Super-high resolution analysis of mussel shell by NanoSIMS

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Previous super-high resolution analysis of cultivated giant clam shells showed a diurnal variation in the Sr/Ca ratio, which may reflect the daily light cycle [1]. To apply the analytical method to other biogenic carbonate skeleton, we adopted a Mediterranean mussel (*Mytilus galloprovincialis*) collected at the Otsuchi bay, on the Pacific coast of northeastern Japan. This bivalve was living at intertidal zone and colletected on September 6th 2011, that should have experienced a great tsunami induced by the 2011 magnitude 9.0 Tohoku-Oki earthquake on March 11th.

Soft tissues were removed from mussel and the shell was cut along the maximum growth axis and mounted in Araldite disk together with a carbonate standard. This species is known to form a growth line with organic matter daily or bidaily at the air exposure time [2], which may facilitate age-model with tidal record by counting the etched-stained lines by “Mutvei’s solution”. After polishing and gold coated, we analyzed Mg/Ca, Sr/Ca and Ba/Ca ratios of the shell by low resolution (10-micron spot at 100-micron interval) and high resolution (2-micron spot at 3-micron interval) using NanoSIMS [3].

Annual variations of Mg/Ca and Sr/Ca ratios, high in summer and low in winter, are clearly visible at low resolution. Mg/Ca ratios of the inner edge, corresponding to most recent date, show daily or bidaily cyclic changes at high resolution. High values are probably derived from the time of air exposure at low tide. Significant Mg/Ca variation, up to 10 times of normal tide, is found at the tsunami part.

[1] Sano *et al* (2012) *Nature Commun* **40**, 597-608. [2] LeGall (1970) *C.r.hebd. Seanc Acad Sci Paris*, **D270**, 509-511. [3] Sano *et al* (2005) *Anal Sci* **21**, 1091-1097.