Use of Log-Derived High-Resolution Mineral-Based Lithofacies from Borehole Spectroscopy Logs and Microresistivity Images for Enhanced Formation Pressure Sampling and Vertical Interference Tests

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Downhole pressure sampling and vertical interference tests are being conducted more and more as standard practice in the Gulf of Mexico. A key input into the planning of these operations is an accurate understanding of the subsurface lithology, including subtle reservoir internal baffles and barriers. In order to improve planning downhole sampling operations and post-operation calculations, log-derived high-resolution mineral-based lithofacies can be used.

These are computed using borehole spectroscopy and high-resolution micro-resistivity image data. Spectroscopy data is used to classify the rocks into dry-weight mineralogy-based lithofacies based on a specifically designed ternary-diagram classification system. Calibrated high-resolution micro-resistivity image data is integrated with the generated dry-weight mineralogy-based lithofacies to compute a final mineral-based high-resolution set of lithofacies. The final lithofacies can be presented as a detailed geological column, or input as numerical data for additional computation and modeling.

These lithofacies can be used to make sampling and pressure point selections. The output can be quickly delivered to the decision makers whether in the office or at a remote location. The geological display of the lithofacies makes it readily usable and preferred for choosing sampling locations, whether for pressure or fluids. The inherent mineralogical content combined with the higher resolution bedding directly addresses the need to identify potential zones of interest otherwise indistinguishable. Critical depositional events such as maximum flooding surfaces, condensed sections, reservoir seals such as marl layers and shales, continuous or interbedded, are immediately identifiable with these lithofacies.

The use of log-derived high-resolution mineral-based lithofacies helps place the tool probes and/or packers at optimum formation and depth locations, thereby reducing risk and operating time, easing interpretation, and maximizing data and sample recovery.