Optimized Lithofacies Definition through Heterogeneous Rock Analysis and Correlation with Core and Productivity Potential

Nelbett Marfisi[1] and Barillas Cortez[2]

[1]Ecopetrol
[2]Schlumberger

Abstract

The Middle Magdalena Valley (VMM) is well known as one of the more important basins in Colombia. It has numerous conventional reservoir targets from the Tertiary Period. The hydrocarbon in these formations was generated in the La Luna Formation. The La Luna is part of the South American Upper Cretaceous sequence and has been recognized as one of the most important hydrocarbon source rocks in the world. This formation is described as low permeability calcareous shale and limestone, black in color, with high foraminifera content, and limestone concretions. The continuity of this formation has been established by several authors from Ecuador towards the northwest of Venezuela.

The primary focus of this paper is the optimized lithofacies definition in the La Luna Formation through the Heterogeneous Rock Analysis (HRA) and the correlation of these classes with core description, core analysis, and productivity potential. HRA is a log-based unsupervised rock classification method applied in unconventional reservoirs. HRA defines rock classes based on their fundamental attributes of texture and composition as discriminated by log inputs while promoting the uniqueness of the classes.

The electrical logs input selection for the HRA model and quality control for optimal number of class definitions are critical processes to obtain the best correlation with the lithology description. In this case, several basic and advanced electrical logs combinations were used as HRA input to determine the best result taking into account the core facies.

The productivity potential for this formation was defined by both reservoir and completion quality criteria. The reservoir quality is mainly based on petrophysical and geochemistry parameters while the completion quality is based on geomechanical parameters.

Finally a relationship between lithofacies and productivity potential is found through the different domain results integration. This association is applied in nearby wells where no core data is available. The HRA model is used to estimate the lithofacies lateral continuity in these wells to then predict the productivity potential.

Once this methodology is properly calibrated with production data, the costs associated with the core could be drastically reduced.