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Collaboration between Yamagata University and Kamo Aquarium – Rapid adaptive evolution of jellyfishes inhabiting marine lakes in Palau

Zusammenarbeit zwischen der Universität Yamagata und dem Kamo Aquarium – Schnelle adaptive Evolution der Quallen in marinen Seen auf der Insel Palau

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Abstract

The Palau Project Group at the Faculty of Science, Yamagata University, Japan has collaborated with the Tsuruoka City Kamo Aquarium, Yamagata, Japan since 2003. The Palau Islands include approximately 70 marine lakes formed by the rising of ancient coral reefs. In some marine lakes that are completely isolated from outer lagoons, seawater can soak through minute pores in the limestone surrounding the lakes, causing tidal changes to occur. However, marine organisms cannot enter or exit marine lakes. Based on our previous evolutionary genetic analyses, certain fish (in Atherinidae, Apogonidae, and Gobiidae) and mussels (in Mytilidae) exhibit distinct patterns of evolution between marine lake and outer lagoon populations, and also among marine lake populations. Dawson and Jacobs (2001) reported that three distinct species of moon jellyfishes are distributed in Palau; *Aurelia* sp. 3 and *Aurelia* sp. 6 inhabit outer lagoons and *Aurelia* sp. 4 inhabits marine lakes. We surveyed

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and collected jellyfish and confirmed that the species are highly differentiated both genetically and morphologically. Based on additional comparative observations of *Aurelia* sp. 4 and *Aurelia* sp. 3, the former clearly exhibits specific morphological and ethological characters adapted to the environmental conditions that characterize calm marine lakes. Based on geological estimates of marine lake formation, such adaptive evolution in jellyfish occurred rapidly between 5,000 and 15,000 years ago.

Keywords: Adaptive evolution; Jellyfish; Marine lakes; Geographical isolation; Palau

Introduction

The Palau Project Group at the Faculty of Science, Yamagata University, Japan has collaborated with the Tsuruoka City Kamo Aquarium, Yamagata, Japan since 2003. There are approximately 70 marine lakes formed by the rising of ancient coral reefs after the Last Glacial Maximum (approx. 18,000 years ago) in the Palau Islands (Dawson & Hamner, 2005; Fig. 1). In some marine lakes that are completely isolated from outer lagoons, tidal changes have occurred, as seawater can soak through minute pores in the limestone surrounding the lakes. However, marine organisms cannot enter or exit these lakes. Marine lakes and outer lagoons differ in environmental conditions and in species composition, including that of jellyfish, sea anemones, sea cucumbers, mollusks, crustaceans, and fish.

Previously, we performed evolutionary genetic studies on marine animals in Palau marine lakes, and demonstrated conspicuous patterns of divergence between marine lake

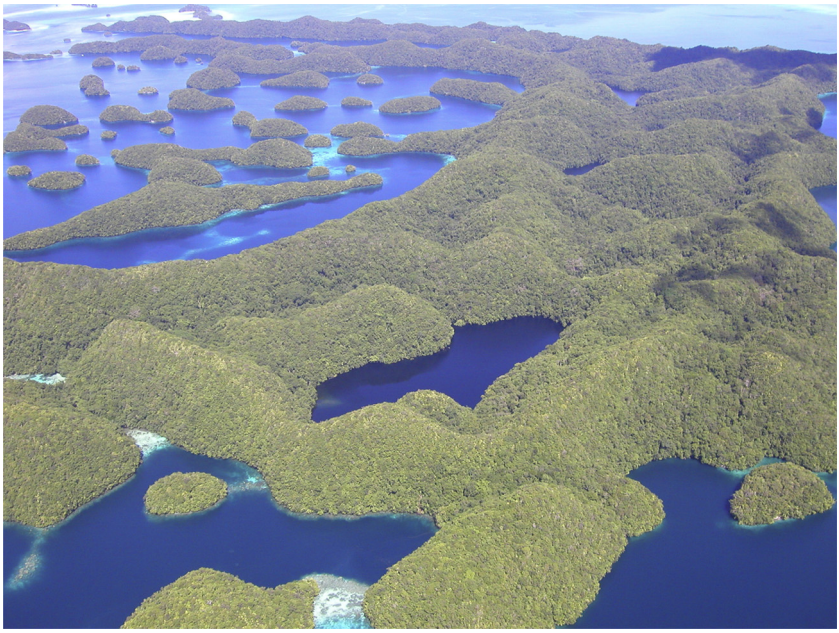

Fig. 1. Aerial photograph of marine lakes in Mecherchar Island, Palau.