694825 Meteoric Diagenesis of Microporous Carbonates. Example of the Mishrif Fm. (Cenomanian - Early Turonian) of Qatar (Middle-East)

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Shallow marine carbonate sediments of the Mishrif Formation (Mid-Cenomanian to Early Turonian) were deposited on a low energy ramp, before a Mid-Turonian relative sea-level fall. Depositional environments vary from inner ramp to open mid-ramp, with very shallow rudist biostromes. In the predominant mud-supported sediments (mudstones, wackestones…), the heterogeneity of reservoir properties (e.g. porosity, permeability, pore access radii distribution…) is closely related to micro-textures of the micritic matrix. Microporosity is relatively constant, high (up to 35%) and represents up to 98% of the total porosity. Permeability is low (below 1mD) to moderate (up to 100mD).

Using cathodoluminescence (CL), scanning electron microscopy and isotopic analyses, 240 samples coming from seven cored wells of a Mishrif oil field have been studied to characterize the sedimentary and diagenetic factors that have controlled reservoir properties.

Micritic facies with the best permeability (up to 100mD) and the higher pore threshold radius (PTR - up than 0.5µm) generally show coarse, badly sorted and poorly luminescent micrites. These micrites are spatially and chronologically associated with eogenetic phases indicating the development of an important oxidizing vadose interval (up to 30m thick) below the Mid-Turonian exposure surface: (1) endokarstic cavities; (2) rare poorly luminescent sparry low magnesium calcite (LMC) with low δ18O and low δ13C; (3) corrosion gulfs on early spars. In this vadose zone, the development of coarse (crystallometry > 2µm), poorly luminescent micrites with similar geochemical signature is explained by the early dissolution of fine aragonite and HMC particles leading to a simultaneous overgrowth of LMC particles.
Below the vadose zone most of micritic facies are associated with low permeability and PTR (less than 10mD and 0.5µm, respectively). Micrites are finer (crystallometry less than 2µm), well sorted and luminescent under CL. This micritic pole is explained by a mineralogical stabilization of micritic particles that ends later, in poorly oxygenated waters, probably after the deposition of the Laffan shales that sealing the Mishrif reservoir.

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