Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

BPO003-P01 Room:Convention Hall Time:May 26 14:00-16:30

Three sets of temperature proxy revealed from coral Porites cylindrica

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Numerous studies on scleractinian corals, especially massive Porites corals, have been conducted to establish potential tracers (Sr/Ca, Mg/Ca, and U/Ca) of sea surface temperature (SST) (e.g., Beck et al., 1992; Min et al., 1995; Mitsuguchi et al., 1996). In particular, the Sr/Ca of aragonitic coral skeleton is widely used to reconstruct SST variability using modern and fossil corals (e.g., Gagan et al., 1998). It should be noted that most of previously published paleothermometers have been derived from massive Porites corals, thus evaluation of other coral species as useful proxy is also significantly required which may provide more detailed investigation of paleoenvironmental reconstruction with high temporal and spatial resolution. Recently some investigations suggested that the coral Mg/Ca ratio significantly reflects not only seawater temperature, but also skeletal growth effects (Inoue et al., 2007). In order to examine such effect, data on culture experiment of coral species having variable growth rate are needed.

With these objectives in mind, we conducted a laboratory culture experiment utilizing scleractinian branching coral Porites cylindrica to examine the incorporation of Sr, Mg and U into the skeletons under three temperature settings (22, 26, and 30 degrees C), and subsequently evaluate the reliability of Sr/Ca, Mg/Ca, and U/Ca as potential seawater temperature proxies. The advantage of using P. cylindrica is that it has a relatively higher growth rate of up to ˜3 cm/year (Custodio III and Yap, 1997) compared to massive Porites corals. P. cylindrica is a branching stony coral widely distributed in the tropical-to-subtropical Indian and Pacific Oceans and is very common in shallow water near the coast (Veron, 2000). Hence, results of this study will provide new valuable information for reconstructing past SST variability, which will contribute to the development of paleoceanography and paleoclimatology.

Keywords: Porites cylindrica, paleothermometer, metal/Ca ratio, culture experiment, distribution coeffiient