EXTENT OF BASALTIC VOLCANISM IN SOUTH POLE-AITKEN BASIN. C. M. Pieters and J. W. Head III, Dept. of Geological Sciences, Brown University, Providence, RI 02912 (pieters@mare.geo.brown.edu).

Since recognition of the full size and depth of South Pole-Aitken Basin (SPA) from Galileo and Clementine data [1, 2, 3], the minor amount of late and middle Imbrian mare [4, 5, 6, 7] filling this enormous basin seems inconsistent with the low topography and minimal crustal thickness of the region [2, 8]. The distribution, mineralogy, and chronology of mare basalts reflects constraints on processes of secondary crust formation, including thermal and compositional properties of local source regions. Assessing the character and abundance of lunar mare basalts must also include the presence of "cryptomaria", lunar mare units hidden by overlying ejecta deposits from later events [9]. We use the global multispectral Clementine UVVIS mosaics [10] to evaluate the mineralogy of mafic material within SPA. We first reaffirm the basaltic nature of maria found in SPA interior. We then show evidence for the presence and distribution of pre-Orientale basaltic cryptomaria. Although basaltic volcanism has been an integral part of the evolution of SPA and mare emplacement appears to parallel the extended period of volcanism on the nearside, the volume of SPA basaltic deposits remains small relative to that of the nearside.

Identification of Basalts. Lunar maria are low albedo due to their overall mafic nature, but their basaltic composition is recognized by the presence of abundant high-Ca pyroxene. Ferrous absorptions that occur near 1 µm are well-suited for distinguishing among iron-bearing lithologies [11, 12]; low-Ca pyroxene has a much shorter wavelength than high-Ca pyroxene. Spectral parameters have recently been developed to capture the strength and shape of these critical ferrous absorptions using Clementine data [13, 14]. Examples of how these parameters are used to characterize mafic mineralogy in SPA are shown in Figures 1 and 2.

Non-mare mafic compositions of SPA interior are rich in low-Ca pyroxene [13, 15]. In contrast, the basaltic nature of maria, and smooth plains suspected of being ancient maria, is readily identified by the detection of high-Ca pyroxene at fresh craters within the unit. All craters excavating materials rich in high-Ca pyroxene appear green in Figure 2. Mapped maria within SPA [4,5,6,7] are confirmed to be basaltic by this method. Mapped boundaries are not re-evaluated, however, since mineral characterization is obtained only at unweathered craters. In addition, several areas mapped as smooth plains exhibit a basaltic signature in material exposed by craters. We interpret such smooth plains to be cryptomaria, an example of which occurs south of Apollo. (Note that the method of identifying cryptomaria by the presence of "dark haloed craters" [16] is not appropriate for SPA due to the mafic-rich nature of local material.). A summary of the distribution of basaltic materials across SPA is shown in Figure 3.

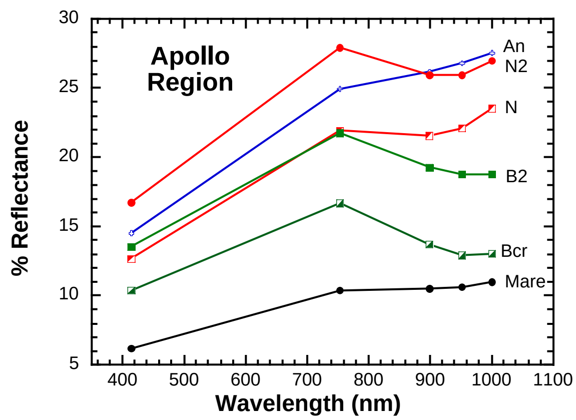

Figure 1. Clementine 5-channel spectra for areas indicated in Figure 2. The basaltic character of Apollo mare is confirmed by the long wavelength absorption exhibited by mare crater Bcr (a spectrum for mare soil directly to the south is also shown). Noritic compositions (N, N2) exhibit ferrous absorptions at a shorter wavelength and anorthositic compositions (An) exhibit no ferrous absorption. Secondary craters from Orientale have excavated basaltic material (B2) in the smooth plains south of Apollo.

Summary of Conclusions: On the basis of this assessment of basaltic volcanism in SPA, we find that:

1) Although the mineralogy of SPA interior is very mafic, there is no evidence for extensive mare basalt deposits similar to those that have flooded most of the basins of the nearside. In contrast, SPA late-Imbrian-aged mare basalts occur primarily in the form of patches of impact crater fill and intercrater plains. Volcanism associated with the SPA basin floor is more like that found at Mare Australe [e.g., 9, 1], than the more extensively filled nearside basins.

2) Basaltic volcanism also occurred in SPA prior to the Orientale Basin event. Significant deposits of basaltic cryptomaria have been identified, and their pattern is similar to that of mapped basalts. They occur primarily as patches of intercrater plains in the basin interior and may have been emplaced contemporaneously with similar cryptomaria on the eastern side of the Orientale basin [17].

3) Some of the lighter deposits which mask older mare as cryptomaria may predate the Orientale event. For example, for S. Apollo cryptomaria shown in Figure 2, the albedo of smooth plains soils is too low to simply be a similar mixture of mare and Orientale debris. Furthermore, Orientale secondary craters have excavated through the masking deposits of the region.

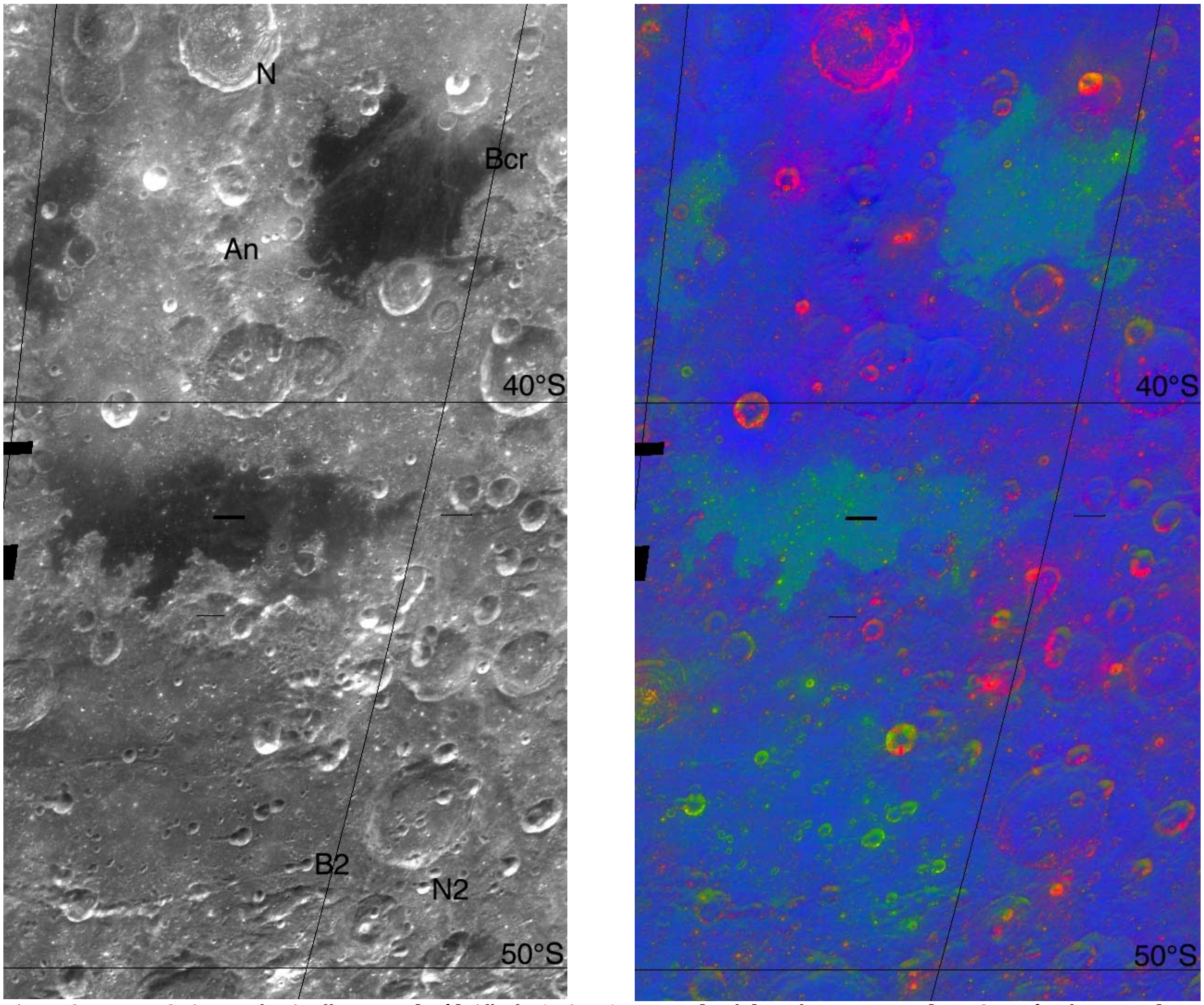

Figure 2. Eastern SPA near the Apollo Basin. [Left] Albedo (750 nm) mosaic. [Right] Rock Type image [see 13, 14 for description]. For relatively immature areas, <u>*red*</u> indicates the presence of abundant low-Ca pyroxene (noritic), <u>*green*</u> indicates abundant high-Ca pyroxene (basaltic), and deep <u>*blue*</u> areas that are also high albedo indicate low iron compositon (anorthositic). In this RGB display, mature soils are also shown in blue.

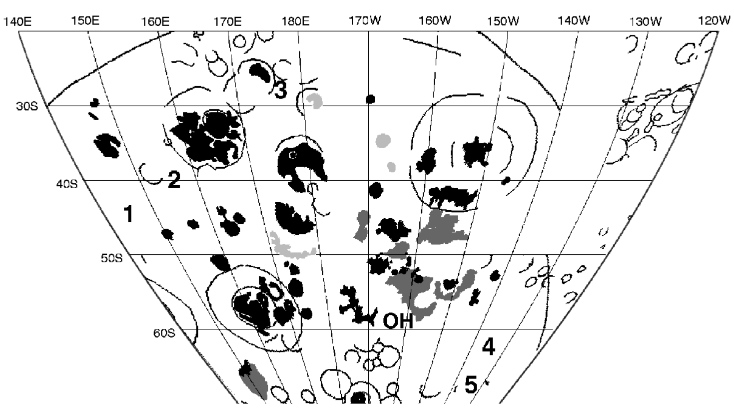

Figure 3. Distribution of basaltic material in SPA [13]. Mapped mare areas [4] confirmed to be basaltic are shown in black. Areas mapped as smooth plains [4] that also contain abundant high-Ca pyroxene are interpreted to be cryptomaria, earlier basaltic volcanism (shown in dark grey).

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