

A New Workflow Integrating MICP with Conventional Logs, NMR and Image Logs to Characterize the Storage and Flow Properties of a Giant Carbonate Reservoir from Abu Dhabi

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ABSTRACT

The improvements brought to reservoir characterization by a new workflow for MICP processing and their integration with other logs (conventional logs, Images and NMR logs) are exemplified here. It allows the process of MICP of varied vintages, pressure range and number of pressure steps, their display in X-plot and layout views and the application of clustering and data prediction techniques. By means of the latter techniques, the MICP measurements are easily upscaled at log scale and integrated, with other petrophysical parameters into a continuous Rock Type log regularly sampled with depth, fit for the purpose of well to well correlation, saturation height modeling and 3D geo-cellular facies modeling. This workflow is specific and innovative because it is purely “data driven” and thus devoid of user bias. It combines the Purcell model and the trial solutions proposed by Pittman, Swanson, Katz and Thompson, Walls and Amaefule to partition the porous network of the rock samples into the fraction which actually contributes to flow by permeability mechanism and the “storage only” fraction. It is shown that, by applying the MRGC clustering technique on the array log representing the contribution of each class of Pore Throat Size to permeability, rather than onto PSD, the saturation pressure curves are optimally discriminated into natural groups, particularly in complex porous network. A special emphasis is put on illustrating its capabilities to delineate and quantify the contribution to flow and storage properties of the varied types (from nano to mega) of porosity and texture present in a rock and relate them to the conventional, Images and NMR logs.