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A Geological Model for Cretaceous Carbonate Reservoirs in the Maracaibo Basin, Venezuela

Significant quantities of light oil have been produced in western Venezuela from cretaceous carbonate reservoirs. Reserves exceed 1.2 MMM STB and approximately 3.9 MMM STB of oil remain to be discovered through exploration.

To date, plans for further drilling and development have been hampered by the complex geometry and distribution of reservoirs and H2S production. However, recent findings aimed at solving and minimizing drilling risks and controlling H2S have created new and important opportunities.

Three different areas are analyzed and characterized to establish models for exploration and production. Critical geophysical, geological, stratigraphical, petrophysical and reservoir engineering parameters were identified from each field, which allowed prediction of the geometry, distribution and potential for each reservoir. A drilling program based on these models is recommended to optimize exposure to open fractures and zones of preferential porosity development.

The Totumos field, located on land in the west of the lake, is an example of a stratigraphically controlled reservoir in which matrix and intercrystalline porosities provide the main storage and fluid flow capacity. The reservoirs are packstones and grainstones associated mostly with shoaling highstand system tracts, in addition to dolomitic intervals. A gently dipping homocline structure and tight carbonate units provide the trapping mechanism.

Lake Maracaibo Block 1, on the other hand, is a highly compartmentalized reservoir on the downthrown side of the Icotea Fault, controlled by faults and fracture swarms with subordinate matrix porosity. The storage capacity is provided mainly by the matrix, while faults and fractures are permeability conduits. Individual reservoirs are related to faults in the vicinity of the Icotea Fault zone and their associated fracture "halos". This productivity may be increased if these fractures cross particular stratigraphic prospective areas of faulting whereas anomalous amplitude behavior is associated with fracture intensity. Stratigraphy is inferred from well control and seismic.

Lake Maracaibo Block II is also a reservoir controlled by faults and fractures, but it is believed that a sedimentological control may be exerted through clastic input from the south which adds to the storage capacity.