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NanoSIMS analysis of trace elements in a giant clam shell

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A giant clam is a marine bivalve living in tropical and sub-tropical regions of the Indo-Pacific Ocean. Since the clam lives up to 100 years and the shell secretes annual as well as daily layers of aragonite, it may keep a key information of marine environment with a high resolution. The stable isotope composition of modern clam shell has been studied [1], while trace element geochemistry is not well documented [2]. In this work we have measured Sr/Ca, Mg/Ca and Ba/Ca ratios of a giant clam shell collected in Ishigaki Island by using a NanoSIMS.
Analyzed sample is a giant clam (Tridacna derasa) cultivated from March 2003 to October 2005 in the Ishigaki Island of Japan. The sample shell was cut to expose the section at the maximum growth axis and mounted in an epoxy resin disk together with a carbonate standard (JCp-1). They are polished to provide a flat surface for sputtering of secondary ions. The Ca, Sr, and Mg abundances in the sample were first imaged by using a EPMA. Then annual and daily variations of trace elements were measured by using a NanoSIMS. For the long-term variation, we have used 20 micro-meter diameter spot of oxygen primary beam and analyzed the Mg/Ca, Sr/Ca and Ba/Ca ratios of the sample along the growth axis of inner layer from the bottom to the top at 50 micro-meter interval. For short-term variation, we have measured the Mg/Ca and Sr/Ca ratios by using 2 micro-meter diameter spot at 2 micro-meter interval from the bottom to about 470 micro-meter ahead. Experimental details are give else where [3].
It is noted that the long-term variation covers date approximately from October 2005 (bottom) to October 2003 (top). There is a tendency that the Mg/Ca and Sr/Ca ratios are low in summer and high in winter even though there are irregular variations in the Mg/Ca ratio. On the other hand the Ba/Ca ratio is high in summer and low in winter. Phase of the Sr/Ca variation agrees well with that of sunlight intensity and slightly different from that of seawater temperature. By counting the daily layer, the short-term variation covers from October 14 to September 22 of 2005 (22 days). It is reported that there is a positive correlation between the sunlight intensity and width of daily layer [4]. An EPMA mapping observation shows that the Sr counter is high in the wide layer and low in narrow. There is a significant daily variation of Sr/Ca ratio by NanoSIMS analysis. The ratio is apparently high in the night and low in day time. These evidences as well as the long-term variation suggest that the Sr/Ca ratio of a giant clam shell is a possible hyper-fine pyrheliometer at few hours.
References [1] Aharon (1983) Nature 304, 720; Watanabe & Oba (1999) J. Geophys.Res. 104, 20 667 [2] Elliot et al. (2009) Palaeogeo. Palaeocli. Palaeoecol. 280, 132. [3] Sano et al. (2005) Anal. Sci. 21, 1091. [4] Hirunuma & Nakamori (1995) Monthly Earth 17, 718.

Keywords: Giant clam shell, high resolution analysis, NanoSIMS, Sr/Ca ratio, daily variation, annual variation