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Core Characterization of the Crane Creek Interval in the Paradox Formation from the State 16-2 Well

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Abstract

The State 16-2 well was drilled in Emery County, Utah as part of a U.S. Department of Energy funded field project run by the University of Utah and Zephyr Energy to explore and improve production in the emerging Cane Creek shale of the Paradox oil play (DE-FE0031775). The computed tomography (CT) facilities and multi-sensor core logger at the National Energy Technology Laboratory were used to collect non-destructive data and characterize the lithology and structure of the State 16-2 core to better understand the reservoir quality and fracture network to effectively produce this play.

The core includes roughly 110 feet from a depth of 9,638 to 9,748 feet encompassing the Cane Creek interval and the top of #22 halite cycle. Low-resolution CT images were acquired of the core, along with gamma density, p-wave velocity, magnetic susceptibly, and handheld X-Ray fluorescence measurements every 6 cm. Several sections of core were also analyzed with high-resolution CT imaging to interrogate internal structures. Sidewall and horizontal core plugs were examined with a steady-state gas permeameter under effective pressures up to 4,500 psi to semi-quantitatively examine the impact of stress-state on permeability.

The Cane Creek interval consists primarily of carbonate mudstone with 1 to 3-foot carbonate units throughout the cored section. These units lack fractures; however, they tend to have interbedded mudstone where structural movement occurred. Fractures exist in the mudstone intervals and most appear to be generated post-deposition, are mineralized, and vertical to subvertical with respect to bedding. The base of the Cane Creek interval has some interbedded zones of halite that have overturned bedding; an increase in the fracture intensity at the base of the formation was not observed.

Preliminary results from core plugs and selected intervals showed a wide variation in permeability, ranging over four orders of magnitude. High resolution CT imaging of gas flow experiments under effective pressures up to 4,500 psi reveal that micro-fractures adjacent to larger grains can dominate the flow through the cores under higher effective pressures.

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