An Integrated Core Description, Sequence Stratigraphy, Facies and Diagenesis Study was performed on Lower Cretaceous carbonates, offshore Abu Dhabi, in order to understand the variations and controls on reservoir quality. More than 3000ft of core were described to develop a depositional model, establish a high-resolution sequence stratigraphic framework, and to investigate and map depositional diagenetic processes. In addition, this study changes some of the pre-existing models for Lower Cretaceous carbonate deposition in the region.

Four key reservoir zones are identified, bounded by regionally correlatable 3rd-order sequence boundaries. 4th-order sequences have been identified within this framework and define the framework for the reservoir layering scheme. The 3rd-order, and in parts 4th-order, Transgressive Systems Tracts (TSTs) are commonly non-reservoir intervals dominated by low energy, moderately organic, locally argillaceous, matrix dominated, typically Middle and Middle to Outer Ramp lithofacies. Within 3rd- and 2nd-order Highstand Systems Tracts (HSTs) these 4th-order TST intervals become shallower and grainier toward the larger-scale sequence boundaries. This interpretation is in contrast to that of previous authors, who interpreted the non-reservoir ‘dense zones’ as restricted inner shelf, lagoonal sediments.

The 3rd- and the 4th-order HSTs commonly comprise the reservoir intervals and are dominated by higher energy Upper Ramp and Shoal sediments. Within the large scale 2nd-order sequences the HSTs exhibit an overall shallowing upward trend resulting in coarsening upward reservoir packages. In parts, the HST intervals are dominated by algal boundstones and floatstones with Lithocodium/Bacinella and coated grain/skeletal peloidal grainstones.

Reservoir quality is controlled by a combination of depositional environment, sequence stratigraphic position and diagenesis. The best reservoir quality is seen in leached algal-dominated lithofacies and coated grain/skeletal peloidal grainstones with good primary porosity. The best reservoir quality is typically found in the 4th order HST intervals. Calcite cementation is the main porosity reducing process within rudist rudstones. The leached algal-dominated lithofacies can create permeabilities a magnitude higher than the average permeabilities. This permeability contrast has to be addressed in smart completion designs of the development wells.

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