Mechanical Characterization in Unconventional Reservoirs:
A Facies Based Methodology

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Abstract

A new core testing protocol has been created to characterize rock mechanical parameters based on lithologic composition and rock texture. The goal is to characterize the main rock types using the geologic model as the integration point. High quality mechanical core test calibration data is a fundamental requirement to reduce stress analysis uncertainty, the workflow presented includes systematic quality control measures to ensure data integrity. The mechanical data supports log-based stress models by providing the static to dynamic transforms of the elastic properties. The elastic transforms can be used to calibrate common frac gradient models. The data also supports facies based geological models, such as those requiring layer-by-layer properties, using the concepts of mechanical lithofacies and mechanical stratigraphy. The mechanical stratigraphy is constructed by integrating the mechanically characterized rock types with a stratigraphic layering model created from core or log descriptions. This geologically conditioned mechanical facies model containing elastic, inelastic, and failure properties is developed as an alternative and complimentary mechanical methodology to the standard log-derived elastic model.