

Dear Erin McClymont,

Re: Manuscript ID: cp-2022-67 and Title: Deglacial records of terrigenous organic matter accumulation off the Yukon and Amur rivers based on lignin phenols and long-chain *n*-alkanes. by Mengli Cao et al., *Clim. Past Discuss.*, <https://doi.org/10.5194/cp-2022-67-RC1>, 2022

We really appreciate your efforts in reviewing our manuscript. Your careful review has helped to make our study clearer and more comprehensive. According to your suggestions and comments, we amended the relevant part in the manuscript. All of your questions are answered one by one in the following.

**Comments to the author:**

Thank you for outlining your responses to the three reviewers of your manuscript. The reviewers gave positive comments and constructive suggestions for how to ensure that readers can follow your new data interpretations. Your responses indicate that these can largely be incorporated into the manuscript.

All reviewers recommended significant revisions to the Introduction, which should be carefully undertaken before submitting a revised version of the manuscript, since this is important for ensuring the new data and analyses are clear, as well as the framework in which you will interpret the results. Likewise, significant changes to the Discussion structure have been suggested and positively responded to, but will require careful checks to ensure that there remains a good flow through the text.

Response: We agree with this comment regarding the introduction of our manuscript and realize the need to re-organize the text and include additional aspects. The structure of the discussion section has been changed in the revised manuscript. We discussed organic matter sources based on biomarker concentrations first, followed by vegetation development in the two basins.

**Some minor queries:**

- *reply to reviewer 1 comment on line 44. Your suggested response does not completely clarify the “beneath offshore Arctic continental shelves”. An alternative: “It occurs both on land and on the continental shelves offshore, and underlies...”*

Response: Changed (line 45, revised manuscript).

- *reply to reviewer 2 comment on line 88. I don't think the reviewer was asking for this to be removed, but rather to flag that in contrast to the lignin phenols (which you have already explained), the BIT index could have been noted as having a different bacterial (soil) source. Is a deletion necessary?*

Response: This sentence is an example to explain that lignin phenols can be used to assess vegetation development and it comes from this paper by Seki et al. (2014). We'll cite this paper in the discussion of vegetation changes. This sentence thus will be removed to avoid duplication. In addition, the comment on line 88 is for the explanation of the parameter BIT, and the explanation of which has been added in the revised introduction. Therefore, there is no need to keep this sentence in the revised manuscript.

- *line 91-32: is it true that no records exist which combine “both types” of biomarker (which two are you referring to here? I assume n-alkanes and lignin phenols), or is it that such a record does not exist in this region? This needs clarification.*

Response: Thanks for your kind suggestion, which is highly appreciated. We have revised this text and hope that it is now clearer: “However, no records exist that combine lignin and *n*-alkanes data to explore the potentially different transport of terrestrial OM archived in Arctic marine sediments during the last deglaciation.” (line 109–111, revised manuscript)

- *reply to reviewer 2 comment on line 238. The first sentence of your revised text needs to be more clear about which ratio refers to which signal e.g. what does S/V indicate, and what does C/V indicate? In this sentence you mention 2 ratios but it isn’t clear which is which. An alternative: “Vegetation development can be assessed using the S/V (angiosperm vs. gymnosperm) and C/V ratios (woody tissues vs. non-woody tissues). You need to add citations of the literature to support these interpretations.*

Response: Thanks a lot for this comment. Brief descriptions of these parameters have been included in the revised results section: “Vegetation development can be assessed using the S/V (angiosperm vs. gymnosperm) and C/V ratios (woody tissues vs. non-woody tissues) (Hedges and Mann, 1979). The 3,5Bd/V and Paq ratios can be used to indicate the change of wetland extent in the study area (Goñi et al., 2000b; Amon et al., 2012). Similar to (Ad/Al)<sub>s</sub> and (Ad/Al)<sub>v</sub> ratios, S/V, C/V, and 3,5Bd/V ratios are also affected by degradation processes (Ertel and Hedges, 1985; Hedges et al., 1988; Otto and Simpson, 2006).” (line 364–369, revised manuscript)

- *reply to reviewer 2 comment about the GDGT extractions. Thank you for clarifying that the GDGT data were newly generated for this paper, alongside the n-alkane data which has previously been published. The methods as outlined here lack some detail: you note that the GDGTs were extracted from the extract using hexane, but is that from a total extract or did you do some column chromatography or saponification as clean-up steps? If not, this sounds like you took a dry extract and dissolved it in hexane and injected that onto the LC, but the mention of “neutral compounds” sounds like you saponified first, and it is also common to filter samples before running on the LC. Can you expand the method details in the revised submission? [I subsequently found that in your response to Reviewer 3 you include notes about saponification. Please ensure that your methods section is appropriately detailed for a reader to replicate your methods]*

Response: Yes, the details of this method have been included in the revised manuscript (line 292–306, revised manuscript).

- *reply to reviewer 2 comment on lines 104-106. A suggestion to change the text slightly: “The Yukon Basin was mostly unglaciated during the LGM, but had permafrost (Schirrmeister et al., 2013). Although some permafrost in the Yukon Basin thawed during the last deglaciation (Meyer et al., 2019; Wang et al., 2021), most of the basin is still covered by permafrost today (Fig. 1).”*

Response: Changed (line 143–146, revised manuscript).

- *reply to reviewer 2 comment on lines 106-107. A suggestion: “Arctic coastal erosion is rapid today, with average rates of erosion at 0.5 m year<sup>-1</sup> (Lantuit et al., 2012; Irrgang et al., 2022), ...”*

Response: Changed (line 146–147, revised manuscript).

- *reply to reviewer 2 comment on line 108. Your reply gives some additional detail which is helpful, but it doesn't quite get to the issue which is why a time of sea level rise is expected to cause increased erosion. If you could break this long sentence into several smaller ones, you may be able to lead the reader through (i) high rates of coastal erosion today; (ii) expected sea level rise in the past (iii) rising sea levels cause more erosion (with supporting literature) (iv) past rises in sea level might then have contributed more coastal erosion, including organic matter. At the moment, part (iii) is missing from your interpretation.*

Response: We agree with this comment and we will change it as follows: “Arctic coastal erosion is rapid today, with average rates of erosion at 0.5 m year<sup>-1</sup> (Lantuit et al., 2012; Irrgang et al., 2022). Sea level rise will lead to greater wave impact on arctic shorelines which increases the coastal erosion (Lantuit et al., 2012). This suggests that during past times of rapid sea-level increase like in the B/A and PB periods coastal erosion was more intense than it is today (Lambeck et al., 2014; Fig. 2, b). Coastal erosion causes a large amount of terrigenous organic matter to enter the ocean (Couture et al., 2018; Winterfeld et al., 2018), suggesting that during past periods of sea-level rise, similar to today or even stronger erosive forces were at play supplying vast amounts of terrigenous materials to marine sediments.” (line 146–154, revised manuscript).

- *reply to reviewer 2 comment on line 199. I agree with the reviewer that saying there are 8 here but not outlining which 8 until line 230 is confusing.*

Response: In the revised manuscript, the 8 lignin phenols are introduced in line 233 and following, while  $\Lambda 8$  and  $\Sigma 8$  are introduced in lines 267 and 274.

- *reply to reviewer 2 comment on line 295-296. I don't see a change here in your reply. A suggestion “The deglacial evolution of the TEX86L-derived SST shows an overall warming, from ~4.5 °C at (date) ka BP to 10.8 °C at (date) ka BP.” Add in the relevant dates here and the sentence may be easier to follow.*

Response: It has been changed in the revised manuscript (line 356–357).