

Sea surface pH over the last 7 kyr reconstructed by boron isotope ratio of sclerosponges

K. TANAKA^{1*}, K. SHIRAI¹, A. KITAMURA^{2,3}, R. SHINJO⁴

¹ Atmosphere and Ocean Research Institute, Univ. Tokyo, Japan (*correspondence: kentaro.t1@gmail.com)

² Faculty of Science, Shizuoka Univ., Japan

³ Center for Integrated Research & Education of Natural Hazards, Shizuoka Univ., Japan

⁴ Dept. Physics & Earth Sciences, Univ. Ryukyus, Japan

The atmospheric CO₂ concentration ($p\text{CO}_2$) has changed with glacial/interglacial cycles during the last 800 kyr. From the last glacial maximum to pre-industry age, $p\text{CO}_2$ rose from 180 to 280 ppmv. Since seawater pH responds to the CO₂ flux between the atmosphere and the ocean, change in $p\text{CO}_2$ is accompanied by pH shift in the oceans. In this study, sea surface pH in the last 7 kyr is estimated by $\delta^{11}\text{B}$ of sclerosponge skeletons.

Fossils of sclerosponge (*Astrosclera willeyana*, n=24) were collected from the cave sediments (10–30 m water depth) in Okinawa, Japan, which includes the deposit over the last 7 kyr (Yamamoto et al., 2009). After micro-sublimation separation of boron, $\delta^{11}\text{B}$ were measured by multi-collector ICP-MS housed at University of Ryukyus.

$\delta^{11}\text{B}$ varied in the narrow range (~19 – 20‰). Considering that $\delta^{11}\text{B}$ of sclerosponges is restricted by surrounding pH, the sea surface pH derived from $\delta^{11}\text{B}$ ranges between ~8.1 and 8.2. Assuming constant total alkalinity, CO₂ concentration in seawater was calculated to be ~230 – 280 μatm . These results imply that CO₂ concentration in the western Pacific has been stable from 7 ka to the pre-industrial age, being nearly equilibrium to $p\text{CO}_2$. Further, we also discuss the vital effect on $\delta^{11}\text{B}$ of sclerosponges.

Reference

Yamamoto, N., Kitamura, A., Ohmori, A., Morishima, Y., Toyofuku, T., Ohashi, S., 2009. Long-term changes in sediment type and cavernicolous bivalve assemblages in Daidokutsu submarine cave, Okinawa Islands: evidence from a new core extending over the past 7,000 years. *Coral Reefs* 28, 967–976.