**THE $^{81}$KR-KR DATING TECHNIQUE FOR METEORITES**

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**Introduction:** The $^{81}$Kr-Kr exposure age dating technique (e.g., [1,2]) is self-correcting for shielding and to some extent also for sample chemistry. However, comparisons of $^{81}$Kr-Kr ages of meteorites with ages determined by the $^{36}$Cl-$^{36}$Ar method, which is also self-correcting for shielding [3], revealed significant age differences (up to 25% with large uncertainties) between both methods [4]. Possible explanations are: 1) the production rates for Kr, obtained from lunar samples, are not valid for stony meteorites either due to different concentrations of the main target elements (Rb, Sr, Y, Zr and Nb) and/or due to different irradiation conditions. 2) $^{81}$Kr-Kr ages of the former study [4] were compromised by high amounts of trapped Kr and relatively low exposure ages. Here we further compare $^{81}$Kr-Kr ages (obtained on bulk samples) with $^{36}$Cl-$^{36}$Ar ages (obtained on metal separates) from selected ordinary chondrites.

**Methods and Samples:** Samples were selected according to the following criteria: ordinary chondrites (sufficient metal for Cl-Ar dating), high petrographic type (H5, L5, L6, to minimize trapped Kr contributions), low weathering grade and long exposure age. To determine $^{36}$Cl-$^{36}$Ar ages, we analysed $^{10}$Be, $^{26}$Al, and $^{36}$Cl by AMS and $^{3,4}$He, $^{21,22}$Ne, and $^{36,38}$Ar by noble gas mass spectrometry in clean metal separates of fourteen meteorites. So far, $^{81}$Kr-Kr ages (as well as He, Ne, and Ar isotopes) were determined in bulk samples of seven of these meteorites.**Results and discussion:** Cosmogenic $^{81}$Kr (~100 times above blank levels) was detected in all seven bulk samples (1-3×$10^{-14}$ ccSTP/g), which also show well-resolvable contributions of stable cosmogenic Kr isotopes ($^{83}$Kr/$^{86}$Kr >0.8; $^{84}$Kr/$^{86}$Kr >3.3). Corrections for trapped Kr (air or Q) are ~30% ($^{78}$Kr) and ~70% ($^{83}$Kr), respectively. Cosmogenic $^{81}$Kr/$^{83}$Kr ratios have uncertainties of 2-7%. Using the Kr isotope data and the $^{36}$Ar-$^{36}$Cl exposure ages, calculated after [5] with uncertainties of 2-6%, we determine a new empirical equation for the production rate ratio $^{81}$Kr/$^{83}$Kr as a function of $^{78}$Kr/$^{83}$Kr. The slope of the new equation is in agreement within 2% with that given by [6] and within 13% with the relation proposed by [4].

**Outlook:** The agreement between the different equations adds more reliability to the Kr-Kr dating system. Our new data, in combination with new model calculations for cosmogenic production rates of Kr isotopes [5] will help reducing uncertainties on the final Kr-Kr dating. This will be of great importance for exposure age studies, e.g., on chondrules and CAIs [e.g., 7]

**References:** [1] Marti K. 1967. *Physical Review Letters* 18: 264-266. [2] Eugster O. et al. 2006. in: *Meteorites and the Early Solar System II*: 829-851. [3] Graf Th. et al. 2000. *Icarus* 150: 181-188. [4] Leya I. et al. 2004. *Antarctic Meteorite Research* 17:185-199. [5] Leya, I and Masarik, J. 2009. *Meteoritics & Planetary Science* 44: 1061–1086. [6] Lugmair, G.W. and Marti, K. 1971. *Earth and Planetary Science Letters* 13:32-42. [7] Vogel, N. et al. 2009. *Meteoritics & Planetary Science* 43, suppl., A212.