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A New Approach to Measuring Rock Properties Data from Cores & Cuttings for Reservoir & Completions Characterization: an Example from the Bakken Formation

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The application of rock physics data for improved reservoir characterization is well known and documented and, can help to delineate fluid and facies changes down the borehole. With the advent of unconventional exploration & production, and the production requirement of a series of long laterals to maximize return, use of elastic rock properties for completions characterization becomes important.

Traditionally, rock elasticity has been determined through geomechanical laboratory measurements on core pieces or plugs and log derived calculations. Unfortunately, these data sets are rare (i.e. core) and inconsistent/expensive to collect (i.e. logs) along long laterals. However, cuttings are always available for the whole borehole. They provide a source of compositional and textural rock data that can be quantitatively measured to train standard petrophysical analysis in order to implement rock physics equations (e.g. Young's Modulus, ν, λ, λ–ρ, and μ–ρ). Using E-beam systems, such as RoqSCAN™, quantitative mineral compositional data, together with high resolution textural information (e.g. pore volume, pore fabric, pore size distribution and pore aspect ratio) from cuttings is measureable, allowing input parameters (e.g. pore aspect ratio) to be directly measured on rocks rather than mathematically derived.

424 cuttings and core samples were collected from two wells (vertical-lateral pair) penetrating the Bakken Formation in Montrail county, North Dakota and the quantitative compositional mineralogy and key elemental and pore data derived textural parameters were measured. These rock derived data were used to train a standard petrophysical package to generate definitive bulk mineralogy and fluids curves. Eight mineralogical rock types were defined through the vertical Bakken section with measured pore data for each rock type used as final inputs into elastic properties models. Additionally, rock based shear curves were generated using the mineral grain density and porosity data. Comparison of the new rock defined dataset to measured geomechanical data from adjacent wells showed good statistical agreement.

This work will demonstrate the benefits and importance of using cuttings based measured rock properties for better reservoir and completions characterization along long laterals, where core and log data are scarce.