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Reducing the uncertainty of static reservoir model in a Carbonate Platform, through the implementation of an integrated workflow: Case A-Field, Abu Dhabi, UAE

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ABSTRACT

Predicting the spatial distribution of petrophysical properties within heterogeneous reservoirs is affected by significant uncertainties when based only on well information. However, integrating additional constraints, such as 3D seismic data and sedimentary concepts, can significantly improve the accuracy of reservoir models and help reduce uncertainties on predictions away from wells.

The aim of this study is to build a reliable 3D geological static model using petrographic and sedimentary reports and current understanding of the sedimentary conceptual model for the field. These core interpretations provide a clear description of the facies architecture across the A-Field, serve as excellent reference during seismic stratigraphy interpretations, and lead into a more geological distribution of the petrophysical properties in the reservoir through the facies models.

In the area of interest, Reservoir 1 is dominated by skeletal peloidal packstone with common thin interbedded good reservoir quality rudstone and algal unit in the upper part of the reservoir. Reservoir 2, on the other hand is dominated by foraminiferal algal peloidal packstones with thin units of floatstone. An integrated approach for facies modeling was implemented in order to generate stochastic models of the facies associations capable of reproducing the natural transition through the sequences. This method was adopted to model the high-resolution prograding pulses in the carbonate platform that were interpreted through cores description and facies association interpretation for both reservoirs.

The final 3D sedimentary-stratigraphic architecture is used as the main constraint to model the petrophysical properties for each reservoir. Under this approach, these models can account for varying the spatial continuity of reservoir properties honoring the different sedimentary facies. Facies-based property models preserve the facies- specific statistical distribution of the property, as well as its depositional direction. The facies-based 3D petrophysical models provide an improved prediction of petrophysical properties distribution and reservoir heterogeneity. The permeability simulation based on facies and the cloud transform between porosity and permeability allows better control of spatial connectivity patterns across the reservoir that could be used for improved reservoir performance prediction as we carried out in the present static model.