland basin backbulge. We analyzed the DZ U-Pb signatures of the Early Cretaceous Lytle and Plainview units, and the mid-late Cretaceous Muddy sandstones to help define provenance and sediment routing, and provide maximum depositional ages (MDAs). Lytle and Muddy fluvial systems had headwaters in the Sevier fold-and-thrust belt and magmatic arc, consistent with previous interpretations. However, samples from Purgatoire and Canon City represent a slightly different source terrain from samples at Dinosaur Ridge and Fort Collins, which indicates two long-lived west-derived river systems. Moreover, we obtained MDAs of ca. 148-150 Ma from the underlying Jurassic Morrison Formation, and ca. 98-100 Ma from Muddy sandstones: both units were deposited during periods of high flux in the magmatic arc, syndepositional zircons are common, and MDAs are consistent with biostratigraphic ages. The Lytle and Plainview are Barremian through early Albian in age from biostratigraphic data, a time period that corresponds to a magmatic lull, hence syndepositional zircons are uncommon and we did not obtain useful MDAs.

Our Dakota Group study is part of a broader effort to understand Early Cretaceous sediment routing to the Alberta foreland. Early DZ U-Pb studies proposed that the Barremian to Aptian McMurray Formation in Alberta represents the trunk stream of a continental-scale south-to-north flowing river system. We test this model with DZ U-Pb analyses from the McMurray, as well as the basal Cretaceous Cheyenne sandstone of western Kansas and Lakota sandstone of the Black Hills in South Dakota, and Dakota Group sandstones of eastern Nebraska and Kansas. DZ U-Pb signatures of the Cheyenne and Lakota are statistically indistinguishable from the McMurray signature in east central Alberta, and represent a mixture of Lytle sandstones of the Front Range, and the classic east-derived Appalachian DZ U-Pb signature in Dakota Group strata of eastern Nebraska and Kansas. These data refine previous interpretations of a continental-scale river system, with headwaters that stretched from the Sevier fold- and-thrust belt and magmatic arc to the Appalachians: this river system was the Amazon or Mississippi of its time, and predated Latest Cretaceous to Paleocene continental-scale drainage reorganization that routed water and sediment from southern North America to the Gulf of Mexico.