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A unique Cr-enriched bed across the Guadalupian-Lopingian boundary (Permian) in mid-Panthalassan paleo-atoll carbonates

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We examined in detail the chemical composition of a thin clayey bed (~1 cm) recognized at the Guadalupian-Lopingian boundary (G-LB) in the mid-oceanic paleo-atoll limestone in Japan (Kamura and Akasaka sections), to clarify whether or not the clayey bed is the product of a large-scale explosive volcanism that led to the end-Guadalupian mass extinction (Isozaki and Ota, 2001; Isozaki, 2007). Results of X-ray mapping and ICP-MS analyses revealed that the clay materials both in Kamura and Akasaka are roughly identical in compositions and are characterized by high-chromium contents (ca. 3000 ppm in anhydrous basis). This contradicts the previous notion that the bed represents rhyo-dacitic tuff brought by explosive eruption of acidic magma. Despite this, the widespread occurrence of Cr-enrichment at the G-LB horizon is inferred from the fact that the G-LB mudstones in continental shelf limestone in South China (Wangpo Bed at Chaotian and Shangsi sections) have geochemical affinity to the Cr-rich clayey bed at Kamura and Akasaka sections deposited in western Panthalassa. From these data, together with the normal platinum-group element signatures throughout the G-LB samples, we invoke a global fall-out of Cr-rich air-borne ash originated from mafic or ultramafic magma, most likely related to the mantle plume-derived large igneous provinces (LIPs). This might be possible at the initial phase of intrusion/eruption of basaltic to picritic magma that formed the Emeishan LIP in South China (~260 Ma) or other continental LIPs emplaced during the breakup of the supercontinent Pangea, if such high-temperature magmas were effectively carbonated and hydrated through the reaction with the thick sedimentary piles of limestones and shales.

Keywords: geochemistry, ICP-MS, clayey bed, Guadalupian-Lopingian boundary, mass extinction, Emeishan flood basalts