Application of Azimuthal Deep Resistivity and Azimuthal Near-Bit Gamma during Reservoir Navigation in Highly-Dipping Sand Reservoirs, Grand Isle 16 Field, Gulf of Mexico

Vinod Kumar[1], Alex Tseo[1], Casey Slattery[1], and Mary Lindsey Bateman[2]

[1]Baker Hughes, Inc., Houston, Texas

[2]Energy XXI, 1021 Main St., Ste. 2626, Houston, Texas 77002

ABSTRACT

The correct placement of horizontal wells in highly-dipping sand reservoirs and managing to stay within the reservoir has long presented challenges. Landing and subsequent navigation requires rapid and accurate decision making as drilling progresses, often at high rates of penetration. The use of traditional triple-combo measurements usually does not suffice due to the lack of azimuthal capability and the excessive distance between formation evaluation sensors and the bit. A combination of near-to-bit measurements with azimuthal capabilities has shown to assist in timely decision making and aid in simplifying complex navigation problems.

This paper discusses the interpretation and application of deep azimuthal resistivity and near-bit gamma ray measurements during reservoir navigation in thin, complex reservoirs with very high dips. When used with reservoir navigation software, the azimuthal deep resistivity measurements provide reservoir navigation engineers timely information as to whether a conductive formation is approaching, from which direction, and the distance to the most conductive bed. Also, azimuthal near-bit gamma ray measurements provide early indication of the wellbore exiting the reservoir and an estimation of structural dip measurements from real-time azimuthal gamma ray image obtained from measurements near the bit. This information is critical for adjusting the wellbore trajectory, if necessary, to stay within the reservoir section and avoid exit.

The advantage of using deep azimuthal resistivity and azimuthal near-bit gamma ray measurements is highlighted by a field example demonstrating its successful application in a complex and highly-dipping sand reservoir located in the Grand Isle 16 Field, Gulf of Mexico. Timely indications of reservoir geometry changes, together with the deep azimuthal resistivity and near-bit gamma image from this service, helped successfully drill a horizontal section in highly-dipping sand with 80% net-to-gross ratio.

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