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Towards the effective elimination of interlaboratory bias in U-Pb ID-TIMS geochronology

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Uncertainty in the Pb/U ratio of tracer solutions utilised in U-Pb isotope-dilution thermal ionisation 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 integration of data generated in different laboratories at the 0.1% level of precision, the level which is required for addressing issues related to, for example, evaluating cause and effect relationships related to mass extinctions. In order to assess the degree of (dis-) agreement between the various laboratories, an interlaboratory experiment involving dating of two natural zircon standards (R33 and Temora) and recalibration of tracer solutions against one or more mixed U-Pb gravimetric standard solution(s) was proposed and has been carried out to varying degrees by laboratories.

As part of the EARTHTIME Initiative, a new mixed U-Pb tracer solution was prepared and calibrated in sufficient quantities to permit community-wide distribution and long-term use for high precision geochronology. Although the tracer will be available for high-precision dating, calibration of existing tracers against common gravimetric solutions is also encouraged. The use of a common U-Pb tracer solution will effectively eliminate uncertainty in the tracer Pb/U ratio for the inter-comparison of high-precision U-Pb datasets generated by different labs. In addition, calibration of the EARTHTIME U/Pb tracer against multiple gravimetric solutions will ensure more robust intercalibration with other geochronometers. The next stage is to repeat the Temora/R33 experiment, as well as other U-Pb data acquisitions using the new tracer solution with the aim of identifying and eliminating other sources of interlaboratory bias. 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 for the $^{40}Ar/^{39}Ar$ method community.