The stability and collapse of marine ecosystems during the Permian-Triassic mass extinction

Yuangeng Huang*†[1], Chen Zhong-Qiang‡ , Peter Roopnarine , Michael Benton , Zhao Laishi , Feng Xueqian , and Li Zhenhua

[1]China University of Geosciences [Wuhan] – China

Abstract

The history of Earth's biodiversity is punctuated episodically by mass extinctions. These are characterized by major declines of taxon richness, but the accompanying ecological collapse has rarely been evaluated quantitatively. The Permian–Triassic mass extinction (PTME; _˜252 million years ago), as the greatest known extinction, permanently altered marine ecosystems and paved the way for the transition from Paleozoic to Mesozoic evolutionary faunas. Thus the PTME offers a window into the relationship between taxon richness and ecological dynamics of ecosystems during a severe extinction. However, the accompanying ecological collapse throuogh the PTME has not been evaluated in detail. Here, using food-web models and a marine paleocommunities dataset spanning the PTME, we show that after the first extinction phase, community stability decreased only slightly despite the loss of more than half of taxonomic diversity, while community stability significantly decreased in the second phase. Thus, taxonomic and ecological changes were unequivocally decoupled, with species richness declining severely _˜61 kyr earlier than the collapse of marine ecosystem stability, implying that in major catastrophes a biodiversity crash may be the harbinger of a more devastating ecosystem collapse.

Keywords: Resilience, food web, guild structure, cascading extinction on graphs, modelling, biodiversity, tipping point, environmental perturbation, end, Permian, South China

*Speaker

†Corresponding author: yg-huang@foxmail.com

‡Corresponding author: zhong.qiang.chen@cug.edu.cn