

Paleoenvironmental reconstruction using nitrogen and carbon contents and isotopes in lake sediments of Tiefer See, NE Germany

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Lake Tiefer See (Mecklenburg/Germany) is a seasonally stratified lake formed in a north-south directed subglacial channel system with a maximum depth of 63 m. In order to understand the lake productivity and nitrogen cycle depending on natural variability and anthropogenic forcing, we compared the recent input and productivity, monitored in sediment traps in the hypo-, meta- and epilimnion since 2012 with the sedimentary record of the last 400 years.

Light stable isotopes of nitrogen and carbon are interpreted to reflect human impact by extensive land use, manure, sewage input, and atmospheric nitrogen compounds. The sediment trap material clearly shows high $\delta^{15}\text{N}$ (+7 to +14‰), and low $\delta^{13}\text{C}_{org}$ (-28 to -33‰) values, whereas surface soil and terrestrial plant materials are characterised by lower $\delta^{15}\text{N}$ (+3 to +6‰), and higher $\delta^{13}\text{C}_{org}$ (-28 to -25‰) values. Recent high $\delta^{15}\text{N}_{\text{NO}_3}$ values of up to +15‰ in the epilimnion water together with low $\delta^{18}\text{O} < +10‰$ indicate nitrogen input from sewage probably from the nearby farming facilities. The NH_4^+ content of hypolimnion lake water is low with $\delta^{15}\text{N}_{\text{NH}_4^+}$ of around 0‰. The recent high $\delta^{15}\text{N}$ values of phytoplankton reflect assimilation of dissolved nitrogen compounds enriched in ^{15}N . The lake sedimentary record shows a continuous increase in $\delta^{15}\text{N}$ from +3 to +8‰ over the last 400 years interrupted by short term phases of decreasing $\delta^{15}\text{N}$ depending on land use, historical and environmental development.

This study is a contribution to the Virtual Institute of Integrated Climate and Landscape Evolution Analysis – ICLEA – of the Helmholtz Association.