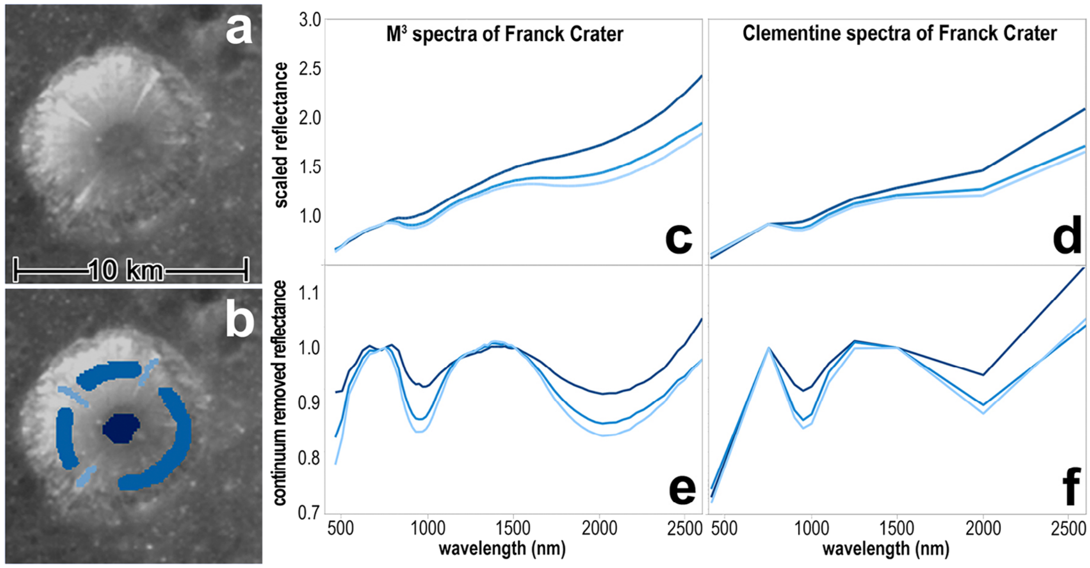

Figure 4. (a) M^3 750 nm albedo image of Franck Crater (location north of Mare Tranquillitatis shown as blue open square in Figure 3a). (b) Locations in crater from which pixel data were averaged to create spectra shown in Figures 4c–4f. Colorsof features in Figure 4b correspond to colors of spectra in Figures 4c–4f: dark blue, crater floor; medium blue, crater wall; light blue, light streaks on wall. (c) M^3 spectra scaled to 750 nm albedo. (d) Clementine spectra scaled to 750 nm albedo. (e) Continuum removed M^3 spectra; continuum calculated at 750 nm and 1510 nm. (f) Continuum removed Clementine spectra; continuum calculated at 750 nm and 1500 nm.

as a function of albedo. Clementine DIMs use a reversible phase function and include a full-resolution map of phase angle for each pixel. This was done with the intention that one could use the phase map to remove the existing phase correction and apply a new phase correction, or apply a second correction, specific to a desired terrain or phase angle.

[12] Clementine absolute reflectance values are significantly higher (by a factor of 1.5–2) than what is expected based on calibrated telescopic measurements of the Moon from Earth [*Shkuratov et al.*, 2001]. This difference in albedo is likely a Clementine calibration issue linked to the necessity to use an Apollo 16 soil sample measured in the laboratory to calibrate Clementine DN to reflectance. The comparative albedos between Clementine and telescopic data revealed that lab measurements of a mature soil are brighter than natural remote measurements of a comparable mature soil. The cause of the discrepancy is unclear, but may be related to the calibration correction for the halon reference standard [*Blewett et al.*, 1997], scattered light, and/or to differences in roughness and compaction between the studied soil samples and the actual lunar surface [*Hillier et al.*, 1999; *Shkuratov et al.*, 2001]. Therefore, we expect Clementine spectra to be brighter than M^3; even when M^3 data are photometrically corrected to the same geometry as Clementine. To remove these albedo effects and properly compare spectral differences between the two data sets we scaled Clementine and M^3 spectra to their respective 750 nm reflectance values.

[13] Even after normalizing both data sets to their respective 750 nm albedo, we expect there will still be a contrast difference because many areas of the UV-VIS data have a significant additive signal due to scattered light. P. Lucey (USGS Clementine NIR global mosaic, 2007) developed a set of corrections to better match the UV-VIS and NIR data to telescopic measurements near Aristarchus Crater. These corrections may help to improve the scattered light and other photometric effects, but do not fix Clementine's high albedo issue. We have opted not to use these correction factors in this analysis to keep with our effort to compare the instruments at similar levels of calibration. The K calibrated M^3 data used for the analysis reported here used no spectral correction based on spectral data from another instrument.

3. Analytical Techniques

[14] To compare spectra between Clementine and M^3 we selected regions on the lunar nearside that are easily recognizable, selenographically identifiable, cover both mare and highland lithologies, and where image data from both instruments were acquired under reasonably similar illumination geometries. Knowledge of the spacecraft's viewing geometry, in particular the phase angle, is essential for proper conversion to reflectance, cartographic, and photometric applications. The solar phase angle is the angle between the vector to the Sun and the vector to the spacecraft from a given point on the Moon's surface. The phase angle that describes a mapping orbit (and as discussed herein) refers to the angle between the vector to the Sun and the intersection of the spacecraft's orbit with the Moon's equator. The optimal solar phase angle for mapping lunar mineralogy is between 20 and 40 degrees. At lower angles the data begin to suffer from the opposition effect: a rapid