Oral

Quantifying abrupt climate events in a varved lacustrine record from MIS 11

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Although varves have numerous applications to many palaeoclimatological questions, they are almost unique in being able to address issues relating to abrupt climate change. Abrupt events, frequently lasting for decadal or centennial timescales, can only be identified within annually-resolved records that contain multiple climate proxies. A key palaeoclimatic question is whether abrupt climatic changes within interglacials, such as the 8.2 ka event, are unique to the Holocene or whether short-term climatic instability is common to most Pleistocene interglacials. In this new study we use a varved record of early MIS 11 (*ca.* 410 ka BP) from eastern England to resolve the climatic characteristics of an "8.2 ka-like" event, previously identified by a sudden decrease in arboreal pollen. Here we use varve chronology coupled with multiple proxies (pollen, oxygen isotopes, chironomids, biomarkers) to characterise the structure, magnitude and duration of this abrupt climatic event. This approach using a varve record will provide a timescale for climate forcing, and for understanding differences in the rate of response by the different proxies. We conclude by discussing the potential problems of deriving comparable climatic data from varve thickness and structure and outline strategies for future research.

Oral

Varved Lake Żabińskie, northeastern Poland: a promising site for high-resolution multi-proxy paleoclimatic reconstructions for the last millennium

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Reconstructing spatial variations in the climate over the last millennium holds the key for understanding the natural variability of European climate. One of the best locations for investigating European climate is northeastern Poland, which explains up to 86% of the variance of winter temperature in Eastern Europe and shows high teleconnectivity to the dominant North Atlantic - European circulation patterns. The aim of the recently established project CLIMPOL (Climate of northern Poland during the last 1000 years: Constraining the future with the past) is a quantitative reconstruction of climate change from varved lakes in northern Poland during the last 1000 years. The reconstruction will be based on laboratory analyses of annually-laminated lacustrine sediments using precise chronology and biological (chironomid head capsules, chrysophyte stomatocysts, diatoms, pollen), stable C- and O-isotopic, sedimentological and geochemical proxies. The obtained results will be calibrated

with a modern training set of about 50 lakes (transfer function) and a calibration-in-time approach using instrumental measurements validated with early instrumental and documentary data available. High-precision dating of the sediment record is most critical as it influences directly the quality of the calibration statistics.

Lake Żabińskie located in the Masurian Lakeland was selected as a master site for our project. Preliminary field investigations showed that sediments of this lake fulfill two criteria which are crucial for the annually resolved reconstruction: (1) sediments from the deepest basin are continuously varved, and (2) high sedimentation rates allow for subsampling for the multiple proxies with annual resolution.

This relatively small (40.1 ha) and deep (43.5 m) lake presents features typical for kettle-hole lakes: basin morphology is not complex and shows the maximum depth in the central part of the lake bottom, surrounded by regularly steep slopes. The lake has one major and several minor inflowing streams and one outflow that connects it to the much larger Lake Gołdopiwo. First measurements of physical and chemical properties of the lake water indicate a thermally stratified, hardwater lake with seasonal anoxia in the hypolimnion. The present trophic status can be described as eutrophic.

The core ZAB-11/3 was collected in September 2011 from the central part of the deep basin (54°07'54.5"N; 21°59'01.1"E; 42.8 m water depth) using an UWITEC gravity corer. The total length of the core is 213 cm which covers ca. the last 300 years. The sediment record shows a varved structure of biogenic–calcareous gyttja along the entire length. Although the sediment trap study is ongoing, similarity to other lakes from northern Poland suggests that lamination in Lake Żabińskie sediments is produced by a seasonal biological and sedimentological succession, and can be defined as a biogenic type with pale spring/summer layers composed of autochthonous carbonates (calcite) and dark fall/winter layers made of detritic components. This is confirmed by first results of high-resolution XRF scanning which shows excellent agreement of calcium peaks with the position of pale layers. Lamination is clearly visible after oxidation of the sediment surface. Mean varve thickness is 6-8 mm and varies along the core in the range of 2-10 mm. Based on these promising results we are going to apply a multiple dating approach (varve counting from thin sections supported by XRF scanning results, AMS ^{14}C, ^{210}Pb and ^{137}Cs) and age-depth modeling techniques to obtain the most reliable and precise time scale for the reconstruction of winter and summer temperatures in northern Poland during the last 1000 years.