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Bio- and chemostratigraphy (87Sr/86Sr, d13C$_{carb}$) across the Middle-Late Permian boundary: the Akasaka Limestone case

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The end-Permian mass extinction event was double-phased. The first extinction occurred across the Guadalupian-Lopingian boundary (G-LB) recorded as the high biodiversity drop of the Permian fauna. In order to clarify the global environmental change around the G-LB, detailed litho-, bio-stratigraphy and isotope stratigraphy of ^{87}Sr/^{86}Sr and d^{13}C$_{carb}$ were analyzed at Akasaka Fm. in central Japan.

Akasaka Limestone forms a part of a paleo-atoll complex deposited primarily on the top of a mid-Panthalassan seamount. This limestone likely retains the general information of shallow, low latitude Panthalassa, without local continental effects. The study section consists of 3 units; i.e., unit 1 (Middle Permian black limestone, 112 m thick), unit 2 (white-black striped limestone; 8 m), and unit 3 (Upper Permian light gray dolomitic limestone; 22 m), in ascending order. We described the detailed stratigraphy of 2) that corresponds to the transitional interval between the black (underlying) and white (overlying) carbonates. Fusuline stratigraphy gives following ages to the units, i.e., unit 1 belongs to the *Neoschwagerina* Zone (Wordian, 8 m), *Yabeina* Zone (Capitanian, 96 m) and the lower part of the barren interval (Capitanian, 17 m), unit 2 to the upper part of the barren interval, and unit 3 to the *Codonofusiella-Reichelina* Zone (Wuchiapingina, 21 m), respectively. ^{87}Sr/^{86}Sr values stayed extremely low around 0.7068 throughout the Capitanian, started to increase rapidly at the disappearance level of large fusuline, and reached to over 0.7074 by the Wuchiapingian. On the other hand, ^{87}Sr/^{86}Sr ratios remained high, i.e., larger than 0.7070 in the Wordian. This study in high stratigraphic resolution confirmed for the first time that the 'Permian minimium' appeared in and persisted throughout the Capitanian. The d^{13}C$_{carb}$ values stayed very high up to $>$ +6 permil from the uppermost Wordian to the latest Capitanian, followed by the drop down to +2 permil at the G-LB. We speculate that the primary productivity of surface ocean was very high in the Middle Permian (Kamura event) until the G-LB.

These isotope data are correlated well with those of Iwato Formation in Kyushu. Thus these isotopic profiles reflect the general signature in the low latitude superocean. The close timing of the rapid increase in ^{87}Sr/^{86}Sr and the extinction of large fusulines suggests that the non-biological process has triggered the mass extinction and the following decrease in primary productivity. The extremely rapid increase in ^{87}Sr/^{86}Sr ratio in the Capitanian may indicate a certain sudden tectonic event, such as the initilal rifting of Pangea.

Keywords: G-L boundary mass extinction, Akasaka limestone, ^{87}Sr/^{86}Sr, d13C$_{carb}$