QUANTIFYING HABITAT-SPECIFIC DIATOM PRODUCTION: A CRITICAL ASSESSMENT USING MORPHOLOGICAL AND BIOCHEMICAL MARKERS IN COASTAL ANTARCTIC LAKE SEDIMENTS

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The reconstruction of primary production and identification of the taxonomic groups that contribute to it, are fundamental components in many paleolimnological and paleoceanographic studies. However, as only a small number of autotrophic organisms deposit recognisable morphological fossils (*e.g.* diatoms, chrysophytes and coccolithophore bearing haptophytes), biochemical markers such as fossil pigments have been widely used as proxies of past production and algal community composition. A fundamental question for paleo-ecological research however, and one that is too often overlooked, is the extent to which environmental signals are archived in sediments. This aspect needs to be addressed before meaningful interpretations of sedimentary proxies can be made. Here we thus critically evaluated the morphological and biochemical markers of diatom production by direct comparison of diatom marker pigments with absolute diatom biovolume, and partitioned diatom production between the main habitats (plankton, sea-ice and benthos). Therefore, sediments spanning the last 10,000 yr in two cores from the Larsemann Hills, were analysed for siliceous microfossils (diatoms and stomatocysts) by microscopy, and for fossil pigments by high performance liquid chromatography. Following correction for temporal autocorrelation, analyses demonstrated that diatom pigments (diadinoxanthin, diatoxanthin, fucoxanthin) were highly correlated (r^2=0.557 and 0.357, p<0.0001) with diatom biovolume in the marine sections of both cores, but only weakly correlated in the lacustrine zone (r^2=0.102, p=0.111 and r^2=0.144, p=0.012), probably due to degradation of diadinoxanthin and diatoxanthin. In contrast, fucoxanthin was better preserved in the lacustrine sediments. By combining both microfossil and pigment proxies, we provided a first estimate of diatom production in specific habitats (benthic, sea-ice and planktonic). Analyses indicated that benthic diatom production was greatest in the lacustrine intervals, when benthic microbial mats dominated the flora as shown in the previous chapters, whereas diatoms were associated mainly with the water column and sea ice during the marine intervals. The combination of both proxies in marine and freshwater environments have thus the potential to allow more accurate and detailed interpretation of pigment and diatom data in paleo- and neo-ecological research.