

Techlog Geomechanics

Supporting safe and efficient drilling operations

APPLICATIONS

- Wellbore stability in deviated wells
- Pore pressure analysis
- Optimized trajectory selection

BENEFITS

- Ensures hydraulic safety
- Improves efficiency of drilling operations

FEATURES

- Fully integrated with other Techlog modules
- Fast, intuitive interface
- Multiple wells analyzed concurrently
- Real-time operating environment

The ability to understand your drilling environment is paramount to ensuring safe and efficient operations. Using this information in real time to update and validate models is essential. With the Pore Pressure Prediction (PPP) and Wellbore Stability (WBS) modules within the Techlog* wellbore software platform, you can perform drilling risk analyses with confidence.

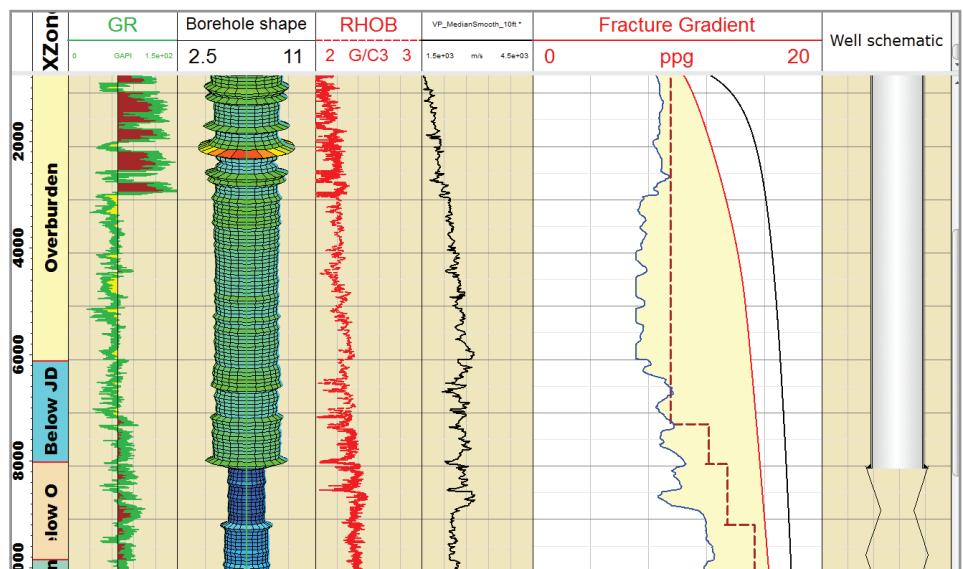
Ensure hydraulic safety across multiple wells

Accurate pore pressure prediction using all available calibration data is crucial in reducing uncertainties related to drilling a well. The PPP module is fully integrated with other Techlog modules, such as Quanti and Formation Pressure, supporting seamless use of pore pressure analyses.

The PPP module incorporates industry-standard methods to compute pore pressure and fracture gradients, and establish the safe mud weight window to ensure hydraulic safety. Analysis can be carried out on single wells or concurrently on multiple wells, with full Monte Carlo uncertainty.

The pore pressure estimation in shales is based on indirect methods that link pressure with seismic velocity, sonic, or resistivity. All these methods require the accurate estimation of the vertical stress (overburden), which is the first step in the pore pressure prediction workflow. The overburden stress magnitude can be estimated from a continuous density curve up to surface. When density measurement is incomplete (e.g., near surface), a synthetic density curve is calculated using interactive methods such as extrapolation, the Amoco Gulf of Mexico correlation, or the Gardner equation.

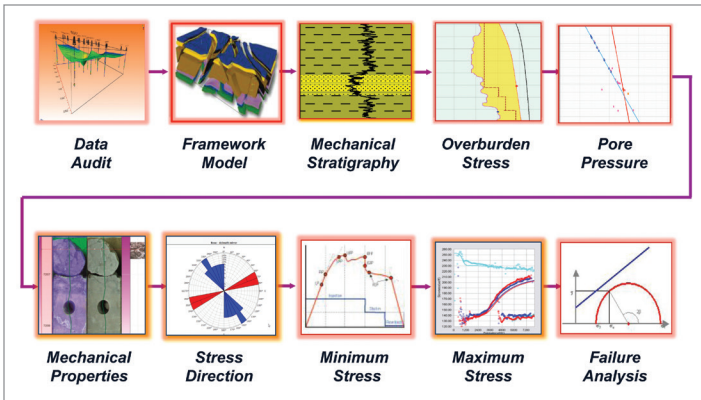
Next, the pore pressure is established in shales and nonshales using different workflows. In shales, popular pore pressure transforms (e.g., Eaton, Bowers, and Traugott) can be built using sonic, seismic, or resistivity logs. The fast and interactive nature of the PPP module allows users to easily select their facies and edit the trend lines to obtain results that are consistent with the various calibration data (drilling events, formation pressures, leak-off tests, etc.).



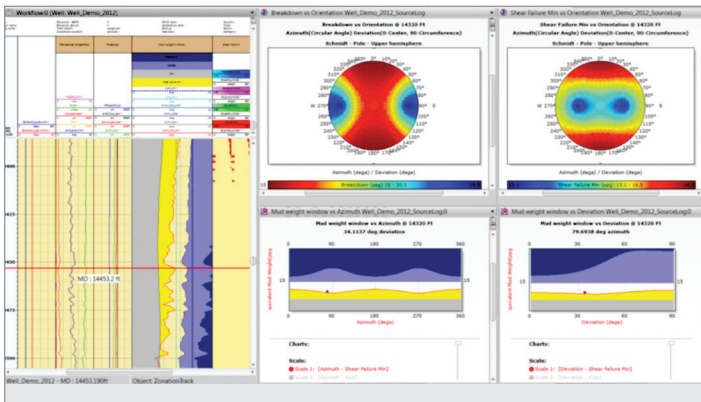
Pore pressure and fracture pressure analysis using upscaled sonic data.



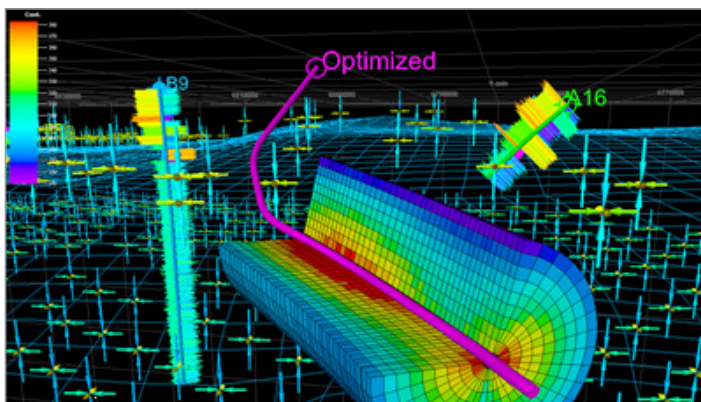
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The mechanical earth model provides profiles of elastic and rock-strength parameters to predict pore pressure, minimum and maximum horizontal stresses, and vertical stress.



Wellbore stability analysis (left side) and variation of breakdown and breakout pressure on the wellbore deviation and azimuth at a particular depth (right side).



3D geomechanics in the Petrel platform, calibrated to the Techlog MEM and used to predict wellbore stability issues in planned wells.

The fracture gradient is then established using techniques such as the Eaton and the Matthews and Kelly methods, which are calibrated with local knowledge from leak-off tests and fracture closure pressures.

The PPP module makes full use of new functionality in the Techlog platform, such as the workflow wizard, which helps users build and share their workflows quickly and interactively. The module also relies on the real-time enablement of the Techlog platform to deliver updates to calculations while drilling.

Efficient drilling through better understanding of wellbore stability

The WBS module enables users to further develop the understanding gained from analysis in the PPP module by taking into account the in-situ stress states around the wellbore. The user is guided through the different steps required to build a calibrated mechanical earth model (MEM), which integrates all data. The MEM helps the user gain a thorough understanding of the properties of the rock surrounding the wellbore and the in-situ stresses, enabling the prediction of potential shear and tensile failures at the borehole walls. The WBS module can predict the breakout and breakdown pressure based on the wellbore direction versus the azimuth of the principal stresses.

Several shear failure criteria are available, including Mohr-Coulomb, Mogi-Coulomb, and Modified Lade.

The user can plan the mud weight for safe drilling based on the mechanically stable mud weight window (from breakout to breakdown pressures) and look at different wellbore deviation scenarios based on the sensitivity analysis tool in the Techlog platform.

Perform 1D to 3D geomechanics

Having performed 1D geomechanics, this data can be used to calibrate and generate a full 3D geomechanical model in the Petrel platform. The simulation engine performs 3D static of 4D flow-, pressure-, and temperature-coupled calculations for rock stresses, deformations, and failure. This can then be used to optimize well trajectories, predict mud weight windows anywhere in the field, and identify potential well survivability risks that would require mitigation.



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