Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

PPS024-15 会場:103 時間:5 月 23 日 10:00-10:15

かぐや(SELENE)測月データによる南極エイトケン盆地の構造
Structure of South-Pole Aitken Basin of the Moon from KAGUYA (SELENE) Selenodesy

佐々木 晶[1*], 石原 吉明[1], Goossens Sander[1], 松本 晃治[1], 荒木 博志[1], 花田 英夫[1], 菊池 冬彦[1], 野田 寛大[1], 並木 則行[2], 岩田 隆浩[3], 大竹 真紀子[3]
Sho Sasaki[1*], Yoshiaki Ishihara[1], Sander Goossens[1], Koji Matsumoto[1], Hiroshi Araki[1], Hideo Hanada[1], Fuyuhiko Kikuchi[1], Hirotomo Noda[1], Noriyuki Namiki[2], Takahiro Iwata[3], Makiko Ohtake[3]

[1] 国立天文台ＲＩＳＥ月探査プロジェクト, [2] 千葉工業大学惑星探査センター, [3] 宇宙航空研究開発機構宇宙科学研究所
[1]National Astronomical Observatory, [2]Chiba Institute of Technology, [3]ISAS/JAXA

Figure Overprinted impact basins in SPA investigated here.

KAGUYA(SELENE) obtained the first precise gravity field of the lunar farside (Namiki et al., 2009) using 4-way Doppler tracking with relay satellite. Multi-frequency differential VLBI observation of two subsatel-lites improved the accuracy of grav-ity. A gravity field model SGM100h was obtained from one-year tracking data (Matsumoto et al., 2010) and the model was refined into SGM100i using VLBI data (Goossens et al., 2011). With topography data (Araki et al., 2009), Bouguer grav-ity anomaly, Moho depth, and crustal thickness are es-timted (Ishihara et al., 2009).

The South Pole-Aitken basin (hereafter SPA) is the largest and deepest impact basin in the solar system. It has abundant su-perimposed craters. Garrick-Bethell and Zuber (2009) (GZ09) showed that SPA is characterized by an ellipse with axes 2400 by 2050 km with the center at 53S - 191E. Here, we analyze the structure of SPA using KAGUYA selenodesy data. The direction of an ellipse denoting the depression is similar to that of GZ09. The region with the thinnest crust is offset southward from the center of SPA. Moho depth at the central region of SPA is around 30km (25km in crustal thickness) and shallower to the southward. This may be explained by the oblique impact hypothesis.

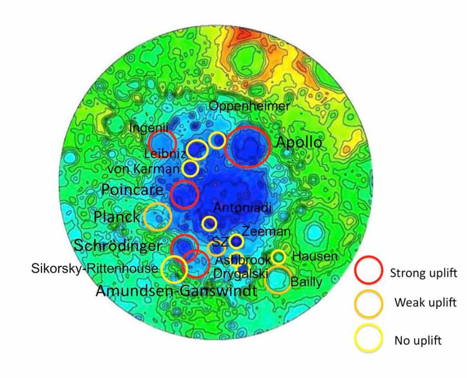
Our crustal thickness is affected by the assumed anor-thosite crustal density 2800 kg/m3. KAGUYA MI show-ed evidence of anorthosite in SPA (Ohtake et al., 2009). But spectral data of central peaks of craters inside SPA suggested the presence of px-rich impact melt sheet (Na-kamura et al., 2009). Then, higher crustal density would result in larger crustal thickness.

Since Bouguer anomaly is relatively flat in SPA, sur-face morphologies could be elastically supported. How-ever, there are overprinted small impact basins with gravity anomaly. We analyzed interior structure of small basins in and around SPA (Figure). We interpret that a positive gravity anomaly at the basin corresponds to a Moho uplift. There is a distinct mantle plug beneath Apollo. Just around the rim of SPA, obscure circular structure Amundsen-Ganswindt has a distinct Moho up-lift, suggesting a buried impact structure. A distinct Mo-ho uplift beneath Schrodinger corresponds to the presence of olivine at the central peak rings there (Ya-mamoto et al., 2010). In comparison between adjacent Poincare and Planck, older, less distinct Poincare shows stronger gravity anomaly. The observed anomaly corre-sponds to Type 2 like anomaly (Namiki et al., 2009), where a significant uplift at the center is probably due to overcompensation just after the impact. Basin structures in the central SPA show little grav-ity anomaly. Although it might be due to lower spatial resolution, there are sev-eral possibilities such as less density difference between crust and mantle and rapid relaxation of the uplift.

We use localized representation of gravity potential according to the Han (2008) where Slepian functions were used to es-timate the gravity field over certain areas of the Moon. Then, we express the gravitational potential with localized spherical harmonics functions. We include data in a spherical cap area with a radius of 40 degree from the SPA center. This area is fully covered by 4-way Doppler tracking of KAGUYA. We obtained gravity adjustment about -70 to 50mGal in preliminary analysis (Goossens et al., in prep.). The revised gravity field would improve crustal thickness with slightly higher resolutions.

References:
Araki, H. et al., (2009) Science 323, 897,
Garrick-Bethell and Zuber (2009) Icarus 204, 399, Goossens, S. et al. (2010), J. Geodesy, in press,
Han, S.-C. (2008) JGR 113, E11012,
Ishihara, Y. et al. (2009) GRL, 36, L19202,
Matsumoto, K. et al. (2010) JGR 115, E06007,
Nakamura, R. et al. (2009) GRL 36, L22202,

Namiki, N. et al. (2009) Science, 323, 900,
Ohtake, M. et al. (2009) Nature 461, 237,
Yamamoto, S. et al. (2010) Nature Geoscience 3, 533



キーワード: 月, 重力, 地殻, 南極エイトケン盆地, クレーター, 衝突
Keywords: Moon, gravity, crust, South Pole Aitken Basin, crater, impact