

Explaining Differing Styles of Salt Deformation in the Campeche and Yucatan Salt Basins, Southern Gulf of Mexico

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Abstract

The extensive Callovian-Bajocian Isthmian salt basin - extending over a distance of 700 km along the southern Gulf of Mexico (GOM) - remains the least explored and drilled areas of the GOM compared to better explored sub-salt plays of the larger Louann salt - extending 900 km along the conjugate margin in northern GOM. The Isthmian salt basin is divided into two salt sub-basins with differing styles of regional salt deformation: 1) the Yucatan sub-basin bordering the northern margin of the Yucatan continental block is characterized by 300-600 m thick salt rollers and normal faults rooted on a basinward-dipping, extensive salt detachment surface which deforms the base of slope into large salt diapirs up to 6 km tall that deform the seafloor; and 2) the Campeche sub-basin bordering the eastern margin of the Yucatan continental block is characterized by a sub-horizontal, top basement surface overlain by the Campeche diapiric salt sheet and its clastic sediment-filled minibasins that are largely in place and unaffected by the type of large-scale, downdip detachments observed to the east in the Yucatan sub-basin. We use an extensive grid of 2D, pre-stacked, depth-migrated seismic reflection data tied to wells to understand the difference in structural style between the two sub-basins. Mapping reveals that the boundary between the two sub-basins is a prominent, 110-km-wide, 400-m-high, northwest-trending basement arch which previous workers had identified from regional magnetic data and named the "Celestun Magnetic Anomaly". From seismic mapping, the basement arch - which we here rename the Celestun arch - exhibits vertical relief of several hundred meters (thus its strong magnetic signature) and is overlapped by

pre-salt, Callovian sedimentary strata demonstrating that the arch was a positive feature prior to the deposition of the combined, Louann-Campeche salt basin of Bajocian-Callovian age. When we remove the late Jurassic oceanic crust of the deep GOM and restore the two conjugate margins along the arcuate, fracture zone directions, the Celestun arch realigns with the DeSoto high on the Florida conjugate margin within an error of ~50 km. We propose that these two arches realign to form the eastern topographic border of the pre-oceanic, Louann-Campeche salt basin. A remaining enigma is why the Yucatan basement dipped more seaward and the Campeche basement remained sub-horizontal during their rift and passive margin stages.