FE-XANES MEASUREMENTS ON ANHYDROUS CLUSTER IDPS.

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Introduction: Chondritic porous interplanetary dust particles (CP IDPs), extremely primitive early Solar System material [1], are, most likely, not a complete, representative sample of their parent body. A typical ~10 μm CP IDP is an aggregate of $>10^4$ submicron grains. But stratospheric collections include many larger non-chondritic, mono-mineralic grains, mostly olivine, pyroxene and sulfide, that have fine-grained, chondritic material (i.e., small bits of CP IDPs) adhering to their surfaces. This indicates at least some of the non-chondritic grains on the stratospheric collectors are fragments from the same parent as the CP IDPs. Cluster IDPs, typically ~100 times the mass of 10 μm CP IDPs containing some large mono-mineralic grains, sample the parent body at a much larger scale than 10 μm CP IDPs. Fe is a major element (~18.5%) in chondritic meteorites, and the Fe-oxidation state distinguishes various meteorite groups [2].

Measurements: We have begun a project to systematically determine the Fe oxidation states of anhydrous cluster IDPs by Fe X-ray Absorption Near-Edge Structure (XANES) spectroscopy. We previously reported that cluster IDP L2009R2 is dominated by Fe with a valance near Fe^{2+} [3] In addition, the absence of large amounts of Fe-metal in L2009R2 suggests that even at the size scale of cluster IDPs the anhydrous IDP parent body is different from the Wild 2 particles analyzed by Olgiore et al. [4], which exhibited significant Fe-metal ($24\%_{-14\%}^{+6\%}$).

Results: We have now performed Fe-XANES on >75% of the area of the anhydrous cluster IDP L2009R1, a Zn-depleted cluster (Zn/Fe = 0.20xCI) that likely experienced Zn-loss due to significant atmospheric entry heating. The average spectrum of L2009R1 (shown in Figure 1) plots between Fe^{2+} and Fe^{-3+}, but is significantly closer to Fe^{3+} than was L2009R2. Again, we see no evidence for significant Fe-metal in this anhydrous cluster IDP, indicating that both large cluster IDPs examined thus far differ significantly from the Wild 2 particles measured by Ogliore [4].

References: [1] Ishii, H. et al. 319, 447-450 (2008). [2] Urey, H. C. and Craig, H., *Geochim. Cosmochim. Acta,* 4, 36-82 (1953). [3] Flynn, G. J. et al., *Lunar & Planet. Sci. XLII,* #2521 (2011). [4] Ogliore, R. et al. *EPSL*, 296, 278-286 (2010).

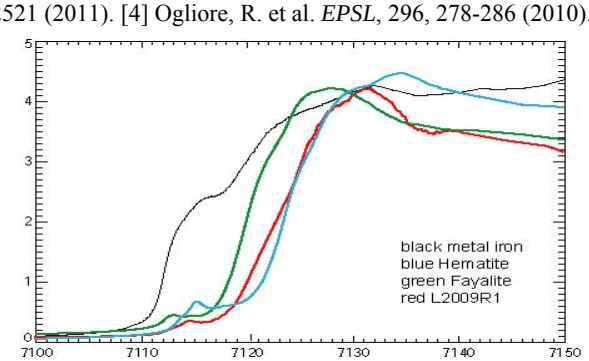

Figure 1: Fe-XANES spectrum summed over the entire analyzed area of cluster IDP L2009R1 compared to the spectra of Fe-metal, fayalite (Fe^{2+}), and hematite (Fe^{3+}) standards.