Core to Log Integration in Alaska's North Slope Nanushuk Formation Using High Resolution Petrophysical Profiling

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Abstract

Proper integration of petrophysical data acquired at log and sample scale is key to generating representative models for subsurface exploration, development and production. Though critical in delivering ground truth assessment of various properties and their spatial variability under the well logresolution, lab-based measurement programs are often adversely affected by sparse sampling and relatively long turnaround times. Fast petrophysical profiling of the core surface offers an intermediate tool with data outputs which can be readily integrated with well logs on the one hand while beingleveraged for picking plug location on the other when enhanced characterization is desired.In this paper, we present a data set combining publicly available log and plug data with the result of a petrophysical profiling campaign conducted on 40 feet of slabbed core from Alaska's North Slope Nanushuk Formation which comprises both sandstone and shale intervals. The petrophysical profiling wasdone with an AutoScan system at a 5mm spatial frequency and included P- and S-wave velocity, permeability, reduced Young's modulus through a unique rebound technique (Impulse hammer), as well as FTIR spectra for mineralogy.The remarkable correlation between permeability values obtained from plugs and AutoScan profiling provides a benchmark for exploiting the superior spatial coverage of AutoScan data and define physically based rock types which can be ultimately used for sampling and to establish core to log transforms. The integration between AutoScan and wireline log triple combo (gamma ray / density / resistivity) data reveals in particular a large variability in

mechanical and compositional layering and forms the basis for transforms that can then be extended over the entire well length. After a thorough review and integration of the available plug, core and well log data, we conclude the paper by outlining a generic workflow aimed at providing an early physically-based option for decision making.