



Development of a novel tool for paleoclimate research based on compound-specific delta18O analyses of (hemi-)cellulose-derived monosaccharides

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For about 10 years, technical improvements allow the coupling of gas chromatographs with isotope ratio mass spectrometers via online pyrolysis reactors (GC-Py-IRMS). While compound-specific deltaD analyses e.g. of plant-derived n-alkanes for palaeoclimate studies were readily adopted by the scientific communities, there are only a few studies having applied compound-specific delta18O analyses, so far. We see large potential for this method especially in palaeoclimate research, because it is well known that not only deltaD, but also delta18O of precipitation and of certain chemical compounds of plants (e.g. cellulose) depend on climate parameters.

In order to overcome extraction, purification and hygroscopicity problems of so far applied cellulose methods based on TC/EA delta18O analyses, we developed a method for compound-specific delta18O analyses of plant-derived monosaccharides like arabinose, fucose, xylose and rhamnose using GC-Py-IRMS (Zech, M. and Glaser, B., 2009. Compound-specific delta18O analyses of neutral sugars in soils using gas chromatography–pyrolysis–isotope ratio mass spectrometry: problems, possible solutions and a first application. *Rapid Communications in Mass Spectrometry* 23, 3522-3532). In our presentation,

- we discuss technical problems, analytical challenges and suggested solutions.
- Theoretical considerations and experimental results demonstrate that oxygen exchange reactions do neither occur to (hemi-)cellulose monosaccharides in natural archives nor during our analytical workup.
- Results from an experimental field study suggest the absence of oxygen fractionation of (hemi-)cellulose monosaccharides during litter decomposition.
- The sensitivity and comparability of the novel proxy with conventional bulk delta18O cellulose methods is addressed by presenting results from a climate chamber experiment.
- A first application is provided for Late Glacial and Holocene high mountain lake sediment cores from Helambu Himal, Nepal, which recorded amongst other paleoclimatic factors the variability of the Asian Monsoon.
- Ongoing work is focussing on achieving not only hemicellulose-derived monosaccharides but also cellulose-derived glucose.

We conclude that in the near future the novel and here presented method may become a valuable tool in palaeoclimate research, which can be applied to a wide range of different climate archives such as tree-rings, peat bogs, lacustrine sediments and loess-palaeosol sequences, as well as in authenticity evaluation of food and beverage.