# Isotopic composition of potassium

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Using accurate isotopic composition of parent and daughter elements in geochronology is important for two reasons. First, it is necessary to assure the absence of systematic bias between the dates calculated with different decay schemes. Second, it is necessary to account for fractionation-induced variation in natural isotopic abundances in parent elements of common isotope chronometers such as K [1-3] and Rb [4,5].

Potassium is the parent element of widely used $^{40}K$-$^{40}Ar$ (in the form of $^{40}Ar$-$^{39}Ar$) chronometer and of exotic $^{40}K$-$^{40}Ca$ chronometer. Relative abundance of $^{40}K$ has been determined in several recent studies [6,7], but as far as we know, all modern studies of K isotope composition use the $^{41}K/^{39}K$ ratio determined by [8] as a reference. As a part of ongoing project aimed at accurate calibration of the $^{40}K$-$^{40}Ar$ method using as few assumptions as possible, we have determined isotope composition of potassium in minerals suitable for K-Ar vs. Rb-Sr age comparison (biotite, sanidine) and in standard materials (feldspar NIST SRM 70a, seawater) using two methods: total evaporation TIMS, and cold plasma, high resolution MC-ICPMS (following the pioneering development of [1]) using synthetic $^{39}K$-$^{41}K$ mixtures prepared gravimetrically from enriched $^{39}K$ and $^{41}K$ in the form of KCl. The results from both methods agree within 0.05%, but MC-ICPMS is 3-4 times more precise and much faster. The method for K separation from rocks and minerals is modified from the procedure for Rb separation by [5] and uses columns (d=3.5 mm, l=60 mm) packed with Eichrom Sr.spec resin, and 3M $HNO_3$ as an eluant. Rb, Ba and Sr can be also separated from the same column pass if desired.

Our preliminary results show that three individual crystals of Itrongay sanidine (from the same pegmatite as the sanidine analysed for $^{40}K$-$^{40}Ca$ and $^{40}K$-$^{40}Ar$ by [9]) have variability in $^{39}K/^{41}K$ over 1 permil, in agreement with the finding by [1] that K-bearing minerals from pegmatites tend to have widely variable $^{39}K/^{41}K$ ratios. The K isotope composition of Mt. Dromedary biotite and NIST SRM 70a feldspar is in good agreement with the results of [1].

[1] Morgan L.E. et al. (2018) *JAAS* 33, 175-186. [2] Wang K., Jacobsen S.B. (2016) *GCA* 178, 223-232. [3] Li et al. (2016) *JAAS* 31, 1023-1029. [4] Pringle E.A., Moynier F. (2017) *EPSL* 473, 62-70. [5] Zhang Z. et al. (2018) *JAAS* 33, 322-328. [6] Wielandt D., Bizzarro M. (2011) *JAAS* 26, 366-377. [7] Naumenko M.O. et al. (2013) *GCA* 122, 353-362. [8] Garner E.L. et al. (1975) *Journal of Research of the National Bureau of Standards*, v. 79a, 713-725. [9] Nägler T.F., Villa I.M. (2000) *Chem. Geol.* 169, 5-16.