Deepwater Reservoirs: How Quantitative Geometric Data and Stratigraphic Hierarchy Can Influence Exploration and Development Projects

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Deepwater hydrocarbon exploration has generated huge volumes of well and seismic data over the last 30+ years. However, reservoir geologists and production engineers are always faced with a lack of data in the sub-seismic and super-well quantitative data when it becomes time to populate a static reservoir model and constrain flow simulation in dynamic models. Outcrop data can provide us with that “missing scale” when it becomes necessary to populate these models. Outcrops provide us with a better understanding of deepwater facies and their stacking patterns and dip or strike variability.

Detailed outcrop observations provide us with quantitative data commonly from 7th order (bedsets), 6th order (architectural elements) and 5th order (storeys). Deep marine outcrops rarely provide quantitative data at the 4th order (complex) and 3rd order (systems) due to size limitations. Over 3,100 architectural elements were compiled into a database that allows searching of the architectural elements so that probabilistic values for Net/Gross. Amalgamation Ratio and Aspect Ratio can be tabulated for the major depositional environments, such as Sheets, Channels and Levees. It was observed that there is a predictable variation of these values related to scale, such that seismic scale (3rd and 4th Order) values of these parameters could be estimated from worldwide outcrop examples. In addition, sub-environments such as Channel Axis, Channel Margin, Amalgamated Sheet, Layered Sheet and Channelized Sheet also show a predictable variability of Net/Gross and Amalgamation Ratio. It is extremely important to take a scaled approach for estimating probabilistic values from analogous outcrops. Any analogues selected during the modelling process of fields should first be selected on the basis of scale and then selected on other geological parameters.