

Connecting end-Permian paleontological and geochemical records using physiology and Earth system models

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The end-Permian mass extinction eliminated nearly 80% of marine animal genera, making it the most severe biodiversity crisis in the half-billion-year history of animal life. Over the past several decades, advances in geochemistry, especially isotope geochemistry, have provided better constraint on the environmental circumstances of this catastrophe and exhaustive sampling efforts have better documented the pattern and timing of diversity loss. Determining exactly how environmental changes caused extinction, however, has remained a challenge. In this talk, I will present the geochemical and paleontological data that have painted an increasingly clear picture of end-Permian environmental and biological change. I will then discuss how data from physiological experiments can be combined with Earth system models to test mechanistic models for the extinction event. The success of this approach suggests that it may also be useful in forecasting future extinctions and that past events can be used to calibrate the relationship between environmental change and biodiversity loss.

Biography: Dr. Jonathan Payne received a B.A. in Geosciences from Williams College in 1997. He spent two years working as a high school math and science teacher, then returned to graduate school, earning a Ph.D. in Earth and Planetary Sciences from Harvard University in 2005. Following a post-doctoral fellowship at Penn State, he joined the faculty at Stanford University in the fall of 2005. His research addresses the relationship between environmental change and biological evolution in the fossil record, with a focus on mass extinction events and long-term trends in the ecological structure of marine ecosystems. He teaches undergraduate courses in historical geology and invertebrate paleobiology and graduate courses in carbonate sedimentology, geobiology, and paleobiology. He served as the Chair of Geological Sciences at Stanford from 2015 to 2019 and has served as a Senior Associate Dean for Faculty Affairs since 2020, first in the School of Earth, Energy & Environmental Sciences and, since September 1, 2022, in the Doerr School of Sustainability.