Application of a Slimhole LWD Electrical Borehole Imaging Technology for Oil-Recovery Enhancement

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Horizontal drilling, coupled with the application of a slimhole, high-resolution, Logging While Drilling (LWD) electrical borehole imaging technology has been used to successfully evaluate Miocene sands in the Round Mountain Oil Field, California. The reservoir target is a high-porosity, shallow marine sandstone in a fault-bound homoclinal structure. This technology was selected to help accurately steer the wellbore in the target zone and evaluate the presence of potential geohazards to enhance field productivity. The study comprises detailed analysis of subsurface data from two recently completed horizontal wells.

Borehole imaging technology was used to identify sub-seismic faults, fractures and lithofacies within the borehole. It also helped with the interpretation of geological features in the context of reservoir navigation and sedimentary steering. Comprehensive analysis of the faults and natural fractures constrained the regional tectonic setting and explained the cause of a few mud-loss events. The two wells show a variety of styles and orientations of natural fractures, largely due to the complex tectonic setting of the area. Statistical fracture description revealed the presence of two major fracture-orientation clusters, each belonging to a discrete fault system.

Based on the interpretation of textural variations on the borehole image logs, as well as available mud-log data, three distinct pseudo-facies representing different depositional environments were identified. Of these, one is a good reservoir facies, defined as a moderately sorted, fine-grained, oil-bearing sandstone characterized on the image log by its high-resistivity signature. The relative proportion of the good reservoir facies to the entire well interval helped quantify the productivity of the well.

An understanding of the wellbore's framework geology was essential in mitigating potential geohazards, minimizing the degradation of reservoir quality, and increasing potential secondary oil recovery. The study results were incorporated into the field model to make modifications to the drilling program and completion strategy.