

Unlocking the provenance of the Upper Miocene to Holocene southern South American loess record through U-Pb detrital zircon geochronology

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Abstract

South America, from southernmost Bolivia through central Argentina, contains a useful Late Miocene to Holocene record of eolian sedimentation that can be used to advance our understanding of atmospheric circulation and dust production pathways over that interval. Our research indicates that loess provinces in the eastern Andes, Chaco Plains, and Pampean Plains had quasi-independent dust production pathways. A summary of our findings is as follows. 1) Detrital zircon crystals in the high-elevation upper Pleistocene loess deposits in the eastern Andes area of Tañi del Valle were primarily derived from the Puna Plateau to the west. At a latitude of $\sim 27^\circ$ S, this necessitates a several-degree equatorward shift in the upper- and lower-level westerlies during intervals with high dust accumulation in Tañi del Valle. 2) Upper Pleistocene to Holocene eolian sand deposits of the Pampean Sand Sea and loessic strata in the central and eastern Pampas contain detrital zircon U-Pb age spectra indicating derivation from the Río Desaguadero, Río Colorado, and Río Negro which drain the central Andes. Although the present-day Puna-Altiplano Plateau is hyperarid, the presence of major Argentine river systems in the dust production pathways of the Pampas is important for identifying the relative importance of precipitation and river courses on dust production, which parallels the relationship between the Yellow River and Chinese Loess Plateau in East Asia. 3) Upper Miocene strata of the Cerro Azul Formation, deposited between ~ 8.9 and ~ 5.5 Ma, include loess and aggradational paleosols. These eolian strata yield detrital zircon U-Pb age spectra that are consistent with the present-day Río Colorado and Río Negro, and similar to the Upper Pleistocene to Holocene deposits of the Pampas. This suggests a Late Miocene establishment of the Pampean eolian system. Interestingly, the Pampean eolian system and Chinese Loess Plateau both cover the same latitudes ($\sim 33^\circ$ - 39°) but in different hemispheres, and both were established at roughly the same time during the Late Miocene. These observations point to bihemispheric intensification of Hadley circulation in forcing the establishment of these two large eolian provinces.

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