REVISED U-PB AGES OF THE TRIASSIC-JURASSIC BOUNDARY AND THE EARLIEST JURASSIC AND THEIR IMPLICATIONS

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The end of the Triassic period is marked by one of the five largest mass extinction events, and concomitant changes in the global climate and carbon cycle. The terminal Triassic and earliest Jurassic therefore represent a critical interval for the Earth system, and assessing the chronology of events and rates of processes need a precise and accurately calibrated time scale. Key calibration points for the current geological time scale (GTS2004, GRADSTEIN et al. 2004) are U-Pb ages of 199.6 ± 0.4 Ma from immediately below the Triassic-Jurassic boundary (TJB) on Kunga Island (Queen Charlotte Islands, Canada) (PÁLFY et al. 2000) and 200.4 +2.7/-2.8 Ma from the Middle Hettangian of Puale Bay (Alaska, US) (PÁLFY et al. 1999). The first one effectively serves as the best estimate of the TJB in GTS2004. Both dates were obtained on air-abraded multi-grain fractions of zircons separated from volcanic ash layers intercalated in marine sediments with precise biostratigraphic age control. However, the accuracy of the ages is compromised by unrecognized Pb loss (due to averaging effects from the use of multi-crystal samples for the former) and a combination of inheritance, Pb loss and age discordance for the latter age. Here we report preliminary results of re-dating the same samples using chemical abrasion pretreatment (CA-TIMS) on single zircons which effectively eliminates the effects of Pb loss. The use of single crystals allows recognizing of and accounting for age dispersion. Eleven single crystals were analyzed from the Kunga Island sample; three of them carried minor inherited older Pb and one remained affected by Pb loss. A coherent cluster for seven analyses yields a weighted mean ^{206}Pb/^{238}U age of 201.7 ± 0.6 Ma that we regard as the crystallization age and use as the revised best estimate of the TJB age. Twenty single crystals were analyzed from the Puale Bay sample; one of them was affected by inheritance and another three showed Pb loss. Sixteen analyses are mutually overlapping and yield a median ^{206}Pb/^{238}U age of 200.8 +0.6/-0.4 Ma (ages are 2σ, not including uncertainties on the ^{238}U decay constant).Our results are in good agreement with recently reported CA-TIMS zircon U-Pb ages from Peru (SCHALTEGGER et al. 2008) which suggest 201.58 ± 0.28 Ma for the TJB and 199.53 ± 0.29 Ma for the Hettangian-Sinemurian boundary. These new data together firmly suggest that the end-Triassic extinction and environmental events were indeed synchronous with volcanism in the Central Atlantic Magmatic Province and the biotic recovery in the Hettangian took place in a relatively short time, when the early Hettangian did not exceed 1 Ma in duration. Several other samples from both the uppermost Triassic and lowermost Jurassic of the Queen Charlotte Islands are being analyzed and it is expected that their CA-TIMS U-Pb ages will help further constrain the time scale at the Triassic-Jurassic transition.

References

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