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GEOLOGICAL STRUCTURE OF THE LUNAR SOUTH POLE-AITKEN BASIN BASED ON DATA DERIVED FROM SELENE MULTIBAND IMAGER

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The SPA is the biggest impact basin on the lunar far side. Previous studies have suggested that the mantle materials have been exposed. This excavation depth has estimated about 120 km. Crustal thickness of lunar farside is about 100 km, so most of the anorthosite composing the crust may have been excavated and ejected from the basin. However, the basin formation process and consequent mineralogy of this basin are still unclear because of the degradation after the supposedly ancient the SPA basin generated impact. For example, it is averaged of the lunar surface elevation by the rock collapse or space weathering. Therefore, crater scaling law in previous studies may not be applied to this basin, and it is possible that the impact melt size, transient cavity size and excavation depth of the SPA basin will not be estimated using crater scaling law in previous studies. On the other hands, previous observations are indicated that the crustal material remembered on the center of the SPA basin, and are apparently inconsistent with the theory of previous studies. And we study about the impact melt of the SPA basin to extrapolate the scale and the azimuth of the impact. In this study, we analyzed the distribution of the minerals and the topographic feature (such a peak ring) within the SPA basin, and compared these results. Finally, we supposed the geological structure, for example, impact melt pool size, transient cavity size and excavation depth, of this large impact crater.

We used the topographic data derived from SELENE LALT and the mineralogical data derived from MI. There are four rings investigated from previous data such as altimetry data of Clementine. However, they are not uncovered the full ring structure of the rings. We extended the previous identification by plotting the points with the same altitude. On the other hands, mineral phases have diagnostic absorption features depending on the minerals. Plagioclase, olivine and pyroxene have absorption bands at around 1250 nm, 1050 nm and 950 nm, rerespectively. These minerals are the three commonest minerals on the Moon. We identified these three minerals within the SPA basin using MI data. Especially, to select anorthosite (plagioclase$>$90%) spectra, we detected a peak shoulder at around 1250 nm.We made a color-composite image (RGB image) in which red, green and blue are assigned to a continuum removed absorption depth at 950nm,1050nm and 1250nm,respectively. We provided the geological structure of the SPA basin by comparing these topographic rings and the mineralogical distribution.

We identified four rings from the LALT data. The West- East example diameter of the second ring estimated 1,330 km. The fourth ring estimated 610 km. The topography inside the fourth ring is smooth compared to the outside areas. On the other hands, from the RGB map, we found out the lithofacies distribution. First, plagioclase located near the fringe region within the SPA basin. Second, on the middle area, where is red and yellow patches presented area, there are low and high-Ca pyroxene. And third, on the center of the basin, high-Ca pyroxene present. The mineral composition of this area is uniformity than other area.

The boundary derived from topographic data matched the presence of the anorthosite distribution derived from mineralogical data. This suggests that second ring corresponds to a transient cavity within which crustal material is excavated. On the other hand, it is possible that impact melt filled within only the fourth ring, because this ring is the innermost ring. If impact melt filled within the second ring or the third ring, it might not present peak ring inside these rings. And, the mineral composition within the fourth ring is uniformity than outside this ring. If the impact melt filled within this ring, the diameter of impact melt pool of the SPA basin is about 610km. This estimate is about the same diameter of calculation from previous studies.

Keywords: moon, South Pole-Aitken, basin, geological structure