

Spatial variation of neodymium and strontium isotope ratios of shellfish soft bodies in the coastal sea of eastern Tohoku District

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Sr isotope ratio ($^{87}\text{Sr}/^{86}\text{Sr}$) has been used as a geographical index of water and vegetation and a tracer of animal migration in terrestrial ecosystem. However, it has little power in marine ecosystem because of extremely homogeneous $^{87}\text{Sr}/^{86}\text{Sr}$ ratio in seawater. In contrast, the Nd isotope ratio ($^{143}\text{Nd}/^{144}\text{Nd}$) has a potential to become effective tracer of marine organisms because the $^{143}\text{Nd}/^{144}\text{Nd}$ ratio of seawater is known to show a variation in the area and depth in the ocean (Amakawa et al., 2004). Nonetheless, there is little report on the Nd isotope ratio for marine and even terrestrial organisms, largely due to the extremely low content of Nd in organisms, and the resultant poor awareness of the element in ecological fields.

In order to explore the potential of Nd isotope as a biogeographical tracer in marine ecosystem, we determined the isotope ratios of Nd and Sr in soft bodies of shellfishes, mainly oysters and mussels in the coastal sea of eastern Tohoku district. Our results show that the $^{143}\text{Nd}/^{144}\text{Nd}$ ratio of the shellfish has a wide variation (0.5123-0.5128), whereas the $^{87}\text{Sr}/^{86}\text{Sr}$ ratio lies in the narrow range (0.70912-0.70921), which is almost equivalent to the value of seawater. Although the shellfish has lower $^{143}\text{Nd}/^{144}\text{Nd}$ ratio than the exchangeable fraction of river sediments in the watershed of the coast, both ratios show a strong positive relationship ($r^2 = 0.75$). Further, the shellfishes have higher $^{143}\text{Nd}/^{144}\text{Nd}$ ratios than seawater in the northern Pacific, and the exchangeable $^{143}\text{Nd}/^{144}\text{Nd}$ ratio of river sediments has a weak negative relationship with the $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of the associated river water ($r^2 = 0.37$). These results demonstrate that the shellfish contains Nd derived from the watershed rocks of the adjoining river and Nd from oceanic water. It is concluded that the Nd isotope ratio has promise as a geographical index of habitat and foraging site of marine organisms and an effective tracer of marine animal migration at least in coastal sea zones.

Keywords: Nd isotope ratio of organisms, soft bodies of shellfish, marine ecosystem