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Arctic ocean water mass distribution and mixing from dissolved ^{10}Be and ^{9}Be

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The Arctic Ocean basin is confined by landmasses similar to the Mediterranean. There is only little deep water formed seasonally on the shelves of the Arctic Ocean despite the low temperatures due to a freshwater lid originating from the Arctic rivers. The deeper Arctic Ocean water masses can thus only be renewed at comparatively low rates via the only deep connection to the Atlantic Ocean, the Fram Strait. Biogenic particulate fluxes in the central Arctic Ocean are very low due to perennial sea ice cover and detrital particle fluxes from either eolian or riverine sources are also very low.

We present the first combined dissolved ^{10}Be (cosmogenic) and ^{9}Be (continental sources) depth profiles from water samples of the major Eurasian basins of the Arctic Ocean, which were collected during the Swedish Arctic Ocean 2001 expedition. Due to the weak particle reactivity of Be and the low particulate fluxes, Be isotopes can serve as quasi-conservative tracers for different origins of water masses (Atlantic Ocean, Pacific Ocean, Arctic rivers).

Our results show relatively uniform concentrations of both Be isotopes at depths below 500 m and thus also a constant ^{10}Be/^{9}Be ratio of 7×10^{-8}. This value is intermediate between deep-water ratios from the Atlantic and Pacific Oceans. In the upper water column large variations are observed. The upper 100 m of the central Arctic profiles (Amundsen and Makarov Basins) are characterized by up 5 times higher concentrations of ^{9}Be (similar to Nd and Hf) and up to twice as high ^{10}Be concentrations as the deeper waters which corresponds to a pronounced salinity minimum caused by freshwater input from the Siberian rivers. The corresponding surface water ^{10}Be/^{9}Be ratios are only 2×10^{-8}. This suggests that considerable amounts of Be are supplied by the Siberian Rivers but also that the isotope ratio with which Be is supplied is significantly different from the deep Arctic Ocean. Comparison of the surface ocean ^{10}Be variability with data obtained 10 years ago, when the salinity minimum was absent, clearly shows that Be is a reliable quasi-conservative water mass tracer in the Arctic Ocean.

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Temporal variations of $^{239+240}$Pu profiles in the water columns of the North Pacific

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The plutonium isotopes, ^{239}Pu (half-life: 2.44×10^{4} y) and ^{240}Pu (half-life: 6.58×10^{3} y), have been added to the Pacific Ocean mainly as a consequence of global fallout from atmospheric nuclear weapons testing [1], while a second source has been close-in fallout from Bikini Atoll weapons tests [2]. A number of studies have been made on the water column distributions of $^{239+240}$Pu in the North Pacific [e.g., 3,4,5]. The concentrations of $^{239+240}$Pu increased to a maximum value at around 500 - 800 m depth and then decreased with depth. The concentrations and water column distributions of $^{239+240}$Pu should change with time. One of the objectives of R/V Hakuho Maru cruise in 2000 (The Bootes Expedition) was to re-visit the GEOSECS stations. The comparison with previous data can be used to develop the $^{239+240}$Pu time series in the water column.

Seawater samples were collected at Stns. BO-1 (GEOSECS-222), BO-3 (GEOSECS-212), and BO-4 (GEOSECS-235) in the western and central North Pacific during the KH-00-3 cruise. The profiles of $^{239+240}$Pu in water column from three stations showed nearly the same variation with depth. The sub-surface maximum values decreased by a factor of 2 - 3. The $^{239+240}$Pu concentrations below 1000 m at these stations did not change significantly over 27 years. Water-column inventory of $^{239+240}$Pu at Stn. BO-1 (GEOSECS-222) decreased from 93 (in 1973) to 77 (in 2000) MBq/km^{2}. This value is approximately two times higher than that of the global fallout input at the latitude of 30 - 40 °N [1].

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