Magnesium and zinc stable isotopes in stream ecology

*Kai Nils Nitzsche[1], Yoshikazu Kato[1], Ki-Cheol Shin[1], Hiromitsu Kamauchi[1], Ichiro Tayasu[1]

1. Research Institute for Humanity and Nature

Magnesium (Mg) and zinc (Zn) play important roles in biological production in stream ecosystems. Aquatic organisms take up metals from the diet and the water; however, relative contributions are largely unknown, which is assumed to depend on feeding habits. We determined Mg and Zn stable isotope ratios (δ^{26}Mg, δ^{66}Zn) of aquatic macroinvertebrates and of small goby, and their potential Mg and Zn sources (periphyton, plant litter, stream water) from upper and lower reaches of two temperate streams in the Lake Biwa catchment. Our goal was to understand Mg and Zn sources to aquatic organisms, and to explore δ^{26}Mg and δ^{66}Zn variations across feeding habits. δ^{26}Mg and δ^{66}Zn did not correlate with each other indicating that Mg and Zn sources differ across functional feeding groups and/or different degrees of isotopic fractionation during Mg and Zn uptake. Grazers, shredders and predators showed offsets to higher δ^{26}Mg values compared to metal sources indicating isotope fractionation during Mg accumulation, while stream water was the main Mg source to filter-feeders. In contrast, δ^{66}Zn of grazers and filter-feeders indicated Zn was often a mixture between periphyton and stream water, while δ^{66}Zn of shredders and predators gave evidence for Zn isotopic fractionation. Our results demonstrate the usefulness of applying non-traditional isotopes to understand metal sources to aquatic organisms, which could be used to trace the ultimate origin of metals from the catchment.

Keywords: Aquatic animals, Stream food web, Magnesium, Zinc, Non-traditional isotopes

