Tracing energy source and flow of hydrothermal vent fauna from the KIOST Vent Field at the Indian Ocean mid-ocean ridge

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We investigated carbon fixation pathways and energy flow in benthic ecosystems in newly discovered hydrothermal vent site, named KIOST Vent Field (KVF), at the Indian Ocean mid-ocean ridge. To do this, we analyzed sulfur ($\delta^{34}S$), carbon ($\delta^{13}C$), and nitrogen ($\delta^{15}N$) stable isotopic compositions in surface sediments, particulate organic matter (POM) from surface chlorophyll maximum layer (water depth = ca. 90 m), and vent fauna including mollusks, arthropods, and polychaetes collected from the KVF. The $\delta^{34}S$ values in benthic organisms ranged from 1.8‰ to 12.8‰ indicating uptake of chemosynthetically rather than photosynthetically (POM = 18.7‰) derived organic matter. The $\delta^{13}C$ values ranged widely between -31.7‰ (mussels) and -11.5‰ (gastropod) suggesting the occurrence of different metabolic pathways of energy production (i.e. CBB cycle, rTCA cycle, and methanotrophs) in the KVF and variation in energy sources contributions to vent fauna. For example, mussels (-31.7‰) may have derived their energy largely from the CBB cycle organic matter indicated by ^{13}C-depleted $\delta^{13}C$ values, whereas shrimp (-15.0‰), crab (-16.5‰), and gastropods (-11.5‰) may have taken organic matter produced by rTCA cycle or methanotrophs which have relatively high $\delta^{13}C$ values. The $\delta^{15}N$ values indicate trophic position of the organisms and increase by 3.4‰ by trophic level. Shrimp recorded highest $\delta^{15}N$ values (5.7‰) while gastropods and mussels had 10-15‰ lower $\delta^{15}N$ values (-5.6‰ and -13.5‰, respectively) than the shrimp. Such a large range in $\delta^{15}N$ values in these vent fauna reflect large offsets in $\delta^{15}N$ values among energy sources (i.e. CBB and rTCA cycle-derived bacteria). This study demonstrates that chemosynthetic bacteria produced by CBB or rTCA cycle are the dominant energy sources for the vent fauna in the KVF and their contributions to consumers vary among species. We suggest further study on carbon fixation pathways of symbiotic bacteria of these vent fauna to refine the interpretation of stable isotopic results in this study.