Syn-rift Stratigraphy And Sedimentary Evolution Of The Midyan Basin: From Geological Observations To Forward Stratigraphic Modeling

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Abstract

Objectives/Scope: The Callovian-Oxfordian Arabian Intrashelf Basins have been defined and discussed in detail in numerous publications over the last three decades. However, new data and increasingly advanced seismic technologies have enabled higher-resolution analysis of the configuration and sequence stratigraphic architecture of the intrashelf basins. The objective of study is to provide critical new insights into an important yet poorly understood component, i.e., detached middle-ramp patchy shoal complexes. These new findings were revealed by integrating sequence stratigraphic analysis, 3D seismic mapping, advanced seismic attributes, and core-based sedimentological interpretations.

Methods, Procedures, Process: It is challenging to directly map these middle-ramp patchy shoals, partly due to seismic resolution limitations and lack of well penetrations in areas towards and within the intrashelf basins, which were previously considered devoid of potential grainier shoal facies. However, these patchy shoals were able to be identified and mapped using changes in isochron thickness of the overlying sequence, which had been defined and interpreted from well-logs and seismic volumes. High-resolution chrono-seismic stratigraphic analysis and advanced seismic attribute extraction provided additional imaging and validation of the middle-ramp patchy shoals. Core-based sedimentological studies were used to define and characterize the patchy shoal facies, which in turn were used to interpret the evolution of depositional environments.

Results, Observations, Conclusions: The mapped middle-ramp shoal patches occurred along the margins and in areas of subtle paleo-topographic highs in the interiors of the intrashelf basins. Sedimentological examinations of core indicated that the middle-ramp shoal patches were characterized and dominated by peloidal packstone/grainstone and wackestone facies associations. The basin-interior shoal patches were deposited during periods of base-level fall, which shifted the middle-ramp facies towards distal areas of the intrashelf basins, whereas the shallow-water shoal complexes were prevalent in the proximal areas.

Novel/Additive Information: The recognition of these detached middle-ramp shoal complexes provided additional insights that improved understanding the configuration, stratigraphic architecture, and evolution of depositional environments of the Callovian-Oxfordian Arabian Intrashelf Basins.