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Constraints on sediment transfer from the Andes to the coast of northern Chile

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While rates of denudation have been suggested as having the potential to link tectonic processes with climate in many settings, the roles that sediment transport must also play have been largely neglected. It is the transport, or not, of eroded material, not necessarily the rate at which that material is produced which is the critical factor in many models of tectonic-climatic interactions. The notable lack of sediment in sections of the Peru-Chile trench has been implicated as a key control of subduction zone processes and consequently Andean mountain building, but little empirical data on sediment transport in the region exists. Here, we present the initial results of a study aiming to constrain the westward transfer of sediment from the Andes Mountains to the Pacific Coast of northern Chile by using in situ-produced cosmogenic nuclides. Fluvial sediments were collected at the mouths of several large catchments between 19˚S and 26˚S, where they drain into the Pacific, and also from upstream locations within each catchment. Sample sites were selected in order to investigate the cosmogenic nuclide derived basin-averaged denudation rates of the western flank of the Andes, and to compare this with the cosmogenic nuclide concentrations of fluvial sediments further downstream where the catchments exit to the coast. A simplistic interpretation of the cosmogenic ^{10}Be concentrations as denudation rates gives results varying between $\sim$10 and 300 m/Myr. We would expect the most rapid erosion to occur on the steeper, wetter western Andean flank and for slower erosion to be recorded from the more gentle sloping, hyperarid/arid regions between the foothills of the Andes and the Pacific coast. This pattern is observed in some basins but in others the nuclide concentrations imply the opposite, with several-fold higher erosion rates measured for the large catchments sampled at the coast in comparison to their mountainous Andean headwaters. One explanation for this unusual pattern of rates is that during travel downstream the modern alluvium is being amalgamated with previously stored sediments that have lost ^{10}Be by decay, thus lowering the average nuclide concentration and artificially inflating apparent erosion rates. The partner cosmogenic ^{26}Al concentrations for the above ^{10}Be results are pending and will also be presented. The differential decay between these two radionuclides after burial allows us to test the above explanation and constrain the potential mixing ratios of stored and non-stored sediments. In turn these results can be used to identify sources for the sediments currently being transported offshore. Potential lag-times between sediment generation and offshore deposition after transport across, or storage in, the hyperarid desert regions could complicate the cause and effect relationships proposed to exist between climate, erosion and mountain building in this region. Mechanisms controlling sediment routing thus become a key variable.