Depositional Architecture of the Gotnia Basin during the Deposition of Najmah Formation in Kuwait

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ABSTRACT

The Najmah Formation, having a thickness of around 120 feet in the North and close to 300 feet in the South is subdivided into Lower, Middle and Upper. The lower unit is represented by alternations of dominantly wackestone and minor mudstone with few thin intervals of bituminous mudstone. The Middle unit named as Najmah Organic rich Limestone is dominantly bituminous mudstone with several grain flow units sourced from south, causing significant thickness variations within unit from South to North with diminishing thicknesses towards North. The upper unit is represented by oncoidal bioclastic packstone to rare grainstone representing deposition in Inner Ramp with frequent exposure surfaces marked by leaching and dissolution. The depositional architecture of the basin is suggestive of deposition of Lower Najmah in fluctuating depositional conditions whereas Middle, Organic rich Limestone was deposited in restricted Intra-shelf basin representing anoxic conditions and the grain-flow units represented by grain dominated facies within intra-shelf basin were deposited from shallow shelf area of the basin, which are sourced from south and might have been triggered by some tectonic activity. The Upper Najmah was deposited on a gentle ramp representing deposition in inner ramp setting with frequent exposure surfaces marked by leaching and dissolution. The Najmah Formation in Kuwait is tight, having poor reservoir quality with 2 to 4 percent matrix porosity and are excellent source rocks. Sediments have undergone syndepositional to post depositional diagenetic events with fracturing as one of the major diagenetic event. Diagenetic events are linked to the basin architecture to some extent. These fractured reservoirs are often vertically and laterally heterogeneous due to depositional variability and diagenetic alteration through space and time. The effect of diagenetic events on altering porosities is not very evident except fractures that have modified the porosity to some extent and permeability to a larger extent, leading to a good permeability and productivity inspite of poor matrix porosities. Understanding of role of diagenetic events in deciphering the history of fracturing and relative timing of multiple fractures set and fracture cementation events and its relation to hydrocarbon migration can play a key role in future exploration and planned developments of these reservoirs.