

The Triassic Sudair Prospectivity Understanding in North Sultanate of Oman: The Blessings of Jurassic Unconformity & Early Salt Evacuation to Provide Stratigraphic Traps

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Abstract

In recent years, Petroleum Development Oman (PDO) has embarked on an ambitious new growth program targeting deeper Permo-Triassic carbonates in North Oman. These previously under-explored reservoirs of the Jilh and Sudair Formations were only tested in a few fields as an upside to primary plays such as the Khuff (e.g. in Yibal) or the Mafraq (in Saih Rawl). They were overlooked largely due to the complexity associated with their depositional systems, petrophysical evaluations, poor data acquisition and the lack of good seismic to understand the overall three dimensional trapping configurations. There have been many wells drilled within North Oman that penetrate this stratigraphic section in pursuit of deeper gas targets, and where mud gas, shows and log evaluations show encouraging petrophysical pay. However, due to unavailability of analogues and calibration, these evaluations were always considered carrying large uncertainty, sometimes even when accompanied by strong shows and high mud gas readings. Moreover, some of the high saturation intervals were encountered in areas where there is no clear structural closure, which impose additional challenges on reliability of the interpretations. Finally, the trapping mechanism, the lack of core data and the poor seismic imaging made understanding of these systems challenging. Recently, with the arrival of high-resolution wide azimuth seismic data, and modern petrophysical evaluations of recent wells, a relook to the previously highlighted portfolio areas was undertaken. This integrated approach, with various multidisciplinary inputs including well log correlations, advanced seismic workflows, well test results, pressures and reservoir development from outcrop and QI studies highlighted the controls on the play and the different play concepts that can be defined. This data integration revealed that the salt was evacuated through different geological times, and it can be observed that these salt withdrawal areas preserved part of Jilh and Sudair stratigraphy, providing truncation trap opportunities on both sides of the depocenter of the evacuation. In addition, the Sudair reservoir presence proved to be highly controlled by pre-Jurassic faults (pre-Mafraq), imposing lateral variations in topography. As a consequence, parts of the reservoir units were selectively preserved in the form of islands along the low land areas and grabens, with a major truncation of the entire unit on the paleo high areas to the east. These geometry variations have provided perfect opportunities to have stratigraphic traps as rims, truncation traps and isolated islands of the reservoirs. The evolved understanding of the evolution together with the well results has a significant impact on the prospectivity outlook of these emerging plays in North Oman. This has provided exploration growth potential for follow up in the near future.