Controls on flank erosion rates during valley widening: an application of cosmogenic nuclides in Andean and French valleys

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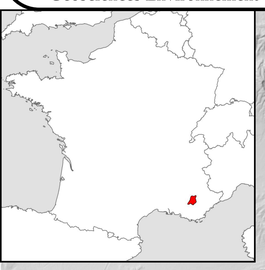


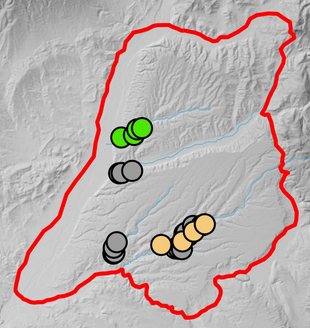
Introduction

- Fluvial valleys present various shapes due to vertical erosion (incision) and lateral erosion (widening).
- Valley widening processes and rates are still poorly documented while valley evolution has a key role in geomorphological processes and global geochemical cycles.
- We measured valley flanks erosion rates on Andean and French valley, trying to link the erosion rate to width (W), incision (I), drainage area (A) and bank and valley floor slopes (Sb and Sf).

Study area

11 sampled rivers :

- 6 in Peru and Chile (+ 2 from Zavala et al. (2021)) and 5 in the South of France.
- Magmatic/volcanic lithology in Peru and conglomeratic lithology in France.



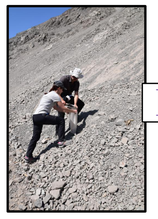
Sampling

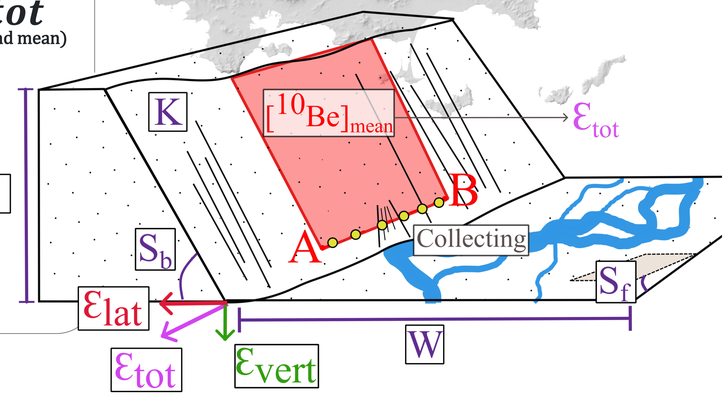
- A total of **84 samples.**
  - → Preliminary results reported : **16 samples.**
- **+ 15 samples** from Zavala et al (2021) : Rio Chiza and Tana.

Methods

Hypothesis :

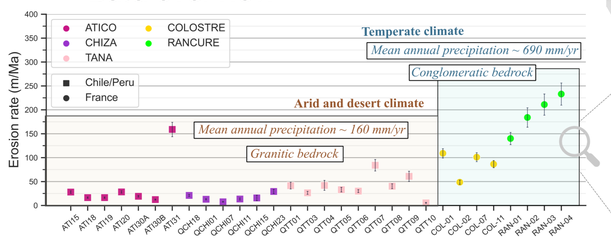
Sample ⋯ ^{26}Al / ^{10}Be ⋯▸ ε_{tot} (local and mean)

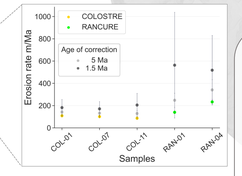




Preliminary results

Data overview





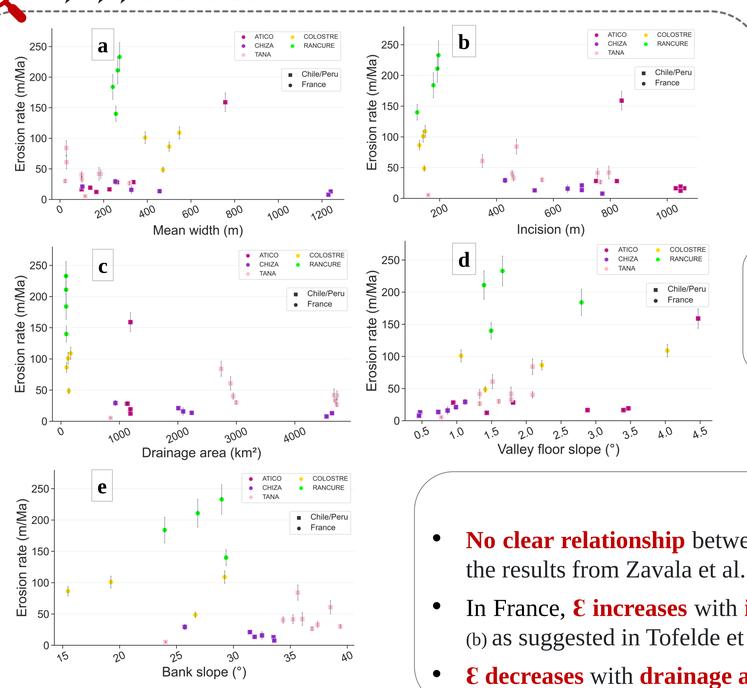
- Consistent and relevant sets of data confirming **robustness** of the method.
- Influence of **climate and lithology.**

- In France : **correction of values** of 5 samples with **inheritance** using this expression :

$$[^{10}Be]_{\varepsilon} = [^{10}Be]_{tot} - \frac{[^{10}Be]_{tot} - \frac{1}{R}[^{26}Al]_{tot}}{(1 - e^{-\lambda_{Be} t})}$$

(λ : exponential decay, R : ratio between $[^{26}Al]$ and $[^{10}Be]$)

W, A, I, Sf and Sb



All valleys together:

- **Decrease** of **Ɛ with W.** (a)
- **Increase of Ɛ** with **Sf** and **Sb .**(d and e)

Per valley:

- **No clear relationship** between **Ɛ and 1/W** (a) : unexpected according to the results from Zavala et al. (2021).
- In France, **Ɛ increases** with **incision** but in Peru and Chile, it **decreases** (b) as suggested in Tofelde et al. (2022).
- **Ɛ decreases** with **drainage area** (c) : significant in French valleys.

Tofelde, S., Bufe, A., & Turowski, J. M. (2022). Hillslope sediment supply limits alluvial valley width. AGU Advances, 3, e2021AV000641

Zavala, V., Carretier, S., Regard, V., Bonnet, S., Riquelme, R., & Choy, S. (2021). Along-stream variations in valley flank erosion rates measured using 10Be concentrations in colluvial deposits from canyons in the Atacama Desert. Geophysical Research Letters, 48