NANOSIMS SEARCH FOR PRESOLAR GRAINS IN MATTER FROM COMET 81P/WILD 2 AND THE CR CHONDRITE NWA 852.

J. Leitner[1], P. Hoppe[1], J. Huth[1], and J. Zipfel[2]. [1]Max-Planck-Institute for Chemistry, 55128 Mainz, Germany. E-mail: leitner@mpch-mainz.mpg.de. [2]Forschungsinstitut und Naturmuseum Senckenberg, 60325 Frankfurt, Germany

Introduction: Primitive solar system materials contain varying amounts of presolar dust grains that formed in the winds of evolved stars or in the ejecta of stellar explosions [1]. Presolar silicates and oxides are among the most abundant types of these grains [2–6]. Although they belong to the most primitive chondrite groups, first studies of CR chondrites indicated only low presolar dust abundances. Recent investigations, however, revealed much higher abundances of presolar dust in individual meteorites of this group [7,8]. Comets are believed to 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 successfully returned it to Earth in 2006 [9]. Preliminary examination revealed the dust to be an unequilibrated mixture of heterogeneous material of mainly solar system isotopic composition. To date, only three ^{17}O-rich presolar grains were found [10,11]. Here, we present first results of our investigation of the presolar silicate/oxide grain inventory of Wild 2 foil crater residues and matrix of the CR2 chondrite NWA 852.

Samples and Experimental: In this ongoing study, impact residues in 18 small craters (∅ 520–1760 nm) on Stardust Al foil C2037N, found in a SEM high-resolution survey, were investigated, as well as fine-grained matrix on a thin section of NWA 852. A ~100 nm primary Cs^+ beam was rastered over the sample areas in the NanoSIMS 50, and $^{16}O^-$, $^{17}O^-$, $^{18}O^-$, $^{28}Si^-$, and $^{27}Al^{16}O^-$ ion images were acquired in multi-collection mode.

Results and Discussion: The 18 investigated craters so far (total area: 25 μm^2, some 3 pg of cometary matter) contain no presolar silicate/oxide grains. All residues are isotopically normal within 2σ, with $\delta^{17}O$ and $\delta^{18}O$ values from -66±42 to +164±94 ‰ and from -32±30 to +24±35 ‰, respectively. In 8 fine-grained matrix areas analyzed in NWA 852, all 10×10 μm^2 in size, we found one presolar silicate grain. The 300 nm-sized grain has $^{17}O/^{16}O = (5.98\pm0.31)\times10^{-4}$ (i.e., 1.55x solar) and solar $^{18}O/^{16}O$. It belongs to group 1, most likely originating in low-mass AGB stars [12]. This grain represents an abundance of ~90 ppm in NWA 852, slightly below the abundances inferred for the CR chondrites QUE 99177 and MET 00426 [7,8].

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