

Tracking cryptotephra: toward developing a tool for precise stratigraphic correlation of lacustrine records in northern Poland (TEPHRA)

Research project objectives / Research hypothesis

The aim of this project is to extend the knowledge about the occurrence and dispersal of the cryptotephra in northern Poland using annually laminated lake sediments. Tephra from explosive volcanic eruptions is considered to be ideal for dating and synchronising sedimentary records in order to obtain information about 'leads' and 'lags' of environmental responses during past abrupt climatic changes. There were numerous tephra studies on the influence of the large-scale eruptions from Iceland and the Eifel Volcanic Field on continental northern and central Europe, but so far studies paid only little attention to sites in Poland and Eastern Europe. The proposed scientific project will concern the occurrence of volcanic ash in Poland, which is a niche issue, mainly due to the large distance from the European volcanoes. The methodological developments during the past years, however, now allow the detection and extraction of small amounts of fine grained (20-100 μm) glass shards, so-called cryptotephra. This will be applied in the implementation of the proposed research project. We hypothesize that cryptotephra occur more commonly in northern Poland than previously proposed, that those can be detected using appropriate novel methods ($\mu\text{-XRF}$ sediment core scanning, high-resolution sediment sampling and processing). We also think that annually laminated lake sediments in a main W-E and subordinate S-N transect are best suitable for tracking the distal tephra dispersal.

Our project will address the following research questions:

1. How can varve chronologies contribute to the detection and dating of cryptotephra?
2. To which extends can we enlarge the dispersal fans of Icelandic tephra towards eastern Europe?
3. Is it possible to establish a tephra database for Northern Poland including tephra dispersal maps, that can be applied on non-laminated sediments and thus contribute to a more reliable dating and synchronisation of paleoenvironmental records?

Research project methodology

The project implementation will require fieldwork, laboratory work and data analysis. Fieldwork will focus on short gravity coring of selected lakes located along the W-E transect in northern Poland in order to investigate the tephra dispersal in the historical times. Microfluorescence ($\mu\text{-XRF}$, ItraxTM Core Scanner, University of Bremen) will be used at the beginning of laboratory phase to detect tephra geochemically in the sediment cores. Preparation of the potential volcanic material will consist of: subsampling of the core sections representing the Lateglacial/early Holocene and the last 200 years in 1-2 cm resolution, removing organic matter and carbonates, dissolving diatoms and wet-sieving at a 100- μm and 20- μm mesh sieve. Dry samples will be analysed under a polarizing microscope in order to identify volcanic glass shards. Those will be embedded on a stub in epoxy resin and polished. Wavelength-dispersive spectroscopy and electron probe microanalysis (WDS-EPMA, CAMECA SX-51, University of Heidelberg) will be used to precisely identify the major element chemical composition of individual glass shards. We will use bi-variate diagrams of the software 'IqPet' (RockWare) in order to discriminate and identify the single eruptive events. The tephra data obtained within this project will be added to existing databases (e.g. TEPHRABASE). In addition, we will compare the two geochronological methods: varve chronology and cryptotephrochronology.