
High Resolution Sequence Stratigraphy and Reservoir Characterization of a Lekhwair Reservoir Unit (Lower Cretaceous, United Arab Emirates)

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Significant hydrocarbon accumulations have been found in the Lower Lekhwair Formation (Lower Thamama Group, Valanginian). The succession studied is interpreted to correspond to the transgressive sequence set (TSS) of a second-order supersequence that ranges from the top Habshan Formations (Lower Valanginian) to the base of the so-called "Lower Dense Zone" of the Kharai Formation (Barremian). The TSS is built by a third-order sequence (Valanginian) that is composed by three fourth-order, high-frequency sequences, comprising three reservoir units and three non-reservoir (dense) zones. The uppermost reservoir unit, the focus of the study, can further be subdivided into four fifth-order parasequences, corresponding to four reservoir sub-units. Third- and fourth-order sequence boundaries, fourth-order maximum flooding surface, as well as fifth-order flooding surfaces were identified in core material from wells of Abu Dhabi and tied to well logs.

Based on texture, grain types, sedimentary structures, faunal content, and lithologic composition, seven reservoir lithofacies and three non-reservoir (dense) lithofacies have been identified. The reservoir unit is composed of limestone, mainly deposited in an open platform, upper to middle ramp to restricted platform subtidal to intertidal environment. Good reservoir quality is developed within Bacinella/lithocodium packstone to floatstone, floatstone to rudstone, and boundstone. Intensively bioturbated, siliciclastic- and organic-rich wackestone and packstone characterize the dense zones.

Using geological (lithofacies) and petrophysical (porosity/permeability and mercury injection) data, five facies associations and ten reservoir rock types (RRT) have been defined for the reservoir unit. The observed heterogeneity of the reservoir is mainly due to depositional facies. Diagenesis (cementation and compaction) is interpreted to play only a minor role in reservoir quality distribution. The established high-frequency sequence stratigraphic framework allows a better prediction of the vertical and horizontal distribution of reservoir lithofacies and reservoir quality throughout the field.
