CALCIUM ISOTOPE CONSTRAINTS ON THE CAUSES OF LARGE CARBON ISOTOPE EXCURSIONS DURING RECOVERY FROM THE END-PERMIAN MASS EXTINCTION

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Abstract

The end-Permian mass extinction, the greatest catastrophe in the history of animal life, was followed by 5 million yr of carbon cycle perturbations, extensive anoxic conditions and reduced biodiversity and ecological complexity. Biodiversity and ecological complexity did not return to pre-extinction levels until five million years later in the Middle Triassic, suggesting that adverse conditions extended beyond the initial extinction. The Early Triassic $\delta^{13}C$ record is characterized by large variability, and can result from volcanism/acidification, organic C burial, authigenic carbonate precipitation or by a local factor (*e.g.* mineralogy or diagenesis). Seawater calcium isotope ($\delta^{44/40}Ca$) composition, reconstructed using carbonate rocks from China and Turkey, helps to constrain C cycling because carbonate precipitation, the largest sink of Ca and C, results in a large fractionation in $\delta^{44/40}Ca$, providing constrains of the major burial fluxes of carbon from the ocean. The co-evolution of carbonate chemistry and redox conditions are linked by multiple processes: (1) DIC and alkalinity are affected by photosynthesis and respiration; (2) anaerobic remineralization increases alkalinity; and (3) burial of organic carbon under anoxia removes DIC only. Using a coupled C, Ca, P, S model, I will test different scenarios against the Ca and C data to determine whether or not the large C isotopic variations following the end-Permian extinction can be explained by carbon cycle behavior in a reducing ocean. Furthermore, understanding fluctuations in carbonate chemistry during the Early Triassic will provide a valuable model for how the oceans may respond to the current rise in CO_2.

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