Project objectives

Freshwater ecosystems are highly vulnerable to climate variability and human impact. One of the major environmental threats related to ongoing global warming and human impact is eutrophication of freshwater systems. As a result, deep waters of many lakes become anoxic. The global spread of anoxia in freshwater systems is widely documented for the last century. However, very little is known about anoxia in lakes in the past, when only weak or no human impact occurred.

With this project we aim to (1) reconstruct lake productivity and local vegetation changes since the beginning of the Holocene (ca. 11,500 years ago) to the present; (2) identify the periods of anoxia and meromictic conditions in the lake; and (3) evaluate the interactions between climate variability / human activity, and their impact on the lake environment.

Research carried out in the project

We will explore and implement the novel technology of hyperspectral imaging (HSI) which allows measurements of specific and diagnostic biomarker proxies in lake sediments at unprecedented spatial resolution and in a very cost-effective and rapid way. HSI is a non-destructive multi-channel reflectance spectroscopy in the visible and near-infrared range (VNIR). This technique can be used to identify organic substances and minerals in sediments on the basis of their diagnostic color absorption properties. This approach will be implemented on excellently preserved varved sediments of Lake Gorzyńskie in northwestern Poland, and supported by wider set of proxies (pollen, diatoms, Cladocera) indicating changes in the catchment land-use and lake productivity.

Motivations for starting the research

Lake Gorzyńskie contains long record of continuously varved sediments. Very good varve preservation, distinct changes in varve thickness, and long history of human impact in the region indicate that the lake has an excellent potential for paleoenvironmental reconstructions, especially in terms of paleoproductivity and mixing regime changes.

With our project we address the following research questions: Were the periods of anoxia consistent with paleoproductivity changes? How was anoxia affected by climate variability and/or anthropogenic disturbance in the catchment (deforestation, erosion, nutrient cycling)? How did Holocene paleoproductivity and anoxia developed during the transition from a nature-dominated to a human-dominated environment? Is the most recent time unusual within the Holocene?