GEOLOGICAL MAP OF THE SOUTH POLE: A FRAMEWORK FOR FUTURE EXPLORATION PLANNING. S. S. Krasilnikov[1, 2], M. A. Ivanov[1] and J. W. Head[3], A. S. Krasilnikov[1], [1]Vernadsky Institute of Geochemistry and Analytical Chemistry RAS, Moscow, Russia, [2]Planetary Remote Sensing Laboratory, Department of Land Surveying & Geo-Informatics, The Hong Kong Polytechnic University, Hong Kong, PR China, (sergey.krasilnikov@polyu.edu.hk), [3]Department of Earth, Environmental & Planetary Sciences, Brown University, Providence, RI, USA.

Introduction: The South Circumpolar Region (SCR) is one of the most intriguing places on the Moon because of 1) the increased concentration of hydrogen in the regolith [1], 2) the possible presence of ground ice [2], and 3) the unquestionable presence of ejecta from the South Pole-Aitken basin (SPA). The SCR region is a destination for future lander-oriented interplanetary missions operated by NASA, Roscosmos, ESA, CNSA and ISRO. Therefore, robust scientific support for these missions is needed. A significant component of this support would be a geological map of the region based on new data.

Geological mapping of the southern polar region: Until recently and aside from larger scale landing site maps [3], only two original geological maps of the SCR of the Moon were available: the map for the Southside of the Moon compiled in 1979 at 1:5 000 000 scale by Wilhelms et al.[4] (which was remastered by Fortezzo et al. in 2020 [5]), and the map of the SPA at 1:500 000 scale by Poehler et al. [6].

We present a final version of geologic map of the southern polar region that extends from the Pole north to 70°S and compiled at 1:300 000 scale [7]. This map is based on photogeological analysis of the LROC WAC images (100 m/px res.) and LOLA-based DTMs (80-20 m/px res.). In key areas, we used LROC NAC images with ~0.5–1 m/px resolution to analyze the surface morphology and refine the relative ages of units. We added compositional information of units based on Clementine, Chandrayaan-1 (M3) and Kaguya data. The age correlations of the map units are based on ~200 measurements of their crater size-frequency distribution (CSFD).

Four types of landforms compose the surface in the map area: (1) high-standing massifs of the SPA; (2) topographically contrasting features associated with craters (walls, rims, and ejecta of the smaller basins and craters); (3) level plains that mostly occur outside craters and can be of both impact (e.g., Cayley Formation) [8] and volcanic origin; (4) landforms related to degradation of crater topography (crater wall terraces and wall-floor arcuate lobes). In some places, these units are deformed by three types of structural features such as: (a) graben depressions and (b) wrinkle ridges that deform the surface of volcanic plains; (c) lobate scarps that occur in a few localities inside and outside of the crater interiors.

Topographically prominent massifs arranged along single trends likely represent pieces of the rim and rings of the SPA basin. These possible remnants of the SPA rings are devided into categories of covered massifs (those overlapped by ejecta of neighbouring craters) and exposed massifs (those lacking recognizable ejecta coatings and with steep slopes).

We have divided craters in the study area into four categories according to their state of preservation [9] and mapped specific components of the craters such as the floor, walls, rims, and ejecta as a single unit: (a) craters with a sharp rim and prominent ejecta; (b) craters with a sharp rim and distinguishable contiguous ejecta; (c) more degraded craters without extensive ejecta but with prominent fields of secondary craters; (e) highly degraded craters with morphologically and topographically subdued rims. We found that the classification agreed well with the absolute model ages (AMA) analyses and concept of gradual degradatio of fresh crater morphology.

Within the SCR map area, we have defined four varieties of plains-forming materials: (1) Light plains that partly fill isolated craters or groups of craters and represent fine-grained fractions of the ejecta of remote craters and/or basins; (2) Light-toned plains that partly cover the central portion of the floor of large craters and represent solidified pools of impact melt; (3) Plains that are localized on the floor of the Schrödinger basin and Antoniadi crater with properties consistent with a volcanic origin; (4) Darker plains with diffuse boundaries that are localized in

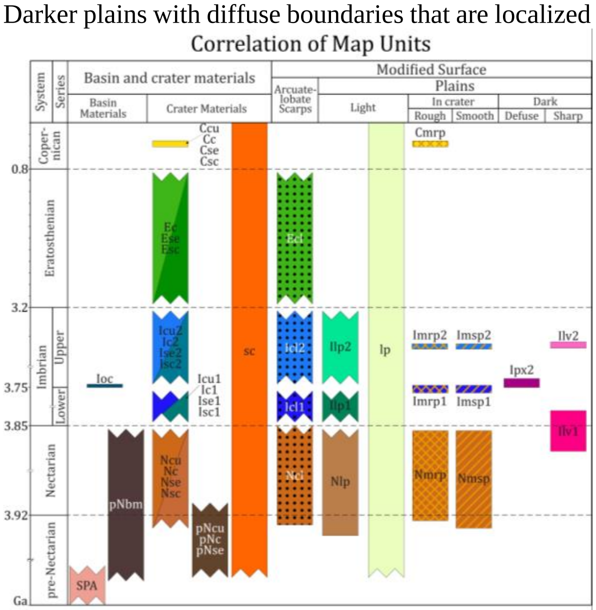

Fig. 1. Legend and correlation of map units.

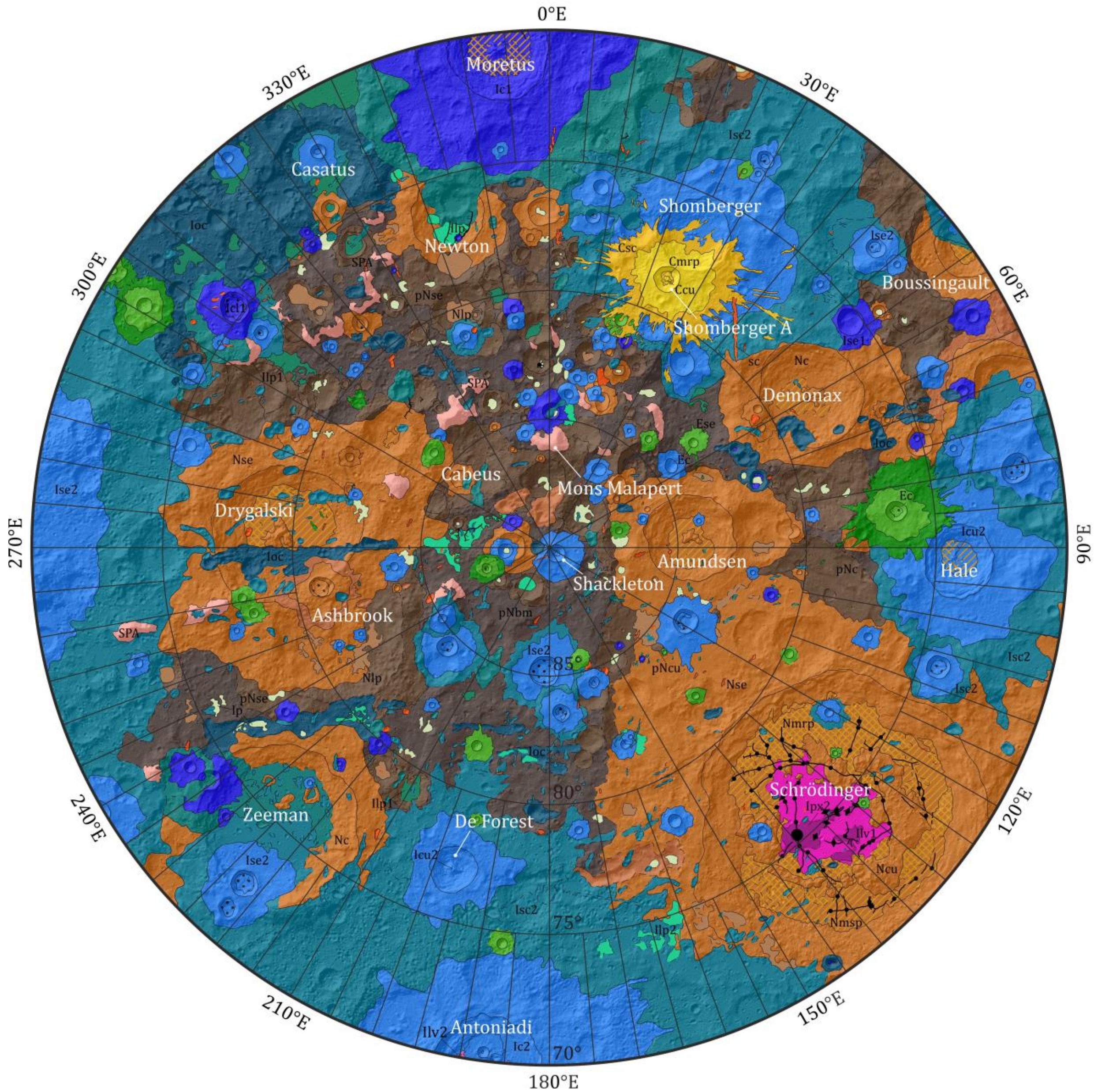

Fig. 2. Geological map of the south polar region (1:300 000 scale)

the Schrödinger basin, interpreted to indicates pyroclastic activity.

The last type of landform is the wall-floor arcuate lobes that may have been formed due to listric wall failure and represent wall collapse landforms. Linear, parallel step-like terrace structures, often tilted toward the crater wall, occur between the crater rim crest and crater floor.

Future research: The next step of our research will be applying the results of this work [7] with estimations of crater ejecta thicknesses radial decay for the southern polar region [10] to develop specific local stratigraphic columns to assist in landing site selection and exploration planning for future lunar missions, and to . assess models of SPA basin formation.

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