Precision of *in situ* isotope ratio measurements by LAM-MC-ICPMS

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The coupling of a laser ablation microprobe (LAM) to a multi-collector ICP-MS has enabled the development of high-precision *in situ* isotope ratio analysis. Like other microanalytical techniques, laser ablation MC-ICPMS provides the benefit of high spatial resolution and produces data that can be integrated with microstructural and other geochemical datasets. 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.

In addition to corrections for mass bias and isobaric/molecular interferences the precision of an individual measurement is primarily a function of the number of ions counted and therefore depends on the concentration of the element in the mineral, the size of the laser pit, the sensitivity of the mass spectrometer and the counting time. Signals produced by laser ablation are transient, but operating conditions for the laser can be chosen to achieve near steady-state signals. Frequency, laser fluence and spot size settings all contribute to signal stability and intensity. Instrument sensitivity is not a problem for isotopic systems where the element is a major constituent of the mineral (e.g. Mg in olivine, Fe in pyrite). Significant limitations remain in the measurement of isotopic ratios of trace elements in common minerals and in many cases the best precision has been obtained at the expense of spatial resolution (effectively using the laser as a solid sampling tool) or limited to minerals with very low parent/daughter ratios. Ablation time and hence counting time can be limited by the size of the mineral grain and the calculation of the precision of individual measurements should take this into account. The use of ion counters in combination with Faraday detectors or multiple-ion counting systems can extend the measurements to smaller ion beam intensities, thereby making it possible to use smaller spot sizes or measure lower concentrations. Although the precision of individual measurements using ion counters can approach the theoretical precision, external reproducibility is dependent on long-term detector stability and gain calibration.