ANALYSIS OF APOLLO SAMPLES WITH THE MULTISPECTRAL MICROSCOPIC IMAGER (MMI).

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Introduction: The Multispectral Microscopic Imager (MMI), similar to a geologist's handlens, generates multispectral, microscale reflectance images of geological samples, in which each pixel consists of a spectrum ranging from the visible to the near-infrared [1], [2]. This spectral range enables the discrimination of a wide variety of rock-forming minerals, especially Fe-bearing phases, within a microtextural framework. The MMI composite images provide crucial geologic and contextual information: 1) for the in-situ analysis of rocks and soils to support hypothesis-driven, field-based exploration; 2) to guide sub-sampling of geologic materials for return to laboratories on Earth; and 3) in support of astronaut investigations during EVAs, or in a lunar base laboratory.

To assess the value of the MMI as a tool for lunar exploration, we used a field-portable, tripod-mounted version of the MMI [1] to image 18 lunar rocks and four soils, from a reference suite spanning the full compositional range found in the Apollo collection, housed in the Lunar Experiment Laboratory at NASA's Johnson Space Center [3]. We present our results from these analyses.

The MMI composite images faithfully resolved the microtextural features of samples, while the application of ENVI-based spectral end-member mapping faithfully revealed the distribution of Fe-bearing mineral phases (olivine, pyroxene and magnetite), along with plagioclase feldspars within samples, over a broad range of lithologies and grain sizes (figure 1). Our MMI-based petrogenetic interpretations compared favorably with thin section-based descriptions published in the literature, revealing the value of MMI images for astronaut and rover-mediated lunar exploration.

References: [1] Sellar R. G. et al. (2008) *Joint Ann. Meet. LEAG-ICEUM-SRR, Abstract #4075*. [2] Nuñez J. I. et al. (2009) *LPSC XL, Abstract #1830*. [3] Allen C. C. et al. (2009) *2nd Lunar Science Forum*.

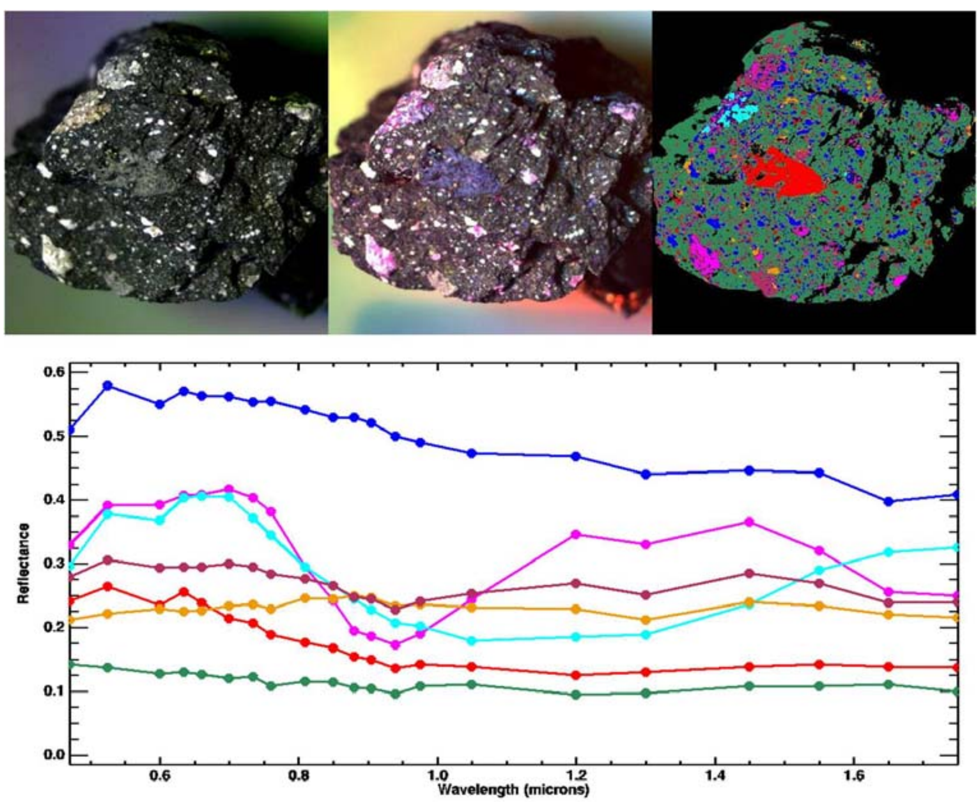

Figure 1. Multispectral images (top left and middle) and corresponding color mineral map (top right) and spectra (bottom) of Apollo sample 15459,53. Subframe field of view: 25 mm x 25 mm (62.5 µm/pixel). Top Left: R = 635 nm; G = 525 nm; B = 470 nm. Top Middle: R = 1450 nm; G = 975 nm; B = 525 nm. Images are 2% histogram stretched. The addition of near-infrared bands enabled the distinction of different rock-forming minerals on the basis of spectral differences.