

EGU2020-2316, updated on 02 Feb 2023

<https://doi.org/10.5194/egusphere-egu2020-2316>

EGU General Assembly 2020

© Author(s) 2023. This work is distributed under the Creative Commons Attribution 4.0 License.



Along-stream variations in valley flank erosion rates measured using ^{10}Be concentrations in colluvial deposits from Atacama canyons: implications for valley widening

Valeria Zavala¹, Sebastien Carretier¹, Vincent Regard¹, Stephane Bonnet¹, Rodrigo Riquelme², and Sandrine Choy¹

¹Géosciences Environnement Toulouse (GET), Université de Toulouse, CNRS, IRD, UPS, Toulouse, France

²Departamento de Geología, Universidad Católica del Norte, Antofagasta, Chile

The downstream increase in valley width is an important feature of fluvial landscapes that may be evident to anyone: even if local exceptions exist, wide fluvial valleys in plains are distinctive of narrow upstream mountainous ones. Yet, the processes and rates governing along-stream valley widening over timescales characteristic of landscape development ($>1-10$ ka) are largely unknown. No suitable law exists in landscape evolution models, thus models imperfectly reproduce the landscape evolution at geological timescales, their rates of erosion and probably their response to tectonics and climate. Here, we study two 1 km-deep canyons in northern Chile with diachronous incision initiation, thus representing two time-stage evolutions of a similar geomorphic system characterized by valley widening following the upward migration of a major knickzone. We use ^{10}Be cosmogenic isotope concentrations measured in colluvial deposits at the foot of hillslopes to quantify along-stream valley flank erosion rates. We observe that valley flank erosion rate increases quasi-linearly with valley-bed slope and decreases non-linearly with valley width. This relation suggests that lateral erosion increases with sediment flux due to higher channel mobility. In turn, valley width exerts a negative feedback on lateral valley flank erosion since channels in wide valleys have a lower probability of eroding the valley sides. This implies a major control of river divagation on valley flank erosion rate and valley widening. Our study provides the first data for understanding the long-term processes and rates governing valley widening in landscapes.