

Integrated Formation Evaluation of a Deepwater Exploration Well on the East Coast of India

Klimentos, Theodore¹, K. Seth¹, G. M. Chavan² (1) Schlumberger, Mumbai, India (2) ONGC, Mumbai, India

Deepwater environment in India presents a unique challenge to formation evaluation. The reservoirs encountered are of complex lithology consisting of feldspathic sands, authogenic clays and heavy minerals. Also, the formations are often unconsolidated. This coupled with the presence of highly conductive clays and thin beds, each having a significant effect both on porosity and resistivity measurements, makes it difficult to rigorously evaluate the formations volumetrically. This paper presents a case study from an Indian deepwater exploration well where the basic measurements combined with nuclear magnetic resonance, elemental spectroscopy, natural gamma ray spectroscopy and dipole sonic have been used to resolve issues such as complex lithology, low-resistivity pay, thin-bed analysis, and gas effect on porosity. Combining the elemental spectroscopy and natural gamma ray spectroscopy measurements to solve for the solids, i.e., determining the volume of clay from the elemental spectroscopy and then splitting it into various clays based upon the natural gamma ray spectroscopy, helped us resolve the complex lithology. The porous space was evaluated by the NMR measurement, which is lithology independent. The fluid encountered was gas; its effect was handled by combining NMR with density and sonic measurements. NMR fluid identification stations were also used for gas detection and flushed-zone gas saturation determination. Moreover, microresistivity borehole images and high-resolution NMR logs were integrated for permeability evaluation over thin-bedded sections. The results from this integrated formation evaluation assisted in optimizing the logging program in the next deepwater well and reduce log acquisition time by 24 hrs.