SOUTH POLE-AITKEN BASIN INTERIOR: TOPOGRAPHIC EXPRESSION OF MARE, CRYPTOMARE, AND NONMARE PLAINS UNITS. B. L. Jolliff[1], K. E. Gibson[1], and F. Scholten[2] [1]Dept. Earth & Planetary Sciences and the McDonnell Center for the Space Sciences, Washington University, One Brookings Drive, St. Louis, MO 63130; [2]German Aerospace Center (DLR), Inst. Planetary Research, Berlin (bjolliff@artsci.wustl.edu)

Introduction: For a sample-return mission to the South Pole-Aitken (SPA) basin such as MoonRise [1,2], landing in the interior near the central part of the basin where there are extensive plains deposits is desirable for several reasons. First, for scientific reasons, the plains represent deposits of ejecta from craters that have impacted into the SPA substrate or impact-melt complex, and this is one of the key target materials for sample return and geochronology. Second, for reasons of landing-site safety, plains deposits are desirable because they are relatively smooth. Plains deposits in the deep interior of the SPA basin are extensive and cover many hundreds of square km (Fig. 1).

The objectives of sample return from SPA basin include obtaining impact-melted materials of the original SPA basin formation to date the SPA event, as well as fragments of rock formed by subsequent basin-sized and large impact craters to determine the chronology represented within SPA basin, far distant from the large and late near-side basins such as Imbrium and Serenitatis. Other objectives include obtaining samples of basalts as derivatives of the far-side mantle, and collecting materials that represent the diversity of the basin deposits for correlation to orbital data.

Recent orbital imaging such as high-resolution coverage by the LRO Narrow-Angle Cameras (NAC) and extensive coverage at multiple incidence angles by the Wide Angle Camera (WAC) [3] reveal morphology at unprecedented scales and allow new assessments of deposits. Images taken by these cameras are also used to derive digital topographic models for assessment of deposits and surface morphology at high resolution. In this abstract, we focus on topography related to three types of deposits, mare, cryptomare (buried, ancient lavas) and nonmare plains deposits, and we use the 100 m grid LROC WAC stereo DTM (GLD100) [4]) to compare these deposit types and assess plains deposit thicknesses. Data from the Lunar Orbiting Laser Altimeter (LOLA), Mini-RF, and DIVINER are also useful for examining slope parameters and/or surface roughness at different scales, but here we focus only on WAC data.

Observations: Elevations covering a range of about -4500 to -5500 m are mostly green in the color stretch of the DTM overlay shown in Fig. 1. These elevations include mare ponds such as those filling craters and low terrain N-NE of Bose Crater as well as S-SW of Bose. These elevations also include areas of cryptomare such as extensive regions NE of Bhabha Crater and N of Stoney Crater. Areas mapped as mare and cryptomare are shown in a companion abstract [5].

Elevations extracted from E-W and N-S profiles in areas of mare, cryptomare, and nonmare plains deposits are shown in Figure 2. The profiles in mare deposits are very flat and smooth, and they have experienced few large impact craters since the time of their formation. In several profiles, regional slopes are evident, but these involve smooth elevation changes of typically only 200 m or less over distances on the order of 50 km, e.g., profiles b-b' and d-d'. Profiles across areas we have mapped as cryptomare appear smooth in image views, but they are not as visibly dark as the more recent surface mare flows, and when viewed in profile, are clearly rougher than the mare surfaces. Remaining plains areas, mapped neither as mare nor cryptomare on the basis of morphology, are characterized by even more irregular topography. Elevation profiles suggest that these areas have deposit thicknesses ranging up to 500 m or more over the elevation where cryptomare would be if it extended beneath these deposits. Profile g-g' intersects the local topographic high south of Bhabha crater referred to recently as "mafic mound" [6]. Deposits at this location and just to the north at h-h' have thicknesses > 500 m.

Conclusions: Understanding the distribution of cryptomare and the thickness of nonmare plains deposits is important in the consideration of potential landing sites for the collection of samples, and assessing what the mix of materials is likely to be in the regolith at a given site. Our interpretation of the deposits in the deep central part of SPA is that there is a significant area of coverage by ancient mare flows, probably more than was appreciated before the recent remote sensing missions. However, plains ejecta deposits from many large impact craters that excavated through the volcanics have produced deposits of hundreds of m thickness over much of the region, and these are exactly the kinds of materials desired for sample collection.

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References: [1] Jolliff B. et al. (2010) *LPSC* **41**, #2412. [2] Jolliff et al. (2010) *Global Lunar Conference, Beijing*. [3] Robinson, M. et. al. (2010) *Space Science Reviews*, **150**, 81-124 [4] Scholten, F., et al. (2011) *Lunar Planet. Sci.* **42**, *this Conf.* [5] Gibson, K. and B. Jolliff (2010) *Lunar Planet. Sci.* **42**, this Conf. [6] Pieters et al. (2010) Abstract, Fall Meeting of the AGU, San Francisco.

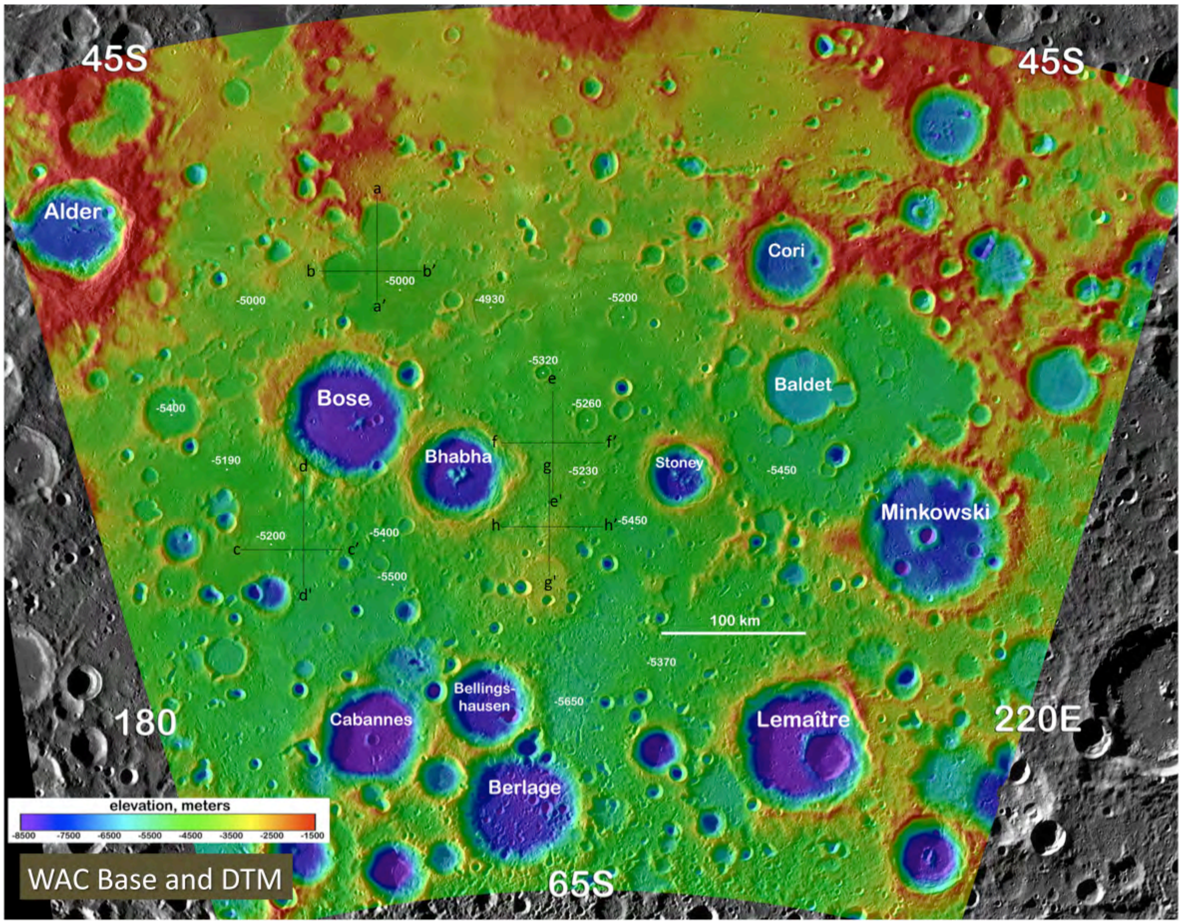

Figure 1. Topography of the interior of the South Pole-Aitken Basin shown on a WAC-derived DTM [4].

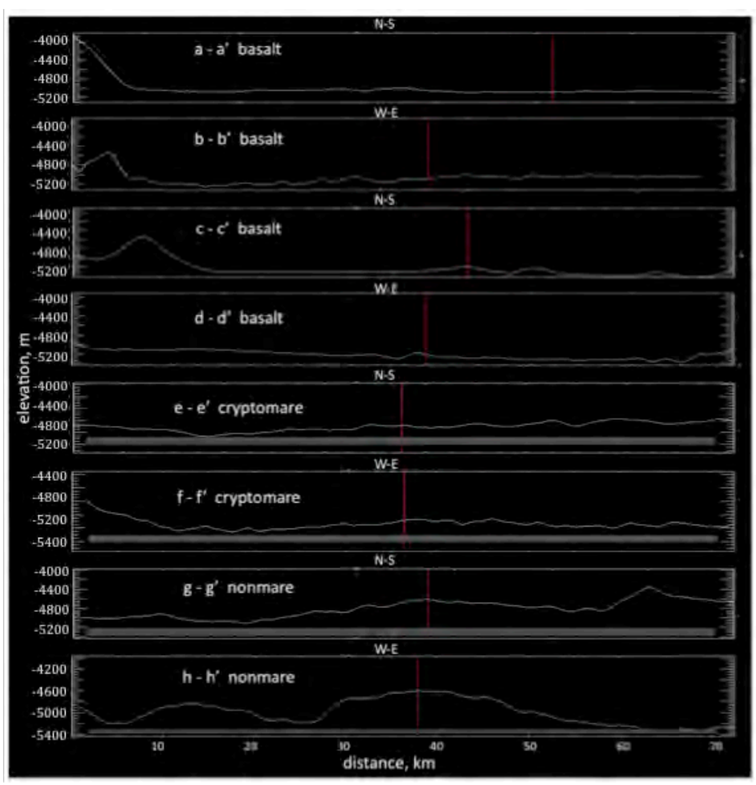

Figure 2. Elevation profiles corresponding to sections marked on Figure 1. Areas mapped as mare and cryptomare are shown in a companion abstract [5]. For profiles in areas of cryptomare, a flat gray bar is shown at the approximate elevation inferred to be the cryptomare surface. This permits a visual estimate of the thickness of overlying deposits. Areas of mare flows do show some broad regional slopes (profiles b-b' and d-d') but these are typically less than 200 m over distances of 50 km. Surfaces in areas of cryptomare are rougher and have deposit thicknesses of up to 200 m. If they overly ancient volcanic deposits, then the nonmare surfaces have deposit thickness of up to 500 m.