Oxygen and Magnesium isotopic constraints on the presence of planetary fragments in meteoritic chondrules.

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Planetary accretion and differentiation took place very early in the Solar accretion disk as demonstrated by the old Hf/W age of magmatic iron meteorites (e.g. Kruijer et al., 2013) which formed within ≈2 Ma after the oldest known solids, the Ca-, Al-rich refractory inclusions. Libourel and Krot (2007) found (in reduced type I chondrules from CV chondrites) aggregates of Mg-rich refractory olivines, which can be demonstrated from their chemical composition and textural characteristic to have formed before the chondrules. Their composition could correspond to that of olivines crystallized from the mantle of a planetesimal undergoing metal-silicate differentiation. These olivine aggregates could thus be fragments of planets formed, differentiated and disrupted before the formation of chondrules.
Recent advances in ^{26}Al chronology allow to constrain precisely the age of chondrules, and thus the minimum age of their precursors (Villeneuve et al., 2009; Luu et al., submitted). In addition, model ^{26}Al ages can be calculated for single Mg-rich olivines from high-precision measurements of their Mg isotopic compositions (Luu et al., in prep), thus constraining the differentiation age of their putative parent planets. The existence of these planets is further suggested by the systematic of Δ^{17}O variations of these Mg-rich olivines (Chaussidon et al., in prep).