Tectono-stratigraphic Framework of the Western Maracaibo Block, Colombia-Venezuela: Implications for Hydrocarbon Exploration

Whitehill, Caroline S.[1]; Mann, Paul [1]; Escalona, Alejandro [2]; Vargas Jimenez, Carlos A.[1] (1) Jackson School of Geosciences - Institute for Geophysics, The University of Texas-Austin, Austin, TX. (2) Petroleum Geosciences, The University of Stavanger, Stavanger, Norway.

The actively deforming, Maracaibo block of Colombia and Venezuela plays a major role in hydrocarbon distribution in western Venezuela and northern Colombia. The triangular Maracaibo block is defined by the right-lateral Oca fault of northern Colombia (70-100 km slip), the left-lateral Santa Marta-Bucaramanga fault zone (SMBFZ) of northern Colombia (50-110 km slip), and the right-lateral Bocono fault of western Venezuela (30-80 km of slip). Oil reserves in the basins overlying or adjacent to the Maracaibo block vary widely from 44 BBOE in the Maracaibo basin, 3.3 BBOE in the Middle Magdalena (MMB), 1.0 BBOE in the Lower Magdalena, 256 MMBOE in the Baja Guajira, and 13.9 BBOE (potential resources) in the Cesar-Rancheria (CRB). We present a kinematic model for the Maracaibo block and its influence on oil resources on overlying and adjacent basins based on subsurface mapping of more than 30,000 km of 2D seismic and well data from the MMB and CRB along with compiled information from previous work in the MB. A major control for oil resources is sedimentary thickness which is optimal for maturation and preservation of light oils in the northeastern MB (5-10 km) but marginal in the CRB (< 3 km) and MMB (~3-8 km). Another major control is erosion during the Eocene-Oligocene uplift event that led to a major hiatus that is greater in the western areas of the LMB, MMB and CRB (Eocene or Oligocene strata on Cretaceous) and less in the eastern area of the MB (Oligocene strata on Eocene). The greater loss of sedimentary cover (including Cretaceous source rocks) has produced less favorable conditions for hydrocarbons. Recent fission track dating shows that the uplift of the northern Andean ranges is coeval with this unconformity with topographic elevations persisting to the present-day. Structurally, we use subsurface and surface geologic data to show that the uplifted margins of ranges associated with the MB are thick-skinned inversion structures similar to Laramide uplifts of the western US rather than thin-skinned structures proposed by previous authors.