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# Do sediments from coastal sites accurately reflect time trends in water column phytoplankton? A test from Himmerfjärden Bay (Baltic Sea proper)

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ABSTRACT: Long-term (1977-2000) ecological biomass data for total phytoplankton, diatoms, and cyanobacteria, based on plankton samples from Himmerfjärden Bay (Baltic proper), were compared to the historical sediment record using diagnostic plant pigment biomarkers. Radionuclides ($^{210}$Pb and $^{137}$Cs) were used to determine chronology, sedimentation, and carbon burial rate. Despite high resolution sampling, using crust-freeze sampling, of sediment layers representing annual varves, no significant correlations between pigments preserved in sediments and phytoplankton biomass in plankton samples were detected for periods of 1-4 yr. This lack of correspondence was probably at least partly due to the importance of resuspension events in Himmerfjärden. When sedimentary pigments were averaged over longer time intervals (5 yr) averages of annual diatom biomass in the Himmerfjärd inlet were positively correlated to down-core concentrations of fucoxanthin ($r^2$ = 0.98) and diatoxanthin ($r^2$ = 0.62). This indicates that pigment biomarkers can still be used to interpret longer term development of eutrophication-related blooms in such estuarine systems. In contrast, zeaxanthin concentrations were not significantly correlated ($p > 0.05$, $r^2$ = 0.05) to cyanobacterial biomass as a 5-yr average. Using fossil pigments to determine relative differences in phytoplankton biomass composition in the absence of historical ecological patterns of phytoplankton composition can be misleading due to selective losses of pigments such as the epoxy-carotenoids. However, while the use of fossil pigments in laminated sediments alone may not allow for detailed interpretations of past phytoplankton communities, it does allow for the simple determination of the presence of significant biomass of phytoplankton classes, for which unique biomarker pigments exist.

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