Sequence Stratigraphy and Structural Evolution of the Perdido Fold Belt, Northwestern Deep Gulf of Mexico

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The Perdido fold belt is one of the last untested major structural provinces inside the continental USA. Analysis of 12,000 km of 2-D multifold seismic data shows three large Cenozoic wedges of deep water deposits in the fold belt that differ in seismic facies, areal distribution, and potential reservoir geometries. Together, these three wedges reflect the changing positions of Cenozoic depocenters and record the evolution of the Perdido structural province.

The Paleocene to middle Oligocene interval, which is strongly folded, reflects pregrowth deposition. Paleocene and Oligocene strata thicken westward and consist dominantly of medium- to high-amplitude, subparallel reflections of varying continuity. Broad channels and channel-levee systems are interpreted, suggesting active turbidite depositon at this time. These strata are potentially sand prone and are interpreted as the downdip equivalent of the Wilcox (Paleocene) and Frio (Oligocene) shallow-water depocenters. Eocene strata are dominantly discontinuous, low-amplitude, subparallel reflections interpreted to be shale prone.

The upper Oligocene to upper Miocene interval consists of multiple well-developed sequences with variable amplitude and divergent reflections, many of which onlap and terminate against the fold crests. Sequences within this interval are often modified by erosion, faulting, and/or slumping against the folds.

The upper Miocene to Recent interval, which overlies most of the folds, consists of channel-levee, overbank, slump, and layered or amalgamated turbidite sheet deposits. These are similar to other coeval large submarine fan sediments in the northern deep Gulf (e.g. Mississippi fan).

The overall structural geometry of the fold belt is relatively simple, although individual structures show a complex array of structural styles. Previous interpretations have modeled these structures as either growth-fault-bend folds or salt-cored detachment folds. Structural interpretation of high-quality 2-D seismic data, combined with detailed analysis of the growth strata and both 2-D and 3-D restorations, provides the necessary control to model these structures accurately.

2-D restorations show that the observed geometries of the folds and their growth strata are compatible with a detachment fold model. The folds developed due to gravitational gliding above and at the basinward limit of a thick layer of autochthonous salt. The growth strata indicate a relatively short period of folding and uplift during the Oligocene to early Miocene.

3-D restorations of an anomalous, dome-shaped structure suggest it formed due to interference between an elongate, NE-SW trending anticline and a NW-SE trending basement feature. The real test of our restorations, and the viability of the Perdido fold belt as a petroleum province, remains to be tested by exploratory drilling.

Biographical Sketch

Joseph C. Fiduk received his Bachelor's and Master's degrees from the University of Florida in Gainesville and was hired by Gulf Oil as a geophysicist. He subsequently completed a Ph.D. at the University of Texas at Austin. He has worked at the Texas Bureau of Economic Geology and is currently a research associate in the Department of Geological Sciences at the University of Colorado. ■