

Sedimentology and High Resolution Sequence Stratigraphy of the Middle Jurassic Dhurma Formation Carbonates Outcrops in the Central Saudi Arabia

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This study investigates the microfacies and sequence stratigraphic frame work of the Middle Jurassic Dhurma Formation in outcrops in central Saudi Arabia. The study contributes to the efforts to understand and enhance local and regional stratigraphic relationship and correlation of the Jurassic carbonate sequences and their significance to reservoir description and prediction in the subsurface.

The study describes and characterizes the sedimentology, microfacies and the stratigraphy of Dhurma Formation from outcrop sections having a total thickness of 70 m. Detailed microfacies and high-resolution stratigraphical analysis were carried out to determine microfacies, cyclicity, sequences and stacking pattern. The study revealed ten lithofacies namely: oolitic grainstone, bioclastic oolitic grainstone, oolitic grapestone, bioclastic grainstone, foraminiferal packstone, echinoderm packstone, peloidal packstone to grainstone, skeletal wackestone to packstone, mudstone, and marlstone. These lithofacies were grouped into five lithofacies associations that deposited on a carbonate ramp setting. The depositional environment ranging from low energy lagoonal setting to high-energy shoals and banks to low energy outer ramp setting. Five high-resolution composite sequences have been defined and each sequence is composed at the bottom of intercalated mudstone/wackestone that passing up into grainstone lithofacies. The composite sequences range in thickness from 7 to 15 m, while the parasequences range from 0.5 to 1.5 m. The composite sequences extend laterally for a distance of more than 350 m. The overall composite section shows a shallowing upward succession of the 4th to the 5th order high-resolution sequences. The dominant lithofacies are the grainy ones, which constitute 30%, 50% and 80% of the studied sections. Furthermore, the parasequences thickness and their bio-components are increasing towards the top. The muddy lithofacies intensively affected the vertical continuity of the lower reservoir interval compared to the upper interval. Detailed examination of thin-sections reflects a clear and well-developed reservoir interval in the uppermost part of the section, which is dominated by peloidal packstone and grainstone. The findings of this high-resolution outcrop analog might help to understand and predict lithofacies, stratigraphic hierarchies and correlations of Dhurma Formation within the interwell spacing. Moreover, this study might also contribute to better reservoir description and assessment of its quality and architecture in subsurface equivalent reservoirs.