

Regional Controls on Intrashelf Basin Development: the Albian-Cenomanian Shilaif-Natih Basin in UAE and Oman

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Abstract

Organic-rich carbonate deposits may become source rocks and be considered as unconventional reservoirs in specific conditions. During the Late Albian to Turonian, the regional distribution of organic-rich sediments in the Middle East was controlled by the development of intrashelf basins within extensive shallow-marine carbonate platforms.

Supra-regional sequence-stratigraphic and biostratigraphic correlations between Oman (Natih Fm.) and Abu Dhabi (Mauddud, Shilaif and Mishrif Fms) have allowed to better constrain the location and evolution of these intrashelf basins through time, explaining the lateral and vertical variability of source rock facies today.

This study confirms that the Shilaif-Natih intrashelf basin was initially created by differential aggradation of shallow carbonate deposits during a phase of significant increase of eustatic sea-level and tectonic stability (Late Albian). However, the evolution of this basin, i.e. the nature and rapidity of its fill, was then clearly influenced by regional low-amplitude structural deformation processes. During the Early Cenomanian, high carbonate production and large wavelength folding favored the fill of the Natih E intrashelf basin until subaerial exposure in Oman, while the Shilaif intrashelf basin remained unfilled (Lower Shilaif Mb.). During the Middle Cenomanian, the aggradation of the Natih D & C shallow carbonate platform was affected by large wavelength folding, possibly preventing intrashelf basin development in Oman, while very few sediments were deposited in the Shilaif intrashelf basin of Abu Dhabi. Subsequent uplift led to subaerial exposure in Oman and probably as far as the “Lekhwair Arch” area (Top Natih C). In the Shilaif basin, organic-rich deposits were then mixed with clays coming from the exposed areas, leading to lower source-rock quality (Middle Shilaif Mb.). During the Late Cenomanian, tectonic stability and a significant increase of global sea-level led to a new phase of intrashelf basin development by differential aggradation in Oman. High TOC organic-rich sediments accumulated in the deepest part of the basins (Natih B, Upper Shilaif Mb.). Then the carbonate fill of the Natih B basin was affected/forced by another phase of structural deformation in Oman, due to the onset of the ophiolite obduction process. Significant uplift and structural deformations occurred in Oman and on the “Lekhwair Arch”, providing clay sediments which progressively filled the Shilaif Basin (Tuwayil Fm., Late Cenomanian-Turonian transition?). Carbonate sedimentation continued in the still subsiding western and south-western part of Abu Dhabi (Turonian) as well as in Iran (Sequence 4 of the Sarvak Fm.).

This combination of stratigraphic and structural wedges as well as erosional truncations has created complex geometries of sequences, difficult to predict and correlate at the regional scale.