GEOLOGICAL CONTEXT FOR THE LUNAR SOUTH POLE: A MAP OF THE SOUTH POLE-AITKEN BASIN REGION.
C. M. Poehler[1], M. A. Ivanov[2], C. H. van der Bogert[1], H. Hiesinger[1], W. Iqbal[1], J. H. Pasckert[1], J. Wright[3] and J. W. Head[4], [1]Institut für Planetologie, Westfälische Wilhelms-Universität, Wilhelm-Klemm-Str. 10, 48149, Münster, Germany, c.poehler@uni-muenster.de, [2]Vernadsky Inst., RAS, Russia, [3]School of Physical Sciences, The Open University, Milton Keynes, MK7 6AA, UK, [4]Department of Earth, Environmental and Planetary Sciences, Brown University, Providence, RI 02912 USA.

Introduction: With the newly sparked interest in the Lunar South Pole as a destination for robotic and human missions [e.g. 1–4], detailed studies of the geological background and setting of the region are necessary. The lunar South Pole is situated on the edge of the South Pole-Aitken basin (SPA). The SPA, located on the lunar farside, centered at ~53° S, 191° E, is the largest and probably oldest lunar basin [5,6]. The entire region is widely influenced by rays of the young Orientale basin [7].

In this study, we mapped the full extent of the SPA basin, covering the South Pole, and extending the map eastward to include part of the Orientale basin; altogether, this provides a comprehensive overview of the geology of the region (***Fig. 1***).

Methods: The map is part of the PLANetary MAPping (PLANMAP - H2020 n°776276) project and extends the map of the Apollo basin [8]. We used the Lunar Reconnaissance Orbiter (LRO) Wide-Angle Camera (WAC) basemap (100 m/pixel). For more detailed, smaller areas, and for identifying specific features, we used Narrow-Angle Camera (NAC; 0.5 m/pixel) [9] and Kaguya (10 m/pixel) data with different incidence angles. We also used a hybrid spectral mapping technique using Clementine [10], M^3 [11] and Kaguya MI [12] data. The topographic features were mostly mapped using Lunar Orbiter Laser Altimeter (LOLA) digital elevation models (DEMs) and a LOLA/Kaguya merged DEM with a resolution of 59 m/pixel [13]. To reduce shadows, particularly in the southernmost latitudes, we produced hillshade maps with various illumination conditions. We used PLANMAP mapping standards [14], an extension of USGS standards [15].

We used morphological appearance and albedo contrast to identify units. First, we determined relative ages of units using morphological evidence. In addition to relative dating of geologic units, we performed crater size-frequency distribution (CSFD) measurements and from these determined absolute model ages (AMAs) using the production and chronology functions of [16]. CSFD measurements were made using CraterTools [17] in ArcGIS, and we determined AMAs with Craterstats [18]. Detailed descriptions of the CSFD measurement technique are given by [16, 19].

Geology: In our study area we defined three classes of geologic features: Basin materials, crater materials, and plains forming materials.

Basin materials are related to the formation of the large basins in the area with the oldest and most dominant being the SPA. We also identified materials related to Apollo, Schrödinger, and Orientale Basins.

Crater materials are divided into different classes according to the state of degradation and shape of the craters. We dated several craters to obtain a consistent chronology.

Plains forming materials are characterized as relatively flat, smooth surfaces and can be further divided into dark and light plains based on their brightness.

The lunar South Pole is mostly influenced by SPA-related material. SPA's rim is obscured by various later impacts and is degraded due to its old age. The most distinctive appearance is in the NW part of SPA, close to the Apollo basin. Here, we identify two topographic rings of SPA rim massifs. Around the South Pole, image quality is lower and features become obscured by the low sun angle. We were able to find traces of the outer massif, but most of the inner massif is hidden below younger craters. Shoemaker crater, located almost directly at the South Pole, shows a relatively sharp crater rim, but displays neither extensive ejecta nor rays. We thus interpret it to be pre-Nectarian in age, consistent with other studies [e.g., 20]. The age of Shoemaker has significant implications for its likelihood to have accumulated ice.

Acknowledgments: This Paper is part of a project that has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement Nº776276 (PLANMAP).

References: [1] Flahaut et al. (2019) *PSS.*, in press. [2] Steenstraet al. (2016) *Adv. Space Res. 58*, 1050–1065. [3] Allender et al. (2018) *Adv. Space Res. 63*, 692–727. [4] Hiesinger et al. (2019) *LPSC 50*, 1327. [5] Garrick-Bethell and Zuber (2009) *Icarus, 204*, 399–408. [6] Hiesinger et al. (2012), *LPSC 43*, 1659. [7] Stuart-Alexander (1978) USGS Map I-1047. [8] Ivanov et al. (2018) *JGR Planets, 123*, 2585–2612. [9] Robinson et al. (2010) *Space Sci. Rev., 150*, 81–124. [10] Pieters et al. (1994). *Science, 266*, 1844–1848. [11] Isaacsom et al. (2013). *JGR, 118*, 369–381. [12] Ohtake et al (2013*) Icarus, 226*, 364–374. [13] Scholten et al. (2012) *JGR, 117*, E00H17. [14] wiki.planmap.eu/display/public/D2.1-public. [15] FGDC (2006). FGDC-STD-013-2016. [16] Neukum et al. (2001) *Space Sci. Rev. 96*, 55–86. [17] Kneissl et al. (2011) *PSS, 59*, 1243–1254. [18] Michael and Neukum (2010) *EPSL, 294*, 223–229. [19] Hiesinger et al. (2000) *JGR, 105*, 29239–29276. [20] Tye et al. (2015) *Icarus 255*, 70-77.

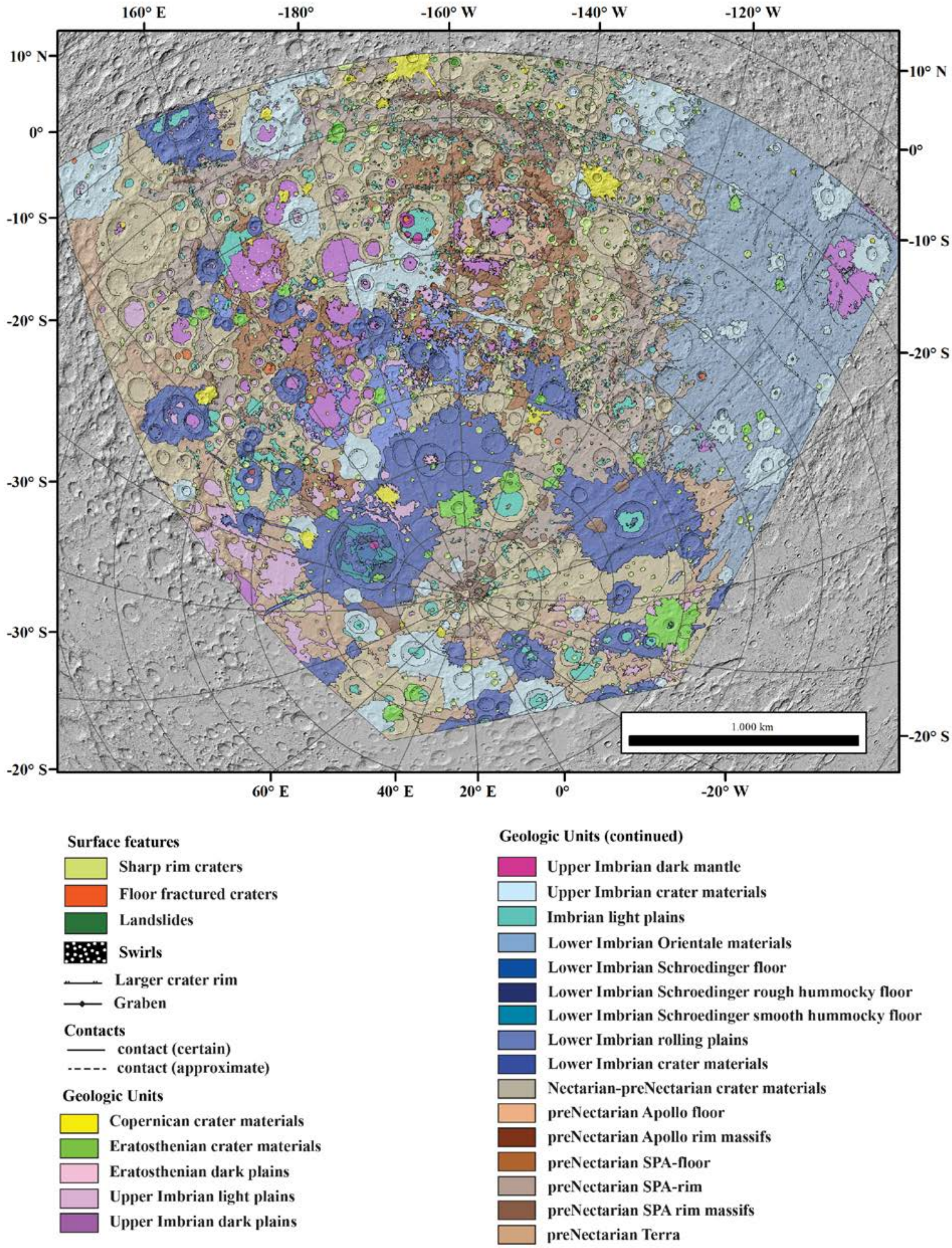

Figure 1. Preliminary geological map of the Lunar South Pole and the South Pole-Aitken basin at a scale of 1:500,000 in Lambert projection centered at 157.5° S and 53° E. The background image is a hillshade compiled from a LROC LOLA global DEM.