

Mixed Carbonates/Evaporites: The Need for Advancing the Understanding of a Complex System

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Since large hydrocarbon reserves were first discovered during the last century in the Middle East, the understanding of carbonate reservoirs has advanced significantly. In the second half of the 20th century, the science of carbonate geology has evolved on many fronts to establish our current understanding of sedimentology, modern depositional analogues, cyclo-stratigraphy, sequence and seismic stratigraphy, forward modeling, geochemistry, and diagenesis. Similar advancements took place in the understanding of pure evaporitic systems. Studies that addressed mixed carbonate/evaporite environments concentrated more on either the formation of evaporites or the deposition of carbonates.

While carbonate deposition is linked to relative sea-level changes, biogenic production and paleogeographic changes, evaporite deposition is primarily controlled by net evaporation of seawater in a basin and reflux processes. Formation of evaporites may be decoupled from relative sea-level changes, and evaporites might occur during rise as well as fall of relative sea-level. In addition, later replacement and neomorphism of evaporites make an interpretation of the original depositional environments more difficult. Further, modern evaporite depositional environments, such as the coastal sabkhas of Abu Dhabi and Lake Mc Cloud in Western Australia, might be limited analogues to the extensive evaporite systems of the past.

Because the largest oil and gas fields worldwide produce from mixed/carbonate reservoirs, there remains the need for further studies on the processes of formation of mixed carbonate/evaporite succession as a system. It is crucial to understand the interplay between carbonate/evaporite deposition in a modern sequence stratigraphic and diagenetic framework. Most of the Giant and Super-Giant fields have been discovered in broad, gentle, four-way dip-closure structural traps. With evaporites proven as an efficient top seal and potential source rock, is it possible that stratigraphic traps with substantial reserves are yet to be discovered? Do other unconventional opportunities exist in associated carbonates? When pushing the limits to go beyond the conventional practices of exploration and production for hydrocarbons in carbonate/evaporite systems, we seek new unconventional resources.