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Timing of global regression and microbial bloom linked with the Permian-Triassic boundary mass extinction: implications for driving mechanisms

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High-precision U-Pb dating of single-zircon crystals by chemical abrasion-isotope dilution-thermal ionization mass spectrometry (CA-ID-TIMS) is applied to volcanic beds that are intercalated in sedimentary sequences across the Permian-Triassic boundary (PTB). By assuming that the zircon crystallization age closely approximate that of the volcanic eruption and subsequent deposition, U-Pb zircon geochronology is the preferred approach for dating abiotic and biotic events, such as the formational PTB and the Permian-Triassic boundary mass extinction (PTBME).

We will present new U-Pb zircon dates for a series of volcanic ash beds in shallow-marine Permian-Triassic sections in the Nanpanjiang Basin, South China. These high-resolution U-Pb dates indicate a duration of 90 $\pm$ 38 kyr for the Permian sedimentary hiatus and a duration of 13 $\pm$ 57 kyr for the overlying Triassic microbial limestone in the shallow water settings of the Nanpanjiang pull apart Basin. The age and duration of the hiatus coincides with the formational PTB and the extinction interval in the Meishan Global Stratotype Section and Point, thus strongly supporting a glacio-eustatic regression, which best explains the genesis of the worldwide hiatus straddling the PTB in shallow water records. In adjacent deep marine troughs, rates of sediment accumulation display a six-fold decrease across the PTB compatible with a dryer and cooler climate during the Griesbachian as indicated by terrestrial plants. Our model of the PTBME hinges on the synchronicity of the hiatus with the onset of the Siberian Traps volcanism. This early eruptive phase likely released sulfur-rich volatiles into the stratosphere, thus simultaneously eliciting a short-lived ice age responsible for the global regression and a brief but intense acidification. Abrupt cooling, shrunk habitats on shelves and acidification may all have synergistically triggered the PTBME. Subsequently, the build-up of volcanic CO_2 induced this transient cool climate whose early phase saw the deposition of the microbial limestone.