IRON-ENRICHED STARDUST GRAINS IN THE METEORITES ACFER 094, QUE 99177 AND MET 00426.

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Introduction: In this study elemental compositions of the presolar grains identified in Acfer 094 are measured in the Auger Nanoprobe. Classification of the presolar silicates into olivine and pyroxene is done on the basis of the Fe+Mg(+Ca)/Si ratio. Fe-Mg silicates (e.g., olivine and pyroxene) are expected to have Mg-rich compositions under conditions of equilibrium condensation in the winds of evolved stars [1]. We also compare the presolar silicate grain compositions found in Acfer 094 to those in the CR chondrites QUE 99177 and MET 00426 [2].

Experimental: NanoSIMS measurements are carried out in raster ion imaging mode by scanning <1 pA Cs^+ primary beam over areas of 10x10 μm^2 (256^2 pixels) and simultaneously collecting secondary ions of $^{12, 13}C^-$ and $^{16, 17, 18}O^-$, as well as secondary electrons. The O-anomalous grains identified in the NanoSIMS are located with the Auger Nanoprobe and spectra are obtained at 10 kV 0.25 nA. High resolution distribution maps of chosen elements are also obtained for most grains.

Results: We report the identification of 42 additional O-anomalous grains in ~0.1-0.5 μm grain size separates from Acfer 094. Auger measurements of 36 presolar grains identify 30 silicates and 6 oxides. Among the presolar silicates measured, 4 grains have olivine-like compositions and 9 grains have pyroxene-like compositions. We found 4 grains with ferrosilite-like compositions, 1 grain with an enstatite-like composition as well as 1 forsterite-like grain. The remaining silicate grains have non-stoichiometric compositions. Among the presolar oxides, 2 grains contain only Fe and 1 grain contains only Ti in addition to O. Measurements on Ti and Fe oxide standards are needed to determine their stoichiometry.

Discussion: All 3 meteorites contain more Fe-rich pyroxenes than Mg-rich ones. Except for 1 Fe-rich olivine-like grain, the remaining olivines in the CR chondrites are Mg-rich. However, most of the silicates with non-stoichiometric compositions are Fe-rich (17 out of 28). In Acfer 094, all the grains with olivine-like compositions are Fe-rich (mg# 11-31), except for the single forsterite grain. In addition, 11 out of 15 non-stoichometric grains are Fe-rich, including 9 silicates with only Fe (i.e., no Mg). The number of oxides containing only Fe is also high in Acfer 094. The presolar silicate compositions are in contrast to spectroscopic evidence of dust around evolved stars that have optical properties similar to crystalline Mg-rich phases such as forsterite and enstatite [3]. However, the spectra of circumstellar environments also indicate the presence of Fe-rich amorphous silicates [3]. The substantial enhancement of Fe contents in the silicate grains of the meteorites could be due to condensation of the silicate grains under non-equilibrium conditions [4] or secondary processing in the solar nebula or on the parent body [e.g., 5]. Alternately, a large fraction of the presolar silicate grains could be amorphous in nature.

References: [1] Demyk K. et al. 2000. *Astronomy and Astrophysics* 364:170-178. [2] Floss C. and Stadermann F. J. 2008. Abstract #1280. 39th Lunar and Planetary Science Conference [3] Molster F. J. and Waters L. B. F. M. 2003. In *Astromineralogy.* p. 121. [4] Gail H. -P. 2003. In *Astromineralogy.* p. 55. [5] Nguyen A. and Zinner E. 2004. *Science* 303:1496-1499.