Deglacial variability of sea surface temperature and salinity in the subarctic North Pacific and its marginal seas

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Today, the subarctic North Pacific is characterized by salinity-driven upper-ocean stratification (permanent halocline) hampering the exchange of gas, heat, and nutrients between the ocean and the atmosphere. However, during the last deglaciation changes in sea surface conditions, which are driven by changes in oceanic circulation and/or atmospheric teleconnections, potentially led to a weakened halocline. Hence, the subarctic North Pacific and its marginal seas may hold an important key for the understanding of Pleistocene changes in atmospheric-oceanic gas exchange. Paleoceanographic reconstructions within the North Pacific realm are sparse due to the shallow-lying lysocline and corrosive bottom waters limiting carbonate preservation.
In this study, we present high-resolution sediment records from the poorly studied southern Sea of Okhotsk, the Northwest Pacific off Kamchatka, and the western Bering Sea, which have sufficient $CaCO_3$ to allow for the application of carbonate-based proxies. Core chronologies are based on aligning core logging data (XRF, color b*) to the NGRIP oxygen isotope ($\delta^{18}O$) record, verified by AMS ^{14}C radiocarbon dating. Alkenone measurements, as well as combined analyses of $\delta^{18}O$ and Mg/Ca ratios derived from the planktonic foraminifera *Neogloboquadrina pachyderma* (sin.) were used to reconstruct changes in sea surface temperature (SST) and salinity (SSS) during the last 20,000 years.
The alkenone-derived SST reconstructions during the last deglaciation show millennial-scale temperature fluctuations, similar to those registered in Greenland ice cores and North Atlantic SST records. This correspondence implies a close linkage to deglacial variations in Atlantic Meridional Overturning Circulation (AMOC) associated with rapid atmospheric teleconnections resulting in a quasi-sychronous SST development between the North Atlantic and the North Pacific. Our temperature reconstructions suggest a deepening of the thermocline due to enhanced upper-ocean stratification during the Bølling-Allerød and the Preboreal warm periods. In contrast, the Heinrich 1 and Younger Dryas cold periods were subject to enhanced ventilation and a shallow-lying thermocline. Moreover, we present supporting evidence that the modern halocline in the subarctic North Pacific developed only since the early Holocene.