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A nutrient control on expanded anoxia and global cooling during the Late Ordovician mass extinction

ZHEN QIU[1,2], CAINENG ZOU[2,3], BENJAMIN J. W. MILLS[4], YIJUN XIONG[5] AND SIMON W. POULTON[5]

[1]PetroChina Research Institute of Petroleum Exploration and Development

[2]National Energy Shale Gas R&D Experiment Center Beijing 100083 China

[3]PetroChina Research Institute of Petroleum Exploration and Development Beijing 100083 China

[4]University of Leeds

[5]School of Earth and Environment, University of Leeds

Presenting Author: qiuzhen316@163.com

Expanded ocean anoxia and global cooling have been invoked as major causal mechanisms for the Late Ordovician mass extinction, but the factors underpinning the extinction remain unresolved. Here, we document two intervals of particularly intense phosphorus recycling in marine rocks deposited across a bathymetric transect in the Yangtze Shelf Sea. The first occurred during the initial phase of the extinction and, coincident with global cooling, drove the development of ocean euxinia on the shelf. The second re-established shelf euxinia after the peak of glaciation, leading to the second phase of extinction. Integration of these data into a global biogeochemical model indicates that phosphorus recycling would have doubled the long-term burial rate of organic carbon, driving ~4°C of global cooling. Thus, through its impact on both the spread of anoxia and global cooling, extensive redox-promoted phosphorus recycling was a critical factor in Earth's first catastrophic loss of animal life.