

Subsurface structures around Chang'e-4 (CE-4) landing site observed by SELENE

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In the lunar landing mission Chang'e-4 (CE-4), subsurface structures at the landing site on the floor of Von Karman crater (VK) inside the South Pole-Aitken (SPA) were observed by the Lunar Penetrating Radar (LPR) onboard the Yutu-2 rover. There were several subsurface ejecta and basalt layers with thickness from 12 m to 100 m within a depth of about 300 m. Their thicknesses suggested that they were provided by Imbrium and Orientale impact events and multiple lava eruption events within the VK crater [Lai et al., 2020]. The subsurface radar sounding around the CE-4 landing site was also performed by the Lunar Radar Sounder (LRS) onboard the SELENE spacecraft. While the range resolution of CE-4/Yutu-2/LPR CH-1 (1-2 m) was better than that of SELENE (75 m), coverage of the area by SELENE was wider than that of CE-4. Comparative analyses of data from CE-4 and SELENE around CE-4 landing site are therefore useful for verifications of discussion based on each data.

The nearest path of SELENE to the CE-4 landing site (177.599°E , 45.444°S) was at a longitude of 177.481°E , 2.4 km west from the CE-4 landing site. In the radargram of SELENE/LRS raw data, the subsurface echoes were not clear. In order to suppress the off-nadir surface echoes, we applied 20-pulse stacking to SELENE/LRS data and found subsurface echoes with time delay of 2100, 3000, and 3700 ns (from reflectors at depths of 130, 180, and 260 m if the permittivity was 6). We also performed surface clutter simulation based on digital elevation model (DEM) and confirmed that they could not be produced by the surface clutters. The time delays of 2100 and 3700 ns are similar to those of echoes found in CE-4. In Lai et al. (2020), they were labeled D and E, and the D-E stratum was interpreted as basalt mixed with small and large-scale ejecta. Using SELENE/LRS data, subsurface structures around the CE-4 landing site could be clarified. The layers above D were thickest around 45.6°S and their cropout could be around 45.7°S . The subsurface structures measured by SELENE in the VK crater would contribute our further understanding of the CE-4's detailed observations at the CE-4 landing site.

Keywords: Chang'e-4 (CE-4), SELENE, Von Karman (VK) crater, Impact ejecta, Volcanic activity