

Lake sediments are very widely used and studied in the scientific literature but very little is known about the specific processes (documented with observational data) that lead to sediment formation and signal preservation in a particular lake setting. Process studies are rarely undertaken because they are costly, time-consuming and logistically demanding, thus relatively little progress has been generally achieved to understand and refine empirical climate-proxy relationships.

Therefore, with this project the following three overall research questions are addressed: (1) Does regional climate and lake stratification play a major role for sedimentation processes?; (2) How climate and other environmental signals are preserved in sediments? To what extent they are interpretable?; (3) How can we use lake sediment archives to approach the temporal resolution of instrumental records? This project creates a unique opportunity to conduct 4-year long and high-resolution monitoring of different elements of the lake system. It will provide a comprehensive dataset not only explaining relationships between meteorological conditions and biogenic varve formation in the investigated lakes, but also demonstrating possibilities and limitations of tracking short-term weather-scale atmospheric phenomena in lake sediments.

The general strategy of the planned process study consists of three pillars: (1) on-site measurements of water column environment using multiparameter sonde, (2) particle flux measurements using sediment traps and (3) analysis of uppermost sediments from short cores using ultra high-resolution scanning and microscopic techniques. For this studies we selected 3 lakes (Lake Łabińskie, Lake Łazduny and Lake Dugań Mały) located in the Land of Great Masurian Lakes. In all of them biogenic varves are excellently preserved. In the frame of this project we are going to document how seasonal and short-term variations of meteorological conditions are reflected in the structure of varves deposited during the observation period as well as verify the use of varve microstructures for reconstruction of meteorological parameters for the last approximately 100 years by linking with instrumental data available.

The implementation of the proposed research will require appointing of a new scientific team at the University of Gdańsk. The new research group will be formed for quantitative studies of modern sedimentary processes in lakes and their application to paleoclimate research. The group will be truly interdisciplinary and deal with limnology, sedimentology, geochemistry, biological proxies and calibration statistics.