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Environmental analysis of various aquatic ecosystems by using ^{13}C and ^{15}N natural abundances

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Natural abundance measurement techniques of stable isotopes have been utilized as animportant analytical tool to study material cyclings in biogeochemical research. Nowadays, this technique has become a general research tool for ecological and environmental research fields. Because the natural abundance of stable isotopes change corresponding to the basic processes (i.e. mixing, kinetic reaction, chemical equilibrium) that control material flows, we could conduct the following three kinds of research from the isotopic analysis of the inorganic to organic materials:

1) The analysis of the kind of the potential sources and their contribution
2) The analysis of the rate limiting reaction and the factors that control the reaction
3) The verification on whether the status are in chemical equilibrium or not

Especially, in the environmental research field, the primary way in application of stable isotope techniques continued to be for the analysis of the potential sources and their contribution. For example, food source analysis was general done by the measurement of the isotopic composition (^{13}C, ^{15}N, ^{34}S) at the individual level of some organisms, while the food web structure could be analyzed at the community level. As for the analysis of nitrate isotopic composition (^{15}N, ^{18}O), the origin of nitrate could be revealed.

In my presentation, I would like to show you how powerful the isotope analysis is as a tool by reviewing my field isotope data in various aquatic ecosystems. The following five case studies will be introduced: 1) The diversity in N nutrition among wetland plants in Midorogaike, Kyoto, 2) The difference in food web structure between lotic and lentic ecosystems revealed by comparison between an oxbow lake and a main stream in the Shibetsu Basin, Hokkaido, 3) The food webs fueled by methane derived carbon in the Horonai river, Hokkaido, 4) The relationships between watershed characteristics and 15N abundance in stream nitrate and various organic materials in Shiga, 5) The quantitative estimation of irrigation drainage by running a four source mixing model in Ibaraki.

Isotope mixing models analyzing the kind of potential sources and their contribution can be useful to examine whether river ecosystems are supported by material loading from its watershed or by regenerated compounds within river ecosystems. Because the ^{15}N natural abundance in organic and inorganic materials was roughly explained by the isotope mixing models based on the watershed landuse patterns, Japanese river ecosystems are likely to be supported by the material loading from the watershed in terms of N cycling.

Keywords: isotope mixing model, nitrogen loading, methane food web, wetland, oxbow lake