HARTENERGY AMSTERDAM THURSDAY

E&P DAILY NEWS

2014 EAGE Conference & Exhibition

OFFICIAL SHOW DAILY PUBLISHER OF THE 76TH EAGE CONFERENCE AND EXHIBITION

Transforming How Interpreters Visually Interact with Prospective Plays

New seismic sensing technology is designed to scale up to a million nodes in a network.

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In recent years, technology has allowed interpreters to take advantage of a series of advanced workflows commonly defined as quantitative interpretation (QI) to reduce the risk associated with billion-dollar field development projects. These techniques take the interpreter beyond structural and stratigraphic interpretation for prospect delineation and focus on characterizing the reservoir properties to better understand the interior of the reservoir in addition to its architecture.

Quantitative seismic interpretation (QSI), the predictive seismic function of the QI workflow, is a primary focus of a number of new features in the Paradigm 14 product suite. The integrated solution suite offers enhancements for advanced seismic interpretation that enable both generalist and specialist interpreters to qualify amplitude prospects and identify potential prospects. Where well data represent the only "truth" in subsurface exploration, QSI workflows allow interpreters to infer or "propagate the truth" throughout the reservoir.

In particular, these enhancements help generalists overcome numerous interpretation challenges by interactively incorporating QSI analysis into their workflows. Chief among these is the ever-present difficulty of data management. Quantitative analysis requires both the integration of well log data with the seismic—both prestack and poststack—and a shared platform to feed this information with well planning and drilling applications.

New seismic interpretation features in Paradigm 14 facilitate QSI workflows that allow interpreters to predict reservoir and interval properties earlier in the geological and geophysical (G&G) cycle. Across the workflow, an interpreter attempts to characterize the rock type, fluid composition and flow characteristics of the reservoir. A wide range of techniques can be employed, from amplitude vs. offset (AVO) analysis and seismic inversion to facies classification, pore pressure prediction, time-lapse reservoir monitoring and reservoir geomechanical behavior analysis. The workflow demonstrates the necessity of the integration and accessibility of all available data (seismic and nonseismic, G&G interpretation, petrophysical and other forms of data) paired with a multidomain expertise approach.

Well-to-seismic tie

The QSI workflow initiates the well-to-seismic tie process. This helps model the seismic response from rock properties derived from well logs to the actual acquired seismic. Additionally, the workflow extends this process to elastic modeling to enable log-based and volume-based modeling of synthetic gathers and the calculation of AVO attributes.

Identify fluid effect

AVO is a seismic amplitude analysis technology for direct hydrocarbon detection. Enhancements for AVO inversion and quality control of prestack data enable efficient fluid identification within the reservoir. As AVO is a recognized technology for direct hydrocarbon detection, qualifying gathers interactively within the post-stack domain enables the interpreter to validate what has been observed in the seismic data and rank the potential targets.

Convert seismic signals into rock properties

Inversion uses well log properties and seismic data to convert the acoustic reflections at layer interfaces into rock properties. Facies analysis, whether electrofacies using well log data or seismic facies analysis, identifies similar groupings of data, allowing interpreters to identify subtle features and distribution of facies heterogeneities throughout the reservoir. Interpreters are able to improve the efficiency and speed of identifying rock properties and other zones of interest.

Determine flow

Advanced full-azimuth fracture orientation and intensity analysis enable better flow prediction and well planning. Pore pressure predictions can be made based on seismic velocities and calibrated to well information. Seismic velocities can be better defined with a 3-D model that includes the major structures and major stratigraphic elements.

Advanced interpretation tools in Paradigm 14 transform how every interpreter visually interacts with prospective plays. The end results of this analysis include a more precise definition of lithology, porosity, estimation of oil and gas in place, brittleness, fracture orientation and intensity. These results allow operators to make better drilling decisions by identifying the most productive parts of the reservoir. ■