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Horizontal Cuttings Analysis Profiling in Unconventional Reservoirs: Laboratory Analyses and Their Applications for Optimizing Completions

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Summary

Unconventional shale gas and oil reservoirs require extensive horizontal drilling and large scale multi-stage hydraulic fracturing treatments in order to produce from these reservoirs. Horizontal drilling and stimulation comes at a high cost and involves precise horizontal well placement and stimulation management to maximize reservoir access. Optimization of drilling and stimulation programs is dependent upon proper characterization of the reservoir geological properties. Collecting cuttings along the horizontal during the drilling process is a cost effective means of understanding the geological characteristics and properties of the formation. Laboratory testing provides invaluable information that can be used to identify optimal hydraulic fracturing zones and help in spacing designs for the completion process. In this study we examine samples from the Duvernay Formation to highlight the utility of the testing and its applications.

Cuttings samples are collected during the drilling process resulting in zero time loss to drilling operations. From these cuttings samples, rapid tests can be performed to give insights on organic content, organic matter maturity, mineralogy, mineral fabric, hardness, fluid compositions or fluid sensitivity to various fluid compositions, to name the most important parameters. The data can then be utilized to identify optimal hydrocarbon targets/zones with, for example, greater brittleness or higher organics, to help optimize fracture spacing and provide a better understanding of the lateral variability along the length of the horizontal. High resolution imaging (thin section and SEM) are also used to evaluate pore systems, the distribution of organic matter and minerals and diagenetic fabric and provides links to understanding the geomechanical properties. By analyzing various parameters of different rock/fluid characteristics, a better (integrated) model of total hydrocarbon resource in place can be achieved. Not only do cuttings analyses provide a cost effective means of better understanding the reservoir properties, they also provide inputs for improved petrophysical models for completion designs.