Measurement of stable isotope $^{41}K/^{39}K$ by MC-ICP-MS

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The measurement of the stable isotope ratio $^{41}K/^{39}K$ by conventional MC-ICP-MS is challenging due to scattered ions from $^{40}Ar+$ and interference by $^{40}Ar^{1}H^{+}$. TIMS and SIMS are not sufficiently precise to resolve the small spread of isotopic variation. The first measurements showing variation in this isotopic system were only recently made; using a Thermo Scientific™ NEPTUNE *Plus*™ MC-ICP-MS, operating in high-resolution mode and using cold plasma conditions and sample standard bracketing [1-3]. The typical reproducibility of measurements is 0.08 – 0.12 ‰ (2σ). An alternative approach has been to use collision cell MC-ICP-MS [4-6]. The potassium isotopic system has applications in terrestrial geochemistry, planetary science, and potentially for biomedical and agricultural research.

Two areas are explored to improve the precision using conventional MC-ICP-MS. The first is to enhance the resolving power of the mass spectrometer, since the mass difference between ^{41}K and $^{40}Ar^{1}H^{+}$ is small. The second is to improve the efficiency and the stability of the sample introduction. Experiments were conducted using a NEPTUNE *Plus* modified for higher mass resolution. This was coupled to an Elemental Scientific™ Apex™ desolvating nebulizer system with a syringe driven flow injection system. Data are reported for $^{41}K/^{39}K$ precision using this experimental setup.

[1] Morgan et al. (2012) *AGU Fall Meeting*. [2] Morgan et al. (2014) *The Goldschmidt Conference*. [3] Santiago Ramos & Higgins (2016) *AGU Fall Meeting*. [4] Wang & Jacobsen (2016), *Geochim. Cosmochim. Acta*, 178(815), 223–232. [5] Wang & Jacobsen (2016), *Nature*, **538**, 487–490. [6] Li, Beard & Li (2016), *J. Anal. At. Spectrom.,* **31**, 1023-1029.