New approach to integrate the diagenetic facies with the reservoir rock typing for 3D modeling of Lower Cretaceous Carbonate Reservoir In UAE

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The 3D modeling of reservoir flow units is a key parameter influencing production and recovery of oil and gas reservoirs. The main challenge is filling the gap between depositional facies and their petrophysical properties based on reservoir characterization rather than mathematical concept to enable efficient distribution in space of reservoir rock types. This study established a link between the geological properties (depositional and diagenetic) and the petrophysical properties to build a robust geological model.

Detailed diagenesis analysis is performed to log all related characteristics may control the pore size and morphology which are consequently impact the flow behavior and reservoir performance. That include the diagenetic overprints such as cementation, dissolution, recrystallization and mineral replacement, compaction, etc. The reservoir analysis are conducted at core scale (3000 ft of core) and thin section scale (2100 thin sections) in integration with the analysis of CL, SEM and XRD. Final geological facies scheme was created to combine the characteristics of the depositional facies and diagenetic overprints. A contingency table is created to analyse the frequency and distribution of the diagenetic facies in respect to their original depositional facies. Both deposition and diagenetic facies analyses are integrated to the mercury injection capillary pressure analysis which classified the reservoir rock types based on their quantitative analysis of pore throat radius (PTR) distribution and connectivity within a volume of rock. All results are linked to the conventional core analysis and log data to establish static rock types.

The results of integrating the depositional, diagenetic and petrophysical properties trends are in harmony and promote a strongly feasible property model. The established workflow is well defined, and built a bridge between the geological aspect (by honoring the depositional and diagenetical/Geological facies models) and the petrophysical properties model (core analysis and log data). Total of 20 diagenetic / geological facies were created and grouped into 6 main diagenetic events categories. The analyses and distribution are constrained by the existing stratigraphy framework and sectored in reference to the area geological setting.