MATURE FIELDS

CASE STUDY

High-Resolution Images Identify Formation Bedding Features and Fractures in Oil-Based Mud

PIXSTAR™ HIGH-RESOLUTION ULTRASONIC IMAGING SERVICE ENHANCES RESERVOIR UNDERSTANDING

TEXAS

CHALLENGE

- Identify fractures and bedding features in oil-based mud

SOLUTION

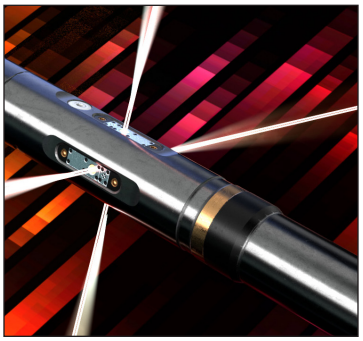
Engineer a drilling solution that included:

- 4¾-inch PixStar™ high-resolution ultrasonic imaging service to identify fractures
- Logging-while-drilling (LWD) measurements configured within a 4¾-inch TerraForce™ positive displacement mud motor in the bottomhole assembly, which included the:
  - DGR™ dual gamma ray sensor
  - ADR™ azimuthal deep resistivity sensor

RESULTS

- High-resolution amplitude images identified fractures, bedding, and sedimentolgical features, enabling accurate fracture placement
- Drilling-induced features observed on both amplitude and travel time high-resolution images

OVERVIEW

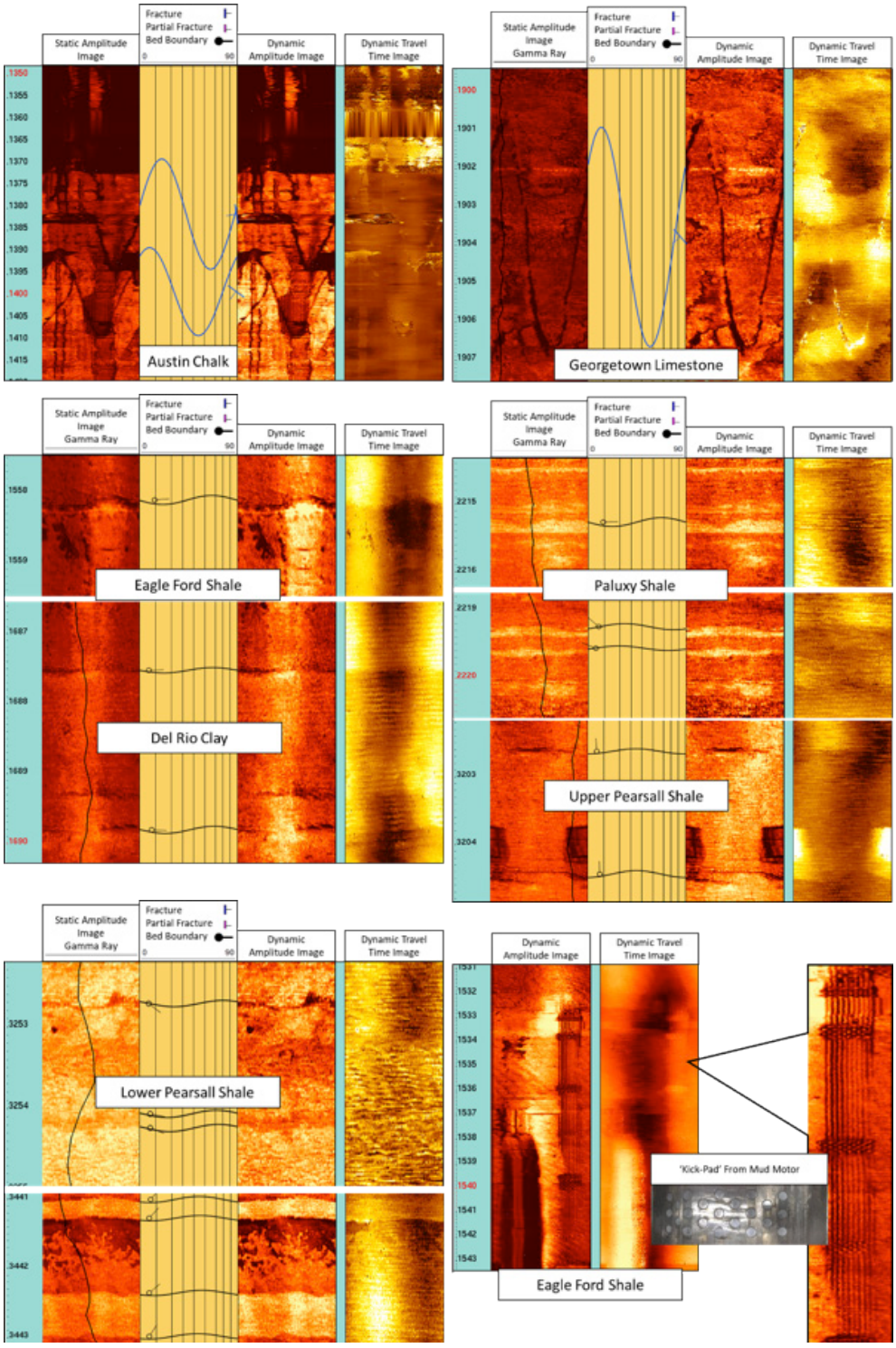


A 6⅛-inch vertical well in Texas was drilled with an engineered solution comprising the PixStar™ high-resolution ultrasonic imaging service, and the TerraForce™ positive displacement motor in the bottomhole assembly (BHA), including a DGR™ dual gamma ray sensor and an ADR™ azimuthal deep resistivity sensor from 1,380 feet (420 meters) to 3,703 feet (1128 meters). The PixStar™ service was used to assess 14 different formations in oil-based mud (OBM), including chalk, shale, limestone, and sandstone. The service helped to identify bedding planes, laminations, and sedimentological features, providing greater wellbore coverage for enhanced reservoir understanding.

ENHANCE RESERVOIR UNDERSTANDING WITH HIGH-RESOLUTION IMAGES

The high-resolution acoustic amplitude and radius images were obtained while logging with a 9.5-ppg OBM. Both images identified features interpreted as fractures within the Austin Chalk and Georgetown Limestone formations. Prominent striations observed within the Austin Chalk and Eagle Ford Shale formations were attributed to inserts on the kick pad of the mud motor being pressed into the side of the borehole during slide sections.

Multiple bedding planes and laminations were identified across the wide range of lithologies that were drilled through, highlighting the potential for real-time amplitude images to be used for geosteering. The high-resolution amplitude images also highlighted the potential for detailed sedimentological analysis, with features interpreted as bioturbation observed in the Cotton Valley Sandstone formation.



Log examples showing high-resolution ultrasonic image interpretation. Fractures within the Austin Chalk and Georgetown Limestone formations (top). Bedding features are shown within the Eagle Ford Shale, Del Rio Clay, Paluxy Shale, Upper Pearsall Shale (middle), and Lower Pearsall Shale and Cotton Valley Sandstone formations (bottom). Vertical striations seen within the Austin Chalk formation from 1,390 feet (423 meters) (top left), and Eagle Ford Shale formation from 1,533 feet (467 meters) are drilling-induced features caused by the kick pad of the mud motor during slide sections (bottom right).

This case study includes data from technical paper 2019-322-URTeC, prepared for presentation at the Unconventional Resources Technology Conference held in Denver, Colorado, USA, July 2019.

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