

Perturbations of the nitrogen cycle in mid-Panthalassa in the Late Guadalupian (Middle Permian)

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To examine the changes in the oceanic N cycle and their possible relationships to the extinction at the end-Guadalupian (Middle Permian), we analyzed the N isotopic compositions ($d^{15}N$) of the upper Guadalupian paleo-atoll limestone, accumulated on the top of a mid-oceanic seamount in the superocean Panthalassa, at Akasaka in central Japan. The $d^{15}N$ values of the limestone are substantially high (ca. +20 permil on average) throughout the analyzed interval. These values are the highest in the previously reported $d^{15}N$ records throughout the entire Phanerozoic. The substantially high $d^{15}N$ values suggest enhanced oceanic denitrification/anammox in the Capitanian (Late Guadalupian). Moreover, the present results revealed remarkably large $d^{15}N$ fluctuations in the analyzed limestone at Akasaka. We interpret that periodic expansion and reduction of the oxygen minimum zone (OMZ) in mid-Panthalassa caused the observed $d^{15}N$ fluctuations in the Capitanian. The suggested OMZ expansions may have been attributed to the high productivity 'Kamura event' in the surface oceans enhancing a biological pump. Chemostratigraphic correlations imply that the enhanced denitrification in the expanded OMZ may have been a global phenomenon in the Capitanian. Widespread developments of the anoxic deep-waters prior to the extinction may have stressed the shallow-marine biota by upwelling at the end-Guadalupian.