IR04

Sequence Stratigraphy of the Mishrif Formation West Qurna-2 Field

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SUMMARY

The Cenomanian–Early Turonian Mishrif Formation represents part of a carbonate platform system that characterised most of the Arabian Plate during this time. The formation is a prolific hydrocarbon reservoir in many regional oilfields, including the hydrocarbon accumulations over the West Qurna arch. Previous regional investigations reveal significant heterogeneities in reservoir quality that are attributed to facies variability (e.g. Lehmman, 2013;Yose et al. 2013; Mahdi, 2010; Aqrawi et al. 2010).

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A sedimentological and sequence stratigraphic evaluation of the Mishrif Formation in the West Qurna-2 Field was conducted based on the analysis of *c*.1300m of core from 12 wells calibrated to over 2000 thin-sections. Wireline logs and FMI data were interpreted to assess lateral facies variability and allow production of facies maps to support the further development of a 3D geomodel of the reservoir.

A hierarchy of 6 large-scale cycles, possibly 3rd order in origin, and 18 small-scale (4th and 5th order) sequences are identified within the overall shallowing-upward trend of the formation. These represent repeated transgressive and regressive events developed on a carbonate ramp system that generally prograded to the SW. Sequences 1 and 2 record the progressive, but cyclical, shallowing from open marine, microporous, mid-ramp deposits to laterally extensive, grain-rich, high permeability shoals that deposited due to the advancement of a shoal barrier complex. The final stages of Sequence 2 led to the deposition of poorer reservoir quality lagoon and intertidal facies over most of the field.

The base of Sequence 3 marks renewed flooding and the deposition of a second laterally extensive shoal unit that pinches out in a proximal direction the N and NW, being replaced by restricted lagoon facies. Due to continued overall progradation, the remainder of Sequences 3 and 4 are dominated by heterogeneous lagoonal and intertidal facies along with more isolated grain shoals and rudist biostromes. Significant lateral facies heterogeneities are also introduced during this time by the development of NE-SW trending 'channel' features towards the south of the field. In Sequences 5 and 6 the presence of more open marine fauna suggests that a barrier complex was absent. However, deposition was mainly low-energy, being characterised by locally argillaceous lagoon facies with isolated shoal units and rudist bioherms/patch reefs.

Reservoir quality is mainly controlled by depositional facies with significant contrasts in reservoir quality between the commonly high permeability shoal units and other facies. The 3D reservoir model will need to accommodate these high permeability contrasts, particularly where facies are heterogeneous as this will affect water flood effectiveness and increase the chance of by-passing of significant hydrocarbon volumes and early water breakthrough in producing wells.

The sequence stratigraphic framework establishes the geological constraints for lithofacies spatial distribution and thus mitigates uncertainties and establishes additional geological controls for properties population in the geological model.