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PhD thesis abstract

Environmental change during the last 2000 years recorded in microfacies and geochemistry of varved sediments from Lake Żabińskie (northeastern Poland)

(Zmiany środowiska w ciągu ostatnich 2000 lat zapisane w mikrofacjach i geochemii osadów warwowych Jeziora Żabińskiego (północno-wschodnia Polska))

This thesis presents paleolimnological research on 2000 years-long varved sediment record from Lake Żabińskie located in northeastern Poland with the aims (1) to develop robust varve chronology, (2) to identify processes responsible for structural and textural variability of biogenic varves, and (3) to identify geochemical proxies impacted by human activity in the catchment of Lake Żabińskie. Statistical methods allowed analysis of the multi-proxy dataset including detailed information on varve structure, texture and geochemical variability, while interpretation of the results was supported by paleoecological data showing changes in land-use at a local and regional scale.

Varve chronologies were developed using microfacies analysis and different manual and semi-automatic counting methods. After validation with independent dating methods such as radiocarbon (AMS ^{14}C), ^{137}Cs peaks and Askja 1875 CE tephra, the most reliable method was recommended for varve chronologies from biogenic varves.

Structural and textural analyses focused on mass accumulation rates, thickness of selected varve layers and grain-size distributions. The whole dataset was used to discriminate varve microfacies. Relationships between sedimentary variables and varve types were explored using principal component analysis (PCA), while end-member decomposition of grain-size distributions (EMMA) showed relative contribution of different deposition regimes in relation to varve types. These analyses demonstrate that varves of Lake Żabińskie are mostly of biogeochemical origin and their composition is controlled mainly by autochthonous deposition related to different in-lake processes.

Geochemical variability based on μXRF and elemental (CNS) analysis provided information about relationships between main geochemical proxies. PCA analysis revealed that variability of iron and manganese in the sediments was mostly independent from detrital inputs. Therefore, the Fe/Mn ratio was used as a proxy of changes in redox conditions in the water column. Redundancy analysis (RDA) indicated that human-induced land-use changes had major impact on the lake mixing and oxygenation regimes, i.e., periods of deforestation co-occurred with intensive lake mixing, while catchment reforestation led to the inception of a meromixis.