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Richard C. Haack¹, P. Sundararaman², Jacob O. Diedjomahor², Nicholas J. Gant², Hongbin Xiao³, Val A. Onyia⁴, Elliot E. Ibie⁴, Eric D. May⁵, Ken Kelsch⁵ (1) Chevron Petroleum Technology Co, San Ramon, CA (2) Chevron Petroleum Technology Co (3) Saudi Aramco, Dhahran, Saudi Arabia (4) Chevron Nigeria Limited, Lagos, Nigeria (5) Chevron Overseas Petroleum Inc, San Ramon, CA

Niger Delta Petroleum Systems: Regional Geology, Organic Facies and Thermal Maturity

Three petroleum systems are present in the Niger Delta and delta frame: Lower Cretaceous (lacustrine), Upper Cretaceous-lower Paleocene (marine), and Tertiary (deltaic). Each system is defined on the basis of source-rock and oil geochemistry, and these data demonstrate that the Tertiary (deltaic) petroleum system is the principal source for oil and gas in the Niger Delta. By building a regional structural and stratigraphic framework around this petroleum system in the northwestern part of the delta, a better understanding of previously elusive aspects of hydrocarbon generation and migration has emerged. In addition, this regionally integrated approach provides useful insights for new play types as well as a better understanding of factors controlling the complex GOR distribution within oil fields and sub-regionally.

The process-response model of *deformation cell* links creation of accommodation space for deposition of sediments on the shelf to the coupled effects of normal faulting of the shelf and thrust faulting down-slope for any time during the delta's history. Distribution and quality of reservoir sandstones are controlled primarily by depositional position relative to paleo-shoreline, paleo-shelf edge and distance down-slope. Shelf sands tend to be laterally continuous and require 3-way, or 4-way, closure for trapping hydrocarbons. Sand deposition on the middle to upper paleo-slope is generally confined to channelized distributary systems controlled by paleo-topography caused by thrust faulting and shale flowage. More distally, sand deposition on the lower paleo-slope and basin floor can be unconfined resulting in extensive amalgamated fan complexes. These deep-water sands trap hydrocarbons in more complex structural-stratigraphic traps.