Nutrient supply from forest to river in eastern Toyama: carbon and nitrogen isotopic composition of Epilithic Organic Matter

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River water has higher concentrations of dissolved components than precipitation because dissolved components are added when precipitation passes through forest areas interacting with rocks and vegetation. To clarify the supply of nutrients from the forest area to the river, in this study we focused on catchment areas and conducted research at river upstream areas in eastern Toyama prefecture where there is with very little human influence. River waters and Epilithic Organic Matter (EOM) were collected from 2016 to 2018. We measured the concentration of major chemical components, stable isotope composition of oxygen and hydrogen (d18O, dD) in water samples, and stable carbon and nitrogen isotopic ratios of EOM. Analysis results are discussed together with topographical data and the vegetation map obtained by GIS. The results are as follows.

1) Judging from d18O values and dD values, river waters were formed by a mixture of precipitation in summer and in winter in an altitude range of 300 ~ 2000 m.

2) There was a correlation between d13C values of EOM and both Calcium and bicarbonate concentration. This suggests that Ca in river water is supplied by carbonate (CaCO3) weathering of rock and soil in the catchment area. Ca, Na, K and Mg concentrations showed a significant positive correlation with the coniferous proportion, it suggests that these chemicals are added into river water when passing through the forest area. Compared to rain water, chemical components were higher in rivers, about 200 times for Ca, 6 times for Na, 8 times for K and 10 times for Mg respectively.

3) A negative correlation exists between riverine nitrate concentration and evergreen percentage of vegetation in the catchment, and more than 90% of nitrate in river water is derived from the forest using oxygen isotopic ratio Δ17O of nitrate. It means the amount of nitrate in precipitation is trapped in the forest and then the forest originated nitrogen discharges into the rivers.

4) Δ15N in EOM, which possibility “records" the nitrogen supply information for several days to weeks when using nitrate from river water, is bounded at the altitude of 1500 m and reflects the vegetation within the catchment areas. In addition, the δ15N value showed a positive correlation with the evergreen percentage in the Catchment area, suggesting that vegetation affects nitrate outflow to rivers.

Keywords: Epilithic Organic Matter, carbon and nitrogen isotopic composition, nutrient supply, forest area, eastern Toyama

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