New Exploration Targets in Northern Offshore Bahrain: Integration of Seismic Sequence Stratigraphy and Seismic Inversion

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Block-2 Offshore Bahrain covers an area of 2,228 km^2. It is mainly a monocline carbonate-dominated platform deposit located nearby fully proven fields Awali and Abu Sa'fah. The main risk/uncertainty for hydrocarbon exploration in the block is the lack of obvious and identifiable closured prospects in the area. Ambiguity of the structural existence directly upgrades stratigraphic plays to take a major role for further hydrocarbon exploration. Local porous carbonate/minor sandstone series are possible to be stratigraphic reservoirs relating to proven reservoirs in the region.

The petroleum systems in the Arabian Gulf are commonly and fully proved. Two proven source rocks were recognized. Firstly, the Silurian lower Qusaiba Formation represents source rock for Devonian to Permian reservoirs. Secondly, the Jurassic lower Hanifa Formation represents source rock for Jurassic reservoirs. However, the absence of a Cretaceous source rock indicates a significant charge risk to Cretaceous reservoirs because hydrocarbons from underneath older source rocks would need to migrate through the upper effective regional seal Hith Anhydrite Formation.

The potential of stratigraphic traps within Block 2 Offshore Bahrain was evaluated through a sequence stratigraphic analysis of 7 wells and 3,175 line-km of 2D seismic data. The analysis included well-seismic sequence stratigraphic interpretation, gross depositional environment mapping, and play fairway evaluations. In addition, the seismic inversion and attribute analysis were applied and integrated for more intensive results.

Four principal stratigraphic plays were identified, including Unayzah Pinch-Outs, Hanifa Basin Margin Isolated Build-ups, Nahr Umr Channels, and Mishrif Isolated Mounds.

The results of study indicate potential existence of stratigraphic traps which were subsequently used to determine a necessary area for a fit-to-purpose new seismic acquisition program and to avoid acquiring excess seismic data over the block.