The Early Triassic sulfur isotope curve of seawater sulfate from marine carbonates in the Neo-Tethys

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Few aspects of the long-term (~2 Myr) Early Triassic recovery interval following the end-Permian mass extinction, the largest extinction in Earth's history, are completely understood. Previous studies suggest that the Early Triassic marine realm was characterized by intervals of lethally hot temperatures, widespread anoxia, and carbon cycle perturbations. The marine sulfur cycle can provide further insights into environmental conditions during this time-period. Marine carbonates contain a reliable proxy for seawater sulfate $\delta^{34}S$ termed carbonate-associated-sulfate (CAS) and when analyzed in conjunction with pyrite (a sulfide mineral), insights into the two major pools of sulfur in the marine realm are provided.

In this study, we present a new sulfur isotope dataset of CAS ($\delta^{34}S_{CAS}$) and pyrite ($\delta^{34}S_{pyr}$) for the Neo-Tethyan Mud section (Spiti Valley, Himachal Pradesh, India). The Mud section is biostratigraphically well constrained and analyzed for sulfur isotopes in marine carbonate samples from the Griesbachian to the earliest Spathian. This provides a window of ~1.5 Myr after the end-Permian extinction in which to evaluate changes in the marine sulfur cycle for the southern Neo-Tethys. We isolated CAS from powdered whole rock samples through repeated NaCl leaching steps to remove soluble sulfur species and subsequently dissolved the carbonate matrix to release CAS. Pyrite was extracted through the chromium-reduction method from the remaining residue of the CAS extraction.

Results are evaluated in the context of global sea-surface temperature and carbon isotope curves. Previously published $\delta^{34}S_{CAS}$ datasets from the eastern Paleo-Tethys (South China) for the same time interval allow for an assessment of $\delta^{34}S_{CAS}$ trends across the entire Tethys ocean.