Salt Tectonics Within the Offshore Asturian Basin: North Iberian Margin

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ABSTRACT

The Asturian Basin is one of several basins developed in the North Iberian Margin during the opening of the Bay of Biscay. The infill of the basin ranges from the Upper Paleozoic to the present, holding a thick Mesozoic sedimentary sequence with Keuper evaporites at the base and up to 4,000 meters of Jurassic and Cretaceous deep marine sediments that have been explored for 40 years without any significant discoveries. The structural architecture of the offshore Asturian Basin is strongly related to salt tectonics. We present new interpretations showing minibasin-scale halokinetic features, diapir geometry, and pre-salt structures that illustrate the relationship between diapirism and regional tectonic events. Two salt tectonic domains are identified; a Western Salt Domain, dominated by vertical salt walls and an Eastern Salt Domain towards the deeper part of the basin, with fewer diapirs and more salt-detached thrust faults. Additionally, this domain shows more prominent salt sheets with greater lateral extent. We interpret that the Western Domain would have been at a structurally lower position during the initial stretching phase in the Permian-Triassic compared to the Eastern Salt Domain. Therefore, during the time of evaporite deposition, a greater thickness of salt was deposited in the Western Domain due to the greater amount of accommodation space. During the main rifting event, fewer diapirs formed in the Eastern Salt Domain because there was not enough salt supply to facilitate the growth of large, vertical diapirs. Additionally, the greater abundance of pre-salt normal faults in the Western Domain provided more nucleation points for diapirs to form. During the Paleogene, shortening was taken up by the existing vertical diapirs in the Western Domain and was accommodated by the creation of salt-detached thrust faults in the Eastern Domain where few vertical diapirs exist. We conclude with a halokinetic structural evolution that is representative for the interpreted diapiric structures: (i) Early Permian to Triassic stretching was followed by Keuper evaporite deposition; (ii) Upper Jurassic to Lower Cretaceous rifting triggered reactive to passive diapirism over the footwalls of pre-salt normal faults; and (iii) Paleogene shortening caused existing diapirs to be rejuvenated and squeezed, developing salt sheets before getting buried by the Miocene post-tectonic sediments.