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The Winchcombe CM2 Meteorite Fall: Curation and Preliminary Analysis

Sara S. Russell [1*], Tobias Salge[1], Ashley King[1], Luke Daly[2], Katherine Joy[3], Helena Bates[1], Natasha V. Almeida[1], Martin Suttle[1,4], Paul Schofield[1] and the UK Fireball Alliance Team.

[1] Planetary Materials Group, Natural History Museum, Cromwell Road, London SW7 5BD, UK.
[2] University of Glasgow; Glasgow G12 8QQ, UK.
[3] The University of Manchester; Manchester M13 9PL, UK.
[4] Open University, Walton Hall, Milton Keynes, MK7 6AA, UK.
* Corresponding author: sarr@nhm.ac.uk

The Winchcombe (CM2) meteorite fell on February 28th, 2021, at 21:54 UTC. Over a thousand people witnessed a fireball across Wales and England, which along with camera networks coordinated by the UK Fireball Alliance (UKFAll) enabled the meteorite fall site to be accurately calculated. The main mass of Winchcombe (319g) fell on the driveway of the Wilcock family in Winchcombe, Gloucestershire, where it shattered into a pile of pebbles and dust. It was collected by the family into clean bags without touching the meteorite the following morning within 12 hours of the fall. The largest stone (152g) was found in a nearby field following a systematic search of the local area by UK meteoriticists and the UKFAll team; further small stones were found during various searches over the following month. The main mass of the meteorite was taken to the Natural History Museum. Within a week of the fall, oxygen isotope measurements (undertaken at the Open University), XRD, TGA and SEM analyses had confirmed its classification as a CM2 brecciated chondrite [1].

Initial SEM/EDS survey

At this early stage we also undertook an SEM/EDS survey, to look for water-soluble and delicate minerals that have been observed in other very fresh meteorite falls, such as halite [2], oldhamite [3] etc. To undertake this study, we mounted naturally produced ~mm sized fragments of pristine Winchcombe meteorite from the driveway sample onto a sticky carbon stub and analyzed them uncoated/unpolished using a FEI Quanta 650 FEG SEM equipped with an annular, four-channel, high-sensitivity Bruker FlatQuad energy dispersive X-ray spectrometer (EDS). We observed that the fragments were typically coated with smaller particles of meteorite, indicating its highly electrostatic nature. No salts or other fragile minerals were identified, but many indigenous organic globules were observed on the surface, along with other typical CM2 components such as carbonates, chondrules, *etc*. (Fig. 1 and 2).

Preliminary Analysis

The UKFAll team invited the UK community to request samples for analyses. Based on the many (~100) individual requests obtained, 6 teams were formed: Recovery and Curation, Coarse grained petrology, Fine grained petrology, Isotopes, Magnetism, and Organics. Organization into these teams enabled the characterization of the meteorite to be well coordinated and avoided unnecessary replication while allowing different teams perform complementary analyses in a systematic fashion. Papers from each of these teams will be submitted to a special issue of *Meteoritics and Planetary Sciences*.

Meteorite curation and storage

Most of the meteorite fall is currently in storage in a desiccator cabinet. We have secured funding for a bespoke glovebox to enable its appropriate curation in a nitrogen atmosphere in the longer term.

In the talk we will discuss what worked well and what lessons we can learn from the Winchcombe fall that may be applicable to future space mission return material, such as the return of material from asteroid Bennu from NASA's OSIRIS-REx.

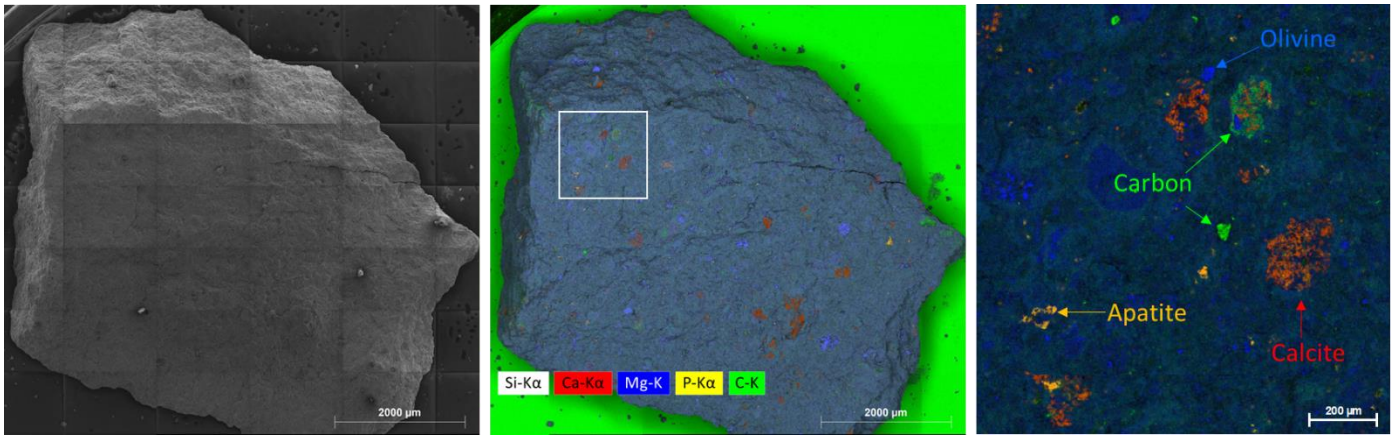

Figure 1. SEM/EDS images of a fragment of the Winchcombe meteorite taken a few days after the fall. On the surface, olivine grains from chondrules, carbonaceous globules, calcite and apatite grains are observed using elemental mapping.

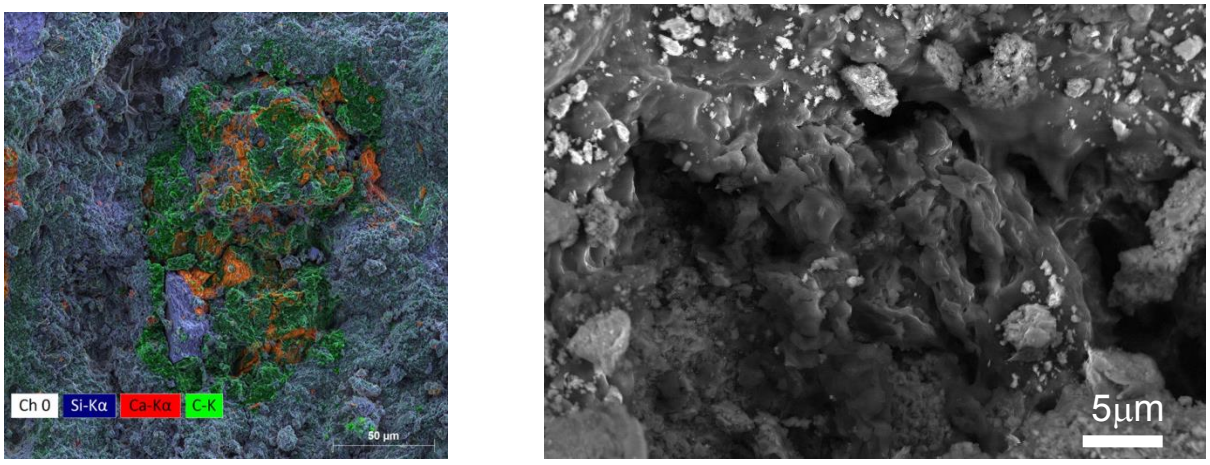

Figure 2. High vacuum analyses at low beam current: 6 kV, 105 pA, 40 kcps. Left: Carbonaceous material associated with calcite. Right: Carbonaceous globule in the chondrite.

References:
[1] Meteoritical Bulletin 110 (2021)
https://www.lpi.usra.edu/meteor/metbull.php?nwas=&strewn=&code=74388
[2] Rubin, Alan E. et al. "The Halite-Bearing Zag and Monahans (1998) Meteorite Breccias: Shock Metamorphism, Thermal Metamorphism and Aqueous Alteration on the H-Chondrite Parent Body." Meteoritics & Planetary Science 37 (2002): 125-141
[3] Christopher W. Haberle, Laurence A.J. Garvie; Extraterrestrial formation of oldhamite and portlandite through thermal metamorphism of calcite in the Sutter's Mill carbonaceous chondrite. American Mineralogist 2017;; 102 (12): 2415–2421. doi: https://doi.org/10.2138/am-2017-6180.

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