Reconstructing the Zama (Mexico) Discovery Source to Sink Story, Part 1: Detrital Zircon U–Pb Provenance Analysis and Implications for Sediment Source Dynamics

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ABSTRACT

The Zama discovery in the Sureste Basin of the Gulf of Mexico is hosted in a three-way closure in Upper Miocene sandstone. This study conducted a detailed detrital zircon (DZ) U–Pb data on 22 sandstone samples from sandstone reservoirs in two Zama wells to determine provenance signatures and maximum depositional ages, reconstruct source areas, and explore regional drainage evolution and hinterland tectonics. The DZ U-Pb age spectra show remarkably homogenous DZ signatures with nearly constant age mode percentages, displaying dominant Permian/Chiapas Batholith (~35–45%), Mesoproterozoic/Oaxaquian (~20–35%), Early Paleozoic/Acatlan (~8–20%), and Cenozoic Magmatic Arcs (~15–25%) age modes, plus some subsidiary early Proterozoic/Archean and Early Cretaceous DZ age modes (<5%), linked to the Guerrero Terrane and Alisitos arc. Despite apparent differences in paleocurrent directions, there are no systematic differences in DZ spectra, indicating a constant provenance and no changes in source area. All Zama samples exhibit abundant syn-depositional Late Miocene DZ grains, clustering between 8.6-10.2 Ma, corroborating a Tortonian depositional age, and yield rapid accumulation rates of ~200 m in <1.4 Ma. These new DZ U–Pb data show a nearly invariant Tortonian provenance signature that is most similar to the modern Grijalva River coming out the Chiapas highland. This paleo-Grijalva drainage, providing sediment to the Late Miocene Zama minibasin, was likely drastically larger as evidenced by 10 Ma plutonic sources - now downfaulted along the Pacific coast in the latest Miocene and no longer present in the modern Grijalva River. Importantly, additional DZ age components attributable to Oaxaquia, Acatlan, and Guerrero/Alisitos point to sediment sources likely associated with Chortis. Such a scenario would invoke a substantially larger Miocene paleo-drainage that would have encompassed both Chiapas and portions of Chortis. This would also reconcile the dramatically enhanced Middle to Late Miocene sediment supply, funnel-

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ing a large sediment flux from a larger and tectonically active hinterland into the salt-defined Zama minibasin and southern Gulf of Mexico.