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Sequence Stratigraphy and Sedimentological Analysis of a Late Jurassic Ooid Shoal System, Abu Dhabi, UAE

William Mills[1], Claire Gill[1], Michael Harrison[1], Salah Al Deen Ali Muhsen Al Qallabi[2], Maniesh Singh[2] , Tarek Solaiman[2] , Gary Stefan Aillud[2] , Kook Sun Shin[2] , and Michel Rebelle[2]

[1]CGG
[2]ADCO-OPCO

ABSTRACT

As part of a detailed sedimentological study, Late Jurassic, Tithonian aged cored sections from seven wells (894' of core) in Field X, onshore Abu Dhabi, were described and interpreted. The work carried out formed the basis of the sequence stratigraphy, reservoir rock-typing (RRT) scheme and subsequent 3D static model helping to better understand reservoir distribution across the field.

A total of 18 lithofacies were identified represented by 4 facies associations. Due to an aggrading wireline log profile a simplified 'lithostratigraphic' style approach was taken to define the sequence stratigraphic architecture. Detailed semi-quantitative petrographic analysis was carried out on 33 thin sections to help establish depositional and diagenetic controls on reservoir quality. These observations were tied with MICP and CCA data in order to classify the porosity/permeability trends. From the data, seven diagenetic facies (DF1-7) were identified. The DF were mapped within the sequence stratigraphic framework and were used to distribute the derived electrofacies within the static model.

The sediments studied form part of a large-scale (up to 160' thick) east/southeast prograding oolitic shoal system. The overall vertical sedimentary sequence shows fining upward packages, which indicate high energy periods and potential shoal migration which in-turn is overlain by a homogenous massive and burrowed sedimentary unit that may indicate final shoal stabilisation and aggradation with the development of a beach/shore-face environment. Two distinct packages are defined; a basal dolomitic sequence and an upper limestone sequence. The trend of the GR peak that marks the upper limestone package is often variable; with either a smooth curvature trend or a sharp peak. This is due to the erosion related to the third order sequence boundary, which is responsible for the variable thickness. Thinning of the sediments is prominent to the west/northwest. A tight zone at the top of the reservoir was picked on log porosity curves (NPHI). A zone that was highlighted in the static reservoir model. This zone has a variable thickness across the field due to the extent of regional erosion at the top of the interval.

Late calcite cementation and early dolomitisation were found to be the most important diagenetic processes for controls on reservoir quality. DF3 is most dominant throughout the upper package of sediments; dominated by microporosity within ooid grains. In wells to the east, DF1 and DF2 are common at the top of the section associated with the third order sequence boundary and are interpreted to relate to the influence of meteoric cementation and the preservation of intergranular pores.