Oxygen isotopic records for the dual habitat of the Late Cretaceous inoceramid bivalves

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The extinct bivalve inoceramids which had been widely diversified in the Jurassic and Cretaceous are known with their unique taphonomy and gigantic size. Some species reached more than 2 m in their shell height, and some other species inhabited the apparent oxygen depleted sea floor. Especially for those recovered from the oxygen depleted condition, their mode of life has been subjected to great argument. The two alternative explanations of their habitat are benthic and pseudoplanktic. Because this heated argument is originally based on modes of occurrence of the fossil inoceramids, it is rather difficult to come to a conclusion only with those taphonomical approaches. On the other hand, oxygen isotopic compositions of their well developed outer prismatic shell layers composed of calcite have been analyzed to discuss their habitat. However, though some analyses produced rather high $d^{18}O$ value which can be comparable to that of benthic foraminifers, others indicate low $d^{18}O$ value of -3 ˜-8 (permil VPDB). Therefore those isotopic compositions have been recognized to be diagenetic signals, and inoceramid habitat has been still debated. Here we present oxygen isotopic analyses of exquisitely well preserved aragonitic inner nacreous layers to discuss the habitat of the late Cretaceous inocermaids.

Inoceramid samples recovered from the Yezo Group, northwestern Hokkaido were utilized for isotopic analyses. In addition to those inoceramids, isotopic compositions of planktic and benthic foraminifers were also analyzed to investigate the thermal structure of the water column. Isotopic temperatures of those foraminifers indicate that surface and bottom water temperatures were 27 and 19 degree C, respectively. Average isotopic temperatures of each inoceramid individual show distinctive bimodal distributions. Among the specimens analyzed, 5 individuals represent 26 ˜29 degree C, which is equivalent to planktic foraminifers. On the other hand, other 2 individuals indicate 21 degree C, which can be comparable to benthic foraminifers. Very interestingly, though 3 individuals of *Sphenoceramus naumanni* indicate high temperatures, the rest of 2 individuals of *S. naumanni* represent low temperatures. Because the single species produced both of high and low temperatures, this bimodality can't be explained with the 'vital effect'. Alternatively, this bimodality of the calcified temperatures of inoceramids probably indicates two different mode of life of the late Cretaceous inoceramids, namely, these inoceramids analyzed exhibit both of benthic and pseudoplanktic mode of life.