1187610 Influence of Major Unconformities on the Heterogeneity of Reservoir Properties. Example of the Mishrif Formation of Qatar

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Shallow marine carbonates of the Mishrif Formation (Cenomanian) were deposited on a low energy platform, before a Mid-Turonian relative sea-level fall leading to the Top Mishrif Unconformity (TMU). Depositional environments vary from inner platform to very shallow bioclastic rudist-rich shoals. In the reservoir, porosity values are up to 35% and permeability is low (below 1mD) to moderate (up to 250mD). Microporosity may represent up to 98% of the global porosity.

Using cathodoluminescence, scanning electron microscopy and isotopes, 280 samples coming from seven cored wells of a Mishrif oil field have been studied to characterize the diagenetic features that have controlled reservoir properties. Results show that the reservoir must be divided into two intervals, having their own diagenetic characteristics.

(1) The upper interval mostly corresponds to the current oil impregnated zone. Several early diagenetic phases related to the TMU are observed in this interval. These phases are (1) endokarstic cavities and (2) poorly luminescent meteoric calcitic cements divided into two sub-zones, C1a & C1b. C1a is assumed to be contemporaneous of aragonitic bioclasts neomorphism, before the complete leaching of the bioclasts. C1b have the petrographic and isotopic characteristics of meteoric phreatic cements. These phases are associated with the development of a thick (up to 50m) meteoric leaching interval below the TMU. Micrites are coarse (>2µm), poorly luminescent and have low δ18O and low δ13C, explained by early mineralogical stabilization in oxidizing meteoric fluids.

(2) The lower interval corresponds to the current aquifer, and is located below the leaching zone. However, meteoric cements are finer, exhibiting bright yellow luminescence, explained by cementation in poorly oxygenated meteoric fluids. In this zone, micrites are finer, highly luminescent, with poor reservoir qualities (permeability generally less than 10mD). This would be explained by a progressive stabilization, leading to neomorphism processes which not extend the porous network.

In this reservoir, drains are so the result of early moldic dissolution, related to meteoric fluids from the exposure surface of the TMU. Moreover, microporosity is also related to early meteoric fluid introduction. However, a burial dissolution stage (related to oil emplacement) is responsible of the enhancement of the existing reservoir properties, mostly in the previous more porous and permeable sediments.

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