Air temperature variability in northern Poland during the past two millennia – quantitative reconstruction based on annually laminated sediments of Lake Żabińskie (CLIMPOL-2k)

Research project objectives / Research hypothesis

This proposal builds naturally on the strong foundations laid by the PSRP project CLIMPOL (Climate of northern Poland during the last 1000 years: Constraining the future with the past) which targeted at climate variability of the last 1000 years (AD 1000 – AD 2000). While the 1000 years was highly interesting in the context of climate variability, it did not cover the whole extend of Medieval Warm Anomaly and questions still remain. Therefore, with our project we address the following three overall research questions in a truly interdisciplinary multi-proxy approach:

1. What were the main patterns and modes of climate variability on annual to decadal timescales in northern Poland during the first millennium (the Roman Time - Medieval Warm Anomaly)?
2. What was the natural unforced climate variability during the Roman Time (100BC – 300AD) when any strong volcanic or solar forcings occurred?
3. How pronounced was the onset of Medieval Warm Anomaly, what was the rate and magnitude of temperature change compared to the instrumental temperature records and the magnitude and pace of the twentieth century warming?

In agreement with our overall research questions, concerted research relying on the expertise from a range of disciplines will establish a quantitative reconstruction of temperature characteristics (variability, trends, amplitudes and extremes) during the first millennium (AD 1 – AD 1000) and to integrate this reconstruction with already existing CLIMPOL reconstruction for the last millennium (AD 1000 – AD 2000).

Research project methodology

The proposed project builds on three pillars which guarantee scientific quality: best quality of the sediment record, careful selection of proxies with demonstrated skill for climate reconstructions, and appropriate statistical tools. Complete sediment record from Lake Żabińskie is already retrieved and archived at the University of Gdańsk. The section of the composite profile which covers the first millennium will be precisely sub-sampled according to varve boundaries with 3-yr resolution. The planned analyses include varve chronology and radiocarbon dating, analysis of biotic proxies (chironomids, pollen and non-pollen palynomorphs, diatoms), as well as geochemical proxies (XRF scanning and elemental analysis). Quantitative reconstruction of air temperature variability will be based on chironomid results, which will be calibrated using Transfer Functions and Calibration-in-Time approach.