

Interactive comment on “Glycerol dialkyl glycerol tetraether variations in the northern Chukchi Sea, Arctic Ocean, during the Holocene” by Yu-Hyeon Park et al.

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Within this paper Park et al. provide downcore records of the relative abundance of GDGTs in 3 sediment cores from the Arctic Ocean. Based on these biomarker records the authors argue that the distribution of GDGTs in the Chukchi region is controlled by sea-ice conditions and changes in Pacific inflow.

The manuscript is well written and easy to follow. The references are up to date and the data support the main conclusions. I agree with the other reviewer that a more thorough discussion about the sources (including in situ production) and preservation of GDGTs is needed.

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The other major comment I have is that the authors should not use TEX86L as the GDGT community is moving away from using this index because of a range of different issues with this particular ratio. In stead, I suggest the authors to use the BAYSPAR calibration in addition to the regular TEX86 calibration -Tierney, J.E., Tingley, M.P., 2015. A TEX86 surface sediment database and extended Bayesian calibration. *Scientific Data* 2, 150029. -Tierney, J.E., Tingley, M.P., 2014. A Bayesian, spatially-varying calibration model for the TEX86 proxy. *Geochimica et Cosmochimica Acta* 127, 83-106. In addition, the authors need to (more thoroughly) discuss their results in context of the evidence that indicates that the application of TEX86 to reconstruct SSTs in the arctic ocean is problematic (see for example Ho, S.L., Mollenhauer, G., Fietz, S., Martínez-García, A., Lamy, F., Rueda, G., Schipper, K., Méheust, M., Rosell-Melé, A., Stein, R., Tiedemann, R., 2014. Appraisal of TEX86 and thermometries in subpolar and polar regions. *Geochimica et Cosmochimica Acta* 131, 213-226.).

I therefore recommend publication with moderate revisions.

David Naafs

Minor comments in order of appearance. Line 21-22: change to “.....but their application to sediments from the Arctic Ocean is limited. Here we analyzed the GDGT distribution in three sediment cores.”

Line 24-25: Delete sentence

Line 26: introduce the BIT (branched over isoprenoidal tetraether) and CBT (cyclisation of branched tetraethers) indices

Line 28: Not sure what “incomplete sea-level rise” means. Delete

Line 31: add “a reduction in” after “controlled by”

Line 63: Change to “Biomarker research, including the use of glycerol.”

Line 80: Add reference to Schouten, S., Hopmans, E.C., Sinninghe Damsté, J.S.,

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2013. The organic geochemistry of glycerol dialkyl glycerol tetraether lipids: A review. *Organic Geochemistry* 54, 19-61.

Lines 92-104: Overall this paragraph is poorly structured and not complete. The authors need to spell out the different indices. Show how TEX86 is calculated, which GDGTs are used. Same for the other indices (BIT, MBT, etc). In addition, the use of all the different indices should be properly referenced here (not in section 2.3). So Schouten et al., 2002 for TEX86, etc. Lastly, the GDGT-0/Cren ratio should be introduced here (with proper reference). Also clearly explain that TEX86 and MI are based on archaeal isoGDGTs and MBT/CBT on bacterial brGDGTs.

Line 92: replace “measured” with “the abundance of”

Line 92: GDGTs

Line 93: add “the” before “TEX86”

Line 96-98: delete part of sentence starting at “is based on (..) polar waters (Kim et al., 2010).

Line 98: Change to “The MI can be used to indicate the contribution of anaerobic methanotrophs to the sedimentary GDGT pool (Zhang et al., 2011)”

Line 113: delete “the” before “sea level”

Line 113: replace “at the time of” with “during”

Line 153: rephrase came out with slightly”

Line 169: delete “mixture of”

Line 171: explain which solvents and how much were used to elute the different fractions. E.g. 5 ml of hexane for F1, etc

Line 172: change to “Fraction 4, including the GDGTs,”

Line 172: not clear what “treated according to procedure. . .” means. Explain and ex-

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Line 175-177: was the LC-MS operated in SIM mode? State what m/z's were scanned for.

Line 180-181: how are these standard deviations calculated? Also state the calibration errors here (which are much larger).

Line 167-185: How did you quantify the GDGTs? I assume using a C46 std. Did you calculate response factors? Explain this in this section.

Line 188-189: delete sentence

Line 193-195: "fraction abundances of isoprenoidal GDGTs", is vague. Be more specific. For example; "The relative abundance of crenarchaeol increases, etc"

Line 201: replace "to" with "at"

Line 204: delete "show a"

Line 208-209: Delete sentence

Line 212: add "those reported in" before "surface sediments"

Line 228-229: Sentence not clear. Rephrase.

Line 230: introduce this ratio in the method section. In addition, in figure 5 you call it cald/cren ratio. Change this to GDGT-0/cren (consistent with the appendix)

Line 244: delete "s" in "occur"

Line 257: delete "fast"

Line 258: I do not think Figure 6 shows the increase in GDGTs from 9-8 ka. Change to figure 5

Line 262: change to "...was driven by an increase in bioproduction of (thaum)archaeota with the..."

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Line 267: add “,” after “(Fig. 5)”

Line 274: How does this offset work? How does this result in a lag of a few kyr?
Expand

Line: 289: “characterize” is misspelled

Line 325: add “the” before “GDGT”

Line 331: add GDGT-0

Line 334-341: Acknowledge that most of the variation in the TEX86 records is within the calibration error

Line 357-359: ending with the note that more research is needed is not good as it gives the idea that you didn’t accomplish much. Delete and end with a clear statement that highlights the overall result of the study

References: Some times a journal name is abbreviated and sometimes a DOI is given. Follow journal guidelines and be consistent.

Table 1: not sure this table is needed. This information can easily be described (and partly already is) in the material/method section

Figure 2: this appears to be a copy of the figure from Park et al., 2014. If no new information is provided here, delete figure and refer to original manuscript in the text.

Figure 6: Is this figure really needed? Does it show anything that is not seen in figure 5? In addition, I am not sure I understand the meaning of the dotted line. Does the data from Park et al. 2014 indicate that surface samples from > 75oN have high CBT values and all plot above the dashed line? If so, I think instead of showing a dashed line, the authors should show the raw data from Park et al., 2014 in this figure with a clear distinction between samples from > 75oN.

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