Potassium Isotopes in Iron Meteorites: Reassessing the Constancy of Galactic Cosmic Rays

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Introduction: Cosmogenic potassium isotopes, particularly ($^{40}K/^{41}K$), provide a robust method for determining cosmic-ray exposure (CRE) ages of iron meteorites. The ^{40}K-K dating method, established over 50 years ago, has not produced new data since 1984, despite improvements in measurement techniques and a large amount of new meteorites. Comparisons of ^{40}K-K ages with ^{36}Cl-^{36}Ar ages show systematic discrepancies, possibly indicating temporal variations in cosmic-ray flux. Our work re-establishes the ^{40}K-K dating system and improves cosmogenic potassium isotope measurements.

Experimental: Potassium was extracted from six iron meteorites. ($^{40}K/^{39}K$) and ($^{41}K/^{39}K$) ratios were measured using TIMS. The challenge is separating ppb-levels of cosmogenic potassium from ppm-levels of native potassium. We conducted 31 procedural blanks and 22 standards, as well as measuring 27 meteorite aliquots.

Results: Despite dominant native potassium, a clear cosmogenic signal is detectable, particularly in ^{40}K. Reproducibility across aliquots of the same meteorite is good. Further improvements in separating native and cosmogenic potassium are ongoing. Model calculations of the $^{40}K/^{41}K$ production rate ratio refine CRE age determinations. Preliminary results will be presented.