Geological Society of Malaysia — Petroleum Geology Seminar 1989

INDUCTION, RESISTIVITY AND MWD TOOLS IN HORIZONTAL WELLS

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Conventional induction and focused resistivity tools are designed to measure resistivity from a vertical borehole surrounded by a cylindrically invaded zone while minimizing the signal contribution from adjacent horizontal beds. In recent years our understanding of these devices was extended to include beds exhibiting a large dip relative to the borehole as in the case of a highly deviated well. We shall investigate the applicability of induction and resistivity devices to horizontal wells, where the borehole run parallel to the bed boundaries.

The presence of the borehole may be simply ignored for induction sondes and the tool response is computed via an analytic solution. Because of the relative simplicity of the induction solution, the log response is computed for entire trajectories for the more common radii of curvature used in the drilling process.

On the other hand, for focused resistivity devices such as the dual laterolog or the MWD toroid sonde the borehole is an essential part of the problem. The tool response is evaluated using a numerical solution to stimulate accurately the complex physical situation.

The modeling results for the resistivity devices indicate that the measurement is more sensitive to conductive than to resistive shoulder beds. Typically, for the MWD sonde fifty percent of the resistivity signal comes from the adjacent conductive bed when it is half a foot away from the approaching borehole wall. A similar sensitivity to a resistive adjacent bed is not attained until the borehole has actually penetrated the bed. The reverse physical situation is evidenced with induction devices; resistive adjacent beds are more readily detected than conductive adjacent beds.