Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

BPO02-06 Room:103 Time:May 25 10:45-11:00

Mg isotope fractionation in Porites coral skeletons: evaluation of a new climate proxy from culture experiments

YOSHIMURA, Toshihiro[1*], Masaharu Tanimizu[2], SUZUKI, Atsushi[3], INOUE, Mayuri[4], Kaneko Koga[5], Kazuhiko Sakai[5], KAWAHATA, hodaka[4]

[1]graduate School of Frontier Sciences, The University of Tokyo, [2]KCC, JAMSTEC, [3]geological Survey of Japan, National Institute of Advanced Industrial Science and Technology, [4]atmosphere and Ocean Research Institute, The University of Tokyo, [5]Tropical Biosphere Research Center, University of the Ryukyus

Recent developments in inorganic mass spectrometry have allowed new stable isotope systems to be explored by paleoceanographers. In the field of low-latitude climate reconstruction, proxy developments in massive hermatypic corals are still highly desirable for more accurate temperature reconstructions. Stable isotope compositions of the major and minor constituents, such as Ca and Sr, of coral aragonite are potentially new proxies for environmental studies (Boehm et al., 2006; Fietzke and Eisenhauer, 2006). These studies have focused on the temperature dependency of isotope fractionation during the precipitation of biogenic carbonates, because water temperature is the most fundamental parameter controlling the earth's surface environment. Although Sr/Ca is regarded as useful temperature proxy, Mg/Ca is thought to mainly reflect the growth rate (e.g., Inoue et al., 2007). Evaluation of Mg isotope fractionation process in hermatypic coral aragonite must be addressed in order to understand a coral biomineralization and develop a new palaoceanographic proxy. Many researchers have analyzed Ca isotopes in biogenic and inorganic calcium carbonates, with the first objective being to evaluate them as a potential new paleothermometer. They have found a small but resolvable temperature dependence of Ca isotope fractionation (e.g., Gussone et al., 2009). Strontium is important minor element in CaCO3, and in inorganic aragonite and cultured hermatypic corals, it displays similar isotope fractionation mechanisms to those of Ca (Fietzke and Eisenhauer, 2006). Previous studies have reported some steeper temperature dependence (slopes) in Ca and Sr isotope fractionation of biogenic CaCO3 and the differences in temperature slopes are interpreted as a large kinetic isotopic effects depending on how fast the crystal growing rate and relative mass difference (rmd) among isotopes. Growth effects on Mg isotope are expected to be highly concerned since Mg/Ca is known to clearly dependent on growth rates (Inoue et al., 2007). In this study, we performed high-precision Mg isotope measurements in Porites coral cultured in thermostated tanks. We here evaluate the plausible factors controlling Mg isotope fractionation in coral CaCO3 skeletons and present the relationships between Mg isotope values and e.g., water temperature, minor elemental concentrations, growth rates.

Keywords: hermatypic coral, magnesium isotope, MC-ICP-MS, culture experiment