

Impact of climatic extremes during MIS 3 on Alpine vegetation: evidence from Nesselstalgraben (SE Germany)

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Outcrops in the Nesselstalgraben ravine close to Berchtesgaden (SE-Germany)

Nesseltalgraben site

Best dated and most complete high-resolution MIS 3 (59-29 ka cal BP) sedimentary sequence in the northern Alps

Previous investigations

- Bacon age model based on 30 ^{14}C dates and Laschamp paleomagnetic excursion
- High-resolution (2 mm) XRF scans
- Grain size
- Isotope geochemistry of bulk organic matter

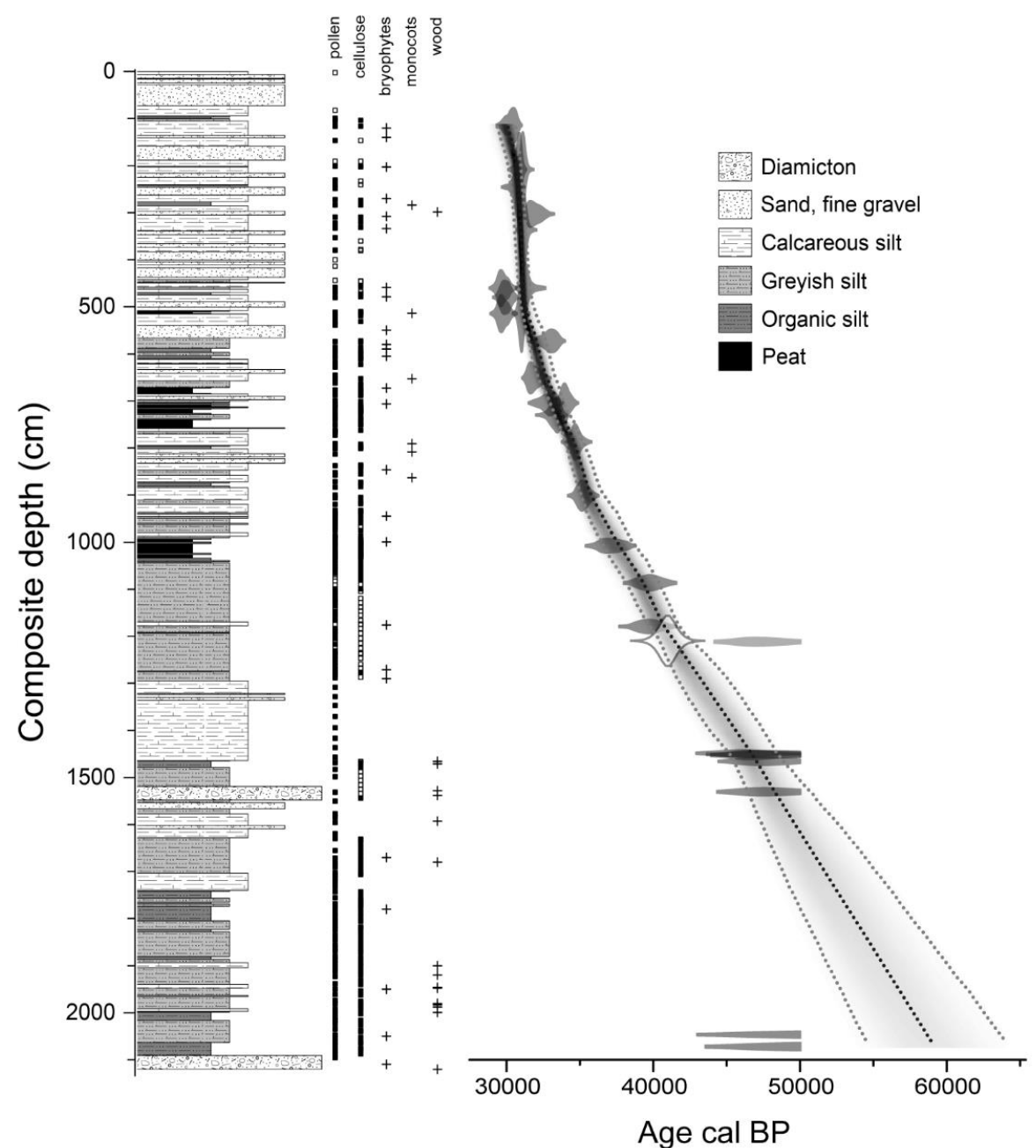
Mayr et al. 2017, *J Paleolimnol* 58:213-229

Mayr et al. 2019, *Quat Sci Rev* 218:122-136

New investigations

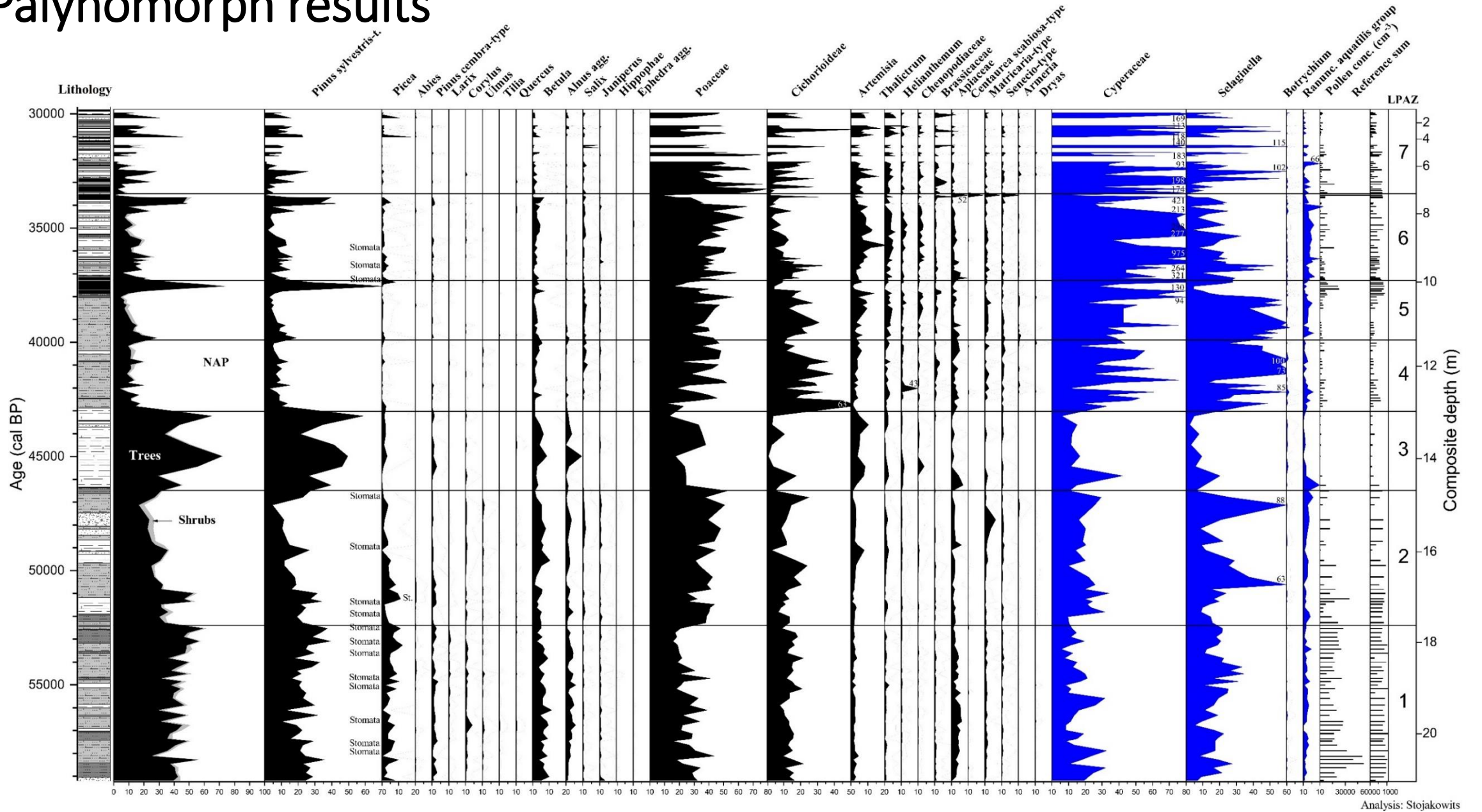
- Palynology
- Bryophyte assemblages
- Cellulose stable isotopes of bulk sediments, bryophytes, wood, monocots

Stojakowits et al. accepted, *Quat Sci Rev*



Nesseltalgraben profile. Lithostratigraphy, sample densities, age model (^{14}C : grey, Laschamp excursion: white)

Palynomorph results

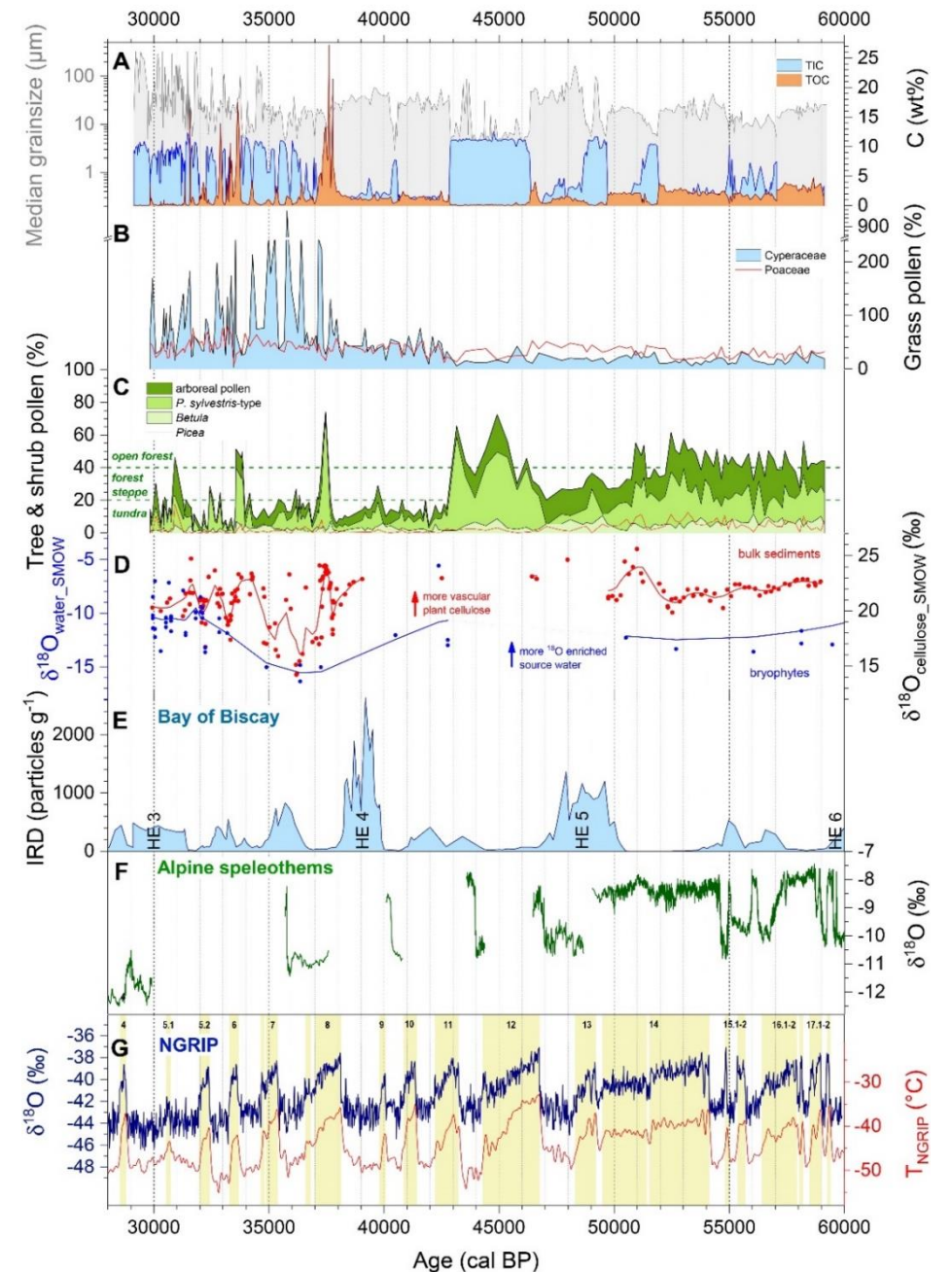


Pollen diagram. Black: terrestrial pollen, blue: aquatic taxa and spores, LPAZ: Local Pollen Assemblage Zones

Interpretation

- Pine-dominated **open forests** during Greenland interstadials 17-14, 12-11, 8, 6, and 5.1. Minima in arboreal pollen characterize HE 5 and 4.
- **Tundra-like grasslands** dominate after 43 ka cal BP.
- High diversity of **fen-dominated wetlands** indicated by bryophyte assemblages for entire MIS 3.
- **Stable isotope record** of bulk sedimentary cellulose reflects variable contributions of **terrestrial plants** (dominant during interstadials) **vs. bryophytes** (during stadials).
- **Source water $\delta^{18}\text{O}$** inferred from bryophyte cellulose was lowest at 36.4 ka cal BP indicating waterlogged conditions in a permafrost environment.

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Proxy records. A,B,C,D: Nesselalgraben, E: Sánchez-Goni et al. 2008, Daniau et al. 2009, F: Moseley et al. 2014, Luetscher et al. 2015, G: Rasmussen et al. 2014, Kindler et al. 2014