Well Log Cluster Analysis and Electrofacies Classification: A Probabilistic Approach for Integrating Log with Mineralogical Data

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Abstract

Understanding reservoir mineralogy is critical to quantify the effect of the matrix on well log response for petrophysical analysis. Identifying mineralogical variations associated with sequence stratigraphy may also facilitate well to well correlation. Furthermore, quantifying the mineralogy is becoming increasingly important to estimate key properties like TOC and brittleness from logs in unconventional reservoirs. The most reliable source of information on the mineral makeup of a reservoir comes from direct measurements on core or cutting samples. However, due to the scarcity of cores and the limited vertical resolution of cuttings, well log data are ultimately necessary to propagate mineralogical information at higher resolution over the entire zone of interest along a wellbore. Consequently, a proper integration of well log data with mineralogical data derived from core or cuttings is paramount. This integration is challenged by the variable vertical resolutions and sampling rates of these different types of data, which result in a non-linear relationship between them. In this paper, we explore an innovative approach using well log cluster analysis and electrofacies probabilities for integrating quantitative mineralogy measurements from cores and cuttings with conventional well log data.