The relative intensity of kinetic and metabolic isotope effects for skeletal carbon and oxygen isotopes in *Porites* corals

TAMANO OMATA[1], ATSUSHI SUZUKI[2], HODAKA KAWAHATA[2,3] AND MINEO OKAMOTO[4]

[1]Marine Ecosystems Research Department, Japan Marine Science and Technology Center (JAMSTEC), 2-15 Natsushima, Yokosuka, Kanagawa 237-0061, Japan (omatat@jamstec.go.jp)

[2]Institute for Marine Resources and Environment, National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Ibaraki 305-8567, Japan

[3]Tohoku University Graduate School of Science, Sendai, Miyagi 980-8587, Japan

[4]Tokyo University of Fisheries, Minato-ku, Tokyo 108-8477, Japan

Introduction

We discuss the relationships between kinetic isotope effect and metabolic effect in *Porites* coral skeletons using vector notation.

Method

Porites corals, which were collected at depths between 11.6 and 15.1 m below mean sea level, showed relatively large differences in skeletal linear growth rates ranging between 2.4 and 8.0 mm yr^{-1}. Then oxygen and carbon isotope ratios are measured at intervals of 400 micro meters along coral growth axis.

Discussion and result

Fast-growing corals (> 4.8 mm yr^{-1}) from shallower depths (< 13.0 m) showed a negative correlation between carbon and oxygen isotope ratios, which is consistent with the previously reported relationship for corals at low-tide line in the region. The negative correlation is caused by a metabolic effect, which is photosynthetic ^{13}C enrichment in the coral skeleton due to strong solar radiation in summer, together with greater depletion of ^{18}O due to higher SSTs. On the other hand, slow-growing corals (< 4.8 mm yr^{-1}) in the deeper region (> 14.4 m) showed a positive correlation between oxygen and carbon isotope ratios.

Conclusion

Negative correlation between carbon and oxygen isotope ratio for rapid growing corals are due to stronger effect of metabolic effect than KIE. While positive correlation for slow growing corals are due to weaker effect of metabolic effect.

Chemical characterization and microbial diversity within high Arctic cryptoendolithic habitats

C. R. OMELON AND F. G. FERRIS

Department of Geology, University of Toronto, Toronto, Ontario, Canada (omelon@geology.utoronto.ca)

Introduction

Microbial communities inhabiting the near-surface environment of sandstone outcrops on Ellesmere Island in the Canadian high Arctic are a unique example of microorganisms maximizing opportunities for survival in polar desert regions. Current research shows that the subsurface "zone of habitability" experiences warmer temperatures and prolonged moisture retention in comparison to the rock surface, which provides significant advantage for microbial growth and sustainability over direct exposure to the harsh polar climate. Earlier work on cryptoendolithic environments hosting microbial populations in the Antarctic Dry Valleys shows similar physical and microbial conditions, providing a valuable opportunity to compare these habitats.

Microbiology and Biogeochemistry

Microorganisms inhabiting high Arctic cryptoendolithic environments include algae and cyanobacteria as well as heterotrophic bacteria and fungi, but the diversity of dominant microbial populations varies between sites. Published reports of Antarctic cryptoendolithic communities show similar patterns of microbial variability as well as variations in the chemical composition of host substrates at the different sites. Vertical redistribution patterns of inorganic elements suggests that microbial activity plays an important role in creating conditions for nutrient availability and subsequent colonization. Consequently, this activity leads to increased rates of weathering of the host substrate and subsequent destruction of cryptoendolithic habitat.

This work focuses on identifying relationships between the chemical environment and microbial diversity as well as related biogeochemical interactions at sites with different microbial populations. The high Arctic experiences overall warmer temperatures and higher levels of precipitation than the Antarctic Dry Valleys, which suggests higher rates of microbial activity and associated mobilization of inorganic elements and nutrients within the cryptoendolithic habitat. These conditions, however, are also likely to accelerate weathering rates of the host substrate. Assessing the balance between these factors and their consequences for cryptoendolithic microbial activity is currently under investigation.

References

Friedmann E.I. (1982), *Science* **215,** 1045-1053.

Johnston C.G. and Vestal J.R. (1989), *Geomicrobiol. J.* **7,** 137-153.