

Transport and sedimentation of terrestrial particulate organic matter in Lake Akkeshi

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The sources of organic matter in estuarine and coastal sediments and their distribution are important to the understanding of global biogeochemical cycles. In these transitional systems, primary production generates large amounts of organic matter of which a significant portion sinks through the water column. Therefore, these areas show the complex nature of organic matter in estuarine sediment. A variety of parameters ($\delta^{13}\text{C}$, C/N ratio, biomarkers) have been used to determine the sources of organic matter. The objective of this study is to elucidate the transport and sedimentation of terrestrial organic matter from a wetland region to coastal ocean using carbon isotopic signatures.

Field experiments were carried out at a small river, Bekanbeushi River, along a low moor in Bekanbeushi Moor, and a brackish lake, Lake Akkeshi located in eastern Hokkaido, Japan during 2004-2011. We collected suspended solids in river waters from the Bekanbeushi River and surface sediments in Lake Akkeshi. Stable carbon isotopic ratio of a sample and the VPDB standard used for normalization were made by analyzing a triple collector mass spectrometer with a precision of ± 0.05 permil as $\delta^{13}\text{C}$ value. Radiocarbon was determined using accelerator mass spectrometry at the National Institute for Environmental Studies and the Japan Atomic Energy Agency. Radiocarbon values were reported as $\Delta^{14}\text{C}$ corrected for sample $\delta^{13}\text{C}$ with absolute error less than 10 permil.

Organic matter in riverine suspended solids shows almost constant: -29.1 permil to -28.7 permil for $\delta^{13}\text{C}$ value. In contrast, the $\Delta^{14}\text{C}$ value shows wide variations from -103 permil during snowmelt event to +9 \pm 16 permil during summer and winter. The river mouth sediments show wide variations in carbon isotopes. The $\delta^{13}\text{C}$ value increases from -27.3 permil at the river mouth to -21.5 permil at off the mouth. On the other hand, the $\Delta^{14}\text{C}$ value decreases with increasing the distance from the river mouth, ranging from -44 permil to -157 permil. The surface sediments in Lake Akkeshi show a small variation in $\delta^{13}\text{C}$ value from -20.0 to -18.7 permil and $\Delta^{14}\text{C}$ value from -168 to -139 permil. These results indicate that the sedimentation of particulate organic matter derived from wetland occurs at the restricted area near the river mouth. However, major part of terrestrial organic matter may be transported from Lake Akkeshi to Akkeshi Bay.

Keywords: river water, radiocarbon, suspended solids, coastal marine sediments, terrestrial organic matter, land-ocean interaction