Shale/Mudstone Plays, Facies and Processes—Why Do We Need Core?

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Abstract

Describing, integrating and up-scaling the physical character of mudstones poses a unique challenge, due to the fine grain size (<63μm) of their most abundant framework mineral components and cements, which is just at or below the resolution our typical toolset. The acquisition of porosity, permeability, fluid saturations, mineralogy, organic matter content, facies, and mechanical properties represents a challenge, wherein interrelationships remain poorly understood. In order to make advances in this field, there is a need to develop a more effective methodology to aid in the understanding of these complex and heterogeneous lithologies that appear uniform to the eye.

COP approach has been to gather and analyze whole core material to evaluate texture, composition and how facies changes affect mechanical, petrophysical and geochemical properties. However, the issue is not only one of acquiring the rocks, making the measurements and up-scaling, but one that lies on the inherent heterolithic nature of these rocks. It is therefore necessary to tailor the sample analysis at a scale that has to be assessed individually on a formation/unit case.

To achieve this through rock characterization, it is necessary to relate the physical measurements to specific facies by grouping similar rock composition and texture. Facies are then defined within a regional geological reservoir, with the building blocks being a detailed (play-tailored) core description that includes transport processes and post depositional modifications. This is done with the aim of predicting the effects on the evolution of petrophysical properties of the rock due to diagenesis of framework minerals, cements and organic matter.

We present a description of this methodology using several examples of shale plays that show rock datasets obtained from vertical wells and how they can offer valuable information that ultimately contributes to play delimitation. These detailed core based datasets have helped understand the lateral and vertical variability within the zone(s) of interest, and to ultimately provide a rock characterization, that when coupled with petrophysics and basin wide modeling, has paved a more effective avenue for risk mitigation.