HIGH-RESOLUTION RECONSTRUCTION OF ANOXIA ACROSS THE END-PERMIAN MASS EXTINCTION FROM COMPOSITE URANIUM ISOTOPE RECORDS. S. J. Romaniello[1], F. Zhang[1], T. J. Algeo[2,3], and A. D. Anbar[1,4]. [1]School of Earth & Space Exploration, Arizona State University, Tempe, AZ, U.S.A. (email: sromanie@asu.edu), [2]Department of Geology, University of Cincinnati, Cincinnati, OH, U.S.A., [3]State Key Laboratories of BGEG and GPMR, China University of Geosciences, Wuhan, China, [4] School of Molecular Science, Arizona State University, Tempe, AZ, U.S.A.

Introduction: The end-Permian mass extinction (EPME) was the most severe biotic crises of the Phanerozoic, resulting the extinction of 70% of terrestrial and 90% of marine species. There is a growing consensus—supported by new high-precision U-Pb dating[1]—that the extinction event was closely tied to the eruption of the Siberian Traps and subsequent CO_2 release, global warming, ocean acifidication, ocean anoxia, and impacts on ozone chemistry.

Although the basic architecture of events surrounding the EPME appears to growing clear, the timing and relative importance of specific kill mechanisms remains a matter of debate. Determining exactly how the extinction unfolded is a crucial test of our understanding of biogeochemical dyanamics and causality.

During the EPME, there is ample evidence for ocean anoxia which is usually included among a host of other possible factors responsibe for the mass extinction. However, views on the timing, duration and extent of ocean anoxia all vary widely, and thus opinions on the significance of anoxia as a kill mechanism range from primary driver to relatively unimportant[e.g. 2-3].

The recent development of uranium isotope variations ($\delta^{238/235}U$) in carbonate rocks as a globally-integrative paleoredox proxy has opened up new opportunities to explore anoxia during EPME[4-6]. The $\delta^{238/235}U$ of seawater is well-mixed throughout the ocean and is sensitive to burial of reduced U(IV) under anoxic conditions. When the seawater $\delta^{238/235}U$ signal is recorded in carbonates, it thus records an estimate for globally-integrated redox conditions, avoiding the need to extrapolate from isolated local or regional records. Here, we combine several such records from widely-space sections to construct a high-resolution $\delta^{238/235}U$ profile across the EPME and use this profile to provide new, quantitative contains on the timing and extent of anoxia during the EPME.

Results: We combined published EPME $\delta^{238/235}U$ records from Dawen[4], Dajing[5] and Taskent[5] (all located in the Tethys) with a new unpublished Panthlassic section from Kamura, Japan, which was measured in our laboratory. These sections were temporally-correlated to the precisely-dated Meishan[1] section using a combination of $\delta^{13}C$ records and condonant biostratigraphy. The correlated sections show excellent agreement with clear evidence for elevated $\delta^{238/235}U$ (−0.2 to +0.1 ‰) prior to 251.94 Ma and sharp drop to low $\delta^{238/235}U$ (−0.6 to −0.8 ‰) by 251.88 Ma before beginning a partial recovery over at least the next several hundred thousand years.

Discussion: In order to interpret these results in a quantitatively, we combined the isotope data and associated age model with a dyanamic ocean box model of $\delta^{238/235}U$ evolution to predict the fraction of seafloor anoxia over the course of the EPME. In order to fully address uncertainties associated with the isotopic data, age model, and isotopic modeling, we used an Monte Carlo approach to rigorously evaluate the combined uncertainties introduced at each step of the calculation.

Our preliminary modeling results demonstrate that the most probable explanation for the observed decrease in $\delta^{238/235}U$ is an abrupt and short (~10 ka) but intense increase in marine anoxia covering 30-90% of the ocean floor which is coeval with main EPME extinction horizon. Following this event, most simulations display a similarly brief (~10-20 ka) period of recovery to near pre-extinction conditions (corresponding an abrupt shift in the slope of $\delta^{238/235}U$ compilation), followed by a protracted (>300 ka) period of either mild (<10-20%) or intense (~20-80%) seafloor anoxia which directly depends on ones assumption regarding the magnitude of syndepositional diagenetic offset $\delta^{238/235}U$ undergoes during incorporation into carbonate sediments which is a subject on on-going research[7-8].

Our preliminary results are most consistent with models of EPME which predict warming, weathering, or ocean circulation changes which result in a rapid shift from relatively oxic conditions to 30-90% ocean anoxia within ~10 ka. This places strong contraints on the timescale of warming, nutrient delivery, and circulation changes required to provoke such a response.

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