

Operator Achieves More Reservoir Insight Using a New Azimuthal Gamma Ray Service

AZIMUTHAL GAMMA-RAY IMAGES UNCOVER STRATIGRAPHIC FEATURES IN A SEEMINGLY FEATURELESS UNCONVENTIONAL RESERVOIR

MIDDLE BAKKEN SHALE, NORTH DAKOTA

CHALLENGE

- » Achieve accurate wellbore placement in a formation with little gamma-ray variation

SOLUTION

- » Utilize the Radian® azimuthal gamma and inclination tool to better understand stratigraphic location and to provide instantaneous drilling direction for more accurate wellbore placement

RESULTS

- » Radian tool provided greater insight into the formation than traditional gamma ray tools for better wellbore placement
- » Avoided more expensive LWD options, thus saving costs

OVERVIEW

An operator in North Dakota's Middle Bakken shale formation sought a solution that would enable effective drilling and geosteering in a formation with little gamma ray variation, while minimizing drilling costs. The operator needed the benefits of using the Radian® azimuthal gamma and inclination service to better understand the stratigraphy of the formation and the wellbore position within the reservoir.

LOW GAMMA-RAY VARIATION POSES CHALLENGE TO WELLBORE PLACEMENT

Unconventional resources are often costly to produce as a result of the need for hydraulic fracturing. In order for these shale plays to be considered economical, drilling costs must be kept to a minimum, and many operators drill and geosteer wells with only average gamma-ray measurements obtained from a logging-while-drilling (LWD) tool. While the Three Forks formation has sufficient gamma-ray character to effectively geosteer, the wellbore placement in the Middle Bakken formation can be more challenging because of the limited gamma-ray variation, making it difficult to interpret structural changes along the wellbore and to refine the structural map.

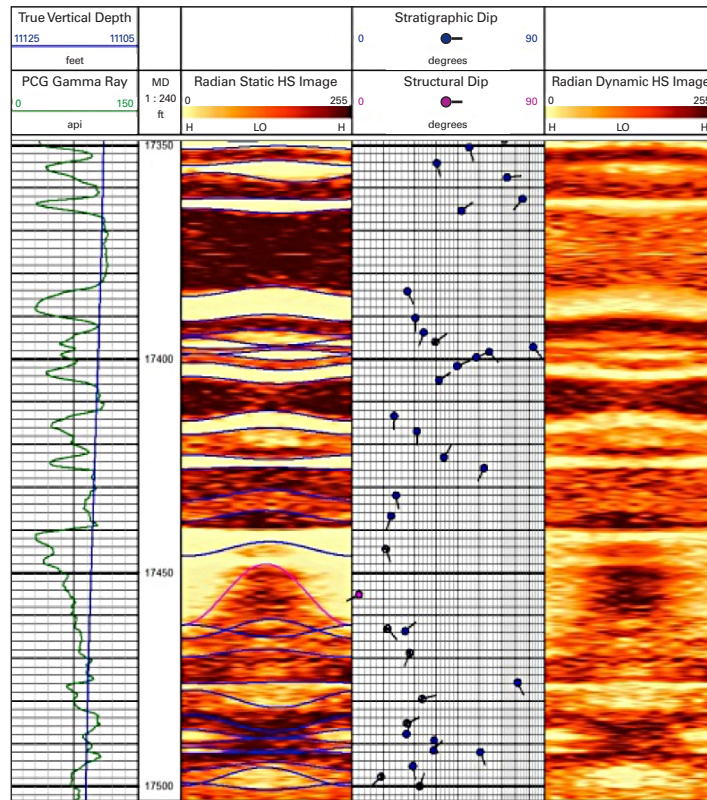
A NEW HIGH-QUALITY AZIMUTHAL GAMMA-RAY TOOL HELPS TO BETTER UNDERSTAND THE STRATIGRAPHIC LOCATION WITHIN THE FORMATION AND THE INSTANTANEOUS DRILLING DIRECTION (UP OR DOWN)

At the recommendation of Sperry Drilling, the operator drilled two wells using the Radian azimuthal gamma and inclination tool. The Radian tool features four scintillation detectors spaced 90° apart that allowed for gamma-ray imaging while rotating or sliding, along with an inclinometer that provided continuous inclination measurements for real-time monitoring of the well trajectory. Even with low gamma-ray variations in the formation, the target zone can be precisely identified based on the superior gamma-ray images provided by the Radian service. In addition, the Radian tool allowed for an enhanced survey based on the continuous inclination data for a more accurate structural map. A stratigraphic correlation between average (non-azimuthal) gamma-ray measurements and the enhanced survey was performed on one of the two wells in real time. Real-time interpretation of Radian data made it possible to detect the stratigraphic movement of the wellbore, where bulk gamma-ray measurement was featureless.

“...demonstrated that it provided images with sufficient clarity to delineate the stratigraphy of the area, while saving costs from not having to run a more expensive LWD option.”

RADIAN® TOOL PROVIDES BETTER UNDERSTANDING OF STRATIGRAPHY FOR MORE ACCURATE WELLBORE PLACEMENT

The use of real-time azimuthal gamma-ray images helped to determine whether the wellbore was moving up or down stratigraphically. Borehole dip and true dip were calculated from the gamma-ray images, using the Halliburton Borehole Imaging Studio software application, resulting in a more accurate correlation of the Middle Bakken surfaces and a better understanding of the stratigraphy surrounding the borehole. The gamma-ray images were compared with the high-resolution LWD resistivity acquired in a nearby well, and showed similar stratigraphic features. This validated the results from the Radian tool and demonstrated that it provided images with sufficient clarity to delineate the stratigraphy of the area, while saving costs from not having to run a more expensive LWD option. The azimuthal gamma-ray measurement provided the operator with greater insight into the stratigraphic well placement within the Middle Bakken formation than could be determined from average gamma-ray measurements alone.



The Radian® azimuthal gamma and inclination service provided high-quality azimuthal gamma-ray images for insight into the stratigraphy of the formation for better wellbore placement, and proved to be a service that was difficult for a conventional gamma-ray tool to deliver.

www.halliburton.com

Sales of Halliburton products and services will be in accord solely with the terms and conditions contained in the contract between Halliburton and the customer that is applicable to the sale.

H012434 2/17 © 2017 Halliburton. All Rights Reserved.