Biogeosciences Discussions

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Comment on bg-2022-116

David Naafs (Referee)

Referee comment on "From soil to sea: sources and transport of organic carbon traced by tetraether lipids in the monsoonal Godavari River, India" by Frédérique M. S. A. Kirkels et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2022-116-RC1, 2022

In this manuscript Kirkels et al. use tetraether lipids together with inorganic data to explore the sources and transport of organic matter in soil, river, and marine sediments in India. In my opinion the two main conclusions are that there is additional evidence for riverine production of brGDGTs (adding to a greater body of literature that finds evidence in support of this) and that brGDGTs in marine sediments cores, even if positioned relatively closes to the coast, are produced in situ in the marine realm and hence can not be used for terrestrial climate reconstructions.

In my opinion this is a solid Biogeosciences paper. Some of the data presented here has been published (Dearing Crampton-Flood et al., 2020), but there is enough novel data to make it worth a publication. The results from this manuscript add to the growing body of literature that highlights the widespread production of brGDGTs in a range of environments and the associated complexity with using these compounds in marine sediments cores for paleoclimate reconstructions. The manuscript is nicely written and the figures are informative. The data support the conclusions.

However, I have three overall comments to improve the manuscript:

- I suggest you shorten the results section. It is very long with a lot of details that sometimes make it hard to follow and some details appear not to be necessary. Condensing the results by focussing on the key results will improve the readability of the

manuscript.

-Why are the isoGDGTs not discussed? Crenarcheaol is used for BIT, but what about the others? For example cren/cren' ratios can tell us something about the potential source organisms and this differs between mineral soils and aquatic production in some places (Li et al., 2016). The isoGDGTs are measured already (I assume) as part of the brGDGT runs, so potentially there is a lot of extra information available with minimal effort?

-Why is the focus on core GDGTs and not IPLs? For the SPM samples especially, would it not make sense to look at the IPLs to determine in situ production? The signal in the IPLs might be even stronger compared to the core GDGTs?

Related to this, I see (line 221) that some fractions were saponified, but others were not. Although not extracted with a BD protocol, this saponification of the TLE might release IPLs. This affects what fraction of the GDGTs you look at (core for the non-saponified and a mixture of IPL-derived cores and cores for the saponified samples). Couldn't this difference in sample work up in theory explain some of the observed differences between the different sample types? This needs more explanation.

Other minor comments and typos:

Lines 64-66: both papers cited here are using mineral soils, not peat.

Line 75: also cite culture results from (Halamka et al., 2021)

Line 97: is this due the overall higher pH in rivers compared to soils?

Results: I suggest you shorten the results section. It is very long with a lot of details that sometimes make it hard to follow. Condensing the results through focussing on the key results will improve the readability of the manuscript.

Figure 5 (and associated text); In samples with such a low BIT values, can we ever use MBT'5me? Not sure it makes sense to show this data in this graph.

Line 485: Figure 5?

Line 510: how does this fit the with brGMGT data (Kirkels et al., 2022)?

Line 525: you mean low BIT?

Line 539: PCA

Line 573: Cite (Halamka et al., 2021)

Line 598-604: Explore broader isoGDGT distribution to provide more insights into the archaeal source, for example cren/cren' ratios, etc.

Line 741: FIG??

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References:

Dearing Crampton-Flood, E., Tierney, J.E., Peterse, F., Kirkels, F.M.S.A., Sinninghe Damsté, J.S., 2020. BayMBT: A Bayesian calibration model for branched glycerol dialkyl glycerol tetraethers in soils and peats. Geochimica et Cosmochimica Acta 268, 142-159.

Halamka, T.A., McFarlin, J.M., Younkin, A.D., Depoy, J., Dildar, N., Kopf, S.H., 2021. Oxygen limitation can trigger the production of branched GDGTs in culture. Geochem. Persp. Let. 19, 36-39.

Kirkels, F.M.S.A., Usman, M.O., Peterse, F., 2022. Distinct sources of bacterial branched GMGTs in the Godavari River basin (India) and Bay of Bengal sediments. Organic Geochemistry 167, 104405.

Li, J., Pancost, R.D., Naafs, B.D.A., Yang, H., Zhao, C., Xie, S., 2016. Distribution of glycerol dialkyl glycerol tetraether (GDGT) lipids in a hypersaline lake system. Organic Geochemistry 99, 113-124.