Evolution of the Paleogene Wilcox Group Yoakum Canyon and Linking Gulf of Mexico Margin Submarine Canyons to Regional Tectonics

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ABSTRACT

In northern Gulf of Mexico, a clustering in a 100-150 km wide area of six Late Cretaceous-Paleogene age incisions up to 1000 m deep and 100 km long suggest a structural rather than eustatic control. The incisions counterintuitively align with the basinward trend of the San Marcos Uplift instead of forming in front of large sediment fairways (rivers) that formed depocenters of the Rio Grande and Houston embayments . This study proposes two new possible mechanisms for canyons formation in addition to low sea level stand model. The "low uplift rate" (LUR) scenario suggests the slow vertical rise and extent of the uplift onto the shelf and bulges the shelf edge that in turn increased the shelf and slope gradients triggering the initial incision. The continuous (or intermittent) uplift supported long term headward erosion. The "high uplift rate" (HUR) scenario suggests a fast vertical rise and extent of the uplift into the inner shelf area, the high uplift rates diverted the river away from the area and protruded the shoreline as a headland. The headland diverted the longshore currents and sediment transport toward the shelf margin and eventually cascading over the shelf edge triggering incision and formation of the canyons.

The Sabine Arch and LaSalle Arch also uplift regions around the Gulf of Mexico Basin, which align with large slope incisions that indicate a possible main control of tectonism on canyon formation. The large-scale tectonic uplift control on the location and evolution of the canyons have not been described before, and if this proves to be a common formative mechanism it would have a significant impact on the architecture of the basin margins and basin fill.

In addition to the tectonic control of canyon formation, canyon evolution can be longer lived than previously described for some of the Wilcox Group large scale incisions. By mapping 12 high frequency regressive-transgressive sequences within the Lower Wilcox in the San Marcos Arch region, (1) sand thickening patterns and (2) lack of log signature correlation across the Yoakum Canyon suggests that Yoakum Canyon was active for a longer period than previously described. With the Yoakum Canyon being active during Lower Wilcox time, the canyon(s) evolution would be in the scale of millions of years rather than 100,000 years. Over this time scale, the deep water was supplied from the submarine canyon (s) when lateral switching of the delta depocenters reached the proximity of the canyon during inner to outer shelf transits. The relationship of Wilcox Group incisions with tectonics and long lived evolution of canyons provides insight into the large volume of clastic sediment and possible new mechanisms for sediment delivery to the deep water Gulf of Mexico.

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