

# Can Low-Temperature Thermochronology Constrain Quaternary Glacial Erosion?

## A Case Study from the Tauern Window, Eastern European Alps



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### Motivation

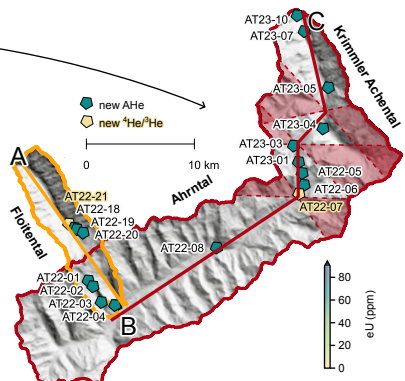
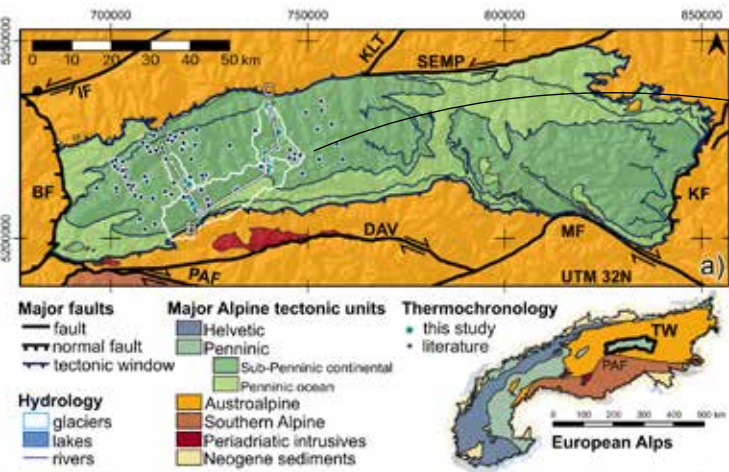
Quantify Quaternary glacial erosion with low-temperature thermochronology

### Aims

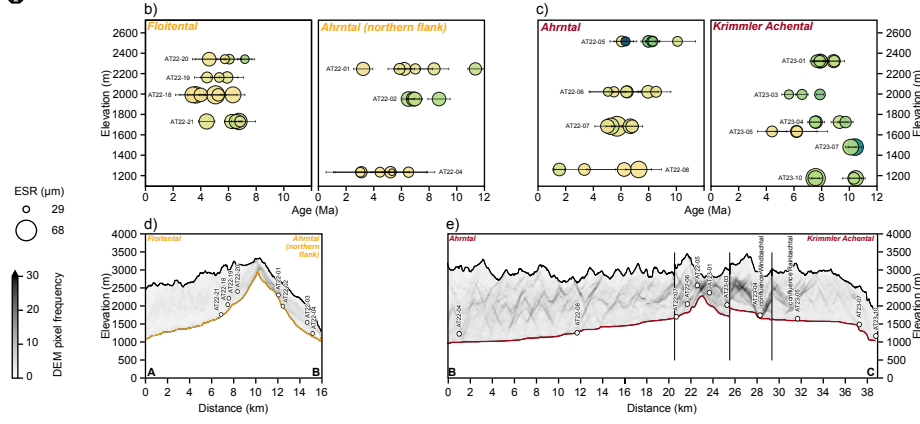
- Constrain tectonic exhumation
- Investigate data's ability to resolve glacial incision
- Compare results to Apatite  $^4\text{He}/^3\text{He}$  results

### Study Area: Western Tauern Window

### Low-Temperature Thermochronology



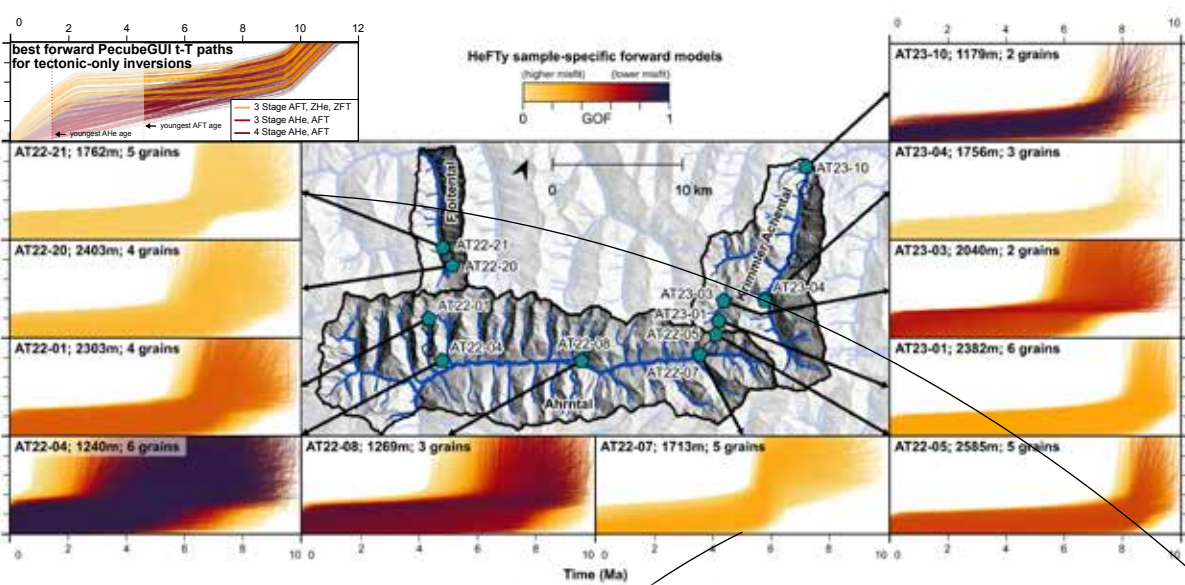
### New Apatite (U-Th)/He data



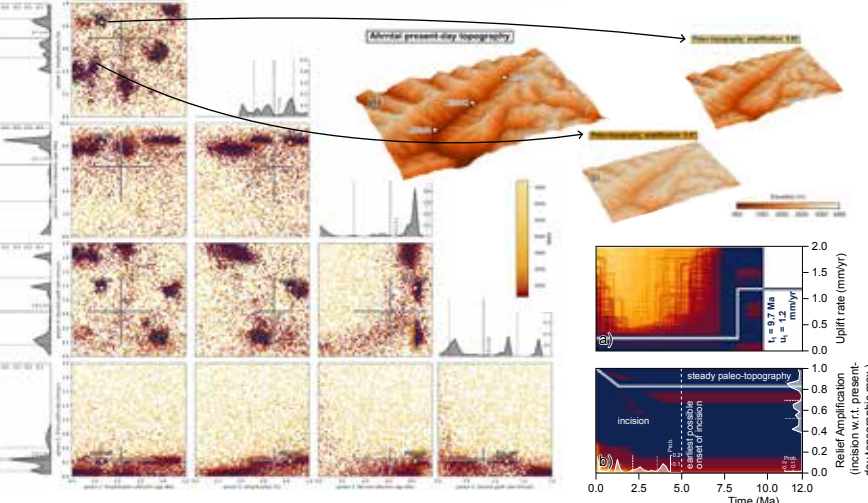
### Tectonic History - is it enough?

### Glacial Landscape Incision - purely elevation-dependent?

tectonic-only models **cannot resolve** elevation-dependent exhumation differences



tectonic + **glacial erosion** models in the Ahrntal lower misfits but are multi-modal



Pliocene-Quaternary exhumation is visible in the **low-elevation Ahrntal** samples

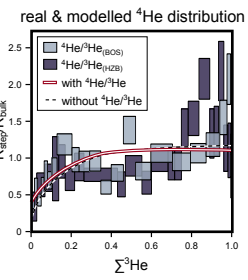
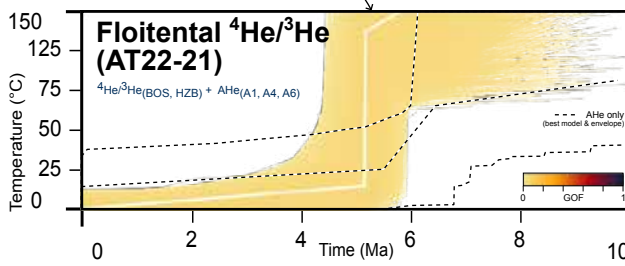
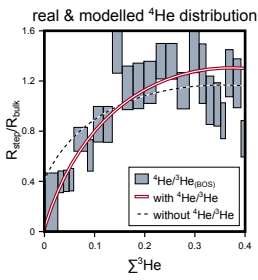
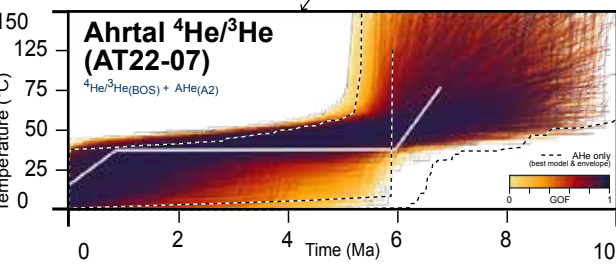
(Models with multiple valleys of **varying sizes** do not converge towards elevation-dependent incision)

### Resolution Improvements with $^4\text{He}/^3\text{He}$ ...

### ...confirm valley-size dependence of glacial signal.

$^4\text{He}/^3\text{He}$  measurements of Quaternary exhumation corroborate this concept of valley-size dependence:

Ahrntal results point further towards glacial incision; yet in the smaller Floitental there was not enough erosion for a signal despite glacial overprinting.



### Conclusions

- Overlooking the effect of landscape change on exhumation can lead to **overestimated uplift rates**
- The ability to record glacial incision with thermochronology is **dependent on elevation and valley size**
- $^4\text{He}/^3\text{He}$  improves constraints on the timing of exhumation from glacial erosion (in large enough valleys)

### USE OUR CODES

- Visualize He data & Pecube inversions
- Matlab & Python

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