Hydrogen isotope response of algal lipids to variable nutrient concentrations in Swiss lakes

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Algal lipids biomarkers are resistant to degradation and can persist in sediment on geologic time scales. Lipids typically record the hydrogen isotope composition ($^2H/^1H$ or δ^2H) of the water in which algae grow, which is controlled by climatic variables such as temperature, rainfall, and atmospheric circulation patterns. H isotopes of algal lipids have therefore been developed as a useful paleoclimate proxy. However, other variables can influence the isotopic composition of algal lipids. In particular, laboratory cultures have demonstrated that $^2H/^1H$ fractionation in marine algae is highly sensitive to nutrient availability. We present preliminary data from the first field investigation into the effect of nutrient levels on $^2H/^1H$ fractionation in freshwater algae. We collected surface sediment and sediment trap samples from ten Swiss lakes with similar climate but different histories of nutrient loading and different trophic states. By measuring $^2H/^1H$ ratios of the algal biomarkers dinosterol and brassicasterol in these sediments, we are able to determine the influence of nutrient availability on $^2H/^1H$ fractionation in lacustrine algae, and assess the robustness of climate records based on this proxy in systems where nutrient concentrations may have changed over time. We also explore the use of changes in $^2H/^1H$ fractionation as a proxy for past changes in nutrient availability in systems where the isotopic composition of water can be inferred from other sources, such as the oxygen isotopes of carbonates.