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High precision time calibration of the Permo-Triassic boundary mass extinction by U-Pb geochronology

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U-Pb dating using Chemical Abrasion, Isotope Dilution Thermal Ionization Mass Spectrometry (CA-ID-TIMS) is the analytical method of choice for geochronologists, who are seeking highest temporal resolution and a high degree of accuracy for single grains of zircon. The use of double-isotope tracer solutions, cross-calibrated and assessed in different EARTHTIME labs, coinciding with the reassessment of the uranium decay constants and further improvements in ion counting technology led to unprecedented precision better than 0.1% for single grain, and 0.05% for population ages, respectively. These analytical innovations now allow calibrating magmatic and biological timescales at resolution adequate for both groups of processes.

To construct a revised and high resolution calibrated time scale for the Permian-Triassic boundary (PTB) we use (i) high-precision U-Pb zircon age determinations of a unique succession of volcanic ash beds interbedded with shallow to deep water fossiliferous sediments in the Nanpanjiang Basin (South China) combined with (ii) accurate quantitative biochronology based on ammonoids and conodonts and (iii) carbon isotope excursions across the PTB. Using these alignments allows (i) positioning the PTB in different depositional environments and (ii) solving age/stratigraphic contradictions generated by the index, water depth-controlled conodont Hindeodus parvus, whose diachronous first occurrences are arbitrarily used for placing the base of the Triassic.

This new age framework provides the basis for a combined calibration of chemostratigraphic records with high-resolution biochronozones of the Late Permian and Early Triassic. Besides the general improvement of the radio-isotopic calibration of the PTB at the $\pm$100 ka level, this will also lead to a better understanding of cause and effect relations involved in this mass extinction.