CHINESE 1:2.5 M GEOLOGIC MAPPING OF THE GLOBAL MOON. Jianzhong Liu[1], Dijun Guo[1, 2], [1] Lunar and Planetary Science Research Center, Institute of Geochemistry, Chinese Academy of Sciences, 99 Lincheng West Road, Guiyang 550081, China (liujianzhong@mail.gyig.ac.cn). [2] University of Chinese Academy of Sciences, Beijing 100049, China. Shengbo Chen[3], Ying Sun[3], [3]Jilin University, 2199 Jianshe Street, Changchun 130000, China. Jianping Chen[4], Xiang Wang[4], China University of Geosciences (Beijing), Xueyuan Road 29, Beijing, 100083, China. Zongcheng Ling[5], Jiang Zhang[5], [5] Shandong University (Weihai), 180 Wenhua West Road, Weihai 264209, China. Xiaozhong Ding[6], [6] Institute of Geology, Chinese Academy of Geological Sciences, 26 Baiwanzhuang Road, Beijing 100037, China.

Introduction: Lunar geologic map is an integration of the crustal lithology, chronostratigraphy, geologic structure, and magma activities of the Moon. A state-of-the-art geologic map, which contains the information of geology, geochemistry and geophysics, is a very useful tool to study the evolution and other aspects of the Moon. Lunar global geologic mapping was pioneered by USGS in the 1970s at the scale of 1:5 M [1-6], however they were mapped diversely and didn't follow a unified standard. In the beginning of the 21st century, a new lunar geologic mapping program was launched by USGS at a scale of 1:2.5 M [7]. However, no global geologic map has been published until now. During the past years of this century, the United States, Japan, China and India explored the Moon many times, and obtained large amount of data. Recently various types of data are available with global coverage, which are unimaginable in the Apollo era. These data make it possible for us to study the Moon thoroughly, and stimulate us to carry out a global geologic mapping program which can integrate the latest results of lunar science and has the most detailed information of the Moon.

Datasets: China started its lunar exploration with Chang'e-1 satellite in 2007, followed by Chang'e-2 in 2010 and Chang'e-3 with a rover named Yutu in 2014 [8-10], and the Chang'e-5 is planed to be launched around 2017, targeting for sample return from lunar farside. With the success of the previous missions, China has completed the collection of various types of data such as global DEM, global high resolution CCD images, hyperspectral images from 70° S to 70° N, the first global microwave data, X-ray and gamma-ray spectroscopy and many others. These data can satisfy the requirements of detail study of lunar albedo, texture, topography geochemical composition, and space environment. Besides, data from other countries can complement the Chinese lunar exploration data. By using of these data, many new findings have been published in this decade. Under such circumstances, a Chinese lunar geologic mapping program at a scale of 1:2.5M, funded by the Ministry of Science and Technology of China was implemented in 2015 and will be concluded in 2020.

Objectives and Contents: This program will mapping the Moon in 30 quads following the scheme of Gaddis et al. (2004) [7] (Figure 1). With five year's work, we will complete the geologic maps of 30 quads, a global lunar geologic map, a global structure map, a map of global distribution of rock types, and establish a series of standards on lunar geologic mapping. To serve the global planetary community, all of the maps will be published in both Chinese and English.

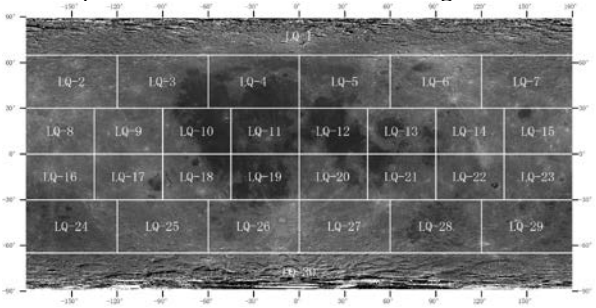

Figure 1 Mapping quad scheme for lunar geologic mapping at a scale of 1:2.5 M. Image base is the Chang'e-1 CCD.

Time scale. To be consistent with the geodynamic evolution of the Moon, we will revise the current lunar time scale [11]. Taking the formation of the SPA basin as a boundary, the pre-Nectarian Period will be divided into two Periods, which temporarily named as Aitkenian or South Pole-Aitkenian and pre-Aitkenian or pre-South Pole Aitkenian. From the geodynamic evolution perspective, three Eon geochronological units are proposed, including Eolunarisian, Paleolunarisian and Neolunarisian. Details refer to the abstract number 1744 of the proceedings.

Features in geologic map. The surface of the Moon is closely scattered with craters and basins, and is covered by layers of ejecta formed in different eras. The geologic map is a tool to recognize and express these formations or rock-stratigraphic units on the Moon. In our program, the craters and basins will be mapped in different facies. With the high-resolution images, the continuous ejecta deposits, discontinuous ejecta depos-

its and crater rays can be distinguished [12]. The OMAT image derived from spectral data will provide an approach to map the fresh craters definitely[13].

Structures. This program is going to establish the lunar structure system on the basis of the influences of endogenic and exogenic geodynamic processes. The structures can be divided into three groups initially: structures formed by endogenic processes such as rilles and wrinkle ridges, structures formed by exogenic processes such as craters, and structures both endogenic and exogenic processes played great roles during their formations such as fractures. Linear structures and circular structures will be separated in each group. Moreover, the GRAIL data provide the opportunity to recognize the deep structure of the Moon [14], which will be included in our lunar structure system, and used to produce the global structure map.

Rock types. Unlike the Earth, the Moon has a simple rock classification because of its short evolution history and lack of water and atmosphere especially the oxygen. The rock types will be classified into five groups: highland rocks, mare rocks, pyroclastic deposit, impact melt, and the other special rocks. Rock types recognized before such as ferroan anorthosite, mare basalt, KREEP, Mg-suite, alkali suite [15, 16] and rocks newly found such as pyroclastic deposit[17], silicic rock [18, 19], impact melt [20], pure anorthosite [21, 22], pink spinel anorthosites [23] will be mapped on the rock types map.

Mapping Approach: To fulfill the requirements of distributed collaborative mapping and big data processing, we developed a GIS-based mapping system. This mapping system is based on Client/Server model, and each of the mapping institutes will have its own server node to store data, documents and temporary files, and to process data and share results. During mapping, most of the data processing work will be completed at the closest server which has a higher performance in computation to improve the mapping efficiency. The sharing functionality will provide us the convenience to correct the errors of the results and to transfer data.

Summary: A new lunar geologic mapping program has been launched in China since 2015, and will last until 2020. The scale of the maps to be carried out is 1:2.5 M. This program will try to integrate all the results of lunar research and make the best use of the data available. Although these maps will rely mainly on the data from the Chang'e missions, other data will make a great complement. A well-established GIS system is going to operate to serve the program. We will try our best to complete this series of maps to serve the science research and society, and we seek for the international cooperations.

References:

[1] Wilhelms D. E. and Mccauley J. F. Geologic Atlas of the Moon, Denver, US Geological Survey 1971. [2] Scott D. H. and Mccauley J. F. (1977) *Geologic map of the west side of the Moon*. US Geological Survey. [3] Wilhelms D. E. and El-Baz F. (1977) *Geologic map of the east side of the Moon*. US Geological Survey. [4] Lucchitta B. K. and Center A. (1978) *Geologic map of the north side of the Moon*. US Geological Survey. [5] Stuart-Alexander D. E. (1978) *Geologic Atlas of the Moon*, US Geological Survey. [6]Wilhelms D. E., Howard K. A. and Wilshire H. G. (1979) Geologic Atlas of the Moon, Denver, US Geological Survey. [7] Gaddis L., *et al.* (2004) *LPSC XXXV,* 1418. [8] Ouyang Z., *et al.*(2008) *Chin J Space Sci*, 5, 361-369. [9] Zou X. D., *et al.*(2014) *Icarus*, 348-354. [10] Ip W. H., *et al.*(2014) *Res Astron Astrophys*, 12, 1511-1513. [11] Guo D., *et al.* (2016) *LPSC XLVII,* 1744. [12] Ohman T., Kramer G. Y. and Kring D. A.(2014) *J Geophys Res-Planet*, 6, 1238-1258. [13] Lucey P. G., *et al.*(2000) *J Geophys Res-Planet*, E8, 20377-20386. [14] Williams J. G., *et al.*(2014) *J Geophys Res-Planet*, 7, 1546-1578. [15] Heiken G. H., Vaniman D. T. and French B. M. (1991) *Lunar Sourcebook: A User's Guide to the Moon*. Cambridge University Press. [16] Jolliff B. L., *et al.* (2006) *New views of the Moon*. Mineralogical Society of America. [17] Gustafson J. O., *et al.*(2012) *J Geophys Res-Planet*, E12, E00H25. [18] Glotch T. D., *et al.*(2010) *Sci*, 5998, 1510-1513. [19] Greenhagen B. T., *et al.*(2010) *Sci*, 5998, 1507-1509. [20] Carter L. M., *et al.*(2012) *J Geophys Res-Planet*. [21] Ohtake M., *et al.*(2009) *Natur*, 7261, 236-241. [22] Yamamoto S., *et al.*(2012) *GRL*, L13201. [23] Prissel T. C., *et al.*(2014) *Earth Planet Sc Lett*, 144-156.