CASE STUDY

HALLIBURTON

Ecuador

Operator leverages seismic attribute analysis to increase production in a mature field

New technology for improving mature field development enables operator to meet production goals

CHALLENGE

- Leverage existing seismic data for improved development of a mature field
- Reduce risk away from well control and increase production
- Develop a better structural framework for static and dynamic modeling

SOLUTION

- Perform pre-stack simultaneous inversion
- Build a rock-physics model with 30+ wells
- Map distributions of desirable attributes across the field
- Perform nonlinear multivariate regression transforms to extract additional attributes

RESULT

- Identified new leads for well locations based on reservoir quality and porosity
- Developed an increased understanding of reservoir complexity in relation to structure
- Employed new seismic technology for improved mature field development
- Enabled operator to increase production to meet drilling plan goals

Overview

A Latin American client was seeking innovative solutions to better leverage its existing seismic data for the exploration and development of a 35-year-old field. Production was declining, with a 4,000-BOPD gap between predicted and actual production. The client's previous exploitation program consisted of drilling 60+ wells to increase production and reduce the gap. The client had an aggressive drilling plan to help boost production and increase reservoir understanding by using pre-stack inversion, rock-physics modeling, and multivariate attribute prediction. The client needed a solution to reduce the risk in exploring the field away from the well control (top of structure) and build a 3D-framework static/dynamic model for a future enhanced oil recovery (EOR) program.

Challenge

The client asked the Halliburton Consulting team to leverage existing seismic data for the development of this mature field to understand why production was 4,000 BOPD below plan and to enable the operator to reduce risk away from well control. The Halliburton team would need to leverage the client's existing seismic data to develop a more accurate structural framework for static and dynamic modeling of the reservoir.

Solution

To maximize the value of the existing data and provide the highest-resolution understanding of the reservoir, Halliburton built a rock-physics model of the reservoir intervals using 30 wells. The team also planned to apply pre-stack simultaneous inversion to 500 km^2 of 3D seismic data and leverage the existing rock-physics model to predict reservoir quality by using the inversion data.

Solution (Continued)

Rock-physics-based acoustic impedance (Vp/Vs) cross-plots showed clean and porous sand interval signatures. Limited seismic reprocessing was performed for signal-to-noise improvement of the pre-stack gathers used for inversion and the post-stack seismic attributes. Deterministic maps of the distribution of high-quality sands over the field showed good correlation with existing wells. Nonlinear, multivariate regression transformations of the inversion data were used in porosity mapping for additional risk reduction and control on field periphery, where well data was sparse or absent. The resulting work was used to map distributions of desirable attributes across the field.

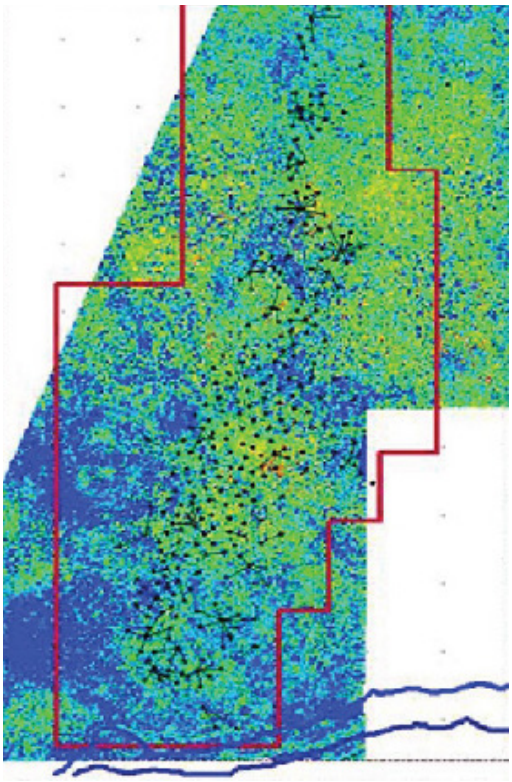

Figure 1: In this porosity thickness map, the average porosity was calculated over the reservoir zone.

Result

The Halliburton Consulting team's analysis clearly showed by using state-of-the-art techniques for data analysis and data management additional reservoir information could be extracted from existing data. The Halliburton team's analysis led to the identification and description of several high-quality targets within the reservoir, which were critical in helping the client increase production to meet the goals of its aggressive drilling plan. The client and Halliburton collaborated to produce new leads for well locations based on reservoir quality and porosity. In addition, Halliburton achieved an increased understanding of the reservoir's complexity in relation to structure because it employed new technology for improving the development of this mature field.

> The Halliburton team's analysis led to the identification and description of several high-quality targets within the reservoir, which were **critical in helping the client increase production** to meet the goals of its aggressive drilling plan.

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