

Clim. Past Discuss., referee comment RC1
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Comment on cp-2022-19

Anonymous Referee #1

Referee comment on "Evaluation of the distributions of hydroxylated glycerol dibiphytanyl glycerol tetraethers (GDGTs) in Holocene Baltic Sea sediments for reconstruction of sea surface temperature: the effect of changing salinity" by Jaap S. Sinninghe Damsté et al., *Clim. Past Discuss.*, <https://doi.org/10.5194/cp-2022-19-RC1>, 2022

In this study, authors presented results of a Thaumarchaeotal culture enrichment, surface sediments, and two composite sediment cores from the Baltic Sea to assess the use of OH-GDGT-based indices, OH-GDGT%, RI-OH and RI-OH', as sea surface temperature (SST) proxies. Based on their enrichment and surface sediments, those indices (RI-OH' in particular) indeed respond to temperature changes, although it appears that quantitative estimate of temperature remains challenging. However, in their sediment core records, those indices become problematic when the Baltic Sea experienced from the fresh Ancylus Lake to the brackish Littorina Sea phases. The RI-OH' values are exceptionally high during the fresh Ancylus Lake phase. Authors conclude that a reduced salinity could increase the RI-OH' values substantially, and thus this effect should be considered when past salinity changed dramatically.

OH-GDGT-based proxies have been proposed to reconstruct past SST, however, confounding factors for these indices have not been fully evaluated, limiting their use as SST proxies. This study presents solid evidence that other factors could also affect those indices. The manuscript is well written and the scientific issue is well articulated and addressed.

I have only one comment. Authors believe that either thaumarchaea adjust their membrane lipid composition differently in freshwater vs. brackish conditions or different salinity could result in a shift in the Thaumarchaeotal species composition and suggest that the salinity effect should be considered when waters became fresh in the past. I'm not sure whether authors could recommend a GDGT-based index, ideally to be retrieved from the same OH-GDGT analysis, to signal this effect, without knowing its salinity history. Based on authors' present and previous study (Warden et al., 2018), it appears that the BIT and MBT⁵ME indices also changed correspondingly, associated with the changes in sedimentary environment, which appears to me that the archaea community may have changed substantially in response to the salinity changes. Thus, the BIT index could be used to signal this effect (but I understand that the BIT index does not indicate

specific changes in the Thaumarchaeotal species composition)? Just a thought.

Line 25: "are omitted", incomplete phrase

Line 205: change "as for" to "than"?