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# Initial Look at the Mineralogy and Petrology of Comet Wild2 Nucleus Samples

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Introduction: The sample return capsule of the Stardust spacecraft was successfully recovered in northern Utah on January 15, 2006, under completely nominal conditions and was delivered to the new Stardust Curation Laboratory at the Johnson Space Center two days later. Within the first week we began the harvesting of aerogel cells, and the comet nucleus samples they contain for detailed analysis. This presentation will present the first results from the mineralogical and petrological analyses that will have been performed. Mineralogy/Petrology: We have performed numerous electron beam analyses (SEM, STEM, EELS, EBSD, microprobe, cathodoluminescence) on microtomed slices and remaining potted butts, and we now have some understanding of the following fundamental sample issues (below). We have also been performing numerous XRD analyses using synchrotron photons, on selected entire grains. We have also been making detailed observations on particle bulk chemistry, isotopic composition, and organics, although mineralogy and petrology will be the focus of this presentation. Examination Goals: The basic goals of the Stardust Preliminary Examination Teams are as follows. (1) Comet nucleus chemistry, mineralogy and petrology. What are the basic aspects of the samples? What is the grain size distribution of the samples, and how crystalline are they? Does a record of the grain accretion process survive (i.e. microporosity or other physical properties)? Are phyllosilicates or other obvious products of aqueous reactions present? How do the samples compare to chondritic interplanetary dust particles (IDPs), Antarctic micrometeorites, and carbonaceous chondrite meteorites? (2) How variable are the samples? For example, do all grains look exactly like anhydrous chondritic IDPs? Or is there a wide range of mineral assemblages and petrological properties, indicating a wide range of preaccretionary histories for the grains? (3) How do we recognize the many IDPs that should have been captured along with the cometary grains? During the cruise phase of the mission, when one collector tray was exposed to the interstellar flux, we undoubtedly collected stray IDPs into both trays. (4) How were the samples altered by the collection process? Based upon two decades of work on grain capture in aerogel both in the lab and on the Mir space station, we expect most captured samples to be fragmented and heated to a wide degree [1&2]. How difficult is it to distinguish the pre-capture state of the samples from the grain residues in the aerogel? (5) What did we capture in the interstellar tray?(6) Finally, what totally unexpected features have we encountered, and how do we learn to deal with them? We can expect to be surprised. References: [1] Barrett R. et al. (1992) Proceedings of the 19th Lunar and Planetary Science Conference, 203-212; [2] Horz F. et al. (2000) Icarus 147, 559-579.