Revelation of surface age of Chandrayaan-2 landing sites using Crater Size Frequency Distribution (CSFD) technique

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Zeroing in on potential landing site of any lunar mission, it is imperative to consider the morphology and surface coverage, chemical composition or the mineralogy, processes and extent of cratering processes and surface age of the lunar surface. Determination of age of the landing surface is intriguing otherwise as it provides sufficient understanding about the chronology of the surface, which in turn helps in paleo geological reconstruction of the planetary body. Unlike conventional methods employed terrestrially like radiometric dating, superposition or stratigraphic tools requiring mandatory ground validation, the Crater Size Frequency Distribution (CSFD) has evolved as a unique technique to assess absolute age of any surface using remotely sensed data products, ubiquitously for all atmosphere-less extra-terrestrial bodies, within its own limitations.

The Lunar Reconnaissance Orbiter Camera (LROC) on-board the Lunar Reconnaissance Orbiter (LRO), 2009 spacecraft of NASA is empowered with a Wide-Angle Camera (WAC) having 100m spatial resolution and two Narrow Angle Camera (NAC) of 0.5m spatial resolution, which provide crucial cues not only to reveal surface morphology in three dimensions but also gets us precise information on cratering process e.g. crater density, shape and dimensions and crater overlapping etc. This work, pertinently, employs the WAC/ NAC data to determine the absolute age of Chandrayaan-2 landing sites using CSFD and the outputs have been corroborated with the ages provided by Lunar Polar Chat (LMP-3) prepared by Defence Mapping Agency and United States Geological Survey.

References

[1] Amitabh, S., Srinivasan, T. P., & Suresh, K. (2018) Lunar and Planetary Science Conference (Vol. 49).

[2] Arya A.S., Rajasekhar R.P., Thangjam G., Gujarati, A., Amitabh, Trivedi S., Gopal Krishna B., Ajay, Kumar A.S. (2012) Current Science, VOL. 102, NO. 5, 10 MARCH 2012.

[3] Hartmann, W.K. (1973) Journal of Geophysical Research (Planets) 78, 4096–4116.

[4] Ivanov B.A., Neukum G., Wagner R. (2001) Astrophysics and Space Science Library. Astrophysics and Space Science Library, vol. 261, pp. 1–34.

[5] Kneissl T., Gasselt S.V., Neukum G. (2010) Planetary and Space Science 59 (2011) 1243–1254.

[6] Michael, G., Neukum, G., (2008) In: Lunar and Planetary Institute Science Conference Abstracts. vol. 39 of Lunar and Planetary Institute Technical Report. p. 1780.

[7] Neukum, G., Ivanov, B.A., Hartmann, W.K. (2001) Space Science Reviews 96, 55–86.

[8] Neukum, G., Wise, D.U. (1976) Mars Science 194, 1381–1387.

[9] Shoemaker, E.M., Hackman, R., Eggleton, R. (1962) Advances in the Astronautical Sciences 8, 70–89.