198-10 - Booth No. 48: INCREASED ACCURACY AND PRECISION IN DETRITAL ZIRCON GEOCHRONOLOGY USING CA-LA-ICPMS

Tuesday, 11 October 2022

2:00 PM - 6:00 PM

Exhibit Hall F (Colorado Convention Center)

Booth No. 48

Abstract

Detrital zircon (DZ) geochronology by laser ablation-inductively coupled plasma-mass spectrometry (LA-ICPMS) is a widely used tool for determining sediment provenance. Data interpretation involves assessing the means, heights, widths and modes of peaks in DZ age spectra using probability density or kernel density plots. However, processes such as Pb-loss, can smear age populations toward younger dates. This skew is difficult to assess for zircons that are Paleozoic and younger and, if pervasive, can lead to erroneous interpretations of DZ age spectra. Here we assess the effects of chemical abrasion (CA) on DZ geochronology. This technique has been shown to reduce Pb-loss in other studies, but has not been rigorously tested for DZ analysis.

To ensure that CA does not systematically bias U-Pb dates, we treated and analyzed a suite of 13 zircon reference materials and compared these data to untreated aliquots of the same materials. The dates of both the CA and non-CA reference materials are undistinguishable within 0.1-4.5% from the reference ages, indicating no negative effects from CA on LA-ICPMS analyses. Additionally, a Precambrian igneous sample that has substantial radiation damage was analyzed to assess the effects of CA on grains with significant Pb-loss. CA-LA-ICPMS results from this sample show increased concordance relative to non-CA data.

Finally, to explore how CA affects DZ age populations, we analyzed two detrital samples. One sample is Mesozoic in age and contains both Phanerozoic (100-300 Ma) and Precambrian (1000-1200 Ma) populations, whereas the second sample is Proterozoic and contains populations between 2000-3500 Ma. Chemical abrasion changed the number and distribution of peak age populations in both samples when compared to non-CA age spectra. In particular, the Phanerozoic age peaks narrowed, which we attribute to a reduction in analyses affected by Pb-loss. We propose that the increased accuracy of individual CA-LA-ICPMS U-Pb zircon dates can increase resolution of DZ age populations in samples where Phanerozoic peaks are tightly spaced in time.

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Author

D

Erin Donaghy
Purdue University

Authors

E

Michael Eddy
Purdue University

I

Mauricio Ibanez
University of Arizona

M

Federico Moreno
University of Arizona

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