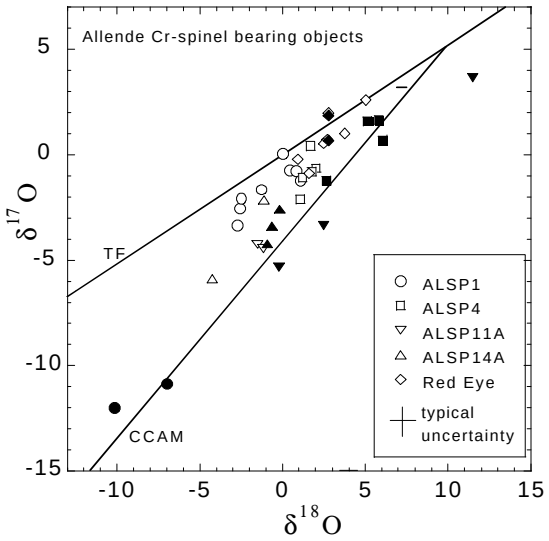
OXYGEN ISOTOPIC COMPOSITIONS OF Cr-SPINEL-BEARING OBJECTS IN ALLENDE. S. B. Simon[1], K. D. McKeegan[2], and L. Grossman[1,3]. [1]Dept. Geophys. Sci., 5734 S. Ellis Ave., The Univ. of Chicago, Chicago, IL 60637. [2]ESS Dept., UCLA, Los Angeles, CA 90095. [3]Enrico Fermi Inst., The Univ. of Chicago, Chicago, IL 60637.

Introduction: We have performed *in situ* measurements of the oxygen isotopic compositions of coexisting spinel and olivine in several Allende chondrules and inclusions. The goal is to determine whether Cr-bearing spinel from Allende is related to either refractory inclusions or to the spinel grains separated by freeze-thaw disaggregation from Murchison whose O-isotopic compositions plot close to the intersection of the terrestrial line with the CCAM line [1].

Samples: The samples were described by [2], except for ALSP4 and Red Eye. ALSP1 consists of a 1.0 x 0.75 mm, chevron-zoned spinel crystal fragment (2-8 wt % Cr_2O_3), partially enclosed by 50-100 µm olivine (Fo_{95-99}) grains set in a groundmass of nepheline and relatively Fe-rich olivine (Fo_{59-85}). ALSP11A is an unusual, spongey, ol-rich object dominated by a euhedral, 150 x 100 µm, homogeneous spinel grain with 23 wt % FeO and 50 wt % Cr_2O_3. The remaining samples are ol-rich chondrules. ALSP4 has subhedral ol (50-100 µm, Fo_{93-97}) with interstitial spinel, Al-cpx and mesostasis. ALSP14A is a chondrule fragment with a large, embayed olivine (400 µm, Fo_{86-99}) and ragged spinel in mesostasis. Red Eye is coarse-grained, with a 4x3 mm olivine grain and spinel grains >150 µm.

Results: Samples were analyzed with the UCLA CAMECA ims 1270 ion probe using established techniques [3]. Burma spinel and San Carlos olivine were employed as standards to correct instrumental mass fractionation; the (1σ) precision and accuracy of individual spot analyses is estimated to be ~1.5 ‰ for both $\delta^{17}O$ and $\delta^{18}O$. Analyses of ALSP1 spinel that traverse chemical zoning bands yield fairly homogeneous O-isotopic ratios, from $\delta^{17}O$ = -3.4, $\delta^{18}O$ = -2.7 ‰ to -0.8, 0.4‰. These values plot slightly below the terrestrial fractionation line and are within the range observed for Cr-spinel from Murchison [1]. They are quite distinct, however, from the compositions of the adjacent olivine, which are much more ^{16}O-rich (e.g., $\delta^{17}O$ = -12.0; $\delta^{18}O$ = -10.1 ‰). These isotopically light compositions plot on the CCAM line and are similar to those reported for refractory forsterite grains, both isolated and in chondrules, in Allende [4, 5]. In ALSP11A, Mg-rich cores of olivine grains are more ^{16}O-rich (e.g., $\delta^{17}O$ = -5.4; $\delta^{18}O$ = -0.2 ‰) than their FeO-enriched rims, ($\delta^{17}O$ = 3.6; $\delta^{18}O$ = 11.5 ‰). The large spinel crystal is isotopically homogeneous. Its composition plots clearly on the CCAM line and is more similar to the olivine cores rather than the FeO-rich rims with which it is in contact. In contrast, in chondrules ALSP4, ALSP14A and Red Eye, spinel and olivine are in O-isotopic equilibrium, with compositions similar to those in Allende chondrules [6].



Compositions of minerals in Allende Cr-spinel-bearing objects. Open symbols: spinel. Closed symbols: ol and pyx.

Discussion: The data confirm that there are two distinct populations of spinel in Allende: ^{16}O-enriched $MgAl_2O_4$ from CAIs and the relatively ^{16}O-depleted Cr-rich grains studied here. O-isotopic compositions of the latter, except for ALSP11A, are constrained to a field that overlaps that of chemically similar spinel from Murchison [1], suggesting that both CV and CM parent bodies sampled spinels that formed in similar nebular environments. The present results are consistent with modes of origin inferred from petrographic criteria. Indigenous spinel has similar isotopic compositions to Mg-rich olivine in the same chondrule, while ALSP1 and ALSP11A olivines are not in isotopic equilibrium with the spinel they enclose, indicating that the two phases are not genetically linked. That the O-isotopic composition of ALSP1 spinel is like those of chondrule Cr-rich spinels indicates that O-isotopic compositions cannot distinguish whether grains from such unequilibrated objects are condensates or fragments from a previous generation of chondrules.

References: [1] Simon S. et al. (1994) *GCA, 58,* 1313. [2] Simon S. et al. (1998) *LPS XXIX,* #1640. [3] McKeegan K. et al. (1998) *Science, 280,* 414. [4] Weinbruch S. et al. (1993) *GCA, 57,* 2649. [5] Leshin L. et al. (1998) *MAPS 33,* A93. [6] Clayton R. et al. (1983) *Chondrules & Their Origins,* 37.