

# **Stratigraphy and Depositional Models for the Upper Ordovician Kahfah and Quwarah Members of Qasim Formation-NW Saudi Arabia, Linking the Outcrop to Subsurface Data and Present Day Reservoir Analogues**

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## **ABSTRACT**

The Upper Ordovician Kahfah and Quwarah members of Qasim Formation in the Northwest Saudi Arabia are composed of deltaic to shallow-marine deposits. The aim of this study was, within a stratigraphic framework, to characterize the depositional facies and their distribution in terms of potential reservoir sands using stratigraphic wireline correlations, outcrop data and present day reservoir analogues from satellite images. Facies mapping was difficult due to the lack of cored wells in the study area. The subsurface succession of Qasim Formation was divided into 27 sequences. Each sequence was recognized by log signatures and mapped out across multiple stratigraphic correlation panels. Two particular facies, the tidal delta and shoreface facies were carefully characterized from Quwarah and Kahfah members of Qasim Formation. The study also included isopach mapping of 8 sequences dominated by reservoir quality sands. Sand:shale ratios were calculated from each well and displayed on each isopach map. The outcrop data from Qasim Formation in the Qasim region and satellite images from the coasts of Australia and Mexico, were utilized to link, interpret and predict the sandstone reservoirs presence and extensions of Qasim Formation. The detached shoreface sedimentation of the Quwarah Member forms coarsening and cleaning upward sandstone units that are correlated regionally. They are significantly cleaner compared to the deltaic sedimentation. Sandbody geometry in the Quwarah Member is likely to be lobate in the deltaic successions, while it is sheet-like in the shoreface sediments. Extensive wave-dominated attached shoreface sediments separated by high-order marine flooding surfaces control the sedimentation in Kahfah Member. The study helped in predicting the changes in the depositional styles in time and space. Consequently, this has determined where the deltaic and shoreface sandstones might preferentially develop as opposed to muddy shorelines. General trends in sedimentation were interpreted from the generated isopach maps and sand:shale pie charts.