Geophysical Research Abstracts
Vol. 20, EGU2018-3106, 2018
EGU General Assembly 2018

Opportunities and challenges for the use of lipids as molecular proxies in environmental reconstructions

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The last decades have seen a dramatic increase in the use of organic matter from soils and sediments as molecular proxy for reconstructing past dynamics of vegetation and climate. Applications range from the use of changes in preserved leaf wax lipid patterns or d13C signatures of organic matter to reconstruct shifts in vegetation composition, to the use of changes in d2H patterns as a past humidity / precipitation proxy. Particularly exciting in this respect are recent developments with respect to combining various molecular proxies. For instance by compound specific d13C and d2H analysis of selected lipids that themselves are used as vegetation proxy. However, as with all scientific development, all that glitters is not gold. Together with great promise, successful application of molecular proxies to reconstruct past environmental change also comes with several important challenges. For instance, to what extent are plant lipid patterns used for vegetation reconstruction affected by genotypic plasticity of the producing plant species? How might the heterogeneity of environmental and biochemical processes on/in different plant species interfere with the successful use of d2H and d13C patterns? What is the influence of differences in input routes into a soil or sedimentary archive, e.g. aboveground vs. belowground, on the desired reconstruction? In this presentation I will discuss both the opportunities and the challenges of the use of organic matter as molecular proxy in environmental reconstructions.

References:
B. Jansen and G.L.B. Wiesenberg, 2017. Opportunities and limitations related to the application of plant-derived lipid molecular proxies in soil science, SOIL, 3: 211-234.