

IDENTIFICATION OF LUNAR VOLCANIC TUBES, A POTENTIAL SITE FOR HUMAN SETTLEMENT USING 3D CHANDRYAAN 1 – TMC DATA . A.S. Arya¹, R.P.Rajasekhar¹, Ajai¹, A.S Kiran Kumar¹, R.R. Navalgund¹, Space Applications Centre, Indian Space Research Organization, Ahmedabad-380 015 (India), arya_as@sac.dos.gov.in.

Introduction: Chandrayaan-1 is the maiden Indian planetary mission to the moon, realised by the state of art technology involving 11 different & complimentary sensors. One of the sensors, the Terrain Mapping Camera (TMC) has high spatial resolution of 5 m and multi viewing capability, enabling 3 dimensional view of the Lunar surface [1]. In future, there may be missions for identifying sites for permanent base stations (PBS) and human settlements on the Moon. There is no preventive atmosphere on the Moon to save it from the impact of meteorites or other bodies, which makes human settlement a very vulnerable proposition. Thus there is a need to identify such locales which have survived the onslaught of meteoritic impacts and furnish excellent locales for the dwelling of human beings on the Moon.

One such entity is the Rille system. A Rille is a remnant of volcanic tube, whose roof has capsized and a valley is created. At places the roof of such tubes have not caved in and remains intact, with hollow interior.

Analysis and Discussion: Volcanic tube has been identified in the Oceanus Procellarum area of the Moon (Central Longitude: 58.317° W / Latitude: 14.111° N) using Chandrayaan-I Terrain Mapping Camera (TMC) data. This rille runs for about 3.65 km in NE-SW direction. A close observation suggests another small rille of 1.73 km length, situated 2 km SW of the existing main rille, which appears to be an extension of this tube while the intermittent stretch between the two rilles seems to be the roof of the lava tube which did not collapse for some reason. The authors have tried to analyse the TMC stereo data to find the length, depth, slopes within and outside the Rille, in order to establish continuity between the main rille and the shorter rille 1.73 km south-west of the former. Fig. 1 shows the nadir view of the study area.

The rille and the area around the rille is investigated in 3D using TMC DEM. For this study both orthoimage and DEM of TMC data with orbit 798 acquired during 13 January, 2009 at an orbit height of 100 km was used. Topographic variations along the profiles/lines in different directions both across and along the feature were studied, so that it provides information about both extent and variation of topogra-

phy versus distance. Colored contour map (Fig. 2) was analysed for understanding three dimensional topographic variation across the area.

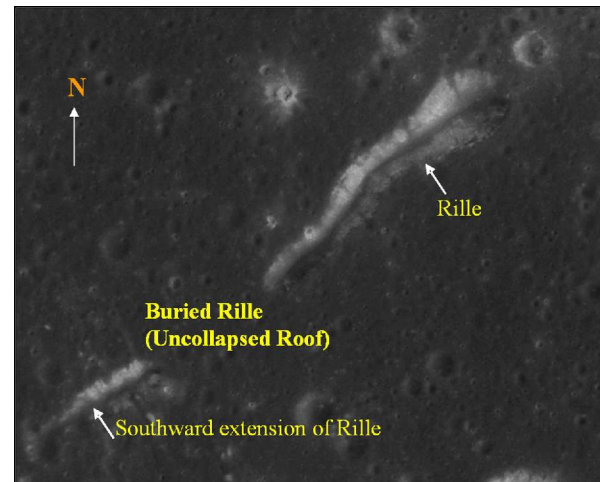


Fig. 1. The TMC view of the rille.

The drop between the two rilles, along the common-strike, is of the order of about 120 m (-1260 to -1140 m), this suggests that the smaller rille is lower than the main rille, thus suggesting a continuity of the main rille in SW direction. Within the study area, south of the main Rille, the topography shows a drop in the slope, around 160 m (-1100 to -1260 m depth) from ESE to WNW. This rules out any possibility of lava flow filling the intermittent portion of these two rilles after their emplacement as one single volcanic tube while the remaining portion in between the two rilles is the un-collapsed roof of the same lava tube.

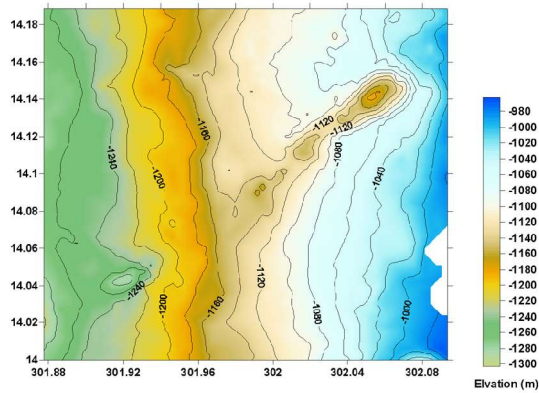


Fig. 2. Colored contour map of the study area

The part of lunar surface between the main rille and smaller rille appears to be an uncollapsed portion of the lava-tube which is an extension of the main rille. This un-damaged tube is about 360 m wide and 2.0 km long, which furnishes a safe and substantial dwelling site for human settlements in future missions.

References:

- [1] Kiran Kumar, A.S. et al. (2009), *The Terrain Mapping Camera on Chandrayaan-1 and initial results*. LPS XXXX, Abstract #1584.