Integrated Geologic Interpretation in the Deepwater Gulf of Mexico using Borehole Spectroscopy Logs, Microresistivity Images, Log-Derived High-Resolution Mineral-Based Lithofacies, and Regional Seismic Data

Zimmermann, Eric;[1] Schneider, Mike;[1] Gallagher, Mike;[1] Kear, George;[2] Kumar, Anish;[2] Briscoe, Brian;[2] and Williamson, David[2]

[1]Dominion Exploration and Production,1450 Poydras Street, New Orleans, Louisiana 70112

[2]Schlumberger Data and Consulting Services, Suite 2700, 1515 Poydras Street, New Orleans, Louisiana 70112

Abstract

Mineralogical inputs are often overlooked when performing subsurface geological and reservoir interpretation; relying often only on borehole image data. Creation of lithofacies aid the geologist in various ways, however, manual lithofacies identification and generation typically is time consuming and may be biased depending on the creator. Some lithofacies software may be available but is either too simplistic or too cumbersome that it is inconsistent or not repeatable. Borehole spectroscopy data in conjunction with high-resolution micro-resistivity images can be used to generate mineral-based high-resolution lithofacies using a log-based classification scheme. This scheme classifies the dry weight mineralogical output from borehole spectroscopy data based on an exclusively designed ternary-diagram classification system, and creates dry-weight mineralogy-based lithofacies. 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 lithofacies can be generated on a workstation within a very short time.

Geological and reservoir interpretation of a deepwater northern Gulf of Mexico well has been conducted using this innovative method of lithofacies classification and generation. The example used for this study incorporates all of the finite elements of the borehole and incorporates regional geologic interpretation from the deepwater Gulf of Mexico. This correlation includes integrated elements of regional deposition and how that is manifested in the borehole image and how it is compared to the core data analysis. Borehole images with associated dips have also been used in the interpretation. Sand units have been identified as sheet sands and amalgamated sheet sands. Interbedded sand/shale sequences have also been interpreted based on these lithofacies. Further, seismic comparison is made to integrate the log interpretation into a more regional framework. Future applications in the field include detailed well-to-well correlation, planning, execution, and evaluation of borehole pressure and fluid sampling programs, and potentially reservoir modeling.