

Extorting the Subsurface: Development Planning in Vertically-Heterogeneous, Shallow-Marine Reservoirs Using a Multiple-Point Statistics (MPS) Depofacies-Based Geostatistical Simulation Model

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The Takula field in offshore Angola, Block 0, is a mature giant oilfield that produces from five separate formations. The Albian-age Upper Pinda Formation is a secondary producing interval that contributes from a gross 800 feet of shallow-marine, mixed clastic and carbonate sandstone units. The field has been producing since the mid-1980's and has recovered 800 MM barrels primarily by depletion drive. A single-well pilot water injection program that was implemented in the mid 1990's has shown a positive response. However, variable water breakthrough indicates significant uncertainty in the vertical permeability profile of the thin, stacked sand intervals. A detailed reservoir model was built to address this uncertainty and help analyze alternatives for waterflood expansion.

The sequence stratigraphic framework suggested that porosity and permeability would best be modeled using a depofacies-based method. Sedimentologic and stratigraphic interpretations were digitized into training images in a geocellular model that provides the basis for Multi-Point Geostatistical Simulation (MPS) of reservoir properties. The inherent speed and flexibility of this application allowed for the expedient simulation of a variety of scenarios pertaining to reservoir continuity and connectivity. Iterative refinement of the MPS-populated geocellular models in the history-matching phase proved to be a vital path to building a dynamic simulation model adequate for development planning.