

Tracking Uplift of the Colombian Andes Using Detrital Zircon Ages, Basin Fill Histories, Low Temperature Thermochronology, and Regional Structural Relationships

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The Cenozoic record of shortening, uplift, and basin development in the northern Andes of Colombia is critical to models of hydrocarbon generation, regional climate, river drainage patterns, and biological evolution in South America. A synthesis of recent results obtained through a joint academia-industry collaboration suggests a complex spatial and temporal history of deformation, erosional exhumation, and sedimentation. Field and laboratory results were obtained along several regional east-west traverses across the Central Cordillera, Middle Magdalena Valley intermontane basin, Eastern Cordillera, and Llanos foreland basin. Provenance results from detrital zircon U-Pb geochronology, sandstone petrography, and paleocurrent analyses allow discrimination among evolving cratonic, magmatic arc, and fold-thrust belt source regions. Cenozoic cooling histories derived from apatite and zircon (U-Th)/He of Andean bedrock and detrital basin fill help pinpoint the timing of exhumation along major fold-thrust structures. Additional constraints from basin-fill histories and other regional assessments (by Ecopetrol-Instituto Colombiano del Petróleo researchers) of growth strata and structural relationships further delimit the record of thrust timing and synorogenic sedimentation. Particularly instructive are major reversals in provenance, changes in cooling histories, and initiation of upper crustal structures. These lines of evidence suggest shifts in drainage patterns and exhumation that can be linked to the early stages of rock uplift in the Central and Eastern cordilleras, and resulting sediment accumulation in the Magdalena and Llanos basins. A synthesis of new evidence suggests that shortening deformation commenced in the Central Cordillera by early Paleocene time, reached the axial zone of the Eastern Cordillera by late Eocene time, and affected the eastern flank of the Eastern Cordillera by earliest Miocene time.