CHARACTERIZATION OF LUNAR FARSIDE PLAINS S.C. Mest[1], W.B. Garry[2], L.R. Ostrach[2], S.-C. Han[3], and M.I. Staid[1], [1]Planetary Science Institute, Tucson, AZ 85719 (mest@psi.edu); [2]NASA Goddard Space Flight Center, Greenbelt, MD 20771; [3]School of Engineering, University of Newcastle, Callaghan, Australia.

Introduction: The Moon contains broad and isolated areas of plains that have been recognized as mare, cryptomare, impact ejecta, or impact melt. These deposits have been extensively studied on the lunar nearside by remote sensing via telescopes and numerous spacecraft, and in some cases, in situ robotically and by astronauts. Only recently have the deposits on the entire farside been able to be observed and evaluated to the same degree. There are spatially extensive plains deposits located throughout the lunar farside highlands whose formation has remained ambiguous. Many of the plains deposits in the lunar farside highlands display higher albedos than mare materials. Some deposits are located in close proximity to relatively younger impact craters suggesting that plains could be composed of cryptomare or ejecta materials. Some deposits are within the range in which ejecta from large basin-forming events (e.g., SPA and Orientale) likely distributed large amounts of ejecta across the surface. **Here we are conducting a series of observations and models in order to resolve the nature and origin of lunar farside plains deposits. Understanding these plains is important for understanding the volcanic and impact histories of the lunar farside, and is important for future mapping and thermal modeling studies.**

Background: Mare deposits consist of low albedo, areally distinct mafic-rich plains that have been extensively studied Most maria occur in regionally extensive areas (e.g., nearside basins) while other maria formed in isolation on the floors of impact craters (e.g., Tsiolkovskiy, Mare Ingenii) [e.g., 1-3].

Cryptomare, interpreted to be basaltic deposits mantled by high albedo materials (anorthositic highlands) [e.g., 3-5], may be morphologically indistinct from ponded basin ejecta deposits [6]. However, cryptomare are able to be distinguished through spectral analyses that identify mafic-rich materials excavated by superposed impacts [3,5,7-9].

Relatively high albedo plains that are less distinct with an ambiguous origin are also observed (e.g., SPA floor, Cayley Plains, Schiller-Zucchius basin) and were hypothesized to be volcanic [10-12], related to KREEP volcanism [13,14], cryptomare [4,15,16], or ejecta from one or more basin-forming impact events (e.g., Imbrium, Orientale) [2,17-19]. Materials commonly interpreted as basin ejecta (e.g., Cayley Plains-type) are relatively flat-lying and smooth to gently rolling; these deposits fill low areas among the highlands and have high albedos similar to surrounding highlands [18,19].

Impact melt deposits tend to appear morphologically similar to mare materials, displaying low albedos, flow lobes, and lobate margins [**20**]. However, impact melt deposits are spatially limited, typically forming on the floors of impact craters as ponds, or emplaced on the rims and walls craters and flowing downslope [**21**].

Geologic Context: We are conducting our study within the lunar farside highlands (±60° latitude and ±90°–180°; Figure 1). This area consists of rugged, heavily cratered, and ancient surfaces bounded to the south by SPA, to the east by Procellarum, and to the west by Mare Smythii and Mare Marginis. Approximately 9.5 kilometers of relief is observed, from the highest elevations (~7.5 km) along the rim of Korolev crater to the lowest elevations (~-2 km) on the floor of the Moscoviense basin. The eastern part of the study area appears topographically higher in elevation than the west and contains several large impact craters (e.g., Orientale, Korolev, and Herzsprung) contributing to topography, whereas the western half appears to contain fewer large craters (e.g., Moscoviense and Mendeleev) and numerous smaller craters. This region, classified as Feldspathic Highlands Terrane [22], is characterized by a high feldspathic composition, high albedo and densely cratered surface.

Methodology: Our plains analysis uses a three-pronged approach of mapping and observation, age determination, and thickness and density estimates from crater depths and gravity modeling. This approach is providing us with a better understanding of the emplacement history of lunar farside plains, as well as the crustal evolution on the farside highlands.

Mapping: We are mapping the extents of relatively flat, low-lying plains that occur within intercrater regions and on the floors of large (diameters >100 km) impact craters within the lunar farside highlands. We are using image, spectral and topographic datasets from the Lunar Reconnaissance Orbiter (LRO), Clementine, Chandrayaan-1, and Kaguya missions to determine the nature of the farside plains through morphologic and spectral analyses, and we are comparing our results to previously studied nearside plains.

Age determinations: The relative ages of mapped plains materials are estimated through measurement of crater size-frequency distributions and observation of stratigraphic relations. Where possible, absolute model ages for identified units are derived.

Thickness estimates: The thicknesses and densities of identified mare and cryptomare deposits, as well as mantling materials, are estimated through numerical modeling of GRAIL gravity data [23] and crater depth/diameter measurements.

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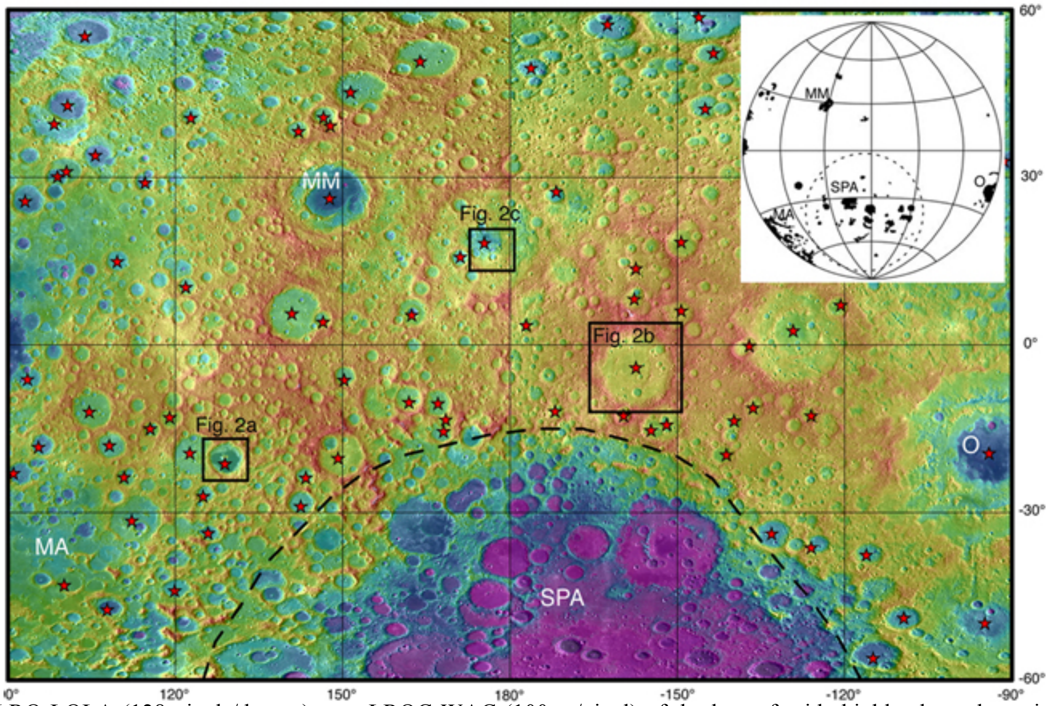

Figure 1. LRO LOLA (128 pixels/degree) over LROC WAC (100 m/pixel) of the lunar farside highlands study region; dashed line bounds SPA. Red stars indicate craters >100 km in diameter that may contain plains materials. Inset shows farside mare deposits [24]. MM=Mare Moscoviense, MA=Mare Australe, and O=Orientale. Locations of Figs. 3a-c are shown.

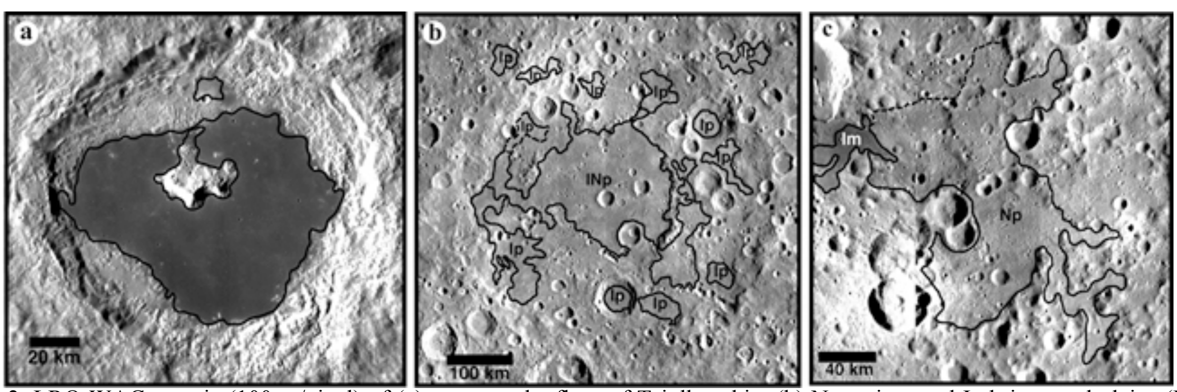

Fig. 2. LRO WAC mosaic (100 m/pixel) of (a) mare on the floor of Tsiolkovskiy, (b) Nectarian- and Imbrian-aged plains (INp and Ip) in and around Korolev (classified as cryptomare), and (c) light plains (Np) filling a low area among the highlands.