

INVESTIGATION OF A PLAUSIBLE LOBATE SCARP MAPPED IN THE MARE FECUNDITATIS REGION USING DATASETS OF TERRAIN MAPPING CAMERA (TMC-2) ONBOARD CHANDRAYAAN-2 MISSION ACQUIRED AT A LOW SUN ANGLE. R.P.Rajasekhar*, A.S.Arya, Amitabh, K.Suresh, Baharul Islam, Ajay Kumar Prashar, Kannan V. Iyer, T. P. Srinivasan, Ankush Kumar, Vishnu kumar D Patel, Arup Roy Chowdhury. Space Applications Centre, Indian Space Research Organisation (ISRO), Ahmedabad-380015, India. *rajasekhar@sac.isro.gov.in

Introduction: The Indian second moon mission Chandrayaan-2 was launched on 22nd July 2019 and carrying out operations successfully. Terrain Mapping Camera-2 (TMC-2) on-board this mission has similar capabilities as its predecessor TMC-1, on-board the Chandrayaan-1 mission. It carries the state-of-art, high-resolution 3D Terrain Mapping Camera (TMC-2) which has the along-track 3-view stereo capability [1]. TMC-2 is developed at Space Applications Centre (SAC), Ahmedabad.

Chandrayaan-2's Terrain Mapping Camera (TMC-2) is providing panchromatic images with a spatial resolution of 5 m and a swath of images is 20 km from the spacecraft altitude of 100 km [1]. Images obtained by Fore, Aft, and Nadir cameras looking at the same location on Lunar surface at an angle of $+25^{\circ}$, 0° , -25° are used to generate the Digital Elevation Model (DEM)s of 10m spatial resolution [2]. The Spatial resolution of orthoimages is 5m.

Lunar lobate scarps are relatively small-scale tectonic landforms that are interpreted to be the surface expression of low angle thrust faults. Lobate scarps are believed to be young lunar landforms and are observed both in the mare and highland regions [3]. In this study, preliminary analysis of a plausible lobate scarp mapped in the Mare Fecunditatis region is carried out using Orthoimage, Digital Elevation Model (DEM) data sets of Terrain Mapping Camera-2.

Data sets used: Image acquired by Terrain Mapping Camera (TMC-2) at a low sun elevation angle of 15° on 15-10-2019 and DEM are used in this study. For the comparison, images of Chandrayaan-1's Terrain Mapping Camera (CH1-TMC), Narrow Angle Camera of Lunar Reconnaissance Orbiter (LRO-NAC) acquired at different sun elevation angles are also used in this study.

Analysis and discussion: A plausible Lobate scarp is identified in the Mare Fecunditatis region (53.58°E , 5.86°S), using orthoimage (Figure.1) and DEM data sets of TMC-2. This NW-SE oriented scarp is located between Dorsa Geike and Dorsa Mawson. Length of the lobate scarp is 1415 m. Relief of topography across the lobate scarp varies from 20 to 26m with an average elevation of 24m (Figure.2).

Absolute Model Age (AMA)s of Foot Wall (FW) and Hanging Wall (HW) regions of the lobate scarp are derived using the approach of Crater Size Frequency Distribution (CSFD) [4]. Craters are mapped in the FW, HW regions using cratertools [5] in ArcGIS software and surface ages are estimated using craterstats software. Absolute Model Age (AMA)s of footwall, hanging walls of the lobate scarp are 53.2 Ma, 64 Ma (Figure.3), respectively. This indicates the lobate scarp might have been formed in the Copernican period. These ages are similar to those of lobate scarps reported in other regions (50-130Ma [6],[7]).

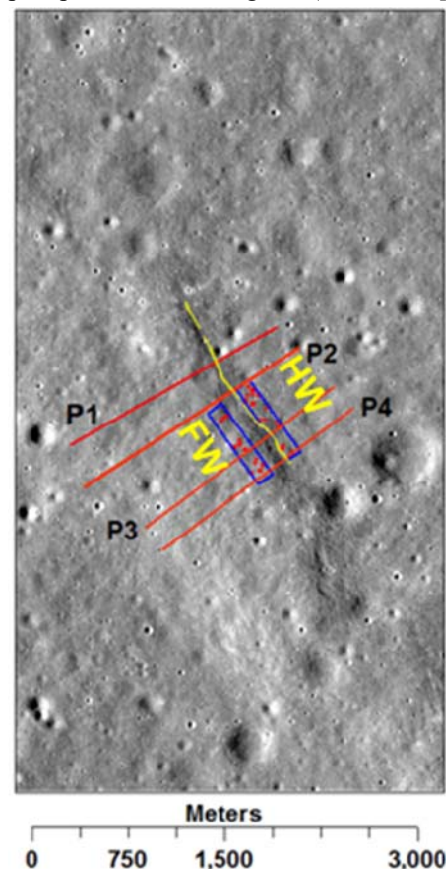


Figure.1 Ortho image of TMC-2 of lobate scarp region. The plausible Lobate scarp (yellow colored line), craters (red colored circles) used for surface age estimation and Hanging Wall (HW), Foot Wall (FW) are indicated by blue polygons. Profiles P1-P4 are shown in the red colored lines.

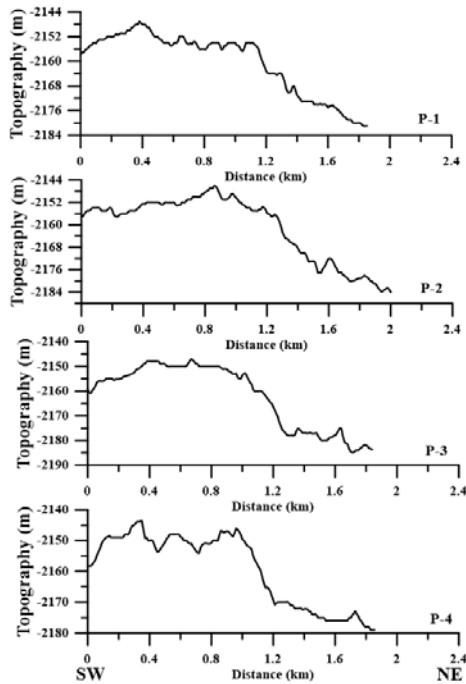


Figure.2 Topographic cross-sections along the profiles P1-P4 (locations of the profiles across the scarp are indicated by red colored lines in Figure.1)

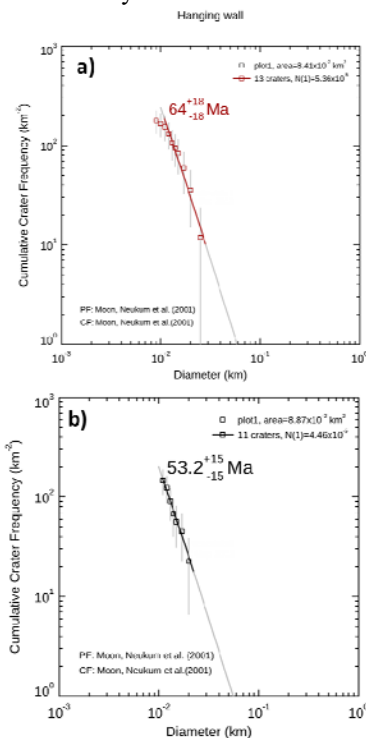


Figure.3 Plots showing the Crater Size Frequency Distribution (CSFD) curves of Hanging Wall (HW-a) and Foot Wall (FW-b), respectively.

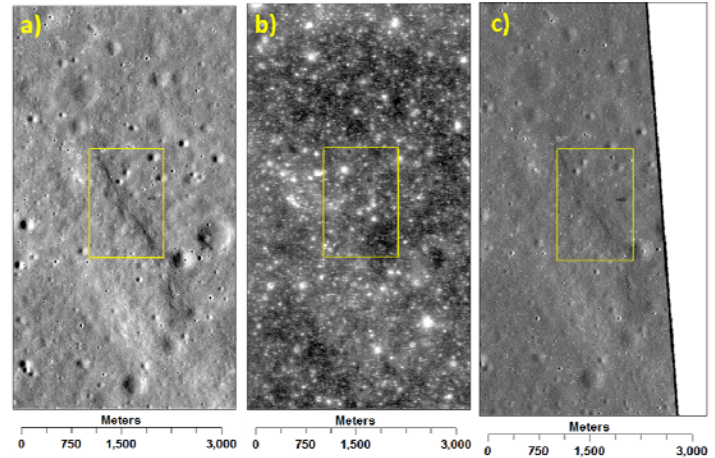


Figure.4 Figure shows a) TMC-2 b) CH1-TMC c) LRO-NAC images of plausible scarp region (yellow colored box).

Discussion: TMC-2, CH1-TMC and LRO-NAC images of plausible scarp region acquired at different sun elevation angles of 15° , 70° , 20° are shown in the Figure.4. These images acquired on 15-10-2019, 5-01-2009, 11-03-2020 respectively. The Spatial resolution of these data sets is 5m, 5m, 2m respectively. This comparison demonstrates the strength of the images acquired at low sun elevation angle for mapping small-scale features such as lobate scarps having small relief. This comparison also demonstrates that low sun elevation angle plays a more important role than spatial resolution of images for mapping small-scale features.

References: [1] Chowdhury, A.R., et al., 2020. *Current Science*, 118, 4, 566-572. [2] Amitabh et al., 2020. *LPS LI*, Abstract # 1127. [3] Nelson, D. M., et al., 2014, *LPS XLV*, Abstract# 2861. [4] van der Bogert et al. (2012) *LPSC XLIII*, Abstract #1847. [5]. Kneissl T. et al. (2011) *Planet. Space Sci.*, 59, 1243-1254. [6] J.D. Clark, J.D et al., 2017. *Icarus*, 298, 78-88. [7] Van der Bogert, et al., 2018. *Icarus* 306, 225-242.