The Sedimentology, Sequence Stratigraphy, and Fluid Migration History of Non-Marine and Shallow Marine Reservoirs, North Apoi-Funiwa Field, Offshore Niger Delta

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The North Apoi-Funiwa field comprises Pliocene and Miocene non-marine and shallow marine sediments offshore of the central Niger River delta. The major sequences, or delta cycles, are controlled by progradation and retrogradation of the Niger delta. Depositional environments of the minor sequences occur on a reservoir scale and comprise a complex mix of shoreface, estuarine, fluvial and delta plain deposits. Sediments deposited along the unstable progradational Niger delta complex were subject to syndepositional slumping and faulting, which contributed to field compartmentalization and apparent reservoir heterogeneity.

The field has 7 to 8 producing intervals with reserves of 500-600 mbo. Enhanced reservoir production can be achieved through rigorous stratigraphic definition of the reservoir intervals within the complex structural overprint. Reservoir compartmentalization and connectivity were defined through detailed core description of physical and biogenic sedimentary structures, well log analysis and sequence stratigraphic correlation.

Although, North Apoi-Funiwa is a mature producing field, there is potential for additional reserves. Stratigraphy and sedimentology provided the initial framework for geochemical modeling of hydrocarbon migration and entrapment of fluids within Upper Miocene to Pleistocene reservoir intervals. However, complex structural features along with fluid flow modeling suggest that there is considerable vertical migration associated with the petroleum system. Maturity modeling indicates that the source rock was at its most productive during the Early to Middle Miocene. Therefore, deeper reservoirs may well indeed be the source of hydrocarbons that migrated to reservoirs younger than the Middle Miocene.