Why are there so few presolar grains in samples from comet Wild 2?

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When the solar system formed some 4.6 Ga ago, it incorporated presolar grains that had condensed around other stars and that escaped the widespread homogenization in the solar nebula. Such grains are still present at ppm-levels in various types of solar system materials and can be identified on the basis of their anomalous isotopic compositions, which reflect their stellar formation conditions. Since presolar grains can easily be destroyed by a variety of parent body alteration processes, relatively high abundances of such grains can attest to the primitive nature of its host material (e.g., interplanetary dust particles, primitive meteorites).

Among the most perplexing results of the analysis of Wild 2 cometary matter, which was returned by the Stardust probe [1], is the fact that it contains large contributions of high-temperature minerals [1, 2], but only very few presolar grains [3-9]. Both observations are in apparent conflict with the expectations for this comet whose residence in the cold Kuiper belt should have provided ideal conditions for the preservation of primitive early solar system materials.

To evaluate whether the low abundance of presolar grains in Wild 2 material could be due to preferential destruction of such matter during sample collection, we are now performing 6.1 km/s test shots of pulverized meteoritic material with known presolar grain abundances into Stardust analog collector foils [9]. Early results indicate that there may indeed be a larger loss of such grains than previously thought, but it remains to be seen whether this can fully account for the observed low abundance. Alternatively, the low abundance may be due to a significant dilution with material from the inner solar system [5]. Various scenarios will be discussed.

[1] Brownlee *et al*. (2006) Science **314**, 1711. [2] Zolensky et al. (2006) Science **314**, 1735. [3] McKeegan *et al*. (2006) Science **314**, 1724. [4] Stadermann *et al*. (2008) MAPS **43**, 299. [5] Stadermann & Floss (2008) LPSC **39**, abstr. #1889. [6] Messenger *et al*. (2009) LPSC **40**, abstr. #1790. [7] Brownlee *et al*. (2009) LPSC **40**, abstr. #2195. [8] Leitner *et al*. (2009) LPSC **40**, abstr. #1512. [9] Stadermann *et al*. (2009) LPSC **40**, abstr. #1188.