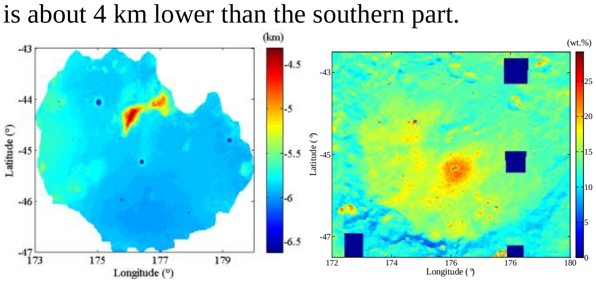
LANDING SITE SELECTION AND PROSPECTIVE SCIENTIFIC OBJECTIVES OF VON KÁRMÁN CRATER WITHIN SOUTH POLE-AITKEN BASIN. Z. G. Meng[1,2,3,4*], Y. Z. Zhu[1], J. S. Ping[4], Q. Huang[5], Z. C. Cai[3], Y. G. Wu[1], and A. Gusev[6], [1] College of Geoexploration Science and Technology, Jilin University, China mengzg@jlu.edu.cn, [2] State Key Laboratory of Remote Sensing Science, Institute of Remote Sensing and Digital Earth, CAS, China. [3] Lunar and Planetary Science Laboratory, MUST- Partner Laboratory of Key Laboratory of Lunar and Deep Space Exploration, CAS, China zccai@must.edu.mo, [4] Key Laboratory of Lunar and Deep Space Exploration, National Astronomical Observatory, CAS, China jsping@bao.ac.cn, [5] Hubei Subsurface Multi-scale Imaging Key Laboratory, Institute of Geophysics and Geomatics, China University of Geosciences, China qianhuang@cug.edu.cn, [6] Geology Institute, Kazan Federal University, Russia agusev33@gmail.com.

Introduction: Von Kármán Crater, inside the South Pole-Aitken (SPA) basin on the lunar farside, is initially selected as the landing area of Chinese Chang'E-4 mission [1]. It is a pre-Nectarian circle whose diameter is 180 km and center is 175.9 °E, 44.8 °S [2, 3]. Von Kármán Crater is substantially filled with mare basalt flows and it possess a cental peak [4]. Also, the Crater is within the estimated dimensions of the SPA Basin [5, 6]. Combined with the approximated relatively thinner crust [4] and the Thorium anomaly distribution [7], Snape et al. considered it as a promising location for sampling SPA-derived impact melt, the lower crust and probably upper mantle mateials [8]. We outline the prospective scientific objectives of Von Kármán Crater with the topography, compositions, temperature and gravity observations.

Topography: The LRO LOLA data are employed to analyze the topography features (Fig.1(a)). The highest elevation in the Crater occurs at the central peak (175.9 °E, 44.5 °S), with about -4323.8 m high, while the lowest is in the carter (174.9 °E, 44.3 °S), about -6621.3 m. The average elevation of the floor of the carter is about -5852.0 m. The northern Crater floor is about 4 km lower than the southern part.



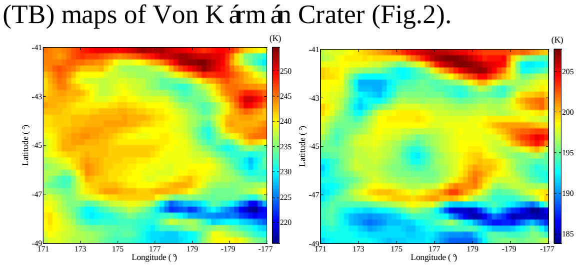
(a) (b)

Fig.1 (a) Elevation map and (b) ($FeO+TiO_2$) abundance map

The western part of the Crater floor was thought as mare dome material (Imd), generated by basaltic intrusions or extrusions [8, 9]. However, the topography indicates that the high elevation is continuously with its western rim, and this is interpreted as a huge gravitational landslide masses in our study.

Compositions: Based on the improved Lucey model [10-12], the ($FeO+TiO_2$) abundance (FTA) of Von Kármán Crater was inverted from the Clementine UV-VIS data. Fig.1(b) presents the relatively higher FTA values within the floor. But, in the craters (176.0 °E, 46.8 °S), (177.0 °E, 176.96 °S???), (177.26 °E, 177.26 °S???), (177.29 °E, 177.29 °S???), (177.54 °E, 46.36 °S), and northern (174.82 °E, 174.82 °S??), (174.81 °E, 44.28 °S) and their nearby regions, the FTA is higher than the sourroundings. Such phenomenon hints the the FTA-rich mare basalt in depth in the Crater.

Thermal Emission: The passive microwave signals are very sensitive to the composition and temperature of the lunar regolith [13-15)]. The CE-2 CELMS data are used to generate the brightness temperature (TB) maps of Von Kármán Crater (Fig.2).



(a)noon (b) midnight

Fig.2 Brightness temperature of the Von Kármán Crater at 37 GHz

The TB performance in the southern part of the Crater agrees well with the high FTA value according to the conclusions by Meng et al. [16]. However, in the northern part, the TB is relatively high no matter at noon or at midnight, which is even higher than that in the southern part with higher FTA. This is not rational. Meng et al. also found the same phenomenon in Orientale basin, and reasoned as the higher substrate temperature [15]. If so, the in-situ temperature probe will provide a new and important reference to better understand the thermal evolution of the Moon.

Deep Structure: Based on the newly acquired GRAIL gravity data (http://pds-geosciences.wustl.edu/grail/grail-l-lgrs-5-rdr-v1/grail_1001/shadr/) [17], the subsurface structure of the Von Kármán Crater is estimated. Results show a positive Bouguer anomaly in the center and the sourthern rim of Von Kármán. This indicates that there possibly existed a huge uplift magma intrusion. Thus, the later Von Kármán impact event likely diged out the deep mantle material.

Moreover, the crust thickness of the Von Kármán Crater is relatively thin, less than 5 km [18]. The lunar radar and other equipment carried by CE-4 will provide important support for the detection of this target.

Potential Landing Sites: We identified three potential landing sites within Von Kármán Crater (Fig.3), including Site I in the northern part, Site II near the central peak, and Site III in the southern rim of the Crater floor.

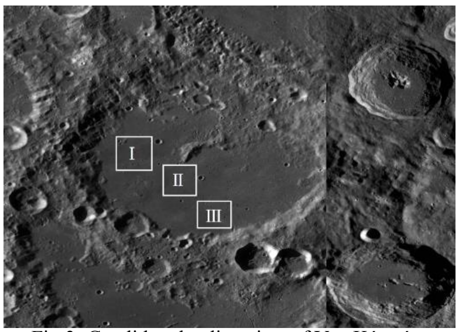


Fig.3 Candidate landing sites of Von Kármán.

Site I. There is a small uplift structure in the area, which is the remnant of the original Von Kármán impact event. Two large and several relatively smaller craters also exist in the Site. The possible scientific discoveries are as follows:

(1) To measure the older Imbrian basalt samples and study the original raw material of the SPA basin.

(2) To study the layered structure of the mare basalt and the compositions of the substrate medium.

(3) To pursuit the causes of TB anomalies. It is of great significance to better understand the thermal evolution of the Moon.

Site II. The second site is in the central portion of the crater, which straddles the boundary between the older northern part and the younger southern part. The central peak is in the north, and the huge landslide masses are in the west. The possible scientific discoveries are as follows:

(1) To sample the original plagioclontic and KREEP materials in the landsite masses.

(2) To study the rocks representing the lower crust or even mantle near the central peak.

(3) To determine the basalts ages of Von Kármán Crater and SPA basin through measuring the rocks in the western, northern, southeastern parts and the cental peak.

(4) The TB is abnormal in the north and it is normal in the south. The in-situ measurements will identify the causes of the temperature anomaly over the Moon surface.

Site III. The third site is near the south crater rim, and the surface is covered by the later mare basalt. The possible scientific discoveries are as follows:

(1) To obtain the later Imbrian basalt samples.

(2) To analyze the layered structure of the mare basalts through the study of the materials around the relatively small crater with high FTA.

(3) Terrain analysis results show that the Von Kármán Crater overlaid in a existed larger older crater (named Von Kármán M). Thus, this site may collect the original SPA substance, material from M crater and the late Imbrian basalt.

Conclusions: Von Kármán Crater is located in the middle of the largest impact basin in the moon, which is our CE-4 mission scheduled landing site. This will be the first time of lunar farside soft landing and in-situ exploration, whose achievements will be significant for the current scientific researches of the Moon.

Acknowledgements: This work is supported by the National Natural Science Foundation of China (No. 41371332, 41590851, 11403020), the Open Fund of State Key Laboratory of Remote Sensing Science (Grant No. OFSLRSS201706), and opening fund of Lunar and Planetary Science Laboratory, MUST - Partner Laboratory of Key Laboratory of Lunar and Deep Space Exploration, CAS (Macau FDCT grant No. 039/2013/A2).

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