# COSMOGENIC POTASSIUM ISOTOPES IN IRON METEORITES – CURRENT STATUS OF A NEW EXTRACTION SYSTEM

I. Leya[1] and H. Khan[1], [1]University of Bern, Space Science and Planetology, 3012 Bern, Switzerland (ingo.leya@unibe.ch)

**Introduction:** $^{40}$K-K cosmic ray exposure (CRE) ages for iron meteorites have been studied in the past by H. Voshage and co-workers, e.g., [1,2,3]. Thanks to this early work, about 80 CRE ages have been published. The $^{40}$K-K CRE ages are particularly important because the half-live for $^{40}$K of 1.25 Ga is relatively long and therefore $^{40}$K is not reaching saturation, not even in iron meteorites, which typically have CRE ages in the range of a few hundred million years. Consequently, in contrast to other radioactive cosmogenic nuclides, $^{40}$K-K CRE ages reflect the irradiation conditions, e.g., fluence and spectral shape of the galactic cosmic rays, during the entire exposure of iron meteorites. In contrast, shorter-lived cosmogenic radionuclides are only sensitive to the last few half-lives of cosmic ray exposure, which is, e.g., 5-7 Ma for $^{10}$Be. As a consequence, $^{40}$K-K CRE ages are not only very reliable, cosmogenic potassium isotopes also enable to study whether or not the galactic cosmic rays were constant over time.

However, the last $^{40}$K-K CRE ages have been published more than 40 years ago. Since then, no new data have been measured. Considering the importance of $^{40}$K-K CRE ages, the fact that no new data have been published for a long time, and considering that some of the old data are rather uncertain, i.e., they have uncertainties in the range of 100 Ma, we decided to re-visit and to re-establish the $^{40}$K-K dating system for iron meteorites.

**Experimental:** We designed and built a system for the extraction of potassium from iron meteorites based on the principles of fractional evaporation. Since potassium has a low first ionization potential, some of the element is ionized when in an iron melt and can be extracted using strong electric fields. In this set-up, we melt about 3 g of a pre-cleaned iron meteorite in a high vacuum system. During melting, a high voltage of 4 kV between the sample and a pre-conditionned Re filament is applied and some of the potassium from the iron meteorite is collected onto the filament. After about 30 min of melting and trapping, the heating current and the extraction voltage are both switched off and the sample is cooled back to room temperature. As filaments, we use standard Re filaments later used in a double filament set-up of a Thermo Fisher TIMS mass spectrometer. For the TIMS measurements we established protocols for measuring small samples. Doing so, in various dilution series we demonstrated that we can reliably and reproducibly measure potassium isotope ratios down to sample masses of 0.5 ng total potassium. So far me measured various aliquots of the IIIAB iron meteorite Casas Grandes (single and multiple extractions), the IIIAB iron meteorite Grant, Nantan (IAB), and Kayakent (IIIAB). In total we analysed seven iron meteorite samples.

**Summary**: The findings so far can be summarized as follows:1) Each of the analysed samples show indications for cosmogenic potassium; 2) We can reliably and precisely measure potassium isotope ratios down to about 0.5 ng of total potassium; 3) Since the potassium is implaneted into the filament, getting stable signals during the TIMS measurements is difficult, sometimes compromising the data quality; 4) The potassium isotope ratios are all close to terrestrial ratios, which is surprising considering that the instrumental blank is low; 5) We already changed and improved the system a couple of times to enhance cosmogenic potassium contributions relative to terrestrial potassium, so far with only limited success.

**References:** [1] Voshage H. (1984) *Earth Planetary Science Letters* 71:181-194. [2] Voshage H. and Hintenberger H. (1959) *Z. Naturforsch*. 14a: 828-838. [3] Voshage H. (1978) *Earth Planet. Sci. Let.* 40:83-90.