Molecular $\delta^{13}C$ values of leaf wax components from plants growing in different tropical habitats

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Long-chain leaf wax components from tropical C_3 plants were analysed for their carbon isotopic composition. Averaged $\delta^{13}C$ values for alkanes (weighted mean average of the *n*-C_{27} to *n*-C_{35} alkanes) were -33.5 ± 2.8‰ for savanna plants and -36.9 ± 2.5‰ for rain forest plants. The difference of 3.4‰ originates mainly from (1) the different isotopic composition of the source CO_2 caused by recycling effects in the closed canopy of the rain forest, and (2) the stronger discrimination of the heavier carbon isotope due to slower assimilation of CO_2 in the shady rainforest. Similar differences (3.3 to 3.8‰) were found by Ehleringer *et al*. (1987) for leaf tissue material of shrubs, trees, ferns and grass from open and closed canopy habitats.

In general, tropical vegetation changes from rain forests over savannas and finally to arid grasslands due to climatic conditions. Woody C_3 plant contribution decreases with an increase of grassy C_4 plants. The $\delta^{13}C$ values of the *n*-C_{27} to *n*-C_{35} alkanes increase in the course of this vegetation change (Fig. 1). The C_4 grasses of the savanna have the highest values due to their different metabolic pathway.

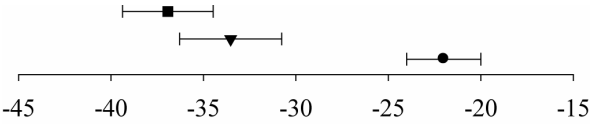

Figure 1. Averaged $\delta^{13}C$ values of *n*-C_{27} to *n*-C_{35} alkanes (weighted mean average) from leaf wax of C_4 grasses (circle, Rommerskirchen *et al*., 2006, n = 34), savanna C_3 plants (triangle, n = 24) and rain forest C_3 plants (square, n =18).

These results give a clearer look at key data for studies estimating the variation of land plant biomarker contribution to dust, soils and sediments in tropical regions. Until now such research projects often only distinguished between the molecular carbon isotopic signatures of C_3 and C_4 plants. Our study provides data about a significant difference in the molecular $\delta^{13}C$ values of C_3 plants from savannas and rain forests. This has to be taken into consideration, e.g., in palaeoclimatic studies.

References

Ehleringer *et al*. (1987), *Oecologia* **72**, 109-114.

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Surface water freshening and high-latitude river discharge in the Eocene North Sea

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A fish-teeth derived $\delta^{18}Op$ record of the early Palaeogene North Sea mirrors the global oceanic temperature evolution, except of a 2-4 Myr period across the Palaeocene-Eocene transition, when unusually light $\delta^{18}Op$ values in teeth of surface dwelling sharks indicate substantial surface water freshening. The $\delta^{18}Op$ decrease with a magnitude of 6.3 ‰ commenced during the Palaeocene-Eocene thermal maximum (PETM), and prevailed until the early Ypresian. Coeval occurring bottom dwelling sharks indicate normal marine conditions and strong water column stratification in the early Ypresian North Sea. The magnitude of the negative $\delta^{18}Op$ excursion suggests a depletion of surface water $\delta^{18}O$ by 3.6 ‰ relative to Eocene mean ocean water. This value is lower then that of coeval freshwater lakes and indicates that large rivers sourced by strongly fractionated precipitation drained into the North Sea. The investigated odontaspid and lamnid sharks are fully marine organisms and do not live in waters with salinities lower than 20 ppt today. We consider this value as the lower salinity tolerance limit for large predators. The construction of a mixing line between marine and brackish waters and their corresponding oxygen isotopic compositions in the Eocene results in $\delta^{18}O$ values of -10 to -13 ‰ for river waters. These values are in a good agreement with the isotopic composition of Arctic precipitation, recently estimated from hydrogen isotopes in terrestrial plant-derived n-alkanes (Pagani *et al*. 2006), and suggest a high-latitude source of the river discharge into the North Sea. The commencement and duration of brackish surface-water conditions in the North Sea coincide with the main phase of effusive basaltic volcanism and associated tectonic uplift in the North Atlantic region. As a result, the North Sea probably became temporarily isolated and the fluvial catchment areas extended into the high latitudes. The marginal North Sea became reconnected with the North Atlantic Ocean during the transgression at 54 Myr, when normal marine conditions returned indicated by $\delta^{18}Op$ in teeth from surface and bottom dwelling sharks.

Reference

Pagani, M. *et al*. (2006), *Nature*, **442**, 671-675