Improved precision in isotope and element ratio measurements by quadrupole-based ICP-MS

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Quadrupole-based ICP-MS (Q-ICP-MS) is typically used for routine elemental analysis with very low detection limits and good precision. However has low precision (~0.5%) for isotope and element ratio (I&ER) measurements. Consequently, the later are usually performed by TIMS or MC-ICP-MS, where "flat-top" peaks results in highly precise I&ER measurements, in contrast to those obtained from the "Gaussian" peaks observed in Q-ICP-MS mass spectra.

We have developed a methodology based on measuring the area of the Gaussian peaks, instead of their height. This allows us to improve the precision (2σ) of I&ER measurements by Q-ICP-MS by 5 to 10 fold. The procedure consists in obtaining a number of mass spectra for each sample, and calculating the peak area corresponding to each element or isotope in each spectrum. I&ER are obtained by divining the resulting areas. Further data treatment is identical to "peak height methods".

We present two applications of this methodology:

1. Measurement of Pb isotopes in NST SRM 981 and 983, as well as zircon and feldspars previously measured by TIMS.
2. Measurement of Mg/Ca, Sr/Ca, Ba/Ca and U/Ca ratios in speleothem material.

The methodology developed represents an inexpensive alternative to MC-ICP-MS and TIMS measurement of I&ER, with sufficient precision for a wide range of applications.