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Reconstructing the Zama (Mexico) Discovery Source to Sink Story, Part 2: Implications for and Predictions within the Depositional Sink

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ABSTRACT

Source terrane history and paleolandscape illuminated by detrital zircon U–Pb ICP–MS and (U–Th)/He data provides context for understanding transport processes and autocyclic factors controlling reservoir distribution in the upper Miocene Zama basin of offshore Mexico. Empirical scaling relationships allow testable predictions submarine fan run-out lengths and widths over lease blocks being evaluated for exploration.

The reconstructed basin margin resembles modern Mexico with a narrow shelf and slope leading into a deep marine basin. The point of basin entry of sand-rich high density turbidity flows was probably near the modern Grijalva delta or further west, depending on the strength of paleo-longshore currents which today flow westward. There are no documented large scale canyon systems in the area that might confine flows to a single-entry point. However, any number of pathways to the two Zama discovery delineation wells sampled for detrital zircon would involve deepwater flows encountering paleobathymetric highs resulting from Neogene salt tectonics. In any case, entry to the upper Miocene Zama salt-defined mini-basin must have involved sustained sediment flux from the south and east from the delta entry point. Prospects that are present to the south and east of the Zama wells aligned with these pathways would likely contain comparable volumes of similar-age sandstones as in the Zama wells.

The uniform provenance of the upper Miocene samples suggests sustained contribution from a single source terrane. This appears initially to be at odds with image log analysis indicating paleocurrents shifting from transport to the west, northeast, and west-northwest over the geologically short Tortonian stage timeframe documented with maximum depositional age analysis. Therefore, it may be concluded that image log interpretation of paleoflow is more a reflection of autocyclic processes of compensatory deposition and local flow deviation and not major changes in provenance.

Detrital zircon thermochronology indicates estimated sedimentation rates of 200 m in 1.4 m.y. (470 ft/m.y.), which are comparable to the Lower

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Wilcox of the northern Gulf of Mexico. This is surprising, given the much smaller size of the paleo-Grijalva drainage system. However, passage of the Chortis block related to Pacific margin tectonics probably increased contributing catchment sizes and river dimensions by 30 to 105%. Combined with rapid uplift and high precipitation rates, this likely led to a pronounced but temporally short increase in discharge and sediment delivery to the deep basin. Empirical scaling relationships which include the Chortis block passage would predict maximum submarine run-out lengths of nearly 400 km, covering much of the Campeche salt basin. Of course, the rugose paleobathymetry related to near surface salt bodies in the Tortonian would be expected to locally impede or shorten coeval deepwater channel-lobe systems.