Pore Types Modeling Workflow Using Multipoint Statistics for the Build-Up of Isolated Carbonates in the Central Luconia Province

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9.29.2020 - 10.1.2020 – AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

The Miocene in Central Luconia province represents a period of extensive reef development and is characterized by several important changes influencing both carbonates-producing biota and stratigraphic architecture. Different factors have been playing an important role on the development of reef architecture such as global eustatic fluctuations, differences in climate such as wind direction and strength as well as precipitation, subsidence rates and local variations in the reef growth rates, reef morphology, and orientation. All these factors provide an imprint to internal facies distribution, lateral and vertical heterogeneity in porosity type and distribution have influenced the resulting complex rock framework, permeability heterogeneity, and susceptibility to early diagenesis in facies distribution that can be related with most of the problems encountered in carbonates reservoirs modeling. Due to a complex stratigraphic architecture which is the result of multiple erosions of lack deposition the use of traditional modeling workflow proved to not represent exactly facies distribution as porosity types are heterogeneous, i.e. biomoulds, intercrystalline pores, micro porosity, vuggy and mouldic, for example single porosity values may be related to permeabilities that vary within 3 orders of magnitude. A Multiple-Point Statistic (MPS) workflow for isolated carbonates build-ups 3D pore-types modeling in offshore Malaysia is proposed to improve geological realism honouring both soft and hard data to predict permeability architecture. For this case study three training images (TIs) are built reflecting local and regional geological process (e.g. sea level changes, tectonics, and karstification) resulting in three main sedimentary stages: flooding,

aggradation and progradation, while reef growth development are used to reflect the spatial distribution of geological facies (pore types) in different depositional settings such as deep lagoon, shallow lagoon, proximal reef (lagoon), reef rim, upper talus, lower talus. Selective, global - scale study of three reef sites on exploring the relationships between reef morphology and the surrounding oceanographic conditions for input parameters of trend maps and training images for Multiple Point Statistics simulations. These curves are built to control the distribution of the pore types and match with the conceptual model at different scales from the calibrated seismic core and modern analogues. This method proved to be a good first pass approximation to build a meaningful geological model where carbonate heterogeneity mapping is captured at various scales both vertically and laterally using the input data with relevant sedimentary contribution and weight.