

# Two Dimensional Basin Modeling and Petroleum System Critical Analysis of La Concepción Field, Lake Maracaibo, Venezuela

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Two dimensional basin modeling of La Concepción Field, Venezuela reveals the significant impact of pulsed tectonics upon the maturation and migration of hydrocarbons in the prolific Maracaibo basin. Principal source rock criticals include the Type II La Luna Formation (95 Ma) and the Machiques Member (125.7 Ma). Initial oil generation occurred around 60 Ma, expulsion at 45 Ma, and cracked gas around 40 Ma. Principal migration criticals were cross-linking fault zone pathways in the carbonates and through juxtaposed reservoirs in the siliciclastics. Reservoir rock criticals consist of the Cogollo, La Luna, and Guasare fractured limestones and the Eocene Misoa sandstones. Tectonic activities provided four distinct phases of structuring and thermal perturbations and yielded two distinct petroleum systems: the Cretaceous and the Cretaceous/Eocene.

Thermal maturity analysis and migration modeling suggest the timing critical for the Cretaceous petroleum system first opened in the Mid-Eocene (43 Ma). The structural trap forming processes commenced in the Late Cretaceous and were completed by the Mid-Paleocene. Substantial generation, migration, accumulation and preservation of hydrocarbons immediately ensued. Lying in a tectonically dynamic region, La Concepción Field underwent a multi-staged deformation resulting in the formation of both structural and stratigraphic traps. Structural traps include faulted blocks, anticlinal features, and transpressional flower structures. Stratigraphic traps are sandstone lenses and pinch-outs within the Misoa Formation shale units. The extensive amounts of small-scaled faults and reactivated basement-involved, high-angle faults suggest that rheologically, La Concepción Field represents present-day transpressional elastic deformation providing dominantly vertical hydrocarbon migration.