Cenozoic Inversion Patterns in the Eastern Cordillera of Colombia: Implications for Petroleum Systems

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A principal unknown for petroleum exploration in the Subandean basins of Colombia has been a poor knowledge of the timing of fold-thrust deformation. This chronology issue also applies to many Subandean basins throughout South America. Recognizing this problem, Ecopetrol developed the project “Cronología de la deformación en las Cuencas Subandinas” in cooperation with other institutions. In this contribution, we present new results from this project related to apatite fission track (AFT) analyses, mapping of growth stratal relations based on seismic information and surface mapping, biostratigraphic determinations for basin fill, and balanced cross sections. Our results show that there has been more or less continuous deformation in the Eastern Cordillera from the Late Eocene to present, with an important earlier phase of end Cretaceous-Paleocene deformation recognized in the Middle Magdalena Valley basin. The datsets further indicate that exhumation affected the entire Eastern Cordillera by early Miocene time and was initially focused along inherited basement anisotropies in the foothill areas on both the eastern and western flanks of the range. In the foothills zones, where Oligo-Miocene exhumaton is less significant and sedimentation is faster, the initial Late Oligocene activation of low-amplitude flat detachments outside of the Lower Cretaceous rift domain is recorded by growth strata. These relationships of timing and structural style are the central to understanding why significant oil accumulations are scarce in the Eastern Cordillera yet abundant in the eastern and western foothill regions flanking the range.