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Assessing the stardust inventory of comet 81P/Wild 2 by NanoSIMS

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Introduction. Comets most likely have formed in the cold, outer regions of the protosolar cloud, representing the most primitive matter in the solar system. NASA's Stardust mission collected dust from the coma of comet 81P/Wild 2 and returned it to Earth in 2006 [1]. Besides low-density aerogel, aluminum foil provided a second valuable capture medium for cometary dust [1,2]. Impactor residues were found inside crater cavities or on crater rims. Preliminary examination revealed the dust to be an unequilibrated mixture of heterogeneous material of mainly solar system isotopic composition [2,3]. To date, only three ^{17}O-rich presolar grains and one presolar SiC grain were found [4,5].

Results and Discussion. We investigated the O isotopic composition of impact residues in small craters (∅ 0.25–4.4 μm) on Stardust Al foils by NanoSIMS. 120 craters have been analyzed so far, with a total area of 135 μm^2. None of the residues show isotope signatures characteristic of presolar grains. δ^{17}O and δ^{18}O are between -223±64 and +202±138 ‰ and between -52±6 to +111±48 ‰, respectively. Together with results for two large craters (C2013N & C2086N), we obtain an upper limit of ~30 ppm for the presolar silicate/oxide abundance in Wild 2. With the results from [4], this yields an abundance of 11 ppm, significantly lower than for other primitive solar system materials. This value may be biased in the investigated samples: Presolar grains that melted during foil impact may have been mixed with matter of solar system composition. Thus, isotopic anomalies might have been lost by dilution in large impact craters (∅ > 20 μm), which make up more than 90 % of the investigated material. Isotopic anomalies are much easier preserved in small craters (∅ < 2 μm), even for complete melting. Thus, small impact craters are the most promising objects to infer the abundance of presolar grains within Wild 2 matter. Based on our investigation of small craters, we obtain a preliminary upper limit of 8000 ppm for presolar grains.

[1] Brownlee et al. (2006) *Science* **314,** 1711–1716. [2] Hörz *et al.* (2006) *Science* **314,** 1716–1719. [3] McKeegan *et al.* (2006) *Science* **314,** 1720–1724. [4] Stadermann & Floss (2008) *LPS* **39**, #1889. [5] Messenger *et al.* (2009) *LPS* **40**, #1790.