

Identification of lacustrine metalimnetic oxygen minimum dynamics in the Mid-Late Triassic Chang 7 shales and its implications

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The Middle-Late Triassic Ordos Basin has gained increasing attention due to its significance in recording the earliest known recovery-radiation of terrestrial aquatic ecosystems following the Permian-Triassic mass extinction (PTME) and its abundant non-renewable resources. Despite numerous attempts to elucidate the mechanisms for high organic carbon burial, the pattern of carbon cycle and its associated environmental variations remain largely unknown, probably ascribed to multi-periodic deposition of volcanic ashes and complex lacustrine depositional architectures. Herein, we reconstructed environmental variations within basinal and global contexts and identified the formation of metalimnetic oxygen minimum area in paleo-lacustrine environments. Our results demonstrate a shift of oxygen-deficient and organic matter hyper-enriched areas from the central basin in the lower part of Chang 7–3 (interval I) towards the periphery in the upper part (interval II). This transition is ascribed to enhanced weathering intensity but weakened volcanic activity, which is contemporaneous with terrestrial bio-evolution across the Mid-Late Triassic boundary. In addition, the contemporary variations in carbon isotopes and relatively sea and lacustrine levels around the Paleo-Tethys Ocean, along with the rare occurrence of high redox metal abundances in lacustrine environments, indicate a (intermittent) water connection between the Ordos Basin and Paleo-Tethys Ocean during the latest Middle Triassic to early Late Triassic. We hypothesize that mild to moderate volcanic activity induced genetic disturbance and stimulated bio-irradiation in the late Ladinian. In contrast, intensified weathering resulted in biological proliferation but also transiently elevated mortality in the early Carnian, which appears to be the prelude of spectacular Triassic terrestrial radiation that dominates modern ecosystems [1].

Reference: [1] Elemental-organic geochemical evidence for the lacustrine metalimnetic oxygen minimum dynamics in the Mid-Late Triassic Chang 7 shales, Bian, L., Wang, X., Chappaz, A., Xiong, Z., Ye, M., Zhang, S. & Zhao, W (2025), *Earth Planet. Sci. Lett.* 651, p.119153.

