

Core-Based Stratigraphy: Integrated Fairway Analysis for Regional Play Concepts in Hadriya Source Rocks

Saad Al-Awwad¹ and Abdullah Al-Dhubaib

¹Saudi Aramco

Abstract

Hydrocarbon shows have been indicated via well testing, and on shale shakers while drilling in the Tuwaiq Mountain Formation, south of Haradh Field. These indications are inconsistent, unpredictable and appear to shift through irregular, stratigraphically discrete stringers within the Tuwaiq Mountain Formation. The study location has been previously interpreted as an intrashelf-basin that formed the locus for organic-rich, deep-water carbonate deposition. Both the Callovian Tuwaiq Mountain Formation and Oxfordian Hanifa Formation formed the source rocks that fed the overlying Kimmeridgian reservoir rocks across the giant Saudi Arabian fields in the Arabian intrashelf basin. This study used detailed core characterization of the Tuwaiq Mountain Formation to addresses the lithofacies, biofacies and stratigraphic variability in the area. Integration with micropaleontologic, wireline logs, seismic, chemostratigraphic and pressure data yielded new depositional and stratigraphic models that reveal shifting progradational trends during the Callovian stage. In addition, the effect of paleotopography on the depositional setting within the Arabian intrashelf basin is discerned in terms of reservoir development through the analysis of facies lateral variability and their stacking pattern modulations. The organic rich facies described represent tempestite slope deposits intermittent with episodes of relatively calm background sedimentation that can be subdivided into three 4th order high-frequency sequences. These facies are both sourcing and containing hydrocarbons that are trapped in pure stratigraphic traps extending across vast areas within the basin. The study led to the development of new fairways and regional play concepts that constitute a tremendous potential for future exploration in the Hadriya source rock.