Nutrition sources of meiofauna revealed by stable carbon and nitrogen isotope ratios and natural radiocarbon abundances explain meiofaunal distribution patterns at hydrothermal vent fields

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Deep-sea hydrothermal vents host unique marine ecosystems which mainly rely on organic matters produced by chemolithoautotrophic microbes. Although there are abundant meiofauna at the hydrothermal vent field, studies on their distributional patterns and nutritional sources are still limited due to their small body sizes. In this study, we investigated dietary sources of meiofauna at hydrothermal vent fields in the western Pacific using stable carbon and nitrogen isotope ratios ($d^{13}C$, $d^{15}N$) and natural radiocarbon abundances ($D^{14}C$). Based on these data, we evaluated how much do the hydrothermal vent meiofauna gain their nutrition from the chemolithoautotrophic microbes and how does it related to their distributional patterns around hydrothermal vent fields. Bacterial mats of the hydrothermal vent chimney typically exhibited heavy $d^{13}C$ values (up to -10‰) and depleted $D^{14}C$ values (~600‰). The $d^{13}C$ and $D^{14}C$ values of Dirivultidae, an endemic copepod family inhabiting hydrothermal vent chimney, exhibited similar values to the bacterial mat but distinct from those of sediments at surrounding area or water column plankton, suggesting that they exclusively rely on bacterial mat at the vent chimney. Other copepods at the vent chimneys may also rely on bacterial mat to some extent. To the contrary, $d^{13}C$ values of nematodes at vent chimneys were -26.6 and 23.2‰, which were similar ranges to those at non-vent sites, suggesting vent nematodes did not gain their nutrition from the chemolithoautotrophic microbes. Those nutritional facts obtained from isotopic compositions explain well about distributional patterns of these meiofauna; while dirivultid copepods exclusively distribute at vent chimneys and other copepods are more abundant at vent chimneys than in non-vent sediments, nematodes showed similar abundances between vent chimney and non-vent sediments.

Keywords: Hydrothermal vent ecosystem, meiofauna, feeding habit, stable isotope ratios, natural radiocarbon abundance

