Vegetation Response to Past Climate Change at Lygra, Norway

UNIVERSITY OF BERGEN

Didrik Aamold, Emmeline Broad, Evi Naudts, Paula Weddeling & Annette Østrem

Aims

Did heathland biota, local to an area in Western Norway respond to past climate change?.
Is there a persistence of some key species in comparison to their modern day distribution and can we make inferences regarding temperature fluctuations over the period sampled?

Methods

- Sediment cores were taken with a Russian corer from a peat bog in Lygra, Norway.
- Visual analysis of sediment was conducted as a pollen count [1][2].
- Species identified as being key responders to climate change were determined by comparing known optimum growth conditions [3][4].
- Age of the sample was determined by assuming the depth of sedimentation in this region was linear where the sample at 430cm which crossed a clay/peat interface is known to be ~10,500 yr BP [5].
- Zones I-V within the stratigraph highlight changes in pollen abundance, associated climate change over time determined by the presence /absence of these species is visualised in fig.2.

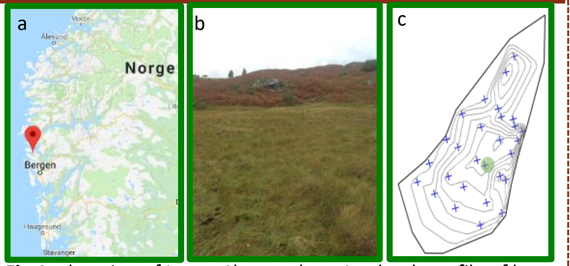


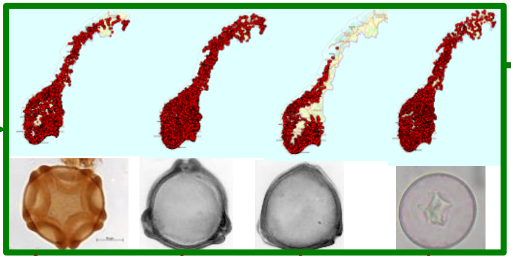
Fig.1a: location of Lygra, 1b: peat bog, 1c: depth profile of bog. The green dot indicates location of sediment core depth ~6m.

Conclusion

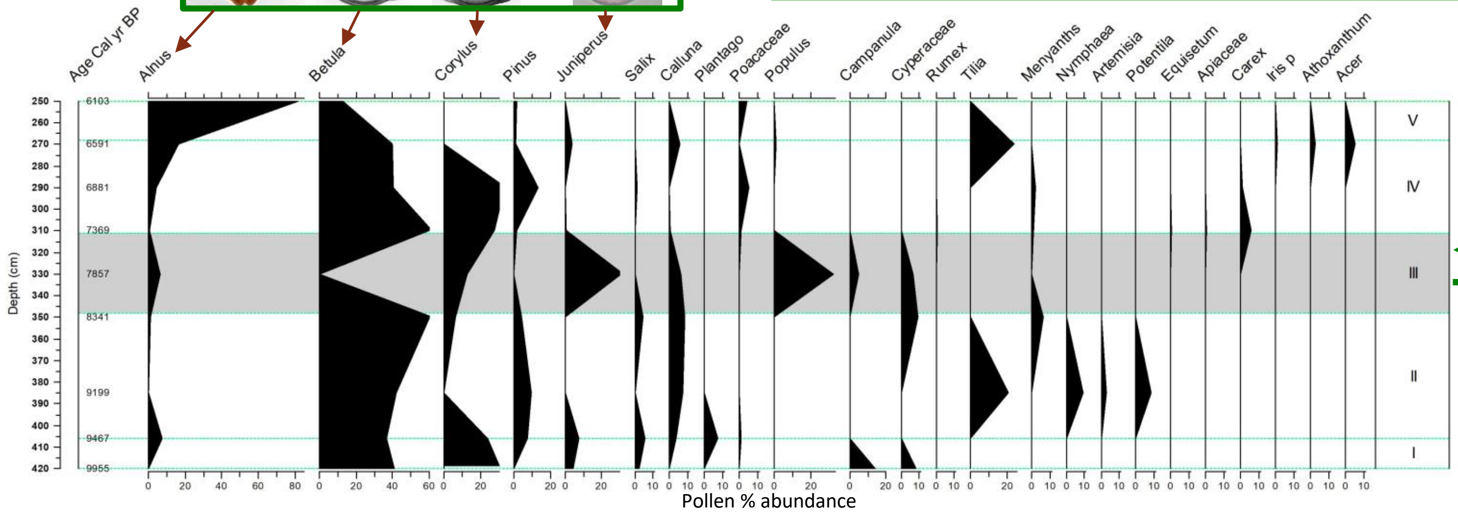
- We estimate the age of the deepest sample (sediment transition from clay to peat) at 430 cm ~10,500 years BP, which is attributed to the disappearance of fresh glacial meltwater though similar findings at sites close to Lygra and northern Norway[6][7].
- Our results show the environment starts to become colder between ~9467 to 8341 years BP. The expansion of *Juniperus* in zone III~7857 years BP, points towards cold and treeless conditions, the validity of which is supported by evidence in published findings regarding the early Holocene sediments of northernmost Norway [5].
- From ~7369 years BP, a sharp rise in *Betula &Corylus* pollen can be coupled with the rewarming of the environment which is succeeded by the reduction of *Betula & Corylus* and increase in *Alnus* meaning colder conditions from ~ 6591 BP.
- Our low-resolution pollen sequence, supported with literature, allowed us to conclude that past climate fluctuated indicated by presence/absence of key species.

Results

Modern day Norwegian distribution of pollen proxies



Zone I: High abundances of *Betula* and *Corylus* pollen might indicate warmish and wet conditions.
Zone II: Drop in relative *Corylus* pollen counts can be associated with a cooling of the environment *Pinus* and *Calluna* start to appear additionally the occurrence of freshwater taxa as *Nymphea* might suggest the occurrence of freshwater environment.



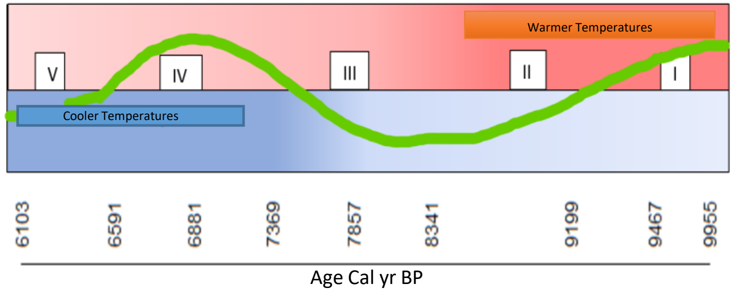


Fig.2 With zones I-V we show how the climate may have changed with time

Zone III: Drop in relative *Betula* counts and peak in *Juniperus* suggest colder and treeless conditions
Zone IV: Increase in *Betula* & *Corylus* pollen together with a decrease in *Juniperus* point to a wetter and warmer environment
Zone V: Dominated by *Alnus* which is associated with wet environments additionally a drop in *Corylus* indicates colder conditions.

[1] Beug, H. (2004). Leitfaden der Pollenbestimmung fu¨r Mitteleuropa und angrenzende Gebiete. Munchen: Dr. Friedrich Pfeil. [2] Globalpollenproject.org. (2018). Home - Global Pollen Project. [online] Available at: https://globalpollenproject.org [Accessed 25 Sep. 2018]. [3] Ellenberg H, Leuschner C. (2010). Vegetation Mitteleuropas mit den Alpen. Verlag Eugen Ulmer, Stuttgart [4] databanken.no. (2018). [online] Available at: https://artsdatabanken.no/ [Accessed 25 Sep. 2018]. [5] Birks et al, (2012). From cold to cool in northernmost Norway: Lateglacial and early Holocene multi-proxy environmental and climate reconstructions from Jansvatnet, Hammerfest. Quaternary Science Reviews, 33, pp.100-120. [6] Brooks, S. & Birks, H. (2000). Chironomid-inferred late-glacial and early-Holocene mean July air temperatures for Kråkenes Lake, western Norway. Journal of Paleolimnology, 23 pp.77-89. [7] Birks, H.(1993). The importance of plant macrofossils in late-glacial climatic reconstructions. Quaternary Science Reviews, 12(8), pp.719–726 .