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Characterization of Unconventional Reservoirs Using Rock Physics and Drill Cuttings

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ABSTRACT

The application of rock physics modeling for reservoir characterization is well known and can help to delineate fluid and facies changes. With the advent of unconventional resource exploration and production, and the adoption of long laterals to maximize reservoir contact and recovery, use of elastic rock properties for reservoir characterization becomes increasingly important. Derivation of an accurate, robust, and reproducible predictive reservoir characterization models has proved challenging in unconventional plays. Lacking the model with robust predictive power, drilling and completion decisions are often made on non-geologic criteria tangentially related to the rock properties within their production targets. Zones of interest originally assumed to be homogeneous and isotropic are proving to be quite complex leading to renewed interest in the utilization of workflows to create geological and engineering models ahead of the drill bit. Technological advances in both equipment and computer software have enabled the implementation of new approaches in generation of mineralogical datasets at well sites. These datasets are currently utilized by hydraulic fracturing engineers to assist in designing optimized fracture stage intervals in horizontal wellbores, in contrast to the assumption of uniform intervals between fracturing stages. Mineralogical data is generated by downhole wireline logging tools, and on drill cuttings, whole cores, and rotary sidewall core plugs utilizing a variety of analytical instrumentation techniques. In this paper, we present a workflow to incorporate microtextural data derived from drill cuttings into rock physics modeling (RPM). Several wells from one of the unconventional fields have been interpreted for petrophysical properties. Corresponding drill cuttings have been analyzed and interpreted to derive microtextural data. RPM has been performed and a set of synthetic elastic logs has been computed and calibrated to well logs available in vertical well. Weakness planes have been incorporated into computation of the weakness and finally, breakdown pressure has been derived and com-

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pared to the actual pressure obtained in-situ. Results are in good agreement, thus providing valuable insights and merging field observations with RPM–based analysis.