SPECTRAL MAPPING OF MARE MOSCIVIENSE, LUNAR FARSIDE, FROM CLEMENTINE UVVIS DATA.
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Background:
The Clementine mission provided the first high resolution multispectral image data set of the far side of the Moon. While near side surface morphological units have been studied extensively from earth based spectral measurements, this is the first opportunity to examine the compositional properties of far side areas. Moscoviense is one of the prominent large impact basins on the lunar far side centered on (147 deg 27E, 26 deg 27N), approximately 445 km in diameter. The geomorphology is complex possibly resulting from sequences of explosive volcanism, mare emplacement by effusive volcanism, and subsequent smaller impacts as discussed in [1]. The terrain exhibits great variation in brightness, color and texture on a very small (several hundred meter) to large (ten to hundred km) scale.

Analyses and Preliminary Results:
We are using Clementine UVVIS multispectral images for compositional mapping of the Moscoviense basin and surrounding areas. The data have been calibrated, image planes co-registered and mosaiced at the USGS, Flagstaff [2]. The five image bands are centered at 0.415, 0.750, 0.9, 0.95 and 1.0 microns. For this preview study we shrunk the original image by a factor of four, to 474 m/pixel resolution. Preliminary results from linear mixture modeling indicate that at least five spectral endmembers are needed for a decent model fit to this area. Further, spatially coherent spectral units are distinguishable through spectral classification. A preliminary classification map is shown in Figure 1 (original figure in color). The units are as keyed in Figure 2, which shows average spectra of the training areas for each spectral unit. The unit names indicate the types of locations where training spectra were extracted. The spectra look generally consistent with those in [3] and [4]. The known major surface units appear to be compositionally distinct too, and in general agreement with albedo and color ratio images [5]. The basin floor is covered by three distinguishable mare deposit units (A, B, C) which are all relatively dark, exhibit increasing redness from A to C, and are likely to be of different ages [1].

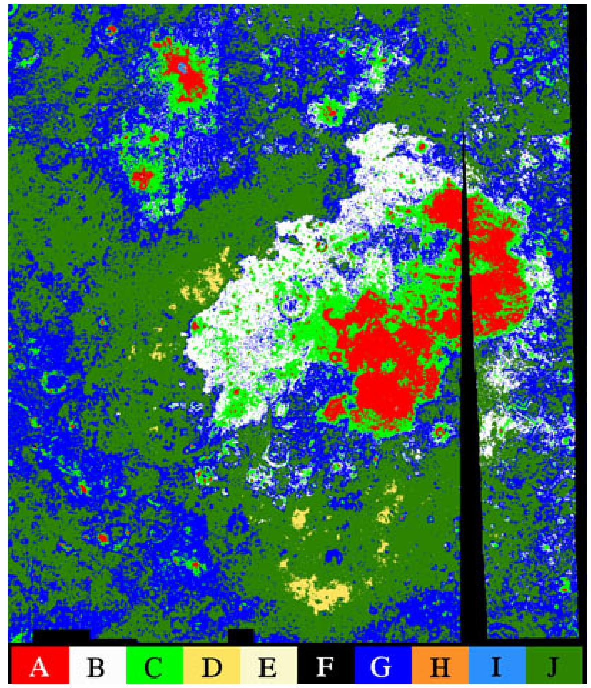

Figure 1. Spectral units in Mare Moscoviense, showing general correspondance with major surface features. Keys and typical spectra are shown in Figure 2. (Image is color PostScript.)

Along the circular inner basin rim, outlined by the boundary of the mare (A and B) and of the class J, brighter and redder soils cover most of the highland areas (D and J). These materials extend outward from the rim to the larger surroundings. Concentric to the basin rim there appears to be another ring-shaped unit (G). Closer inspection of the small impact craters along this ring reveals small (several hundred meter) areas with H and I type, very bright spectra, usually at the center or on the rim of the crater, suggesting mafic mineralogy (perhaps olivine) in freshly disturbed soil. These spots are often adjacent to other small units of F type. The E, F, I and H classes occur in very small, several pixel (500 – 1500 m) patches, which are hard to distinguish at the resolution of the image figure presented here. The most representative of these kinds of small variations are two craters, one toward the top of the image, about one third from the left, the second at the left edge of the image. about two thirds from the top. The central peak of both exhibit compositional heterogeneity: the first has F and H type spectra embedded in a small contiguous unit of I class, H suggestive of olivine rich troctolite [6]. The second shows small patches of E and F type spectra among highland/mare material. E and F spectra may exhibit registration errors. Intercalibration of spectral bands as well as co-registration is still being improved. Results from more detailed analyses at full (118 m/pixel) spatial resolution, and spectral interpretations will be presented.

References:

Craddock, R.A., et al., Proc. Lunar Planet. Sci. Conf. 28, 1997. [2] McEwen, A.S., and Robinson, M.S., Mapping of the Moon by Clementine, Advances in Space Research, submitted, 1996. [3] Pieters, C.M., et al., Science, 266, pp 1844–1848, 1994. [4] Tompkins, S., and Pieters, C.M, Proc. Lunar Planet. Sci. Conf. 27, pp 1333–1334, 1996. [5] Robinson, M.S., et al., fall AGU, 1996. [6] McEwen, A.S., et al., Science, 266, pp 1858–1862, 1994.

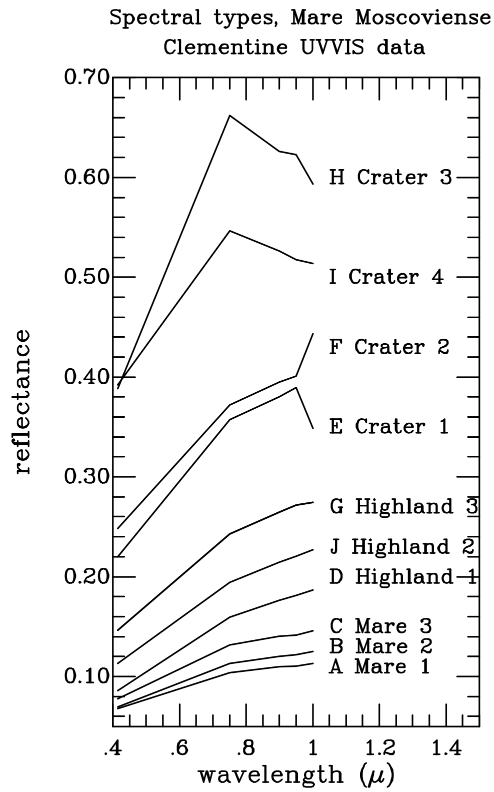

Figure 2. Representative spectra of the units shown in Figure 1.