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Geologic mapping and stratigraphic investigations of the lunar crater Tycho

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We produced a new geologic map and studied important stratigraphic relationships for Tycho crater. This crater is ∼102 km in diameter and is located in the southern highlands on the nearside of the Moon. We used high-resolution Lunar Reconnaissance Orbiter Camera (LROC) and Selenological and Engineering Explorer (SELENE) Terrain Camera (TC) images for detailed mapping, stratigraphic investigations, and dating of geologic units with crater size-frequency distribution (CFSD) measurements. In addition, we used Clementine FeO and TiO_2 maps [1] and Moon Mineralogy Mapper (M^3) [2] data to investigate the mineralogy.

CSFD measurements at young lunar craters are important for helping us better understand the impact rate over the last billion years [3]. Melt pools dated with CSFDs on LROC Narrow Angle Camera (NAC) images, show model ages between 24.2 ± 5.6 Ma and 80.0 ± 14.7 Ma, whereas our model age for the ejecta blanket is 119 ± 12 Ma. The apparent absolute model ages measured for melt pools at Tycho are younger than the ejecta blanket. However, the impact melt and ejecta blanket should have formed at about the same time [4]. One interpretation of the discrepancies between the model ages of the melt pools and the ejecta blanket is that they have different target properties, i.e. the melt pools could be less porous and stronger [3,5]. Alternatively, self-secondary cratering might cause differences in CSFDs [6].
Our detailed geological map shows the distribution of melt pools in the study area. In particular, it shows a large coherent melt sheet within the crater, melt pools and flows along the terraced crater rim, and melt pools on the continuous ejecta blanket. The mapped distribution of melt pools is consistent with an oblique impact of the Tycho impactor from the southwest, as proposed by [7,8]. In addition to the distribution, we will also present results of the volume of melt pools associated with Tycho.

References

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