LWD Imaging Guides Well Placement Through Productive Zones in Faulted Carbonate Reservoir

MicroScope HD service identifies productive zones, characterizes faults and fractures for challenging carbonate oil field

CHALLENGE
Drill horizontal well through formation with seismic uncertainty in terms of faults, fractures, and other geological features.

SOLUTION
Use MicroScope HD* high-definition imaging-while-drilling service to acquire detailed borehole images, identify key structural features, and guide geosteering.

RESULTS
Enabled better understanding of the fracture and fault network; placed 550-m drain hole in the most productive zones.

CASE STUDY
Increase production in complex carbonate oil field
An operator in Italy aimed to increase production in its limestone oil field by drilling a horizontal well inside faulted structural blocks. The target reservoir formation was known to consist of vuggy, laminated dolomite and to contain a complex fracture network in the power portion. The well placement team set the objective to geosteer the well along the top of the formation without exiting or touching the sealing formation above.

With seismic uncertainty about the presence and position of faults and dips, the plan was to use LWD high-resolution imaging and distance-to-boundary measurements to precisely describe the reservoir and interpret the complex structure setting for optimal well placement.

A static 2D image (Track 2) and dynamic 3D image (Track 3) of the interbedded formation with thin, low-contrast beds showed induced and natural fractures at a depth of X,214.2 m. Courtesy of ENI.
CASE STUDY: MicroScope HD service guides geosteering to land 100% in zone, Italy

Geosteering wellbore through target reservoir

Schlumberger provided a BHA with the MicroScope HD service for real-time and recorded high-definition images to identify faults, fractures, and geological features and to compute structural dips. Integrating the borehole images from MicroScope HD service with PeriScope® bed boundary mapping service measurements also guided the placement of the drain hole close to the top of the objective target reservoir.

High-resolution images from MicroScope HD service enabled geosteering decisions to keep the wellbore in the target reservoir along the entire drain length, identified the most productive zones, and provided the data needed to perform a detailed study of the structural setting.

With the combination of LWD datasets sent uphole by the ShortPulse integrated MWD platform, the well placement team was able to direct the PowerDrive X6® RSS within the target with precise directional control.
CASE STUDY: MicroScope HD service guides geosteering to land 100% in zone, Italy

Placed well 100% in zone

The high-definition images from MicroScope HD service and bed-boundary measurements from PeriScope service guided accurate well placement to maximize reservoir exposure through the most productive zones. The BHA was able to continue data acquisition while drilling in a total mud-loss environment. In addition, the customer reassessed fault locations compared with seismic data.

The MicroScope HD service’s LWD images enabled describing the fracture network and fault characteristics. Combining this information with the data acquired using PeriScope service allowed the well placement team to geosteer the 550-m drain hole 100% within the target zone.

In addition to real-time acquisition for Schlumberger experts to interpret during drilling operations, the service provided recorded-mode imaging to be used for addition analysis. The operator has plans to deploy the MicroScope HD service in additional wells of nearby fields.

High-definition images used to determine heterogeneity and porosity distribution helped to distinguish isolated, connected vugs from porosity due to matrix only. Courtesy of ENI.

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