GeoConvention 2015
GEOSCIENCE
new horizons
Telus Convention Centre • 4-8 May 2015 • Calgary, AB Canada

Multimineral modeling using new core scanning technology

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Abstract

Recent advances in core-scanning technology have provided the necessary data to model unconventional reservoirs at extremely high resolution using non-destructive techniques. These include Dual Energy Computed Tomography (DECT) and X-Ray Fluorescence (XRF), which measure bulk density and chemical composition (rock matrix), respectively. These fine-scale core scanning methods resolve geologic thin-beds (cm-scale), and output data can be up-scaled to match traditional wireline logs for regional assessment. Core-scanning also provides rich chemical datasets, and in the case of XRF yields up to 30 elements, including majors and traces – this greatly exceeds that of industry standard core gamma scans (K, U and Th).

The integration of both core scanning techniques (XRF and DECT) can also be used to generate high-resolution reservoir models. Bulk density and elements from XRF scanning are used to solve for mineralogy, total porosity, clay bound water and effective porosity. Continuous kerogen estimation is also possible by calibration of elemental proxies, and is critically important for organic-rich source beds. Summation of the calculated mineral volumes and kerogen, if present, defines solid-phase matrix density, which can be combine with bulk and fluid densities to calculate reservoir storage along with bound versus free fluids in the reservoir. This multimineral model is calculated using core scanning results; hence has utility for comparison to log-based petrophysical solutions.