RELATIONSHIP BETWEEN CARBON AND SILICATES IN COMETARY DUST. N. A. Starkey[1], I. A. Franchi[1], T. Salge[2] A. J. Brearley[3] and [1]PSS, Open University, Milton Keynes, UK. Email: natalie.starkey@open.ac.uk. [2]Natural History Museum, London, UK. [3]Dept of Earth & Planetary Sciences, University of New Mexico, Albuquerque, USA.

Introduction: Meteorite collections are biased towards sampling and preserving coarser-grained, structurally 'robust' material as opposed to fine-grained, fragile material. However, Interplanetary Dust Particles (IDPs) and, to a lesser extent, Antarctic Micrometeorites (AMMs) can preserve a higher proportion of unaltered, fine-grained and labile material. Obtaining detailed information about organic and mineral phases in micrometeorites is challenging which hampers efforts to understand their formation, and relationships between their reservoirs. Here we extend our previous multi-technique investigation of primitive IDPs [1,2] with the addition of elemental mapping to provide detailed information on the silicate grains and organic matter (OM).

Methods: We focus on an IDP (Midford4) from Collector L2006, Cluster 14 from which we have previously analysed other fragments [1,2]. We analysed the IDP using Raman, FEG-SEM and NanoSIMS 50L following methods in [1, 2]. SEM-EDX element maps were acquired at high spatial resolution using low accelerating voltages (5 kV) with an annular Bruker FlatQUAD SDD, a technique which is useful for analysing fine-grained materials of mixed mineralogy.

Results: Element mapping reveals the ultracarbonaceous (UC) nature of Midford4. An organic matter matrix, ~60% area fraction, contains ~100-800 nm sized Mg-rich silicates and iron sulphides. Raman reveals the primitive nature of the OM, as in previous fragments [1]. $\delta^{13}C$ varies from -40 to -55 (± 2 (2σ)) ‰ across Midford4, with bulk δD = 1728 ± 67 ‰ (with hotspots up to 7000 ‰) which is lower than that measured in other fragments in a previous study where bulk δD = 8146 ± 55 ‰ [2]. These results indicate some isotopic heterogeneity across the larger Midford cluster (Cluster 14). The bulk O-isotope composition of the silicate grains is, $\delta^{17}O$ = -11.6 ± 17.3 ‰ and $\delta^{18}O$ = -11.6 ± 7.6 ‰ (2σ error). The OM contains measureable amounts of O with $\delta^{17}O$ = 29.4 ± 15.6 ‰ and $\delta^{18}O$ 14.8 ± 6.8 ‰.

Discussion: The relatively ^{16}O-rich composition of the Mg-rich silicates supports an inner Solar System origin. The fact that these crystals are held within ^{16}O-depleted, high δD and low $\delta^{13}C$, fragile C-rich material indicative of an outer SS origin suggests that the silicates might have been transported to the comet-forming region from the inner Solar System, as suggested for Wild2 [3], unless they are interstellar in origin. Whether they were initially dust-sized objects or fractured pieces of large refractory grains, is unknown. Element mapping combined with isotopic imaging reveals that the carbon content, distribution and composition of Midford4 is similar to that of UCAMMs [4] and our findings support the suggestion that both are cometary in origin. These samples are structurally fragile and are, therefore, not likely to often survive atmospheric entry. Consequently, they appear rarely in collections, but may be more common, particularly if related to cometary CHON particles.

References: [1] Starkey N. A. et al. 2013. *Meteoritics & Planetary Science* 48: 1800-1822. [2] Starkey N. A. and Franchi I. A. 2013. *Geochimica et Cosmochimica Acta* 105: 73-91. [3] McKeegan K. D. et al. 2006. *Science* 314: 1724-1728. [4] Duprat J. et al. 2010. *Science* 328: 742-745.