

# **Evaluation of Low Resistivity Oil Zones Using Mud Gas Data, a Case Study**

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## **Abstract**

Low resistivity oil zones can often be mischaracterized in shallower zones where majority of petrophysical downhole measurements are lacking. However, petrophysical indices while drilling derived from mud gas data can be used in combination with field studies to provide a better understanding of the formation fluids.

This paper will detail how mud gas analysis methods can help bridge the gap in fluid typing and assist in uncovering additional production opportunities. This case study focuses on a horizontal well in an oilfield located in the South China Sea. Seven wells were previously drilled on the oilfield with the one main reservoir to be target of the horizontal well. However, the shallower, upper section of this reservoir displayed a drop in resistivity consistent with water-bearing reservoirs in the field. Taking all LWD logs into consideration, the resistivity log response in upper section was not reasonable and the fluid type in shallow interval could not be determined. Mud log gas composition logged in upper and lower reservoir intervals were comparable, but gas values (ppm) in the upper section were higher. A study was made combining mud gas derived porosity and saturation indices to compare against the LWD derived values to provide clarifying insights on the differences between the upper and lower sections' reservoir properties.

In the lower section of the reservoir the mud gas derived porosity and saturation indices are very comparable to the LWD derived data. These similar values indicate that the effective porosities are filled with oil. However, in the upper section of the reservoir, the porosity indices from LWD and mud gas differed with mud gas showing a lower porosity, but still with a similar saturation indicating the existence of water-bound capillary porosity. This observation was confirmed by core analysis and NMR data from the field. According to the analysis, the low resistivity value in the shallow interval is due to capillary bound water.

The study shows that petrophysical indices derived from mud log data are useful for identifying low resistivity oil reservoirs. In addition, this analysis can be made in real-time as the mud gas is lagged to surface allowing additional time for decision making on post-drilling data acquisition or changes to such programs to verify the initial fluid typing from mud logs.