

Main geochemical characteristics of boreal high humus catchment/lake sediment system

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Lake sediments are frequently used to estimate contaminant loading and interpretation is often based directly on the concentration levels or enrichment factors. This approach, however, is inadequate in some cases because hydrological processes, lake morphology, trophic level etc. affect the elemental enrichment or dilution in the sediments.

To study this, sediments from 164 small headwater lakes with till dominated boreal forest catchments in Central Finland were sampled. The samples were dated with the ¹³⁷Cs method and post-1986 (Chernobyl) accumulation was calculated. The multi-element sediment composition was determined by acid leaching (EPA 3051). The mean carbon content of sediments was 21 % (s.d. 8). The dataset combined with catchment till fines (< 0.06 mm) geochemistry (Aqua regia leach) and water quality data. To eliminate the variation in dry matter (DM; median = 74 g/m²/a), element accumulation rates in each lake were normalized by regression based on the lake dataset – with DM as an independent variable. Standardized residuals of the elements were used for the statistical processing.

According to the results, Cu, Ni, S and Zn reflect most accurately catchment till geochemistry. On the other hand, accumulation rate of As, Co, Fe, Mn, P and V correlated positively with the water depth and also with secchi depth and pH, referring to the effect of lake morphometry and acid humus fractions from topsoil. The behaviour of Pb deviated from other elements, correlating negatively with the water P. Thus mobility/accumulation rate of Pb is highest in the oligotrophic catchment/lake system. Thus, the Pb immobility is brought into question. The average Pb accumulation rate in the post-1986 sediment was estimated to be 5 mg/m²/a.