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Sequence Stratigraphic Framework of the Triassic Jilh Formation in the Rub' al-Khali Basin of Southern Saudi Arabia

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ABSTRACT

Several efforts have appeared in the last decade to unravel the eustatic control of, and propose sequence stratigraphic models for, the Arabian Plate. These efforts were made because the distribution of reservoir facies and potential stratigraphic trapping mechanisms are strongly influenced by eustacy, which has implications for flow units and hydrocarbon migration along the chronostratigraphic layers. The published work is predominantly based on well and outcrop data. We explore reservoir levels primarily based on seismic stratigraphy (picking the discontinuities in reflection geometries) and integrating with well data to establish a sequence stratigraphic framework, with an additional intent to identify viable stratigraphic potential. Our primary dataset consists of extensive regional 2D seismic data coverage controlled by Triassic well penetrations in the Rub' al-Khali basin of southern Saudi Arabia. At the basin scale, this task is highly challenging due to the limited number of wells, poor seismic data quality, scarce biostratigraphic data, and in some cases, uncertainties in the well tops.

In central Saudi Arabia, a proven reservoir interval lies within carbonates of the Middle to Late Triassic (Anisian- Norian) Jilh Formation and its time equivalent rock units in the surrounding regions. Substantial oil/gas shows from this formation in the Rub' al-Khali basin qualifies its revision in greater stratigraphic detail. The Jilh Formation is a complete petroleum system having reservoir facies (predominantly dolomite, limestone and sandstone), source (interbedded shale layers) and seal (shales and evaporites). A number of EW and NS oriented seismic transects were constructed for consistent interpretation by picking various seismic reflection surfaces to delineate system tracts. Based on this interpretation, Jilh strata are genetically divisible into four third order sequences. A rigorous effort was made to establish a reliable chronostratigraphic framework based on a consistent relationship between seismic and well data (logs and core/cutting) to understand vertical and lateral distribution of rock facies. Several maps (two –way time, isochron, etc.) are prepared and integrated with seismic geometries and well data to delineate gross depositional environment maps. The results of this milestone show that there are opportunities for maturing stratigraphically trapped hydrocarbon accumulations.