Interpreting a Complex Subsurface During Drilling Operations Using Nonconductive Mud Systems: Addressing Gulf of Mexico Reservoir Characterization Challenges in Real-Time with an Innovative Dual-Imager Tool

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Abstract

Reservoir characterization in the Gulf of Mexico is frequently challenging due to the presence of salt intrusions, which compromise seismic data interpretation. Under such conditions, acquiring and interpreting well log data while drilling becomes essential for efficient operations and achieving the high-quality formation evaluation needed in making real-time decisions. Acquiring borehole images has proven to be important in reservoir studies and extremely helpful in making real-time decisions when determining completion intervals. Unfortunately, the acquisition of high-quality borehole images can be challenging in nonconductive mud systems, which are routinely used in Gulf of Mexico drilling operations. A well, recently drilled by an Operator penetrated the modern shelf of the Gulf of Mexico waters off of Louisiana. Logging-while-drilling measurements were performed to confirm the presence or absence of laminated facies in the reservoirs. To achieve the logging objectives, data from a high-definition dual-imager-while-drilling tool was integrated with the petrophysical information provided by the Schlumberger multifunction logging-while-drilling service, including mineralogy composition. This Gulf of Mexico area is known to be populated with low-contrast, low-resistivity reservoirs; hence, conventional logging

technologies and standard resolution images do not provide data with the required detail. With an acoustic vertical resolution less than 0.2 in., coupled with the integration and placement of electromagnetic and ultrasonic images, the dual-imager-while-drilling tool helped the operator select completion intervals. Additionally, comparing the apparent resistivity obtained by the electromagnetic sensor with the deep-resistivity helped to establish the oil/water contact, important information for well completion operations. Real-Time transmission of borehole images allowed for identifying and interpreting crossbed sand as opposed to the highly anticipated laminated facies. This type of information provided an insight into the reservoir architecture and depositional environment. The integration of this new technology data, obtained while drilling, has proven essential in enabling the Operator to identify completion intervals and define formation structural features such as fractures, which would have otherwise not been identified. The case study presented in this paper clearly demonstrates how applying new technologies in challenging environments helps to solve reservoir characterization problems while reducing overall well costs.