

Supplementary Information to Holocene sea ice and paleoenvironment conditions in the Beaufort Sea (Canadian Arctic) reconstructed with lipid biomarkers

Madeleine Santos^{1,2}, Lisa Bröder¹, Matt O'Regan^{3,4}, Iván Hernández-Almeida^{1,5}, Tommaso Tesi⁶, Lukas Bigler^{1,7}, Negar Haghipour^{1,8}, Daniel B. Nelson², Michael Fritz⁹, Julie Lattaud^{1,2,7}

This supplement contains Figure S1 to S7 and supplementary references.

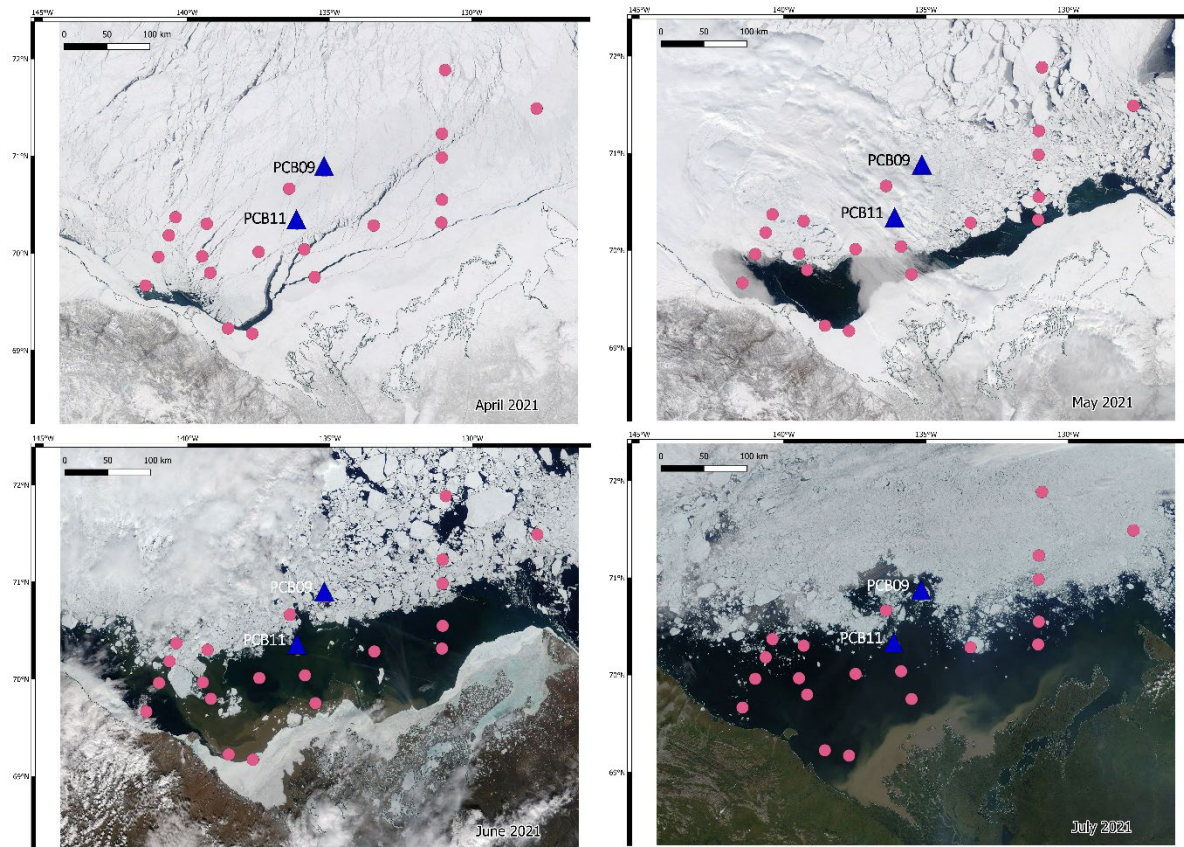


Figure S1: Sea ice extent in the studied area, satellite data from NASA worldview for 2021. Blue triangles indicate the locations of the two studied long core, pink circles indicate the location of the surface sediments used for calibration.

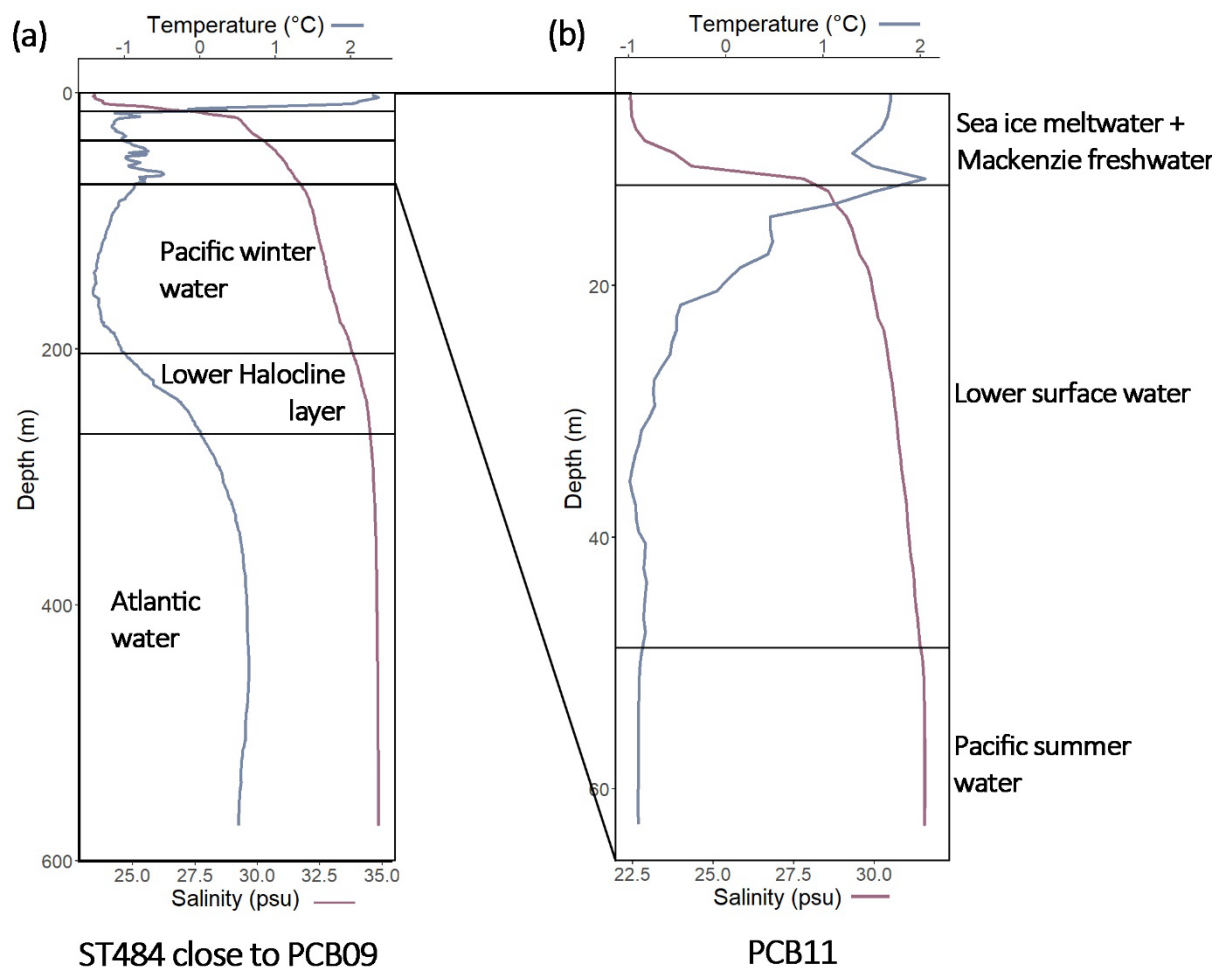


Figure S2: Water column parameters recorded during the expedition in September 2021. (a) for St484 close to PCB09 (on the shelf break) and (b) PCB11 on the outer shelf. The water masses are defined following (Matsuoka et al., 2012).

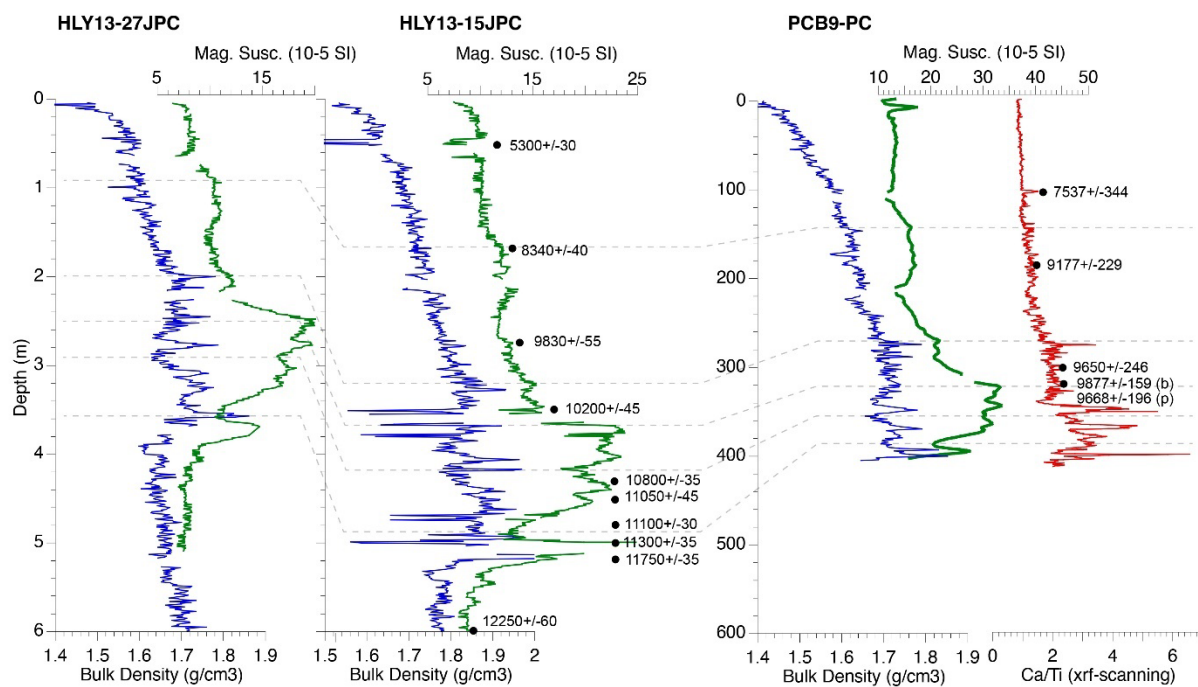


Figure S3 Tie-points and radiocarbon ages from 27JPC and 15JPC (Keigwin et al., 2018) in comparison to PCB09.

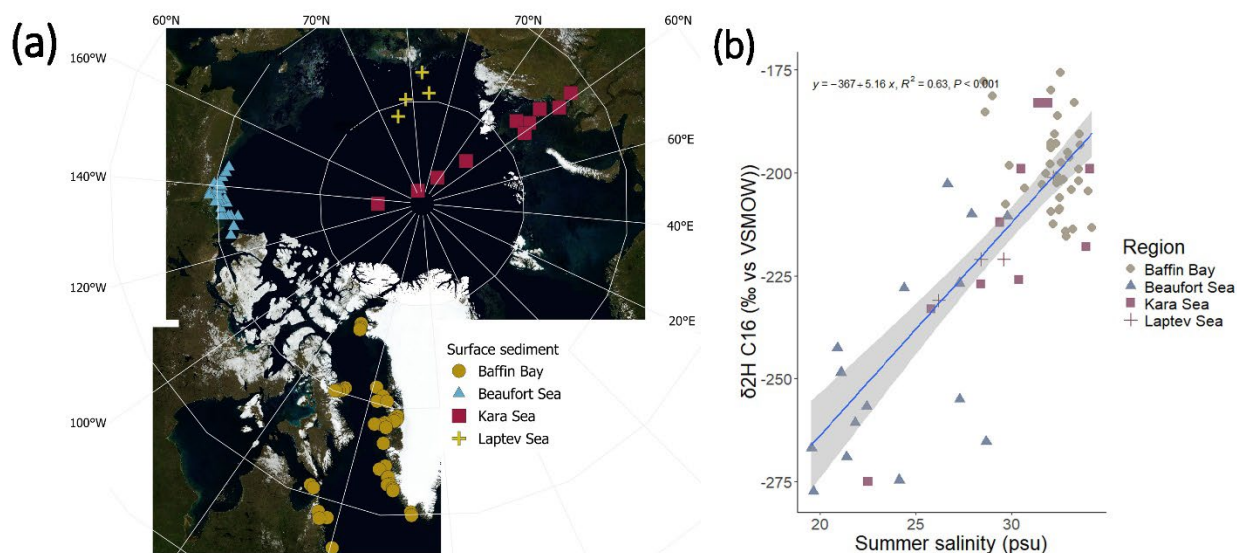


Figure S4: Regional calibration of the salinity proxy with (a) location of the studied surface sediments Beaufort Sea, this study, Kara and Laptev Sea from (Sachs et al., 2018) and Baffin Bay from (Allan et al., 2023), and (b) $\delta^2\text{H}$ of $\text{C}_{16:0}$ fatty acid using Beaufort Sea surface sediments from this study (blue triangles), Baffin Bay (grey circles, Allan et al., 2023) and the Siberian shelf (red squares and red crosses, Sachs et al., 2018) .

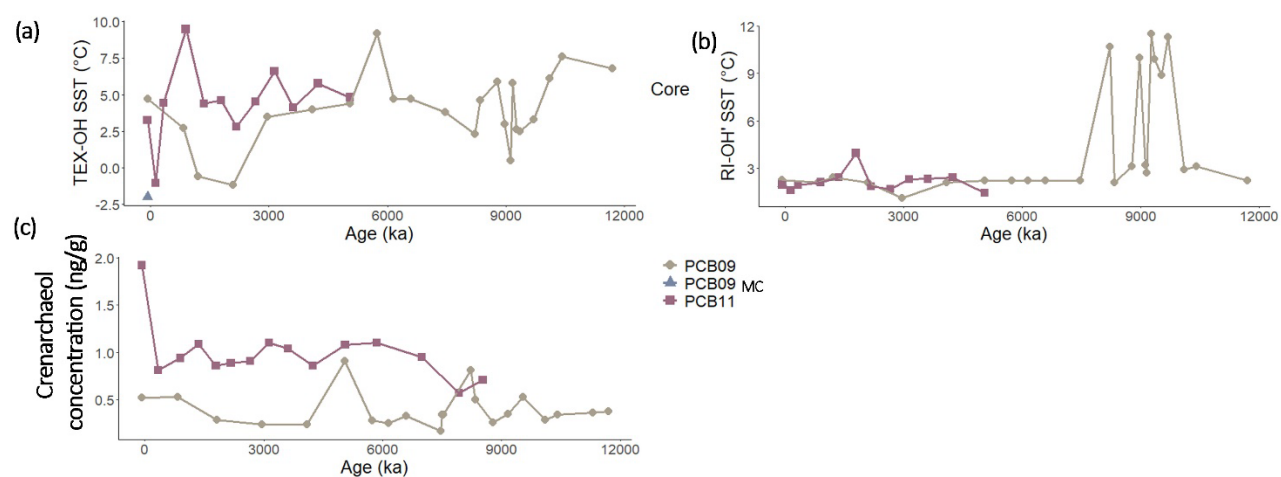
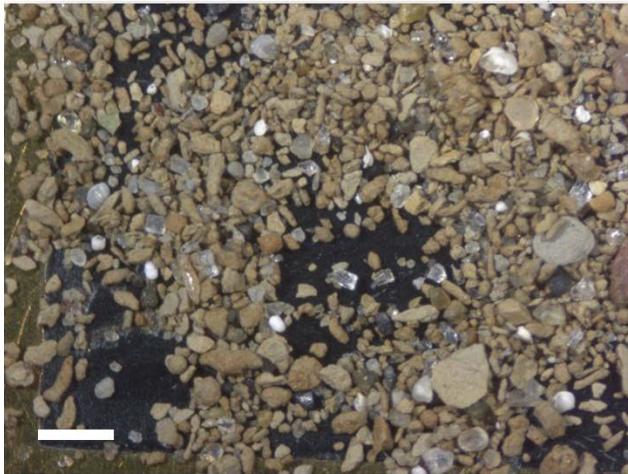


Figure S5 Sea surface temperature (SST) reconstructions using (a) TEX-OH and (b) RI-OH' and the calibrations of (Varma et al., 2024) in cores PCB11 and PCB09 and (c) Crenarchaeol concentration.

(a)



(b)

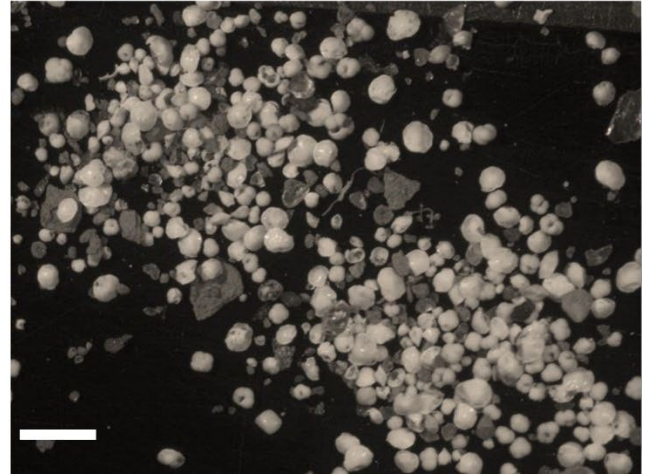


Figure S6: Pictures of foraminifera sieved from PCB09 under the stereoscopic microscope. a) PCB09-S2-30-31cm has abundant sandy detrital clasts with fragmented and sparse foraminifera shells. b) Sample PCB09-S4-0-1cm contains gray mud aggregates with abundant foraminifera shells. The scale bar represents 400 μm .

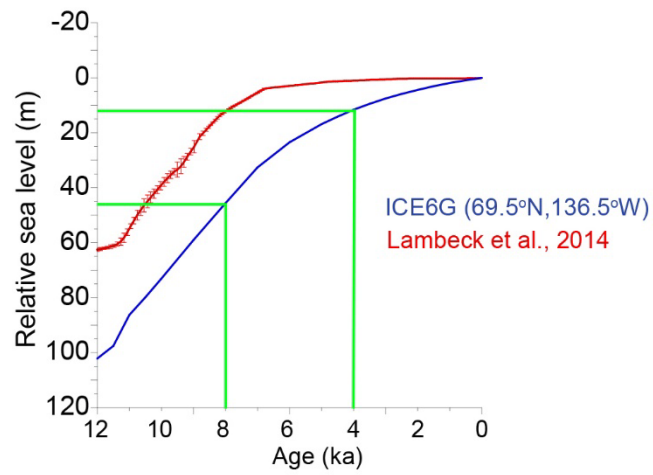


Figure S7: Comparison of global sea level (Lambeck et al., 2014) and the relative sea-level curve for the outer Beaufort Shelf predicted by ICE 6G-C (Peltier et al., 2015). The lowered ICE6G-C sea level on the outer shelf arises due to glaciostatic influences.

References

- Allan, E., Douglas, P. M. J., de Vernal, A., Gélinas, Y., & Mucci, A. O. (2023). Palmitic Acid Is Not a Proper Salinity Proxy in Baffin Bay and the Labrador Sea but Reflects the Variability in Organic Matter Sources Modulated by Sea Ice Coverage. *Geochemistry, Geophysics, Geosystems*, 24(9), e2022GC010837. <https://doi.org/10.1029/2022GC010837>
- Lambeck, K., Rouby, H., Purcell, A., Sun, Y., & Sambridge, M. (2014). Sea level and global ice volumes from the Last Glacial Maximum to the Holocene. *Proceedings of the National Academy of Sciences*, 111(43), 15296–15303. <https://doi.org/10.1073/pnas.1411762111>
- Matsuoka, A., Bricaud, A., Benner, R., Para, J., Sempéré, R., Prieur, L., Bélanger, S., & Babin, M. (2012). Tracing the transport of colored dissolved organic matter in water masses of the Southern Beaufort Sea: Relationship with hydrographic characteristics. *Biogeosciences*, 9(3), 925–940. <https://doi.org/10.5194/bg-9-925-2012>
- Peltier, W. R., Argus, D. F., & Drummond, R. (2015). Space geodesy constrains ice age terminal deglaciation: The global ICE-6G_C (VM5a) model. *Journal of Geophysical Research: Solid Earth*, 120(1), 450–487. <https://doi.org/10.1002/2014JB011176>
- Sachs, J. P., Stein, R., Maloney, A. E., & Wolhowe, M. (2018). An Arctic Ocean paleosalinity proxy from $\delta^{2}\text{H}$ of palmitic acid provides evidence for deglacial Mackenzie River flood events An Arctic Ocean paleosalinity proxy from $\delta^{2}\text{H}$ of palmitic acid provides evidence for deglacial Mackenzie River flood events. *Quaternary Science Reviews*, 198(November), 76–90. <https://doi.org/10.1016/j.quascirev.2018.08.025>
- Varma, D., Hopmans, E. C., van Kemenade, Z. R., Kusch, S., Berg, S., Bale, N. J., Sangiorgi, F., Reichart, G.-J., Sinninghe Damsté, J. S., & Schouten, S. (2024). Evaluating isoprenoidal hydroxylated GDGT-based temperature proxies in surface sediments from the global ocean. *Geochimica et Cosmochimica Acta*, 370, 113–127. <https://doi.org/10.1016/j.gca.2023.12.019>