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Ocean acidification impact on growth and the pH dependence of trace elements in skeleton of hermatypic corals

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The rising CO_2 concentration in the atmosphere is changing the carbonate chemistry of the ocean. Elevated partial pressure of CO_2 (pCO_2) has caused significant decrease in surface seawater pH and carbonate ion concentration. Therefore, ocean acidification has a negative effect on calcification of marine calcifying organisms. Especially, hermatypic corals are basic animals in coral reef ecosystems, so their calcificication is a key to determine the health of reef ecosystems. Many researches have been studied on coral calcification, but the results of these studies have been differed from species, culture experiment periods and experiment conditions. In addition, the growth of the skeleton of polyp corals has been little studied. The aim of this study is to clarify the effects of acidified seawater on coral calcification and incorporation of trace elements into coral skeleton by rearing experiment with controlled environment factors.

Colonies of Acropora digitifera and Porites australiensis, which are the dominant species around the Ryukyu Islands, were collected at Sesoko Island, in the northern part of Okinawa, Japan. We reared polyp corals and adult coral nubbins of A. digitifera in seawater with different pCO_2 settings (300, 400, 600, 800, 1000ppm), and adult coral fragments of massive P. australiensis in seawater controlled different pH settings (7.4, 7.6, 8.0) controlled by CO_2 bubbling. Calcification rate of adult coral was calculated by weighting coral nubbins following buoyant weight technique once a week during the period of experiments, while skeletal growth of polyps was evaluated by measuring the dry weight of each skeleton at the end of experiments. The concentrations of trace elements in coral skeletons were analyzed by Inductively Coupled Plasma Mass Spectrometry (ICP-MS).

The results of experiments for A.digitifera showed that the growth rate of adult corals had no significant correlation against pCO_2, but dry weight of polyp skeletons decreased with increase in pCO_2. Growth rate of P. australiensis typically showed a positive correlation with pH. In addition, seawater pH seems to have impacts on incorporation of uranium into coral skeletons.