海洋酸性化と温度ストレスに対する造礁サンゴ類の群体特異的応答

Form 3

Abstract

Colony-specific responses of scleractinian corals to ocean acidification and temperature stress

Anthropogenic climate change is an ongoing concern, and can impact reef-building corals in different forms. Of these global warming and ocean acidification are known as potentially the most devastating threats. As well, in recent years, the incidence of cold temperature events is also considered an important stress for coral reefs. Coral responses at genus, species and population levels to the aforementioned stresses have been studied. However, intercolonial responses of corals, particularly to combined stresses, have been overlooked. In this doctoral dissertation, I first investigated coral responses to the 2012 massive bleaching in the northern Persian Gulf using a colony-based method. I then investigated how individual coral colonies (genets) and their endosymbiont *Symbiodinium* spp. respond to acidified conditions, anomalously high and low temperatures and their combinations in laboratory experiments in Okinawa. The main findings of these experiments include the following: 1) regardless of the type of stress there are significant intercolonial differences among colonies in a given population even when the number of studied colonies is limited; 2) although a few coral colonies of *Montipora digitata* died 1-3 months after being exposed to high thermal stress (31°C-31.6°C for 41 days), the reminder showed opposite post-bleaching responses; 3) colonies of *Montipora digitata*, exposed to acidified conditions under natural light and temperature conditions for 110 days, showed reverse calcification rates and although the majority of colonies had declined calcification rates, two colonies showed stable calcification rates and one showed decalcification; 4) combination of anomalous high temperature and acidification confirmed high intercolonial variations and revealed that tolerance to either OA or T is not synonymous with tolerance to the other parameter and tolerance to both OA and T does not necessarily lead to tolerance of OA and T combined; 5) a combination of anomalous low temperature and acidification, in spite of colony-specific impacts, led to partial mortality of *Montipora digitata*, 6) intercolonial differences in responses to stresses are not related to *Symbiodinium* type as colonies with similar *Symbiodinium* types show different responses, and 7) pooled data obscure actual responses of individual colonies or present a response that is not observed in any individual. From the numerous results of this study I recommend incorporating colony-specific investigations to experimental designs of studies to better understand coral physiological responses to climate change.

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