COMPARISON OF INCLUSION SIZE FREQUENCY DISTRIBUTIONS OF ROCKS ON RYUGU AND CARBONACEOUS CHONDRITES.
K. A. Otto[1], A. Greshake[2], H. Scharf[1,3], N. Schmitz[1], S. Schröder[1], K. Stephan[1], F. Trauthan[1], S. Elgner[1], K.-D. Matz[1], F. Preusker[1], F. Scholten[1] and R. Jaumann[1], [1]Deutsches Zentrum für Luft- und Raumfahrt (DLR), Berlin, Germany (katharina.otto@dlr.de), [2]Museum für Naturkunde, Berlin, Germany, [3]TU Bergakademie Freiberg, Germany.

Introduction: JAXA's Hayabusa2 mission arrived at C-type near Earth asteroid Ryugu in June 2018 and the on-board Mobile Asteroid Surface Scout (MASCOT) was dropped by Hayabusa2 on October 3rd, 2018 [1, 2]. MASCOT is equipped with four scientific instruments including a camera (MasCam), a radiometer (MARA), a hyperspectral microscope (MicrOmega) and a magnetometer (MasMag) aiming at investigating the surface's structure, mineralogical composition, thermal behaviour and magnetic properties [3]. After successfully settling on the surface and activating an internal mobility unit, MASCOT achieved the desired orientation for in-situ observations on the surface where it operated for 17 hours and 17 minutes during day and night time. MasCam [2] imaged the surface during day time at ambient illumination conditions and during night time using four colored LED arrays (red, green, blue, infrared).

The rocks imaged by MasCam on the surface of Ryugu showed an abundance of bright inclusion resembling the texture of carbonaceous chondrites [2]. Spectroscopic as well as inclusion texture comparison suggest a link with CM2 type meteorites (Table 1). Here we report on the comparison of inclusion size frequency distributions on Ryugu with measurements that we acquired for various carbonaceous chondrites of the meteorite collection of the Natural History Museum in Berlin using the qualification model of MasCam.

Aim: We aim to constrain the link between the rock imaged by MasCam on Ryugu and carbonaceous chondrites by investigating the color and size frequency distribution of inclusions on Ryugu and a number of typical carbonaceous chondrites.

Method: Using the qualification model of MasCam, we imaged a variety of carbonaceous chondrites including all meteorites mentioned in Table 1 at the Natural History Museum in Berlin. The samples were in the order of a few centimeters in size. We tried to mimic the measurements on Ryugu by placing the meteorite samples at a similar distance to the camera and illuminating them with the four color LEDs on a neutral background (Figure 1). The pixel resolution of the so acquired images is approximately 0.2 mm. This approach also allowed us to acquire information on the color of the inclusions and enables us to derive an inclusion size frequency distribution based on spectroscopic characteristics. Please also refer to our second abstract submitted to this meeting focussing on the spectral diversity of inclusions [5].

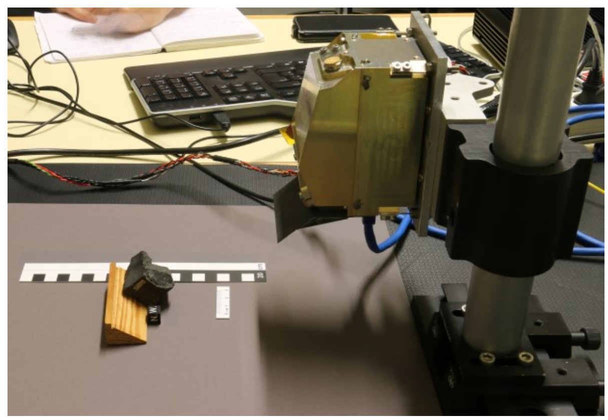

Figure 1: Measurement set up with meteorite on a wooden wedge, scale bars and the MasCam qualification model.

Example and Outlook: Figure 2 shows bright inclusions mapped on Ryugu in red illumination and the corresponding grain size frequency distribution (based on a MasCam 3D surface model [6]). Here we assumed a simple correlation between the areal (n_A) and volumetric (n_V) density given by $n_V = n_A^{1.5}$ [7]. We will repeat this procedure for other areas on Ryugu and for the carbonaceous chondrites imaged at the Natural History Museum in Berlin and will compare the results between the different samples and Ryugu. We will also provide a catalogue of our measurements for future in

Meteorite	Reflectance factor at 0.55 µm	Refractory inclusion abundance (vol%)	Inclusion size (mm)	Chondrule inclusion abundance (vol%)	Chondrule mean diameter (mm)
CI1 (Orgueil)	0.063	<<1	0.1 – 3*	<<1	
CM2 (Murchison)	0. 065	5	0.5 - 4.5	20	0.3
CO3 (Ornans)	0.10-0.13	13	0.2-0.5	48	0.15
CV3 (Allende)	0.086	10	0.29 ± 0.38	45	1.0
Ryugu	0.02	10	0.38 ± 0.55		

Table 1: From Jaumann et al. 2019 [1]. The distribution of inclusions and chondrules in typical carbonaceous chondrites extracted from the literature and the rock imaged by MasCam on Ryugu.

situ missions and as a reference for samples returned by Hayabusa2 and OsirisRex.

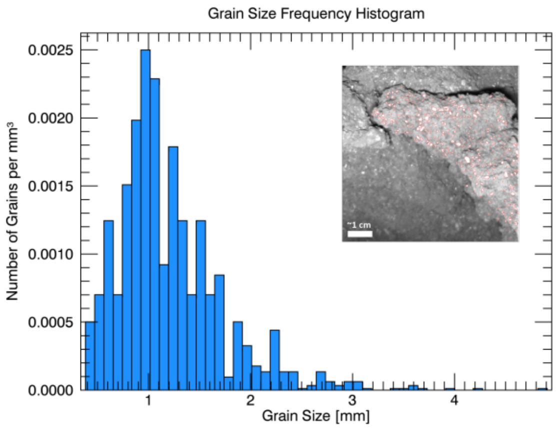

Figure 2: Grain size frequency distribution of bright inclusions on Ryugu imaged with the red LED.

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