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40Ar/36Ar geochronology on a quadrupole mass spectrometer: Where are we going?

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$^{40}Ar/^{39}Ar$ analysis has passed many milestones since its first application (Wänke & König, 1959). From the early all-glass Reynolds-type vacuum system to today's high quality, bakeable all-metal piping and valve systems, the evolution of ultra high vacuum systems has been considerable. Extraction systems have faced similar changes over time. Early furnaces made partially of glass were later replaced by full metal constructs containing a high temperature resistant molybdenum alloy tube and heating mechanism, sometimes contained within an insulating secondary vacuum chamber. Laser extraction techniques further refined the approach allowing very small samples or sample parts to be analyzed.

The principal type of mass spectrometer used for $^{40}Ar/^{36}Ar$ geochronology is the magnetic sector instrument, which has the resolution and sensitivity necessary for measuring argon isotopes and achieving high precision over a large age range. We present $^{40}Ar/^{39}Ar$ data from basalt samples collected from a number of different locations, all obtained using the Hiden HAL Series 1000 quadrupole mass spectrometer at Vrije University, Amsterdam. We show that quadrupole technology is not only a viable option in K-Ar geochronology (Rouchon et al., 2008) but also in $^{40}Ar/^{39}Ar$ geochronology. The data was obtained from groundmass hand-picked from 200-500 um size fractions. Sample amounts of 200 to 500 mg were used for incremental heating experiments. The quality of the data is demonstrated by convergence of plateau and isochron ages, replicate analyses and by comparison to results of independent studies. Sample ages range from 40 ka to 400 ka, demonstrating the potential of quadrupole instruments for dating even very young rocks using the $^{40}Ar/^{39}Ar$ incremental heating technique.

Rouchon, V., Lefevre, J.-C., Quidelleur, X., Guerin, G., Gillot, P.-Y. (2008): Nonspiked 40Ar and 36Ar quantification using a quadrupole mass spectrometer: A potential for K-Ar geochronology. International Journal of Mass Spectrometry 270, 52-61.

Wänke H., König H. (1959): Eine neue Methode zur Kalium-Argon-Altersbestimmung und ihre Anwendung auf Steinmeteorite. Z. Naturforschung, 14a, 860 – 866.