Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.15344

Carbon and oxygen isotopic compositions in cultured brachiopod shells

CLAIRE ROLLION-BARD[1], DR. HANA JURIKOVA[2] AND DANIELA HENKEL[3]

[1]Laboratoire des Sciences du Climat et de l'Environnement
[2]University of St Andrews
[3]GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel

Presenting Author: claire.rollion-bard@lsce.ipsl.fr

Biominerals produced by marine calcifying organisms are a key tool for reconstructing the environmental parameters during their lifetime, as they act as archives of environmental conditions that prevail during their growth. Brachiopods were ubiquitous throughout the Phanerozoic and continuous in the fossil record since the Early Cambrian up to now. As they secrete a shell made of low-magnesium calcite, more resistant to diagenesis, the isotopic compositions and element/Ca ratios derived from fossil brachiopod shells are a powerful tool in paleoenvironmental studies.

In this contribution, we provide in situ measurements by SIMS (Secondary Ion Mass Spectrometry) of oxygen and carbon isotopic compositions of brachiopod shells of the cold-temperate water species *Magellania* venosa [1]. *M. venosa* shell is constituted of a primary and secondary layer. The brachiopods studied here grew under control conditions mimicking the natural environment and in experiments under low-pH and high-temperature conditions. All carbon and oxygen isotopic composition profiles show the typical brachiopod pattern, with the primary layer being depleted in ^{18}O and ^{13}C relative to equilibrium and then showing an increase until reaching a plateau of values close to equilibrium [2]. The $\delta^{13}C$ values of the specimen grown under low-pH conditions (7.35) show a large drop during the period of culturing. This reflects the low value of the Dissolved Inorganic Carbon (DIC) due to the source CO_2 used to lower the pH of the culture medium. The primary layer, despite being in isotopic disequilibrium, still reflects the DIC $\delta^{13}C$ value and the isotopic fractionation is quite similar between control and low-pH conditions. We show also that during the growth of the brachiopod, there is addition of new precipitated calcite on the calcite layers already existing, thus empirically validating the conceptual model of [3]. Our SIMS data will be compared to the study of [4].

[1] Dixon (1789), *Maradan Paris*, Appendix N°1, 281.
[2] Rollion-Bard et al (2019), *Chem Geol* 524, 49-66.
[3] Ackerly (1989), *Paleobiology* 15, 147-164.
[4] Ye et al (2019), *Biogeosciences* 16, 617-642.