Optimised performance characteristics of an active 2-volume cell for laser ablation ICP-MS

DHINESH ASOGAN[1*], CIPRIAN C. STREMTAN[1], SIMON E. JACKSON[2], MAURIZIO PETRELLI[3], PETER WINSHIP[1], CHRIS LAY[1]

[1] Teledyne CETAC Technologies, Omaha, NE 68144, U.S.A. (*correspondence: dhinesh.asogan@teledyne.com)
[2] Natural Resources Canada, Ottawa, Ontario, K1A 0E8, Canada
[3] Department of Physics and Geology, University of Perugia, Perugia, 06100, Italy

In 2013, George Gehrels presented data [1] outlining the limitations inherent in the design of an active 2-volume cell used for laser ablation inductively coupled mass spectrometry applied to U/Pb geochronology. In his study, he found that there was sample position-dependent signal bias present in the cell when nuclide ratios were calculated and compared to values obtained from the centre of the cell.

As a result of these data, the design of the cell was reviewed and improved to eliminate the effects shown and provide the end user with a high degree of confidence in the accuracy of data obtained from any position within the cell volume. Improvments include:

- Redesigned inner cup to improve the active flow that controls the ablation plume
- Redesigned sample holders to control the distance between the sample and the inner chamber volume
- Evaluation and redesign of critical gas seals to eliminate potential leaks
- Optimised purging routine to allow the cell to stabilize efficiently

As a result of these improvements, signal bias was reduced to within experimental error across the usable area of the cell, with most elements having a variability of less than 1%.

Additional benefits presented are improved mechanical stage return accuracy (0.7 ± 0.1 μm), faster time to purge (3 minutes) and ultimately faster total time to stable backgrounds (< 8 minutes).

[1] Gehrels (2013), *Resolving Bias in Geochronology Workshop – Charleston, South Carolina*, http://www.plasmage.org/images/documents/Charleston_workshop_2013/Gehrels_-_cell_fractionation__standards_2013.pdf