REMOTE SENSING STUDY OF A LARGE LUNAR CRATER JACKSON. N. Hirata[1], J. Haruyama[2], M. Ohtake[2], T. Matsunaga[3], Y. Yokota[2], T. Morota[2], C. Honda[1], Y. Ogawa[1], K. Kitazato[1], Y. Shibata[1], T. Sugihara[4], H. Miyamoto[5], H. Demura[1], and N. Asada[1], [1]The University of Aizu, Ikki-machi, Aizu-Wakamatsu, Fukushima, 965-8580, Japan, [2]The Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency, [3]National Institute for Environmental Studies, [4]Center for Deep Earth exploration, Japan Agency for Marine-Science and Technology, [5]The University Museum, The University of Tokyo. Corresponding author's e-mail address: naru@u-aizu.ac.jp

Introduction: We investigated a large lunar crater Jackson with LISM/SELENE data to reconstruct the impact event forming the crater from distributions of its ejecta and other associated features. Jackson is placed near the center of lunar farside (22.4°N 196.9°E). Although Jackson is one of the freshest craters on the lunar farside in this size range [1,2], it has never imaged with any high-resolution imager before LISM/SELENE [3]. Fine structures of surface features and spectroscopic characteristics found in and around the crater cavity give important clues to reconstruct and understand impact cratering and pre-impact subsurface structures. Large and fresh lunar craters are best targets, because only space weathering and limited degradations by small impacts are major processes that disturb original structures of ejecta units.

Jackson has a bright ray system with a large forbidden zone in the NW sector and two minor ones in both S and SE sectors (Fig. 1). This appearance suggests that Jackson was formed by a oblique impact of the NW-SE direction.

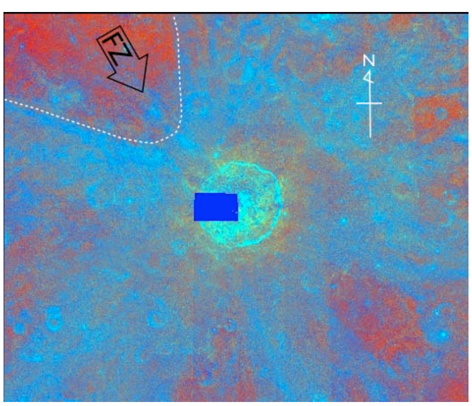

Fig. 1. Clementine UVVIS ratio image of Jackson. The ray system is appeared as a radial pattern of bluish units. The ejecta forbidden zone (FZ) and an inferred impact direction are shown. Images on a blue square on the crater are missing.

The central peak of Jackson consist of pure anorthosite with very high plagioclase abundance, but it also has a very dark unit at its summit [4]. Although this anorthositic outcrop is regarded as an exposure of the pristine crustal materials of the moon, its detailed exposing process during the cratering event and the origin of the dark cap are still unclear.

Data and Method: A high-resolution mosaic image composed of data from Terrain Camera (TC) [5], and a 9-band cube mosaic image of Multiband Imager (MI) [6], are used for our analyses. The MI mosaic is an image cube of MI-VIS and MI-NIR, and each image plane is resampled to 20 m/pixel. A digital terrain model (DTM) derived from TC stereo pairs was also employed. The Clementine DIM was to supplement the other data. All data are converted to the Lambert azimuthal equal-area projection with the projection center at the crater center, and are co-registered on this common projection coordinate. We basically follow a precedent study on data reduction procedure for the multiband cube [4].

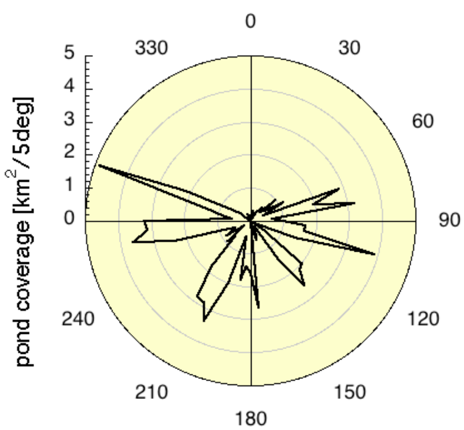

Fig. 2. Radial distribution of melt ponds on the ejecta blanket.

Melt Pond Distribution: Impact melt ponds on the ejecta blanket show a heterogeneous distribution (Fig. 2), whereas the ponds on the terrace zone do not. The ponds on the ejecta blanket are concentrated to the downrange direction and the both side. The similar trend on the pond distribution is found at Tycho crater [7]. Both results indicate that melt transportation is strongly affected by heterogeneous excavation flow induced by an oblique impact.

Floor Lithology: Our new false-color composite reveals a wide variety of both crystalline materials and glassy materials in the crater floor. We identify at least four different lithologies for crystalline materials (C1-C4 in Fig. 3) and three for glassy ones (F1-F3 in Fig. 3). A pert of them were identified in the previous study [4]. While most of the floor is covered with glassy (reddish units in Fig. 3) materials, crystalline materials appear at the central peak and hummocks. The crystalline units are hilltops of megablocks or basement on the cavity that exposed in the melt sheet, of which surface was quenched to glassy material. The unit C1 includes the pure anorthositic material at the central peak. This unit is also found at smaller hummocks around the central peak. Hummocks near the terrace zones show different spectra (Fig. 4). The northern group (C2) has similar spectrum to that of C1, although C2 is darker than C1. The southern group (C3) shows more mafic spectrum than those of C1 and C2. The unit C4 is found at steep slope of the terrace zone, and its spectrum is also mafic but brighter than C3. Spectra of 3 glassy units are rather similar: difference mainly come from absolute reflectance.

Interesting finding on this analysis is that distributions of both crystalline materials and glassy ones seem to be connected. The units C1 and F1 distribute in the central area of crater. C2/F2 are in the northern area, and C3/F3 are in the southern area. This suggest that these pairs of crystalline and glassy units are originally connected. One possible explanation is that the crystalline units are the original lithologies at the Jackson area, and the glassy units are melt products of corresponding crystalline units. This view is supported by evidence that crystalline materials appear within fissures in the glassy units, and their spectra are similar to those of corresponding crystalline units. Two possible implications rise with these results: Mixing of impact melt during cratering process is not so effective at least in several tens kilometer scale, and Current distributions of material types inherit the pre-impact subsurface structure. However, disturbance of the original structure by an oblique impact cratering should be assessed, too.

References: [1] McEwen A. (1993) *JGR*, 98, 17207–17231. [2] Grier J. (2001) *JGR*, 106, 32847-32862. [3] Hirata N. et al. (2008) *MetSoc, 71*, Abstract #5175. [4] Ohtake M. et al. (2009) *Nature*, 461, 236-240. [5] Haruyama J. et al. (2008) *Earth Planets and Space*, 60, 243-255. [6] Ohtake M. et al. (2008) Advances in Space Research, 42, 301-304. [7] Hirata N. et al. (2009) *LPS XXXX*, Abstract #1514.

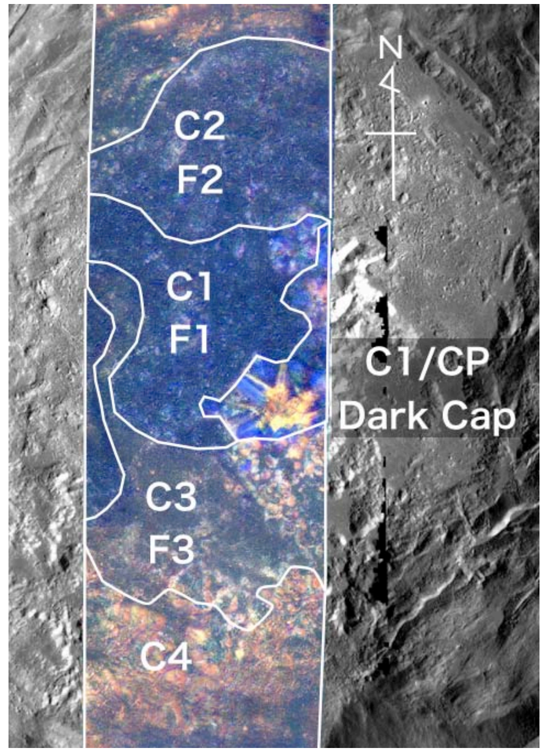

Fig. 3. False-color composite of MI image over TC mosaic. Red, green, and blue are assigned to continuum-removed-absorption depths of 950, 1050 and 1250 nm, respectively. Identified units are indicated in the image. C1-C4 are crystalline units, and F1-F3 are glassy units on the floor.

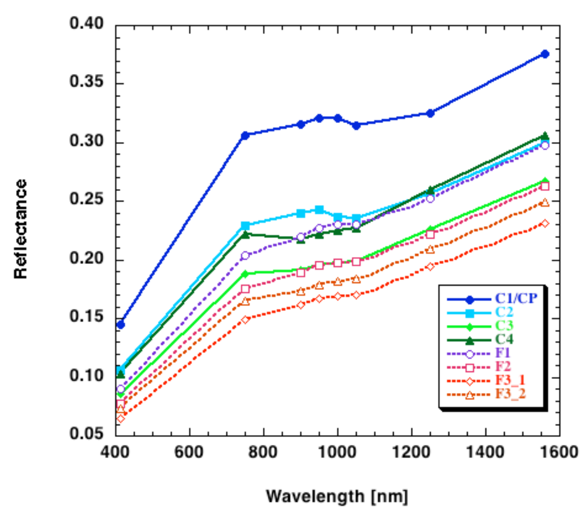

Fig. 4. Reflectance spectra of crystalline and glassy lithologies in the crater cavity. Eight-band spectra are extracted from the MI image cube. Data are averaged over all pixels classified into corresponding units. F3 unit is divided into two subunits by clustering analysis.