Extent of Early Triassic global marine anoxia from multiple uranium isotope records and numerical modeling

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Siberian Traps volcanism and carbon cycle perturbations occurring immediately after the end-Permian mass extinction have been linked to widespread low-oxygen marine conditions. Evidence from basin-scale proxies indicates that ocean anoxia continued through most of the Early Triassic, but the global extent of this condition and its relationship to the carbon isotope record are poorly constrained. To address this deficiency, we present new $\delta^{238/235}$U data measured in carbonate sediments collected across a depth transect at the Great Bank of Guizhou, south China, and from the Aladag Nappe, Turkey. Multiple negative $\delta^{238/235}$U shifts provide evidence that anoxia persisted globally through most of the Early Triassic.

We use uranium concentration and isotopic records to estimate the severity of bottom water anoxia and the relative changes in the flux of uranium to the oceans. Model data suggest that the spatial extent of anoxia increased by an order of magnitude across the end-Permian extinction horizon, synchronous with the widely observed negative δ^{13}C excursion. Correlation with the carbon isotope record links anoxia with continued CO_2 emissions from the Siberian Traps. An increase in continental weathering rates during this interval may have increased the delivery of both weathered uranium and nutrients to the ocean, increasing productivity and expanding the area of low-oxygen bottom waters on the continental shelves. We hypothesize that anoxic conditions resulting from this process continued to inhibit the recovery of biodiversity and metazoan reefs across the majority of Early Triassic time.