Trace Element Concentrations in GSJ Carbonate Standards, JCp-1 and JCt-1 by Inductively Coupled Plasma Mass Spectrometry

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The CaCO3 (aragonite) skeletons of reef-building corals are potentially useful indicators of the chemistry of ambient seawater around corals. Monitoring both natural and anthropogenic impacts in the present and also past marine environments is important for predicting the future of global environments and annually-banded massive corals provide good archive of such impacts. However, the concentrations of elements in coral skeletons have been reported in a wide range due to differences in analytical methods and sampling sites. Another technical problem, sample pretreatment procedure, is still a matter of debate. Establishing reference values of trace elements in calcium carbonate, especially aragonite, is necessary to overcome these problems. Geological Survey of Japan (GSJ) prepared carbonate reference materials, Coral JCp-1 and Giant Clam JCt-1 from skeleton of Porites sp. and Tridacna sp., respectively. In order to improve the reliability of trace elements in a coral skeleton as environmental proxies, we determined nineteen trace elements in JCp-1 and sixteen in JCt-1 (measured elements are listed at the end). Determination of elements was conducted using Inductively Coupled Plasma Mass Spectrometry (ICP-MS; HP 4500) following the standard addition method in order to control the matrix effect and to gain accurate and high precision results. Carbonate samples were digested by only 2% HNO3 in Teflon beakers without any pre-concentration or ion exchange in order to minimize blank values and shorten the time-consuming process. Scandium, yttrium and bismuth were added as internal standards. Number of determinations were eight consisting of four selected bottles of reference materials and duplicates of each digested solution. Precisions for trace elements, including cadmium, barium and lead in JCp-1, were typically better than 10% RSD (relative standard deviation) and concentrations ranged from 0.002 ug g-1 (Cs) to 8.02 ug g-1 (Ba). Although the concentrations of all trace elements in JCt-1 were lower than those in JCp-1, precisions for all elements with concentrations higher than 0.04 ug g-1 were also better than 10% RSD, and concentrations were found to be between 0.001 ug g-1 (Cs) and 4.84 ug g-1 (Ba). The concentrations of more than fifteen trace elements in the carbonate reference materials are reported here for the first time.

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