

EVALUATION OF $^{26}\text{Al}/^{27}\text{Al}$ AT CRYSTALLIZATION IN EFREMOVKA CAIs BY HIGH-PRECISION, IN SITU ION MICROPROBE ANALYSES.

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Introduction: Estimates of the initial “canonical” ($\sim 5 \cdot 10^{-5}$) value of $^{26}\text{Al}/^{27}\text{Al}$ in the solar nebula are based primarily on ion microprobe analyses of high Al/Mg phases in CAIs [1]. Some of these minerals (e.g., plagioclase, melilite) are known to be susceptible to alteration and sub-solidus isotopic mobility [2]. Recent high-precision analyses by ICPMS have uncovered evidence for apparently higher ($> 7 \cdot 10^{-5}$) initial $^{26}\text{Al}/^{27}\text{Al}$ values characteristic of bulk CAIs [3] or of more magnesian mineral phases in coarse-grained CAIs [4]. These data can be interpreted as indicating an appreciable temporal gap between initial Al/Mg fractionation during formation of proto-CAIs and subsequent melting/crystallization [3]. Indeed, many large CAIs in CV chondrites are known to have had complex thermal histories, and complementary data obtained on bulk Al-Mg reservoir evolution and internal mineral isochrons on the same objects could potentially provide important information on the timing of high-temperature processes in the nebula. This approach requires an ability to measure Al-Mg isotopic evolution on Mg-rich minerals with high spatial resolution and precision. We have developed a multiple-collector ion microprobe method that allows determination of $^{26}\text{Mg}^*$ with precision better than 0.1% in $\sim 20 \mu\text{m}$ spots of Ti-rich pyroxene (fassaite), spinel, and åkermanitic melilite, permitting the resolution of radiogenic ^{26}Mg ingrowth in phases with $\text{Al/Mg} \geq \sim 0.5$.

Samples and Results: We have preliminary data on a suite of compact Type A and Type B CAIs from CV3 chondrites Efremovka and Allende. All samples show well-resolved $^{26}\text{Mg}^*$ in spinel and fassaite that is correlated with Al/Mg. Inferred initial $^{26}\text{Al}/^{27}\text{Al}$ values range from ~ 4 to $6 \cdot 10^{-5}$. Of particular significance is sample E44 since pyroxene in this CAI retains evidence for the in situ decay of ^{41}Ca [5]. An Al-Mg isochron fit through the origin and 17 spots of pyroxene and spinel yields $^{26}\text{Al}/^{27}\text{Al} = (5.2 \pm 0.3) \cdot 10^{-5}$ with little scatter ($\sigma = 1.5$), whereas Mg isotopes in melilite and anorthite are clearly disturbed. If a primary $^{26}\text{Al}/^{27}\text{Al} > 7 \cdot 10^{-5}$ is characteristic of the solar nebula, then current estimates of initial $^{41}\text{Ca}/^{40}\text{Ca}$ ($1.4 \cdot 10^{-8}$), based on E44 pyroxene, would need to be revised upward by approximately an order of magnitude.

References: [1] G.J. MacPherson et al. 1995. *Meteoritics* 30:365-386. [2] T. LaFourrette and G.J. Wasserburg 1998. *Earth and Planetary Science Letters* 158: 91-108. [3] A.Galy et al. 2004. Abstract #1790, 35th Lunar & Planetary Science Conference. [4] J.I. Simon et al. Abstract #1668, 35th Lunar & Planetary Science Conference. [5] G. Srinivasan et al. 1996. *Geochimica et Cosmochimica Acta* 60: 1823-1835.