

# **The land-attached Al Wajh Carbonate Platform (Saudi Arabia, N Red Sea) - An Analogue for Rift-Basin Carbonates situated in a Salt Tectonic Setting**

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## **Abstract**

Ancient carbonate platforms developed on rifted continental margins represent important hydrocarbon producing reservoirs, and in addition often also form the foundations on which later passive-margin platforms develop. Here we present an analogue of a land-attached carbonate-platform from the Red Sea margin, which is currently transitioning from rift to passive margin state. The Al Wajh platform is likely the largest existing modern analogue for ancient carbonate platforms that transitioned from rifting to passive margin state. The platform is located in western Saudi Arabia at the intersection of the largest drainage system on the Arabian shield and the deep Red Sea. It extends over an area of 2200 km<sup>2</sup> is almost completely framed by an nearly rectangular 115 km reef-shoal belt, while its complex interior consisting of a 42 m deep lagoon, patch and pinnacle reefs, and coral reef islands. Present day lagoonal sediments are dominated by carbonates but can consists locally up to 40% siliciclastics that originate from aeolian and rare fluvial input. Detailed analysis point to significant lateral texture heterogeneities within the lagoon, which are controlled mainly by topography, internal currents and variations in biota. The shapes of islands and shallow-water sediment bodies are controlled by the NW prevailing wind direction and resulting surface currents, and tidal currents. The thicknesses of these sediment packages are controlled by palaeo-morphology, wind-driven shedding and also internal currents. Below a thin veneer of sediments the upper section of islands is composed of highly porous carbonates that were deposited during the Late Pleistocene sea level highstand and are already significantly overprinted by early diagenetic processes. Based on high resolution bathymetry data the outer platform margin features steep slopes incised by dozens of gullies, alternating with gently inclined slopes with amphitheatre-like scarps, deeply incised canyons and drowned reefs. Numerous mini-basins surround the platform ranging in size from 5-14 km. Morphological analysis and shallow seismic data point to a significant impact of salt tectonic on the Al Wajh platform margins. Salt flows protrude from the margin partly covering some mini-basins. Steep ridges bounding mini-basins are interpreted as exposed salt walls and anticlines, while graben-structures suggest reactive diapirism or/and extensional movements. Drowned reefs, slope failures and dipping basin strata indicate that parts of the margin slide towards the basins likely induced by instability caused by underlying salt. The study gives an overview of the multitude of processes shaping the Al Wajh platform and controlling lateral texture heterogeneities within its lagoon. In addition, some of the spectacular features of the platform are valuable analogues to ancient platforms in petroleum provinces controlled by salt tectonics.