The Rosetta Stone Project – II: Spectral Analysis of the Pore Geometries and Their Relationships to Reservoir Properties for the Arab D Limestones

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The Rosetta Stone project was launched in 2001, to acquire a much more extensive data set from 10 cored wells and containing: geological, petrophysical and reservoir property data.

Four porositons (distinct and separable pore-throat size distribution modes) are the fundamental building blocks of the Arab-D limestone pore systems. The “M” porositon (macroporosity) carries 99.98% of the permeability of the multimodal pore systems. Of the three forms of microporosity, the one with the largest pore throats (porositon “1”) is prevalent in the best reservoir rocks (that is, they have an “M_1” porositon combination). The presence of macropores and micropores, e.g., M_1, in certain of the HWM facies types causes them to act to a first approximation as dual porosity – single permeability system.

Conclusions about the relationships between porositons and reservoir properties include:

• Efforts on permeability modeling are focused on the M porositon resulting in an improved permeability model • Relative permeability shows significant pore geometrical controls in addition to wettability, especially in that microporosity contributes to measurable relative permeability primarily through a water saturation offset • Among a range of M_1 dual porositon samples prepared consistently with regards to wettability, Type 1 microporosity controls the water saturation value at which the oil relative permeability curve, Kro, starts to decrease from 100%. • Among a range of M_1 dual porositon samples prepared consistently with regards to wettability, the curve shape of the oil relative permeability curve, Kro, as it declines from 100%, is controlled only by the permeability of the M porositon and steepens as that permeability increases. • Ultimate recovery forecasts from relative permeability concepts require knowledge of the micro and macro pore systems.