

# Landing and Characterizing STACK Laterals Using Volatile Analysis Service of PDC cuttings.

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The analysis of volatiles from drill cuttings is breakthrough technology with its ability to determine present day fluid characteristics. The Volatiles Analysis Service (VAS) invented by AHS and distributed by Baker Hughes, a GE company, provides a high value log with no additional logging time that can identify the landing zone and characterize the lateral to enable optimized completion strategies to get the most value out of a unconventional play asset. We present the analysis done in horizontal drilling of the Meramec formation, as well as Upper and Lower Osage Carbonates in the STACK, OK.

Major oil migration pathways in the STACK are shown to occur on faults. Reservoir rocks adjacent to faults that are oil migration pathways are charged. Reservoirs at a significant distance to the fault migration pathways are not charged. Oil and gas, including Helium, migrate predominantly into reservoir rocks in the hanging wall above the fault plane. Basinal brines migrating with oil and containing organic acids migrate predominantly into the foot wall below the fault plane. The migration of oil and gas into the fault adjacent reservoirs preserves reservoir quality. Basinal brine and organic acid migration encourage the formation of tight rocks with poor reservoir qualities in the foot wall of these faults.

PDC cuttings are typically sub-millimeter in diameter. PDC cuttings that contain larger amounts of oil and gas are formed from extremely tight rocks that are thought not to significantly add to production. Good quality oil-charged reservoirs have cuttings that have lost most of the oil and gas. The oil and gas in cuttings from good-quality charged reservoirs are lost during the drilling process, transport in the mud system usually 1.5 to 2 miles or more, washed and dried and the analyzed.

The new volatiles analysis technology delivers the occurrence and composition of oil and gas in the cuttings, as well as mechanical strength, permeability, oil saturated water, proximity to pay, and location of potential pay zones and faults. Osage carbonate exploration has been very successful in the STACK by targeting mostly crinoid-bryozoan grainstones as their major productive interval. We believe the cuttings' volatile chemistries is mapping in this play are helping to identify these calcarenites in the laterals.

The measurement of volatiles from drill cuttings is a gentle extraction and analyses technology that utilizes all the volatiles in a cuttings sample. The VAS technology is not limited to Fluid Inclusions, but analyzes all extractable volatiles in a sample, unlike the other existing technologies in the marketplace.

PDC cuttings samples are analyzed using a Cryo Trap Mass Spectrometer (CT/MS) system invented and built at AHS. Volatiles are extracted from each individual sample at two distinct pressures, frozen onto liquid nitrogen (LN2) traps, and analyzed by allowing the frozen volatiles to sublime and enter the mass spectrometer according to their sublimation points under high vacuum. This provides a measure of compound separation and quantification like that obtained in Gas Chromatography Mass Spectrometer (GC/MS) systems. However, unlike GC/MS, this unique CT/MS system is non-selective. All volatile compounds that can be extracted and frozen are analyzed.

As an advantage to operational workflows, the measurement's turnaround time is very short, allowing the results to be considered in frac and stage design on laterals; and in picking landing sites from pilot holes, or from curve data in heal-down laterals.