HARTENERGY MADRID THURSDAY

EAGE DAILYNEWS
2015 EAGE Conference & Exhibition

OFFICIAL SHOW DAILY OF THE 77TH EAGE CONFERENCE AND EXHIBITION

Accurate Pore Pressure Prediction Is Key to Safe Well Engineeing

Solutions enable pore pressure prediction and analysis before, during and after drilling.

BY JOANNE WANG, PARADIGM

Overpressured formations are encountered worldwide where exploration wells are drilled. Unexpected overpressure is a major cause of drilling hazards, costing the industry billions of dollars and posing a huge potential risk for damage to the environment. Pore pressure prediction is an important way drilling companies and operators can reduce risk and ensure safe well engineering.

Accurate pore pressure prediction can help drilling engineers plan wells with proper mud program and casing design in anticipated high overpressure zones and prevent a variety of drilling problems, including wellbore collapse, lost circulation, stuck pipe and even complete loss of the wellbore.

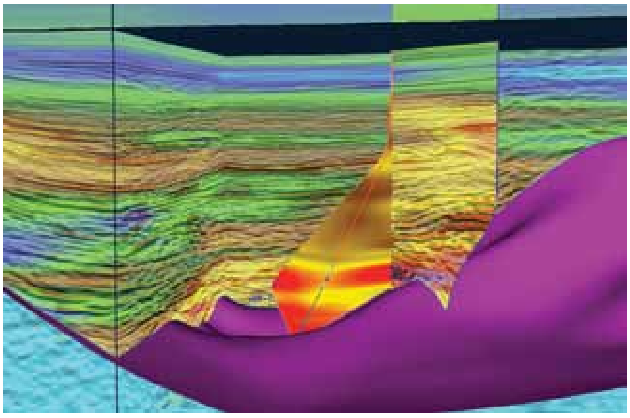
Pore pressure prediction can be performed using well data at the wellbore or using seismic data for pressure spatial distribution. Log-based pore pressure prediction can be used to predict pore and fracture pressure profiles in wells based on logging data. During the pore pressure prediction process, well data or seismic velocity measurements are converted to pressure attributes with a selected empirical relationship.

Pore pressure predictions and transformations that make use of seismic velocity measurements have a huge impact on drilling safety and the economics of drilling design and well construction. Pore pressure models derived from the integration and careful calibration of traditional wireline logs, petrophysical logs, seismic velocity data, vertical seismic profile data and field test data provide the information needed to make critical predrill stress and overpressure predictions and the pathway to secure a safe and economic well program.

To deliver the most accurate results, a comprehensive pore pressure solution will include high-resolution velocity model determination, chronostratigraphic structural and property modeling, well data and petrophysical analysis, geostatistics, and seismic inversion to enhance the predictive capacity of petrotechnical data to model pore pressure. These solutions are strengthened by powerful technologies for co-visualizing geophysical and geological models, transforming seismic velocity measurements to pore pressure and stress properties, calibrating predicted pressures, interpreting pore pressure models and modeling pore pressure.

Determining accuracy and resolution of predicted pressures

To accurately predict pressures from seismic data, suit-for-purpose velocity analysis is required, including automatic, high-resolution, residual velocity analysis and tomographic velocity updating. Constrained velocity inversion ensures derivation of geologically plausible interval velocities, while anisotropic velocity analysis corrects anisotropy effects on seismic velocity, when necessary.



Co-visualization of a prestack migrated amplitude image, pore pressure field, interpretation data and well paths is shown. Interwell pore pressure sections show connectivity of pore pressures.

Ensuring pore pressure prediction quality, productivity

Calibration to field pressure measurements provides a mechanism for optimizing the input data to match predicted pressures to these measurements. This process demands a sophisticated visualization and analysis environment that incorporates pressure prediction, calibration, interpretation and analysis in a seamless process, to ensure pore pressure prediction quality and productivity. A common data repository will make data, such as well logs, pressure measurements, seismic data, interpretation data and production data, available to geoscientists belonging to different disciplines.

Cross-disciplinary teamwork

Pore pressure prediction is a cross-disciplinary application. Properly interpreting pressures requires an understanding of lithology, structure style and geological history. The software platform must contain rich technologies to meet such demands and support teamwork between petrophysicists, geophysicists, geologists and engineers. These technologies include quantitative seismic interpretation, which identifies lithology spatial distribution, key to understanding pressure lateral transfer and estimating pressure in a formation with relatively high permeability. Other features, such as seismic structure interpretation and structural attributes, are useful for understanding geological structure impact on pore pressure distribution, e.g. pressure compartmentalization related to faults.

When optimally performed, well log analysis, velocity modeling, structural interpretation and lithology prediction provide the most accurate input for the key transformation and interpretation tasks of pore pressure estimation and calibration, sand pressure estimation, and structural deformation (strain) analysis, with co-visualization of the results. ■