RELICT CAI WITH HIGHLY FRACTIONATED OXYGEN ISOTOPES INSIDE A TYPE I CHONDRULE.

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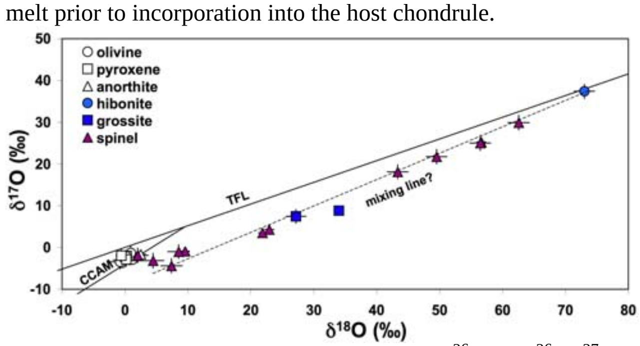
FUN CAIs and platy hibonite crystals (PLACs) with highly fractionated O are very rare igneous objects, which also have no or small excess of ^{26}Mg (^{26}Mg*) due to decay of ^{26}Al [e.g., 1-3]. The only ^{26}Al-rich CAIs with highly fractionated O are forsterite-bearing CAI TE [4] and hibonite-rich CAI Kz1-2 [5]. Here we describe a compound object, ACF209-UH1#1, composed of a relict CAI with highly fractionated O inside a Type I chondrule from the CR chondrite Acfer 209. The CAI portion, 200×300 µm^2, has an igneous, concentrically-zoned texture and consists of grossite with perovskite inclusions, hibonite, and spinel. Spinel grains near the CAI-chondrule boundary appear to be corroded by chondrule melt and contain variable Cr contents. The host chondrule, ~500 µm in diameter, is composed of olivine, Al-rich and Al-poor low-Ca pyroxenes, anorthitic plagioclase, and Fe,Ni-metal. Oxygen and Mg isotopes of ACF209-UH1#1 were measured *in situ* using the UH Cameca ims-1280 [3,6-7]. Data for chondrule olivine, low-Ca pyroxenes, and plagioclase are uniformly ^{16}O-depleted (Δ^{17}O ~ –2.5‰) and cluster slightly above CCAM line. CAI minerals are ^{16}O-depleted and fractionated to varying degrees. Hibonite is the most fractionated (δ^{18}O = +73‰) and ^{16}O-depleted (Δ^{17}O = –0.5‰). Data for grossite (δ^{18}O = +27‰ and +34‰; Δ^{17}O = –7‰ and –9‰) and spinel (δ^{18}O = +2‰ to +63‰, Δ^{17}O = –8‰ to –3‰) are less fractionated and define a linear array with slope of ~0.6, different from mass-dependent fractionation line (Fig. 1). Data for Cr-bearing spinels near the CAI edge plot close to the chondrule minerals. We infer that this array recorded incomplete O-isotope exchange between highly fractionated CAI minerals and unfractionated chondrule melt. Oxygen compositions of the relict CAI indicate that it experienced significant evaporative loss from melt prior to incorporation into the host chondrule.



Chondrule anorthite shows no resolvable ^{26}Mg*, (^{26}Al/^{27}Al)$_0$ < 6×10^{-6}. Spinel, hibonite, and grossite show very small intrinsic Mg-isotope fractionation and no resolvable ^{26}Mg*, (^{26}Al/^{27}Al)$_0$< 4×10^{-7}. The lack of ^{26}Mg* in CAI minerals could be due to either the absence of ^{26}Al in the original CAI, or Mg isotope exchange between the relict CAI minerals and/or the host chondrule melt. The preservation of ^{26}Mg excesses and deficits in relict hibonite inside chondrules [8] and rare occurrences of ^{26}Al-rich CAIs with highly fractionated O (TE, Kz1-2) support the former.

References: [1] Lee T. et al. 1980. *GRL* 7: 493. [2] Ireland T. R. et al. 1992. *GCA* 56: 2503. [3] Krot A. N. et al. 2008. *LPS* 39, #2162. [4] El Goresy A. et al. 1991. *LPS* 22, 345. [5] Ushikubo T. et al. 2006. *EPSL* 254: 115. [6] Nagashima K. et al. 2008. *LPS* 39, #2224. [7] Makide K. et al. 2008. *LPS* 39, #2407. [8] Krot A. N. et al. 2006. *ApJ* 639: 1227.