# CONTRASTING MG ISOTOPIC SIGNATURES IN LEOVILLE (CV3r) CHONDRULES

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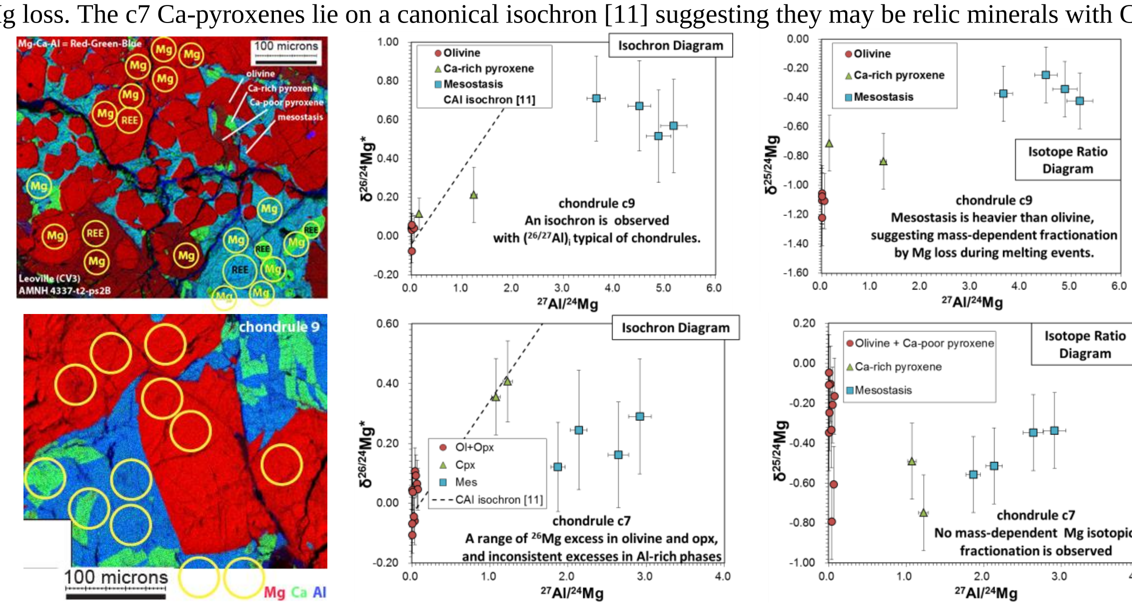
**Introduction:** Chondrules and more refractory inclusions in carbonaceous chondrites include material from pre-existing generations of condensates. It is usually considered that CAIs formed before chondrules, evidenced by the fact that some chondrules include CAIs [1, 2], however Pb-Pb ages suggest some chondrules are as old as CAIs [3]. Chondrules contain 45-70% of the Ca and Al in reduced CV [4] and even more in LL chondrites. Mg-rich olivines can be relics of chondrule precursors. $^{26}$Mg deficits in relict olivines isolated from the nebula before $^{26}$Al extinction could constrain precursor ages, but deficits of only tens of ppm [5] require techniques with very high precision. The apparent ~1.5 Ma $^{26}$Al-$^{26}$Mg age gap between CAIs and chondrules [6] is either (1) an artifact due to heterogeneous distribution of $^{26}$Al in the accretion disk [7] or (2) is real and reflects the fact that mineral isochrons in chondrules only time their last melting, while chondrule precursors can be as old as CAIs [5, 8]. Potential Al-rich relict minerals (e.g., cpx or spinel) could provide direct constraints on the age of chondrule precursors, and also constrain how chondrules obtained their younger mineral isochron ages by melting. The $^{25}$Mg/$^{24}$Mg ratios can be used to study the condensation and evaporation history of chondrules since high-T magmatic Mg isotopic fractionations are not significant [9]. It is therefore important to obtain $^{25}$Mg/$^{24}$Mg ratios together with mineral isochrons.

Here, we present analytical results for two petrographically similar chondrules from Leoville (CV3 reduced). While their REE abundances in olivine, pyroxenes and mesostasis are typical, their Mg isotopic systematics differ considerably. At the meeting we will present results from a larger suite of Leoville and Vigarano (CV3) chondrules.

**Methods:** Strong matrix effects limit accurate measurement of $^{25}$Mg/$^{24}$Mg by SIMS [e.g., 5,6,10]. Here, a novel LA-MC-ICP-MS technique is used, providing Ca/Mg and $^{27}$Al/$^{24}$Mg ratios, and $^{26}$Mg/$^{24}$Mg and $^{25}$Mg/$^{24}$Mg ratios simultaneously on one 40μm spot. This requires careful correction for $^{48}Ca^{2+}$ interference on $^{24}Mg^{+}$ and for permil levels only matrix effect-induced Mg isotope fractionation, reaching a precision of ±16 ppm (2se) on $\delta^{26/24}$Mg* and ±0.19‰ on $\delta^{25/24}$Mg. Ca/Mg and $^{27}$Al/$^{24}$Mg ratios are calibrated with a set of silicate glass and olivine standards.

**Results:** Preliminary analytical results show chondrule c7 with both positive and negative $^{26}$Mg excesses in Al-free minerals, and inconsistent $^{26}$Mg excesses in Al-rich phases. By contrast c9 shows an isochron and evidence of Mg loss. The c7 Ca-pyroxenes lie on a canonical isochron [11] suggesting they may be relic minerals with CAI ages.

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