Mineral Compositions of the Bright Rayed Craters and Lunar Far-side Crust Revealed by the by Spectral Profiler on SELENE/KAGUYA

Yoshiko Ogawa[1]; Tsuneo Matsunaga[1]; Ryosuke Nakamura[2]; Makiko Ohtake[3]; Hiroshi Takeda[4]; Kazuto Saiki[5]; Takahiro Hiroi[6]; Tomoko Arai[7]; Takamitsu Sugihara[8]; Junichi Haruyama[3]; Yasuhiro Yokota[3]; Chikatoshi Honda[9]; Tomokatsu Morota[3]; Tokuhiro Nimura[10]; Naru Hirata[11]; Hirohide Demura[11]; Noriaki Asada[11]; Junya Terazono[11]

[1] NIES; [2] AIST; [3] ISAS/JAXA; [4] Chiba Inst. of Tech.; [5] Earth and Space Sci., Osaka Univ.; [6] Geological Sci., Brown Univ; [7] Univ. of Tokyo; [8] CDEX, JAMSTEC; [9] JAXA; [10] Earth and Planetary Sci., Tokyo Univ; [11] Univ. of Aizu

The Spectral Profiler (hereafter we write SP) is a visible and near infrared spectrometer onboard SELENE/KAGUYA satellite. It covers 500-2600 nm in wavelength with spectral resolutions of 6-8 nm and high SNRs of ˜2300@810-860 nm, accompanying three detectors (VIS: 513-1010 nm, NIR1: 884-1676 nm and NIR2: 1702-2588 nm). SP data includes very critical information to identify the mineralogical compositions of the lunar surface with unprecedented accuracy.

By its nominal mission for about 1 year, the SP data accumulated so far amounts to more than 4500 polar orbits at the end of November, 2008. We now obtained the global set of continuous spectra of the lunar surface; the observed points by SP are every 500 m along the tracks and the gaps across the tracks are less than a several kilometers on average, which definitely contributes to the completion of the global mapping of the mineral distribution.

Based on the SP spectral data we are conducting a preliminary survey to collect compositional information of the lunar highland crust on the far-side. We targeted small-medium sized (9-23 km in cavity diameter) craters accompanying distinctive bright rays. Such craters with rays generally suggest they are fresh (less than 1 Ga) and we can retrieve the spectral signatures easily with less error. We investigated the spectral features for these craters using SP data. For quantitative comparison, we derived the following 3 parameters representing the spectral features: continuum slope, wavelength position and the depth of 1 micron absorption band for each of the spectrum observed by SP. We also conduct Modified Gaussian Modeling (MGM) for the representative spectrum for more accurate estimate of the potential compositions.

We found the spectra of the crater floors show some common feature: very deep, sharp and symmetric absorption centered around 0.95-0.97 micron, and the continuum slopes are comparatively small. They also accompany asymmetric, distinctive absorption band around 1.2-1.25 micron without exception. Since the crater diameter is limited in the above range now, the excavated depth would be only a few kilometers, so the compositions inferred from the spectra may represent the shallower part of the highland crust.

We discuss about the interpretation of such spectra and try to deduce possible thermal events of the crust. They could represent very local heating event after the formation of the crust or might be an outcome of the last stage of solidification of magma ocean.