

Warmer and wetter past interglacials in northeast Greenland recorded in speleothems

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1 Introduction

- This study utilises **inactive speleothems from northeast Greenland** to investigate the palaeoenvironment under warmer and wetter climate conditions
- One period of significant speleothem deposition is **marine isotope stage 11 (MIS 11)**, an unusually long interglacial with a similar orbital composition as the Holocene (1)
- Based on ancient DNA (2), Pollen (3) and the cessation of proglacial sediment deposition (4), it is known that large areas were **ice-free** and a **boreal forest** developed in **south Greenland** during MIS 11 but a knowledge gap exists for other parts of Greenland

3 Results

- U-Th dating:** samples cover the same time interval as the peak in pollen concentration in marine core (3)
- Pollen analysis:** pollen concentration of 2.3 grains/gram; depiction of a whole forest ecosystem with dominance of *Abies* and *Pinus*, occurrence of *Fagus curius*; tracing of pollen provenance is ongoing but could be regional

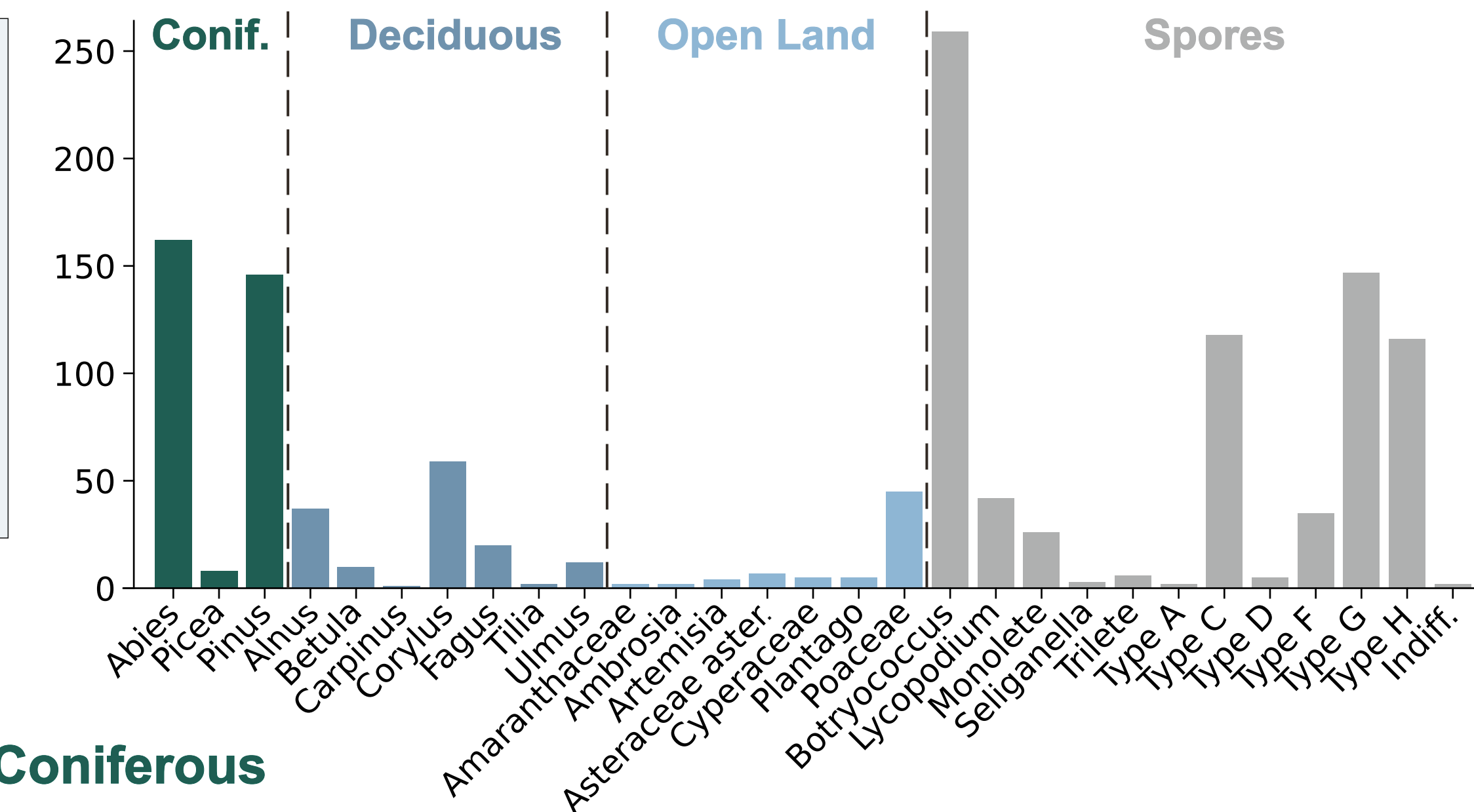
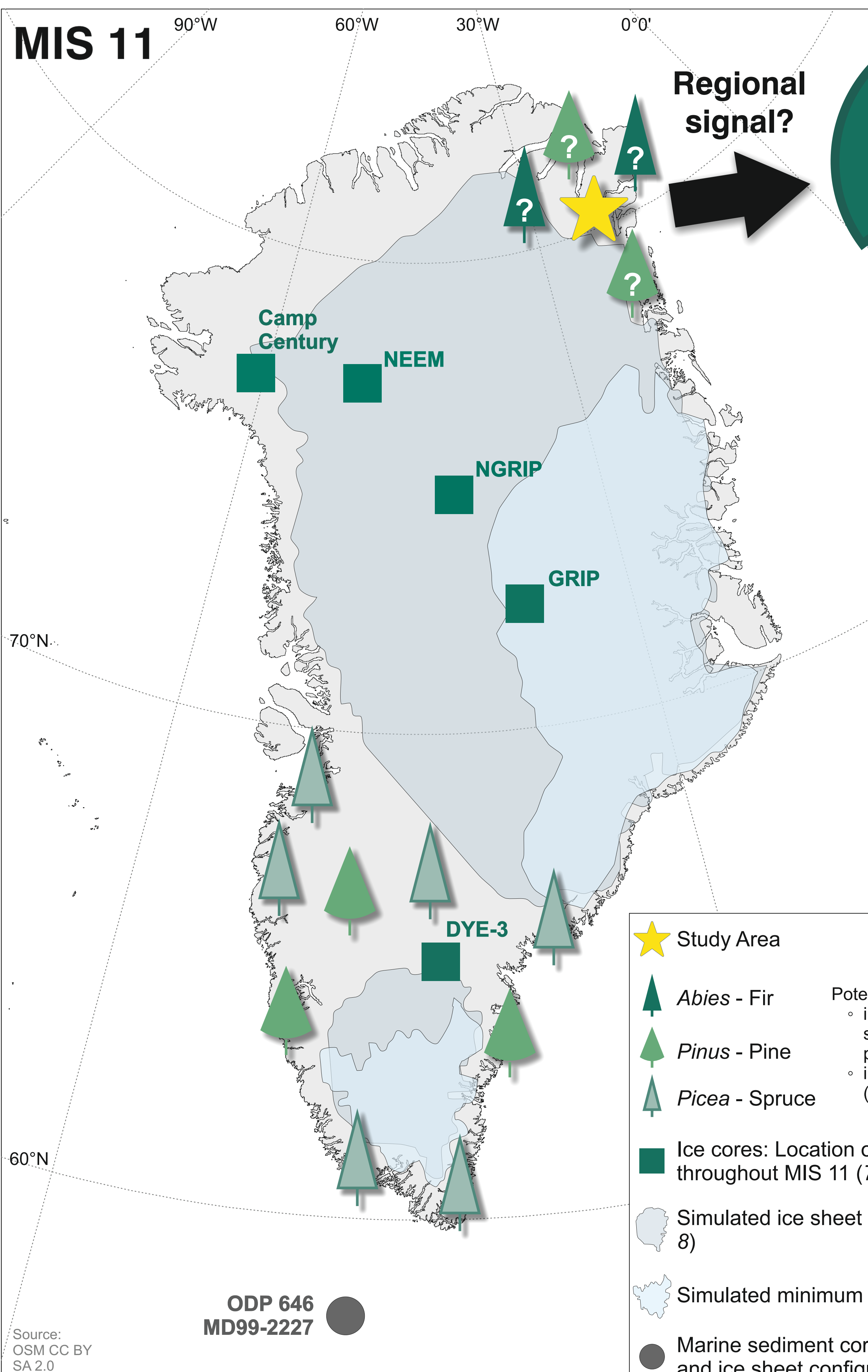


Fig. 3: Results of pollen and spore analyses. The histogram (top) shows absolute counts of the individual species, including so far unidentified spore types, from a bulk flowstone sample (228 g). In the pollen fraction (left), it is clearly noticeable that *Abies* (fir) and *Pinus* (pine) dominate while pollen from deciduous trees make up a quarter.

4 Conclusions and outlook

- If the pollen are indeed of **regional origin**, this would provide valuable insight into the climatic conditions as well as the extent of the ice sheet in northeast Greenland during MIS 11
- current focus: determine provenance of pollen and incorporate results from other caves in the area
- Preserved **spores** leave potential for further investigations of environmental conditions
- Work is ongoing to find pollen from **older interglacial periods** (MIS 13-15) in other speleothems from the same study area and interpret centennial-scale excursions in $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ variability



- ★ Study Area
- ▲ *Abies* - Fir
- ▲ *Pinus* - Pine
- ▲ *Picea* - Spruce
- Ice cores: Location of DYE-3 was ice-free (2, 4), while GRIP existed throughout MIS 11 (7, 8)
- Simulated ice sheet at peak summer regional warming (410.6 ka BP, 8)
- Simulated minimum ice sheet volume (402.8 ka BP, 8)
- Marine sediment cores used to reconstruct vegetation (ODP 646, 3) and ice sheet configuration (MD99-2227, 4) in south Greenland

Fig. 2: Greenland during MIS 11, showing the study area, simulated ice sheet extents for two dates (8) as well as ice and marine core locations that provide the basis for vegetation reconstruction. Note that the distribution of coniferous trees is meant to be symbolic.

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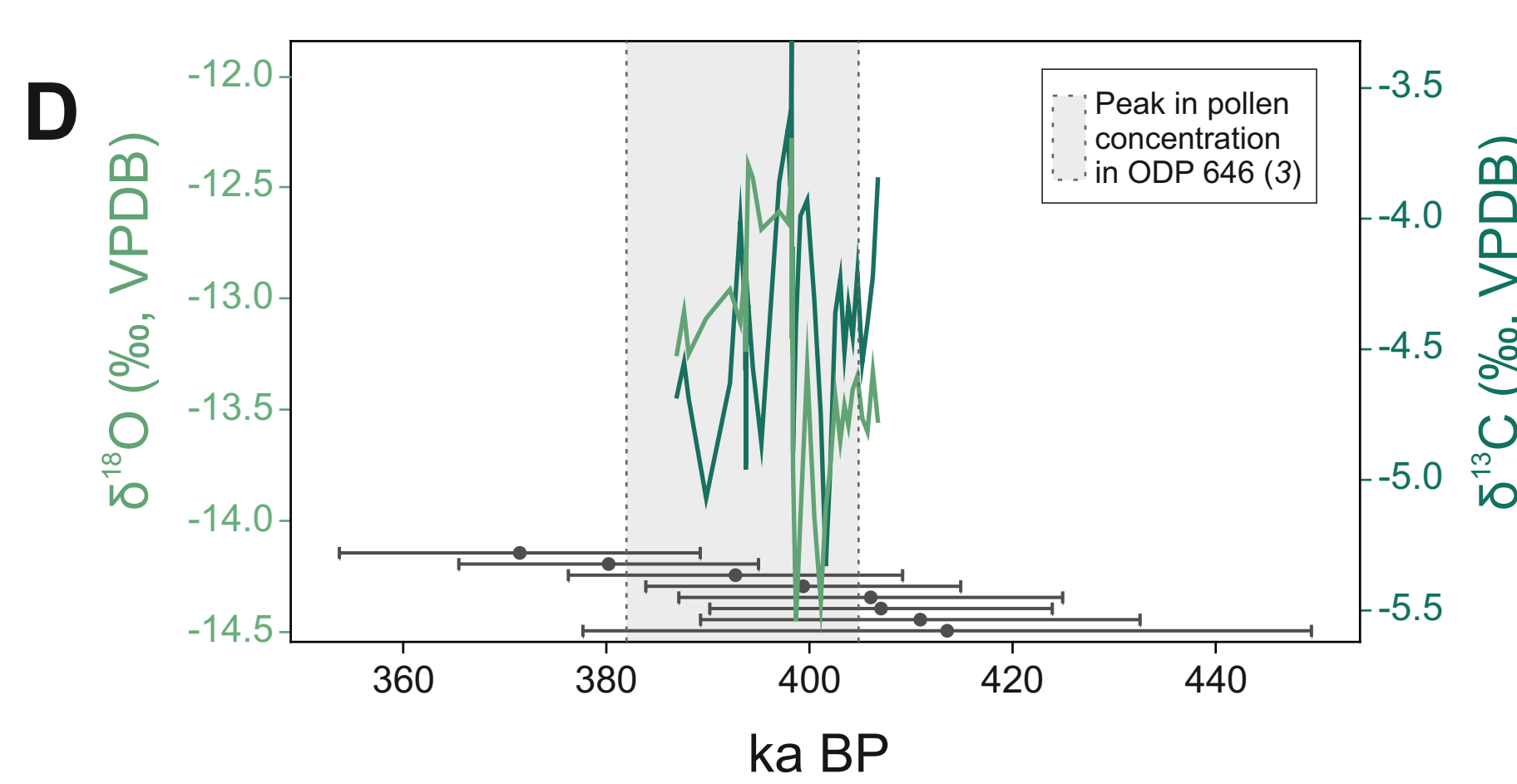


Fig. 1: View of the study area (A) and into Flowstone Bridge Cave (B). Four flowstone samples (C) were used for U-Th disequilibrium dating and C and O stable isotope analysis. StalAge (5) was used to create an age model based on the results (D).

2 Today's environment and samples

- The study area is located at ca. 80°N and 22°W and is characterised by an arid climate (ca. 200 mm a⁻¹, 6), permafrost and a mostly barren landscape except for a few small alpine plants and shrubs
- Today's environment inhibits speleothem deposition but caves in the region host **extensive speleothem deposits**: the most recent significant deposition occurred during **MIS 11**
- Samples:** several subsamples from one flowstone sequence from Flowstone Bridge Cave