MATURE FIELDS

CASE STUDY

High-Resolution Images Identify Formation Bedding and Fractures in High-Angle OBM Well

PIXSTAR™ HIGH-RESOLUTION ULTRASONIC SERVICE ENHANCES RESERVOIR UNDERSTANDING IN NEAR-HORIZONTAL WELLBORE

NORTH AMERICA

CHALLENGES

- Identify and interpret fractures and bedding features in OBM, in a near-horizontal wellbore
- Remove the risks, well time, and costs associated with running a wireline OBM imager

SOLUTIONS

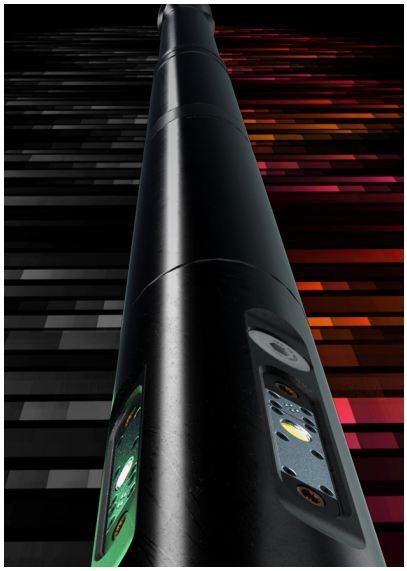
Engineer a drilling solution that included:

- PixStar™ high-resolution ultrasonic imaging service to improve wellbore stability
- Logging-while-drilling (LWD) measurements configured with a bottomhole assembly that included a:
  - 4¾-inch TerraForce™ positive displacement motor
  - DGR™ dual gamma ray sensor
  - ADR™ azimuthal deep resistivity sensor

RESULTS

- Eccentricity-normalized, high-resolution reflection amplitude images identified fractures and bed boundaries
- Interpretation from ultrasonic images removed the need for a separate wireline run

OVERVIEW

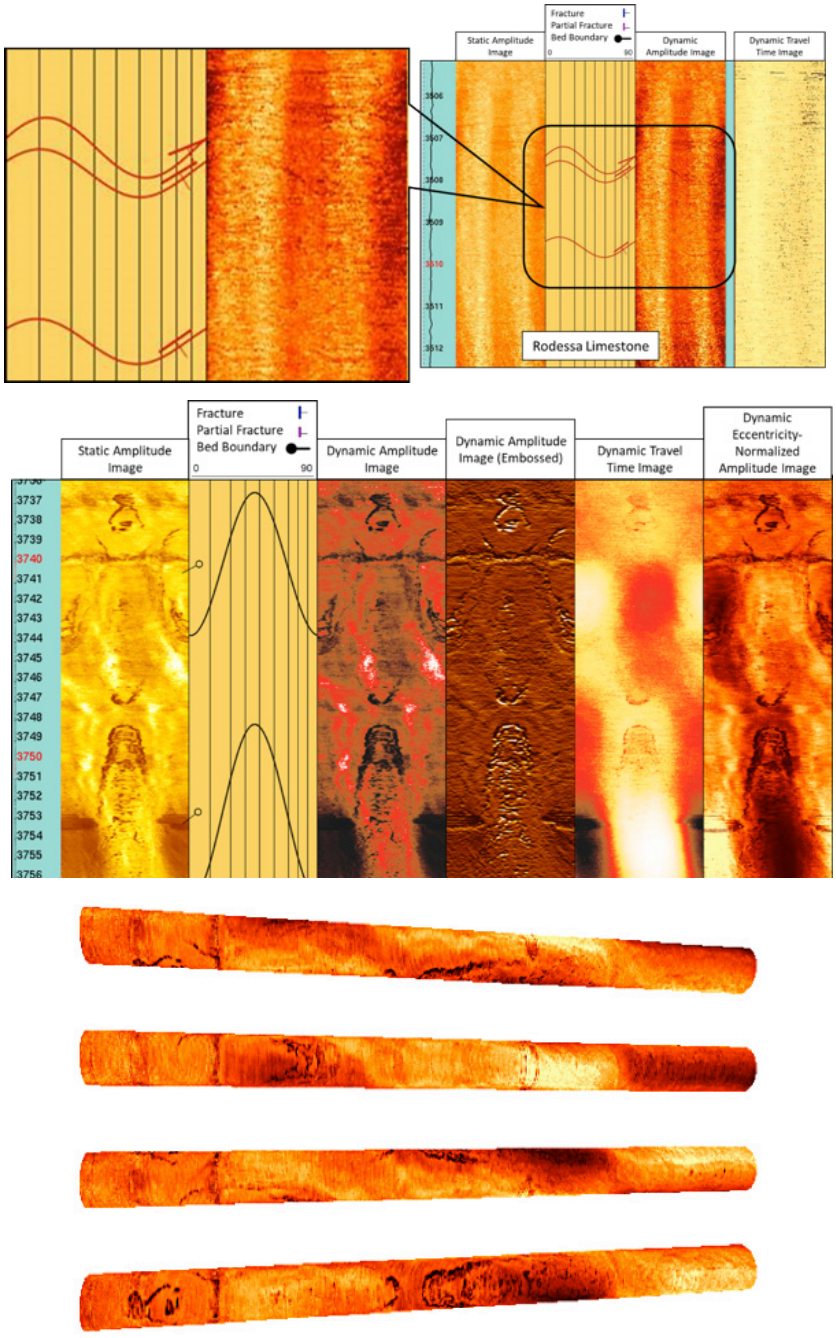


A near-horizontal 6⅛-inch well was drilled in Texas in oil-based mud (OBM), and a PixStar™ high-resolution ultrasonic imaging service was used to assess fractures and bedding features across multiple lithologies, including chalk, shale, and limestone. The service included a bottomhole assembly (BHA) with a 4¾-inch TerraForce™ positive displacement motor, a DGR™ dual gamma ray sensor, and an ADR™ azimuthal deep resistivity sensor. Inclination was built from vertical to 87 degrees, drilling 2,965 feet (904 meters), using 9.6-ppg OBM.

ENHANCE RESERVOIR UNDERSTANDING WITH HIGH-RESOLUTION IMAGES

The high-resolution reflection amplitude images revealed fractures, bedding features, and drilling-induced features, highlighting the potential use of real-time images for geosteering applications. The four-transducer design of the PixStar sensor section enables accurate assessment of tool position within the borehole, allowing an eccentricity normalization to be applied to remove the potentially detrimental effect of lateral tool motion and eccentricity on the reflection amplitude images.

By enhancing reservoir understanding through interpretation of the high-resolution images, the need for a separate wireline run, and the associated risk and cost, was removed.



This case study includes data from technical paper SPE-196126-MS, prepared for presentation at the 2019 SPE Annual Technical Conference & Exhibition held in Calgary, Alberta, Canada.

These illustrations include log examples showing high-resolution ultrasonic interpretation. The top image depicts fracture interpretation from high-resolution reflection amplitude images in the Rodessa Limestone formation. The middle image shows high-angle bedding features seen on both reflection amplitude and radius images within the Rodessa Limestone formation with a borehole inclination of 87 degrees. The dark feature seen between 3,753 feet and 3,754 feet on all the images is caused by the kick pad from the mud motor at the start of a slide section. The bottom image shows 3D visualization of high-angle bedding features.

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