Thermal history of lunar lithosphere based upon subsurface structure and topography by Selene data

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Lunar Radar Sounder (LRS) onboard Selene transmits radiowaves to the moon, and receives scattered waves not only at the lunar surface but also at the subsurface discontinuities. LRS data is expected to provide information on subsurface structures in the lunar lithosphere. The shapes of the subsurface discontinuities in maria indicate deformation after deposition of mare basalts, and thus can tell us tectonic activities that created the current shapes, and the physical properties of the lunar lithosphere, e.g., effective elastic thickness that is strongly controlled by temperature of the lithosphereÅDOn the other hand, Topographic Camera (TC) as a part of LISM instrument on Selene will be able to provide a high resolution forward-backward stereoscopic digital image pair, so that we will be able to analyse lunar surface topography by photogeologic interpretation and to generate a high resolution Digital Elevation Model (DEM). By combining information to be derived from these instrument data, we plan to carry out studies on the thermal histories of the lunar lithosphere.

For instance, viscous relaxation of a lunar crater depends upon the lithosphere viscosity that is strongly controlled by the lithosphere temperature. We have analysed the viscous relaxation from the topography of lunar craters, and suggested that the lithosphere in Procellarum KREEP Terrane (PKT) had higher temperature compared with the surrounding areas in Pre-Nectarian era (Makino et al., 2004). In order to estimate the viscous relaxation, we need to know a real crater depth by adding the eject thickness to an apparent depth, which was measured by shadow of a crater rim. The ejecta thickness was estimated by model calculation based upon the theoretical ejecta distribution by impact cratering. However, it is likely that the estimations by these methods can include considerable errors. We expect that the TC DEM and Selene altimeter (LALT) data will provide us a crater depth with much higher accuracy. Moreover, we will be able to know the ejecta thickness from LRS data. Accordingly, we will be able to estimate the viscous relaxation with higher accuracy, and thus the thermal histories of the lunar lithosphere with higher confidence.