Comparison of the Mineralogy of Comet Wild 2 Coma Grains to Other Astromaterials

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We propose that Kuiper Belt samples (in this case comet coma grains from the Jupiter family comet Wild 2) are recognizably different from the bulk of materials in outer belt asteroids, because of their different formation positions and times in the early solar system. We believe this despite similarities found between some Wild 2 grains and components of carbonaceous chondrites (i.e. some CAI and chondrules). Kuiper Belt samples must preserve measurable mineralogical and compositional evidence of formation at unique positions and times in the early solar nebula, and these formational differences must have imparted recognizable special characteristics. We hypothesize that these characteristics include: (1) Unique major element compositional ranges of common astromaterial minerals, especially olivine and pyroxene; (2) Unique minor element compositions of major silicate phases, especially olivine and low-Ca pyroxene; (3) Degree and effects of radiation processing – including amorphous rims, metal coatings, and Glass with Embedded Metal and Sulfides (GEMS) [1-3]; (4) Presence of abundant presolar silicate grains as recognized by anomalous oxygen in silicates [1,3,4]; (5) Oxidation state of the mineral assemblage [5].

We are working our way through all available Wild 2 samples, selecting 1-2 non-consecutive viable TEM grids from each possible extracted Wild 2 grain. We especially prefer TEM grids from grains for which complete mineralogical details have not been published (which is to say the majority of the extracted grains). We are performing a basic mineralogic survey by E-beam techniques, to establish the essential features of the extracted Wild 2 grains. We are making a particular effort to carefully and accurately measure minor elements of olivine and pyroxene, as these minerals are widespread in astromaterials, and comparisons of their compositions will serve to place the Wild 2 silicates in contact with asteroids, meteorites and chondritic interplanetary dust particles processing [1-6]. We are also making a special effort to search for mineralogical products of aqueous alteration, since their presence would reveal that Wild 2 was once internally heated, a result with dramatic implications for models of early solar system primitive bodies. Thus far carbonates are the only potential evidence for aqueous alteration for Wild 2.

[1] Bradley (1994) *Science* **265**, 925-929. [2] Chi et al. (2007) *Lunar And Planetary Science XXXVIII.* abstract.
[3] Nakamura-Messenger et al. (2008) *MAPS* **43**, paper id. 5247. [4] McKeegan et al. (2006) *Science* **314**, 1724-1728. [5] Westphal et al. (2008) *Lunar and Planetary Science XXXIX*. Abstract. [6] Zolensky et al. (2006) *Science* **314**, 1735-1740.