224-3 Transient river processes modulate landscape response to rock uplift in the Colombian Andes

Session: From the Cosmos and Back: Quantifying Processes and Rates of Landscape Change (Posters)

Poster Booth No.: 212

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Abstract:

The spatial distribution of erosion in mountain landscapes is often interpreted as a response to tectonic forcing, but baselevel dynamics from fluvial processes can exert an important role in a landscapes response to tectonics. We present 10 new ^{10}Be-derived catchment-averaged erosion rates from transverse rivers draining the Garzon Massif in the Eastern Cordillera of Colombia, ranging from 0.05 - 0.5 mm/yr. These erosion rates decrease from north to south and correspond to variations in channel steepness, relief, and slope. Climate and lithology vary slightly across catchments but do not explain the observed erosion gradient.

Erosion rates systematically decrease upstream of two major knickzones along the Magdalena-Sauza River, a longitudinal system that flows parallel to the Garzon Massif within a hinterland basin. We interpret this pattern as a response to baselevel segmentation imposed by the knickzones, which act as barriers to baselevel fall and influence how tributaries respond to rock uplift. Tectonics contribute to spatial erosion patterns, as localized uplift along the Potrillos Thrust likely enhances erosion in transverse drainages downstream of the lower knickzone. Similarly, strike-slip deformation along the Algeciras Fault created a series of pull-apart basins in the upper Magdalena-Sauza system, which are now being incised by the uppermost knickzone. Despite tectonic influences, the transient knickzones along the Magdalena system act as the limiting baselevel control for these transverse rivers. Analyses of the position and morphology of the Magdalena knickzones suggest they are transient features that we interpret to be formed by a combination of drainage capture and regional rock uplift from steepening of the Nazca slab.

In hinterland settings like the one studied here, geomorphic response to uplift is highly sensitive to localized baselevel controls such as local faulting, structural segmentation, sediment trapping, and drainage reorganization. In contrast, tributaries on the eastern flank of the Garzon Massif that drain into the foreland basin exhibit erosion rates more closely tied to regional rock uplift patterns inferred from faulting and thermochronology. These results underscore the importance of drainage configuration and baselevel evolution when interpreting erosional patterns across active orogens.

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Topical Sessions

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3:30–5:30 p.m.

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