Biogeosciences Discuss., 10, C7498–C7501, 2013
www.biogeosciences-discuss.net/10/C7498/2013/

Biogeosciences
Discussions
Open Access

Interactive comment on "On the stratigraphic integrity of leaf-wax biomarkers in loess-paleosols" *by* C. Häggi et al.

M. Gocke

martina.gocke@uni-bayreuth.de

Received and published: 20 December 2013

The manuscript prepared by Häggi et al. provides an interesting study on lipid molecular proxies in terrestrial archives. However, from our point of view, not all of the conclusions might be substantially supported by the available data.

First of all, the selection of sampling sites might be a bit biased as two soil profiles in till and one loess-paleosol section (LPS) were investigated without sufficient explanation, why these sites are relevant with respect to the aims and combined in the current study. We agree that compound-specific radiocarbon dating is a time- and labor-intensive approach and therefore was performed solely on the LPS, which was the main target of this study. However, the other approach, quantification of the respective biomarkers, includes much simpler analyses, and therefore should have been done also on the

LPS for comparison. Otherwise, it is difficult to transfer quantitative results from the till sites to the loess profile. Large differences not only in soil type and thickness, but also climatic conditions, vegetation and thus weathering as well as rooting depth and density do not allow for a direct comparison of both archives.

Furthermore, it remains questionable how the authors can identify presence or absence of root-related overprint, if root traces like biopores and rhizoliths were neither assessed quantitatively nor qualitatively, and modern vegetation including roots was also not analyzed. It was recently demonstrated by Gocke et al. (2014) that long-chain n-alkanes in ancient calcified roots and surrounding sediment can be strongly enriched in C25 and C27 homologues, which was not regarded in the current study, although the authors found a considerably younger age of these homologues compared to bulk organic carbon, fatty acids and n-alkanes with a longer chain-length. Therefore, this might argue for postsedimentary incoporation by roots and rhizosphere processes. The respective observation was discussed by Häggi et al. in a different way, citing other literature, without taking into account potential root origin as discussed in recent publications.

Additionally, the low sample density at the LPS does not allow for an assessment of the potential postsedimentary overprint by rooting, as roots and root traces may occur in high abundances at the lower level of a soil or even below a soil or paleosol, as recently observed for various LPS and soil profiles (Gocke et al., 2013).

Other general concerns are related to the general principle of C allocation in soils as published e.g. by Schmidt et al. (2011) for bulk C, and by other authors for fatty acids and alkanes recently. Hence, Häggi et al. argue that almost no allocation of fatty acids and alkanes occurs belowground without giving insight into potential incorporation mechanisms on-site and comparison to other recent studies.

Another shortcoming is the comparison of the results from Crvenka with marine sediments, whereas existing literature on terrestrial settings (e.g. Bol et al., 1996; Huang

et al., 1996; Rethemeyer et al., 2004a, b) related to 14C ages of various lipid fractions was not included in the discussion.

Minor comments:

A lack of information of the study is related to the statistical evaluation of the data, i.e. if 'significant' is related to what common readers understand as statistically relevant.

p. 16913 l. 9: 'input of leaf-wax lipids by roots' can lead to misunderstandings. How can roots produce leaf-wax lipids?

To summarize, we think that the manuscript could contribute to our scientific understanding of terrestrial archives, if the discussion would be improved in a more balanced way, also taking into account a contribution of root-derived lipids, especially as the data partially even support this point of view. Unfortunately, the root abundances and chemical analyses of roots from the selected archives seem to be not available, thus disabling to prove a real correlation of roots and potential postsedimentary overprint.

Martina Gocke and Guido L.B. Wiesenberg

References

Bol, R., Huang, Y., Meridith, J.A., Eglinton, G., Harkness, D.D., Ineson, P., 1996. The 14C age and residence time of organic matter and its lipid constituents in a stagnohumic gley soil. European Journal of Soil Science 47, 215-222.

Gocke, M., Gulyás, S., Hambach, U., Jovanović, M., Kovács, G., Marković, S.B., Wiesenberg, G.L.B., 2013. Biopores and root features as new tools for improving paleoecological understanding of terrestrial sediment-paleosol sequences. Palaeogeography, Palaeoclimatology, Palaeoecology. DOI: 10.1016/j.palaeo.2013.11.010.

Gocke, M., Peth, S., Wiesenberg, G.L.B., 2014. Lateral and depth variation of loess organic matter overprint related to rhizoliths - Revealed by lipid molecular proxies and X-ray tomography. Catena 112, 72-85.

Huang, Y., Bol, R., Harkness, D.D., Ineson, P., Eglinton, G., 1996. Post-glacial variations in distributions, 13C and 14C contents of aliphatic hydrocarbons and bulk organic matter in three types of British acid upland soils. Organic Geochemistry 24, 273-287.

Rethemeyer, J., Grootes, P.M., Bruhn, F., Andersen, N., Nadeau, M.J., Kramer, C., Gleixner, G., 2004a. Age heterogeneity of soil organic matter. Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms 223–224, 521-527.

Rethemeyer, J., Kramer, C., Gleixner, G., Wiesenberg, G.L.B., Schwark, L., Andersen, N., Nadeau, M.J., Grootes, P.M., 2004b. Complexity of soil organic matter: AMS 14C analysis of soil lipid fractions and individual compounds. Radiocarbon 46, 465-473.

Schmidt, M.W., Torn, M.S., Abiven, S., Dittmar, T., Guggenberger, G., Janssens, I.A., Kleber, M., Kögel-Knabner, I., Lehmann, J., Manning, D.A., Nannipieri, P., Rasse, D.P., Weiner, S., Trumbore, S.E., 2011. Persistence of soil organic matter as an ecosystem property. Nature 478, 49-56.

Interactive comment on Biogeosciences Discuss., 10, 16903, 2013.