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Climate of the Past
Discussions

Interactive comment on "How dry was the Younger Dryas? Evidence from a coupled δ^2H-δ^{18}O biomarker paleohygrometer, applied to the Lake Gemündener Maar sediments, Western Eifel, Germany" *by* Johannes Hepp et al.

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I disagree with the other comments that this is a novel approach. It is advocated by the authors since several years with various applications. My comment on it, however, remains the same each time: The approach cannot be done in soils or sediments as it compares apples with pears.

This is due to two reasons. First, plants incorporate the leaf water enrichment signal to variable degrees in their waxes and hemicellulose (Kahmen et al., 2013, Zech et

al., 2014). Leaf water is not the sole source of the hydrogen in waxes and oxygen in hemicellulose but a leaf water – xylem water mixture which is different between plants. It is not only grasses versus other plants as suggested here but various plants to a variable degree.

Second, plants produce waxes and hemicellulose in highly variable amounts (e.g. Diefendorf & Freimuth, 2017) depending on plant type and not correlated with each other, i.e. higher wax content is not necessarily associated to higher hemicellulose content.

In sedimentary archives or soils this means that the hydrogen isotope signal of leaf waxes is a wax-production weighted signal of the primary signal (temperature, amount, source effect) overprinted to a certain degree by evapo-transpiration and the hemicellulose oxygen isotope signal is a hemicellulose-production weighted signal of the same primary signal but affected to a different degree by evapo-transpiration due to different vegetation contributions to both parameters. Both δD of wax lipids and δ18O of hemicellulose are thus qualitative hydrologic parameters that are not directly correlated and comparable. The position of the data points in δ18O-δD space is thus dependent on vegetation composition and changes thereof and cannot be interpreted as reflecting leaf water isotopic enrichment in a quantitative approach. Application of such approach to sediments or soils will lead to erroneous and misleading interpretations.

Diefendorf, A.F., Freimuth, E.J., 2017. Extracting the most from terrestrial plant-derived n-alkyl lipids and their carbon isotopes from the sedimentary record: A review. Organic Geochemistry 103, 1-21.

Kahmen, A., Schefuß, E., Sachse, D., 2013. Leaf water deuterium enrichment shapes leaf wax n-alkane δD values of angiosperm plants I: Experimental evidence and mechanistic insights. Geochimica et Cosmochimica Acta 111, 39-49.

Zech, M., Mayr, C., Tuthorn, M., Leiber-Sauheitl, K., Glaser, B., 2014. Oxygen isotope ratios (18O/16O) of hemicellulose-derived sugar biomarkers in plants, soils and sediments as paleoclimate proxy I: Insight from a climate chamber experiment. Geochimica et Cosmochimica Acta 126, 614-623.

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