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Fracture Characterization of the Cane Creek Play, Paradox Formation, Southeastern Utah: A Multi- Scale Approach Incorporating the Geology and Petrology of Core and Well Cuttings

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Abstract

Fracture analysis is an important component of reservoir rock characterization primarily because of the potential for enhanced migration of hydrocarbon along natural fractures that are open in-situ. The actual permeability ranges for an unconventional 'fracture play' are often anomalously higher than expected for porosity-based permeability predictions. Most fracture evaluation studies have so far depended on core and/or wellbore image logs for verification. This study presents a unique approach that integrates cuttings-scale microfractures with core-scale fractures using petrology interpretations. Also incorporated in this study are results from whole core X-ray CT (computed tomography) and wellbore image logs. This study focuses on the recently drilled State 16-2 (vertical) and State 16-2LN-CC (horizontal) wells in Grand County, Utah, with the target being the Cane Creek production zone of the Paradox Formation. Cuttings from three legacy vertical wells are also included in the study to represent the three main Cane Creek production areas in the Paradox Basin.

Core-based observations provide perhaps the best geological context for fracture geochronology. Fracture sets from the same structural event or geological timeframe generally show consistent orientation patterns and diagenetic mineralization. However, fracture geometry and mineralization may also show local variations depending on lithological attributes such as mineralogy and porosity/permeability as well as the composition of interstitial/pore fluids. Whole core CT reveals the volumetric interactions between fractures and rock facies that have unique composition and microtextural features including stylolite.

Cuttings-based microfractures are reasonably correlated with fractured sections of the core based on similarities in petrology features that include diagenetic mineralization of both the fractures and the microfractures. Initial findings indicate local interactions between some of the mineralized microfractures and microstylolites that are at various stages of development. As an example, organic- filled microstylolites that are incipient stage occur in tangential contact with mineral-filled microfractures. Many forms of isolated microstylolites are also evident in some cuttings where they are commonly lined or filled with organic material. These types of features are typical in many fracture plays. Drilling-induced microfractures and associated deformation features that characterize the cuttings also show good correlation with petrology-based rock facies and may therefore be good indicators of geomechanical behaviors such as fracturability and elasticity.

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