

Facies-based Carbonate Reservoir Models: The Link between Facies and Pore Systems

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A pore systems database is the backbone of any reservoir model. It links the hydrocarbon storage in the pore space to the flow behaviors of the reservoir. This paper shows how important it is to link the pore systems to the rock fabrics within reservoir lithofacies in order to build good static and dynamic models. The reservoir we present here is a heterogeneous carbonate reservoir. Fourteen high-resolution lithofacies were described from hundreds of cored wells. The pore systems were defined from the analysis of comprehensive Mercury Injection Capillary Pressure (MICP) data measured from more than two thousands core plugs. The pore system with macro and micro-porosity quantifications was used to define six classes of Petrophysical Rock Types (PRTs). Abundant and representative field data were studied to produce the link between pore systems and rock fabrics. The pore systems are predominantly bimodal (60 %), monomodal (30%) and trimodal (10%). The fourteen lithofacies range from the mud dominated to the grain dominated. Six defined mud-dominated lithofacies (F1 to F6) in the lower intervals of the reservoir are deep or open marine deposits. Monomodal Type 1 microporosity pore system dominates these open marine deposits. The grain-dominated lithofacies (F7-14) are found in shallow, moderate to high-energy marine deposits. The important bimodal PRT M_1 (Macroporosity with type 1 microporosity) dominates in these grain-dominated lithofacies. We succeeded to produce the link between pore systems and rock fabrics within the lithofacies. The link will assist in the spatial distribution of micro and macro-porosity and will ensure better reservoir characterization and simulation. Having the right population of micro and macro-porosity within reservoir lithofacies ensures accurate reserves estimates and helps to achieve field ultimate recovery.