

## **Description of Instrumentation Capabilities and Data Reduction Protocols Employed During In-Situ LA-MC-ICP-MS Analyses**

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In recent years, techniques for isotopic measurement using the multiple collector (MC-) inductively coupled plasma mass spectrometry (ICP-MS) have been developed to a level where the typical within-run (internal) precision and between-run (external) precision are comparable to TIMS (thermal ionization mass spectrometry). Another significant advantage of the MC-ICP-MS is the capability to couple a laser ablation system and perform in-situ spatially resolved isotopic measurements. This innovation has led most notably to the combined U-Pb and Lu-Hf isotopic analysis of zircon ( $\text{ZrSiO}_4$ ), as well as studies of a range of other isotopic systems, including both radiogenic ones (e.g. Sr, Nd) and 'non-traditional' stable isotopes (e.g. Cu, Fe). There are many advantages to be gained by LA-MC-ICP-MS analysis, the most important being the potential information that can be obtained at the high spatial resolution. As with other microanalytical techniques, laser ablation-MC-ICP-MS generates data that can be interpreted within spatial context and integrated with microstructural and other geochemical datasets. Other advantages associated with LA-MC-ICP-MS analyses include the removal of the sample digestion and chemical purification procedures, high-sample throughput, and little or no memory. Despite the advances in recent years there remains a perception that the accuracy and precision of the in-situ measurements suffer in comparison to solution measurements because of matrix effects and isobaric interferences. Other issues that also need to be addressed for LA-MC-ICP-MS analyses are the availability of suitable reference materials, especially for matrix-matching in studies of mass-dependent isotopic fractionation, and laser-induced isotopic fractionation. There are many factors that contribute to the accuracy and precision of in-situ measurements, and these can be considered as the interplay between parameters related to the sample, the laser operating conditions and processes in the mass spectrometer.

The main purpose of my lecture is to examine the role of mass bias on the accuracy and precision of isotopic analysis by LA-MC-ICP-MS, which includes a brief review of the theoretical basis for isotopic normalisation using a ratio of the same element (internal normalisation) and investigates the factors that affect the magnitude of the mass fractionation. I also discuss the techniques of isotopic normalization using a different element (external normalisation) and 'standard-sample' bracketing. I also discuss the potential issues related to laser-induced isotopic fractionation and plasma loading, which relate to the laser operating conditions and the transient nature of the signal.