Carbon and oxygen isotopic compositions of modern brachiopod shells from a warm-temperate shelf environment, Sagami Bay, Japan.

Yasufumi Iryu[1]; Kazuyuki Yamamoto[2]; Ryuji Asami[3]

[1] Depart. Earth & Planetary Sci., Nagoya Univ.; [2] INPEX Corp.; [3] TRO-SIS, Univ. Ryukyus

This study presents carbon and oxygen isotopic compositions of shells of an articulated brachiopod (Laqueus rubellus) which lived in a warm-temperate environment in Japan. High-resolution, three-dimensional samplings were conducted (1) to clarify variations in the isotopic compositions in a single shell, (2) to evaluate offset of the compositions from those of the calcite in precipitated isotopic equilibrium with ambient seawater (equilibrium calcite), and (3) to specify shell portions that reflect the isotopic composition of ambient seawater.

The d13C and d18O values of the samples from the secondary shell layer that constitutes the main body of the shell are in and/or out of those of the equilibrium calcite. The isotopic compositions of the samples from the outermost part of the secondary shell layer are correlated well with growth rates. Positive correlations are recognized between the d13C and d18O values of these samples, which can be ascribed to a kinetic fractionation effect.

The d18O values of the samples from the outermost part of the secondary layer (= outer surface of the secondary shell layer) along a growth axis of L. rubellus would be a reliable environmental proxy, because the values mostly fall in a range of those of the equilibrium calcite. Although the samples from the inner series of L. rubellus are enriched in 13C by about 1 per mil relative to the equilibrium calcite, variability of isotopic values is relatively small. The carbon isotopic composition in this series, therefore, would be useful if the values are appropriately corrected. Isotopic compositions of the shell portions free from significant physiological effects would enable to decipher secular isotopic fluctuations at relatively high resolution of 0.5 per mil or less.

This study clearly illustrates that the carbon and oxygen isotopic compositions of the modern brachiopod shells are influenced by the kinetic fractionation effect. However, appropriate selection of species and shell portions that reflect the isotopic composition of ambient seawater enables to reconstruct secular variations in d13C or d18O in the oceans.