

20-7 - THE EFFECTS OF CHEMICAL ABRASION (CA) PRIOR TO LA-ICP-MS FOR U-PB DETRITAL ZIRCON GEOCHRONOLOGY AND DEFINITION OF MAXIMUM DEPOSITIONAL AGES (*Invited*)



Sunday, 15 October 2023



10:10 AM - 10:30 AM



320 (3, David L Lawrence Convention Center)

Abstract

Detrital zircon (DZ) geochronology by LA-ICP-MS is a common tool for determining maximum depositional ages (MDAs) and sediment provenance. However, Pb-loss can impact zircon age populations by skewing affected zircon toward younger apparent ages, leading to biased results. Chemical abrasion (CA) is a technique that reduces/eliminates Pb-loss in zircon, but it has yet to be applied to large-n DZ analyses. We applied CA to 3 large-n DZ samples (2 Cenozoic; 1 Proterozoic) for LA-ICP-MS and compared treated and untreated aliquots to assess the effects of CA on DZ analyses and estimation of MDAs. We show CA does not negatively impact or systematically bias U-Pb dates and improves accuracy and precision.

We first tested how CA impacts U-Pb dates by comparing treated and untreated zircon from 13 reference materials. The dates of both CA and non-CA aliquots are indistinguishable and within 0.1-4% from the reference ages, indicating that CA does not systematically bias dates. We also analyzed a Precambrian igneous sample that experienced substantial radiation damage to test how CA impacts grains with significant Pb-loss. We show that CA-LA-ICP-MS significantly improved concordance, precision, and accuracy of measurements relative to the non-CA data. Our results for DZ samples show the differences between age distributions in analyzed DZ spectra are slight, indicating that Pb-loss present in untreated samples would not significantly bias the interpretation of sediment sources on a broad scale. However, CA did sharpen several Phanerozoic peak ages and increased concordance in Precambrian zircon populations.

To better assess how CA impacts MDA estimation, the youngest 3-5 zircon in both aliquots from one Cenozoic sample were analyzed using ID-TIMS following LA-ICP-MS screening. All CA-LA-ICP-MS dates are within 0.8-1.5 myr of the CA-ID-TIMS dates and overlap in 2s uncertainty. In contrast, all LA-ICP-MS dates are systematically younger and ~3-9 myr different from their respective CA-ID-TIMS dates. As a result, calculated MDAs from treated and untreated aliquots are substantially different, with the CA-LA-ICP-MS aliquot more closely reflecting CA-ID-TIMS dates. These results suggest that CA prior to LA-ICP-

MS may be a useful tool for research that requires higher resolution in DZ age spectra and better constrained MDAs.

Geological Society of America Abstracts with Programs. Vol. 55, No. 6, 2023
doi: 10.1130/abs/2023AM-392875

© Copyright 2023 The Geological Society of America (GSA), all rights reserved.

Author



Erin Donaghy

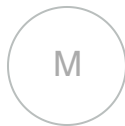
Authors



Michael Eddy



Mauricio Ibañez-Mejia
University of Arizona



Federico Moreno
University of Rochester

View Related
