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Integration of Whole Core, Drill Cuttings, and Well Log Data for Improved Characterization in the Wolfcamp Formation

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Oil production from the Permian region is now over 2 million BOPD despite large declines in rig count over the last 12 months (EIA, April, 2016). The Delaware Basin is contributing an increasing share of Permian production. The well analyzed for this project was drilled in 2014 and had a full diameter core sample of about 247 feet in length. Dual-energy CT (DE-CT) scanning and spectral gamma logging was used to compute mineralogy and TOC along the core. Over the same vertical interval, drill cuttings were acquired at a sample interval of 5 ft. Drill cuttings were also acquired at 30 foot intervals along the lateral portion of the wellbore. Wireline log data obtained on this well includes quad combo, spectral GR, image log, elemental components log, and a full wave sonic. This data has been used to compute fluid and volumetric properties as well as rock mechanical properties. Ion-milled SEM data and 3D FIB-SEM data was used to obtain PAOM, pore size, and permeability from about 30 plug samples. A major goal was to quantify total porosity (Φ_T), effective porosity (Φ_E), porosity associated with organic matter (PAOM) from core samples and use this data to aid in interpretation of the wireline log data. In this work we also demonstrate that rock properties can be up-scaled throughout the nano-scale to core scale by combining DRA, Machine learning (ML) techniques, and high performance computing (HPC) platforms.

