Regional to Inter-well Scale Sedimentology of a Triassic - Jurassic Carbonate Ramp (UAE/Oman) Analogous to Middle Eastern Reservoirs

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Abstract

Triassic and Jurassic carbonates across the Middle East host large amounts of hydrocarbons, but the degree of sedimentary heterogeneity across different scales in carbonates varies significantly. In this study we investigate the regional evolution of a carbonate ramp across the Late Triassic to Early Jurassic on the Musandam Peninsula (UAE and Oman) in a series of wadis, 45 km apart (Wadis Naqab, Ghalilah, Al-Ghabbah and 'Jabal Sall Ala'). Lithostratigraphy as well as carbon isotope stratigraphy were used to correlate the sections on a regional scale, and this work revealed that the broad environment of deposition was continuous over the region throughout the studied time interval. However both the conventional reservoir facies (oolitic grainstones) and the unconventional reservoir facies types (marls and shales) are mostly discontinuous across the study area. This implies that slight modifications of the regional paleogeographic map for the Late-Triassic to Early Jurassic are needed. We have also investigated smaller scale (<1 km, or inter-well scale) facies heterogeneities using seven closely spaced Middle Jurassic sections logged across a 1900 x 1200 x 120 m fault-bounded outcrop, which offers a pseudo-3D view of the stratigraphy. Sections were correlated by walking key surfaces and/or by using photopanels, to produce a detailed lithofacies map. The main conclusion at the inter-well scale is that lithofacies types deposited on the subtidal part of the carbonate ramp show a high degree of lateral and vertical variability, especially in the shallow-water, high-energy ramp despite a largely 'layer-cake' bedding pattern. We attribute this large amount of lateral heterogeneity, facies merging and interfingering as result of currents and waves in the overall shallow part of the carbonate ramp. This dynamic environment of deposition resulted in a closely spaced facies mosaic, which is still preserved today. If facies have contrasting porosities and permeabilities in subsurface reservoirs, this has important implications for hydrocarbon production from subtidal carbonate units.

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