

Nd isotopic variation of seawater along the Pacific coast of Tohoku district and its causal factor

*Yu Saitoh¹, Jun Matsubayashi¹, Hiroyuki Togashi³, Hiroshi Amakawa², Ki-Cheol Shin¹, Takanori Nakano⁴, Ichiro Tayasu¹

1. Research Institute for Humanity and Nature, 2. Tohoku National Fisheries Research Institute, 3. JAMSTEC, 4. Waseda University

Nd isotope ratio of seawater is known to vary between regions or water masses in the ocean. This contrasts to the fact that Sr isotope ratio of seawater is quite homogeneous. Therefore, Nd isotope ratio has the potential to become an effective tracker of marine animals or marine products. However, Nd isotopic variation in coastal sea region is not investigated well compared to that in global scale. In this study, we investigate the alongshore variation of the Nd isotope ratio of seawater and its causal factor at the Pacific coast of Tohoku district, northeast Japan, of which hinterland is composed of varied geology.

The Nd isotope ratios of seawater samples, which were taken from 14 coastal sites located between 38.17N and 40.55N, vary from -8 to +1 in ϵ_{Nd} . These values are well correlated ($r=0.72$) with Nd isotope ratios of river water samples taken from the adjacent river of each coastal site, which ranges from -8 to 2 in ϵ_{Nd} . This indicates that the ϵ_{Nd} of coastal seawater is largely defined by the value of land water. On the other hand, the range of Sr isotope ratios of seawater samples is quite narrow and high (0.70916 to 0.70919) despite that the value of river water ranges widely from 0.7055 to 0.7085. The Nd isotope ratios of seawater and water of the adjacent river differ from each other in most sites although they are correlated significantly. Nd contribution from offshore seawater should be considerable. Mixing of river water and offshore seawater of Tohoku district (-4 to -3 in ϵ_{Nd} ; Amakawa et al, 2004) is consistent with the linear regression expression of ϵ_{Nd} of seawater to that of river water ($y=0.65x-0.83$).

Contribution of land water is suggested to be limited to nearshore regions. Surface seawater samples were taken along an offshore-directed line from the Abukuma River mouth in December 2015 (winter) and July 2016 (summer). Nd isotope ratios in summer were almost uniform around -9 in ϵ_{Nd} in the interval between 2km and 60km from the shore, whereas in winter it increases offshore from -6 to -2 in the interval between 35 km to 60 km from the shore. The ϵ_{Nd} of about -9 is considered to be that of the Kuroshio Current (Amakawa et al., 2004), which dominates in summer at the region, whereas that of -2 is consistent with the value of the Oyashio Current (Amakawa et al., 2004). On the other hand, the ϵ_{Nd} of the Abukuma River water (-2.9) is not reflected even at the site only 2 km apart from the shore. In spite of this regional limitation, Nd isotope ratio can newly provide a tool to trace animals and products at least in coastal seas.

Keywords: Nd isotope ratio, seawater