

High resolution analysis of bivalve shell by NanoSIMS

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We developed a method to measure Mg/Ca, Sr/Ca and Ba/Ca ratios of natural carbonates with high resolution using NanoSIMS. Previous analysis of cultivated giant clam shell with 2 micro-meter spot showed a diurnal variation in the Sr/Ca ratio, which may reflect the daily light cycle. In order to apply the analytical method to other bivalve shell, we measured Mg/Ca, Sr/Ca and Ba/Ca ratios of a Mediterranean mussel collected at the Otsuchi bay, on the Pacific coast of northeastern Japan. This bivalve was living at intertidal zone and collected on September 6th 2011. 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, which may facilitate age-model with tidal record by counting the etched-stained lines. After polishing and gold coated, we analyzed trace elements of the shell by low resolution (10 micro-meter spot at 100 micro-meter interval) and high resolution (2 micro-meter spot at 3 micro-meter interval) using NanoSIMS installed at University of Tokyo. Annual variations of Mg/Ca ratios, high in winter and low in summer, are clearly visible at low resolution, similar to those of cultivated giant clam shell. Mg/Ca ratios of the inner edge, corresponding to most recent date together with data of December 2010 estimated by the age-model, show daily or bidaily cyclic changes at high resolution. High Mg/Ca ratios are probably derived from the time of air exposure at low tide when the shell is closed.