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Chondritic $\Delta'^{50/47}$Ti in refractory olivines with highly unradiogenic $\Delta'^{26/24}$Mg implies canonical $^{26}Al/^{27}Al_0$ widespread in protoplanetary disc

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The spatial homogeneity of $^{26}Al/^{27}Al$ in the early Solar System is debated due to apparent discrepancies between the absolute Pb-Pb and relative Al-Mg ages of chondrules[1]. The earliest formed solids — calcium-aluminium-rich inclusions (CAIs) — are often used as 't=0' for the Solar System, with an initial $^{26}Al/^{27}Al$ ($^{26}Al/^{27}Al_0$) of ~ 5×10^{-5}. This approach has been questioned given CAIs are distinct from other Solar System materials in a range of nucleosynthetic isotope anomalies, *e.g.*, $\Delta'^{50/47}$Ti. Thus, the $^{26}Al/^{27}Al_0$ of CAIs may not represent a common value for the proto-solar nebula as a whole.

A recent study using refractory forsterite grains (RFs) from chondritic meteorites showed unradiogenic $\Delta'^{26/24}$Mg signatures consistent with a chondritic reservoir with canonical $^{26}Al/^{27}Al_0$ ~ 5×10^{-5}[2]. This implies (1) RFs formed nearly simultaneously with CAIs and (2) if RFs and CAIs formed in different reservoirs, the reservoirs had similar $^{26}Al/^{27}Al_0$.

To exclude a close spatial relationship between CAIs and the RFs — which would make the unradiogenic $\Delta'^{26/24}$Mg in the RFs unnoteworthy — we investigated the provenance of the RFs by measuring the mass-independent titanium isotopic compositions in the same grains analysed for $\Delta'^{26/24}$Mg. RFs are generally µm-mm sized and contain only ~500 µg g^{-1} titanium; our samples contained a median of 20 ng of titanium, requiring an exceptionally low-blank ion-exchange chemistry and careful measurement *via* multi-collection inductively coupled plasma mass spectrometry.

Our results show that RFs do not have elevated, CAI-like $\Delta'^{50/47}$Ti, and we observe no correlation between $\Delta'^{50/47}$Ti and $\Delta'^{26/24}$Mg. Thus, RFs did not form in the same reservoir as CAIs. Therefore, the canonical $^{26}Al/^{27}Al_0$ implied by the unradiogenic $\Delta'^{26/24}$Mg of RFs shows a consistent $^{26}Al/^{27}Al_0$ between spatially separated reservoirs, unrelated to the nucleosynthetic variability of other systems, pointing towards $^{26}Al/^{27}Al$ homogeneity post-CAI formation.

[1]Bollard *et al*., GCA, **260, 62–83** (2019). [2]Gregory *et al*., Sci. Adv., **6, eaay9626,** (2020).