COMPOSITION OF MATRIX IN C3.0 ACFER 094.
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Introduction and experimental: The origin of the nebular fine fraction is a matter of contention. Some have proposed that it largely preserves the record of presolar materials [1], others that it is almost entirely the product of evaporation and recondensation in the solar nebula [2]. These end models lead to different predictions: uniform compositions for presolar fines, variable compositions for recycled fines.

The Acfer 094 ungrouped C3.0 chondrite appears to have largely avoided aqueous alteration and thermal metamorphism. It has volatile abundances similar to those in CM chondrites [3] but our recent analysis [4] showed a highly fractionated K/Na ratio (0.8, 10× lower than mean CM-CO-CV). Evidence that it is especially primitive is the presence of anomalous ^{17}O-rich isotopic compositions [5].

We used a 3-µm electron microprobe beam to determine concentrations of 10 elements in 10 49-point grids, each ~50 µm on a side. An advantage of this approach compared to broad-beam analysis is that we could develop criteria for eliminating anomalous points (e.g., those with excessive amounts of a mineral phase or low totals). The fraction of discarded points was 26%. Duplicate grid analyses on different days on the LAP 02342 CR chondrite showed excellent reproducibility.

Results and Discussion: Of special importance is S, the most volatile element in our set. We measured 29.5 mg/g S in the matrix; this is 1.33× the bulk value of Dreibus et al. [3].

As observed in LAP 02342, compositions vary among grid areas; points that cluster on one diagram are resolved on other diagrams. On the K-Al diagram (Fig. 1) 3 grids are fully resolved from all other grids; the remainder overlap 1 other grid (2 points), 2 grids (1 point) or 3 grids (4 points). The cluster of 4 points (right-center in Fig. 1) resolve into 2 clusters on a Na-Al diagram; one of these has a unique composition on a S-Fe diagram.

The simplest model to explain these variations is that the fine nebular fraction preserves a clumpiness in the distribution of phases vaporized or lost as mesostasis spray during chondrule forming events. We suggest that low-degree (ca. 10%) melting of chondrule precursors created structures that survive nebular processing prior to agglomeration. That the same features are shared by Acfer and LAP implies that the processes were widespread.

References: [1] Alexander C. 2005 MaPS 40: 943; [2] Wasson J. Icarus 195, in press; [3] Dreibus et al. 1995 Meteoritics 30, 439; [4] Rubin et al., GCA 71, 2361; [5] Sakamoto et al. 2007 Science 317, 231.