MORPHOLOGY OF THE COPERNICAN DAS CRATER ON THE FARSIDE OF THE MOON. Jappji Mehar, P. M. Thesniya*, and V. J. Rajesh, Department of Earth and Space Sciences, Indian Institute of Space Science and Technology, Valiamala, Thiruvananthapuram 695547, India (thesniyathesni91@gmail.com; rajeshvj@iist.ac.in).

Introduction: Copernican craters on the Moon are of greater importance for understanding the recent geological history of the Moon. The location of Copernican-aged Das crater centered at 26.48° S and 137.0° W on the lunar farside at the periphery of the degraded peak ring of the 2600 km wide South Pole Aitken basin, as well as low crustal thicknesses of about 5 km in the locality and the presence of a linear gravity anomaly in the region, make it a potential site for exploration (Fig. 1a). The present study attempts to carry out the detailed morphological mapping of the Das crater using orbital remote sensing data from various lunar exploratory missions.

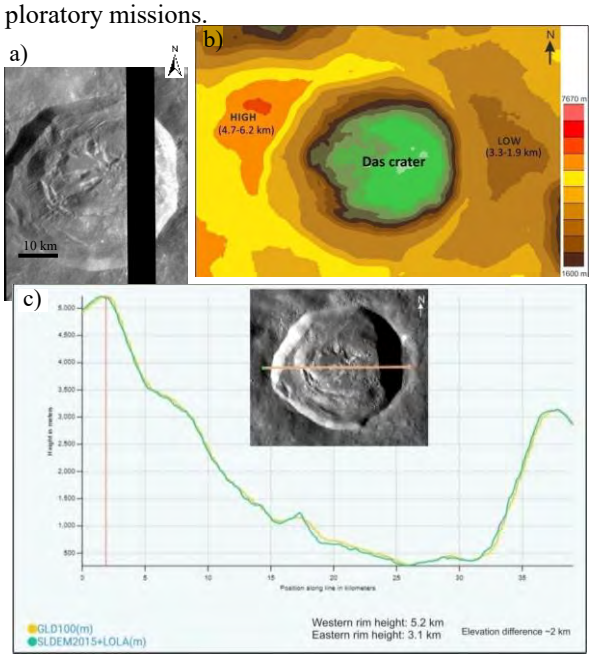

Fig. 1 (a) Chandrayaan-1 TMC mosaic of the Das crater. (b) SELENE-LOLA merge Digital Elevation Model of the Das crater showing the topographic variations. (c) Topographic profile across the (west-east) crater.

Datasets: Terrain Mapping Camera (TMC) images from Chandrayaan-1 mission, NASA's Lunar Reconnaissance Orbiter Camera (LROC)-Wide Angle Camera (WAC), Narrow-Angle Camera (NAC), SELENE DEM, and Lunar Orbiter Laser Altimeter (LOLA) data have been utilized for the understanding the topography and morphological characteristics of the Das crater.

Results: Das crater has a higher topography in the western and north-western terrain surrounding the crater and a low lying topography in the eastern part of the terrain surrounding the crater (Fig. 1b). Thus the pre-impact terrain is sloped in the west to east direction. The maximum elevation of the surrounding terrain is 5.4 – 6.2 m and occurs to the northwest of the crater depression (Fig. 1c). The minimum elevation of the surrounding terrain is 2.2 – 2.5 m and occurs to the east of the crater. Broadly, the morphology of Das crater can be divided into an outermost crater rim region, crater wall region, and the central floor region (Fig. 2). The crater shows a central peak feature and terraced wall features. The crater rim is approximately circular and is uplifted relative to the surrounding terrain (Fig. 1b-c).

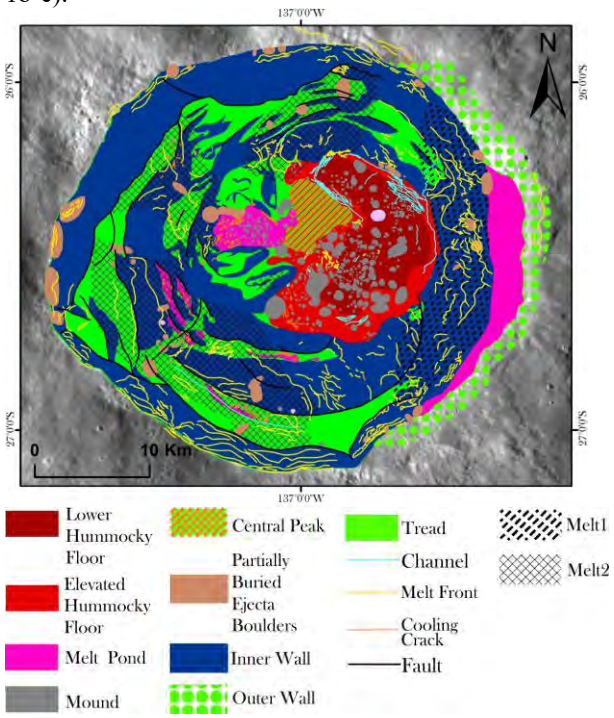

Fig. 2 Detailed morphological map of the Das crater overlaid on LROC WAC mosaic.

The wall region of Das crater is steeply sloped to the east. A prominent scarp is seen in this region, while a system of terraces is seen in the western, southern, and northern parts. Massive slumping is seen towards the inner part of the wall closer to the floor (Fig. 2). The massive slumping features are distinct from the scarp and tread system as they are not bounded by faults (Fig. 2). The summit of these slump blocks is a linear structure that forms a physical continuity with the wall scarps while the bounding sides slope steeply on either side of the linear summit feature. The floor region is

the lowest part of the crater cavity. Elevated Hummocky Floor, Lower Hummocky Floor, and an elevated Melt Platform are the major floor units (Fig. 2). The crater shows numerous impact melt features such as melt flow lobes, impact melt pools both interior and exterior to the crater and negative relief features such as cracks or fractures in impact melt pools and flows (Fig. 3a-b) [2]. A very prominent melt flow lobe is seen on the western wall innermost tread (Fig. 3b). This feature has an area of 5.4 km^2 and has 2 very pronounced lobes. The impact melt fronts on the eastern wall of the crater are interspersed with partially buried ejecta boulders (Fig. 3c). The melt pools are characterized by smooth-surfaced low albedo deposits in topographically low lying areas or gently sloped level surfaces, particularly on the tread part of the wall terraces of the southern and south-western parts of the crater wall (Fig. 3b-c). The melt platform is the flat terrain of its extent in Das crater (Fig. 3d). It has a slope of 0° – 4.4°. It is the most elevated region (1667 – 1995 m) of the crater floor. The melt platform occupies an area of roughly 17 km^2 to the north-west of the crater. The melt platform is smooth except for clasts of sizes from 50 m – 0.5 km. Both the elevated floor and lower floor of the crater have a hummocky texture (Fig. 3e) [1] These floor units are marked by the presence of several blocks or clasts of boulder type fragments of sizes varying from 100 - 2000 m interspersed in impact melt (generated during the impact event due to a large amount of energy injected into the target material by the impacting projectile (Fig. 3e). These clasts do not occur to protrude from underneath the impact melt nor do they appear to lie completely above the impact melt. Rather they are buried underneath the impact melt as the lower parts or toes of the slump blocks disaggregate to form hummocks and clasts which may or may not be digested by the overlying impact malt depending on the volume and thickness of the impact melt lining the cavity in that region [1]. The average size of the hummocks to the northern part of the floor is about 160 – 200 m and that of the large-sized hummocky deposits to the south-western part of the crater floor is of the order of approximately 1 km.

Conclusions: The transient cavity from which Das crater formed was likely 31.8 km wide and 9.54 – 10.4 km deep [3]. The central uplift must have begun to rise from the maximally compressed rocks in ~30 s after the impact. The central peak could only have risen from rocks deeper than 3.2 km from the surface. The peak shock pressures and maximum impact melt generation occurred approximately in the south-western portion of the cavity.

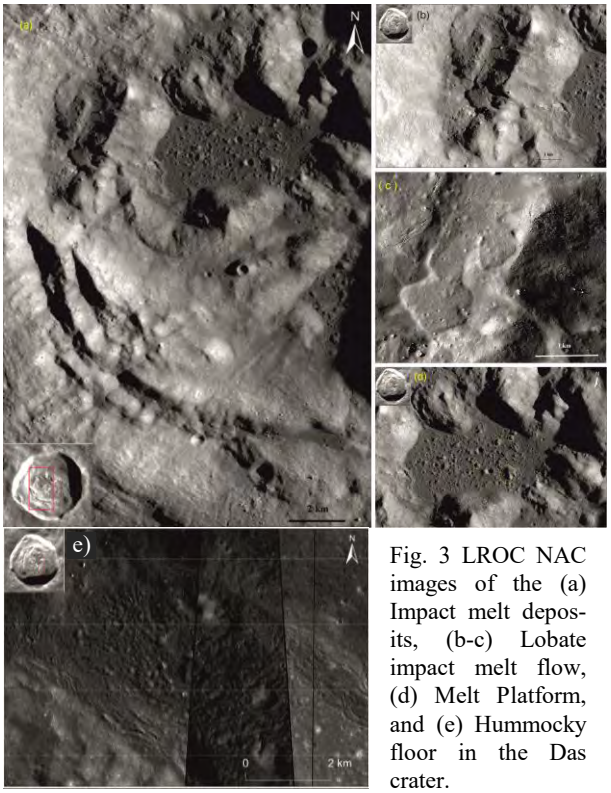

Fig. 3 LROC NAC images of the (a) Impact melt deposits, (b-c) Lobate impact melt flow, (d) Melt Platform, and (e) Hummocky floor in the Das crater.

The effective thickness of impact melt lining the transient cavity throughout its growth was ~0.03 km. The floor units of Das crater, i.e. Elevated Hummocky Floor, Lower Hummocky Floor, and Melt Platform have variable clast content. This is probably dependent on the amount of mixing with solid fragments during the excavation flow and the local thickness of melt lining which further depends on the rate of rebound of the compressed rocks and the rate of melt phase excavation. Impact melt solidification in Das crater was on the order of a few minutes. Extensive fractures in impact melt at the boundary between the floor and eastern wall scarp show that solidification occurred after the wall-failure resulting in the formation of the eastern wall scarp unit.

Acknowledgments: This work is a part of the ISRO-project under the Chandrayaan-1 AO (Announcement of Opportunity) program, funded by DoS (Department of Space, ISRO/SSPO/Ch-1/2016-17, 13 October 2016). We acknowledge the use of data from the Chandrayaan-1 TMC, SELENE, and LRO-LROC.

References: [1] Cintala M. J. and Grieve R. A. (1998) *Meteoritics & Planet. Sci., 33,* 889–912. [2] Dence M. R. (1971) *JGR., 76,* 5552-5565. [3] Melosh H. J. (1989) *Oxford Uni. Press, 253*, 11.