Trace element concentrations in carbonate reference materials; coral JCp-1 and giant clam JCt-1 by inductively coupled plasma mass spectrometry

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The $CaCO_3$ (aragonite) skeletons of reef-building corals are potentially useful indicators of the chemistry of seawater around corals. Monitoring both natural and anthropogenic impacts in the marine environments is important for predicting the future of global environment and annually-banded massive corals provide good archive of such impacts. However, the problems, such as sample pretreatment procedure, are still a matter of debate. Therefore establishing reference values of trace elements in the carbonate reference material, especially aragonite, is necessary to overcome these problems. The Geological Survey of Japan (GSJ) prepared carbonate reference materials, coral JCp-1 and giant clam JCt-1 from *Porites* sp. skeleton and *Tridacna* gigas shell, respectively. In order to use these carbonate reference materials as standards for trace elements, we determined nineteen trace elements in JCp-1 and sixteen in JCt-1 (measured elements are listed at the end) using Inductively Coupled Plasma Mass Spectrometry (ICP-MS; Hewlett Packard HP 4500). The standard addition method was used in order to control the matrix effect. Carbonate samples were digested in Teflon beakers by 2% HNO_3 and scandium, yttrium and bismuth were added as internal standards. Precisions for trace elements, such as cadmium, barium and lead in JCp-1, were typically better than 10% RSD (relative standard deviation). Although the concentrations of all trace elements, except for Cu, in JCt-1 were lower than those in JCp-1, precisions for all elements with concentrations higher than 0.04 $\mu g\ g^{-1}$ were also better than 10% RSD. The reference values of trace elements in these reference materials will cotribute to environmental reconstruction based on coral skeletal analyses.

Measured elements in Coral JCp-1: Lithium (Li), Vanadium (V), Chromium (Cr), Manganese (Mn), Cobalt (Co), Nickel (Ni), Copper (Cu), Zinc (Zn), Rubidium (Rb), Zirconium (Zr), Molybdenum (Mo), Silver (Ag), Cadmium (Cd), Tin (Sn), Caesium (Cs), Barium (Ba), Tungsten (W), Lead (Pb), Uranium (U).

Measured elements in Giant Clam JCt-1: Li, V, Mn, Co, Cu, Rb, Zr, Mo, Ag, Cd, Sn, Cs, Ba, W, Pb, U.

Long paleoenvironmental records in Lake Baikal sediment cores

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Purpose of this study

The information of long-term paleoenvironmental changes is mainly obtained by the analyses of marine sediment cores, but is scarcely obtained from lake sediment cores in continental interior. We report organic components in the BDP96&98 sediment cores from Lake Baikal to elucidate paleoenvironmental changes during the last 12 Myr in the Eurasian continental interior and in the world.

Biological production

Total organic carbon (TOC) contents ranging from 0.13 to 2.8% with an average of 0.93% showed that biological production in the Lake Baikal basin was generally low during the last 12 Myr. The TOC contents demonstrated that biological production changed largely in short-period of time (within 1.2 kyr).

Paleoenvironmental change

The TOC and total nitrogen (TN) contents revealed the decrease of biological production less than a half from the past 12 Myr to the present caused by global cooling of the climate. The major warming episodes were the past 12-9.5, 7.7-7.0, 4.4-3.6 and 2.0-1.6 Myr, while the major cooling episodes were the past 8.6, 6.2-5.8, 2.8-2.2 and 1.2 Myr. The higher biological production in the warm with humid climate conditions was mainly attributed to the contribution of land vascular plants.

Molecular information

Long-chain *n*-alkanes (>C_{20}), *n*-C_{27}, *n*-C_{29} and/or *n*-C_{31}, and long-chain *n*-alkanoic acids, *n*-C_{26} and *n*-C_{28} were abundant in the sediment cores, and reflecting that dominant plants of the Lake Baikal basin were *Pinus* spp., *Betula* spp., *Salix* spp., etc. Normal-C_{31} alkane is a marker of herbaceous plants, increased from 1 Myr ago to the present, suggesting the aridification of the Baikal basin. Squalane which is a marker of methanogens, was abundant at the past 9.5, 6.3, 5.1 and 0.9 Myr. Changes in the $C_{29}/(C_{27}+C_{29})$ sterol ratios showed the contribution of allochthonous organic matter, and were consistent with those in the allochthonous matter estimated from the TOC/TN ratios. C_{27} stanol/sterol ratios suggested that the lake bottom was oxic condition for the past 12-10 Myr, but was anoxic condition for the past 8-6 Myr.