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Constraints on the uplift of the southern edge of the Chilean Central Andean plateau, above the Nazca flat slab, using (U-Th)/He and AFT thermochronology

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In this study we use (U-Th)/He and apatite fission-track dating as a novel proxy for surface uplift of kilometric deep incised canyons in the western southern edge of the Andean Central Plateau (30º-32ºS). Samples collected in the two kilometers deep canyons, incised by the Elqui and Choapa River in the west flank of the Principal Cordillera, yield continuous incision rates of ∼63m/my between 37±3 Ma and 14±1 Ma. This implies that the Principal Cordillera reached one third of its present elevation by 20 Ma (∼1070m) and about the half by 14 Ma (∼1450 m). The fact that the uplift was continuous suggests that river incision kept pace with uplift during thin- and thick skinned thrusting throughout Eocene to Middle Miocene times. The accelerated uplift rate we suggest (132 m/myrs) since the Middle Miocene, to reach the present-day elevation, can be related to the subduction of the Juan Fernandez Ridge. Despite ridge subduction led to the transfer of shortening from the Principal Cordillera to the Frontal Cordillera (∼14Ma), it caused the removal of a significant portion of the lithosphere to accommodate slab shallowing and continental crustal thickening. The removal of part of the lithosphere produced important regional isostatic uplift. Rapid uplift exceeded the rate of river incision, which was being reduced by the establishment of stable arid conditions at least since ∼15Ma. We estimate exhumation rates of <1.5 km for the Coastal Cordillera and Principal Cordillera since Late Cretaceous and Eocene respectively.