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Paired organic and inorganic carbon isotope evidence for a coupled Early Triassic carbon cycle

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Large δ^{13}C excursions (CIEs), anomalous carbonate precipitates, and evidence for marine euxinia in the Late Permian and Early Triassic are reminiscent of Neoproterozoic geochemistry. Middle Triassic diversification coincided with the waning of anoxia and stabilization of the global carbon cycle, suggesting that environment-ecosystem linkages were important to biological recovery. However, the Earth system behavior responsible for these phenomena remains poorly constrained. Here we examine the extent to which the Early Triassic CIEs record changes in δ13C of marine DIC. Biostratigraphically correlated strata across the Paleo-Tethys and Panthalassic oceans display multiple coeval δ^{13}C shifts, suggesting the record is reflective of large perturbations in the exogenic carbon cycle. However, diagenetic processes (Derry et al., 2010; Knauth and Kennedy, 2009; Swart and Eberli, 2005) and oxidation of a large DOC pool (Rothman et al., 2003) are other proposed drivers of large δ^{13}C excursions. If paired $\delta^{13}C_{carb}$ and $\delta^{13}C_{org}$ measurements are coupled and other evidence for diagenetic control of the δ^{13}C record is absent, the record is likely driven by changes in marine DIC composition. If not, the perturbations may be related to non-steady state carbon cycle behavior and the buildup of a large DOC reservoir, as suggested for the Neoproterozoic.

Here we present one of the first Early Triassic $\delta^{13}C_{org}$ records from south China and apply it as a test of carbon cycle coupling through this interval. Regression modeling demonstrates a clear relationship between $\delta^{13}C_{org}$ and $\delta^{13}C_{carb}$ across multiple sections that span a paleoenvironmental gradient. A simple explanation is that at least some fraction of the preserved C_{org} formed from the contemporaneous DIC pool, implying that the observed excursions reflect variation in the δ^{13}C of the exogenic carbon reservoir.

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