ANALOGUES FOR WILD2: CARBONACEOUS CHONDRITES SHOT INTO AEROGEL

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Introduction: Terminal grains in *Stardust* keystones provide the most pristine cometary material for study collected from Comet Wild2. Investigation of these particles has revealed increasing evidence of similarities between the Wild2 constituents and carbonaceous chondrites. Such evidence includes Al-rich, and FeMg chondrule fragments and particles similar to late-forming chondrules in CR chondrites [1,2], as well as Al-rich and Ti-bearing clinopyroxenes with Mg-Al spinel consistent with CAI's [3,4]. Another feature of the Wild2 particles is the iron oxides identified in *Stardust* keystones, suggesting further similarities with carbonaceous chondrites [5-7]. Magnetite and magnetite-hematite mixtures [6,8] have been found along track walls and magnetite has been found in terminal grains [5,9,10], which are consistent with carbonaceous chondrite matrix material. The magnetite is assumed to be the result of the hydrous alteration of co-existing ferromagnesian minerals, also abundant in the Wild2 grains [10].

In order to identify the closest chondrite analogues for Wild2 we are studying mineralogically characterised CR2 and CV3 powders shot into aerogel, and then prepared as keystones, analogous to the way Wild2 samples were captured by *Stardust* and subsequently analysed.

Methods: Polished sections were made from NWA 4502 (CV3) and NWA 10256 (CR2). Interior parts of each sample, away from the crust, were ground into a powder with grain size 25 - 200 µm. Half of the powders were fired into aerogel of density gradient 25-55 mg/cm^3 at speeds of 6.1-6.3 kms^{-1} using the University of Kent light gas gun [11] while the other half were made into polished blocks for further analysis. The sections and blocks were characterised using a Phillips XL30 ESEM with Oxford INCA 350 EDX system at the University of Leicester. Raman analyses were made at the University of Kent [6] and keystones at the University of Berkeley [12].

Results: Image analysis of NWA 4502 showed 38% matrix, 14% CAI's and 48% chondrules. Pyroxene is $En_{50-98}Wo_{0-34}Fs_{0-2}$ and olivine Fo_{66-100} within chondrules; with olivine Fo_{36-50}, Fe-Ni-metals, Fe oxide and sulfides present in the matrix. NWA 10256 was found to have 42% matrix including sulfides, metal and Fe oxide. Chondrule pyroxene and olivine are $En_{89-98}Wo_{0-1}Fs_{1-10}$, Fo_{91-99}, with more fayalitic olivine Fo_{34-40} present in the matrix.

Raman Analyses of the Tracks. Hematite, enstatite and forsterite have been identified in three of the aerogel tracks of the CR2 powdered sample.

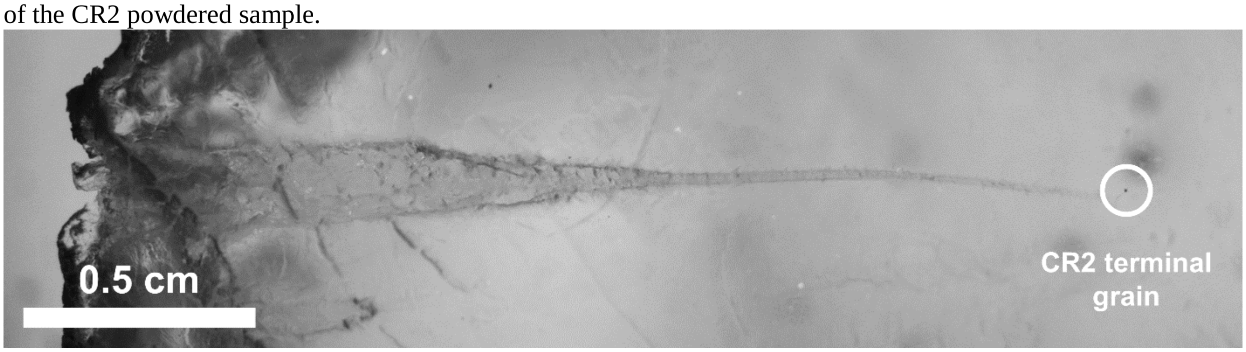

Fig. 1. Impact track in aerogel, with a length of 22 mm. The shot material is bulk NWA 10256 CR2 carbonaceous chondrite.

Discussion: In addition to Raman, synchrotron X-ray diffraction (XRD), X-ray absorption (XAS), and X-ray fluorescence (XRF) will be used on tracks in keystones in order to characterise the mineralogy in the same way as we have used for the *Stardust* tracks [5,9,10]. In this way we expect to gain a more accurate comparison between Comet Wild2 and different carbonaceous chondrite types of varying mineralogy.

References: [1] Bridges J.C. et al. 2012. *Earth and Planetary Science Letters 341-344*, 186–194. [2] Brownlee, D. et al. 2012. *Meteoritics and Planetary Science* 47, 453–470. [3] Ishii H.A. et al. 2010. Abstract #2317. 41st Lunar & Planetary Science Conference. [4] Simon S.B. et al. 2008. *Meteoritics and Planetary Science* 43, 1861–1877. [5] Hicks L.J. et al. 2014. Abstract #2051. 45th Lunar & Planetary Science Conference. [6] Bridges J.C. et al. 2010. *Meteoritics and Planetary Science* 45, 55-72. [7] Changela H.G. et al. 2012. *Geochimica et Cosmochimica Acta*, 98, 282-294. [8] Stodolna J. et al. 2010. Abstract #1657. 41st Lunar & Planetary Science Conference. [9] Price M.P. et al. 2015 Abstract #2000. 46th Lunar & Planetary Science Conference. [10] Bridges J.C. et al. 2015. Abstract #EPSC2015-866-1. European Planetary Science Congress. [11] Burchell M. J. et al. 2008. *Meteoritics and Planetary Science* 43, 23-40. [12] Westphal A. J.., et al. 2004. *Meteoritics and Planetary Science* 39, 1375–1386.