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PLANT-WAX LIPIDS AS (PALAEO-) CLIMATE RECORDERS: HOW FRESH ARE THEIR SIGNALS?

Enno SCHEFUSS[1,2] and Timothy I. EGLINTON[1]

1. Marine Chemistry and Geochemistry, Woods Hole Oceanographic Institution, Woods Hole, 02543 MA, USA
2. Research Center Ocean Margins, University of Bremen, 28359 Bremen, Germany

Plant-wax lipids and their isotope signatures are favoured for (palaeo-) climate reconstructions due to their relative stability against degradation. Their refractory nature, however, potentially leads to extensive storage in intermediate reservoirs, such as soils, which might cause a significant delay between incorporation of environmental signals and ultimate deposition in sedimentary archives.

In order to resolve fresh and pre-aged fractions within distinct lipid biomarkers and shed light on their potential to carry contemporary climate signals, extensive compound-specific radiocarbon dating was undertaken on a riverbed sample from the Congo River estuary, central Africa. Organic matter of this surface sediment sample, which was collected in 1976, should have recorded elevated radiocarbon contents resulting from the atmospheric ^{14}C "bomb spike" due to above-ground nuclear weapons testing in prior decades, if it contains recently photosynthetically fixed carbon. Among the investigated fractions are total organic carbon (TOC) and series of *n*-alkanes, *n*-alkanoic acids, and *n*-alkanols. Stable carbon isotope compositions of TOC and long-chain *n*-alkyl lipids indicate predominant C3 plant sources with comparable hydrogen isotope compositions reflecting a consistent continental hydrological signal. High carbon-preference indices of the *n*-alkyl lipids suggest relative freshness of the plant-wax lipids, whereas a high BIT index also indicates significant soil-derived carbon. The presence of degraded vascular plant-derived organic matter is also suggested by lignin degradation parameters. Compound-specific radiocarbon concentrations of *n*-alkyl lipids range from about +460 permil, higher than the atmospheric value at the time of sampling, to around -220 permil, equivalent to about 2000 years age. Within *n*-alkyl lipid classes distinct patterns of radiocarbon contents with chain-length and relative abundance emerge, indicating common sources and selective degradation processes. Mass-balance calculations allow distinguishing relative fresh vs. pre-aged fractions within single lipids. The significance of these results will be discussed in the context of production and preservation mechanisms and with regard to the applicability of plant lipids for (palaeo-) climate reconstructions.