

SUCCESSFUL WELL SPACING

FUGRO'S ROCKMOD TECHNIQUE PRODUCES HIGHLY DETAILED 3D RESERVOIR MODELS

Optimising a production drilling pattern was the goal of a recent Fugro project in Russia's Timano-Pechora field. Seismic inversion proved to be the most advanced, accurate and reliable method of reservoir characterisation and the resulting reservoir model provided the detailed information needed for success.

Oil and gas fields rarely have one large pool from which operators can extract hydrocarbons. Instead, a single field can have many reservoirs of different sizes and properties. To get the most out of the field, operators need to know where the reservoirs are and how well the hydrocarbons are likely to flow. Fugro's specialist products and services help operators to gain this understanding through quantitative analysis and construction of 3D numerical models.

"RockMod combines geostatistics and rock physics with innovative seismic inversion methods to integrate disparate data from multiple sources into highly detailed, realistic 3D numerical models of rock and reservoir properties."

Joe Jacquot, Strategic Marketing Manager, Fugro-Jason

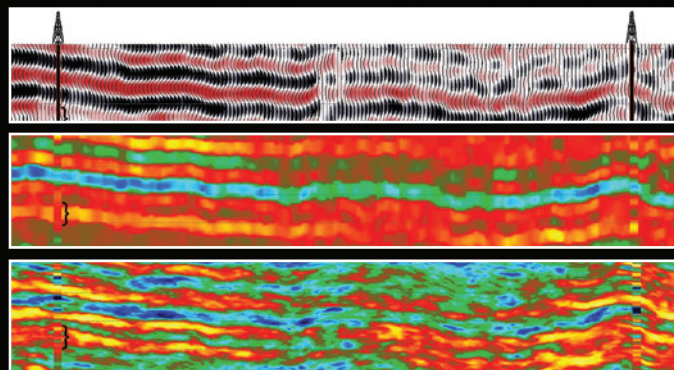
The first step in building a model of the Timano-Pechora field for operator LUKOIL-Komi was to identify all the available data, which comprised a 250 square kilometre 3D seismic survey, a suite of standard petrophysical logs from eight wells and core data from three of those wells. The data showed that the rock formations most likely to hold hydrocarbons were carboniferous shallow water shelf carbonates, which included limestone and dolomite. Reservoirs in these kinds of formations are often vertically thin, so they can be difficult to detect and to correlate across wells.



The measured petrophysical logs were remarkably close to the range of values predicted by the models

Specialist Techniques

Fugro's analysis began with deterministic full stack seismic inversion which focuses on how different rocks respond to the sound pulse from the seismic survey. They then applied deterministic partial stack inversion to look at two different ways that rocks respond. This approach requires more data preparation but is more sensitive to changes in rock layers, porosity and hydrocarbon saturation. The team successfully discriminated between the various reservoir types and non-reservoir rock but more detail was needed to calculate the reservoir thickness and potential volume.

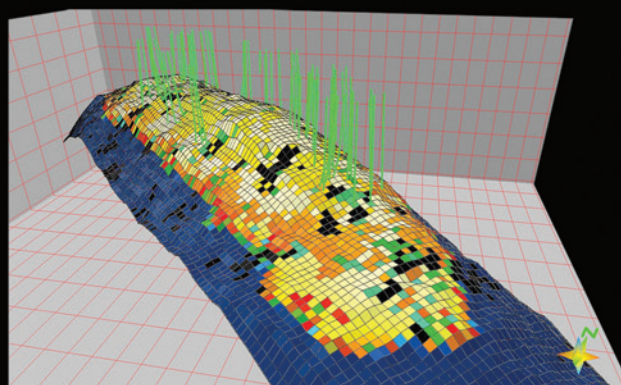


Comparison of the amount of detail in seismic data, deterministic inversion and RockMod geostatistical inversion for a sample field. RockMod geostatistical inversion provides more detail on thin layers

The next step was to perform RockMod geostatistical inversion. This technique leverages the vertical detail of well logs with the lateral detail of seismic data to yield highly detailed 3D reservoir models. Since RockMod accounts for uncertainties in the input data, several plausible 3D models are produced, each of which honours all known information about the reservoir. Probabilistic analyses can then be used to quantify and understand the uncertainty of the properties and their distribution throughout the reservoir. Based on these predicted models, three new wells were drilled; the measured petrophysical logs were remarkably close to the range of values predicted by the models and provided LUKOIL-Komi with the data needed to plan their production drilling pattern.

"The Timano-Pechora study shows that the estimation of reservoir properties in carbonate formations based on geostatistical partial stack inversion can be confirmed by newly-drilled wells. The results can be invaluable for planning production well locations especially in complex carbonate reservoirs with high lateral variability and limited well coverage."

Eric Adams, Global Service Line Manager, Fugro-Jason



RockMod-derived lithology, porosity and saturation from a sample field are input to the geological model