# RAMAN SPECTROSCOPY OF *STARDUST* TRACKS 170, 176, 177 AND 178: COMPARISON TO CHONDRULES FROM QUE 99177.

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**Introduction:** We present a summary of Raman spectroscopy results from a set of terminal grains found in tracks C2112,4,170,0,0 ('170', 1 grain), C2045,2,176,0,0 ('176', 10 grains), C2045,3,177,0,0 ('177', 12 grains) and C2045,4,178,0,0 ('178', 13 grains) taken from the cometary side of NASA's *Stardust* mission sample collector [1]. In addition, preliminary results from the Raman mapping of the surface of four chondrules from a CR3 chondrite (QUE 99177).

**Results - *Stardust* grains (and see [2]):**
*#170:* Previous in situ XANES and EXAFS analyses carried out on the terminal grain of track 170 concluded that the grain contained a mixture of Fe-metal and Cr- and Ca-bearing silicate [3]. Raman spectroscopy results supported the initial results of Bridges *et al*, and determined that the mineralogy of the silicate phase was Mg-rich olivine, $Fo_{95}$ [4].
*#176* presents significant carbon signatures with strong olivine and enstatite (verified in [5]).
*#177* is olivine rich (Mg rich) with some carbon (verified in [5]).
*#178* has significant carbon (especially around the bulb), but fewer olivine signatures. We speculate that this could be a reflection of the bulb-like nature of the track, implying an organic rich impactor, with embedded magnetite grains identified by XRD (forming much of the terminal particles, [3]). By analogy with carbonaceous chondrites the magnetite may have formed through water-rock interaction on a precursor parent body.

**Results - chondrules:** In order to provide a comparison with the *Stardust* organic analyses, a sample of CR3 chondrite QUE 99177 was analysed (kindly supplied by A. Brearley). This sample is rich in carbon globules and has undergone minimal aqueous alteration [6]. Initial Raman mapping has been undertaken on four (out of six) of the chondrules.
*C#1 & C#2:* similar in composition with small (~1 µm) grains of olivine and pyroxene (mostly diopside) in a carbon-rich matrix.
*C#3:* as C#1 and C#2, but more intense carbon lines.
*C#4:* as C#3 but with small grains of hematite.

**Future work:** The chondrules are now embedded in epoxy and will be polished down to reveal their internal structure and mineralogy. They will then be mapped using Raman and SEM-EDX to give a quantitive comparison of the relative abundances of minerals present in the chondrules and the *Stardust* grains. Additionally, detailed analyses will be undertaken of the 'D' and 'G' carbon bands to try and ascertain if they are the result of impact induced pyrolysis of an organic compound, or intrinsic to the *Stardust* grain. The results will be presented at MetSoc.

**References: [1]** Brownlee D. E. et al. (2006), *Science*, 314, 1711. **[2]** Price M. C. et al. (2014). *45th LPSC, #1252*. **[3]** Bridges J. C. et al (2012), *43rd LPSC, #2214*. **[4]** Price M. C et al (2012), *EPSC*, EPSC2012-333. **[5]** Hicks L. et al. (2014). *45th LPSC, #2051*. **[6]** Abreu N. et al (2008). 39th LPSC, #2013.