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Influence of Micropalaeontologically Determined Antecedent Topography on Reservoir Quality in Saudi Arabian Carbonates

The Arabian Platform was a site for the accumulation of extensive sheets of shallow marine carbonates, most of which have important hydrocarbon reservoirs. In many reservoirs, primary porosity is significant; in others, dolomite intercrystalline porosity is significant. Investigations into controls on reservoir development and variations in reservoir quality typically focus on core-based sedimentological aspects. This approach produces limited success because of limited palaeoenvironmental resolution achieved from carbonate sedimentology alone.

Recent studies of Palaeozoic and Mesozoic carbonate reservoirs of Saudi Arabia have involved sedimentological and sequence stratigraphic studies that closely integrate semi-quantitative micropalaeontological data with core, geochemical, and wire-line log data. Sedimentological, micropalaeontological, geochemical and log data permit the confident recognition of depositional cycles, parasequences, and high-frequency sequence sets.

In addition, micropalaeontological elements possess subtle palaeoenvironmental significance, especially within the maximum flooding zones, which result in a refined interpretation of vertical and lateral variations of palaeoenvironment and palaeobathymetry.Biofacies also serve to provide, for the first time, variations in the depositional environment across the area, in which localised regions of relatively shallower conditions prevailed atop antecendent topographic highs.

These micropalaeontologically-determined, regional palaeoenvironmental patterns highlight antecedent topography and provide potential guides for an improved understanding of the distribution of primary vs. intercrystalline porosity. . Shallower maximum-flooding events are distributed beneath micropalaeontologically barren sections related to adverse shallow marine conditions prone to exposure at the cycle boundaries. It is these exposure episodes that provide appropriate conditions for freshwater leaching and dolomitization within the mixing and marine phreatic zones.

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