GeoCellular Static Modelling of Basement Reservoir of Madanam field, Cauvery Basin, India

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Abstract

The unconventional nature of the Basement play makes it more challenging. Few primary conditions need to be fulfilled for hydrocarbon entrapment within the fractured Basement. It is a known fact that igneous bodies are themselves not having primary porosity or act as source rock. Thus for it to qualify as a reservoir it needs to be fed by the source rocks which exist in the vicinity and for porosity, the rock type needs to be fractured with the development of secondary porosity and fractures has to be well connected for good permeability. Along with this, the reservoir also needs to have a lateral or vertical seal. A better understanding of the Basement play, needs a fracture intensity model with reference to regional stress field, knowledge of open fractures and their connectivity. The study encompasses 3D Geocellular modelling (GCM) for fracture characterization, facies modelling, porosity modelling & Water saturation modelling and evaluation of the performance of the wells of Madanam field in Cauvery Basin. The rock type in study is granitic basement. The challenge lay in characterizing such basement reservoirs with significant heterogeneities in mineral facies, in situ stress fields, seismic amplitudes, fracture properties and connectivity, and flow potential. Both the mega fault and minor/ mesoscopic fractures system are prerequisites for an ideal condition for hydrocarbon accumulation and production. The occurrences and fracture density of minor and mesoscopic fractures apparently do show some influence on the well performance. The mega fracture/fault systems serve as the main conduit for hydrocarbon charging of the trap reservoir block. The smaller scale fracture system observed on well logs provides porosity and permeability to the reservoir. The present study is an attempt to build a robust Basement characterization model incorporating the heterogeneities within it. The Workflow assimilating structural modeling using seismic attributes (Variance, Curvature and Ant-track) and petro-physical interpretations (Facies, Porosity, Saturation and Formation Micro Imaging data) for fracture drivers and GCM generated and this model was used and was further fine-tuned using geological concepts and point data extracted from well data analysis.