Geodynamics of the Mexican Orogen and Foreland Basin System at the Latitude of Linares, Nuevo Leyn, Mexico

Gary G. Gray[1], Bill Farrell[2], and David Blank[3]

[1]Rice University, Houston, Texas
[2]ExxonMobil Upstream Oil and Gas, Houston, Texas
[3]Applied Research Laboratories, Austin, Texas

Abstract

The Monterrey salient is a prominent foldbelt in northern Mexico that developed during Late Cretaceous–Paleogene time along with a significant foreland basin. Recycled carbonate grains in Coniacian sediments indicate the onset of deformation and foreland sedimentation. Sediment accumulation and deformation waned in the Eocene.

Recent work at the latitude of Linares, Nuevo Leyn, has established that the entire deformational belt rides on an east-verging evaporite detachment beneath Uate Jurassic strata. This detachment occurs at a relatively constant elevation, suggesting a nearly horizontal basement and little duplication of the cover section. Local basement uplifts refold and cut the detachments.

This foldbelt presents several enigmas. There is no crystalline core ‘back stop’ to the west, raising questions about what drove the foldbelt eastward. Similarly, there is limited structural duplication (thickening) in the cover sequence, which is an inadequate load to explain the foreland basin. A third conundrum is provided by thermochonology, calibrated with fluid inclusion analysis and vitrinite reflectance. These data indicate that 7 km of sediment was deposited on top of the foldbelt between 80 and 40 Ma.

Faulting in the foldbelt has been directly dated as young as 47 Ma, thus, the foldbelt subsided at the same time it was contracting. We propose that both the contraction and subsidence were due to coupling between a relatively flat subducting oceanic plate and the overriding continent. This coupling contracted the cover rocks while dynamically pulling the crust downward, resulting in sediment being piled on the active foldbelt. Dynamic pull-down ceased once the slab rolled back to the west, which led to rapid inversion and recycling of the sediments eastward into the Gulf of Mexico.