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Deglacial-Holocene variability of sea ice and surface water temperature in the Bering Sea: Reconstruction based on "IP25" and alkenone data

M. Meheust, R. Stein, and K. Fahl
Alfred Wegener Institute, Geosciences, Bremerhaven, Germany (ruediger.stein@awi.de)

Overall goal of our study of sediment material collected during RV Sonne Cruise 202 (INOPEX) in 2009 (Gersonde et al., Curise Report 2009), is the reconstruction of the short-term variability of sea-ice, sea-surface temperature (SST), primary productivity and terrigenous input in the subpolar North Pacific/Bering Sea and their relationship to global climate change, using organic-geochemical proxies (i.e. organic-geochemical bulk parameters and biomarkers such as: TOC, hydrogen indices; long-chain n-alkanes, sterols, alkenones; Uk37 and TEX86-Index; BIT-Index; HBIs, IP25, PIP25). In a first phase, these organic-geochemical proxies have been determined in surface sediments. The results show that the biomarker proxies reflect modern sea-ice and SST distributions as well as areas of increased primary productivity and increased input of terrigenous (organic) matter quite well. In a second phase of the project, the biomarkers have been determined in three selected sediment cores:

Core SO 202-18-6 (Umnak Plateau/Bering Sea; 60.127°N, 179.444°W; water depth 1105 m; core length 7.21 m; age interval 0 to 14 kyr.BP).
Core SO 202-07-6 (Detroit Seamount/western subpolar North Pacific; 51.272°N, 167.700°W; water depth 2340 m WD; core length 4.69 m; age interval MIS 1 to 3).
Core SO 202-27-6 (Patton Seamount/eastern subpolar North Pacific; 54.296°N, 149.600°W; water depth 2919 m; core length 2.91 m: age interval MIS 1 to 3).

Here, we concentrate especially on the variability of sea-ice cover and SST, using the newly developed sea-ice proxy "IP25" (Belt et al., 2007) and alkenone data, respectively, determined in the AMS14C-dated Core SO 202-18-6. Based on these biomarker records, sea-ice cover and SST changed significantly in the northern Bering Sea during Deglacial-Holocene times. The Younger Dryas interval is characterized by extended sea-ice cover, coinciding with a drop in SST to 2-4°C. With the end of the Younger Dryas, between 460 and 420 cmbsf, sea-ice cover decreased with increasing SST. Between 420 and 120 cmbsf representing the early Holocene (Thermal Maximum), IP25 is absent and maximum SST of about 6°C was reached. During the upper 120 cmbsf representing the late Holocene, IP25 occurred again and increased towards the top, paralleled by a decrease in SST of about 3°C. A very similar contemporaneous trend of increasing sea-ice cover during the late Holocene was recorded in the northernmost North Atlantic (Fram Strait), paralleled by an advance of glaciers in Norway, a colder climate over Greenland, a colder and dryer climate in Siberia, and a decrease in Siberian river discharge (Stein et al., 2004; Müller et al., 2009; 2012).

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