State-of-Art Logging Technologies Provide Comprehensive Reservoir Evaluation Behind Casing in the Absence of Open Hole Log Data: A Case Study from Western Offshore, India

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Abstract

Well A, which was drilled as a deviated development well in the offshore region of western India, had many complications and terminated in Bassein formation. In this well, no open hole logs could be acquired due to bad hole conditions. In correlation with nearby wells, a zone in the Bassein formation was perforated, which produced gas with condensate for a few years, but it stopped flowing due to water loading. To revive the well, it was planned to re-complete the well from Bassein to Mukta formation. Hydrocarbon bearing intervals in the Mukta formation were identified by acquiring data in cased hole condition using state-of-art logging technologies.

In the absence of any open hole log data, an initiative was taken out to explore technological options for estimating the saturations in a low porosity formation in the cased hole section of well A for the required workover. The evaluation of cement bond quality behind casing helped decide the efficiency of subsequent logs recorded in the well. Geochemical logs were recorded for mineralogy and lithology characterization of the formation by elemental analysis for accurate well saturation estimations. A cased hole neutron log was recorded for evaluation of neutron porosity. Four component dipole waveform data was used to generate images of geological structures near the well and calculate acoustic properties of the formation. Multi-detector pulsed neutron logging data provided current formation saturation which helped in re-completing the well in hydrocarbon bearing zones of the Mukta formation.

Pulsed neutron logging technology provided greater saturation insights by accounting for variations in porosity and mineralogy when open hole logs were not available even in low porosity and large borehole. The cement evaluation and casing integrity data showed that the casing integrity was largely intact. Pulsed neutron logging accurately measured salinity-independent gas indicative data, and quantified gas saturation provided a clear picture of reservoir gas volumes. It was observed that the saturations determined using the pulsed neutron well log were in good agreement with formation evaluation results using conventional logs of nearby Well B. Based on acquired logs in Well A and in correlation with nearby Well B, the re-completion was successfully accomplished. The hydrocarbon bearing interval in the Mukta formation was identified and perforated. The well successfully produced gas.

This paper describes a case study of careful planning of an optimal and suitable design of the log suite to meet the requirements. A comprehensive cased hole formation evaluation has been made possible by meticulous planning and coordination. Despite many challenges such as large diameter cased hole section and tight formation, the recompletion was successful, and the well was producing hydrocarbon.