Nutrition sources of deep-sea hydrothermal vent meio- and macrofauna revealed by natural-abundance radiocarbon and stable carbon and nitrogen isotope ratios

Hidetaka Nomaki[1], Uejima Y[2], Ogawa NO[1], Yamane M[3], Watanabe HK[1], Senokuchi R[2], Kitahashi T[1], Yokoyama Y[3], Ohkouchi N[1], Shimanaga M[2]

[1]JAMSTEC; nomakih@gmail.com
[2]Kumamoto University
[3]The University of Tokyo

Deep-sea hydrothermal vents host unique marine ecosystems, which largely rely on organic matter produced by chemoautotrophic microbes. The dependence on chemosynthetic organic matter varies between organisms; some megafauna exclusively gain their nutrition from their autotrophic symbiont, while some megafauna partly rely on phytodetritus. Although meiofauna is abundant at the hydrothermal vent fields, studies on its nutritional sources are limited due to its small size. In this study, we investigated dietary sources of meio- and macrofauna at hydrothermal vent fields around Japan using stable carbon and nitrogen isotope ratios (d13C, d15N) and natural-abundance radiocarbon (D14C). Bacterial mats of the hydrothermal vent chimney and Paralvinella inhabiting on that exhibited high d13C values (up to -10‰) and low D14C values (-700 to -580‰). The d13C and D14C values of Dirivultidae, a copepod family endemic to hydrothermal vent chimney, were on average -11‰ and -661‰, respectively, and were similar to the bacterial mat and Paralvinella but distinct from non-vent copepods (d13C: ~-22‰) or water column plankton (D14C: ~40‰). In contrast, d13C values of nematodes from vent chimney were similar range to those at non-vent sites (ca. -25‰). The results suggested that Dirivultidae relied on bacterial mat at the vent chimney as their nutrition source, while vent nematodes did not gain their nutrition from the chemoautotrophic microbes. The nutritional insights obtained from isotopic compositions are consistent to the distributional patterns of the meiofauna. The combination of stable and radioisotope analyses on hydrothermal vent organisms provides valuable information on their nutrition sources and hence their adaptive ecology to chemosynthesis-based ecosystems.