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Mg isotope composition of CAIs from CV chondrites and implication for early Solar System heterogeneity

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Calcium-aluminum-rich inclusions (CAIs) are the oldest solids condensed the solar nebula. They are thought to have formed near the Sun, before being transported to the outer Solar System (SS). As a result, CAIs can provide insights into the properties of the material infalling onto the nascent Sun, as well as disk dynamics in the early SS. Key to such explorations is the ^{26}Al-^{26}Mg system: Most CAIs show ^{26}Mg excesses that are positively correlated with ^{27}Al/^{24}Mg, reflecting the ingrowth of ^{26}Mg by the decay of short-lived ^{26}Al ($t_{1/2}$ = 0.7 Myr). While internal ^{26}Al-^{26}Mg isochrons typically acts as a relative chronometer of crystallization age, the isochron of bulk CAIs records unique information about CAI precursors: the slope (initial ^{26}Al abundance: ^{26}Al/^{27}Al) carries the age information, and the intercept (initial ^{26}Mg/^{24}Mg composition: $\delta^{26}Mg^*_0$) characterizes the Mg isotope composition of CAI precursor materials [1]. Recently, the observation of two parallel bulk isochrons defined by CAIs from CV and CR chondrites, respectively, was interpreted as evidence for episodic formation of CAIs in the nascent SS [2].

Here, we revisit this question and measured the Mg isotope compositions in 19 bulk CAIs from CV chondrites (Allende, Efremovka, Leoville, Axtell, NWA 3118). The CAI samples analyzed in this work cover a wide range of CAI types, including fine-grained, FTA, CTA, Type B and FoB. Mineralogical and petrological characterization shows limited secondary alterations of these CAIs. Both Mg isotopes and ^{27}Al/^{24}Mg were measured using a *Neptune Plus* MC-ICPMS at Isotoparium.

The newly analyzed CAIs show bulk ^{26}Al/^{27}Al generally consistent with the canonical value [1, 3]. In detail, however, these CAIs plot between the proposed CV and CR CAI isochrons [2]. In contrast to the proposal of [2], our data thus point to a continuous formation of CAIs from materials with isotopically evolving compositions in the CAI forming region, which is consistent with the evidence from Mo isotope anomalies in CAIs [4].

[1] Jacobsen B. et al. (2008) *EPSL* 272, 353-364. [2] Larsen K. et al. (2020) *EPSL* 535:116088. [3] Larsen K. et al. (2011) *ApJL* 735(2), p.L37. [4] Budde G. et al. (2023) *54th LPSC*, 2806.