Dissolved beryllium isotopes distribution in the northern South China Sea

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Atmospheric cosmogenic radionuclide ^{10}Be and stable isotope ^{9}Be in seawater may serve as a quasi-conservative tracer for water mass mixing and freshwater input, but such data are rare. Here we present dissolved ^{10}Be and ^{9}Be concentrations of a section from Pearl River estuary through shelf areas to deep water, as well as of the surface water in the northern South China Sea (SCS). Surface water ^{9}Be concentrations of all stations range from 8.8 pmol/kg to 43.6 pmol/kg. The maximum ^{9}Be concentration occurs near the Pearl River estuary and forms a notably tongue-shaped high ^{9}Be zone. There is a trend of ^{9}Be decrease from northwestern coast towards the southeastern inner basin. Dissolved ^{10}Be concentrations of surface water vary between 118 atoms/kg and 576 atoms/kg and show a decreasing trend from east to northwest. Patterns of vertical distribution of the dissolved ^{9}Be and ^{10}Be concentrations as well as $^{10}Be/^{9}Be$ ratios for the section vary with the water depth of the stations. Both surface ^{9}Be and ^{10}Be concentrations decrease southward from Pearl River estuary. Below surface water, ^{9}Be concentrations decrease southward while ^{10}Be concentrations increase slightly. At the most shallow site on the shelf, the ^{9}Be and ^{10}Be show inverse variation trends from surface to bottom: ^{9}Be concentrations increase by a factor of 2 from surface to bottom while ^{10}Be concentrations decrease from 458 atoms/g to 182 atoms/g, this results in a sharp decrease of $^{10}Be/^{9}Be$ from 3.14×10^{-8} to the lowest 0.61×10^{-8}. For the two deep stations in the SCS inner basin, ^{9}Be concentrations are doubled from surface to ~500 m and remain constant at deeper depths, while ^{10}Be concentrations show an increasing trend towards bottom. The $^{10}Be/^{9}Be$ ratio at both stations increases with depth, apparently dominated by the ^{10}Be concentration. The $^{10}Be/^{9}Be$ for the water sample collected at 3040 m at Station SEATS is 9.57×10^{-8}. The distinct distributions of seawater Be isotopes in this study provide us an opportunity to further our understanding on their variations as a result of oceanographic processes such as freshwater input, mixing, bottom scavenging, and influence of intruded Kuroshio Current or deep boundary current.