IRON ISOTOPIC COMPOSITIONS OF PRESOLAR SILICATE GRAINS FROM ACFR 094. C Floss, W. J. Ong and F. Gyngard. Physics Department, Washington University, St. Louis, MO 63130, USA. (email: floss@wustl.edu)

Introduction: Presolar grains help constrain stellar evolution and nucleosynthetic processes. Iron is of particular interest due to its importance in s-process nucleosynthesis. Iron isotopic measurements are still limited, but the available data show inconsistencies with current stellar models [1-4]. Presolar silicates are good candidates for these measurements because of their high Fe contents [5-8], but the analyses are difficult because the grains are small and are typically identified in meteorite thin sections or densely packed grain size separates. We are carrying out Fe isotopic measurements of Acfer 094 presolar silicates with the NanoSIMS, using positive primary and negative secondary ions to reduce signal overlap due to the larger O^- primary beam and to help locate the grains via secondary electron images [9].

Experimental: We used the Cs^+ beam to measure the Fe isotopes as oxides in two magnetic fields: 16 (^{16}O), 68 (^{52}CrO), 70 (^{54}FeO, ^{54}CrO), 73 (^{57}FeO), and 78 (^{62}NiO) in detectors 1–5, followed by 72 (^{56}FeO) and 74 (^{58}FeO, ^{58}NiO) in detectors 2–3. The mass resolution was high enough to largely separate $^{56}Fe^{16}OH^-$ from $^{57}Fe^{16}O^-$, with a contribution from $^{56}Fe^{16}OH^-$ to the $^{57}Fe^{16}O^-$ peak of ~ 1%. The reproducibility for $^{57}Fe/^{56}Fe$ and $^{54}Fe/^{56}Fe$ on both Fe,Ni metal and Acfer 094 matrix silicates is ~20–30 ‰. Corrections for ^{54}Cr on ^{54}Fe were ≤ ~10 ‰ for all grains. The $^{58}Fe^{16}O^-$ signal is dominated by $^{58}Ni^{16}O^-$; thus, no data are reported for $^{58}Fe/^{56}Fe$.

Results: O-anomalous grains were initially identified by ion imaging of an Acfer 094 grain size separate. Most belong to oxygen isotope group 1, but one is a group 4 grain [10]. Of the grains measured for Fe, one is enriched in both ^{54}Fe and ^{57}Fe ($\delta^{54}Fe = 70 \pm 25$ ‰; $\delta^{57}Fe = 80 \pm 30$ ‰). The remaining grains have normal $^{54}Fe/^{56}Fe$. Three of these (including the group 4 grain) also have normal $^{57}Fe/^{56}Fe$, but three others show marginal depletions in ^{57}Fe ($\delta^{57}Fe/^{56}Fe = -75 \pm 35$; -90 ± 50; -100 ± 35 ‰) and one is strongly depleted in ^{57}Fe ($\delta^{57}Fe/^{56}Fe = -210 \pm 35$ ‰).

Discussion: Grains condensing around low-mass AGB stars are expected to show s-process enrichments in ^{57}Fe and ^{58}Fe, and to have $^{54}Fe/^{56}Fe$ ratios that don't differ substantially from the initial values of their parent stars [1]. This is consistent with the ^{57}Fe enrichment observed in one of the group 1 grains; the grain's elevated $^{54}Fe/^{56}Fe$ ratio may be due to galactic evolution [e.g., 1].

The depletions in ^{57}Fe observed in four grains are not easily explained by current models of AGB nucleosynthesis. Similar depletions have been seen in some mainstream SiC grains [1], and in an FeO grain from Acfer 094 [2]. Supernova models also predict enrichments in ^{57}Fe (and in ^{54}Fe); although most SiC X grains do have elevated $^{57}Fe/^{56}Fe$ ratios, some X grains with ^{57}Fe depletions have also been reported [1]. The inconsistencies between the grain data and model predictions for both supernovae and low-mass AGB stars show that our understanding of stellar nucleosynthesis is incomplete and that additional data as well as updated models are needed.

[1] Marhas et al. (2008) *ApJ* 689, 622. [2] Floss et al. (2008) *ApJ* 672, 1266. [3] Vollmer et al. (2010) *LPS XLI*, #1200. [4] Trappitsch et al. (2012) *LPS XLIII*, #2497. [5] Floss and Stadermann (2009) *GCA* 73, 2415. [6] Vollmer et al. (2009) *GCA* 73, 7127. [7] Bose et al. (2010) *ApJ* 714, 1624. [8] Nguyen et al. (2010) *ApJ* 719, 166. [9] Ong et al. (2012) *LPS XLIII*, #1225. [10] Nittler et al. (1997) *ApJ* 483, 475.