

A New Approach for Reducing Uncertainties in Formation Evaluation

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ABSTRACT: The Cooper Basin is the largest onshore petroleum producing province in Australia. The hydrocarbon-bearing formations were deposited in a glacio-fluvial complex that evolved to a fluvial-lacustrine environment. Elevated geothermal gradients and high clay contents have produced variable, heterogeneous and generally low permeability reservoirs with a strong variance in production behaviours. In such situations, wide uncertainties in petrophysical parameters can be expected, particularly between different reservoir layers and hydraulic flow units. Recent studies document significant variation in formation water resistivity (R_w) and cementation exponent (m). While this study is not intended to resolve variability in R_w , the uncertainty in m can create a large, if not larger, error in interpreted water saturation (S_w). This potential error requires a model for understanding and predicting the variability. An integrated geological/petrophysical approach using a rock catalogue concept has been applied, using 20 years of core and log data. In addition, more than two hundred plugs and off-set plugs were obtained and analysed. Core descriptions over a few thousand feet, special core analysis (SCA), log evaluation, petrography results, and engineering and production data were incorporated in a searchable database to provide geological, petrophysical and engineering data quickly and at minimum cost. This work presents examples and applications through a number of case studies showing how the technique can reduce uncertainties and enhance the estimation of recoverable hydrocarbons. The technique contributes to a better understanding of performance behaviour in heterogeneous reservoirs and assists in defining more efficient development strategies.
