AP04

Integrated Regional 3D Basin Modeling of Triassic and Jurassic Petroleum Systems, Northeastern Saudi Arabia: Implications for Exploration Potential

R. Schmidt* (Saudi Aramco), D.Z. Tang (Saudi Aramco), M. Hamed (Saudi Aramco) & A. Bhullar (Saudi Aramco)

SUMMARY

This assessment focuses on regional 3D basin modeling through integration of a stratigraphic framework, newly defined gross depositional environments (GDEs) and lithofacies maps of Triassic and Jurassic source rocks, reservoirs, and seals that were revealed by integrating seismic interpretations and geological and petrophysical mapping in northeastern Saudi Arabia.

The Triassic Jilh and Minjur formations represent two separate third-order composite sequences, consisting of proven source rocks, reservoirs (e.g., Jilh Dolomite and Minjur Sandstone), and seals. The Lower Jurassic Marrat Formation and Middle Jurassic Dhurma Formation represent a third-order and a second-order composite sequence, respectively. Proven Dhurma source rocks (equivalent of Sargelu source rocks) and a variety of grainier carbonate reservoir rocks, spanning the Marrat, Faridah, Sharar, and Lower Fadhili reservoirs, were taken into account as inputs. Well-defined depth grids, derived from regional seismic and well-based mapping and integrated GDE/lithofacies maps of Triassic and Jurassic source rocks, reservoirs and seals, have been utilized for constraining this newly built 3D basin model.

This integrated 3D basin modeling has resulted in significant insights for hydrocarbon migration and charge of the Triassic and Jurassic petroleum systems. The Triassic hydrocarbon accumulations are primarily self-sourcing from Jilh source rocks, with exceptions where hydrocarbons are charged from Paleozoic source rocks due to breaching at high-relief structures (e.g., Northeastern Arabian Offshore). The Dhurma source rocks (Sargelu equivalent) primarily charged a variety of Lower and Middle Jurassic reservoirs. Additionally, basin modeling results support insights on HC migration and charge for exploration concepts related to stratigraphic traps and new play fairways.