

DIATOM ASSEMBLAGES IN ARCTIC SEA ICE - INDICATOR FOR ICE DRIFT PATHWAYS

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During RV "Polarstern" expeditions ARK IV/3 and ARK VI/1 well-preserved diatom assemblages were recovered from particle-laden sea ice collected from the western Barents Shelf, and the Arctic Ocean between Svalbard (81°N) and the Nansen-Gakkel Ridge (86°N). Distinct variations in the abundance pattern and species composition of diatoms were found north and south of ca. 83°N.

Highest diatom concentrations were encountered in multi-year sea ice in the core of the Transpolar Drift Stream between 83° and 86° N. In this area diatom assemblages are dominated by marine-brackish benthic species. Apparently, these assemblages originate in shelf waters north and east of Siberia, where they are incorporated into the sea ice as a bottom ice assemblage. During the transport of the ice floes across the Eurasian Basin within the Transpolar Drift Stream, seasonal basal freezing and surface melting processes may have led to an accumulation of diatoms at the sea-ice surface.

South of ca. 83° N the sea ice samples contained significantly lower numbers of diatoms, dominated by fresh-water taxa. Between 83°N and 81°N these assemblages are dominated by planktonic freshwater taxa, but on the Barents Sea Shelf, east of Svalbard, significant numbers of benthic fresh-water taxa and benthic marine-brackish species also are found. This ice may originate in the Barents Sea and/or the Kara Sea, which receive a large influx of fresh water by the Siberian rivers Ob and Yenesei.

It can be concluded that the distribution pattern of diatoms in particle-laden sea ice can be used for identification of ice drift pathways.

QUATERNARY HISTORY OF THE ANTARCTIC CIRCUMPOLAR CURRENT, ITS FRONTAL SYSTEMS AND ANTARCTIC SEA ICE (ATLANTIC SECTOR)

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The presented results of late Quaternary Antarctic Circumpolar Current (ACC) history and sea-ice distribution are based on quantitative analysis of siliceous and calcareous microfossil assemblages, and isotopic and biogenic opal measurements in selected well-dated sediment cores from a N-S transect across the ACC between 40° and 56°S. First results focus on a comparison of the present-day situation with three time intervals: the climatic optima at 125 ka (stage 5.5) and at 9 ka (Holocene climatic optimum in the Southern Hemisphere), and the last glacial maximum (LGM) at 18 ka.

During climatic optima a relative warming of the surface water in the area of the polar frontal zone and the adjacent Antarctic zone is indicated by the southward migration of Sub-Antarctic radiolarians. The lack of sea-ice diatoms shows a significant southward shift of the winter sea-ice boundary, while opal measurements indicate a southward extension of the opal belt.

During the LGM, radiolarian taxa that dwell today in the polar frontal zone migrated northward to the area of the present Sub-Antarctic front. The winter sea-ice boundary was located north of its present position. Our data do not show a northward shift of the high-accumulation opal belt established during the climatic optima south of the present polar front. However, the pattern of the productivity proxies indicate a relative increase in productivity during glacial time periods in the area north of the polar front.

Similar to the findings in the southern zones of the ACC, the analysis of planktonic foraminiferal assemblages in a core located under the subtropical front gives no evidence for significant glacial/interglacial latitudinal shifts of the subtropical front.

The scenario of rather stable location of the frontal systems is also supported by the isotopic record. The difference between Holocene (core top) and LGM $\delta^{18}O$ values is notably constant on a latitudinal transect across the ACC.

RADIOLARIAN-BASED, TRANSFER FUNCTIONS FOR THE ESTIMATION OF PALEO-ENVIRONMENTAL PARAMETERS IN THE SOUTHERN OCEAN (ATLANTIC SECTOR)

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The radiolarian data set of 60 taxa in 35 undisturbed surface sediment samples collected with a multicorer in the area of the Antarctic Circumpolar Current (ACC, eastern Atlantic sector) was resolved by the Q-mode factor analysis into four varimax factors, accounting for 94.45% of the distributional variance of the species included. Each factor represents a faunal assemblage which shows a close spatial correlation to present-day hydrography (e.g. the zonal bands of the ACC).

A multivariate regression analysis was used to derive a transfer function relating the four varimax factors to surface-water temperature, salinity, and phosphate concentration. Temperatures and salinities used represent mean austral summer values (December to March). These values were chosen because sediment-trap experiments indicate that export production in the Southern Ocean is restricted to the austral summer.

The transfer functions for summer surface temperature, salinity, and phosphate values have high correlation coefficients and low standard errors of estimates (temperature: 1.28°C; salinity: 0.08‰; phosphate concentration: 0.22 $\mu\text{mol/l}$). The validity of the transfer functions can be judged by the geographical analysis of residuals, which shows no obvious geographical distribution pattern.

Because of the low standard errors of the derived transfer functions for summer surface temperature, salinity and phosphate concentrations, this method provides a good tool for down-core reconstruction of paleoceanographic parameters in Quaternary sediments in the Southern Ocean.

RADIOLARIAN PARTICLE FLUX IN THE SOUTHERN OCEAN (ATLANTIC SECTOR)

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The study of the flux pattern of radiolarians provides information on productivity, ecology, dissolution processes, vertical and horizontal transport of radiolarians in the Antarctic Ocean. Data on radiolarian particle flux were gathered with sediment traps moored at six sites located in the Drake Passage, Powell Basin, Bransfield Strait, NW Weddell Sea, SE Weddell Sea (west of Maud Rise), and at the polar front. The data were also compared to those obtained by the study of radiolarian assemblages preserved in the surface sediments.

The annual radiolarian particle flux is characterized by significant seasonal and inter-annual variations. Flux pulses, accounting for 80 to 90% of