HARTENERGY LONDON PREVIEW

E&P DAILY NEWS

2013 EAGE Conference & Exhibition

OFFICIAL SHOW DAILY PUBLISHER OF THE 75TH EAGE CONFERENCE AND EXHIBITION

Achieving Deeper Insight into 3-D Facies Models

Subsurface module software can build realistic geologic models for increased confidence in reservoir forecasts.

BY MATTHIEU QUINQUET, PARADIGM

Three-D geological models are critical to understanding which hydrocarbons are in place and how they flow through the reservoir. This understanding is derived from four main deliverables and properties, including:

- The reservoir grid, which is a 3-D discretization of the reservoir volume, used to compute the bulk volume. It must accurately honor the reservoir structure;
- Porosity, used to compute pore space available for fluids;
- Fluid saturations, used to compute the quantity of fluid present; and
- Permeability, used to compute how fluid will flow.

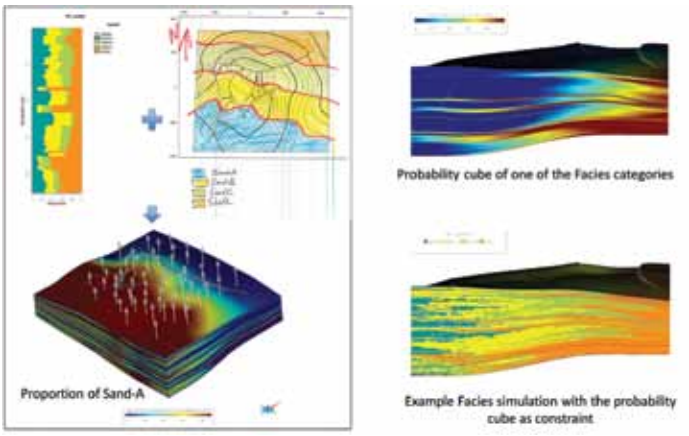
Facies distributions also control the properties of the reservoir model and, consequently, should be represented in the model. For example, facies constrain porosity and fluid saturation properties, therefore driving in-place volumes. Facies also contribute to the creation of flow barriers and conduits in the reservoirs, condition permeability distribution, and therefore control flow.

Facies can be determined locally at the wellbore from core and log data and can be estimated away from wells through seismically derived facies volumes. Besides subsurface data collected through well measurements and seismic acquisitions in the volume of interest, facies models also can be constrained from analogs such as outcrops or nearby reservoirs. They must honor the conceptual models defined by geologists after their analysis of the subsurface data based on their knowledge of the depositional environments in the studied area.

Building a realistic 3-D facies model must precisely honor the wellbore data, be constrained away from the wells, and represent the geologist's 3-D conceptual understanding of the reservoir. Data integration and facies analysis, together with building a model that accurately reflects the reservoir, are some of the most challenging reservoir characterization tasks for many geoscientists.

In pursuit of the commitment made from its inception to provide geoscientists with more realistic and more reliable 3-D geological models, Paradigm's SKUA 2011.3 suite of subsurface modeling modules delivers tools designed to bring geologists' conceptual models to life. The software can give geologists added control and provide the tools to extract the maximum amount of information from wells and seismic while honoring conceptual models. Data can be used to interactively generate vertical proportion curves as well as facies proportion maps carrying both facies probability for each facies category and most probable facies.

In addition to the facies proportion maps created from the data, conceptual trend maps can be easily created and used to model facies transitions. Methods are available to capture various geological concepts from deposition azimuth or from digitized facies boundaries. The latter includes a blending factor option to ensure smoother transitions across facies boundaries.



A 3-D facies trend created from a combination of a vertical proportion curve and a trend map is shown next to an example of facies simulation constrained by the 3-D facies trend. (Image courtesy of Paradigm)

SKUA also offers a variety of methods to create facies probability cubes by combining various input data such as seismic facies with wells facies or facies maps with vertical proportion curves and global proportions. Geologists are given a broader choice to combine a larger spectrum of input data and capture more detailed geological contexts. For example, facies trend cubes can be computed by combining trend maps with vertical proportion curves. This method enables accurate modeling of the horizontal and vertical facies transitions and easy modeling of prograding and retrograding systems.

Facies is the single most important reservoir architectural property, as it constrains and determines other properties from which in-place reserves and fluid movements are directly estimated. The company's subsurface modeling module software can provide a comprehensive, easy-to-use, interactive set of tools to derive facies probabilities followed by a comprehensive set of algorithms to stochastically simulate facies.

To learn more about SKUA 2011.3, visit Paradigm at booth 1230. ■