OXYGEN ISOTOPIC COMPOSITIONS OF WILD 2 SILICATES.

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Introduction: Comet 82P/Wild 2 Stardust samples have both similarities and differences with carbonaceous chondrite meteorites and anhydrous interplanetary dust particles. Oxygen isotopic measurements show that presolar grains are present but rare, that the average composition is near terrestrial values, and that CAIs are present [1]. These results indicate that much of cometary material formed at high T and cycled over vast distances early in solar system history. In order to elucidate the relationships between cometary and meteoritic components we are pursuing a systematic coordinated mineralogical and isotopic study of Stardust samples. Here we report O isotopic measurement of silicate minerals from 4 tracks. The samples were embedded in epoxy or acrylic and 70 nm thick sections were obtained for TEM investigation. Following the TEM study, the samples were analyzed for O isotopic compositions by isotopic imaging with the JSC NanoSIMS 50L ion microprobe.

Results: The samples included an 8 μm forsterite (Fo98) terminal particle (C2067 Track 112,1), a 1 μm forsterite (Fo98) grain from track 10,84 (Arrina), and two 1 μm enstatite grains (Track 80,1,6, Tule) and (Track Fc 13b,1). Adjacent sections of the latter enstatite grain contained organic materials and are enriched in D/H [1,2]. The small forsterite and enstatite grains had terrestrial O isotopic compositions within error ($\delta^{17}O = 10 \pm 11$, $\delta^{18}O = -9 \pm 5$; $\delta^{17}O = -16 \pm 18$, $\delta^{18}O = 0 \pm 5$; $\delta^{17}O = 16 \pm 12$, $\delta^{18}O = 13 \pm 8$, 1σ), respectively. These values are similar to values we previously found for enstatite, fayalite, and tridymite grains from tracks Ada and Febo [3]. In contrast, forsterite grain T112,1 was significantly ^{16}O-rich ($\delta^{17}O = -65 \pm 4$, $\delta^{18}O = -59 \pm 3$). Isotopic images of T112,1 have homogeneous O isotopic composition.

Discussion: O isotopic compositions of Wild 2 samples are generally near terrestrial values. Notable exceptions are the CAI-like particle Inti ($\delta^{17}O = \delta^{18}O = -40‰$) [1] and a fine-grained olivine/pyroxene particle Gozen-Sama whose O isotopic composition is heterogeneous and falls along the CCAM line with $\delta^{17}O$ and $\delta^{18}O$ values ranging from ~0 to -45‰ [4]. T112,1 is somewhat more ^{16}O-rich in comparison with these samples, falling near the endpoint of the CCAM trend line. The isotopic, mineralogical, and chemical compositions of T112,1 are similar to components of some AOAs and a unique chondrule [5,6]. The large ^{16}O enrichment and Mg-rich composition is consistent with this grain having condensed from a high T gas, possibly together with refractory inclusions in meteorites.

References: [1] McKeegan K. D. et al 2006 *Science* 314, 1724 [2] Sanford S.A. et al. 2006 *Science* 314, 1720 [3] Matrajt G. *et al*. 2006, *Met. Planet. Sci*. 43, 1 [4] Nakamura T. et al. 2008, Lunar Planet. Sci. 39, #1695 [5] Imai H & Yurimoto H 2003, *GCA* 67, 765 [6] Kobayashi S. et al. 2003, *Geochemical Journal* 37, 663.