Cenozoic Tectono-Stratigraphic Evolution and Petroleum System of the Eastern Cordillera Foothills and adjacent Basins (Colombia)

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Abstract

The Foothills of the Eastern Cordillera Colombia and adjacent basins represent an important region for oil production. We use new gravity, magnetic, well and 3D seismic data to understand how regional structures and tectonic movements have affected the petroleum system and the sedimentary history. The Garzón fault has been previously interpreted as a right-lateral strike-slip fault. New seismic, well, and gravity data demonstrate that the Garzón fault is also a low-angle (12–17 degrees) Andean age fault thrusting PreCambrian basement 10 to 17 km northwestward over Miocene rocks of the Upper Magdalena Valley (UMV) in a prospective footwall anticline. New geophysical data as well as previous field mapping were used to produce the first gravity and magnetic maps and retrodeformable structural cross section of the northern Garzón Massif. The new model distinguishes for the first time distinct episodes of "thin-skinned" and "thick-skinned" deformation in the Garzón Massif. Seismic attribute analysis (spectral decomposition) and sequence stratigraphy for the Cenozoic sedimentary succession south of the giant Cusiana oil field were used to develop new chronostratigraphic concept models and facies predictions. Exploration in the eastern foothills of the north Andes has largely been focused on structural traps, which has led to a number of significant discoveries such as the Cusiana and Cupiagua oil fields. However, for more challenging stratigraphic play types we use spectral decomposition (STFF, CWT, MP) to enhance our understanding of the fluvial reservoir architecture. Use of this technology could open a new era in hydrocarbon exploration in the eastern foothills of the north Andes and adjacent basins.