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The stable isotope composition of reef-dwelling foraminifers subjected to varied pCO_2 seawater

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Ocean acidification in response to rising atmospheric pCO_2 is generally expected to reduce rates of calcification by reef calcifying organisms, with potentially severe implications for coral reef ecosystems. Various studies have revealed potentially dramatic responses in a variety of calcareous organisms to the range of pCO_2 values projected to occur over this century. In our previous culture experiment with reef-dwelling foraminifers, *Amphisorus kudakajimensis* and *Calcarina gaudichaudii* at five different pCO_2 conditions seawater for four weeks, net calcification of *A. kudakajimensis* was reduced under higher pCO_2, whereas calcification of *C. gaudichaudii* generally increased with increased pCO_2. The contrasting responses are possibly due to differences in calcification mechanisms, but the factors affecting these calcification mechanisms are poorly understood. In this study, to get better understanding of the effect of ocean acidification on foraminiferal calcification, we cultured three reef-dwelling foraminifers: *Amphisorus hemprichii*, belong to imperforate species, *Baculogypsina sphaerulata* and *C. gaudichaudii*, belong to perforate species, using same experiment systems in the seawater of five different pCO_2 conditions for twelve weeks and we address the response of carbon and oxygen isotope compositions of the carbonate shells of foraminifers. Oxygen isotope value of cultured foraminiferal tests under five varied pCO_2 seawater indicated no significant correlation to pCO_2 values. The oxygen isotope values stay constant within narrower range from carbonate ion concentration. On the other hand, carbon isotope of foraminiferal tests indicated heavy trend with rising pCO_2 in all species. Alteration of carbonate chemistry result from ocean acidification may be effect strongly on carbon isotope composition relate to metabolic system. In perforate species, carbon isotopes are close to DIC value with increasing CO_2. It is possible that decreasing of metabolic CO_2 supply for the shell construction. In perforate species, both of oxygen and carbon isotope was lower than that in imperforate. For oxygen isotope variation possibility among species would be caused by their Mg-content concentration in calcite shells. The distinct difference in the level of carbon isotope values between pure calcite and perforate foraminifera might be influenced by the degree of dependency on metabolic CO_2 used for shell construction. While ˜7% of the carbon used for calcification would be derived from respiratory for the perforate species, the imperforate species would use most carbon derived from bicarbonate ion of seawater directly because carbon isotope of shell is almost same to that of pure calcite. This study suggested that oxygen and carbon isotope of foraminiferal test have the potential to reveal difference in calcification mechanism of two species.

Keywords: stable isotope, reef-dwelling foraminifera, ocean acidification