

Prediction of Sealing Capacity of Jurassic Carbonates by Integrating Petrography, Mercury Injection Capillary Pressure Data and Well-logs: Implications for Exploring Stratigraphic Traps, Eastern Saudi Arabia

Wenbin Tan¹, David Z. Tang¹, and Philippe Rabiller²

¹Saudi Aramco

²Rabiller Geo-Consulting

Abstract

The exploration for Jurassic oils over the past few decades has primarily been focused on structural plays in Saudi Arabia. Considerable hydrocarbon resources are believed to be stratigraphically trapped in Jurassic reservoir sequences. Seal integrity becomes increasingly important for exploring subtle and stratigraphic traps. This paper focuses on assessing seal capacity by integrating petrography, core-measured mercury injection capillary pressure (MICP) data, and well-logs of Jurassic carbonate reservoir and seal rocks.

A total of 1892 core plugs representing Jurassic rock facies (e.g., sealing and reservoir rocks) were acquired for thin-section petrographic analysis and mercury injection capillary pressure (MICP) measurements. The core-derived MICP data were processed and calibrated with well-logs using electrofacies prediction technique. The pore-throat-size distribution (PSD), seal efficiency threshold index, and hydrocarbon column height can be predicted from well-logs for seal capacity evaluation. Petrographic and diagenetic examinations provided further insights for seal integrity assessment.

The predicted electrofacies for varying reservoir quality and sealing capacity from wells were upscaled to a seismically detectable level, and then output as numerical codes into the calibrated seismic facies modeling of 3D seismic volumes. The Middle and Upper Jurassic Upper Fadhili and Arab-D reservoirs were taken as examples for the above approach. The results have demonstrated that existing stratigraphic trap analogue, and potential new stratigraphic traps can be successfully predicted. Such an approach has also provided great insights for exploration risk management (e.g., seal integrity), and defining new Jurassic play fairways for stratigraphic trap opportunities.