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Reservoir Characterization while Drilling; A Real Time Geosteering Answer to Maximize Well Values. A Case Study, Offshore Abu Dhabi.

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ABSTRACT

The late Jurassic (Kimmeredgian-Tithonian) Reservoir-D represents a 3rd order, regressive carbonate sequence, that has been deposited offshore Abu Dhabi in various environments extending from shelf, through offshore bars to a lagoonal environments with tidal flats, overlain by shoal deposits within the middle and upper layers. The reservoir is showing a wide range of lithofacies and rock types, mudstones at the base, to oolitic grainstones, at the top, depending on the water depth and energy during the deposition, at or below the wave base. The vertically and laterally heterogeneous petrophysical character of Reservoir-D results in a poorer predictability of porosity and permeability distribution and requires careful design of data gathering programs. Better understanding could be achieved via extensive studies incorporating cores and log measurements in vertical and low-angle deviated wellbores.

Oil production started from Reservoir-D, offshore Abu Dhabi in the early 1960s while Down-Flank Water Injection started in 1973 and Crestal Gas Injection in 1994. The current field development plans of Reservoir-D are based on drilling horizontal and highly deviated wellbores along the layers of Reservoir-D to enhance the injection and production efficiency. Running radioactive-based porosity logging tools with such well architecture is associated with high operation and environmental risks. To reduce this risk we are presenting a case where nuclear magnetic resonance (NMR) as a source-less porosity logging device, run with the conventional resistivity-gamma ray logging while drilling combination achieved effective real-time formation evaluation and supported efficient well placement to maximize the reservoir contact.
Insights into the (NMR) real-time log data as a lithology independent porosity logging tool are being discussed with much focus on the added value of the transverse relaxation time (T2) spectrum analysis to characterize the pore size distribution, geosteer the wellbore to track the better quality pores and generate a real-time permeability profile. The formation evaluation, including the NMR log analysis for this highly deviated well has effectively supported the design of the following Inflow Control Valves (ICV) completion operation for water injection, in a timely effective process.