Arid Region Carbonate Platforms: Middle East Reservoirs

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Calclitic grainstones and some dolomitic packstones are amongst the most common Middle East reservoir lithologies and they host some of the best hydrocarbon reservoirs in the world. They are well-sorted, winnowed carbonate deposits with little or no carbonate mud, normally formed in moderate to warm shallow-water, high-energy settings. Substantial accumulations of this facies may form in relatively shallow, subsiding basins so that deposition and subsidence remain in balance thus permitting continuous deposition. Where these sediments remain only partially cemented, fairly open porosity is maintained and upon burial there is only moderate compaction and such sediments can act as excellent hydrocarbon reservoirs. The packstones accumulated both downslope from the grainshoals and updip to their lea. Their porosity is in part depositional and in part diagenetic.

Evaporites form excellent seals for the grainstone and packstone porosity. In the same basinal settings, small worldwide sea-level fluctuations produce more restricted marine circulation, and evaporite formation may result. While shallow-water carbonate accumulation takes place at 1–3 cm/1,000 years (for non-reefal carbonates) and 1–3 m /1,000 years (reefal carbonates), the shallow-water evaporites (in the same settings) may form at 1–40 m/1,000 years for sulphates and 10–100 m/1,000 years for halite. While carbonate deposition commonly just keeps up with developing basinal accommodation (at about the same rate), evaporites completely fill all available basinal capacity within a very short time period, perhaps a few thousand years, vastly exceeding subsidence.

Evaporites can also tell you something about the geological history of a basin. For open-water marine carbonates, small changes in sea level merely result in lateral depositional shifts, as the products of biotic carbonate formation and deposition are redistributed by migrating wave action and associated currents. However evaporites fill almost any basin nearly up to sea level, within a few thousand years. This creates almost perfect depositional time lines. These depositional fill-surfaces may also become truncated wherever sea level actually drops below the regional sediment top and become karstified down to the levels of regional drawdown. The next marine sea-level rise that overtops the regional barriers permits re-establishment of open-marine deposition, a much slower process, thus new accommodation can develop. In this way regional correlation is relatively easy and the evaporites represent a useful time line.