Reduced diversity and productivity of diatoms and other protists during the Early Holocene in the subarctic North Pacific

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Background and objectives

Marine protists are a phylogenetically diverse group of single-celled eukaryotes that respond sensitively to changes in environmental conditions. Yet, our understanding **how long-term climate variability has shaped the taxonomic composition and diversity** is mostly unknown, especially of non-biomineralizing groups, (e.g. green algae), since traditional micropaleontological studies are limited to the analysis of microfossil remains with often hardly discernable morphological differences between species (e.g. diatoms).

objectives

1. trace temporal changes of diatom / protist sedimentary ancient DNA (sedaDNA) composition and diversity over the past 19.9 cal kyr BP
2. relate changes to environmental conditions

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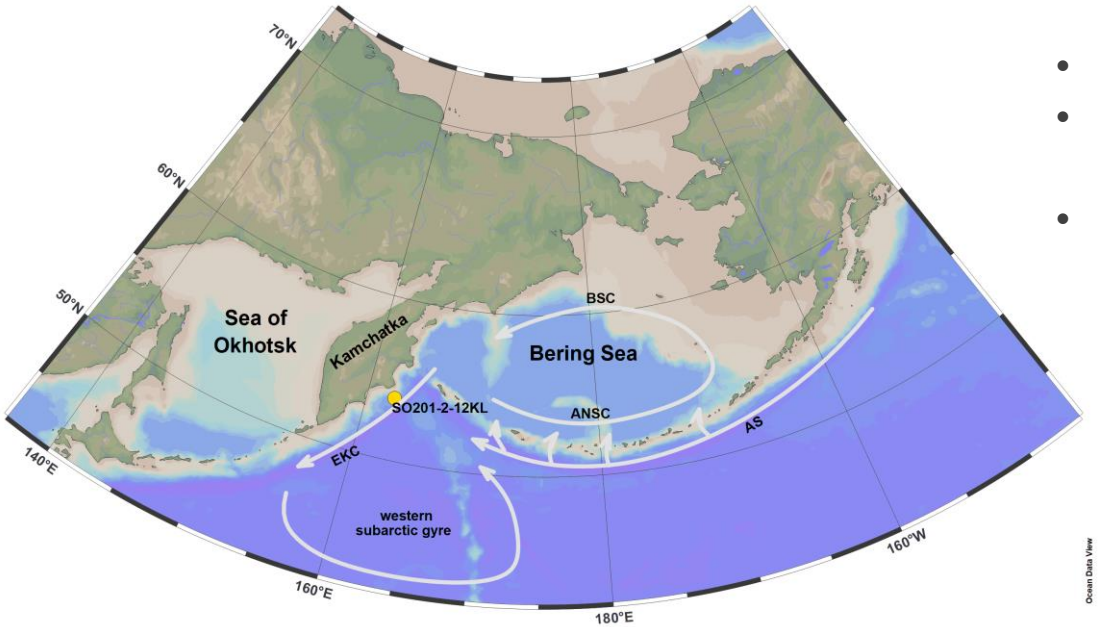
Core material and methods



- core taken at 2173 mbsl
- core is 9.05 m long and covers the past **1.08-19.9 cal kyr BP**
- site influenced by different ocean currents

ANSC= Aleutian North Slope Current
AS=Alaskan Stream
BSC= Bering Sea Current
EKC = East Kamchatka Current

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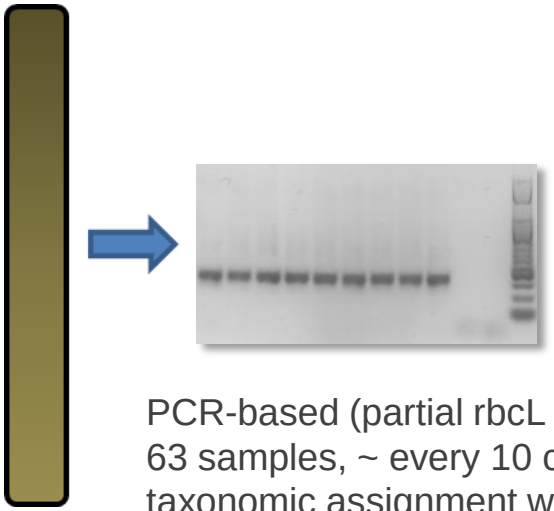
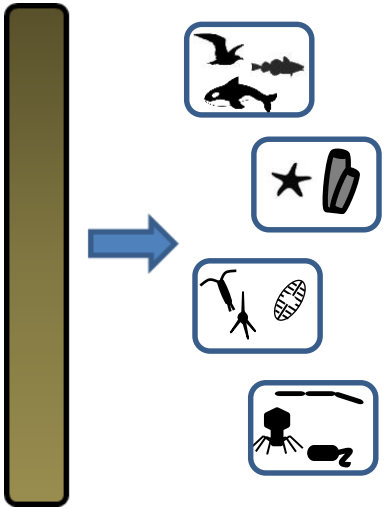
Sedimentary ancient DNA

DNA metabarcoding:
diatom-specific composition & diversity



PCR-based (partial rbcL gene 76bp[1])
63 samples, ~ every 10 cm
taxonomic assignment with OBITools
(custom database; embl release 138)

Shotgun metagenomics:
composition & diversity across domains



25 samples
taxonomic assignment:
Kraken2, NCBI nt database

[1]Stoof-Leichsenring et al. (2012)

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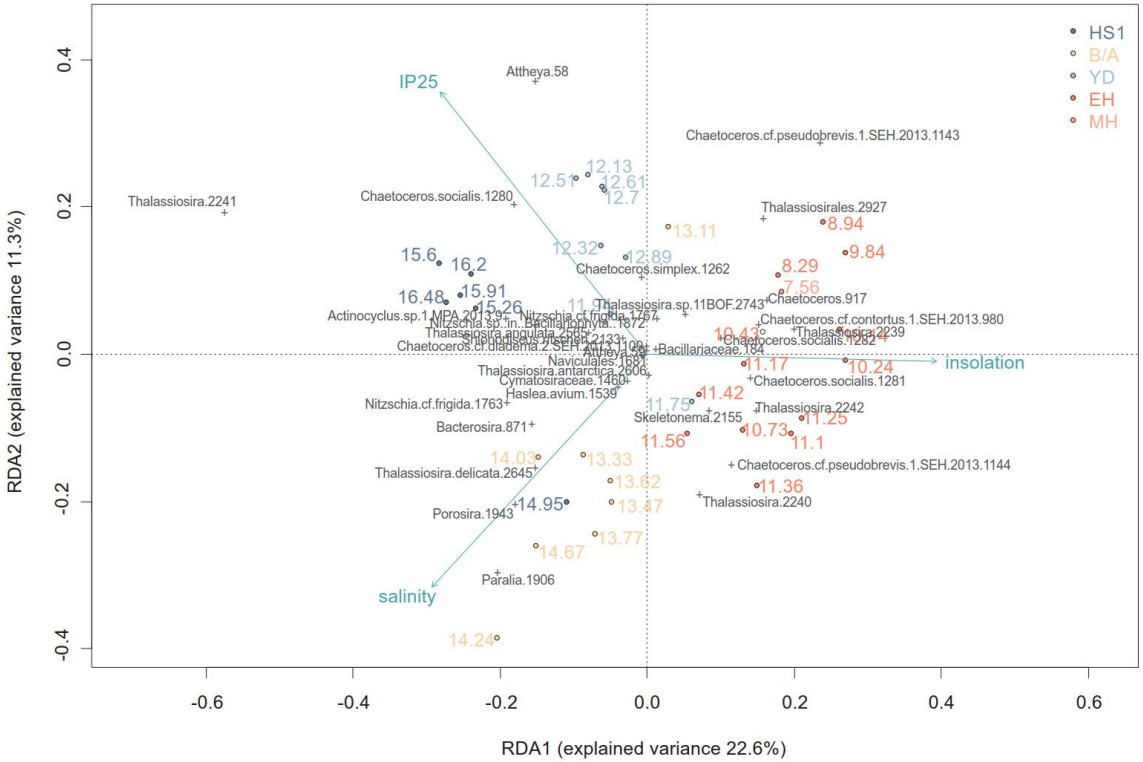
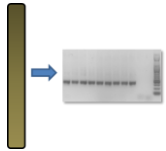
Diatom sedaDNA composition





…reflects overall cold conditions and is influenced by insolation, sea ice and salinity

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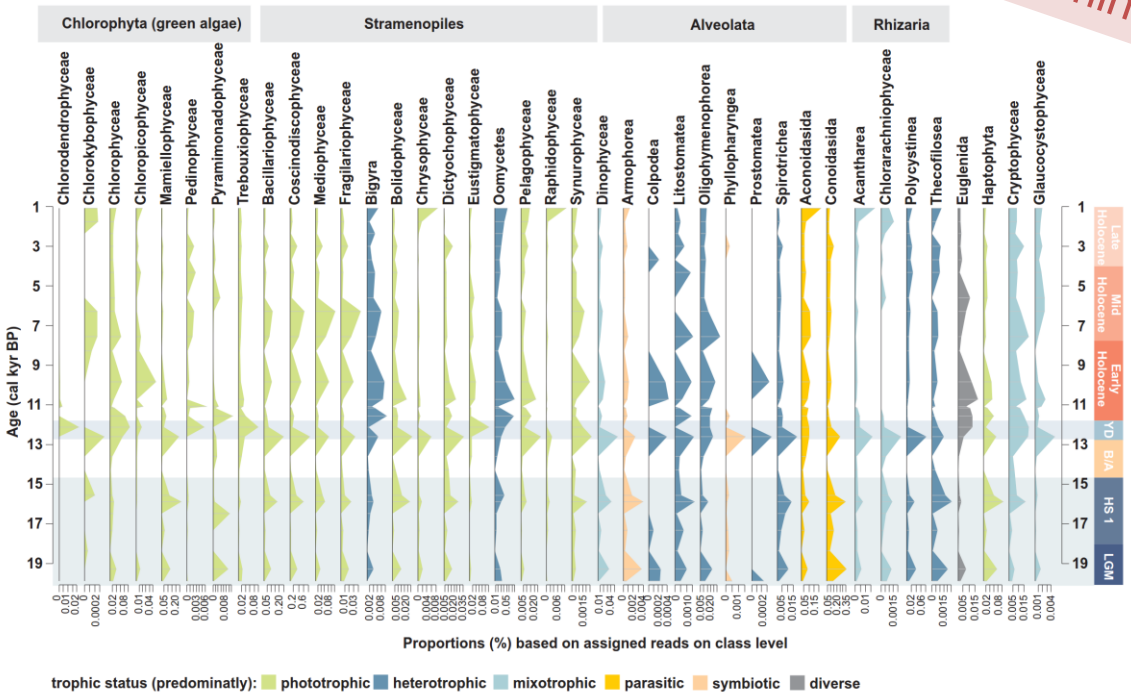
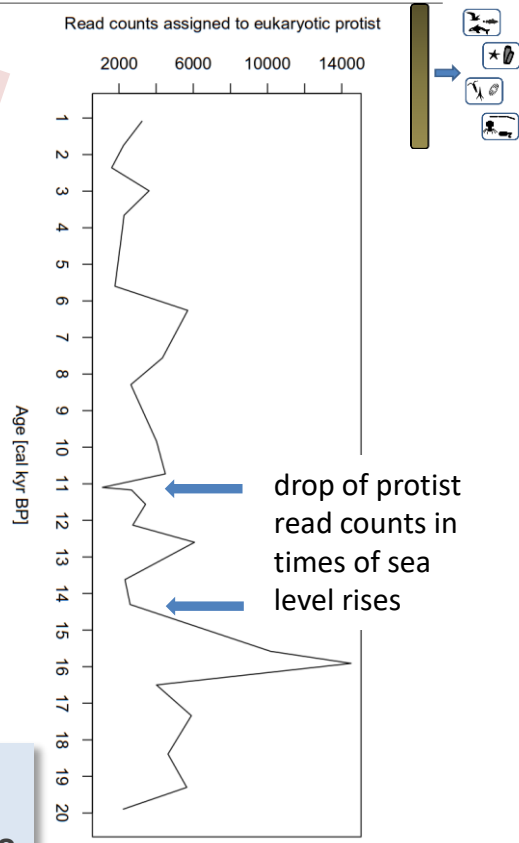
Shotgun metagenomics

preliminary results





- broad diversity of protists with patterns related to environmental changes
- diatoms, green algae and parasitic Apicomplexa display highest proportions
- drop of reads assigned to protists at **~15 & 11 cal kyr BP → reduced productivity?**

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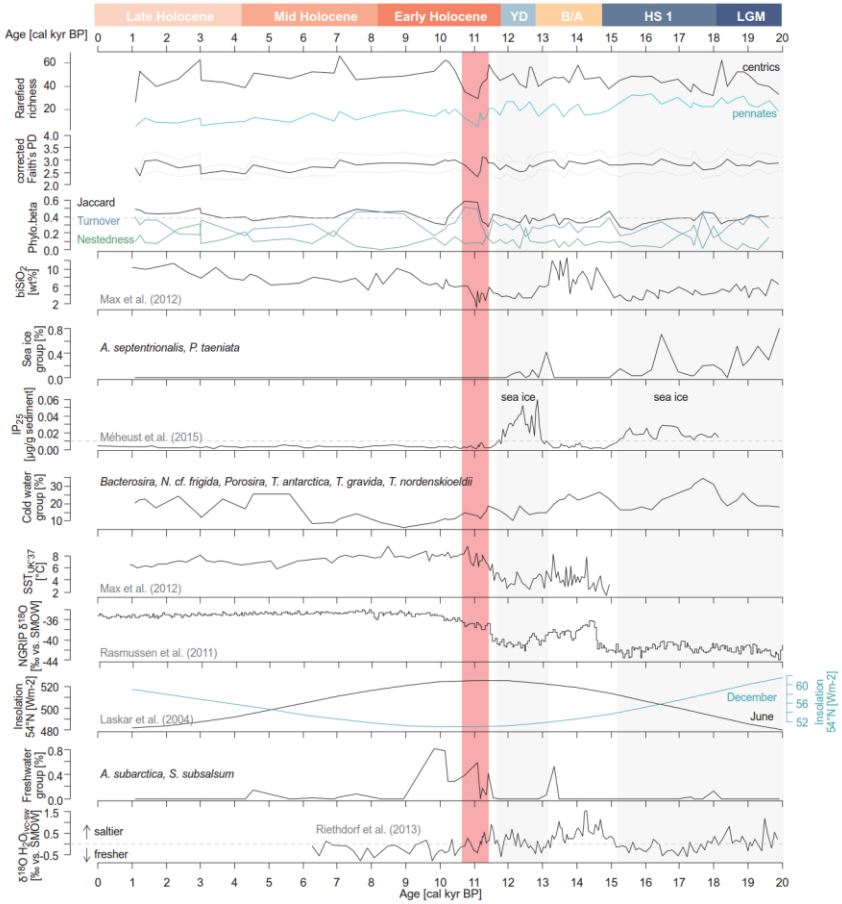
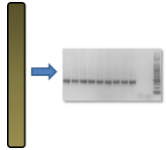
Early Holocene loss of diversity

…coincides with

- drop of productivity ($biSiO_2$)
- peak in summer insolation
- rising sea surface temperatures (SSTs)
- post-glacial opening of Bering Strait
- absence of winter sea ice cover (IP_{25})
- onset of sub-surface freshening ($\delta^{18}O_{ivc\text{-}sw}$)
- increase of *sed*aDNA freshwater group





Current hypothesis:
Reduced protist diversity during the Early Holocene resulted from freshening and warming of the upper ocean column which led to a strengthened vertical **stratification** which could have reduced past productivity due to **limited nutrient supply** from deeper waters to the photic zone.

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