

Regional Stratigraphic Framework and Exploration Concepts for Jurassic Carbonate Stratigraphic Traps and Unconventional Resources, Eastern Saudi Arabia

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ABSTRACT

Jurassic carbonate reservoirs host significant oil reserves and produce from giant and super giant oil fields in Saudi Arabia. For unraveling exploration concepts for Jurassic carbonate stratigraphic traps and unconventional resources, a robust sequence stratigraphic framework was revealed by integrating core, welllogs, 2- D/3-D seismic interpretations and attributes mapping, seismic sequence chronostratigraphy, and forward stratigraphic modeling.

Distinctive intrashelf basins were developed over the Arabian carbonate platform interior during the Jurassic times. Significant source rocks were deposited within the intrashelf basins during the Bajocian-Bathonian (e.g., Dhurma/Sargelu source rocks), and the Callovian-Oxfordian (e.g., Tuwaiq Mountain-Hanifa/Najmah source rocks). These source rocks are exceptionally organic-rich and proven to be of significant exploration potential for unconventional resources. A variety of grainier carbonate reservoirs were deposited along margins of the intrashelf basins over the carbonate platform. The Hith Formation evaporites (Tithonian) provide excellent regional seal of the exceptionally prolific Jurassic petroleum systems. The Jurassic stratigraphy is characterized by extremely dynamic evolution through time and space, resulting in lateral and vertical facies juxtaposition. Therefore, significant exploration potential for stratigraphic traps has been revealed.

Gross depositional environment (GDE) maps of Jurassic formations have been reconstructed by integrating core/drill cutting sedimentology, welllog electrofacies, and seismic attributes. These GDE, lithofacies maps and seismic depth grids were input for 3-D basin modeling of the Jurassic petroleum systems. The results have provided great insights into hydrocarbon migration, charge history, and new exploration concepts for exploring Jurassic stratigraphic traps and unconventional resources.