# Subsurface geological survey of the Moon by means of the Lunar Radar Sounder (LRS) onboard the KAGUYA (SELENE)

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Subsurface geology of the Moon is being observed by the Lunar Radar Sounder (LRS), a ground penetrating radar onboard the KAGUYA (SELENE) spacecraft. In this paper, we report the first result of the LRS experiment using the data from Mare Serenitatis and its surrounding areas. This region was chosen to compare the results of the ALSE (Apollo Lunar Sounder Experiment) on the Apollo 17 mission. LRS is capable of penetrating to depths of several kilometers with a range resolution less than 100 m and with a footprint of several tens of km in diameter. Subsurface stratification under lunar maria is a suitable target for LRS with this wide footprint, because their level surfaces are believed to be underlain by largely horizontal strata with thicknesses up to a few kilometers. Using the ALSE data, Peeples et al. (1978) chronicled subsurface stratification in the southern part of the mare.

Mare Serenitatis is a circular basin with a diameter of ca. 600 km made by a 3.98 Ga impact (Neukum and Ivanov, 1994), and occupies the latitudes 16-38$^o$ N and longitudes 8-29$^o$. Serenitatis is a typical mason basin that has thick mare deposits and mare ridges in the basin and grabens along the basin rim. We investigated LRS data along some 20 north-south trending tracks across the region.

First, LRS revealed subsurface stratifications, although we use only a simple data for each shot to date (January, 2008). Numerous horizontal and low-angle interfaces were found under Mare Serenitatis. Most of their reflections were faint, but there were prominent ones as well. In the southern part of the basin, prominent reflectors were found at a few hundred meters below the surface. Some of those were identified at the same or similar depths along neighboring tracks. Transect of ALSE ran largely along the parallel at 20$^o$ N, where Peeples et al. (1978) depicted two subsurface interfaces almost under the entire length of the transect. However, those interfaces were not verified by LRS to date. The prominent reflectors evidenced by LRS were significantly shallower under the ALSE track than those of Peeples et al.

Second, we verified the folding or faulting of strata denoted by prominent interfaces under mare ridges, indicating the tectonic origin of the ridges. This was suggested by ALSE (Maxwell et al., 1975; Peeples et al., 1878).

Third, we found layering under highlands around Serenitatis. Although the signals from those interfaces were weak, their apparent dip angles or depths in the profiles were similar to each other under different tracks. This coherence indicates the confidence of their existence. The strata under the highlands to the north of Serenitatis from Montes Caucasus to Lacus Somniorum show basin-ward tilting with the apparent dip angles of ca. 1/100. Under the Montes Haemus which marks the southern margin of Serenitatis the dips of substrata appeared to change along the length of the mountain range: they were tilted basin-ward to the southwest of Serenitatis, whereas they were inclined in the opposite direction under the western part of the mountains, which rises to the south of the basin.