Schlumberger

Image Logging Horizontal Wells Guides Successful Completion Strategy

High-definition photorealistic formation images from the ThruBit FMI through-the-bit formation microimager enable determining fracture heterogeneity and RQ

Efficiently conducting image logging for characterizing natural fractures and the stress regime made it possible for an operator to geoengineer its completion strategy and overcome inconsistent inflow performance by multistage lateral completions.

Unconventional reservoir challenges

Horizontal wellbore environments are difficult to cost-effectively log for obtaining critical information on the formation and fracture heterogeneity to determine reservoir quality (RQ), which has a significant influence on well productivity.

What Schlumberger recommended

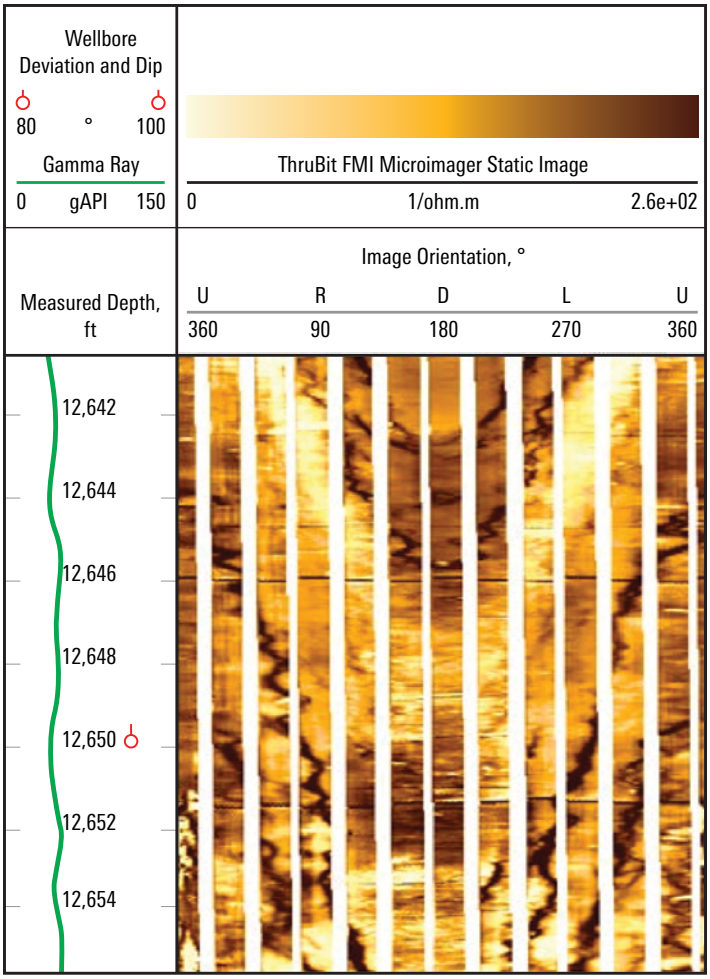
ThruBit FMI* through-the-bit formation microimager is cost-effectively and reliably deployed through the bit in geometrically complex and unstable wells by using the unique conveyance platform of ThruBit* through-the-bit logging services. A single run of the 2⅛-in-diameter ThruBit FMI microimager provides high-resolution images that enable accurate interpretation and characterization of structural, stratigraphic, and geomechanical considerations in accounting for reservoir anisotropy in the well completion.

How completions were optimized

High-definition formation images efficiently obtained with the ThruBit FMI microimager were used to differentiate healed from open continuous fractures intersecting the wellbore and target the stress-enhanced larger-aperture fractures in crafting a successful geoengineered completion strategy.

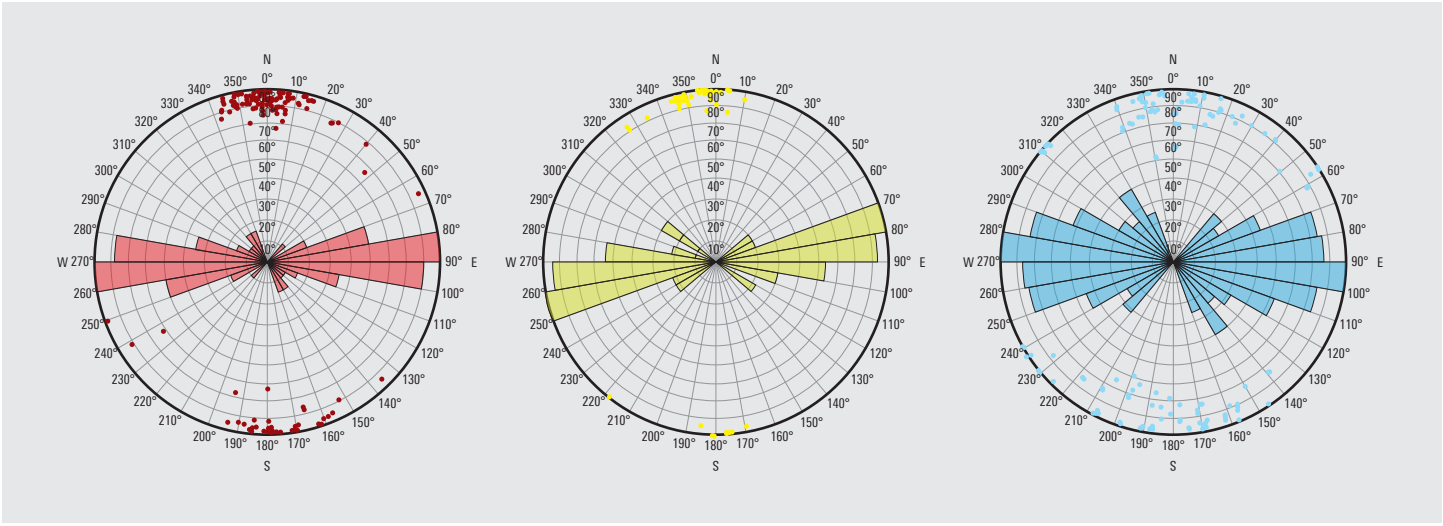
More technical details

See URTeC 2690051.

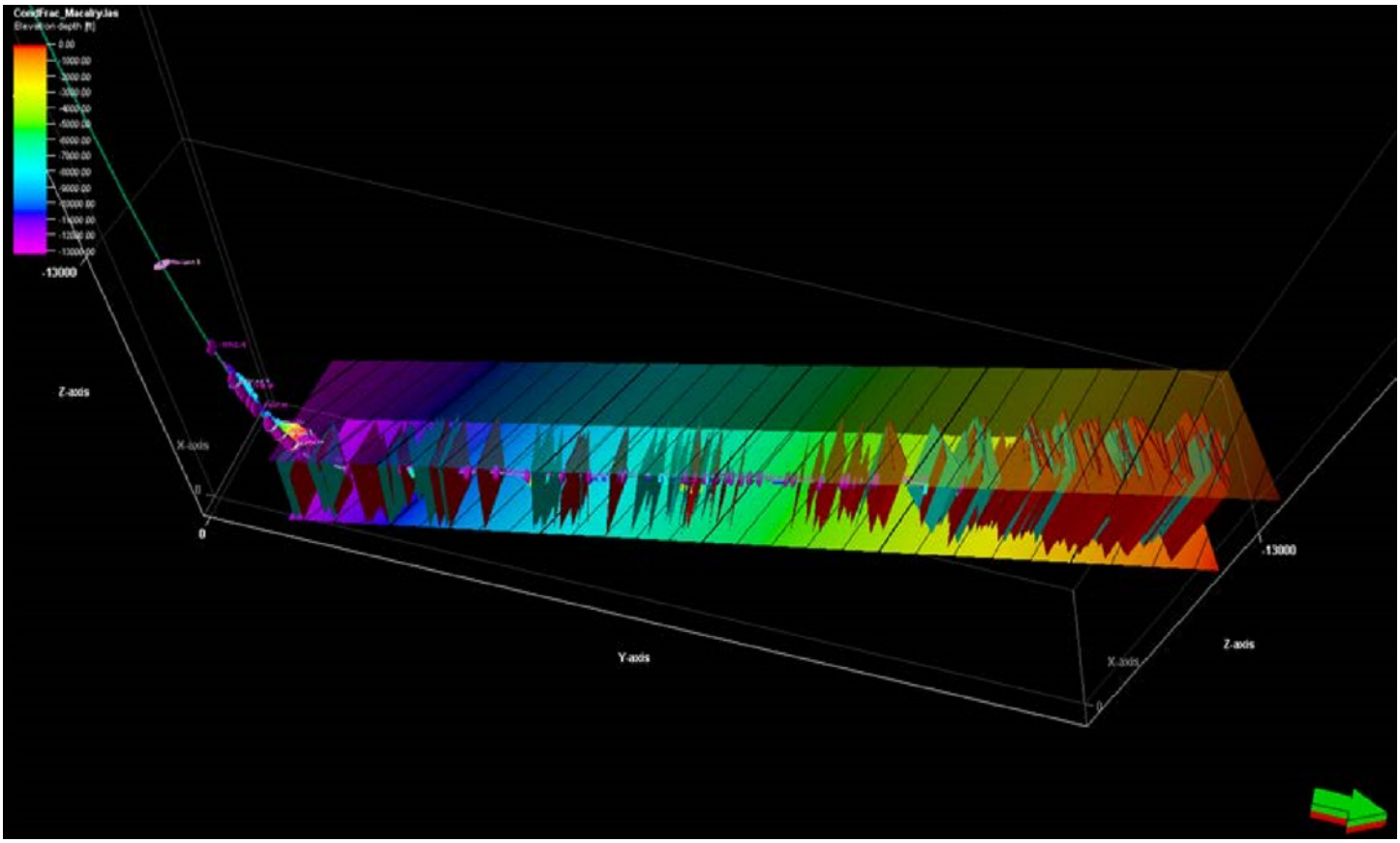


The ThruBit FMI microimager's static image log shows the wellbore cutting upsection through chert beds, with through-going conductive (dark) fractures at 12,646 and 12,651.5 ft. Both fractures are subvertical, assumed open (filled with conductive water-based mud), and striking close to east–west. Because the strike of the conductive fracture population overlies the maximum horizontal stress interpreted from drilling-induced fracturing observed on the log in the vertical section of this well, these fractures are considered stress enhanced and dilated at the wellbore for preferentially targeting with the geoengineered completion. The image also shows evidence of transverse drilling-induced fracturing and bed-bound fractures that are controlled by the lithology.

Case study: Image logging horizontal wells guides successful completion strategy, Oklahoma



Stereonet and strike plots from fracture characterization based on the ThruBit FMI microimager logging show (left to right) conductive (assumed open) continuous and through-going fractures, large-aperture conductive continuous fractures, and resistive continuous (assumed mineralized or healed) fractures. The maximum horizontal stress is interpreted from the vertical section as N85°E. Fracture populations that strike away from the maximum horizontal stress potentially complicate hydraulic fracturing.



Simple, single-well discrete fracture network (DFN) model using stochastic modeling of image-based fracture interpretation can provide a more realistic representation of the natural fracture network as an input for hydraulic fracturing simulations.

slb.com/ThruBit

Schlumberger