Abstract

[Research Title]

Monitoring of Coastal Environments and Assessment of Benthos Response to Global Warming and Hypoxia Based on Bivalve Sclerochronology

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[Abstract]

Since the Industrial Revolution, various environmental changes that threaten coastal ecosystems and human activities, such as global warming, ocean acidification and hypoxia, have come to the surface. Environmental monitoring using geochemical records in shells is beneficial for the protection of coastal ecosystems and the sustainable economic activities. This study had been developing geochemical proxies of bivalves to reconstruct environmental information and assess environmental impacts on organisms.

We proposed a method for estimating temperature and growth history of bivalves using oxygen isotope ratios of shells (Nishida et al., 2023), and a method for estimating dissolved oxygen concentration using molybdenum concentration of shells (Tanaka et al., 2023). We developed a new analytical method of stable C, N, O isotope ratios of periostracum. Furthermore, we applied the new method to the bivalves collected from Tokyo Bay and demonstrated that isotopic signatures of periostracum reflect the anthropogenic nitrogen loading to the coastal area.

Our RNA-seq analysis and SEM observations revealed the biological mechanisms underlying the plastic expression of shell microstructure in response to low temperatures (Sato et al., 2022) and hypoxia (Sato et al., 2023). Considering together with environmental monitoring data, anomalous shell microstructures can serve as potential proxies for environmental alterations. We concluded that stable carbon isotope ratio in bivalve shells faithfully correlated with the decline in dissolved oxygen in bottom waters.

As described above, bivalve shells are very useful for long-term environmental monitoring and are expected to contribute to environmental policy.

[References]

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