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Extraction of salinity proxy by means of high resolution minor trace element analysis in venerid bivalve shell

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Elemental profiles in biogenic carbonates such as corals and foraminifers are well-known proxies of climate change and past environmental conditions. For examples, Sr/Ca ratios in coral skeletons were used for reconstruction of oxygen isotope ratio of seawater (= salinity) with oxygen isotopes of the skeletons. Mg/Ca ratios in foraminiferal tests were regarded as important as proxies of seawater temperatures. However, the factors controlling the Element/Ca ratios of bivalve shells are generally much less understood than those governing stable oxygen isotope ratios. For this reason, there is no consensus to widely use bivalve shell Element/Ca rations for detailed environmental reconstruction.
Ba/Ca ratios have been proposed as a proxy of dissolved seawater Ba/Ca in coral skeletons and foraminiferal tests, providing information on salinity, nutrient and alkalinity distributions in past oceans (e.g., Sinclair and McCulloch, 2004). Ba/Ca peaks found in calcitic bivalve shells are related to phytoplankton blooms (Lezareth et al., 2003), salinity (Gillikin et al., 2006) but since they are apparently strongly species specific.
This study aimed to determine the proxy of environmental conditions of Ba/Ca profiles in an aragonite bivalve shell. We examined minor trace element compositions using LA-ICPMS in some live-caught shells of a venerid bivalve Phacosoma japonicum from Tokyo Bay, central Japan and also seawater collected same location. This species secrete lunar day-based microincrements (LDI) in the outer shell layer, so that we can mark calendar dates in the LDI sequence (Miyaji et al., 200 7). The obtained results were compared with the environmental data of the nearby seawater during which the shells grew. Some peaks showing high Ba/Ca ratios were recognized in the LDI portions formed during the monsoon (June/July) and typhoon seasons, which can be compared with the high Ba/Ca ratios in the seawater samples collected during the same seasons. These results suggest that the Ba/Ca profile in modern and fossil aragonitic bivalve shells can be used as a proxy of past and present seawater salinity.

Keywords: paleosalinity proxy, Ba/Ca, venerid bivalve