Oxygen and carbon isotope records of freshwater pearl mussel, Hyriopsis schlegeli shell from Lake Kasumigaura, Japan

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Organic gemstone pearls attract people with its warm color and brightness. Natural pearls are formed in the occasion that outer mantle epithelial cell forms pearl-sac by accident. With this faculty, pearl farmers implant mantle pieces (a piece of outer mantle epithelial cell) along with or without nucleuses (a polished bead made from mussel shell) into gonad or connective tissue. Freshwater pearl mussel, Hyriopsis schlegeli is cultured in Lake Kasumigaura and its adjacent canal. H. schlegeli precipitates pearls many times faster than saltwater pearl mussel, even though freshwater is undersaturated with respect to calcium carbonate. In this study, we investigated shell structure and mineralogical and stable isotope compositions of the freshwater pearl oysters to examine biological control in bio-mineralizing processes. Microsampling was performed on multiple shell layers and pearls. This is the first report on isotope composition of freshwater pearls.

In order to produce pearls, a freshwater pearl mussel specimen was performed a surgical operation, planting mantle pieces into connective tissue on July 7, 2004, cultured for about 3 years in an aquaculture facility located in Shin-tone River, a canal connected to Lake Kasumigaura and collected on October 25, 2007. Each side of connective tissue had nine pearls and a total of 18 pearls were collected.

Shells of the freshwater pearl mussel are composed of prismatic outer shell layer, nacreous middle and inner shell layers. All shell layers consisted of aragonite. The oxygen isotope ratio profile of the outer shell layer showed a regular fluctuation of ˜6 per mil in amplitude, which may correspond to the seasonal variations of water temperature that the pearl mussel experienced. However, in detail, winter and summer extreme water temperatures were not recorded, indicating cessation of shell formation during summer and winter. Pearls showed three concentric ring structures inside and rings were presumably annual ones. The oxygen isotope ratios of pearls showed fluctuations corresponding to the structure with almost comparable range to that in the outer shell layers, suggesting the pearls grew continuously except for a relatively short period.