

## **Review of the Petroleum System in the Jurassic Lower Dhurma Siliciclastic Reservoir - Rub' Al-Khali Basin, Saudi Arabia**

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### **ABSTRACT**

The Middle Jurassic Lower Dhurma siliciclastic reservoir forms part of a recently discovered and significant gas play in the central and western areas of the Rub' Al-Khali Basin, Saudi Arabia. The play covers an area of more than 12,000 km<sup>2</sup>, though is defined by less than 15 well penetrations. The discovery of Jurassic sweet gas reservoirs with high flow rates has led to a concerted drilling campaign to further delineate this potentially important gas resource for the Kingdom of Saudi Arabia. The Lower Dhurma reservoir was deposited during a period of relative sea level rise in a mixed fluvial to tidally influenced estuarine environment. The lower part of the reservoir consists of productive tidally influenced mouth-bars, which grade progressively upward, to tight sands deposited in a dominantly estuarine environment. Southwest of the Rub' Al-Khali basin, the Lower Dhurma depositional environment is dominated by fluvial deposits with significantly increased reservoir quality and gross formation thickness reaching up to 550 feet. However, commonly the reservoir shows a great deal of heterogeneity on both local and regional scale - demonstrated by variable lateral and vertical connectivity with porosity values ranging from 3% to 15% and permeability ranging from 0.1 mD to 1 Darcy. Often, extensive cementation is noted to have affected the reservoir quality with evidence of quartz overgrowths and calcite cements, accompanied with high degrees of mechanical compaction in deeper portions of the play. Complexity pertaining to the reservoir connectivity is also observed in the variable overpressures for the tested wells, which poses further challenges in defining the play fairway extent. Thermally mature source-prone sections within the Lower Dhurma are likely responsible for charging the Lower Dhurma siliciclastic reservoir and are represented by dispersed coal/lignite (Type III) and terrestrially-influenced shales and mudstones (Type II/III). Variable source rock kinetics along with the degree of source rock maturity, form primary controls on the liquid content and richness of the discovered gases. It is thought that the variable pressure observed and the isolated nature of the reservoir sands indicate considerable upside potential for stratigraphic trapping mechanisms. The integration of 3D seismic data with facies models will further help delineate future structural and stratigraphic traps and serve in adding significant gas reserves to Saudi Arabia.