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Cretaceous through Paleogene North American Drainage Reorganization from Detrital Zircons

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The past decade has seen advances in our understanding of sediment routing through time using detrital zircons (DZs). This presentation summarizes an extensive DZ dataset that informs on mid-Cretaceous to Paleogene North American drainage reorganization, and Gulf of Mexico (GoM) drainage integration[1].

The primary GoM DZ dataset includes >7000 U-Pb and Pb-Pb ages from 83 samples of Cenomanian, Paleocene, and Oligocene fluvial deposits: samples were collected across outcrop belt on the inner Gulf Coastal Plain, from Alabama to Texas. Moreover, samples were collected from major river systems that feed the GoM, so as to test the efficacy of the DZ as a faithful recorder of drainage basins. Complementary DZ data includes Aptian to Cenomanian samples from the Great Plains and Rocky Mountain Front Range, and the Aptian-Albian Alberta foreland. Collectively, these data show that much of North American drainage during the early-mid Cretaceous was part of a continental-scale network with headwaters that extended from the Appalachian-Ouachita Cordillera to the SW US, and routed sediments to the Alberta foreland backbulge and the Boreal Sea. The Aptian-Albian Mannville Group, primary repository for the Alberta Oil Sands, is the record of this giant river system. During this time, and through at least the Cenomanian, GoM drainage was restricted to the area south of the Appalachian-Ouachita Cordillera: Cretaceous fluvial deposits of the Gulf Coastal Plain contain no indicators of connection with the Western Cordillera, fluvial systems were of regional scale only (<<10^6 sq. km drainage areas), and the largest system is interpreted to represent a paleo-Tennessee River that discharged to the Mississippi embayment and eastern GoM.

By the Paleocene, much of southern North America, from the Appalachians to the Western Cordillera, was routed to the GoM through a series of major fluvial axes that remain extant today. These included the paleo-Tennessee and its Appalachian source terrain, and an ancestral Mississippi-Arkansas system with an estimated drainage area >10^6 sq. km that included the central and northern Rockies. However, the largest axes were farther west in Texas, and included an ancestral Colorado-Brazos system with headwaters in the Sierra Nevada, Sevier fold and thrust belt, and the Rocky Mountains, and an ancestral Rio Grande with headwaters in the Mexican Cordillera: the paleo-Colorado-Brazos axis had an estimated drainage area >>10^6 sq. km, and length scales >2000 km. Beginning in the Oligocene, far western headwaters were tectonically dismembered, and GoM drainage areas extended no farther west than the eastern Rockies, heralding development of the Neogene to present continental divide. Moreover, the primary routing of sediments to the GoM shifted eastward to its present-day location within the Mississippi embayment, most likely due to migrating patterns of geodynamic uplift and subsidence.

References:

[1] Blum, M. and Pecha, M. (2014) Geology, v. 42 (7), p. 607-610.