^{40}K-^{40}Ca – ^{87}Rb-^{87}Sr age comparison: constraints on the ^{40}K decay constant

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A *ca*. 1 % systematic offset between K-Ar and U-Pb ages was attributed to an inaccurate ^{40}K decay constant [1,2]. Multiple attempts to recalibrate it did not achieve consistency among the three unknowns constrained by one equation: the total decay constant, the branching ratio *B* of the ^{40}K decay, and the ^{40}Ar/^{40}K ratio in the irradiation monitor.

We examined 11 natural samples in an attempt to intercalibrate three dating systems: Rb-Sr, K-Ca, and U-Pb. Only a phlogopite from the Phalaborwa carbonatite complex met all requirements of a geological "point-like" event [2]. Our Rb-Sr age of 2058.9±5.2 Ma agrees with the age determined by [3] and with published U-Pb ages. The K-Ca age obtained with an improved technique to measure Ca isotopes [4] and calculated with the constants from [5] is 2040±13 Ma. To achieve agreement of the ages, it is necessary to change the decay constant and/or *B* (Fig. 1). In the literature, *B* ranges from 0.892 to 0.896. This leaves only two sets of constants that agree marginally with [1] and [6].

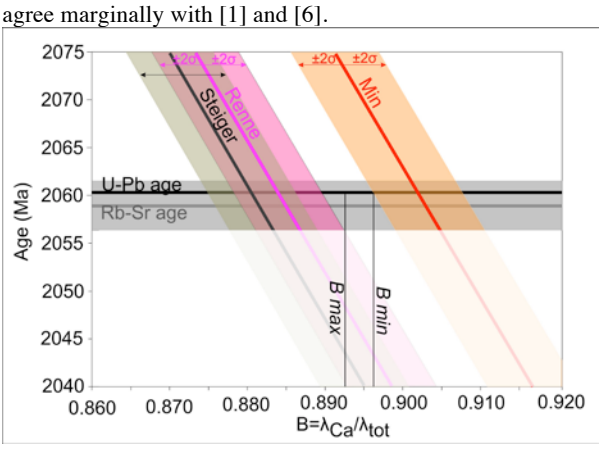

Figure 1. K-Ca age of Phalaborwa phlogopite changes along sloping lines as a function of assumed branching ratio *B*, calculated with the total ^{40}K decay constant of [1]. [5], [6].

[1] Min *et al* (2000) *GCA* 6**4**, 73 [2] Begemann *et al* (2001) *GCA* **65**, 111 [3] Nebel *et al* (2010) *GCA* **74**, 5349 [4] Naumenko-Dèzes *et al* (2015) *Int J Mass Spec* **387**, 60 [5] Steiger & Jäger (1977) *EPSL* **36**, 359 [6] Renne *et al* (2011) *GCA* **75**, 5097