Reservoir Characterization and Stochastic Modeling of the 2nd Eocene Dolomite Reservoir, Wafra Field, Divided Zone, Kuwait-Saudi Arabia

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The Wafra 2nd Eocene Reservoirs are dolomitized carbonates associated with anhydrite deposited under shallow sub-tidal to subkha environments. These are characterized by high porosity and permeability, mainly due to vugs formed by enhancement of the predominantly intercrystalline porosity by leaching and dissolution. This vug dominated heteroloithic pore system cuts across the depositional fabric that has largely been obliterated by dolomitization.

A relatively simple method of porosity modeling, using zonation based on high frequency cycles (HFCs) has been attempted with good results. Based on core petrographic and electrolog studies, the reservoir has been divided into 8 HFCs, further divisible into 14 ‘zones'. Porosity distribution is closely related to this HFC based zonation. Core porosities show a decreasing upward trend between successive HFCs and the lower zone of each HFC has a higher porosity than the upper. Mostly the vugs are localized to zones overlying the tighter, anhydrite rich crusts of the respective lower HFC.

The paper describes stochastic modeling of the reservoir properties and their distribution in a high resolution 3D grid of nearly 10 million cells covering an area of about 350km^2 and average thickness of 500 feet. Vertically the grid was divided into 14 stratigraphic layers based on the subdivision of the 8 HFCs. Porosity was distributed by sequential Gaussian simulation, constrained by semivariogram models generated for each stratigraphic layer. Permeability was distributed by applying powerlog porosity – permeability transforms developed for each stratigraphic layer from core data. Water saturation distribution was further constrained by the model porosity distribution and the oil water transition zone.