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3D Far-Field Sonic Service Maps Natural Fractures to Improve Stimulation, West Texas

Workflow combines high-resolution sonic and resistivity imaging for optimizing completion design and hydraulic fracturing

CHALLENGE

Understand the distribution of natural fractures across the wellbore for guiding the completion design.

SOLUTION

- Simultaneously deploy the Sonic Scanner* acoustic scanning platform to acquire sonic imaging data and Quanta Geo* photorealistic reservoir geology service to acquire microresistivity imaging data.
- Employ 3D far-field sonic service to process both datasets to generate a high-resolution 3D representation of formation features at the wellbore and in the near- and far-field reservoir.

RESULTS

- Mapped location and orientation of natural fractures extending up to 40 ft [15 m] around the wellbore.
- Revealed and mapped fractures, bedding, and other formation features that do not intersect the wellbore.

3D reservoir modeling requires natural fracture details

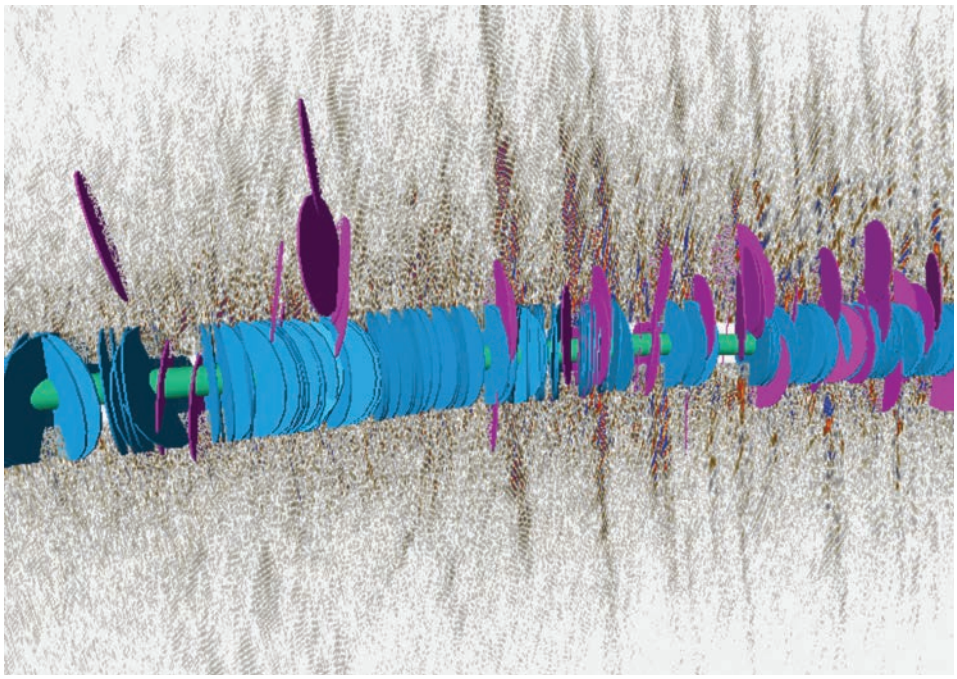
An operator in West Texas wanted to characterize the occurrence and distribution of natural fractures along the lateral of a well. This information would help to better understand the impact of natural fractures on the well completion and production.

Modeling natural fractures requires knowledge of their orientation and density distribution, aperture, length, and height, among other parameters. The conventional way to characterize these fractures is with high-resolution borehole images. The images provide a photorealistic view of fractures that intersect the wellbore, providing information about orientation, density, and aperture.

However, the images rarely indicate fracture length or height and do not reveal the 3D trend of fracture corridors, which are important for accurate reservoir modeling.

Workflow combines microresistivity and sonic imaging

To achieve a complete map of fractures at and around the wellbore, Schlumberger recommended a two-pronged approach: Quanta Geo service would acquire microresistivity images while the Sonic Scanner platform would be configured to also acquire the data necessary to perform a borehole acoustic reflection survey (BARS) for processing using 3D far-field sonic service.



Combining imaging data from Quanta Geo and 3D far-field sonic services enabled 3D mapping of the location, orientation, and length of natural fractures up to 40 ft around the wellbore.

The 3D far-field sonic service workflow automates time picking and event analysis instead of the lengthy conventional manual determination of reflector dip and azimuth. The service rapidly derives the migration parameters from the automated event analysis, which can then be easily integrated with borehole image interpretation. This high-confidence resolution of near-wellbore reflectors is ready to import into 3D geological modeling.

Service maps natural fractures in 3D up to 40 ft around the wellbore

The 3D far-field sonic service mapped the location, orientation, and length of natural fractures up to 40 ft around the wellbore—including fractures that did not intersect the wellbore and thus were not identified by wellbore imaging. The operator was able to import the fracture data into a reservoir model to improve fracturing and stimulation operations.

For additional details, see SPE-194810.

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