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From steady-state to climatically driven denudation across the Central Andes – SE Peru

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To better constrain the orogenic growth of the Andean chain, we investigated the time-Temperature paths of bedrocks from the two morpho-structural highs of the Central Andes that are separated by the vanishing Altiplano, i.e. the Eastern and Western Cordilleras of SE Peru.
The Western Cordillera is a volcanic to volcano-detrital chain that developed ~40-35 Ma ago and is characterized by a 4000m high mean altitude whose origin is poorly constrained. Fission-Track data on apatite and zircon crystals extracted from an Eocene pluton yield ages comprised between 24 and 14 Ma, and 38 and 30 Ma respectively. One of the noteworthy aspects of the data is that analyses reveal a steady-state phase of exhumation from the late Eocene to at least the middle Miocene (38-14 Ma) with no disruption of the exhumation path since 38 Ma either by sedimentary burial and/or rapid exhumation. The uplift of the Western Cordillera was thus probably steady since, avoiding the deposition of foreland basin sequences as in the Altiplano region. Further east, Apatite Fission-Track ages are much younger and range between 7.6 and 2.5 Ma for the Eastern Cordillera and between 11.2 and 1.5 Ma for the Sub-Andean Zone. Age-altitude relationships suggest that denudation increased from a more quiescent Late Miocene period to a high rate of 0.8 km/my for the Pliocene. Such abrupt change is supported by a net in sediment accumulation rates in the Andean Amazon Basin but as far as offshore the Amazon fan. A global climate change is usually invoked for high Pliocene rates; however it post-dated a documented period of surface uplift in the Eastern Andes.
Denudation patterns are much contrasted across the Andes of SE Peru. The western Cordillera, despite significant topography and deep river valleys in the studied area, still yield information that suggest a steady and slow uplift from the late Eocene until at least the middle Miocene. We thus propose a coupled scenario: first the Andean orographic barrier developed from the Eocene by tectonism and probably more recently in the eastern Cordillera (Late Miocene), later focusing the Amazon moisture (5m/y of annual precipitation today) and denudation in the Pliocene along the eastern flank of the Andes. The localization of erosion modified in turn the structure of the belt, limiting the deformation in the narrow Sub-Andean Thrust Belt. Part of the rapid denudation we constrained for the Pliocene possibly corresponds to an erosionaly isostasic rebound that sustains topography since climatic conditions changed along the eastern slope of the Central Andes.