



Structural characterization of the Middle Miocene Mansiyah salt in the Red Sea

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The Red Sea is a rift basin with ongoing salt mobilization. Continental rifting, while poorly constrained, appears to have initiated by the Oligo-Miocene. The early syn-rift sedimentary record is typified by the deposition of a thick half-graben sequence of primarily continental sediments. The Middle Miocene pre-salt Kial Formation shows a change to more marine conditions which quickly became more restricted and transitions upwards to the mostly evaporitic Mansiyah Formation (ca. 14 to 11.5 Ma), with salt thickness reaching a maximum of 2-3 km.

Salt mobilization and emplacement has been identified on a basin-scale across most of the length of the Saudi sector of the Red Sea. Seismic interpretation and structural/stratigraphic analysis was carried out using a regional 2D dataset. This was accompanied by an analysis of high-resolution bathymetric data. A review of the bathymetry data has indicated that salt mobilization is still ongoing at present, with salt extrusion and flows mapped on the sea floor and operating as near surface submarine salt glaciers.

An array of reactive and subsequent passive mobilization salt- and salt-related structures were triggered by the ongoing rifting processes and basinward salt movement along the regional continental slope. These structures include salt rollers, stocks and diapirs, and extensive salt walls with associated minibasins. Allochthonous salt structures and discontinuous/coalesced stock canopies are also evident. Coalesced salt canopies were, on occasion, observed to completely surround, and even tilt, some minibasins suggesting active translation of the salt overburden.

Salt mobilization is largely controlled by down-slope movement along a regionally extensive detachment horizon at the top of the Kial Formation. The Kial detachment slope commonly varies between 2 to 8 degrees, but in some areas it has been observed to reach >10 degrees. Four distinct domains of kilometer-scale long salt walls and canopies were identified along the length of the Red Sea, with each domain characterized by a major salt wall trend. In most cases the strike of the salt walls are parallel to sub-parallel to the coast line, suggesting that the direction of sediment loading and salt sliding has been mostly at high angles to the main strike of the developing rift margins.