



GM7.7

Mountain and ice
sheet glaciations
potential and
diversity: Glacial
landforms and
their
palaeoclimatic
interpretation

EGU21-7706

The extent, timing and palaeoclimatic significance of Late-glacial and Holocene snowpatches and glaciers in the Marrakech High Atlas, Morocco

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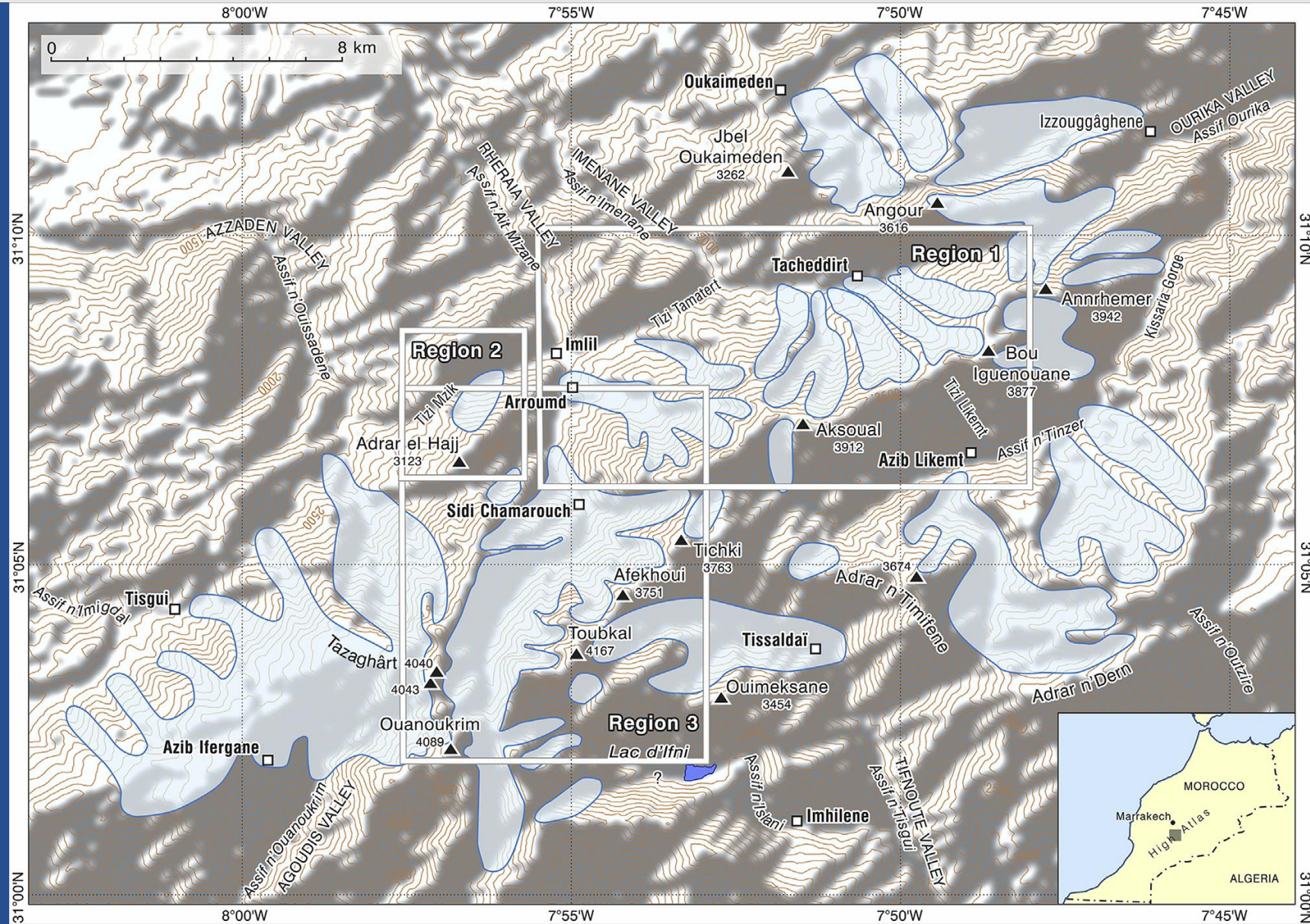
Glaciation in the Marrakech High Atlas

- Extensive glaciation during the Pleistocene
- Youngest glaciers dated to the Younger Dryas
- Possible niche glaciers during the Little Ice Age
- Today:
 - Late lying semi-permanent snow patches across the region
 - Permanent snow patch at Tazaghart (west of Jbel Toubkal)
 - No glaciers

Glaciation in the Marrakech High Atlas

Maximum extent of Pleistocene glaciers in the Marrakech High Atlas (blue outline).

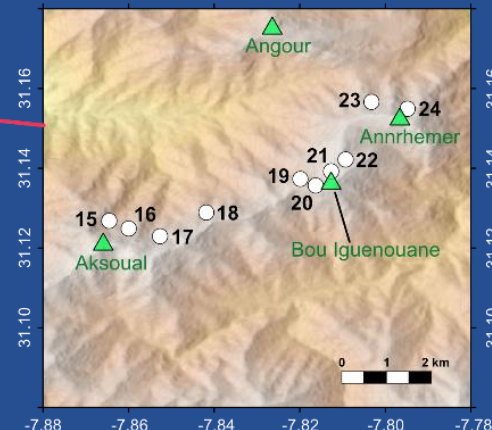
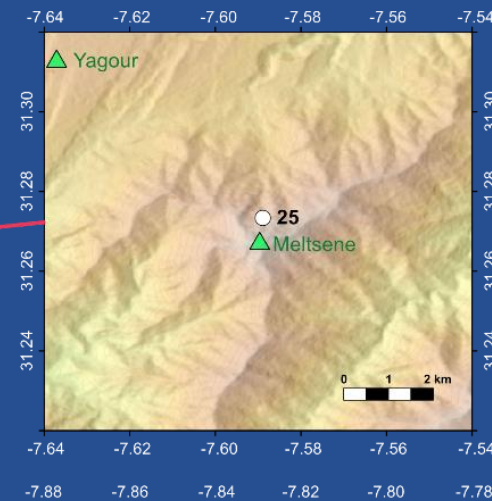
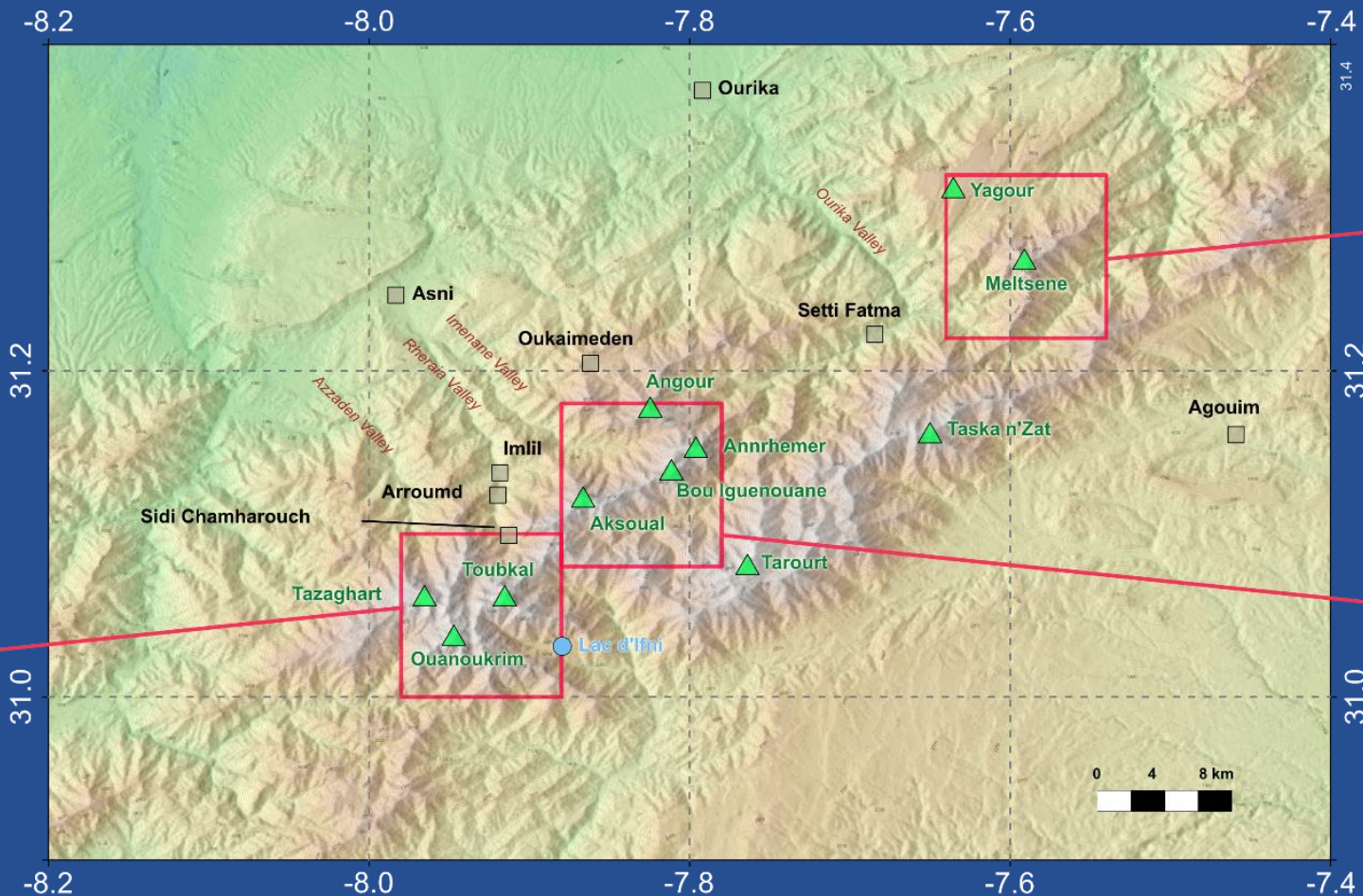
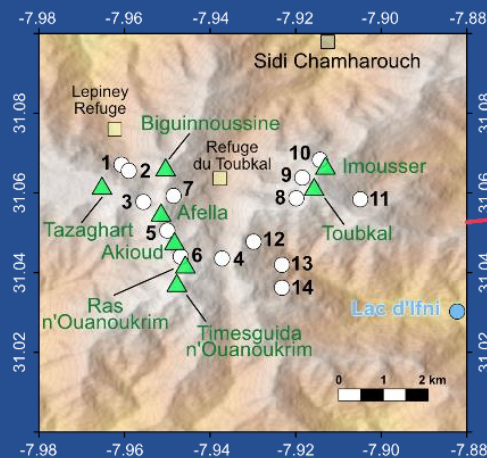
Hughes et al. 2018.
Quaternary Science Reviews.



Glaciation in the Marrakech High Atlas

Late lying snow patches in the Marrakech High Atlas (white circles).

Hughes et al. 2020.
Mediterranean
Geoscience
Reviews.



Glaciation in the Marrakech High Atlas

Névé Permanent,
Tazaghart (William
Fletcher for scale).

September 2019.



Glaciation in the Marrakech High Atlas

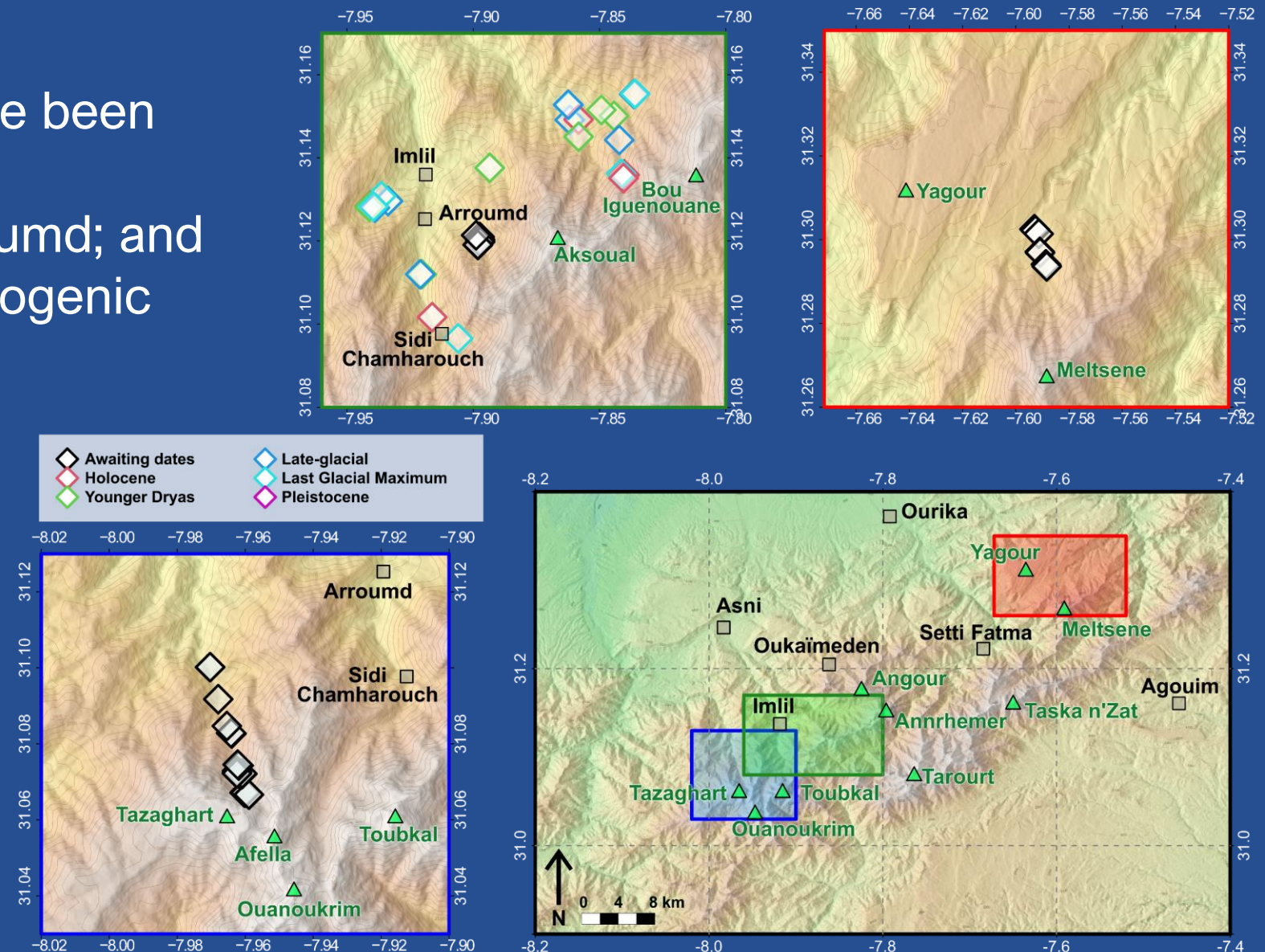
- Not much is known about snow and ice during the Holocene
- Could the Little Ice Age have seen the greatest ice mass since the Last Glacial?
- Or could there have been snow or ice expansion at other points throughout the Holocene?

Glaciation in the Marrakech High Atlas

42 new moraine boulders have been sampled in front of the Névé Permanent; at sites near Arroumd; and near Yagour Plateau for cosmogenic dating.

(alongside 56 existing dates)

This is currently work in progress.



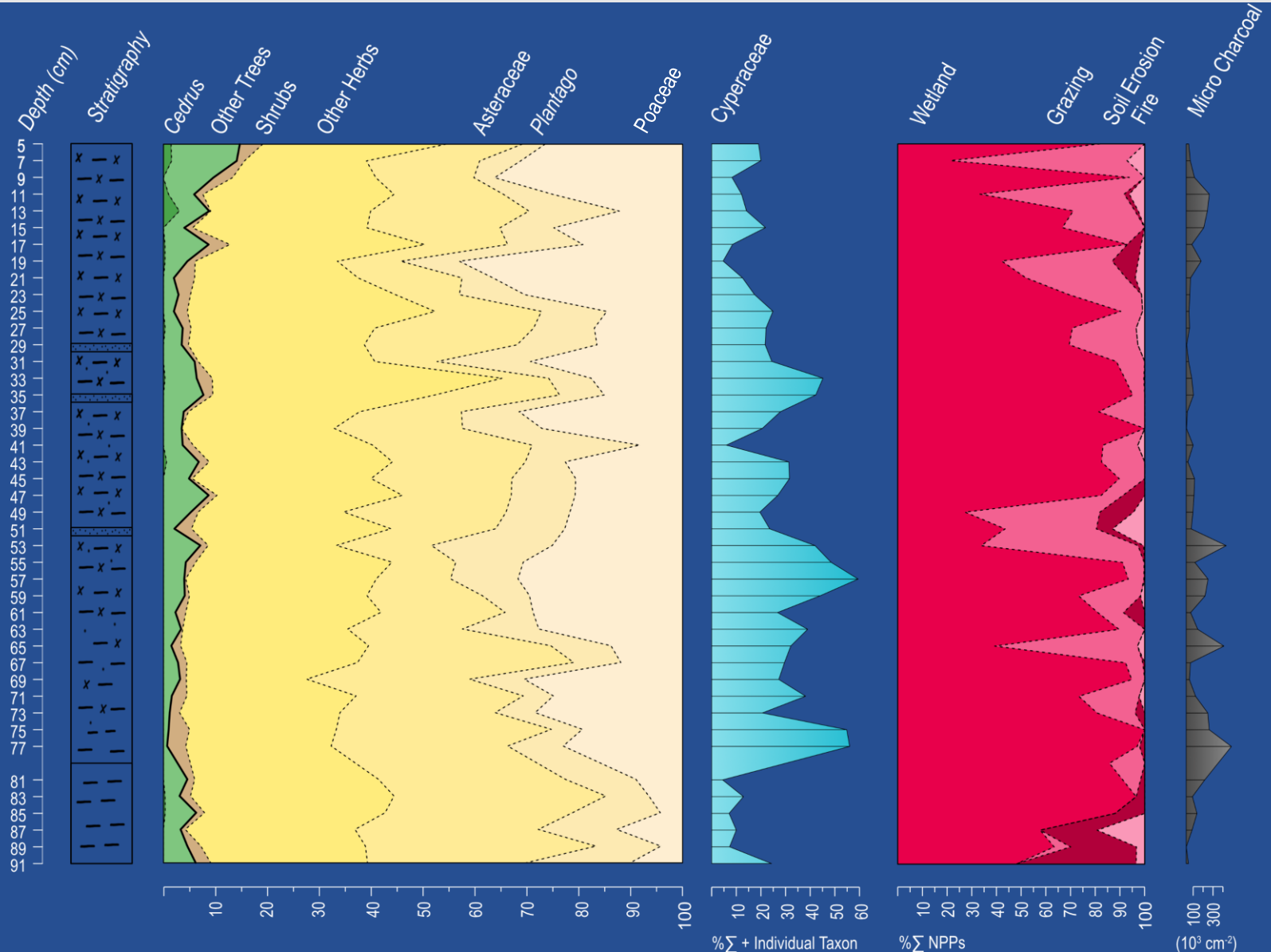
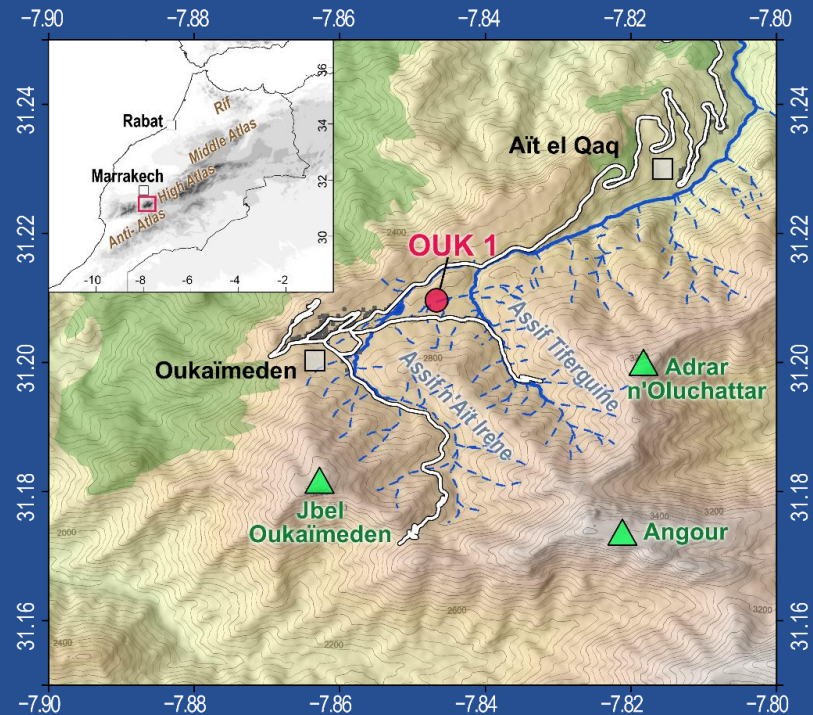
Glaciation in the Marrakech High Atlas

- The cosmogenic dates to be compared with ^{14}C dated palaeo environmental records:
- New ~1000 year high-resolution pollen, NPP and micro-charcoal record from a sub-alpine marsh at Oukaïmeden
- Evidence of climate and human impact on the grassland flora
- Fluctuating wet and dry periods – with wet conditions resultant from enhanced snowpack (particularly during the LIA)

Glaciation in the Marrakech High Atlas

New pollen record from Oukaïmeden.

Bell et al 2021. *Vegetation History and Archaeobotany*. (In Press).



Glaciation in the Marrakech High Atlas

- New Holocene and Late-glacial high-resolution pollen, NPP, charcoal and sedimentological record from a lake margin at Yagour Plateau
- Work in progress. See:
- EGU21-13021, CL1.6, **Rapid environmental changes of the Late-glacial and Holocene in a sediment record from the Yagour Plateau, High Atlas, Morocco.**
- <https://meetingorganizer.copernicus.org/EGU21/EGU21-13021.html>

Glaciation in the Marrakech High Atlas

Coring at Yagour Plateau. June 2019.



Summary

- Evidence of recent snow patches and niche glaciers from topographic features
- Palaeoenvironmental records suggests climatic fluctuations, with impacts on vegetation and human activity
- Increased wetland taxa in the mountains suggest enhanced snowpack during cold events including the Little Ice Age
- 42 new cosmogenic dates to explore ice expansion during the Holocene, to be compared with the palaeoenvironmental records

Check out the website for full details of the project and the on-going work in the Marrakech High Atlas.

<https://highatlasresearch.com>



References

Bell, B. A., Fletcher, W. J., Hughes, P. D., Cornelissen, H. L., Fink, D., Rhoujjati, A. (2021). Palynological evidence from a sub-alpine marsh of enhanced Little Ice Age snowpack in the Marrakech High Atlas, North Africa. *Vegetation History and Archaeobotany*. (In Press)

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