Effects of ocean acidification on shell and somatic growth, and stable isotopes of shell carbonate of two species of abalones

*Kozue Nishida[1,2], Akari Nagoshi[3], Atsushi Suzuki[1], Takahiro Irie[3], Masahiro Hayashi[4], Yuzo Yamamoto[4], Ryota Suwa[4], Yusuke Watanabe[4], Takashi Kikkawa[4], Mizuho Sato[1,5], Rei Nakashima[1], Yukihiro Nojiri[6,7], Hodaka Kawahata[3]

1.National Institute of Advanced Industrial Science and Technology, 2.The University Museum, UTokyo, 3.AORI, UTokyo, 4.Marine Ecology Research Institute, 5.Asahi Geo-Survey Co. Ltd, 6.Hirosaki University, 7.National Institute for Environmental Studies

Ocean acidification is now one of the important issue to appreciate the impact on marine calcifiers (IPCC, 2013), and potentially affects their survival, calcification, growth, physiology and development. To evaluate the effects of elevated CO_2 levels on shell and somatic growth, and stable isotope compositions of two species of abalones (*Haliotis discus discus*, *Haliotis gigantea*), we conducted culture experiments at three treatment levels of seawater pCO_2 (400, 750, and 1200 µatm), at approximately 23 °C.

The effects of seawater pH on calcification (shell width, shell weight) was non-significant in both species. On the other hand, the positive relationships between pH and wet weight of soft tissue of two species were observed. Their adjusted wet weight of soft tissue at 1200 µatm was significantly greater than that at 400 µatm. These results suggest that elevated pCO_2 affected their metabolism (e.g. higher metabolic rates to maintain homeostasis).

Stable oxygen isotope compositions of outer (calcite) and inner (aragonite) shell layers of two species showed non-significant relationships with pH. The negative correlations between carbon isotope compositions and pH of both layers appeared in both species, and the slopes of these relationships of shells were lower than that of dissolved inorganic carbon (DIC) of seawater. We estimated the equilibrium values of carbon isotope compositions at each pCO_2 treatment, and the difference between the carbon isotope compositions of shell and equilibrium values showed gradual increases in shell carbon isotope compositions with decreasing pH. Thus, the pCO_2-induced change in metabolism of abalones might appear in carbon isotope compositions of shells as the metabolic effect.

Keywords: ocean acidification, culture experiment, stable isotopes, abalone, metabolism, biomineralization

