Characterization of Porosity and Permeability of the Upper Jurassic Arab-D Carbonate Reservoir Using 3D Outcrop Analog, Central Saudi Arabia

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Subsurface geological models are considered as a very coarse and low in resolution when compared to the real geology of the reservoir. In this paper a Late Jurassic outcrop analog for Arab-D reservoir, Central Saudi Arabia, was used to build a high resolution outcrop model that can capture the fine geological details. Porosity and permeability derived from the actual subsurface reservoir analog were applied to the outcrop lithofacies. For this purpose data from Ain Dar, Ghwar and Shudgam field were used. Maximum, minimum and average porosity and permeability for every single lithofacies were distributed in the facies model according to their lithofacies type. The result showed nine porosity and nine permeability models for the three field data when using a single geostatistical algorithm. Many realizations were run to see the variability in each model and to quantitatively measure the uncertainty associated with the models. Reservoir potential zones were associated with grainstone, packstone and to some extent wackstone layers. The high resolution lithofacies models allowed detecting permeability barriers and isolated low porosity bodies within the potential reservoir zone. This model gives a chance to examine porosity and permeability distribution along and across very small area of the reservoir rock in the level of one cell dimension of the real subsurface model. It is also highlight on the uncertainty associated with modeling results in terms of algorisms and number of realization used. Consequently, the model is expected to provide better understanding and prediction of reservoir properties and quality at high resolution scale which is unavailable from subsurface data.