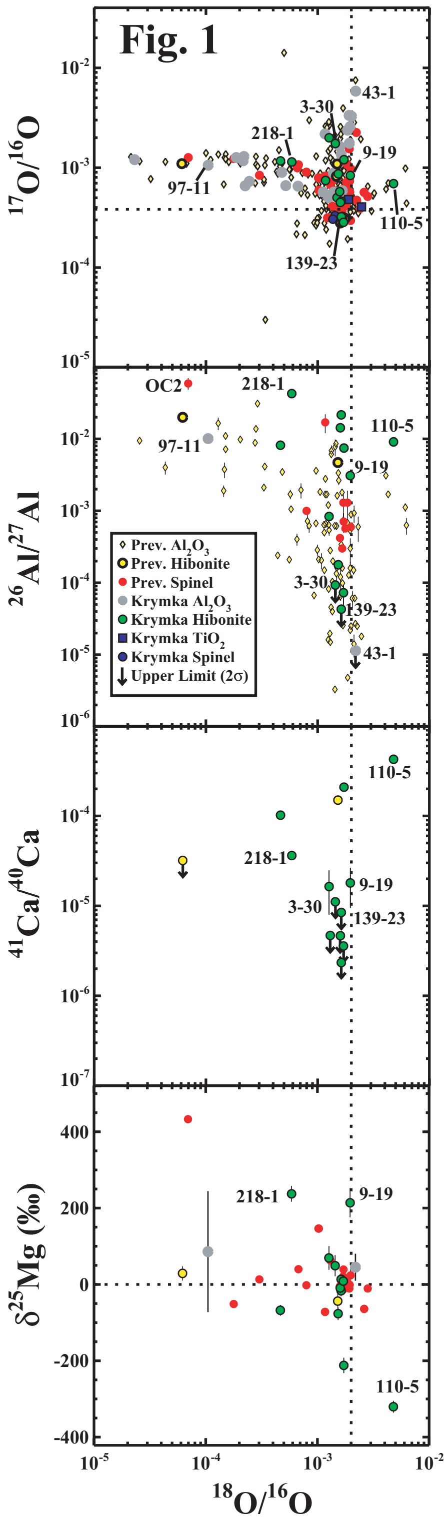
PRESOLAR AL-, CA-, AND TI-RICH OXIDE GRAINS IN THE KRYMKA METEORITE. L. R. Nittler[1], C. M. O'D. Alexander[1], F. J. Stadermann[2], and E. K. Zinner[2]. [1]Dept. of Terrestrial Magnetism, Carnegie Institution of Washington, 5241 Broad Branch Rd NW, Washington DC, 20015, (lrn@dtm.ciw.edu, alexande@dtm.ciw.edu), [2]Laboratory for Space Sciences and Physics Department, Washington University, St. Louis, MO, USA (fjs@wustl.edu,ekz@wustl.edu).



Introduction: Although a large number of presolar Al_2O_3 and $MgAl_2O_4$ grains have now been studied [1-3], only a handful of presolar hibonite ($CaAl_{12}O_{19}$) grains [4, 5] and a single presolar TiO_2 grain [6] have been previously reported. We report the identification and detailed isotopic characteristics of 46 presolar oxides from a new residue of the Krymka unequilibrated ordinary chondrite (LL3.1), including 15 Hibonites and 2 TiO_2 grains.

Experimental: We dissolved a ~8g sample of Krymka in alternating treatments of CsF-HF and HCl, followed by perchloric acid. Size-separated (~1-5μm) aliquots of the resulting residue were deposited on Au foils. SEM analysis indicated that the residue is composed primarily of spinel (~70%), hibonite (~13%), Al_2O_3 (~11%), TiO_2 (~3%), and SiC (~3%). A total of ~5,100 grains on two mounts were automatically analyzed for $^{17}O/^{16}O$, $^{18}O/^{16}O$ and AlO^-/O^- ratios with the Carnegie ims-6f ion probe [6, 7]. Of these, 27 Al_2O_3 (5% of all Al_2O_3), 15 hibonite (2% of hibonite), 2 TiO_2 (1.3% of TiO_2) and 2 spinel (0.06% of spinel) grains had O isotopic signatures indicating a presolar origin. Following their identification, the presolar grains were analyzed by NanoSIMS at Washington University for their O (to confirm 6f results in some cases), Mg-Al, K, Ca and Ti isotopic compositions (not all elements were measured in all grains). The K-Ca and Ti isotopic measurements were done in combined peak-jumping/multicollection mode. All potentially significant interferences (e.g., ^{50}V, ^{50}Cr on ^{50}Ti, etc.) were monitored and corrected for.

Results: Isotopic data are shown in the Figures. The O isotopic ratios of the new presolar grains span the ranges of previously observed presolar oxides. Ten of the 12 measured hibonites and 1 of 2 measured Al_2O_3 grains are highly enriched in ^{26}Mg due to the decay of extinct ^{26}Al. Inferred $^{26}Al/^{27}Al$ ratios span the range of previous measurements, but are typically at the high end of the range (up to 0.04). Half of the 12 measured hibonite grains have ^{41}K excesses due to extinct ^{41}Ca. Inferred initial $^{41}Ca/^{40}Ca$ ratios range from ~10^{-5} to 4×10^{-4}. There is no obvious correlation between the $^{26}Al/^{27}Al$ and $^{41}Ca/^{40}Ca$ ratios, except that all grains with evidence for ^{41}Ca also have ^{26}Al. There are grains with ^{26}Al and no ^{41}Ca, however. In addition to ^{26}Mg excesses from ^{26}Al decay, several hibonite grains show excesses or deficits in ^{25}Mg, similar to, and in several cases more extreme than, those observed in presolar spinel grains [8]. Calcium isotopic ratios are anomalous in many of the hibonite grains; isotopic patterns for the most interesting grains are shown in Fig. 2. Titanium isotopic measurements of the presolar hibonite grains were not possible due to ^{48}Ca interference on ^{48}Ti. However, Fig. 3 shows Ti patterns measured in one of the presolar TiO_2 grains and two Al_2O_3 grains.

Discussion: The O isotopic compositions of most of the hibonite grains indicate an origin in low-mass red giant and asymptotic giant branch (AGB) stars [1]. The inferred ^{41}Ca/^{40}Ca ratios for grains with ^{41}K excesses are in the range predicted for AGB stars [9]. The ^{26}Al/^{27}Al ratios range to somewhat higher values than predicted for typical mixing processes in AGB stars and probably require some cool bottom processing [8, 10]. Grains without ^{41}Ca clearly formed during earlier evolutionary stages than grains with ^{41}Ca and grains without ^{26}Al formed earlier still, probably in stars on the red giant branch [1]. A detailed discussion of the entire data set is beyond the scope of an abstract so we will focus on a few interesting grains. **110-5:** The origin of the Group 4 (^{18}O-rich) grains has remained enigmatic, with high-metallicity AGB stars and supernovae among the candidate stellar sources [1, 3]. Hibonite 110-5 provides additional data to help address this question. This grain has the highest inferred ^{41}Ca/^{40}Ca ratio and one of the highest ^{26}Al/^{27}Al ratios, but is strongly depleted in ^{25}Mg and ^{42,43}Ca. Since these latter isotopes are expected to be enriched in high-metallicity stars due to galactic chemical evolution (GCE) [8, 11], this seemingly argues against a high-metallicity-star origin for this grain. A supernova origin cannot be ruled out, but detailed examination of mixing models is needed. **218-1:** This Group 2 (^{18}O-depleted) grain has a very high inferred ^{26}Al/^{27}Al ratio, a strong ^{25}Mg enrichment, ^{41}Ca/^{40}Ca ~ 3×10^{-5}, a ^{42}Ca depletion and a ^{44}Ca excess. However, contribution of material from a neighboring hibonite grain cannot be ruled out for any of the isotopic measurements and it is likely that the true isotopic signatures are even more extreme than measured. If so, this grain appears to be similar in many ways to the spinel grain OC2, which is believed to have originated in an intermediate mass AGB star undergoing hot bottom burning [12]. **43-1:** This Al_2O_3 grain has a ^{17}O/^{16}O ratio higher than most presolar oxides and higher than is predicted for the envelopes of AGB stars [13]. Like a similar grain reported by [4], it shows no evidence for extinct ^{26}Al. Thus, its Ti isotopic composition is probably the original composition of its parent star. The δ^{46}Ti, δ^{49}Ti, and ^{50}Ti values are consistent with expectations for GCE of Ti isotopes if 43-1 formed in a higher-than-solar metallicity star. Its solar ^{47}Ti/^{48}Ti ratio is inconsistent with this scenario, however.

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