Study on transport of particulate organic matter from river to ocean using carbon isotopes

*Seiya Nagao[1]

1.Institute of Nature and Environmental Technology, Kanazawa University

Global riverine discharge of organic matter to the ocean represents a substantial source of dissolved terrestrial matter and organic carbon particulates. The inputs and fates of terrestrially derived organic carbon discharged to the coastal ocean is still not fully constrained. To resolve the present situation, many scientists have been investigated using a variety of geochemical approaches such as delta^{13}C, C/N ratio and lignin biomarker analyses. Radiocarbon abundances have become an additional indicator of terrestrial versus marine sources because nuclear weapons testing in the 1950s and 1960s injected large quantities of ^{14}C into the atmosphere. This study reports the fate of riverine particulate organic matter (POM) in watershed with forest, paddy field and wetland at eight river systems in Japan by using simultaneous use of capitaldelta^{14}C and delta^{13}C.
We selected two rivers in wetland, Bekanbeushi and Kushiro Rivers, and six rivers in forest and paddy field such as the Ishikari, Saru and Teshio Rivers in northern part of Japan, Kuzuryu River in the central part and the Chikugo River in Kyushu Island in Japan. Suspended particles were concentrated with a single-flow continuous-flow centrifuge from 60-100 l of river waters. Organic carbon contents were determined using a elemental analyzer. Prior to analysis for the riverine suspended solids, carbonates were removed by adding 0.1 M HCl solution. ^{14}C measurements were performed by accelerator mass spectrometry at the Japan Atomic Energy Agency and the National Institute for Environmental Studies in Japan. The capitaldelta^{14}C is defined as the deviation in parts per thousand from the modern standard. delta^{13}C values were determined for sub-samples of the CO_2 gas generated during graphite production, using an isotope ratio mass spectrometer.
The paired capitaldelta^{14}C vs. delta^{13}C distributions vary with the river systems and divided into three groups. Riverine POM in wetland has lower in delta^{13}C and higher in ^{14}C rather than those of rivers in forest and fluvial plain. This indicates higher contribution of younger organic matter at the wetland river systems. The riverine POM has different ranges of delta^{13}C and capitaldelta^{14}C among the rivers running through forest area. The Teshio River samples are plotted in higher delta ^{13}C and capitaldelta^{14}C than those of other rivers. The Tokachi River has larger variations of delta ^{13}C and capitaldelta^{14}C values. On the other hand, the Ishikari and Saru Rivers are almost plotted in similar distribution area except for the spring snow melt sample of the Saru. The capitaldelta^{14} C values of Saru River are -296‰ to -247‰ for the summer and -720‰ for the spring samples. The similar result was observed for the spring samples of Tokachi and Bekanbeushi Rivers. The riverine POM with older age shows the presence of fossil organic matter such as bitumens or kerogen, and/or the entrainment of terrigenous organic matter of long residence times within the drainage basin. The Kuzuryu River system shows different distribution at the Kuzuryu and its brech river, Hino River. Consequently, the land-use type in the river watershed is related to the sources as well as the transport and sedimentation processes of POM.

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