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The Tectonic Evolution of the Southern Margin of North America: Insight from an Interdisciplinary Investigation of Basin Evolution along the Southern Gulf of Mexico

An integrated stratigraphic and structural evaluation of seismic and well-bore data from the Tertiary Veracruz/Coatzacoalcos and Macuspana Basins of southern Mexico reveals a structural framework that is consistent with the tectonic framework of the southern margin of the North American plate. In this context, trap formation and basin evolution is tied to the fragmentation of the Cocos plate into the Cocos-Rivera plate system.

The Veracruz and Coatzacoalcos region represents a modified Laramide-age foreland depression that formed over transitional crust between the Gulf of Mexico and a continental fold and thrust belt. The basin has undergone long-lived transpressional basin inversion characterized by the reactivation of early Tertiary extensional faults to produce marginal uplifts and concomitant downward flexure of the basin center. In the Coatzacoalcos region, folding and thrusting have produced a reentrant of uniform vergence. Maximum strain rates occurred uniformly throughout the region around 6 Ma, which corresponds to the formation of the Rivera plate.

In contrast, the Macuspana Basin is positioned above transitional crust located between the Yucatan Platform and the Sierra Chiapas fold and thrust belt. The early Tertiary history of the basin is poorly defined, but it is suspected that northwest-directed extension accommodated locally thick shale sections during Oligocene. By the middle Miocene, shortening along the southern margin of the basin appears to have triggered shale diapirism, a structural style that dominated until a late phase of basin-wide inversion. Inversion produced most of the four-way closures and is also linked to the reorganization of the Cocos plate at 6 Ma.