

# Elemental, Cu and Zn isotopic compositions in seawater, phytoplankton and zooplankton collected from the East Sea

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Trace metals in marine organisms are reported to be transferred to higher trophic levels through predation in the food web. The most important organisms in the marine environment are phytoplankton, the basis of the food chain, which is susceptible to metal pollution and is used as a biological indicator of pollution within the environment and ecosystem. Trace metals in zooplankton can be accumulated through seawater and phytoplankton, a food source, but are influenced by various physiological factors. The purpose of this study is to further understand the biogeochemical cycle of trace metals in the East Sea by analyzing the concentration, bioavailability, and copper (Cu) and zinc (Zn) isotopes of trace metals in multimedia environmental samples (seawater, phytoplankton, and zooplankton). Additionally, we examine the possibility that Cu and Zn isotope information can be used as a proxy to understand the isotopic fractionation process between seawater and plankton communities.

In October 2023, surface seawater, phytoplankton and zooplankton were collected from the East Sea. Trace metal concentrations were measured using an inductively coupled plasma mass spectrometry (ICP-MS). For Cu and Zn isotope analysis, seawater and plankton samples were separated and purified using an anion exchange resin (AG-MP1) and then analyzed using a multi-detector inductively coupled plasma mass spectrometer (MC-ICP-MS).

For phytoplankton, Fe concentrations had the highest value with the mean of 11,477 mg/kg, followed by Zn (1972 mg/kg) and Cu (527 mg/kg). The average concentration of trace metals in zooplankton was in the following order: Fe>Zn>Mn>Cu>Cr>Ni>Cd>V>Pb>Co. The bioconcentration factor (BCF) of phytoplankton was in the order of Fe>Zn>Pb>Cu>Co>Cr>Mn>Cd>Ni>V, and the BCF of zooplankton was highest for Fe and lowest for V. The bioaccumulation factor (BMF) appeared in the order of Cd>Fe>Mn>V>Co>Ni>Cr>Zn>Cu>Pb, and the BAF of Cr and Fe among trace metals differed by 204 and 175 times, respectively, among sampling sites. For phytoplankton, the average Cu and Zn isotopes were 0.15% and -0.02%, respectively. The Cu isotope of zooplankton had an average value of 0.16%, showing no significant difference from that of phytoplankton. It was found that the Zn isotope in zooplankton