PRELIMINARY OBSERVATIONS AND ANALYSIS OF ORBITER HIGH RESOLUTION CAMERA (OHRC) IMAGE, ON-BOARD CHANDRAYAAN-2. Aditya Kumar Dagar[1*], R. P. Rajasekhar[1], Rohit Nagori[1], Manish Saxena[2] , Amitabh[1], Ajay Prashar[1], Ashutosh Gupta[1], Ankush Kumar[1], A S Arya[1], Vishnukumar D Patel[1], Arup Roy Chowdhury[1], S. Gomathi[3], Vijaysree[3], [1]Space Applications Centre, Indian Space Research Organisation (ISRO), Ahmedabad – 380015, India. [2]ISRO HQ, Antariksh Bhavan, New BEL Road, Bangalore 560 231, India. [3]U. R. Rao Satellite Centre, ISRO, Bengaluru – 560017, India. ([*]adagar@sac.isro.gov.in).

Introduction: Orbiter High Resolution Camera (OHRC) is a panchromatic (0.45-0.70 µm) camera with a very high spatial resolution of 0.25 m (at nadir) onboard Chandrayaan-2 orbiter. The instrument specifications are provided in the summary Table 1. OHRC is designed for imaging in very low sun elevation conditions. High resolution images of OHRC will be useful for understanding recent volcanic, tectonic, mass wasting and impact cratering processes through study of features such as recent volcanic sites, lobate scarps, boulder density around simple/smaller craters, melt pools around complex craters, etc. of dimensions up to few km.

Parameter	**Value**
Spatial resolution (m) at Nadir from 100km	0.25 (corresponds to IFOV of 2.6 µrad)
Swath (km) at Nadir from 100km	3 (corresponds to FOV of ± 0.87 deg)
Spectral Range (µm)	0.45 – 0.70
Time Delay Integration (TDI) Stages	64,128,192,256
Reference Radiance ($mW/cm^2/sr/um$)	3.64 at minimum TDI
SNR (at Reference Radiance)	80 (at 128 TDI)

Table 1. Instrument specifications of OHRC

Initial Observations and Analysis: OHRC has imaged region around the Boguslawsky E crater (Fig. 1) on the Moon, from an altitude of ~100 km on 4th September, 2019. This image has spatial resolution of 0.28 m, which is among the highest spatial resolution imagery of the lunar surface till date. It was acquired at a low sun elevation angle (6°) resulting in long and distinct shadows. This crater is located in the high latitudes near the South pole (74.920° S, 54.520° E), which falls in the highland region. This image covers a part of floor of Boguslawsky E crater and adjoining region, which is dominated by craters. The imaged region is devoid of tectonic features.

Figure 1 (a) shows the complete OHRC image with two regions R1 and R2 highlighted with red color boxes. OHRC has been able to measure the weak signal coming from the floor of the Boguslawsky E crater (Figure 1 (b)) due to its capability to image in very low illumination conditions. This image was acquired in 128 TDI setting of OHRC. Higher TDI settings will result in more signal from the shadowed portions. This capability of OHRC can be exploited to image the areas in polar regions which are not directly illuminated by sunlight, but have some component of rim-reflected light falling on them.

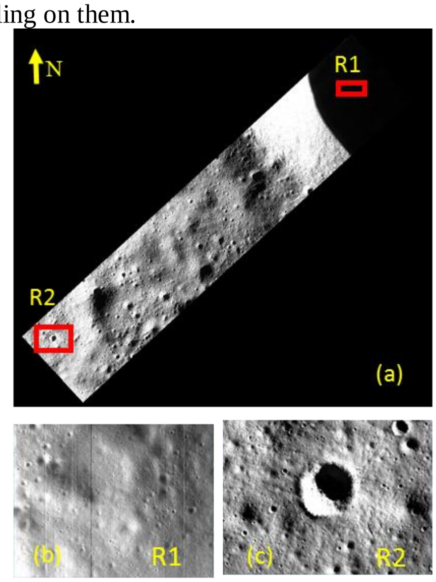

Figure 1. (a) OHRC image showing the rim and floor of Boguslawsky E crater and nearby area. (b) Region R1 in crater floor that has been illuminated by the rim-reflected light. (c) Fresh crater with boulders (R2).

The region depicted in Figure 1 (c) shows a large crater of diameter ~310 m situated around 74.9216° S, 54.5148° E. This is a fresh crater as evident by the presence of a large population of boulders around the crater. These boulders are distinctly seen in the OHRC image because of the high spatial resolution and low sun elevation (which results in long shadows). Figure 2 shows clearly visible boulders in the north-east region of the crater. The distribution of boulders around the crater is mapped manually and their height is also estimated through shadow lengths. The boulders distribution is estimated within a radius of 780 m from the center of the crater so as to include the boulders present within the ejecta spread. Figure 3 shows the distribution of ejecta around the crater and the circle represents the area within which the boulders mapping was done.

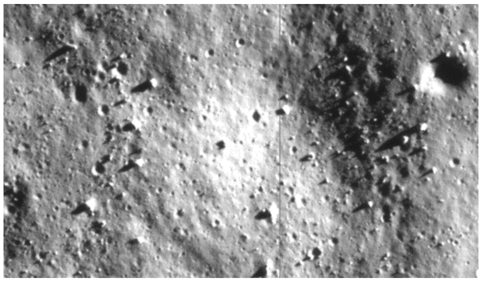

Figure 2. Portion of the region around the crater (R2) shown in fig. 1 (c). The boulders are clearly visible.

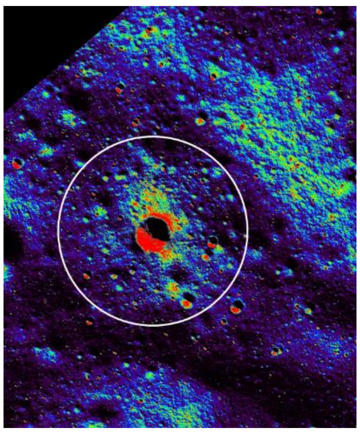

Figure 3. Ejecta distribution (green-red) around the crater and circle represents the boulder counting area.

Result: Diameter and shadow lengths were mapped for a total of 664 boulders. Boulders with size greater than 1.12 m [2] and lying within 780 m (593 in number) have only been considered for further study. Figure 4 shows the frequency distribution of the (a) diameter and (b) height. The mean diameter was found to be around 2.5 m with minimum and maximum diameters as 1.16 m and 6.64 m, respectively. Similarly, the mean boulder height was found to be around 0.7 m with minimum and maximum heights as 0.17 m and 4.34 m, respectively. The size frequency distribution was also computed as shown in Figure 5 which shows the decrease in larger size boulders as we move farther from rim whereas small sized boulders are found close as well as farther from the crater center [2].

Conclusion: Low illumination capability of OHRC was explored. Boulder size distribution around a fresh crater was mapped and it was found that the size of boulders decreases as we move farther from the center of the crater, as expected from the normal boulder distribution around craters.

Acknowledgments: Authors thank Director SAC, DD-EPSA & SEDA, GD-SIPG for their encouragement and support. Thanks are due to Ritu K. (MD) and M. Vanitha (PD) for payload and spacecraft operations. We thank OHRC payload team members from SEDA & SIPG, SAC-ISRO. Special thanks to Chairman ISRO and Director, SSPO for their encouragement and support.

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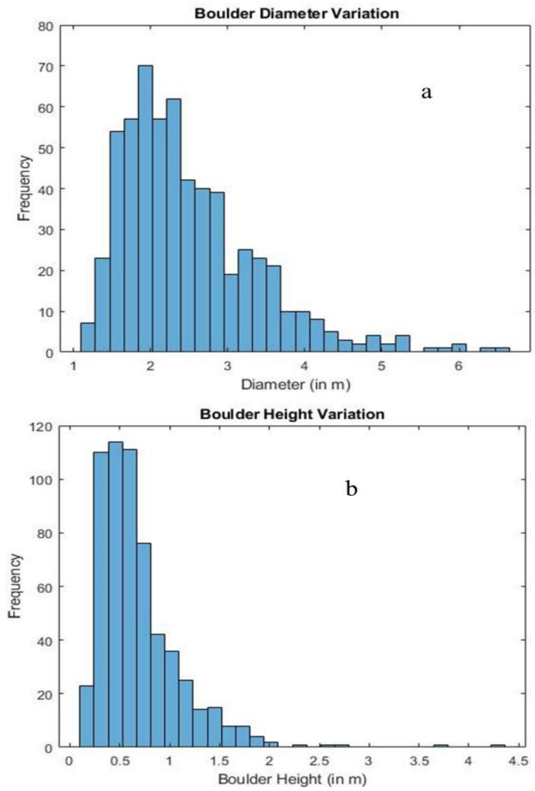

Figure 4 (a) Boulder diameter variation and (b) Boulder height variation with frequency.

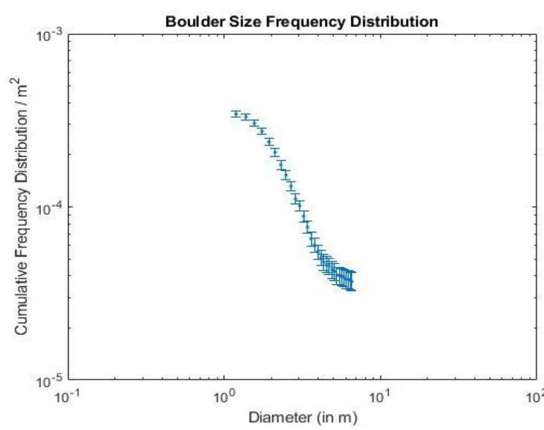

Figure 5 Size Frequency Distribution of boulders.