Mineralogy of the Lunar Crust and Mantle: Issues Addressed with Clementine Global Multi-spectral Mosaics

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The calibrated, registered, and globally mosaiced data for the Clementine UVVIS camera have been released for the whole Moon at 1 km/pixel scale [PDS Imaging Node, USGS, Flagstaff]. Comparable global data sampled at 500m and 100m are in production and should be available soon. Although the spatial resolution of raw pixels varies significantly from ~ 100 to 300 m/pixel, the resampling procedure maintains maximum spatial and color information while transforming all image data onto the same scale for science analyses. With these global mosaics it is now readily possible to evaluate spatial relations between different lunar terrain and to explore several outstanding issues of lunar science. Two examples include the enormous South Pole-Aitken Basin (which perhaps excavated to the mantle) and the diversity of basaltic compositions around the globe (presumed to be partial melts from the mantle).

The ~2500 km diameter South Pole-Aitken basin (SPA) is the largest confidently identified impact basin on the Moon [e.g., D. Wilhelms, *USGS PP 1348, 1987*]. Its size and farside location have made it a focus of analysis because of its associated mineralogical and geochemical anomalies, the potential for having exposed deep crustal and mantle material, and insight it can provide on basin formation and crustal evolution. The mineralogy exposed within SPA is evaluated to constrain basin evolution and to identify regions most likely to contain mantle material [Pieters et al., *LPSXXXI, #1438, 2000*]. The overall noritic character of the SPA mafic anomaly [C. Pieters et al., *GRL, 24, 1903, 1997*] is shown to be widespread. The presence of anorthosites throughout the peak ring of Apollo [Morrison and Bussey *LPSXXVIII, #1501, 1997*] is confirmed, implying shallow upper crust is exposed in the NE part of the basin. SPA also exhibits a very diverse volcanic history; mare basalts (some relatively old) are more abundant in SPA than previously thought. Mineralogy most consistent with a deep-seated origin is seen to occur in the central part of the basin.

Clementine data extend and expand previous analyses of lunar nearside basalts which used earth-based spectroscopic measurements of ferrous absorptions and derived TiO2 abundance [Pieters, *LPSC9, 1978*]. The higher resolution Clementine results indicate that the unsampled young high-Ti basalts in the west are notably olivine-rich as well as FeO-rich [Staid and Pieters, *New Views II*, LPI Cont. 980, 62-64, 1999]. Clementine data for the limb and farside suggest the presence of a variety of basalt types with a substantial range in TiO2 abundance. Farside maria appear to be dominated by high albedo, low titanium basalts with weak to moderate mafic band strengths; none are as Ti-rich as some maria of the nearside. Although feldspathic contamination subsequent to basalt emplacement can be identified for different mare surfaces (especially on the farside), extensive very red and bright maria, such as those on the nearside, are shown to represent a distinct unsampled basalt type [Staid and Pieters, *Icarus, 2000*].