Imaging of an Enigmatic Raft in a Shallow Roho System in the Northern Gulf of Mexico

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ABSTRACT

Allochthonous salt in the northern Gulf of Mexico typically occurs as complex, difficult to image geobodies—particularly in roho systems. Understanding the physical nature of these geobodies (shape, dimension, lithology, etc.) and the timing of emplacement is essential to capture the subsurface architecture for successful exploration. This study investigates a large (>1 km thick) inverted raft that was initially interpreted to be a salt body that has an impact on an accurate velocity model with further implications for successful subsalt exploration.

Initial uncalibrated seismic interpretation of the raft on legacy 3D seismic data yields a possible salt body at the edge of a roho system. However, the inclusion of the 1998 Amerada Hess Wrigley wildcat well (EW922#1) provides clear evidence of more than 1 km of inverted lower Miocene to upper Kimmeridgian section. The juxtaposition of Upper Jurassic limestones, shales, and marls against Zanclian shales and sands creates an acoustic impedance that may closely resemble salt-sediment interface typical for top salt interpretation in the northern Gulf of Mexico, but impedes the velocity model accuracy and proper depth imaging below its base.

The Wrigley well does not appear to exit the raft given the Lower Miocene sediments at the bottom of the well follow the inverted raft sequence. At this point, reprocessed seismic data utilizing modern processing tools such as full-waveform inversion (FWI) provide a more robust higher frequency (>35 Hz) subsurface image to better delineate the allochthonous geobodies from the younger surrounding sediments. The modern depth imaging to the Louann level provides evidence for the kinematics of the raft's emplacement at its current position, and offers a rare opportunity to test central Gulf of Mexico petroleum systems due to the well penetration of Tithonian source rock within the raft.

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