The Laser Ablation Microprobe (LAM)-ICP-MS: A Powerful Trace Element and Isotopic Microprobe

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Laser ablation microprobe (LAM)-ICP-MS is a rapid technique for *in situ* trace element and isotopic analysis of minerals and their inclusions. The LAM uses a focussed UV laser beam to ablate a small area of sample (down to 10 □m). Ablated material is transported to an inductively coupled plasma-mass spectrometer (ICP-MS). The ICP converts ablated particulates to ions, which are extracted into the mass spectrometer for isotopic quantification. "Time resolved" data acquisition allows assessment of the homogeneity of the ablation volume (zoning, inclusions), insights into host sites of the elements (lattice, cleavage planes) and high-resolution (1 □m) elemental "depth profiling".

Calibration is generally performed using glasses, and an internal standard to normalise ablation yields. Good accuracy is achieved for elements that have a similar geochemical affinity to the internal standard. However, volatilisation/condensation processes fractionate elements of differing chemical affinity, which can result in significant errors. "Spot cooling" and alternative carrier gas techniques are under development to minimise this effect. A typical analysis (30 elements) takes about two minutes. Current instruments offer detection limits down to low ppb levels at 40 □m sampling resolution and ppm levels at 10 □m resolution.

A LAM sampler may also be coupled to a multi-collector (MC)-ICP-MS instrument, which uses a magnet and multiple analogue detectors to make extremely precise (ppm) isotope ratio measurements. These instruments are opening up new applications by making possible high precision *in situ* isotope ratios on a mineral scale (*e.g.*, Cu, Sr, Nd, Os, Hf, Pb).