Mg and Cr isotope systematics of Allende CAIs

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Magnesium and chromium isotopes have been used to constrain the ages of important solar system objects such as CAIs and chondrules. Advances in analytical techniques using modern MC-ICP-MS and TIMS now allow for determination of Mg and Cr isotope ratios from fragments of single CAI and chondrule with high precision. Here we report combined high-precision Mg and Cr isotope data of five CAIs from the Allende (CV3) carbonaceous chondrite.

The CAIs used in this study were provided from the University of Alberta meteorite collection. Of the five CAIs analysed, three were spherical in shape (A25-1, A63, A194) whereas the other two were irregular (A123 and A42). All CAIs were coarsely crushed, and fragments and mineral separates weighing sub- to few mg were used for Mg isotope work. For spherical CAIs, additional ~50mg fragments were pulverized for Cr isotope analysis.

The $\delta^{26}Mg^*$ of A25-1 shows strong correlation with the $^{27}Al/^{24}Mg$, yielding an isochron with a slope that translates to initial $^{26}Al/^{27}Al = (5.16 \pm 0.11) \times 10^{-5}$. The initial $^{26}Al/^{27}Al$ of other CAIs ranged from 5.16~5.02 x 10^{-5}. These values are in good agreement with the values reported in Jacobsen et al. [1]. Combining our data with those reported previously using similar analytical technique [1] [2], we observe a negative correlation between the initial $^{26}Al/^{27}Al$ and $\delta^{26}Mg^*_I$ of the individual CAIs. This suggest a progressive evolution of $\delta^{26}Mg^*_I$ over time (i.e. $^{26}Al/^{27}Al$) likely due to either condensation from a common reservoir with a constant Al/Mg ratio or reprocessing of these CAIs over an interval of ~0.2 Ma, overprinting pre-exisiting Mg isotope heterogeneity in the early solar nebula. The Cr from the spherical CAIs shows anomalies in both $\varepsilon^{53}Cr$ and $\varepsilon^{54}Cr$, falling in the range reported previously [3] but with higher precision. While only three data points are available at this stage, the $\varepsilon^{53}Cr$ values correlate with the $^{55}Mn/^{52}Cr$. Further chronological implications of these new results will be discussed.

[1] Jacobsen et al. (2008) *EPSL* **109**, 353-364. [2] Wasserburg et al. (2012) *MAPS* **47**, 1980-1997. [3] Bogdanovski et al. (2002) *LPSC abstract* #1802.