Structural and Geological Interpretation of the Posidonius Crater: Did the Posidonius Crater Floor Float on Basal Sill? Y.Ishihara[1], T. Chiba[2], J. Haruyama[1], H. Otake[1] and M. Ohtake[1], [1] Japan Aerospace Exploration Agency (ishihara.yoshiaki@jaxa.jp), [2]Asia Air Survey Co. LTD.

Introduction: The Posidonius crater locates on northeastern rim of the Serenitatis basin and it is a typical floor-fractured crater [1]. Since the Posidonius is crater located at central nearside, we could observe by ground-base telescopes. Therefore the complex texture of crater floor of the Posidonius crater attracted researchers attention from before lunar exploration era. However, origin or formation histories of floor fractures of the Posidonius crater is not fully resolved yet.

Recently, lunar topographic and geological data have been updated greatly by SELENE, LRO and so on. These recent dataset have very high resolution and quality than previous dataset, and those data could provide us new information of origin of floor-fracture of the Posidonius crater.

In this study, we try to estimate geologic histories of Posidonius crater based on topographic data and multiband image data obtained by Terrain Camera (TC) and Multiband Imager (MI) onboard Kaguya.

Data:

Topographic data: We use SLDEM2013 lunar topographic model, whose resolution is 4096 pixel/degree. SLDEM2013 is a map-projected product by mosaicking digital elevation model from appropriate DTM data of SELENE/TC, SELENE/MI-VIS and elevation data based on LRO/LOLA. Based on SLDEM2013, we made color shaded map (Fig.1) and red relief image map [2] for extracting geomorphological characteristics of the Posidonius crater region.

Geological (mineralogical) data: We use SELENE MI_MAP data for geological interpretation. MI_MAP is a map-projected product by mosaicking 9-band reflectance data of SELENE LISM/MI sensor and whose resolution is 2048 pixel/degree. Based on MI_MAP, we made color composite image (Fig. 2) and FeO abundance map [3].

Results:

Geographical features: A part of crater floor of the Posidonius is flooded by mare basalt. Previous studies interpreted that the source of mare basalt is located somewhere at Mare Serenitatis and flooded into Posidonius crater. The sinuous rille (Rimae Posidonius) is the resulting structure of that flooded basalt flow. However, based on TC topographic data (Fig 1), the Rimae Posidonius indicates opposite flow direction. Based on TC topographic data, we could interpret topographic features as follows; Rimae Posidonius flow from volcanic vent located at northern edge of Posidonius crater floor and flow out to Mare Serenitatis at western rim, the central part of crater floor slightly leaned to west and broken in several regions.

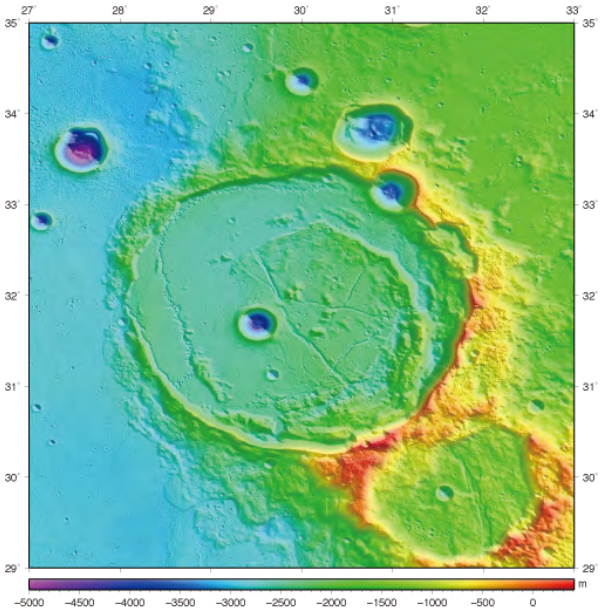

Fig. 1 Color shaded topographic map of the Posidonius Crater Region.

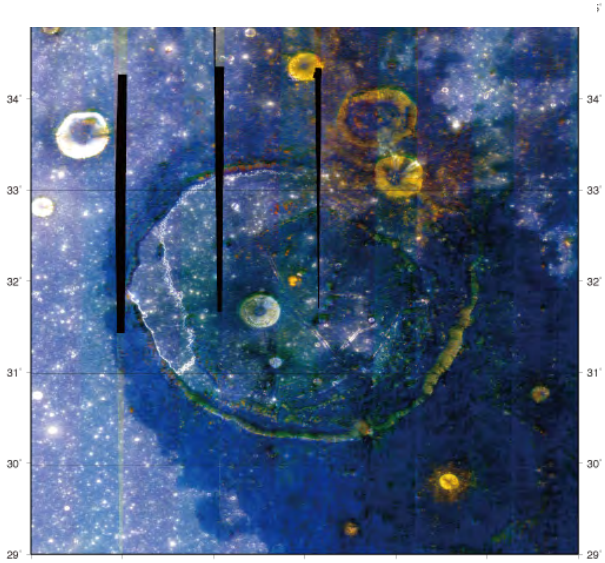

Fig. 2 Color Composite Image of the Posidonius Crater Region (band assignment R:950nm, G:1050nm, B:1250nm continuum-removed reflectance spectra).

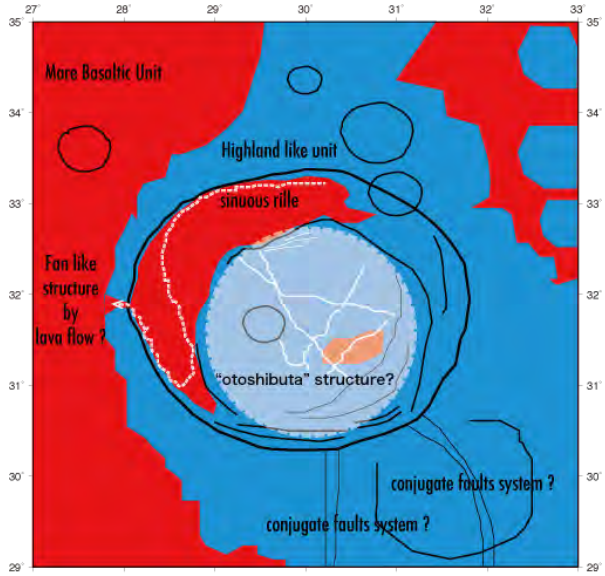

Fig. 3 Structural and Geological Interpretation Map of the Posidonius Crater Region. Red indicate mare basaltic unit and blue indicate highland material unit. White doted line indicate sinuous rill. Solid white line indicate rille (not volcanic origin).

Geological (mineralogical) features: MI color images and MI based FeO abundance data [3] shows that the eastern part of crater floor is mostly consisted by highland materials (dark bluish color) and complex rills are basically not showing the basaltic feature.

Geologic histories of Posidonius crater: Combined both topographic and geologic analysis results, we interpret the cause of complex structure of Posidonius crater is as follows.

1. Posidonius crater forming impact occurred at northeastern rim part of the Serenitatis basin.
2. Large sill intruded below crater floor and uppermost layer of crater floor is delaminated from the basement then floats on basaltic intrusion as "otoshibuta" (Japanese style lid for stew), because highland materials are lighter than basaltic materials.
3. Complex fracture was probably formed delamination and flotation stage by mechanical stress.
4. Some portions of basaltic lava erupted in Posidonius crater floor as extrusion and flooded some portion of floor.
5. Flow out of extrusive lavas and cooling of basaltic lava cause deflation of basal intrusion, and then "otoshibuta" part of crater floor inclined western direction.

References:[1] Schultz, P. H. (1976) The moon, 15(3-4), 241-273. [2] Chiba T. et al. (2008) ISPRS Archives, XXXVII(B2), 1071-1076. [3] Otake H. et al. (2012) 43rd LPS, Abstract #1905.