Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

BBG020-02 Room:201B Time:May 24 16:45-17:00

Ocean acidification impact on calcification of reef-dwelling foraminifera

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Ocean acidification in response to rising atmospheric pCO2 is generally expected to reduce calcification by reef calcifying organisms, with potentially severe implications for coral reef ecosystems. Algal symbiont-bearing, reef-dwelling foraminifers mainly produce high-Mg calcite shells and are one of the most important primary and carbonate producers in coral reefs. Our previous laboratory experiments have shown that a decrease in pH causes Marginopora individuals to reduce their calcification rates [Kuroyanagi et al., 2009]. Here we report results of culture experiments using a high-precision pCO2 control system (the AICAL system) to investigate the effects of ongoing ocean acidification on foraminiferal calcification with possible near-future pCO2 conditions. We cultured asexually produced individuals of two foraminiferal taxa (Calcarina and Marginopora). These foraminifers were subjected to seawater with five different pCO2 levels from 300 to 1000 ppm for 4 weeks in an indoor flow-through system under constant seawater temperatures, light intensity, and photoperiod. After experiments, the shell weight of each cultured specimen was measured. The results showed that net calcification of Calcarina, which secretes a hyaline shell and is host to diatom symbionts, generally increased as pCO2 elevated. Contrary, Amphisorus, which secretes a porcelaneous shell and is host to dinoflagellate symbionts, tended to show reduced net calcification with higher pCO2 conditions. These different responses among taxa are possibly attributed to the decrease in carbonate ion concentration, an enhancement of calcification by CO2-fertilized photosynthesis of algal symbionts, and/or different calcification mechanisms among taxa. Our finding suggests that ongoing ocean acidification will be favorable for some hyaline taxa, but unfavorable for porcelaneous shells at higher pCO2levels.

Keywords: ocean acidification, reef-dwelling foraminifera, calcification, culture experiment