

Case History from the Shu' Aiba Formation, Saudi Arabia: New Tools for Prediction of Carbonate Reservoir Quality

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Abstract

Reservoir quality prediction has historically been the "holy grail" of reservoir geologists, yet few have succeeded at achieving this in a quantitative fashion. This study presents a new approach to pre-drill reservoir quality prediction that involves the integration of a variety of modelling techniques to understand, quantify and predict the geological processes that control reservoir quality.

Since the initial reservoir quality framework is established at the time of deposition by a variety of depositional controls, this approach uses numerical process models to predict initial reservoir quality; results from these depositional models are then modified via a series of process modelling technologies to quantify and predict post-depositional modifications that have significantly affected reservoir quality in the interval of interest.

This approach is illustrated using an example from the Early Cretaceous Shu'aiba Formation in eastern Saudi Arabia, where depositional facies, diagenesis and resulting reservoir quality are predicted and tested against well and seismic data, with generally positive results. Model predicted sediment thicknesses match thicknesses measured in wells to within $\pm 0.5\%$; depositional facies and diagenetic trends seen in key wells from the Shaybah field matched model predicted facies and diagenesis; and model predicted porosity matched observed porosity within ± 1.8 porosity units.