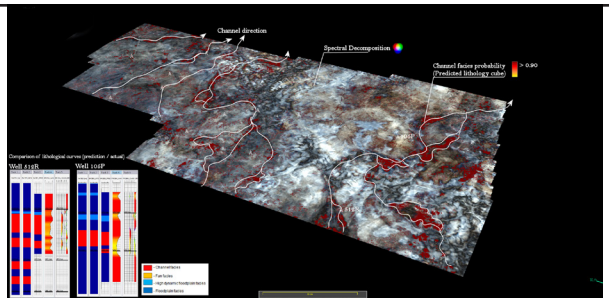
Emerson Rock Type Classification Leads to Increased Understanding of Hydrocarbon Reserves in a "Hard-to-Recover" Reservoir

RESULTS

- Reduced project duration by more than 20%.
- Improved forecast accuracy for lithology in the range of the productive layers.
- The new model delivered a significant increase in the geological reserves of hydrocarbons, due to an increase in the effective oil-saturated volume.



A spectral decomposition slice and the probably of sandstone presence >0.90 (based on cube lithology)

APPLICATIONS

Emerson's Rock Type Classification software using an innovative clustering algorithm.

CUSTOMER

A super-major oil and gas company in the CIS.

CHALLENGE

The area studied is located in Krasnoleninskiy Svod (crest of anticline) on the West Siberian Plate in the western part of Khanty-Mansi Autonomous Okrug. One of the main resources for oil production in this area (65%) is the Tyumen Formation, in which huge oil reserves are concentrated. However, it was difficult to develop the deposits due to low quality, low temporary capacity of productive internals, and inconsistency of the reservoir properties. Today, the reserves in the Tyumen Formation are classified as hard-to-recover.

The quantitative interpretation of seismic data in this area was complicated by two factors: A high degree of lithological diversity of the Jurassic interval of the section; and a small frequency range of the seismic data.

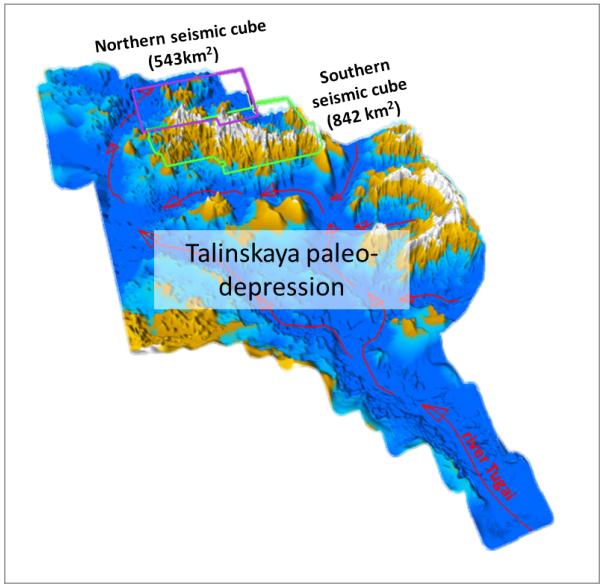
To enhance field development, there was a need to perform reliable prediction of sandy channel facies using seismic and well data.

SOLUTION

To meet this challenge, neural network analysis, one of the latest developments in the field of artificial intelligence available to the oil and gas industry, was used. Neural network analysis allows geoscientists to quickly identify the presence of connections between well data and seismic record characteristics. A distinctive feature of the algorithm is the simultaneous operation of two neural networks with the ability to use cubes of different angular sums or seismograms as input data. This ensures significantly increased forecasting accuracy by taking into account the change in amplitude seismic reflections depending on the angle of incidence of the wave.

"Emerson's interpretation tools are the right solution for solving complex problems. They enable d us to extract and efficiently utilize additional knowledge about the properties and quality of the reservoir."

Customer's Key Specialist



Gross depositional environment map

Emerson E&P Software

For more information:
www.Emerson.com/EPsoftware

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The cubes in each survey were classified independently. Despite the difference in frequency characteristics, the results of each classification were in good agreement with each other (Fig. 3). From the lithology cubes obtained from two different surveys, a reservoir facies volume was extracted and converted to T-surface horizons (Fig. 3). Such volumetric horizons, after conversion to depth, can be directly used as a volumetric trend when building a 3D model of the field.

RESULTS

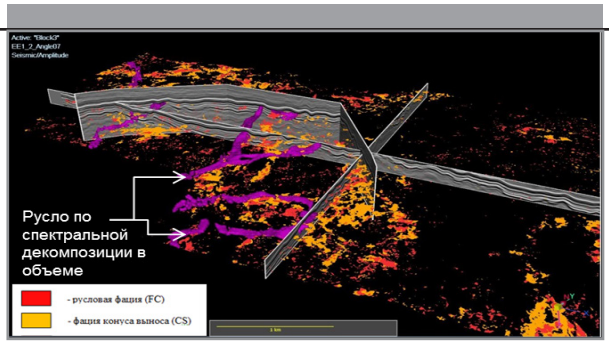
The classification result was used to detect reservoirs by predicting flood plain zones and the minimum probable volume of channel facies. Using this technology, both cubes of lithology and cubes of probability were obtained. For the target interval, we obtained volumes of channel facies (reservoir rock) and flood plain facies (non-reservoir rock).

For predicting geological behavior in the interwell space, the most probable (>0.90) volume of channel facies was extracted from the cubes of probability.

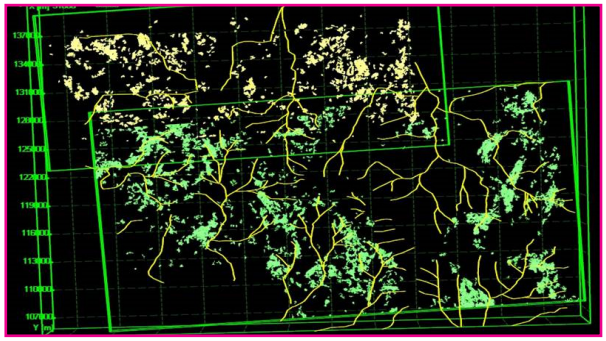
Only when using the integration interpretation of all the different geological and geophysical information (angle stack cubes, informative seismic attributes, the results of spectral decomposition, cubes of elastic parameters and well data), were the users able to obtain a detailed prediction of prospective zones in the 3D domain.

BENEFITS

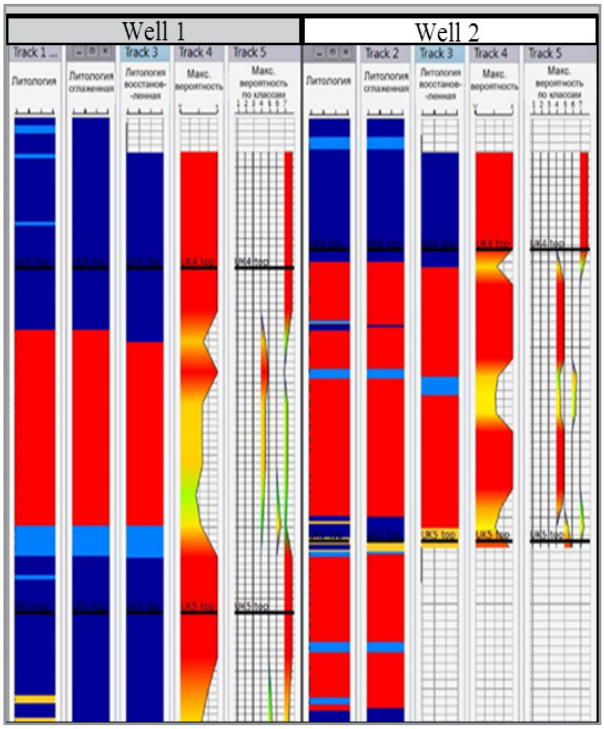
The results of this comprehensive dynamic analysis formed the basis of a new 3D geological model. The new model delivered a significant increase in the geological reserves of hydrocarbons, due to an increase in the effective oil-saturated volume. 75% of the models were confirmed by the new well information.



Sandstone facies volume, southern cube



Reservoir facies probability (> 0.9) in the RH interval



Algorithm validation - analysis of forecast errors

RESOURCES

Based on an article, "HTR (Hard to Recover: Seismofacial Modeling of Complex Reservoirs - Problems and Possible Solutions, Evdokimov Nikolay Alekseevich, TROFIMUKOV'S READING - 2019, Materials of the All-Russian youth scientific conference with the participation of foreign scientists. December 2019. Publisher: Federal State Budgetary Institution of Science Institute of Oil and Gas Geology and Geophysics named after A.A. Trofimuk Siberian Branch of the Russian Academy of Sciences (Novosibirsk)

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