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Modern sedimentation and varve formation processes in Lake Żabińskie, northeastern Poland

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Lake Żabińskie is the main study site of CLIMPOL, a project which aims at establishing a quantitative reconstruction of climate change in northern Poland during the last millennium. The lake is located in the Masurian Lake District (54°07'54.5"N; 21°59'01.1"E) and presents features typical for kettle-hole lakes, i.e. a small surface area (41.6 ha) and a considerable depth (44.4 m) in the central part of the lake bottom. A set of gravity and piston cores collected from the deepest part of the lake indicate that the sediment record contains an undisturbed and continuous sequence of varved deposits.

A regular monitoring of lake water properties and modern sedimentation was initiated to better understand the influences of limnology on the processes of varve formation and preservation in this lake. During monthly field campaigns a broad range of physical and chemical parameters of the lake water column as well as sediment fluxes were measured. Seasonal changes in sediment composition registered in sediment trap allow establishing documentation of an annual deposition model which is here compared with results of microstratigraphic investigations of thin sections and high-resolution XRF scanning of impregnated sediment slabs.

Multiple calcite deposition during growing season of one year is well reflected in the complex structure of varves which include up to six individual calcite laminae. During spring and summer, pennate and centric diatoms occur in addition to calcite crystals. In the late summer grains of vivianite and pyrite are present. Chrysophyte cysts are also very common but no distinct seasonality can be observed. During autumn and winter period minerogenic and organic detritus occurs. XRF measurements confirm that highest Ca concentrations occur during spring and summer which are followed by distinct maxima in Fe, K and S concentrations. Si concentrations, which represent mainly biogenic silica content in the sediments are consistent with Ca while Mn counts exhibit more complex variability with individual peaks occurring irregularly in different years.