Astronomically–driven biogeochemical cycles recorded in the Triassic bedded chert sequence from the Mino Belt, central Japan

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Permian–Triassic bedded chert sequences in the Jurassic accretionary complex of Japan provide important paleoenvironmental information for the evolutionary history of marine pelagic fauna after the end–Permian mass extinction [1, 2]. The chert sequences consist of the rhythmic alterations of chert and shale beds whose thickness variations are thought to be essentially related to astronomical cycles [3]. A cyclostratigraphic approach revealed that a single chert-shale couplet represents a precession cycle of ~20-kyr. In this study, compositional data analysis with bed-by-bed (~20-kyr) resolution was conducted using the 1,186 major and trace element measurements on the Triassic bedded chert sequence in the Mino Belt, central Japan.

Remarkable behaviors of the redox sensitive elements (V, Cr, S) in the Middle Triassic black shales suggest that the oceanic anoxic events developed frequently in the Anisian, despite the fact that the Anisian was the time of the recovery stage from the Superanoxia [1]. Cyclic oscillations of the biogenic apatite abundances have maximum values after the Anisiasn OAEs, suggesting a marked increase in pelagic vertebrates (such as conodont) in the late Anisian. A spectral analysis of major element data reveals that the time–series fluctuations in the chemical weathering intensity were controlled by the Milankovitch cycles and probably affected the oceanic redox condition during the Middle Triassic. Amplitude modulations extracted from the chemical weathering intensity suggest that the climate experienced a transition from a grand eccentricity cycle to a relatively short cycle in the early Ladinian. We hypothesis that a mechanism for the transition may have resulted in changes in organic carbon burial rates during the OAEs and consumption of atmospheric CO_2 by intensified chemical weathering.

[1] Isozaki (1997) *Science* **276**, 235–238. [2] Alroy (2010) *Science* **329**, 1191–1194. [3] Ikeda & Tada (2014) *EPSL* **399**, 30–43.