Understanding Triassic Sudair Trap Configuration and Rock Properties Through Quantitative Interpretation, Sultanate of Oman

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Abstract

The Sudair play is one of the key emerging plays in North Oman. It was deposited during Triassic time as transgressive succession. It is overlain by Base Mafraq (Base Jurassic Unconformity). Sudair is truncated gradually from NW toward NE in the northern part of Oman, and it is subdividing into 3 units (Upper, Middle and Lower), separated by shale units. In this study, the focus is the Middle unit of the Sudair Play. Upper Sudair is eroded and Middle and Lower Sudair are truncating towards the base of the layer above. This play has a potential to enhance the accelerated growth of the exploration portfolio, which is supported by the recent Sudair discovery in a nearby field.

The study aimed at polarising the critical risks and uncertainties especially those related to reservoir quality and seal (top and lateral). This was achieved by evaluating the well results from nearby discovery, reprocessing and interpreting the seismic in the area and conducting seismic quantitative interpretation. Integrating the multi- discipline data was crucial for the success of the study. This work incorporates Rock Physics Analysis (RPA), Deterministic full-stack inversion (CSSI), and Geostatistical Inversion (GI). Geostatistical Inversion is crucial in enhancing the vertical resolution due to the thin reservoir layering of Sudair.

The quantitative interpretation workflow started by running CSSI with the aim of refining horizon interpretation based on inverted band-limited impedance. Achieving reliable horizon interpretation is crucial for building truncation structural framework, which will be used to construct a low frequency impedance model and attribute extractions. Then, RPA was carried out on the well data to understand the rock property trends in Sudair and assess the possibility to discriminate the different rock facies (dolomite/shale). Although shale cannot be fully separated from dolomite, since the two facies overlap in terms of P-impedance, it is possible to separate them into: shale and non-shale. By doing so, the histogram distribution of P-impedance shows that GI can be carried out where low impedances will be assigned as shale and high impedances as non-shale.

GI was conducted to evaluate the rock quality and map the truncation line. It is evident that truncation is introducing seismic tuning effect, making it difficult to reveal the true formation thickness. The inversion has helped minimizing the impact of seismic tuning. Additionally, it provided insights into the rock quality, supported by the good match between the inversion predictions and the results from existing wells. The inversion attribute maps showing the distribution of facies (shale versus non-shale) was utilized to de-risk and rank the opportunities in the area.

The integrated multi-discipline approach has helped in understanding the trapping concept of Sudair play and, hence unlocking its potential. The improved understanding of the play is opening the way to evaluate and de-risk and rank the opportunities in the area and consequently select drill-worthy ones.