

**Unlocking the Potential of the  
Wolfcamp Play by Identifying  
Fractures Using High- Definition  
LWD Borehole Images for a Better  
Completion Strategy**

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The Wolfcamp shale is an oil-rich source rock in the Delaware Basin being targeted for horizontal drilling. The play exhibits a fairly high degree of heterogeneity in rock characteristics, lithology and natural fractures. Particularly, presence of these natural fractures can indicate potentially better reservoir quality (RQ) as well as provide information for better completion quality (CQ). This study covers the implementation of an integrated methodology that combines the expertise of multiple petro-technical disciplines with new-generation LWD technology which can provide critical real-time and recorded information with images for formation evaluation, horizontal well placement, and fracture identification and analysis.

After drilling several horizontal wells that were not producing uniformly, Endeavor Energy recognized that LWD technology would be required to overcome the geological challenges that were impeding production. Schlumberger implemented MicroScope\* (Imaging-While-Drilling tool) in some of the exploration wells which provided full borehole coverage electrical images and laterolog resistivity measurements. During the geosteering operations, it helped determining the formation dip to stay within the target, leading to a higher rate of penetration, and better drilling dynamics with less stick slip, shock and vibration on the bottomhole assembly.

The recorded mode borehole images were then used to accurately identify different fracture types and orientations for an effective completion strategy. Instead of setting equally spaced fracture stages along the lateral, a better

completion design with fewer and more strategically placed stages was achieved. This helped in delivering a successful well by increasing the reservoir contact through stimulating the existing natural fracture network.

At the beginning of 2014 a newer version for the tool: MicroScope HD\* has been used, which has identified far more number of fractures, leading to better RQ and CQ analysis. MicroScope HD high-definition imaging-while-drilling service provides borehole images for reservoir description, from structural modeling to sedimentology analysis. This service enables detailed fracture characterization and completion optimization in conductive drilling fluids.

The interpretation of the LWD memory images on that well included a detailed fracture characterization to identify types of fractures as well as morphology and geometry of each fracture, the fracture density, fracture aperture and fracture distribution along the logged interval.

The geological interpretation of the MicroScope HD\* images revealed the presence of few major open fractures that were likely enhanced during drilling, and a large number of partial discontinuous conductive and resistive fractures. Completion design was then developed to isolate those fractured zones. This enabled a proactive completion strategy helping to optimize well production.

