
Seeing Is Believing: Object Based Facies Distribution and Porosity Modeling Using Facies-Based External Histograms puts Geology back into Geostatistics

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In a thinly bedded reservoir, porosity can be over represented or under represented in a final geostatistical distribution using traditional modeling techniques.

Historically, a geocellular model was considered 'very good', if the porosity distribution of the grid 'matched' the porosity distribution of the wells. But, in a reservoir where the contacts between facies is sharp rather than gradational, attributes such as porosity and permeability tend to get 'smoothed' across the bed boundary. Logging tools such as gamma-ray, sonic, density and neutron have a three foot averaging window, even though data is recorded every 1/2 foot. This translates into at least one foot of transition measurement on each side of a sharp contact.

This 'smoothing' of the log data can be seen in the histograms of the well porosity, especially when split out porosity by facies. The porosity distribution will have a wide range and a skewed mean, reflecting the 1/2 foot sampling across sharp bed boundaries. The most extreme example of smoothing in a thin bed reservoir is visible in turbidities, where sand and shale beds can typically repeat on a centimeter scale.

External histograms derived from core data and grouped by facies; provide a more accurate representation of the reservoir property. The external histograms will tighten the data spread and move the mean higher for the dune facies and lower for the playa facies, thus reducing the 'smoothing' seen in the 1/2 foot re-sampled log derived histograms. The resulting geocellular models show distinctly sharper contacts between layers and an overall crisper porosity distribution within the facies objects.
