

Supplementary data

Bulk mineralogy of the 2019 Aguas Zarcas (CM2) meteorite fall

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Table S1. Description of samples studied

Stone or fragment	Description	Methods
ASU#2121_5	37.8 g typical fragment. Contains chondrule-rich, chondrule-poor, and minor amounts of matrix lithologies.	*XRD, TG, EGA, soluble salts, SEM-WDS AZMF7 – chondrule poor clast AZMF7 - chondrule poor clast#2 AZMF7b – typical fragment AZMF7_watersol – soluble salts
ASU#2121_6	46.7 g fragment. Contains chondrule-rich, chondrule-poor, and minor amounts of matrix lithologies.	XRD AZMF8 – typical fragment AZMF8 – chondrule poor area AZMF8 - chondrule-rich fragment
ASU#2121_7	4.3 g half fusion crusted stone. Dominated by the matrix lithology.	XRD, SEM-WDS AZMF2_again – chondrule poor chip
ASU#2121_8	2.68 g fusion crusted ½ stone. Chondrule rich	XRD, TG, SEM-WDS AZMF6 – chondrule-rich chip
ASU#2121_10	1.1 g fragment. Chondrule rich.	XRD AZMF3 – chondrule-rich chip
ASU#2121_11	3.2 g fragment	XRD AZMF4 – average lithology
ASU#2121_12	9.26 g fragment. Mainly chondrule poor.	XRD AZMF5a – chondrule free area AZMF5b – random fragment
ASU#2121_13	21.66 g fragment. Chondrule rich with areas that are chondrule poor.	XRD AZMF9 – chondrule poor clast AZMF9 – chondrule poor area
ASU#2121_14	33.77 g fragment. Contains chondrule-rich, chondrule-poor, and minor amounts of matrix lithologies.	XRD AZMF10 – 5 mm hard clast AZMF10_slow – typical area
ASU#2121_16	1.1 g ½ stone.	XRD AZMF14a – metal-rich clast
ASU#2121_17	4.72 g stone. Average lithology.	XRD AZMF15a- chondrule-free clast AZMF15b- chondrule-poor area AZMF15c – chondrule-free area
MF1**	114.7 g fusion crusted fragment ½ stone	XRD AZMF12a – Average lithology
MF2	175.6 g fusion-crusted stone nicknamed the “Dog House Stone” since it penetrated the roof of a dog house.	XRD AZMF13a –chondrule poor AZMF13b – chondrule rich AZMF13c – 4-mm hard clast AZMF13d – average looking chip

*XRD – powder X-ray diffraction. TG – thermal gravimetry; SEM-WDS scanning electron microscopy and wavelength-dispersive spectrometry. AZMF refers to individual powder XRD patterns. **MF1 and MF2 are stones that belong to Michael Farmer. Fragments of these stones were studied here.

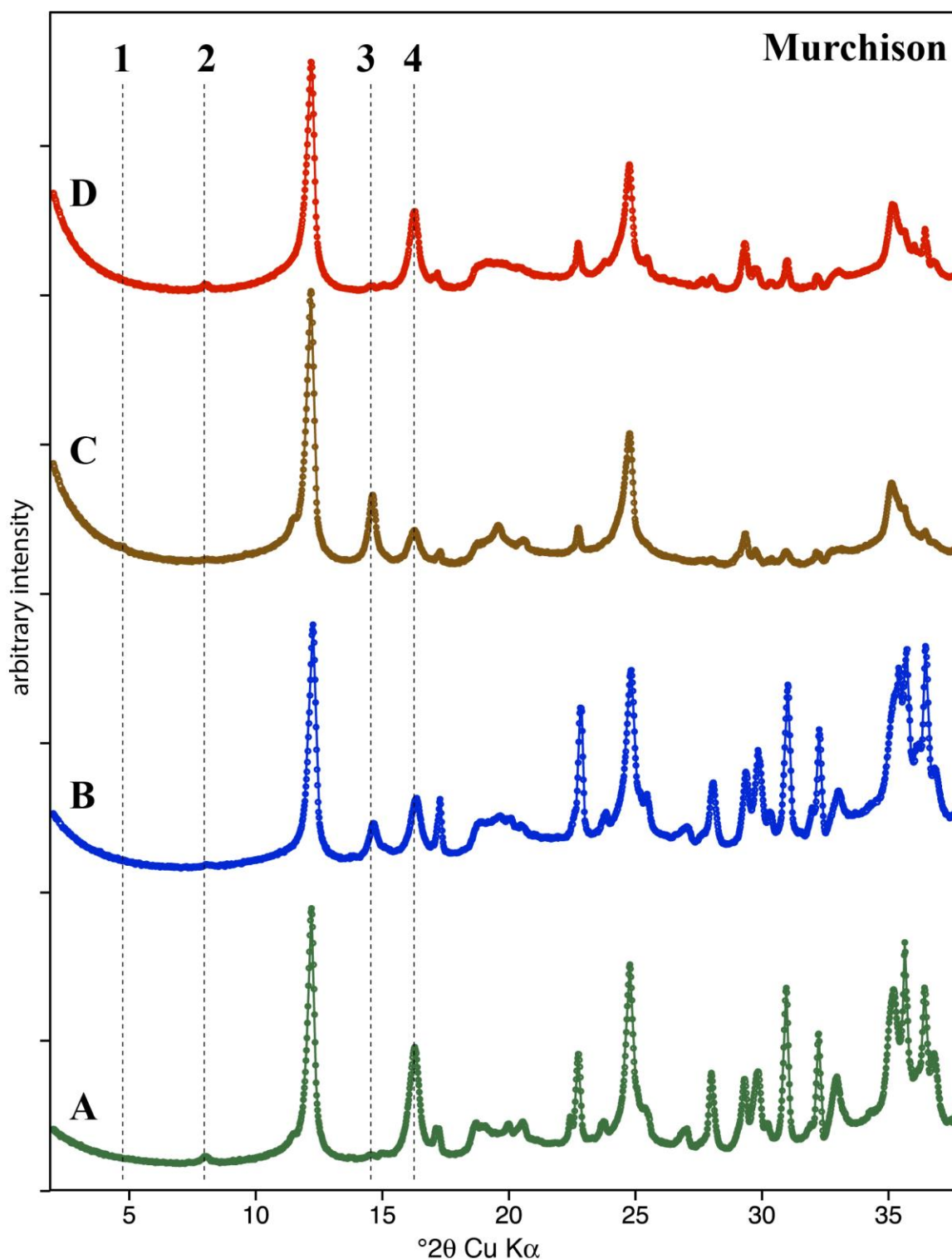


Figure S1. Powder XRD patterns from four 1-mm-sized Murchison fragments from the Center for Meteorite Studies. **A)** #828_27, **B)** #828_MUGB, **C)** #828_33, and **D)** #828_2. Lines 1 and 3 – 18.3Å and 6.05Å reflections for interstratified ferrotchilinite/cronstedtite. Lines 2 and 4 – 10.6Å and 5.4 Å reflections for ferrotchilinite.

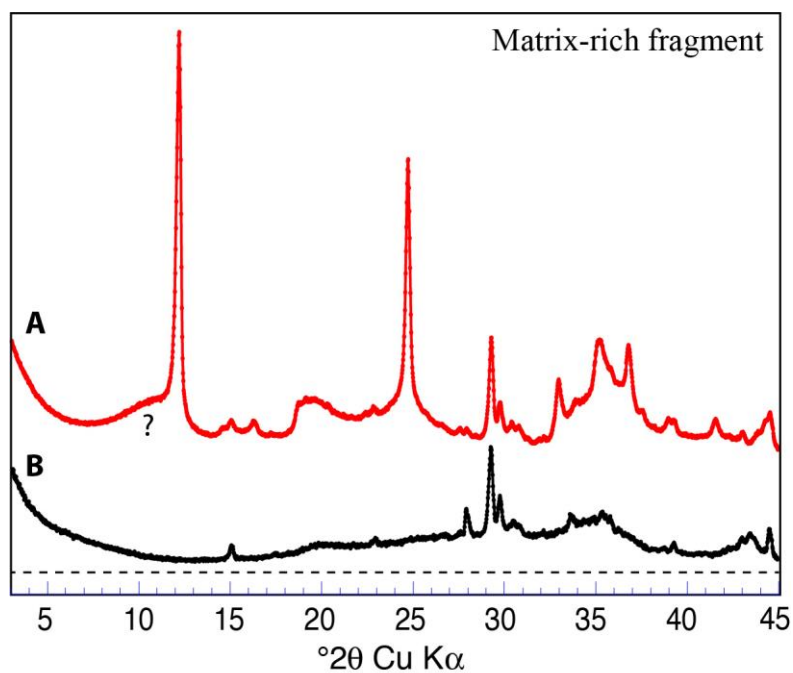


Figure S2. Powder XRD pattern from a fragment of stone #2121_12 with matrix-rich lithology. **A**) unheated **B**) after heating to 500°C under an Ar atmosphere for 1 hr. The two patterns have been scaled to the calcite reflection around 29° 2θ. ? – location of the 8.6 Å broad peak.

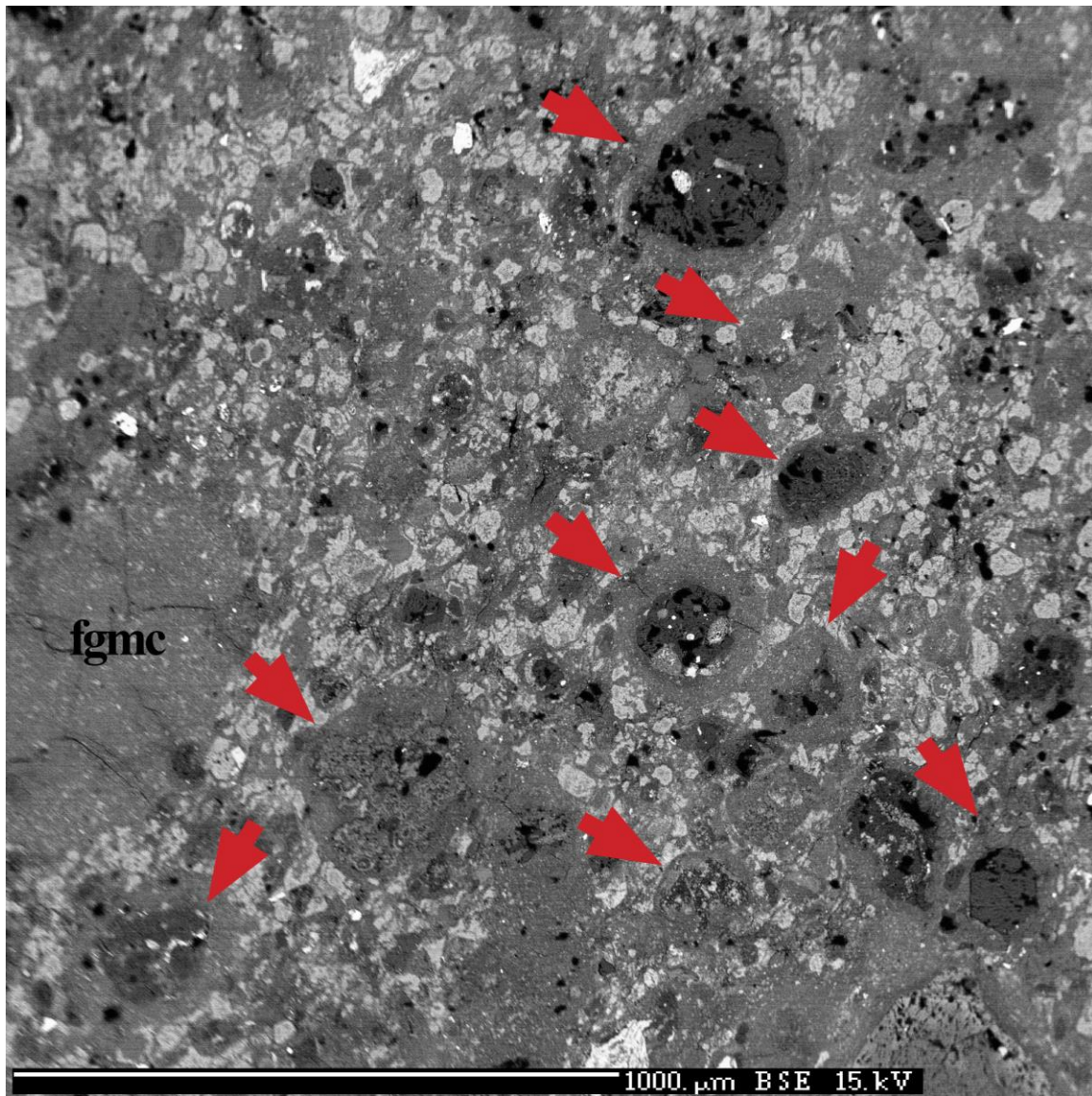


Figure S3. BSE image of a section of the chondrule-poor stone #2121_5 showing an abundance of rounded and sub-rounded TCI objects (bright) in the matrix, fgmc – fine-grained matrix clast, and chondrules (arrows). Most chondrules have thick fine-grained dust rims. The chondrules constitute approximately 15 areal% of the area imaged.

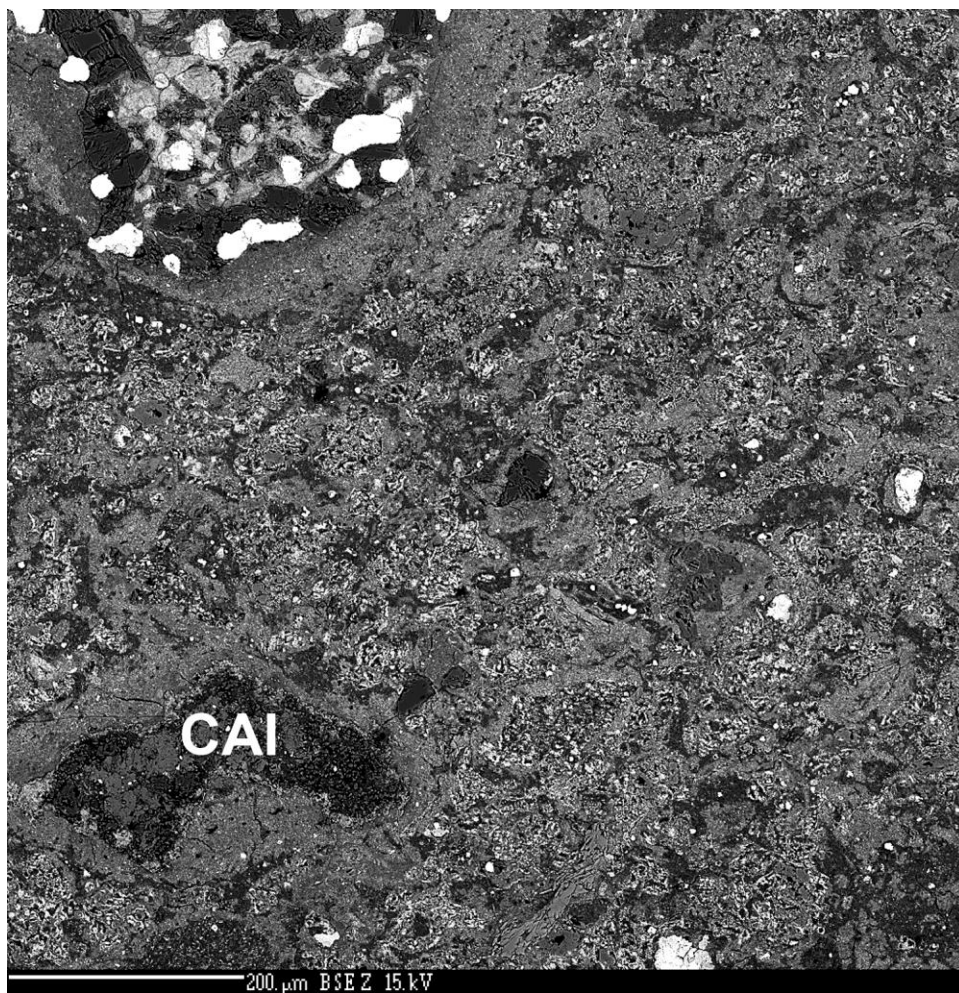


Figure S4. Low-magnification BSE image of a matrix-rich region of stone #2121_7. CAI – calcium aluminum-rich inclusion. Top left shows a large chondrule with fine-grained dust rim. The rest of the area is dominated by matrix.

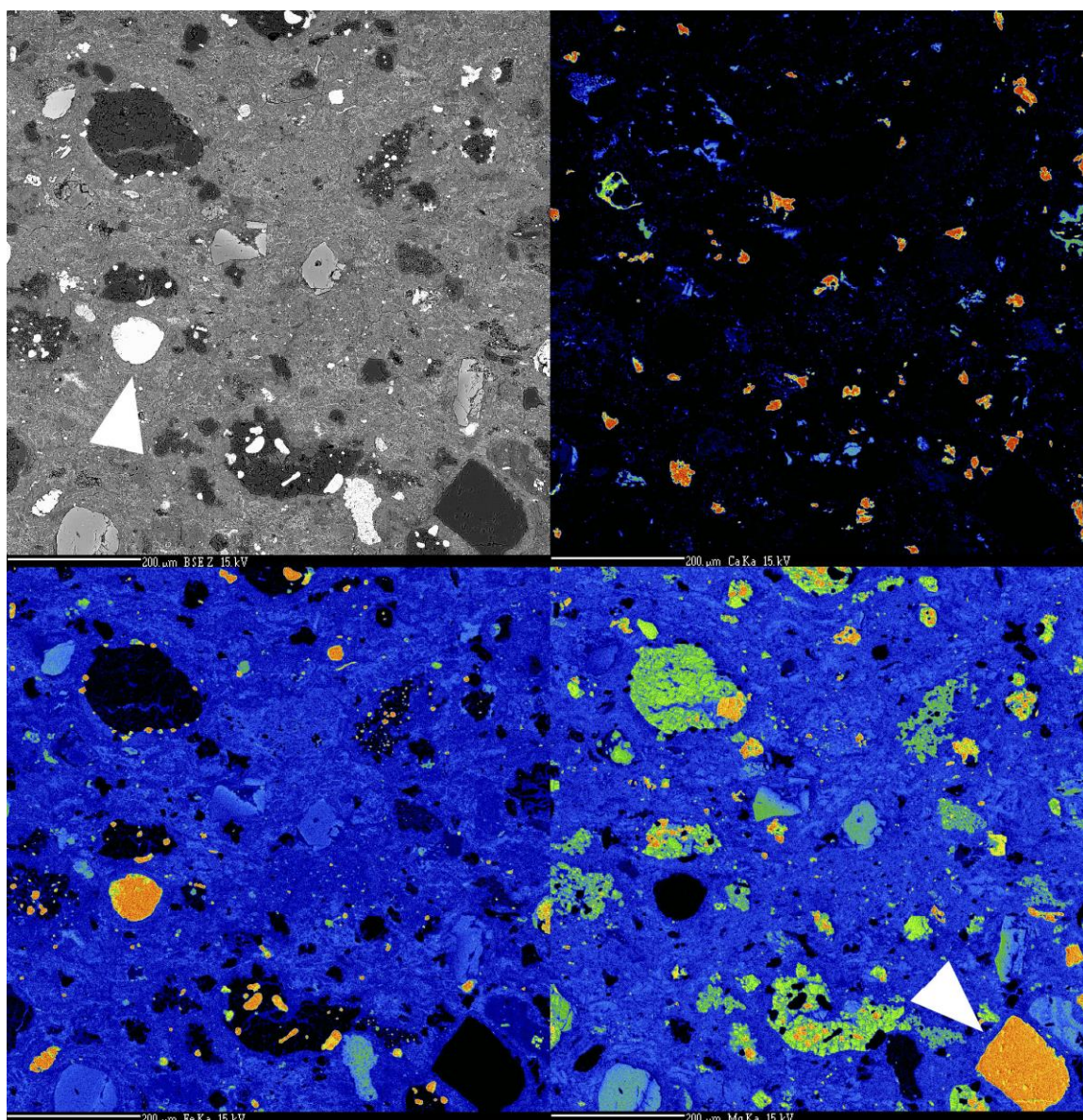


Figure S5. Low-magnification BSE image of the metal-rich area of chondrule-rich stone #2121_8, and corresponding Ca (top right), Fe (bottom left), and Mg (bottom right) X-ray maps. The distribution of calcite is visible as orange grains in the Ca X-ray map. The white arrow in the BSE image points to an Fe-Ni metal grain. The orange grains in the Fe map are Fe-Ni metals. The orange grains in the Mg map are Fe-poor olivine grains, whereas the green grains are olivine with contain several wt% Fe.