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Cenozoic exhumation history in the northeastern Andes: new data based on low-T thermochronology and basin analysis in the Eastern Cordillera of Colombia

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Foreland basin sediments are important recorders of the climatic and tectonic history of mountain belts. However, for a better understanding of foreland depositional processes and sedimentation histories, it is important to compare basin strata and inferred depositional processes with the evolution of adjacent, actively uplifting ranges. Along the northeastern margin of the Andean orogen, a foreland basin system has evolved in the area east of the Central Cordillera of Colombia as a response to shortening and uplift of this range since the Late Cretaceous. Associated with the overall lateral growth of the northern Andes, the NNE-oriented Eastern Cordillera is located immediately to the east of the Central Cordillera and results from tectonic inversion of Mesozoic rift structures. Initial Cenozoic uplift breached the foreland basin adjacent to the Central Cordillera and shifted the active foredeep to the east. However, the onset and subsequent history of exhumation along the most important structures in the Eastern Cordillera has been poorly documented. We used facies, paleocurrent and provenance analysis, and applied a new chronostratigraphic framework based on palynology in the Cenozoic foreland sediments along the eastern deformation front of the Eastern Cordillera, in order to document its long-term denudation history. In addition, we compared these results with low-temperature thermochronology (ZFT and AFT data) in the potential source areas. Both data sets illustrate that exhumation began during the Late Oligocene associated with the main basement thrusts that constitute the eastern margin of the Eastern Cordillera. We calculated exhumation since the Late Oligocene of ca. 0.1-0.2 mm/yr. Our data unambiguously document that these rates were also sustained during the Miocene. In contrast, in early Pliocene time exhuma-

tion increased to peak values of ca. 1 mm/yr. Such a dramatic increase in rates appears to be primarily associated with a response to faster shortening rates in the entire northern Andes, which prompted enhanced surface uplift in the Eastern Cordillera between 6 and 3 Ma. However, the uplift of the mountain range in excess of 3 km also created an important orographic barrier, which constitutes a very efficient barrier for easterly moisture-bearing winds. It is thus conceivable that exhumation has been focused on the windward side and may have further accelerated in those sectors of the orogen that are charcaterized by protracted, focused precipitation and localized removal of material.