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Sequence Stratigraphic Framework and Exploration Potential of the Middle Jurassic Dhurma Formation, Eastern Saudi Arabia

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SUMMARY

The Middle Jurassic Dhurma Formation is of Bajocian-Bathonian age, and represents a composite second-order sequence in Saudi Arabia. An integration of well log correlations, 3D seismic interpretations, and sedimentological studies has been undertaken to unravel the sequence stratigraphic framework. The Lower Dhurma Member is interpreted as a transgressive systems tract, with the maximum shale content of the “Dhurma Shale” representing the maximum flooding surface (MFS) of the second-order Dhurma sequence. The highstand systems tract of this second-order sequence consists of an overall shallowing-up interval comprising the Faridah, Sharar and Lower Fadhili members, with each member representing a third-order composite sequence.

The Faridah grainy carbonate reservoirs that were deposited in the highstand systems tract of the third-order Faridah sequence can be subdivided into the following fourth-order sequences: Lower-, Middle- and Upper-Faridah subunits. The grainier facies of the Faridah highstand changes laterally to muddy limestone and organic-rich mudstone facies (Sargelu-equivalent source rocks) in basinal areas. The top of the Faridah sequence represents a subaerial exposure surface across most of the Arabian carbonate platform, in response to a significant base-level fall. The Sharar third-order sequence comprises a basal lowstand wedge (reworked sediments from carbonate shoaling complexes), transgressive deposits with muddy facies and possible organic-rich facies in the distal and basinal setting; and also a highstand grainy reservoir facies. The third-order Lower Fadhili sequence is dominated by widespread grainier carbonate facies, indicating infilling of most of the accommodation space. The top of the Dhurma Formation (i.e., the top of the Lower Fadhili Member) represents a significant subaerial exposure surface (hiatus).

Gross depositional environment (GDE) maps of the Dhurma Formation have been reconstructed by integrating core/drill cutting sedimentology, well log electrofacies, and seismic attributes. These GDE maps depict evolving depositional environments that span the Faridah, Sharar and Lower Fadhili third-order sequences. A variety of new exploration opportunities have emerged through building a robust stratigraphic framework and reconstruction of gross depositional environments, and detailed play fairway mapping.