

Constraining Salt Diapirs Rise Rates: New Insights from the Pelagian Platform (Northern Tunisia)

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Abstract

Salt involvement is crucial to characterize/quantify in compressive settings where the shortening (e.g. faults and folds) has preferentially deformed the preexisting salt diapirs. Understanding both pre-shortening salt diapirs locations and rise rates would at least help to constrain (i) the initial stages of poly-phased geologic models, (ii) the complex local geothermal gradients, (iii) the sedimentologic facies variations related to the creation of a diapir-growth-related topography and (iv) the hydrocarbon trapping potential and structure integrity. The Fkirine permit of NE Tunisia (Enfidha area) is partially located in the northern limit of the Pelagian platform where sediments were deposited in extensional regimes during Mesozoic and early Cenozoic times. These deposits (mainly carbonate rocks) have been moderately folded (9-12%) during both Early Eocene Pyrenean and Upper Miocene Atlasic compressive events. Our structural cross-sections across the Jebel Edjehaf anticline and the published cross-sections across Djebel Outchtetia suggest the existence of salt-related weld geometries in the Western part of the permit. The initial involvement of salt is therefore unclear where the compressive deformation partially hides the pre-existing salt structures. This study focuses on the pre-shortening configuration and aim to quantify salt diapir rise rates in the south of the studied area where the compressive deformation is slight to absent. Structural field cross-sections and 2D seismic profiles analysis show that salt diapirs have been diachronically active since Jurassic to Pliocene times in the Pelagian platform, delimitating well-preserved km-scale salt mini basins. Estimated sedimentation rates near the mini basin depocenters are comprised between 0.01 mm/year and 0.2 mm/year. This latter value is a maximum in the area for the upper Miocene units and is consistent with the prefolding timing inferred from the vitrinite reflectance data. These sedimentation rates are also consistent with published values for passive margin tectonics settings. Applying an atypical methodology, the computation of salt diapir rise rates highlights that average rates are below 0.1 mm/year. Maximum rates seem to occur during the Paleocene and the Pliocene. The average salt rise range is less or equal to the sedimentation rate in the studied area. These data highlight that the diapiric salt piercing (*sensu stricto*) did not occur during the geological history of the Pelagian Platform i.e. the amount of sediments was always higher than the diapir rise rate. These results are consistent with the loop mechanism of differential charging commonly interpreted as the main enhancement parameter of salt diapir rise.