Early Paleogene Isolation of the Gulf of Mexico from the World's Oceans: From Hypothesis to Theory

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Abstract

Rosenfeld and Pindell (2002, 2003) hypothesized that the Gulf of Mexico evaporated to a level below the world ocean for a brief interval during the Paleocene-Eocene. Further study and the results of recent drilling support this idea and suggest that a major change in the interpretation of the Gulf's history may be warranted.

The idea originally arose to explain several major Paleocene-Eocene paleocanyons found on the contemporaneous shelves and slopes of the Gulf of Mexico (e.g. Yoakum, Chicontepec, etc.), and theextensive unconformity in the deep water area around the mouth of the Gulf (e.g. DSDP Site 535).

The hypothesis ascribes the former to fluvial rejuvenation during the evaporative drawdown of the Gulf upon isolation from the world ocean by the collision of the Cuban Arc against the Yucatan and Florida-Bahamas Blocks, and the latter to erosion during the catastrophic entry of sea water as the oceanic connection was re-established.

An important prediction of this hypothesis is that material eroded from the shelves during the evaporative drawdown would have been redeposited in the deep Gulf basinward of the canyon systems as slope and basin floor fans. This has been confirmed by the discovery of abundant, well developed deep-marine sandstone reservoirs in the Upper Paleocene portion of the Wilcox Formation (Blickwede, et al., 2004) across a wide swath of the western and central deep water Gulf of Mexico (Meyer, et al., 2004). We interpret this thick sand accumulation to consist of Wilcox shelf sands that were remobilized into the deep basin during the lowstand.

More evidence for the evaporative drawdown of the Gulf is a salt body drilled in the Veracruz Basin of Mexico (Pemex Mataespino-101B well). Since the Veracruz Basin formed during the final stage of oceanic spreading in the Gulf (Early Cretaceous), it did not yet exist during the widespread deposition of the Middle Jurassic Salt. Moreover, from its inception, the Veracruz Basin has been separated from the Gulf of Mexico by the Tamaulipas-Golden Lane-Chiapas transform ridge (Bird et al., 2005), or Anegada High. During the drawdown, we propose that this ridge would have completely isolated the Veracruz Basin, which then dried up. Core from the Mataespino salt is stratified and reddish-brown in color and is underlain by reddish-brown shale and siltstone of indeterminate age. It is overlain by thick, homogenous, dark gray marine shale of Eocene age, indicating a sudden return to open marine conditions at that time. Corrected for dip, the salt interval is about 30 meters thick; about the thickness that would precipitate from the complete evaporation of a 2,000 meter sea water column.

Another indication of the drawdown is a group of large sinkholes surveyed south of Florida in water depths ranging from 256 to 439 meters (Jordan, 1954); much deeper than the maximum Pleistocene sea level drawdown of ~130 meters. This suggests that these sinkholes developed subaerially during the proposed Paleocene-Eocene lowstand.

The existence of these sinkholes leads us to predict that an extensive paleokarst surface may be present on the carbonate-capped knolls between Florida and Yucatan (Jordan Knoll, Pinar del Río Knoll, Catoche Knoll), and on the flanks of Catoche Tongue in northeastern Yucatan; all in water depths that exceed 1,000 meters. Detailed study of the available seismic data over these fea-

tures should provide the critical evidence that would convert the Paleocene-Eocene Gulf of Mexico drawdown from hypothesis to theory.

References

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