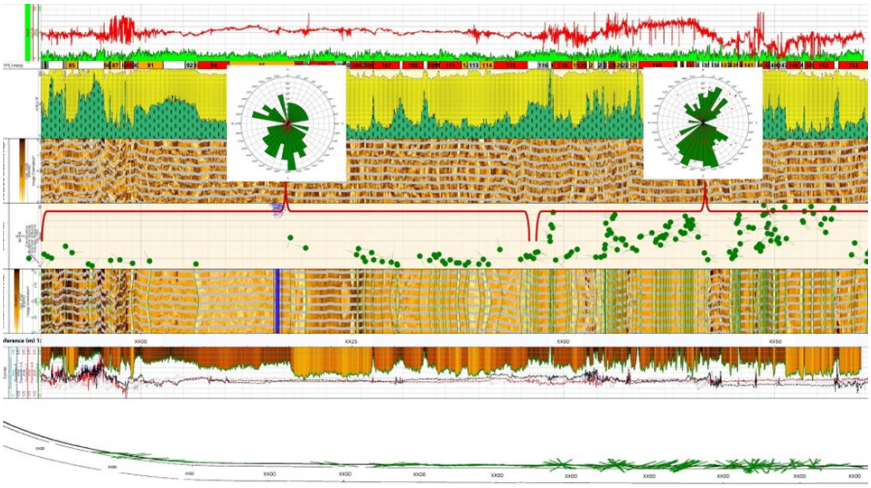
Advanced Openhole Logs Helped to Recognize Unexpected Fault With Lack of Seismic Data, Enabled Adjustment of Fracking Operation



The dip angle of the bedding is quite low in the upper interval. In the lower interval, the bedding dip angle became high and variated drastically along the borehole. The anisotropy azimuth was diverged in a horizontal direction in the lower interval, indicating the angle off from the borehole and formation. The primary azimuth of the bedding is south while the secondary is north, indicating that the strike of the fold and fault is west-east.

Objectives

- Identify possible natural fractures along the horizontal well. With no seismic data available, the customer needed to determine the formation dip and other structure features along the well's trajectory.
- Evaluate the geomechanical properties along the well to guide and optimize the fracturing operation.

Our Approach

- Using a Compact® well shuttle, Weatherford wireline experts deployed a string consisting of the following: gamma ray (MGS), cross-dipole sonic (CXD), and compact microimager (CMI) to acquire gamma ray, cross-dipole sonic, and borehole image logging data.
- Multiple processing types were applied to the CXD log to compute the geomechanical parameters using the anisotropy models including the following: Delta T compressional (DTC), Delta T shear XX direction (DTSXX), Delta T shear YY direction (DTSYY), Delta T Stoneley from Monopole (DTMST), Delta T Stoneley XX direction (DTSTX), and the Delta T Stoneley YY direction (DTSTY).

LOCATION
China

WELL TYPE
Appraisal

HOLE SIZE
8-1/2 in., open hole

DEPTH
9,560 ft (2,914 m)

PRODUCTS/SERVICES
- Compact well shuttle
- Cross-dipole sonic (CXD)
- Compact microimager (CMI)
- Gamma ray (MGS)

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Our Approach (continued)

- In addition, the analysis examined pick dip features like bedding, induced fracture, and resistive fracture along the horizontal via borehole image.
- Analysis of the bedding dips showed the front section of the borehole with a low dip angle, but at the tail of the hole, the variation was dramatic. This discovery indicated the borehole was penetrated into some folds and faults, which was unexpected, as the seismic data was unavailable.
- The anisotropy analysis in this section corresponded to this abnormality: the fast azimuth was not in a horizontal direction, which is theoretical when the borehole is parallel to the formation.

Value to Customer

- Weatherford's discovery of the unexpected folds and faults gave the customer time to change and redesign the planned hydraulic fracturing operation before it started, avoiding subsequent significant losses.

