The Permian-Triassic boundary in Australia: New radio-isotopic ages

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Studying potential causes of the most severe biotic crisis in the Phanerozoic, the Permian-Triassic (P-T) mass extinction, requires knowledge about the timing of events in both marine as well as terrestrial sedimentary archives. Recent radio-isotopic age results from both U/Pb and $^{40}Ar/^{39}Ar$ dating of volcanic ash falls place the age of the Permian-Triassic boundary in marine strata (as defined by the FAD of the conodont *Hindeodus parvus*) and the age of the mass extinction indistinguishably at 252.5 ± 0.2 Ma (based on the U/Pb system) [1, 2]. In addition, new $^{40}Ar/^{39}Ar$ age data confirm the U/Pb ages, with the $^{40}Ar/^{39}Ar$ ages being systematically younger by ca. 1% than U/Pb ages, but yielding identical intervals between dated ashes. This bias is most likely due to systematic errors in the current calibration of the $^{40}Ar/^{39}Ar$ system [3]. It has been notoriously difficult to precisely correlate marine and terrestrial sedimentary records due to a lack of reliable radio-isotopic ages as well as bio- and magnetostratigraphic constraints.

New U/Pb age data on single zircons from a volcaniclastic layer conformably underlying the Rewan Fm. (Bowen Basin, Queensland, E Australia) yield a preliminary mean $^{206}Pb/^{238}U$ age of 252.2 ± 0.4 Ma. The tuff shows evidence of soft sediment deformation by the quartzose sands of the Rewan Fm., suggesting that the units are contemporaneous. The tuff yielded few palynomorphs, but an assemblage 3.8 m above the contact within the Rewan Fm. belongs to the *Lunatisporites pellucidus* Zone and lacks *Aratrisporites* spp.. Traditionally the Rewan Fm. is regarded as a Triassic unit, as it post-dates the Glossopteris coal-bearing strata. Our new age, in combination with our detailed age results from marine strata in S China, correlates this part of the succession with the P-T boundary. This result facilitates improved understanding of the timing of the biotic crisis, but additional radio-isotopic ages (using different isotopic systems), in combination with improved bio-, chemo- and magnetostratigraphy, from terrestrial, paralic and marine sections are essential to link extinction patterns to specific causal events which may have affected the Earth's hydrosphere and atmosphere on global scale during the P-T transition.

References

[1] Mundil, R. et al. (2004) *Science* **305**, 1760-1763.
[2] Renne, P.R. et al. (2004) *32nd Int. Geol. Congr.*
[3] Min, K. et al. (2000), *GCA* **64**, 73-98.