Impact of Facies Modeling on Reservoir Simulation Accuracy - Case Study from Meji Field, Nigeria

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In order to improve the prediction accuracy of flow simulation production forecast, we need to focus on identifying and modeling the key reservoir complexities. One key element is facies architecture. Failure to adequately model reservoir facies architecture even in high porosity and permeability reservoirs can lead to overly simply static/dynamic models and lead to forecasting errors. This paper discusses the impact of the Meji field K-01 reservoir facies modeling on the reservoir performance prediction.

Meji field is located in OML-90, 8 km offshore on the western edge of the Niger Delta with a water depth of 30 feet. The structural setting is a northwest-southeast trending faulted rollover anticline structure. The Meji field is mainly comprised of upper - lower shore face and tidal inlet facies and sand development is typically laterally continuous across the field.

The accuracy of a model can be measured by the amount of tweaking required to match history. A stratigraphic unit model was initially developed based on reservoir and non-reservoir cutoffs. The model required substantial tweaking of porosity and permeability to obtain a good history match. Reservoir facies that were significant for reservoir performance were then identified from the only available cored well. Wireline log criteria of the identified facies were established at the well and used to recognize the reservoir facies in the uncored wells. A reservoir facies model was subsequently built using the identified reservoir facies at each well as control. The facies-based earth model tied with history with very little tweaking applied to the static properties. The reservoir facies model was more accurate because it incorporated rock type variability across the field and associated reservoir connectivity. The reservoir facies model was scaled-up and used for dynamic simulation of the K-01 reservoir.

Challenges:
Limited number of core samples from the target reservoir.
Limited number of well data.
Modeling reservoir complexity/performance from a single core sample.
Constructing accurate static models that match production history without adjustment.

Lessons Learned:
Stratigraphic model may not adequately define reservoir flow behavior even in high net-to-gross sands. Each stratigraphic unit may be composed of a variety of rock types with distinctly different porosity, permeability and saturation characteristics and expected simulation performance.