

EARTHTIME U-Pb Tracer For Community Use

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Uncertainty in the Pb/U ratio of tracer solutions utilised in U-Pb isotope-dilution thermal ionization mass-spectrometry (ID-TIMS) geochronology, is typically estimated at 0.1 to 0.25%. As analytical uncertainties approach 0.1% or lower, tracer calibration represents the greatest hindrance to comparison of data generated in different laboratories at the 0.1% level, the level which is required for addressing issues related to, for example, evaluating cause and effect relationships related to mass extinctions. A community wide experiment using the Temora and R33 zircon standards demonstrate a bias (up to 0.5%) between labs, much of which is probably related to tracer uncertainty.

As part of the EARTHTIME Initiative (www.earthtime.org) a mixed U-Pb tracer solution (²⁰⁵Pb-²³³U-²³⁵U at ca. 1:100:100 proportions) has been prepared in sufficient quantities to permit community-wide distribution and long-term use for high precision U-Pb geochronology. This solution has been calibrated against U-Pb gravimetric solutions prepared in multiple labs. Initial results indicate consistency between calibration against each solution and that it is possible to determine the U/Pb ratio to better than 0.05% (2 σ level).

Although the tracer will be available for high-precision geochronology, calibration of existing tracers against common gravimetric solutions is also encouraged. The use of a common U-Pb tracer solution should effectively eliminate uncertainty in the tracer Pb/U ratio for the interlaboratory of high-precision U-Pb data. The next stage is to repeat the interlaboratory experiment, with labs analysing zircon standards (e.g., Temora and R33) using the new tracer solution with the aim of identifying and eliminating or quantifying other sources of interlaboratory bias. Characterisation of such biases is critical for the intercalibration of U-Pb datasets with other chronometers such as ⁴⁰Ar/³⁹Ar geochronology and cyclostratigraphic techniques. We suggest that an effective strategy for ID-TIMS U-Pb geochronology will be to include appropriate zircon standard data with published datasets as a means to assess accuracy, similar to the approach adopted by the ⁴⁰Ar/³⁹Ar community.