Zircon U-Pb–Lu-Hf petrochronology of the late Cenozoic central Andes of southern Peru

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Geodynamic processes responsible for the formation of high topography in the Central Andean Plateau (CAP) are debated. Specifically, the relationship between crustal thickening and surface uplift in the CAP, and in Cordilleran orogens in general, is poorly understood. End member hypotheses include (1) coupled pure shear crustal thickening and concomitant slow (i.e., km/10s Myr) surface uplift; and (2) decoupled crustal thickening and rapid (i.e., km/Myr) surface uplift driven by foundering of mantle lithosphere. We address these hypotheses with new laser ablation inductively coupled plasma mass spectrometry (LA-ICPMS) paired U-Pb and Lu-Hf isotopic analyses of Oligocene-Miocene zircons from ignimbrite deposits in the Western Cordillera of southern Peru, collected and interpreted in the context of Oligocene – Miocene hinterland basin stratigraphy. Lu-Hf results calculated for the timing of crystallization, εHf(t), range from -0.4 to -16.8, and are consistent with magma generation from thickened continental crust. Results show systematic increases in εHf(t) from 22–18 Ma and 14–10 Ma, followed by a return to median pre-shift εHf(t) values of ~-8. Increases in εHf(t) are interpreted as juvenile magmatic input into thickened, partially recycled continental crust. The timing of pulsed juvenile magmatic input is in sync with a transition in hinterland basin deposition from dominantly fluvial to evaporitic lacustrine deposition, and with recently reported rapid surface uplift between 22 and 10 Ma. Further, decreases in εHf(t), understood to correlate to increases in crustal thickness and recycling, do not correspond to episodes of surface uplift. Although further quantitative analysis is still needed to test our preliminary interpretations, new LA-ICPMS U-Pb – εHf(t) data indicate that the crust was thick by early Miocene time, at the same time when the EC was actively shortening, and suggest times of partial decoupling between crustal thickening and surface uplift in the northern CAP during the late Cenozoic, pointing to dynamic processes driving surface uplift.