Bar Al Hikman Peninsula (Oman): A reservoir Analogue for Carbonate Ramp System in Arid Monsoon Dominated Environment

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Abstract

Analogue studies of modern carbonate systems are an important source to assess reservoir architecture and flow unit dimensions. The mixed carbonate-clastic-evaporite system of Bar Al Hikman is a storm dominated ramp-like carbonate-system (slope ~ 0.01°, 38x36 km) located in the south-east of Oman. The analysis of half a century of satellite images (1972-2022) coupled with multiple fieldworks over the last 20 years provide, today, qualitative and quantitative data to document the modern and recent (Mid-Holocene) lateral facies changes and geomorphologies.First of all, lineament analysis and digital elevation model strongly suggest that the lateral distribution of carbonate facies (e.g reef, lagoon, beach/spit systems, coastal and continental sabkha) are influenced by the modest topographic highs and lows (± 0-3m) governed by faults patterns following the NNE regional trend. Then, as indicates the paleo-coastline 20km northward to the actual coastline, the transgressive/regressive Holocene sequence recorded on the peninsula directly show the impact of short-term relative sea-level change on lateral facies heterogeneities. By comparing the geomorphic features along the present coastline and the remaining Holocene coastal features inland, we highlight different evolution stages of the carbonate geobodies in response to relative sea level changes over the last 6000 years. Finally, the quantitative information extracted from the time series satellite images coupled to meteorological records allow tracking the direct impact of high energy events (cyclones, tsunami) and the monsoon on the stacking patterns (timing, orientation) of the actual carbonate beach system.By quantifying and discussing the geomorphologies of the Bar Al Hikman peninsula our study provides a quantitative catalogue for lateral heterogeneities for a storm dominated ramp-like carbonate-system which can be useful for the construction of analogue subsurface reservoirs and prediction of fluid flow (anisotropy).Also, because the present - and the past - is also the key to the future, a fine comprehension of coastal geomorphologies and their evolution through time can be shown to help to predict and manage the impact of hazards on people and ecology by the coming submersion of the area by a probable 0.70m sea level rise by 2100.