

response to the handling associate editor:

Dear Dr. Sebastian Naeher,

We explicitly thank you for all the work and time you provided to improve our manuscript and to ensure the quality of the review process. In addition, I personally, would like to apologize for the delay of the submission of the revised manuscript and still hope that you are not bothered to much by the situation as well as to thank you for your understanding. Below, we will give a point-by-point answer to your comments (line references given in the answers refer to line numbers of the current marked-up manuscript version). An explicit list of all made text changes is provided in the end of the marked-up manuscript.

Sincerely,

Julia Gensel (on behalf of all co-authors)

1. Attributing n-C29 alkane to reflect an “average” source does not seem appropriate. If I understand correctly, it appears to be rather undiagnostic indicator in your study, because it is the dominant alkane in diverse plant communities. Is that correct? If so, then I wonder if the term “mixed” would be more appropriate here?
We did as suggested and substituted the word “average” with “mixed” within the text and in Figure 8. *The text was changed accordingly.*
2. Could you please specify the last sentence of the abstract (line 23): “This finding raises important constraints for future environmental studies as the assumption of watershed-integrated signals in sedimentary archives retrieved from downstream lakes or offshore might not hold true in certain settings.” I think you would not expect that a lake has the signature from the catchment in all cases, because this will depend on relative contributions of autochthonous vs allochthonous organic matter sources. Catchment signatures can be diluted largely by high productivity and OM export to the sediment. Therefore, you could clarify in the text (e.g. abstract but also elsewhere) that the lake OM signature reflects largely an in-situ signature which seems to largely overprint contributions of allochthonous OM.

Often the assumption is made in paleo-environmental studies applying biomarkers that archives retrieved from terminal water bodies, such as lakes or finally the ocean, reflect integrated signals from the whole river catchment. This is the assumption we were investigating, and our results greatly challenge it in settings which are similar to our study site.

We generally agree that autochthonous OM sources have the potential to substantially dilute signals retrieved from lake cores regarding certain parameters. Usage of long-chain *n*-alkanes derived from higher plants as biomarkers in combination with bulk analyses by Rock-Eval that clearly proves that OM in lake surface sediment samples do not reflect aquatic autochthonous contributions (line 547ff), show that the signals we

find are predominantly derived from the local surrounding vegetation of the lake, but not from the upstream catchment. *No changes in the text were made.*

3. The last few sentences of Section 2.3 could profit from adding values (or ranges of values) and/or fractionation factors where appropriate, so the reader is made aware of the magnitude of the changes that would be expected. It would be useful to specify “slight dependency” (line 173).

The section as well as the whole chapter is thought to broaden the potential readership of the manuscript. As it sometimes might be challenging to understand manuscripts when not being totally familiar with the set of applied methods, we decided to give a very general introduction. To maintain the simplicity and comprehensibility to people of other scientific disciplines and focus, we prefer not to include specific values in the whole section. *No changes in the text were made.*

4. When noting I- and R-indices already in the abstract, you should define there what they are.

We thank you for the suggestion and added the requested information. *The text was changed accordingly.*

5. Line 469 and following (numbers refer to your manuscript with tracked changes) should be reformulated and made more specific, because it may be unclear what you try to say.

We did as suggested. *The text was changed accordingly.*

6. Line 620: Why is “lakeshore” removed? Isn’t this very important here?

Yes and no. The word “lakeshore” was substituted with “[...], which uses the lake’s water as dominant water source.”. This fact clearly points towards the shoreline vegetation as source, but by pointing out the usage of the lake water as water source, the phrase is more concise with the reason given (higher hydrogen isotopic signatures). To make it easier for readers without deep knowledge about hydrogen isotopes and their application, we wanted to add this causal relationship. *No changes in the text were made.*

response to anonymous reviewer #1:

Dear Anonymous Reviewer #1,

We thank you very much for your second review and positive feedback regarding our applied changes based on the first reviews. Below, we will give a point-by-point answer to your comments (line references given in the answers refer to line numbers of the current marked-up manuscript version). An explicit list of all made text changes is provided in the end of the marked-up manuscript.

Sincerely,

Julia Gensel (on behalf of all co-authors)

Specific comments

1. L. 6ff (now l6f) It might be good to shortly explain the I-index and R-index in the abstract like you do for leaf wax lipids and their compound-specific isotopic $\delta^{13}\text{C}$ and δD signature.
We did as suggested. *The text was changed accordingly.*
2. L. 98 ff (now l99ff) Please introduce to the ACL as well, which is presented in the results section and table 1. Due to the general nature of this section, please note that both C_{27} and C_{29} are thought to indicate tree-like vegetation while C_{31} and C_{33} are predominantly synthesized by grasses. However, both C_{29} and C_{31} can reflect a mixed signal of trees and grasses. This statement is only given for C_{31} in the introduction while it is described for C_{29} in the discussion section.
We did as suggested. *The text was changed accordingly.*
3. L. 124 (now l127): Maybe modify to [...] , i.e., ^{13}C -enriched *n*-alkanes, [...] ?!
We did as suggested. *The text was changed accordingly.*
4. L. 144f (now l148).: Besides Herrmann et al. (2017, org. geochem.) also Strobel et al. (2020, STOTEN) discuss the effect of evapo(transpi)ratative enrichment on the δD signature of *n*-alkanes in South Africa. Thus, I suggest to cite both studies here.
We did as suggested. *The citation was added.*
5. L. 337ff (now l240ff).: Is there evidence for dolomite in the catchment/samples which might not be destroyed using HCL without thermal treatment of the samples?
We discussed that issue thoroughly due to the potential presence of siderite and dolomite. Some organic parameters, such as TOC, were determined by both bulk analyses and Rock-Eval. The results were in good agreement indicating that the HCL treatment worked properly which was corroborated by the yellowish color of the acidic solution. However, parameters which we suspected to potentially be affected by mineral presence weren't incorporated into the manuscript. *No changes in the text were made.*
6. L. 278ff (now l281ff).: Is there any reason why plant samples were treated with a different solvent mixture and additional extracting steps (i.e., MeOH, MeOH:DCM (1:1) and DCM) compared to the sediments (DCM:MeOH 9:1)?

Yes. Surface sediment samples were extracted using an ASE which enhances the extraction efficiency due to increased temperature and pressure. To obtain a comparable result for plant samples, which are not suitable for the ASE extraction, requires additional solvent use of different polarities to liberate the lipid fractions. *No changes in the text were made.*

7. L. 291ff (now l294ff).: How about the recovery of the internal STD (squalane) in the samples and blanks?

We added the requested information. *The text was changed accordingly.*

Figure:

1. Figure 6: Please provide a legend which enables faster and more intuitive reading of the figure.
We did as suggested. *The figure was adjusted accordingly.*
2. Figure 8: To overcome questions of the readership of your MS, I suggest to create box-plots for all chain-length (C_{23} to C_{35}) for all sub-environments. Even if you present an extended version of this figure in the supplements would enable the reader to more get a more comprehensive impression of your data. Still, I am a little confused why you present C_{29} , which you refer to as mixed signal, while C_{27} and C_{31} might be mixed signals as well. However, the latter two are not presented and you do not present a reason for that.
We performed statistical analyses to identify groups consisting of at least 2 *n*-alkanes (correlation coefficients and results are given in line 408ff). We decided only to show one representative of each identified *n*-alkane group for visualization purposes (l404f). For the interested reader, the complete dataset including all individual *n*-alkane data can be found in the open access data repository Pangaea. *No changes of the figure were made.*

response to anonymous reviewer #2:

Dear Anonymous Reviewer #2,

We thank you very much for your second review and positive critique regarding our applied changes based on the first reviews. Below, we will give a point-by-point answer to your comments (line references given in the answers refer to line numbers of the current marked-up manuscript version). An explicit list of all made text changes is provided in the end of the marked-up manuscript.

Sincerely,

Julia Gensel (on behalf of all co-authors)

1. l91 (now l64) do you mean mg H/g?

The current version “mg HC/g” is correct. HC stands for hydrocarbon which are measured as effluent to determine the hydrogen amount. *No changes in the text were made.*

2. l93 (now l65) “and” missing...

In the respective line, unfortunately we didn’t find the missing “and”. *No changes in the text were made.*

3. L95-96 (now l68-69) TOC levels? TOC in %? Fresh plant OM for sure has more than 10 or even 40%?

This is correct, and we appreciate your awareness very much. *The text was changed accordingly.*

4. L99 (now l71-73) why would aquatic inputs have generally a distinct HI? I assume you want to express, that the HI can sometimes be used to track sources?

As organisms contributing to inputs considered as aquatic have a different and distinct composition of the related biomolecules, such as proteins, cellulose etc., they show a distinct HI signature which allows the HI usage as rough source indicator. *No changes in the text were made.*

5. L127 (now l99f) specific origin is relative, e.g., not taxa specific, not even genus specific, please be more precise.....

We agree that “specific origin” is relative. Our sentence is phrased generally on purpose as indicated by the beginning “In general,[...]. It is thought to give the opening to the subsection and the general concept of biomarkers in contrast to bulk OM methods. We believe that the sentence is phrased in sufficiently general language to not lead the general reader to the conclusion of a more specific source specificity. *No changes in the text were made.*