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Detailed age determinations for Tsiolkovskiy crater floor

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With respect to its counterpart, the lunar farside is characterized by few basaltic mare exposures. One of these, with a total surface area of approximately 12 000 km^2, covers the floor of the ~200 km diameter Tsiolkovskiy crater (20.4° S, 129.1° E) [1].

The crater size frequency distributions (CSFDs) calculated for this crater led to different results. The age determination performed on the mare infilling resulted in an Imbrian-Erathostenian age of about 3.2 Ga [2], while a 3.6 Ga Late Imbrian age was derived from areas scattered on top of a long run-out landslide generated from the western rim and its surroundings [3-4].

The spectral map produced for Tsiolkovskiy crater [5-6], performed on the ~200 m/pixel Clementine UVVIS color ratio mosaic [7] (R: 750/415 nm; G: 750/1000 nm; B: 415/750 nm), and recently updated suggests for the crater floor the presence of three color units, characteristics of higher 415/750 nm ratio, higher 750/415 nm ratio and average 750/415 nm and 750/1000 nm ratios, defined by a different composition and/or age formation.

In order to discriminate possible age differences ascribable to different eruptive events, on the basis of the spectral mapping we defined several areas for measuring the crater size-frequency distributions of the different color units on the crater floor. In addition, we calculated the age formation of Tsiolkovskiy crater itself by means of hummocky areas interpreted as impact melt identified in accordance to the geological mapping [5-6] performed on the ~100 m/pixel LRO-WAC [8] global mosaic.

The CSFDs measurements have been performed on areas of at least 100 km^2 using the CraterTools add-on [9] in the ArcGIS software on LRO-NAC [8] images with resolution ranging between 0.5 and 1.5 m/pixel. The exported data have then been plotted in the Craterstats2 software [10].

The obtained results highlight that i) Tsiolkovskiy crater formed around 3.6 Ga, in agreement with [3], ii) three different age ranges are discernible and iii) these age ranges are correlated to each one of the three color units of the crater floor.

This allows to reconstruct the evolution history of the crater and in particular of its crater floor, with particular focus also on its compositional variegation.

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