The Port Isabel Fold Belt Driven by Neogene Gravitational Spreading; East Breaks, Western Gulf of Mexico

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ABSTRACT

The Port Isabel Fold Belt (PIFB) is situated at the northwestern corner of the northern Gulf of Mexico forms an allochthonous thrust wedge that ramps up towards West with shallow salt sheets at the front. The fold belt constitutes predominantly Oligocene siliciclastic sequences forming eastward facing folds and thrusts which are well imaged on recently processed 3D seismic data. Crystal III is a wide-azimuth 2011 survey and reprocessed in 2016 leveraging new technologies. 3D deghosting, directional designature, and multi-model 3D SRME resulted in broader frequency spectrum. The new image benefits from unique implementation of FWI, combined with classic tomographic updates.

Seismically transparent zones indicating pressured shales are limited to the core of anticlines or footwalls of internal thrust. Mobile shales associated with diapirs are absent in the study area, whereas mobile salt apparently forms the major PIFB decollement as indicated by salt residuals along the major thrusts and at the core of associated anticlines. Shallow salt diapirs seam to root in the fold belt and lacking evidence for salt feeders connecting to deep salt underlying the Mesozoic/ Paleogene substratum of the fold belt.

Towards the WNW the fold belt is transient into a extensional regime, characterized by deep reaching normal faults forming ultra-deep mini basins filled with Neogene deposits. Kinematic restorations confirm the simultaneous evolution of the ultra-deep mini basins and the outboard fold belt which resembles a gravitational spreading system. In this context the role of salt is enigmatic, as a major detachment ramp conflicts with the interpretation of a destabilized former salt canopy. It rather indicates syn-kinematic salt extrusion from a deeper source along the major thrust. A syn-kinematic (Poiseuille) salt flow along the major decollement (channel

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flow) is required to feed the salt accumulations (sheets) at the frontal section of the fold belt and to supply the shallow salt diapirs.