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Major Deltas as Complete Petroleum Systems: a Sequence Stratigraphic Perspective

Sequence stratigraphy provides the only exploration methodology that can characterize and de-risk most elements of a petroleum system (reservoir, source, seal, and trap). Sequence stratigraphic correlation and mapping illuminate reservoir and seal distribution, help constrain basin modeling, and define hydrocarbon migration pathways. This is particularly true in siliciclastic deltaic systems such as the Niger, Mahakam, and Rajang-Lupar complexes. In spite of high sediment accumulation rates here, detailed correlations can be carried from shoreline to shelf to deepwater basin using the sequence stratigraphic methodology.

Complementary geochemical analysis and basin modeling indicates that these equatorial deltaic complexes are complete petroleum systems. The deltas are sites of accumulation of terrestrial organic matter (TOM) which 1) sources updip shelfal reservoirs from in-situ coals and coaly shales; and 2) is eroded and transported basinward during relative sea level lowstands and deposited in deepwater "kitchens". Sand associated with such lowstands provide reservoir rock volume, while sealing and entrapment occur during relative highstands and trangressive episodes. Migration along sequence-bounding unconformities provides conduits from source to reservoir.

Other factors favor deltas as complete petroleum systems. Many of the world's major deltas existed as far back as Early Miocene and are sites of tremendous Neogene sediment deposition. This "late burial", in comparison to Paleogene and Mesozoic depocenters, lowers risk on the hydrocarbon system. Late burial results in recent migration of hydrocarbons, limiting leakage due to entrapment under imperfect seals or later tectonic modification of traps. Late burial also favors porosity preservation, as much as 10 porosity units over Cretaceous and Jurassic reservoirs. These observations may explain why an unusually high percentage of the world's giant fields are reservoired within Neogene sandstones.