COMPOSITIONAL DIVERSITY IN THE SOUTH POLE-AITKEN BASIN (SPA) AS VIEWED BY THE MOON MINERALOGY MAPPER (M^3). N. E. Petro[1] and C. M. Pieters[2], and the M^3 Science team. [1]NASA\GSFC, Planetary Geodynamics Branch (Noah.E.Petro@nasa.gov), [2]Brown University, Department of Geological Sciences.

Spectral data from the Moon Mineralogy Mapper (M^3), an imaging spectrometer with both high spatial and spectral resolution on Chandrayaan-1, shows clear compositional diversity across the South Pole-Aitken Basin (SPA) interior.

Data from the second optical period of the mission (Figure 1) covers most of the basin interior and shows that 1) the central peaks of a number of large craters and basin rings are dominated by low-Ca pyroxenes (norite), 2) most of the non-mare interior of the basin is largely noritic, and 3) the center of the basin contains a high-Ca pyroxene-bearing (gabbro) lithology [1]. The identification of highly crystalline low-Ca pyroxene in central peaks by M^3 confirms previous findings from the Kaguya Spectral Profiler [2], suggesting that either a several kilometer thick recrystallized zone of noritic impact melt is distributed across the basin or these large craters tapped an underlying crystalline noritic basement. The less spectrally prominent, but pervasive, noritic signature across SPA's interior likely represents a mixed impact-melt breccia derived from the lower crust produced during SPA's formation. The distinctive gabbroic zone found in the center of SPA is centered on what is now called Mafic Mound (formerly Olivine Hill [3]) and probably includes a deep component derived from the lower crust or upper mantle. While olivine is not seen at Mafic Mound, exposures of olivine are reported in the inner ring of the Schrödinger Basin and the central peak of Zeeman Crater [4].

Spectra Example – The Apollo Basin: Data from the northeastern portion of SPA, covering the Apollo Basin is shown in Figure 2. In the Apollo example images A and B illustrate variations in albedo and morphology (from long-wavelength bands), and C illustrates compositional variations in a simple 3-color composite [5]. In Figure 2c, low-Ca pyroxenes are illustrated as green, high-Ca pyroxenes as yellows and oranges, and anorthositic materials as blue. Example spectra illustrating the diversity in pyroxene content of mafic materials in and around Apollo are illusrated in Figure 3.

References: [1] Pieters,C.,et al.,(2010),JGR,submitted. [2]Nakamura,R.,et al.,(2009),GRL,36,L22202. [3]Pieters, C., et al., (2001), JGR. [4]Yamamoto, S., et al. (2010) Nature Geo., DOI: 10.1038/NGEO897. [5]Petro,N. (2010), LPSC, 1802.

Figure 3 (Right): M^3 3x3 averaged spectra extracted from locations across the interior of Apollo. The fresh mare spectrum was extracted from Mare Orientale and dashed spectrum is from the central peak of Antoniadi. The inset image illustrates where Apollo spectra were extracted.

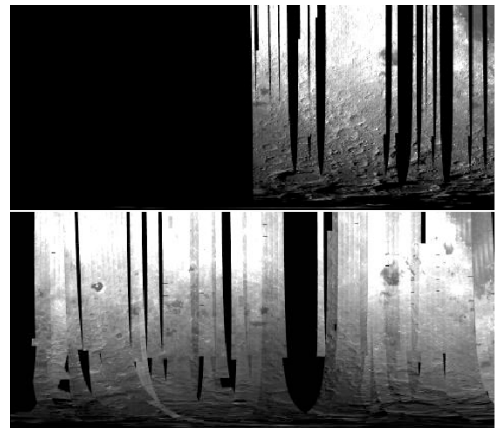

Figure 1. M^3 coverage from the Optical Period 2a (top) and 2c (bottom). Projection is Simple Cylyndrical centered on 180º, below the equator. Registration errors due to spacecraft pointing issues are readily apparent in data from optical period 2c and are presently being addressed.

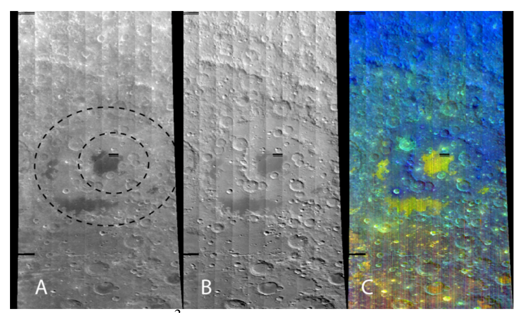

Figure 2. Mosaiced M^3 data at 1.4 km/pixel from OP2c. A) 750 nm albedo image of Apollo Basin. Main (D=480 km) and inner rings (D=240 km) of the basin are identified by dashed circles. B) Long wavelength (2936 nm) image, which is sensitive to surface topography. C) Color composite image with R = Integrated Band Depth (IBD) of the 1000 nm band, G = IBD of the 2000 nm band, and R = 1580 nm reflectance.