Geologic age of Finsen Crater on far side of the moon found to be 3.5 billion years

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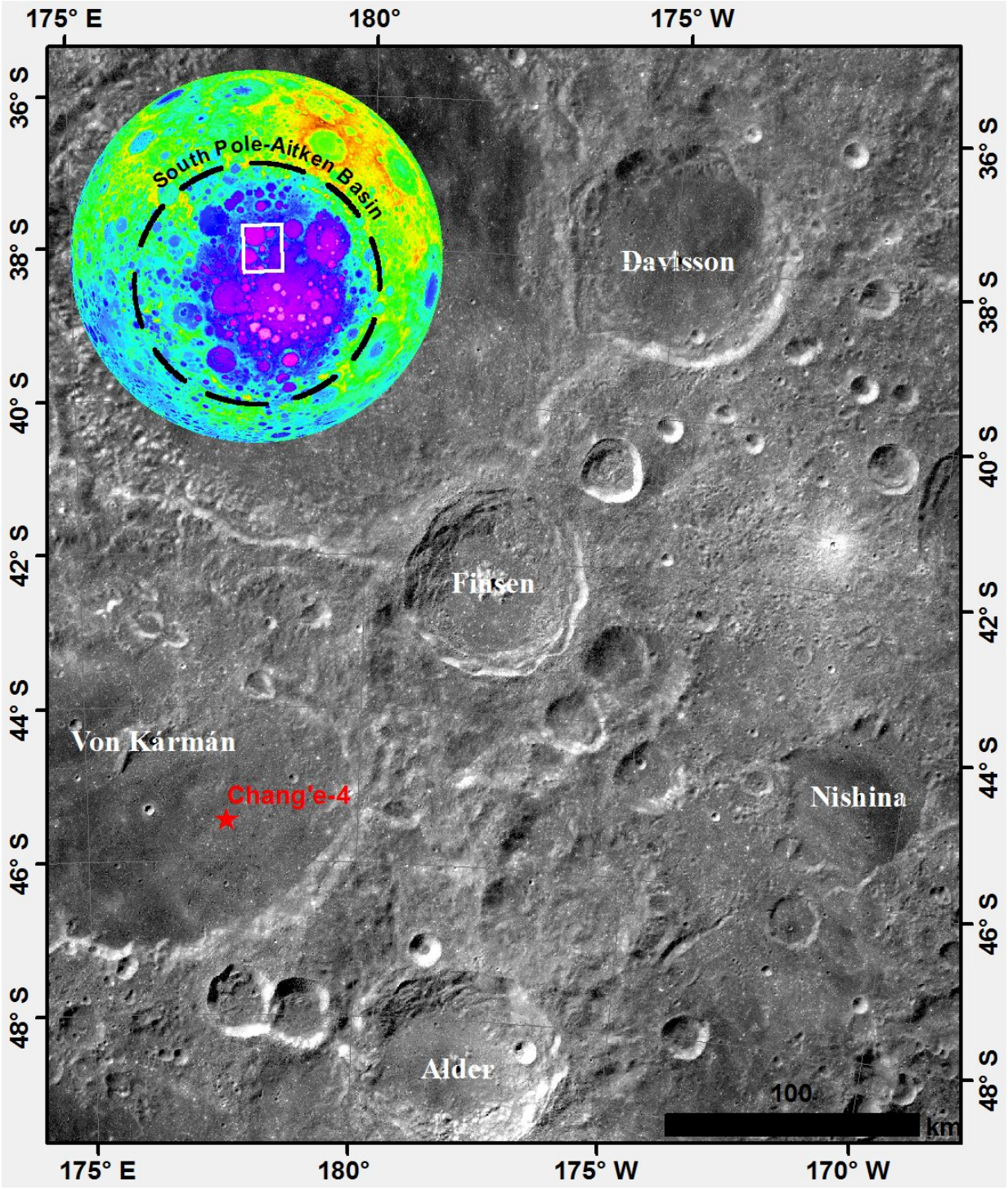

Context map of Chang'e-4 landing site. Credit: AIR

The absolute model age (AMA), or geologic age of Finsen crater on the moon's far side is determined to be about 3.5 billion years (Ga) based on crater counting method, according to a study published in Icarus.

The study was conducted by a research team led by Prof. Di Kaichang from the State Key Laboratory of Remote Sensing Sciences, Aerospace Information Research Institute (AIR) of the Chinese Academy of Sciences (CAS).

Based on this model age, the regolith growth rate at the Chang'e-4 landing site and the crater degradation rate within Finsen crater have also been estimated.

China's Chang'e-4 probe, including a lander and a rover, successfully touched down the floor of Von Kármán crater within the South Pole-Aitken (SPA) basin on the far side of the moon on January 3, 2019. Since then, Chang'e-4 rover has been traversing on the floor of Von Kármán crater and has carried out a string of in situ measurements with equipped scientific payloads.

Although multiple studies have revealed that Finsen crater ejecta is the primary source of materials measured inside of Von Kármán crater, where Chang'e-4 rover landed, the formation age of Finsen crater, which has significant geologic implications, is still debated within the planetary community.

The team used Chang'e-2 digital orthophoto map (DOM) and digital elevation model (DEM) data in their research. They outlined a flat and homogenous area on the floor of Finsen as crater count area, and manually mapped craters in the outlined area.

Finally, the AMA of Finsen crater was determined by fitting the obtained crater size-frequency distribution (CSFD) to standard lunar

cratering chronology. Both cumulative and differential fits revealed an AMA of ~3.5 Ga, indicating Finsen crater was Imbrium-aged.

Radar images indicated that the thickness of the Finsen crater ejecta-sourced fine-grained regolith at Chang'e-4 landing site was about 12 m. The team thus estimated the average regolith growth rate at the Chang'e-4 landing site was about 3.4 m/Gyr.

Compared with Apollo landing sites of similar age, the regolith growth rate at Chang'e-4 landing site was greater, except for Apollo 16, suggesting a low weathering resistivity of Finsen crater ejecta to the harsh space environment.

There are many simple craters on the floor of Finsen crater, which are easily degraded by erosion of crater rim and infilling of crater interior through geologic processes. The team further calculated the current depth of 25 largest craters within the outlined area through a profile-average-depth method and the estimated crater degradation rate within Finsen was about 21 ± 3 m/Gyr.

This degradation rate has the same order of magnitude to that on the lunar maria (about 32 m/Gyr), indicating lunar craters might have a similar degradation rate on a global scale.

However, the rate is much slower than that on other airless rocky bodies, for example, average degradation rate on Vesta is 350 m/Gyr, and on Gaspra is 100-1000 m/Gyr. One of the most likely reasons is that craters on asteroids are easily degraded or even erased by mass movements caused by impact-induced global seismic shaking.

More information: Sheng Gou et al. Absolute model age of lunar Finsen crater and geologic implications, *Icarus* (2020). DOI: 10.1016/j.icarus.2020.114046

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