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Predicting Sealing Capacity of Jurassic Carbonates, Eastern Saudi Arabia: Implications for Exploring Stratigraphic Traps

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ABSTRACT

Seal integrity becomes increasingly important for exploring subtle and stratigraphic traps. Worldwide analogs suggest that more than 50% of stratigraphic trap failures are due to ineffective seals. Over the last few years, Saudi Aramco has pursued rigorous geological and geophysical studies for mitigating risks for exploring stratigraphic traps. This paper focuses on assessing seal capacity by integrating core-based rock typing, core-measured mercury injection capillary pressure (MICP) data, well-log electrofacies prediction, and calibrated seismic facies modeling using 3-D seismic volumes.

The workflow involves:

1. Core-based rock typing for selected Jurassic carbonate formations by integrating core descriptions, thin-section petrography, core plug porosity/permeability, and MICP data;

2. Construction of electrofacies prediction models for selected “Reference Wells” that are extensively cored and representative of the Jurassic reservoir and seal facies;

3. Rigorously testing the prediction models by validating predicted electrofacies versus core-derived rock types. The optimized model was used to predict electrofacies of varying reservoir quality and seal capacity for all the “Application Wells”; and

4. Upscaling the derived electrofacies into coarser-scaled facies assemblages that are seismically detectable, which are used as inputs for calibrated seismic facies classification modelling.

The calibrated seismic facies, rock types and porosity models resulted in much more accurate prediction of lateral and vertical facies changes of reservoirs and seals within 3D volumes. The results have demonstrated that both existing stratigraphic trap analogue and potential new stratigraphic trap opportunities can be successfully predicted. Such an approach has provided great insights for mitigating risks for exploring Jurassic stratigraphic traps. Examples of such settings will be discussed.