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Assessment of skeletal compositions in *A. digitifera* coral as temperature proxies

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Introduction

While biogenic carbonates such as foraminifera and coccolithophorid are attractive tools to reconstruct the past environments, scleractinian corals also provide environmental data around tropical to subtropical region with much higher time resolution. For example, oxygen isotope ratio (δ^{18}O) and strontium-calcium (Sr/Ca) ratio have been used for reconstructing sea surface temperature and salinity by generally using *Porites* spp. In this study, we investigate the effect of temperature on skeletal δ^{18}O and Sr/Ca ratio in *A. digitifera* corals for evaluating temperature proxies for one of paleoceanographic applications.

Materials and Methods

Three colonies of *A. digitifera* were collected at Sesoko Island, Okinawa, Japan. We reared coral samples in seawater with 5 different temperature settings (18, 21, 24, 27, 30 ℃) and set 2 tanks in each temperature treatment (3 coral nubbins$\times$ 3 colonies in a tank). Calcification rate of coral nubbins was measured by buoyant weight technique every two weeks during the period of experiments. Oxygen and carbon isotope ratios (δ^{18}O and δ^{13}C) were analyzed by a stable isotope ratio mass spectrometer, and the ratios of trace elements (Sr/Ca, Mg/Ca, U/Ca and Ba/Ca) were measured by an inductively coupled plasma mass spectrometer (ICP-MS).

Results and discussion

Skeletal δ^{18}O of corals is often used as a seawater temperature proxy. In this study, a strong negative correlation was found between δ^{18}O and water temperature, and the temperature dependency was comparable with that of *Porites* spp. Thus δ^{18}O of *A. digitifera* is suggested to be useful as a temperature proxy without clear influence from growth rate. A negative correlation was also observed between Sr/Ca ratio and temperature, which is compatible with that of *Porites* spp., although the correlation was weaker than δ^{18}O. But variation of Sr/Ca ratio was not controlled by skeletal growth rate, suggesting that the dominant factor controlling the skeletal Sr/Ca ratio is water temperature. Thus, skeletal δ^{18}O and Sr/Ca ratio of *Acropora* spp., at least *A. digitifera*, can be useful as a proxies for seawater temperature as well as *Porites* spp., although more investigation would be required for Sr/Ca-thermometer of *Acropora* spp.

Keywords: coral skeleton, temperature, proxy