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Late Cenozoic acceleration of erosion in the Southern Central Andes revealed by low-temperature thermochronology

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The Earth's topography is shaped by feedback mechanisms between tectonics, climate, and surface processes. To understand the influence of these interactions on mountain building processes, one can quantify the temporal and spatial history of exhumation using thermochronology. The Andes are a suitable natural laboratory to study such feedbacks, because they result from the steady subduction of the Nazca plate below the South American plate and their meridional extent crosses several global climate zones. Furthermore, the recent growth of regional low-temperature thermochronological studies led to an extensive data coverage, which can now be inverted to estimate the exhumation history at the scale of a mountain range. In this study, we present a total of 172 new thermochronological AHe, ZHe, and AFT bedrock ages filling remaining data gaps between 26°S and 34°S latitude. To avoid dating of emplacement ages instead of exhumation, ZHe and AFT analyses are restricted to pre-Miocene intrusions only present in the northern part of the study area. From about 31°S to 34°S, the study area covers a key transitional zone where topography decreases, precipitation increases, and the subduction regime changes from flat to steep dip angle. ZHe and AFT ages to the north of 33°S indicate erosion rates lower than 0.2 mm/yr since the Paleogene, except for few localized areas showing middle-to-late Miocene increased exhumation in their AHe ages. To the south of 33°S, two AHe age-elevation profiles reveal ages between 0.5 to 3.5 Ma and suggest intensified erosion during the Plio-Pleistocene relative to the northern area, with southward increasing rates from about 1.3 mm/yr to 3.8 mm/yr. The transition occurs more than 150 km south of the tectonic change in the subduction regime. However, the establishment of the modern atmospheric circulation pattern in the late Pliocene led to increased moisture transport to the North and the initiation of glaciations. Higher precipitation and/or glaciations in the area south of 33°S latitude could thus explain the intensified erosion in the Plio-Pleistocene. Coinciding with decreasing topography and a narrowing of the Andean mountain belt, these preliminary results may indicate a climatic control on exhumation, and potentially tectonics, in the Southern Central Andes.