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Geology and crater size-frequency distributions of the Apollo 12 landing site

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The Apollo 12 landing site in Oceanus Procellarum provides important calibration points for the lunar cratering chronology, which is used to derive absolute model ages (AMAs) throughout the solar system [e.g., 1-6]. Here, the calibration points are based on the ages of: (1) a surface mare basalt and (2) Copernicus crater via its ray material. We produced an updated geological map and new crater size-frequency distributions (CSFDs) of the landing site using modern data, including Lunar Reconnaissance Orbiter Camera (LROC) Narrow angle (NAC) and Wide Angle (WAC) images, Digital elevation models (DEM), and spectral Clementine and M3 data. The geologic map of the landing site shows various geologic units identified via their albedo, relief, and spectral characteristics.
Stöffler et al. (2006) [6] summarized the radiometric and compositional analyses of the returned samples from the landing site: The collected samples from the Apollo 12 landing site were divided into four basalt types: pigeonite basalt (3.15 Ga), ilmenite basalt (3.17 Ga), feldspathic basalt (3.20 Ga), and olivine basalt (3.22 Ga). Recently, Snape et al. (2016) [7] determined crystallization ages of samples 12038 (feldspathic basalt), 12039 (pigeonite basalt), and 12063 (ilmenite basalt) as 3.28 Ga, 3.20 Ga, and 3.30 Ga, respectively.
The updated radiometric ages are put in context with our new geological map and CSFD distributions to study the lunar chronology [6-9]. Our new CSFD measurements give AMAs of 678 Ma and 3.15 Ga representing the Copernicus crater ray and the surrounding mare unit, respectively. The results are consistent with Hiesinger et al. (2012) [11], who determined an age for the Copernicus crater ray at the landing site. Our results are also consistent with the radiometric age of the pigeonite samples [6]. The newly measured CSFDs N(1) values, together with the latest radiometric ages, were compared with the Neukum et al. (2001) chronology [4] for testing/improving its validity and accuracy.
We are currently reviewing the geology and CSFDs of all landing sites to analyze whether the sample locations and corresponding count areas can be revised [6,8,9] to potentially improve the lunar chronology.

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