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Using cosmogenic nuclides to trace a steep climate gradient over a short distance in hyperarid northern Chile

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Long-term and persisting aridity has preserved an almost relict landscape in northern Chile. Thus, the region provides excellent conditions for the study of paleoclimate and the impact of climate and climate change on Earth-shaping processes and topography formation.

Here we present a set of catchment-wide denudation rates along a short E-W transect on the northern rim of the Río Loa Canyon in the Coastal Cordillera of northern Chile (latitude 21.4ºS). In the study area, a flat sedimentary surface consisting of unconsolidated conglomerates of Miocene age becomes increasingly dissected and changes into a badland-like topography within a few kilometers of distance. We derived the denudation rates from cosmogenic ^{10}Be in amalgamated samples from channel quartz pebbles. The denudation rates increase from east to west within $\sim$3 km of distance, indicating the presence of a steep time-integrated climate gradient in this area. When related to major geomorphologic parameters, the denudation patterns point towards the presence of two different erosional regimes, which are sharply bounded against each other, separating a detachment-limited erosion regime in the eastern portion from a transport-limited regime to its western portion. Only the westernmost catchments show signs of sub-recent discharge. The gradient in landscape modification by fluvial activity evolved over multiple stadial/interstadial cycles. It is likely that the development of the observed geomorphic gradient is accelerated during wetter periods, such as during stadials, when wetter zones shift northward (Lamy et al. 2000, *Terra Nova 12(1), 8-13*). To test this hypothesis we measure in-situ cosmogenic ^{14}C in the pebbles to distinguish between long-term Quaternary (^{10}Be) and Holocene (^{14}C) denudation rates.