UPDATES ON SCIENTIFIC RESULTS AND PRODUCTS OF SELENE SPECTRAL PROFILER. T. Matsunaga[1], M. Ohtake[2], J. Haruyama[2], S. Yamamoto[1], Y. Ogawa[3], R. Nakamura[4], Y. Yokota[2], T. Morota[2], C. Honda[3], M. Abe[2], T. Nimura[2], T. Hiroi[5], T. Arai[6], K. Saiki[7], H. Takeda[8], N. Hirata[3], S. Kodama[4], T. Sugihara[9], H. Demura[3], N. Asada[3], J. Terazono[3], and H. Otake[10], [1]Center for Global Environmental Research, National Institute for Environmental Studies, 16-2 Onogawa Tsukuba 305-8506, Japan, [2]Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency, [3]The University of Aizu, [4]Information Technology Research Institute, National Institute of Advanced Industrial Science and Technology, [5]Department of Geological Sciences, Brown University, [6]Chiba Institute of Technology, [7]Department of Earth and Space Science, Osaka University, [8]The University of Tokyo, [9]Center for Deep Earth Exploration, Japan Agency for Marine Science and Technology, [10]Lunar and Planetary Exploration Program Group, Japan Aerospace Exploration Agency. Contact : matsunag@nies.go.jp

Introduction: Spectral Profiler (SP) is a visible - near infrared grating spectrometer onboard Japanese SELENE (Kaguya) lunar explorer launched in September 2007. SP consists of one reflective telescope, two plane gratings, three linear detectors, one three-stage peltier cooler, and two halogen lamps with a filter for radiometric and spectral calibration. The spectral coverage and sampling interval are 0.5 - 2.6 μm and 6 - 8 nm, and the along-track sampling interval is 500 m. The total number of spectral channels is 296 including several overlapping channels around 1 μm.

The eleven-month-long nominal operation of SP was started in December 2007 just after the initial check out period. The extended mission of SP was started in November 2008 and ended in June 2009 with a controlled crash of Kaguya to the Moon. During the nominal and extended operation periods, SP acquired data from about seven thousand revolutions around Moon and the total number of obtained lunar surface spectra is close to seventy million. The average east-west spacing's between orbits in which SP acquired data are 1 - 2 km at the equator. During most of SP observation, Terrain Camera (TC) or Multiband Imager (MI) was operated to obtain images which can be used to identify the exact locations of SP spectra within the image by image-matching calculation in the later data processing.

Product Status and Release Plan: SP L2B1 products derived from SP data acquired in the nominal mission period are now publicly available from JAXA's Kaguya(SELENE) data archive website (https://www.soac.selene.isas.jaxa.jp/archive/index.html.en). These products contained radiance and diffuse reflectance in each of 296 spectral channels as well as raw data and quality assessment results. One typical SP L2B1 product covers the half of the Moon: from the north pole to south pole or vice versa and contains about ten thousand spectra.

SP L2B2 products, which consist of TC or MI single-band images and SP L2B1 data acquired at the same time as TC/MI images, are being processed and registered to JAXA's data archive. After the completion of SP L2B2 processing, currently scheduled in the end of March 2010, SP L2C processing will be started. SP L2C products will contain photometrically corrected lunar surface spectral reflectance and the location information of each of SP spectra within the accompanied TC or MI image determined by image-matching calculation (Figure 1).

Scientific Results: The first peer-reviewed paper using SP data was published in December 2008[1]. In this paper, SP spectra of central peaks of several craters are shown including clearest and most definite absorption feature of crystalline plagioclase at Jackson crater. The second paper shows, for the first time, the global existence of purest anorthosite (PAN) using mainly MI. SP's continuous reflectance spectrum was used to verify MI's nine-band spectra at Jackson crater[2].

The most recently published paper[3] discussed the possible existence of the ultramafic impact melt sheet beneath the South Pole – Aitken(SPA) basin using SP data. SP spectra of central peaks of craters inside SPA, Antoniadi, Bhabha, Finsen, and Lyman, all show a similar feature: diagnostic absorption centered at near 900 nm. A radiative transfer model[4] was applied to SP data and revealed that these central peaks are commonly composed of an ultramafic assemblage dominated by Mg-rich orthopyroxene (Figure 2), suggesting a homogeneous layer buried under SPA.

In addition to above mentioned peer-reviewed papers, following researches are ongoing:

Global Survey of Olivine and Purest Anorthosite. Global surveys of specific minerals and rocks using seventy million SP spectra are being conducted. Yamamoto et al.[5] are searching for olivine and already found more than two hundred points which show the typical spectral signature of olivine. Ohtake et al.[6] are searching for absorption features in 1.2 - 1.3

μm because they indicate crystalline plagioclase and purest anorthosite (PAN).

Photometric Correction and Absolute Radiometric Calibration .Yokota et al. [7] are now investigating photometric correction scheme for SP and MI. Preliminary photometric correction coefficients to convert observed radiance to reflectance at the standard geometry are already determined for SP data in 0.5 - 1.6 μm region. The final version of these coefficients will be used in absolute radiometric calibration and degradation correction of SP as well as SP L2C processing.

References: [1] Matsunaga, T. et al. (2008) *Geophys. Res. Lett.*, 35, L23201, doi:10.1029/2008GL035868. [2] Ohtake, M, et al.(2009) *Nature*, 461, pp. 236-240, doi:10.1038/nature08317. [3] Nakamura, R. et al. (2009) *Geophys. Res. Lett.*, 36, L22202, doi:10.1029/2009GL040765. [4] Hapke, B. (2001) J. Geophys. Res., 106, 10,039 – 10,074, doi:10.1029/2000JE001338. [5] Yamamoto et al., this issue. [6] Ohtake et al., this issue. [7] Yokota et al., this issue.

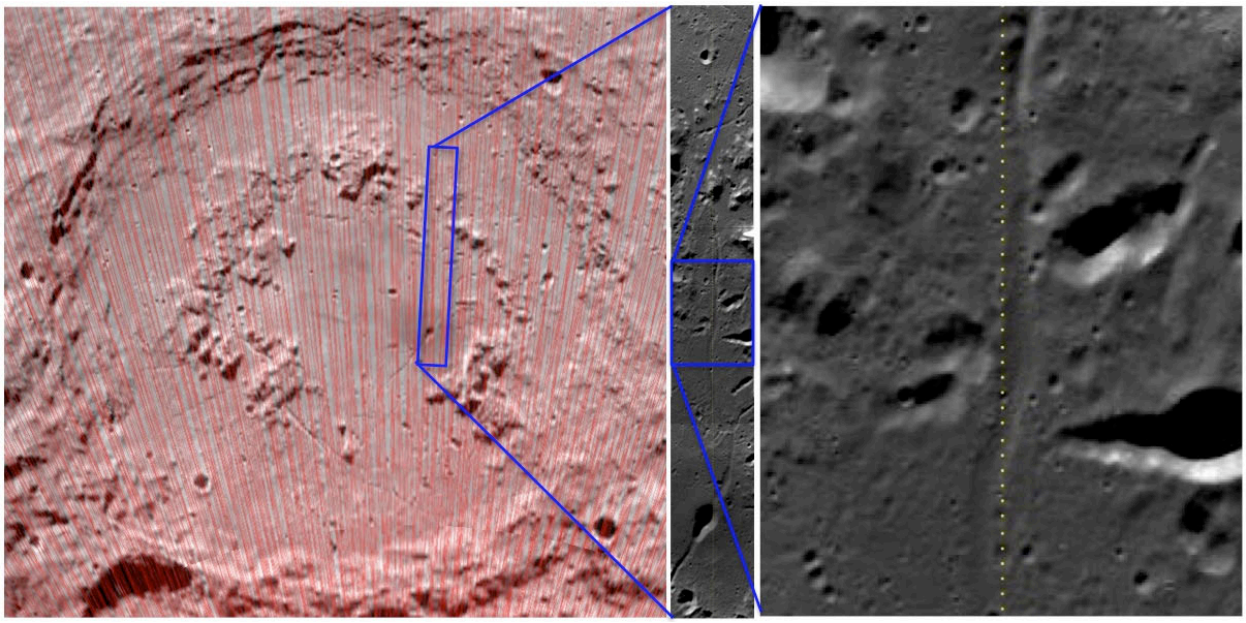

Figure 1. (left) Schrodinger crater (D=312 km) with all SP transects (red lines).
(center) Three-image mosaic within the crater. Images are taken by TC and stored in SP L2C products.
(right) Close-up view of a TC image in a SP L2C product. Yellow dots indicate the locations of each SP spectra in a SP L2C product determined by image-matching calculation.

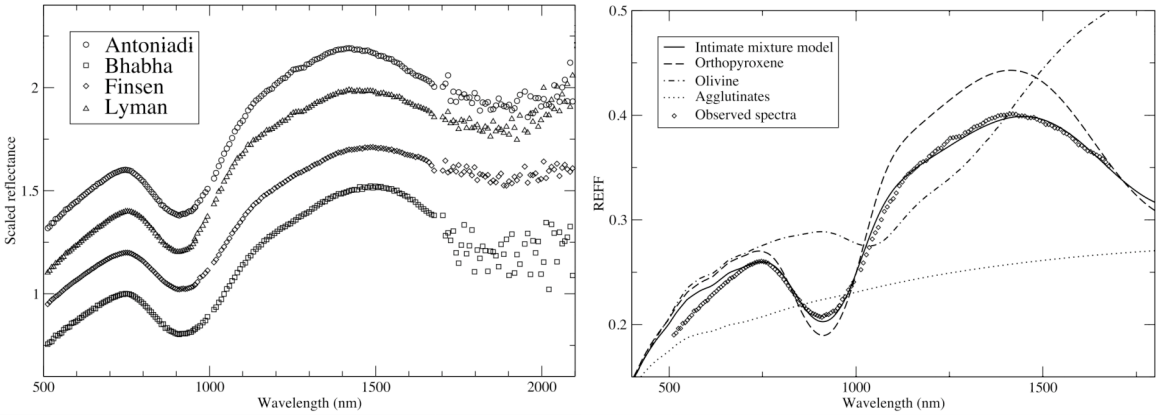

Figure 2. (left) SP Scaled reflectance spectra of central peaks of four craters within South Pole-Aitken basin[3].
(right) A comparison between SP absolute reflectance spectrum of Antoniadi's central peak and the modeled spectrum[3]. Spectra of three model components are also shown.