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Landscape response to the Mid-Pleistocene Transition (MPT) and higher frequency climate change in the Central Andes

Elizabeth Orr¹, Taylor Schildgen^{1,2}, Stefanie Tofelde², and Hella Wittmann-Oelze¹

¹German Research Centre for Geosciences (GFZ), Potsdam, Germany

²Institute for Geosciences, University of Potsdam, Potsdam, Germany

Theory suggests that the response time of alluvial-channel systems to perturbations in climate can be related to the magnitude and direction of the forcing, and the length of the system; shorter systems may record a higher frequency of forcing compared to longer systems. The Toro Basin in the Eastern Cordillera of NW Argentina has preserved a suite of alluvial-fan deposits at the toe of the western flanks of the Pascha Range. Farther downstream, a series of cut-and-fill terraces have been linked to 100-kyr climate cycles since ca. 500 ka (Tofelde et al., 2017). The upper basin fan sequence therefore presents an excellent opportunity to explore (1) how climate-induced channel responses may or may not propagate downstream, and (2) the differences in landscape response to forcing frequency as a function of stream length when comparing the upper to the lower basin fan/terrace sequences.

The abandonment ages of eight fan surfaces based on our new ¹⁰Be-derived exposure ages of 30 boulders and a ¹⁰Be depth profile define two sets of fans: the first set records fan-surface activity and abandonment between ca. 800 and 500 ka, and the second set records activity within the last 100 kyr. By comparing the fan stratigraphy and surface ages with paleoenvironmental records, we can explore whether the complete fan sequence can be explained by the local expression of shifts in regional and global climate.

The older set of fans records an important phase of incision within the basin, punctuated by periods of surface stability and aggradation, between ca. 800 and 500 ka. We argue that this net incisional phase, which has been recognised within other intermontane basins throughout the Central Andes, was likely triggered by prolonged and enhanced global glacial cycles following the Mid-Pleistocene Transition (MPT). A period of relative fan surface stability followed in the upper basin, while 100-kyr cut-and-fill cycles persisted downstream, suggesting a disconnect in the behaviour of the two regions.

The younger set of fans reflect higher frequency climate forcing, possibly the result of precessional

forcing of climate (ca. 20-kyr timescales) without significant net incision. Within these climatic cycles, fan surface activity can be correlated to periods of enhanced warming and aridity within the Central Andes and the previous global interglacial. The incision and abandonment of these surfaces then coincide with periods of increased humidity from an intensified monsoon, regional glaciation and global cooling. The lack of this high-frequency signal farther downstream provides field support for theoretical predictions of a filtering of high-frequency climate forcing with increasing channel length.

Tofelde, S., Schildgen, T.F., Savi, S., Pingel, H., Wickert, A.D., Bookhagen, B., Wittmann, H., Alonso, R.N., Cottle, J. and Strecker, M.R., 2017. 100 kyr fluvial cut-and-fill terrace cycles since the Middle Pleistocene in the southern Central Andes, NW Argentina. *Earth and Planetary Science Letters*, 473, p.141-153.