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Intraspecific variation in isotopic composition and trace element concentrations of Pleistocene brachiopods

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Carbon and oxygen isotope composition ($\delta^{13}C_{VPDB}$ and $\delta^{18}O_{VPDB}$) in fossil rhynchonelliform brachiopod shells has been used as a powerful tool to reconstruct paleoenvironmental conditions. Several petrographic and chemical techniques, such as transmitted light microscopy, cathodoluminescence, scanning electron microscope (SEM), and trace element analysis were applied in those studies to select brachiopod shells that have not been diagentically altered and retain their original isotopic and chemical composition. However, there are few references that showed how the isotopic and chemical composition is modified by several processes operating during meteoric diagenesis. Therefore, we conducted a comparative study of isotopic composition and trace element (Na, Mg, Sr, Mn and Fe) concentrations in modern and fossil brachiopod (*Kikaithyris hanzawai*) shells. The modern and fossil specimens were collected off Amami-o-shima and the Upper Pleistocene Wan Formation in Kikai-jima, respectively. The isotopic profiles of inner shell surface along the maximum growth axis can be divided into three stages that were likely to be related to changes in life mode and shell morphology of this species. The trace element concentrations are irregularly varied on the sampling transects. There are some spots on the sampling transects, where Mn and Fe concentrations are anomalously high. These spots are likely generated by metabolic factor(s) because they are not associated with decreases in $\delta^{13}C_{VPDB}$ and $\delta^{18}O_{VPDB}$ values which are indicative of meteoric diagenesis. Our results suggest that brachiopods with complicated shell morphology which may be related to the change in life mode during the growth are not suitable for paleoenvironmental reconstructions based on their isotopic composition. It is also suggested anomalously high Mn and Fe concentrations cannot be used to identify diagenetically altered portions within brachiopod shells.

Keywords: carbon isotope, oxygen isotope, trace element concentration, brachiopoda, proxy, Pleistocene