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海洋酸性化がサンゴ群集の多様性および生産性に及ぼす影響
Ocean acidification impacts on coral biodiversity and productivity

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Introduction

Threatening of coral reefs by the climate change induced ocean acidification is now one of the biggest issues in the ocean ecosystem. Ocean acidification decreases the calcium carbonate saturation station, which result in the decrease of calcification rate of many calcifiers (Gattuso 1998, Kleypas 2004). Otherwise, the increase of seawater pCO_2 is predicted to increase the photosynthesis rate of phytoplankton and algae. Additionally, the seawater pH change will potentially affect the acid-base balance of marine organisms and impact their metabolic activity. In this study we focused on corals, and we experimentally evaluate the effects of ocean acidification on their physiology (calcification / photosynthesis / respiration). By integrating the future climate changing models and present results, we will discuss the potential impacts of ocean acidification on the coral biodiversity and productivity.

Methods

Three branching coral species from the family Acroporidae (*Acropora digitifera*, *A. tenuis* and *Montipora digitata*), and one encrusting coral species from the family Siderastreidae (*Psammacora contigua*) were collected from the patchy reefs in Okinawa island. All these species are highly common in the indo-pacific coral reefs. Several nubbins or mass of corals were taken from different colonies (5~10) and cultured for about one month under 3 different seawater pCO_2 conditions (380 ~2,300 ppm). These CO_2 conditions were selected according to the IPCC2007 models. All cultures were conducted under natural light conditions and flow through system. The seawater chemistry (pH, total alkalinity, salinity, temperature) was measured every day. Buoyant wet-weight was measure every week, and the physiology (calcification / photosynthesis / respiration) was measured at the end of culture using total alkalinity (TA) and total inorganic carbon (DIC) measurement technique.

Results and discussion

The sensitivity of corals to the ocean acidification was highly diverse among species. While *Montipora digitata* showed the highest decrease on calcification rate, *Psammacora contigua* show less sensitivity and *A. digitifera* was completely insensitive to high CO_2. Additionally, light and dark calcification rate were differently affected between species, and we suggest that dark calcification is possibly one of the keys that dominate the sensitivity of corals to the ocean acidification.

Photosynthesis rate of most corals was not affected by ocean acidification. Otherwise, the respiration rate of both *A. tenuis* and *P. contigua* increase with seawater pCO_2 rise. Since the metabolic activity of corals highly influence the seawater carbonate chemistry, these physiological impact induced by the ocean acidification is suggested to feed back on the reef water carbonate chemistry and may change the coral reef carbon cycle. Additionally, the species-specific response of corals to the ocean acidification is suggested to change the coral community structure and may result in the decrease of coral reef biodiversity.

キーワード: 酸性化, サンゴ, 石灰化, サンゴ礁, 気候変動