EGU23-8474, updated on 21 Feb 2024
https://doi.org/10.5194/egusphere-egu23-8474
EGU General Assembly 2023

Sedimentary ancient DNA reveals plankton community shifts in subarctic western Bering Sea back to the Eemian interglacial

Kathleen Stoof-Leichsenring[1], Stella Buchwald[1,2], Dirk Nürnberg[3], Lars Harms[4], and Ulrike Herzschuh[1,5,6]

[1]1Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Polar Terrestrial Environmental Systems, D-14473 Potsdam, Germany (kathleen.stoof-leichsenring@awi.de)

[2]University of Hamburg, Institute for Geology, D-20146 Hamburg, Germany (stella.buchwald@uni-hamburg.de)

[3]GEOMAR Helmholtz Centre for Ocean Research Kiel, Ocean circulation and climate dynamics, D-24148 Kiel, Germany (dnuernberg@geomar.de)

[4]Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Data Science Support, D-27568 Bremerhaven, Germany (lars.harms@awi.de)

[5]University of Potsdam, Institute of Biochemistry and Biology, D-14476 Potsdam, Germany (ulrike.herzschuh@awi.de)

[6]University of Potsdam, Institute of Environmental Sciences and Geography, D-14476 Potsdam, Germany

Understanding past ecosystems in the Arctic and subarctic oceans is important to project ecosystem development under enhanced warming. Sedimentary ancient DNA (sedaDNA) is a fantastic proxy providing information with sufficient taxonomic width and depth to comprehensively reconstruct past ecosystems. This study uses shotgun metagenomics of 42 sediment samples to decipher phyto- and zooplankton community changes over the last glacial-interglacial cycle back to the Eemian in the subarctic western Bering Sea. We aim to understand the sensitivity of plankton community composition to climate changes and its consequences on food web dynamics and carbon export. Our results indicate that micro- phytoplankton, like sea-ice associated diatoms, and cold-adapted chlorophytes, along with crustaceous zooplankton (copepods) dominated during the last glacial period. Contrarily, pico/nano-sized phytoplankton and the diatom family Chaetocerotaceae accompanied by heterotrophic protists and reduced abundance of copepods characterized the interglacial plankton communities. Further, we identified profound differences between the Holocene and Eemian. Particularly, the Holocene records a pronounced increase of pico-sized cyanobacteria, whereas in the Eemian, cold-water related taxa like Bathycoccaceae and Triparmaceae sub-dominate the community, supporting unique communities in both interglacials, challenging an analogy to future warming scenarios. In summary, our study shows evidence for a shift from micro-sized towards pico-sized phytoplankton with climate warming in the Holocene, accompanied by a more diverse zooplanktonic community dominated by bacterial grazing heterotrophic protists. Under future warming, decreased phytoplankton cell size and shifts in the grazing communities could affect food web linkages and result in reduced potential carbon sequestration and export in the subarctic Bering Sea, weakening its function as an effective carbon sink.