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Cosmogenic ^{10}Be, ^{21}Ne, and ^{26}Al Reveal Long-Term Denudation Rates Apparently Linked to a Topographically-Controlled Precipitation Threshold

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Erosion rates on hillslope interfluves across the slope of the western Central Andes (Arica area, northern Chile) derived from several long-lived terrestrial cosmogenic nuclides (^{10}Be, ^{21}Ne, ^{26}Al) indicate a positive correlation with elevation and the historical precipitation record. Erosion rates are very low and on the order of 15-100cm/My at the hyperarid Western Escarpment, the northern branch of the Atacama Desert. These calculated erosion rates are valid for the whole period of exposure back into the late Miocene. In contrast, erosion rates for the semiarid Western Cordillera are up to 3700cm/My, and are valid at least back into the Holocene/late Pleistocene. Here sediment yield data obtained during the last $\sim$10 years indicate denudation rates of a similar order of magnitude as those deduced from long-lived cosmogenic nuclides. Furthermore, the analysis of multiple terrestrial cosmogenic nuclides and the use of various “erosion-island” diagrams allowed identification of possible complex exposure histories. Complex histories were only identified for non-bedrock samples, such as boulders or amalgamated clast samples. Data from bedrock samples, however, im-

ply steady-state erosion rates over prolonged timescales.

Topographic roughness and observed geomorphological and sedimentary processes correspond to the outlined pattern of denudation and precipitation. Although time scales relevant for the cosmogenic nuclides used here (10^5-10^6 yrs) are several orders of magnitude longer than those relevant for the historical precipitation/sediment yield data (decades), we propose a coupling between denudation and precipitation at least for timescales back into the Pliocene, if not the late Miocene. Previous regional climate studies suggested prolonged arid to hyperarid climate conditions for the Atacama region for similar time intervals. In addition, it is suggested that apart from a arid to hyperarid climate also a very limited tectonic activity on the Western Escarpment may have been responsible to preserve very old surfaces.