

Paleoenvironmental Evolution of the Jurassic Carbonate and Evaporite Platform, Saudi Arabia

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Abstract

Over twelve Gross Depositional Environment (GDE) maps were generated to reconstruct the evolution of paleoenvironments for the Jurassic carbonate/evaporite platform in Saudi Arabia. These maps document a low frequency base level cycle (e.g. expansion and shrinking of carbonate/evaporitic factories, and landward/basinward displacements of their paleoenvironments). This was achieved by integrating isochore maps, well logs, core and seismic interpretations within a sequence stratigraphic framework.

A base level rise hemicycle is interpreted by observing the progressive landward stacking of Toarcian strata and Bajocian-Bathonian. In the Toarcian, the carbonate factory was shifted towards the north and sediment supply was active in the south. In the Early Bajocian, the carbonate factory advanced towards the south and the clastic wedge was shifted further southward. Towards the Late Bajocian, a paleo-depocenter, located towards the Gotnia basin was filled. Finally, at the upper Bathonian, extensive shoaling carbonate depositional systems were mapped towards the south, beyond the Qatar arch structural trend. The maximum accommodation and turn around position of the cycle is observed within the Callovian.

On the other hand, a fall in base level is interpreted by observing the progressive basinward stacking of the Callovian, Oxfordian, Kimmeridgian and Tithonian. In the Early Callovian, there was incursion of the sea towards the west and the flooding is observed towards the south. At Late Callovian, the carbonate factory shifted towards the west, forming a clear shelf margin and confining organic rich facies around present position of Qatar peninsula. The Oxfordian was mapped as a progressive filling of accommodation space. The Early Kimmeridgian represents a punctuated flooding followed by basinward stepping and a filling stage. Late Kimmeridgian to Tithonian strata are represented by widespread oolitic shoals and evaporitic caps. Finally, the Tithonian was mapped as a widespread evaporitic platform that pinched out toward the open ocean and the Arabian shield.

The paleoenvironmental maps generated in this study show the relative position of carbonate factory and adjacent environments through the Jurassic system. They provided insights to illustrate the evolution of shelf margins and associated stratigraphic trap concepts.