

Lake sediments are a valuable source of information about past environmental changes. Of particular importance are annually laminated (varved) sediments, because they provide precise chronology of analysed changes. Although significant progress in recognition of lakes with varved sediments was observed in the past few years, still little is known about the conditions for laminae formation and preservation. Generally, for their formation specific climatic, catchment and limnological conditions are needed.

Analysis of already recognized sites with varved lacustrine sediments shows that many of them have partially laminated sediments usually covering the topmost part of sediment cores. Interesting issue of the occurrence of laminations in recent sediments has been already indicated in the literature and was associated with the worsening of oxygen conditions in the water. Possible causes of this situation are seen in stronger stratification of lake waters caused by climate change or in the anthropogenic eutrophication of lakes from local sources. Identification of factors affecting oxygen conditions in lakes can be carried out with detailed investigations of sites with a clear transition from homogenous (massive) to laminated structure of the sediments, well preserved varves that allow accurate dating of the first appearance of laminations, where existing cartographic materials and documentary sources document the history of changes in the catchment area.

Three lakes located in northern Poland were selected for detailed studies in this project – Dubie, Wąsoskie and Salno. In the topmost parts of their sediment cores laminated structure occurs. Using geochemical analyses and analyses of organisms living in the water (diatoms and Cladocera) that are sensitive to limnological condition changes, we want to verify hypotheses of climatic or local causes of sedimentation of laminated sediments, what is a result of worsening oxygen conditions in lakes. With carefully selected study sites, perfect quality of laminations and interdisciplinary analyses planned within this project we address the following research questions:

- (1) Can the appearance of laminated sediments be associated with the changes in trophic state and worsening of oxygen conditions in the investigated lakes? What factors led to this?
- (2) What was the timing and dynamics of those changes? Should these processes be considered at decadal time scales or they could occur within several years or even one year?

In agreement with the overall research questions, the main research objectives are:

1. Identification of climatic, catchment-related and limnological conditions responsible for the change in sediment structure from homogeneous to laminated.
2. Identification of processes and mechanisms leading to changes in the sedimentation process.
3. Determination of the precise chronology and dynamics of observed changes.

The fact that observed changes in the sediment structure took place around few dozen to hundred years ago, makes it possible to confront obtained results with cartographic and documentary data, what will allow to determine the causes and mechanisms responsible for the sedimentation of laminated sediments. Implementation of the above aims will not only explain the mechanism behind the observed changes in the sedimentation but also, in a much broader context, will help to verify the potential of such analyzes in investigating the historical spread of hypoxia and anoxia in temperate lakes.