AAPG Datapages/Search and Discovery Article #90254 ©2016, GEO-2016, 12th Middle East Geosciences Conference & Exhibition, Manama, Bahrain, March 7-10, 2016

Salt-related deformation in the Red Sea

Basil Tulbah[1], Ahmed Alhani[1]

[1]Saudi Aramco, Dhahran, SAUDI ARABIA

ABSTRACT

During the Middle Miocene within the Red Sea in Saudi Arabia, major marine restrictions lead to the deposition of Kial Formation anhydrites and Mansiyah Formation halites. During the Late Miocene, Ghawwas Formation clastics were deposited on the underlying evaporites. Syn-depositional deformation created locally restricted mini-basins within the Ghawwas, where evaporites were intermittently deposited within the clastics. These are reffered to as the layered evaporite sequence (LES) and appear as layered events within seismic data. Wells that drilled this sequence penetrated clastic sediments interbedded with anhydrites and halite.

This analysis highlights salt-related deformation in the semi-starved Red Sea rift basin. Halokinesis was driven by differential loading and the dip of base of salt. Ghawwas clasitcs deposited in sedimentary depocenters near the rift margin caused the extrusion of the Mansiyah salt into the basin and the evacuation of the salt layer near the rift shoulder. In a semi-starved basin, clastic deposition was controlled by sedimentary point sources. The majority of salt withdrawal is observed to have started at these entry points and prograded outwards.

Late sagging of the basin further accelerated the movement of both salt and the post-Mansiyah sediments toward the axis of the Red Sea. Where topographic variations in the basal geometry exceed the thickness of the salt, the Post- Mansiyah section and the seabed became folded and faulted. Some suggest that sub-salt faults propagated into the post-salt and deformed as a single body. We believe that is not the case near the coastline, where the faults became dormant before the Mansiyah formation was deposited. The salt partitioned the post-salt strata from the pre-salt and the observed deformation was caused by the lateral movement over an uneven base.

We also observe folding and accretionary wedge development in the post-salt Ghawwas strata, even though the basement structure was still being extended. This shortening is attributed to the salt basinward movement, which inflated and caused a space problem for the post-salt strata. With additional contraction, the salt walls commonly evolved into canopies that were extruded over pre-existing autochthonous salt bodies. As observed, relatively thin layers tend to develop isoclinal and recumbent folds, whereas thicker more competent layers may develop thrust faults to accommodate the contraction.