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[PS]Hyperspectral Core Imaging: Spanning the Gap from Plug to Log to Reservoir Scale*

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Abstract

A relatively new instrument developed by Corescan Inc. was employed in this study to achieve a continuous mineral map along the length of conventional core. This instrument utilizes active-scanning hyperspectral imagery (self-illuminated rather than relying on sunlight), in combination with laser profiling, and conventional red, green, and blue photography at 500, 200, and 50 micrometer resolution, respectively, to create a high-resolution, non-destructive, continuous, and quantitative mineral map directly from the undisturbed core surface. The active nature of the Corescan hyperspectral imager has the advantage of utilizing the full spectral range from 400-2500 nanometers without the atmospheric absorption bands (drop outs) that plague natural-light derived imagery such as those used in airborne or ground-based spectral systems. Additionally, spectral identification of clay species is robust in the spectral operating range of the Corescan instrument. A single user can scan ~800 feet (250 m) of core in a single day resulting in a continuous mineral, texture, and photographic core map. In this study, the application of active-scanning hyperspectral imagery is focused on unconventional, fine-grained, onshore tight-oil reservoirs that have mixed lithologies and diagenetic overprints. The rapid acquisition and processing of the spectral data aid in high-grading sample selection zones for routine and/or special core analysis. We demonstrate a workflow on a variety of rock types that outline the benefits of integrating hyperspectral, x-ray diffraction, and mineral elemental mapping to constrain petrophysical models. Such integrated techniques better drive static and dynamic reservoir modeling for unconventional oil and gas plays.