

Variations in carbon and oxygen isotope composition and trace element concentrations of the modern brachiopod shells collected off Okinoshima

*Kazuma Oikawa¹, Hideko Takayanagi¹, Ryuichi Shinjo², Kazuyoshi Endo³, Masa-aki Yoshida⁴, Yasufumi Iryu¹

1. Institute of Geology and Paleontology Graduate School of Science Tohoku University, 2. Department of Physics and Earth Sciences, University of the Ryukyus, 3. Department of Earth and Planetary Science, Tokyo University, 4. Shimane University Faculty of Life and Environmental Science

The carbon ($\delta^{13}\text{C}$) and oxygen ($\delta^{18}\text{O}$) isotope composition of Rhynchonelliform brachiopods (hereafter, called 'brachiopods') have been regarded as useful for paleoceanographic conditions throughout the Phanerozoic. However, recent studies have revealed that the isotopic composition and minor element concentrations in modern brachiopod shells are not only influenced by environmental changes in ambient seawater but also by biological effects such as the chemical composition of calcification fluid and the growth process (e.g., growth rates, metabolism). In order to improve our knowledge on the calcification mechanism of brachiopod shells and to make the isotopic composition and the chemical composition more reliable paleoenvironmental proxies, it is necessary to accumulate data on them from various modern brachiopod species. In this study, we measured $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values and minor element concentrations of the primary (PL) and secondary (SL) shell layers of three (one male and two female) specimens of *Pictothyris picta* collected at a water depth of ~61 m off Oki Island. We performed a high-resolution micrometer-scale sampling along the maximum growth axis, corresponding to time resolution of 3 days to 8 months. Samples were also collected from the innermost shell surface. We examined whether there are differences in isotopic composition and minor element concentrations between male and female specimens. The $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values of calcite precipitated in equilibrium with surrounding seawater ($\delta^{13}\text{C}_{\text{EC}}$ and $\delta^{18}\text{O}_{\text{EC}}$) were calculated using oceanographic data (e.g., temperature, salinity) and isotopic composition of dissolved inorganic carbon ($\delta^{13}\text{C}_{\text{DIC}}$) and seawater ($\delta^{18}\text{O}_{\text{SW}}$) at the brachiopod growth site to compare with the shell $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values.

The $\delta^{18}\text{O}$ values of three *P. picta* of the SL are mostly close to oxygen isotope equilibrium with ambient seawater. The $\delta^{13}\text{C}$ values of the PL and SL show clear seasonal variations. There are no differences in shell $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values between male and female specimens. Whereas, intraspecific (inter-specimen) differences in $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values are not negligible. There is no significant correlation between Mg/Ca and $\delta^{18}\text{O}$ values. Whereas Sr/Ca and $\delta^{13}\text{C}$ values are negatively correlated.

Keywords: brachiopod, carbon and oxygen isotope, trace metal element concentrations