



Correlating the end-Triassic mass extinction and basalt volcanism of the Central Atlantic Magmatic Province at the 100,000-year level by high-precision U-Pb age determinations

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The end-Triassic mass extinction is one of the five largest extinctions in Earth history, though considerable uncertainty remains in terms of its duration, causes and effects. Many workers suggest that the extinction was related directly or indirectly to adverse climate following the onset of the Central Atlantic Magmatic Province (CAMP), which erupted $> 2.5 \times 10^6$ km³ of basalt in less than 1 Ma. However, there remains a need for precise and accurate geochronology to correlate the onset of CAMP volcanism, recorded uniquely in terrestrial sections, with the well-documented marine extinction event. We provide new chemical abrasion ID-TIMS U-Pb age determinations on ash bed and basaltic zircons using the well-calibrated EARTHTIME 202Pb-205Pb-233U-235U tracer solution, yielding data that are up to 70% more precise compared to single-Pb/single-U tracers. We show that the Triassic-Jurassic boundary (TJB) and end-Triassic biological crisis from two independent marine stratigraphic sections in northern Peru and in Nevada (USA) correlate with the onset of terrestrial flood volcanism in the Central Atlantic Magmatic Province (CAMP) to < 150 ka. Ash bed samples reveal complicated U-Pb systematics, showing ranges in 206Pb/238U zircon dates of up to 2 Ma, representing a range of growth histories prior to eruption. Therefore, we use the youngest single closed-system zircon to approximate the eruption date.

Three volcanic ash beds from the Pucara basin, northern Peru, bracket the TJB to a 206Pb/238U age of $201.31 \pm 0.18/0.31/0.43$ Ma (internal uncertainties/ with tracer calibration uncertainty/ with decay constant uncertainties). The first discovered ash bed from the New York canyon, Nevada, 1.5 m above TJB requires a boundary age of less than 201.33 ± 0.13 Ma. We also provide data from two laboratories which yield a new 206Pb/238U zircon age of $201.28 \pm 0.02/0.22/0.31$ Ma for the North Mtn. basalt, the lowest CAMP basalt from the Fundy basin, Nova Scotia.

This narrows the correlation between volcanism and mass extinction by an order of magnitude for any such catastrophe in Earth history. These data also record a concomitant drop and rise in sea level and negative ¹³C spike in the very latest Triassic occurred locally in < 290 ka. Such rapid sea level fluctuations on a global scale require that global cooling and glaciation were closely associated with the end-Triassic extinction and potentially driven by CAMP volcanism.