

Operator Identifies Fractures and Optimizes Completion Design

PIXSTAR™ HIGH-RESOLUTION ULTRASONIC IMAGING SERVICE ENHANCES RESERVOIR UNDERSTANDING IN OIL-BASED MUD

MIDDLE EAST

CHALLENGES

- » Identify fractures responsible for mud losses
- » Evaluate fracture zones to optimize completion design

SOLUTION

Engineered drilling solution, including:

- » 4¾-inch PixStar™ high-resolution ultrasonic imaging service to identify fractures in the reservoir
- » A Geo-Pilot® 5200 RSS bottomhole assembly to provide LWD measurements, using:
 - » ALD™ azimuthal lithodensity service
 - » CTN™ compensated thermal neutron sensor
 - » XBAT™ azimuthal sonic and ultrasonic LWD service
 - » MRIL®-WD™ magnetic resonance imaging LWD sensors

RESULTS

- » High-resolution 256-sector impedance images identified mud loss zone and fractures
- » High-resolution images identified 255 reservoir features, including 63 fractures, optimizing completion design

OVERVIEW

An operator needed high-resolution images to help optimize the completion design in a 6-inch wellbore within a formation known to have wellbore stability issues. Although high-resolution images are available in oil-based mud (OBM) by using wireline technologies, high-angle wells where mud losses are anticipated make the use of logging-while-drilling (LWD) technologies preferable. The PixStar™ high-resolution ultrasonic imaging service from Halliburton Sperry Drilling has the advantage over conventional LWD technologies because it delivers the resolution required to identify fractures in OBM, helping operators enhance reservoir understanding and optimize their fracture and completion programs.

ENHANCE RESERVOIR UNDERSTANDING WITH HIGH-RESOLUTION IMAGES

During the drilling operation, mud losses were observed using a mud weight of 15.5 ppg. To cure the losses, the mud was displaced to a lighter mud, 13.3 ppg. A 4¾-inch PixStar imaging service was added to a Geo-Pilot® 5200 rotary steerable system (RSS) bottomhole assembly – in addition to ALD™ and CTN™ sensors for density and neutron porosity measurements, XBAT™ azimuthal sonic and ultrasonic LWD sensors for acoustic measurements, and MRIL®-WD™ magnetic resonance imaging LWD sensors – for drilling the rest of the hole section.

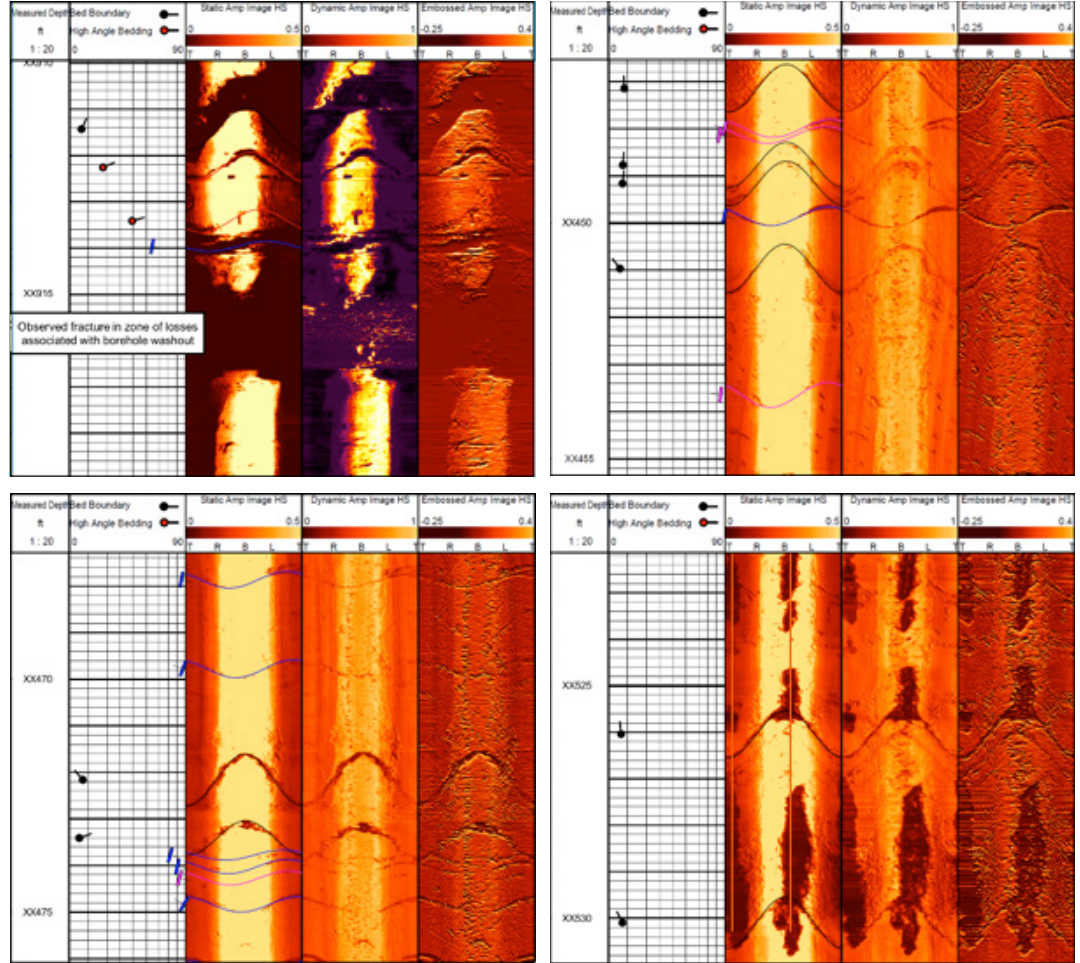
Upon completion of the well, the memory data was analyzed, and the 256-sector acoustic impedance images from the PixStar service were used to assess borehole fractures and geological features. The images provided a clear indication of fractures and borehole enlargement over the zone where the mud losses were observed. The interpreted bed dips from the images were consistent with the known field structure.

PixStar™
Service Identified
255 Features

- » **63 Fractures**
- » **126 Bed boundaries**
- » **16 High-angle features**
- » **50 Breakouts**

OPTIMIZE COMPLETIONS, MAXIMIZE ASSET VALUE

Further processing of the data identified 255 features over the 1,530 feet (466 meters) of logged interval. By knowing fracture locations, and interpreting their dip and strike, Halliburton enabled the operator to optimize its completion design and maximize asset value.



Log examples showing high-resolution ultrasonic image interpretations. The top left image shows the fracture interpreted as being associated with the mud loss zone. The three other images show fracture and bedding plane interpretations, including dip and strike calculations. The interpreted bed dips are consistent with the known field structure. The bottom right image illustrates bedding picks with borehole breakouts. Note that the breakouts appear to terminate at the bed boundaries.

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