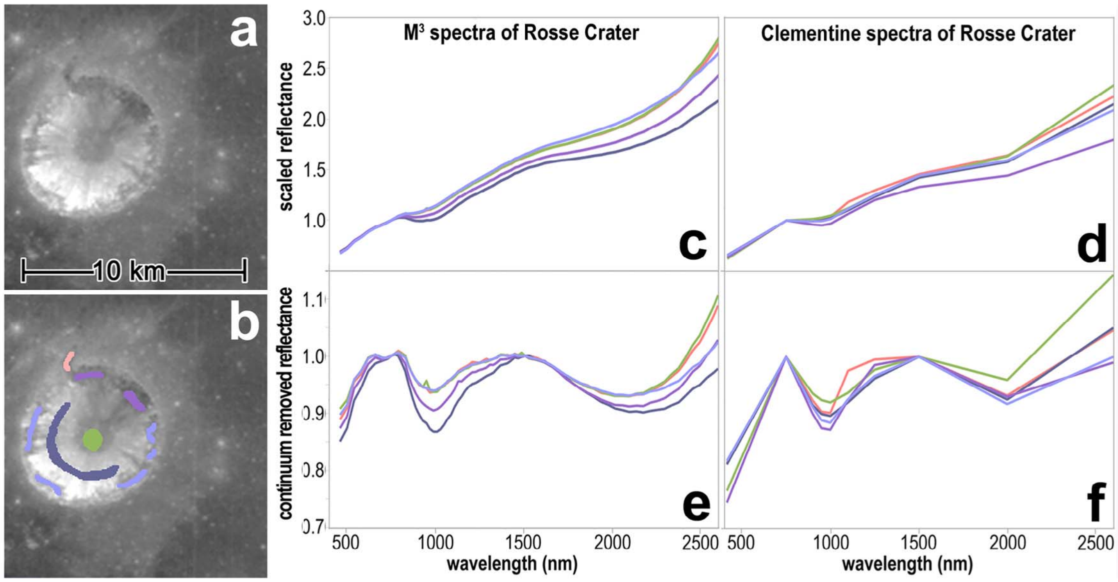

Figure 5. (a) M^3 750 nm albedo image of Rosse Crater (location in Mare Nectaris shown as lavender open square in Figure 3a). (b) Locations in crater from which pixel data were averaged to create spectra shown in Figures 5c–5f. Colors of features in Figure 5b correspond to colors of spectra in Figures 5c–5f: green, crater floor; dark purple, light crater wall; light purple, dark material at top of crater wall (east and west); dark lavender, dark material at top of crater wall (north); salmon, short dark material spilling down proximal ejecta blanket. (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.

increase in albedo as the source of illumination moves behind the observer (the phase angle approaches zero). At angles greater than 40, shadows obscure too much of the image. 30 degrees is the standard phase angle used for laboratory measurements of reflectance spectra, so for ease of comparison, Clementine's orbit was selected to maximize the time period in which the solar phase angle was within 30 degrees [*Eliason et al.*, 1999]. M^3 viewed the Moon from a wider variety of phase angles, and there are few locations where Clementine and M^3 viewed the Moon with the same illumination geometry. The Tranquillitatis-Nectaris region (Figure 3) was selected for this study because it was mapped by both Clementine and M^3 at approximately 30 degrees phase angle.

[15] The Clementine mosaics used in this study (Figure 3a) are resampled to 140 m/pixel to match the spatial resolution of the comparable data from M^3. Our technique samples from several pixels and used the average of these pixels' spectra, which should mitigate problems associated with imperfect registration between the 2 data sets, as well as known issues merging spectra between Clementine's UV-VIS and NIR cameras.

[16] We sampled surface regolith (Figures 3b–3e) and features within two larger (~10 km diameter) craters, Franck (Figures 4b–4e) and Rosse (Figure 5), which were delineated based on albedo and/or morphology. Each spectrum is an average from several pixels (accurately depicted in Figures 3a and 4a) of no less than 4 pixels in one spatial dimension. The 4-pixel restriction ensures we are not sampling from less than the true spatial resolution of Clementine NIR data (500 m/pixel). Averaging several pixels from a single feature reduces noise, and provides a more robust spectrum. Combined with the Small Crater Rim and Ejecta Probing (SCREP) procedure [*Kramer*, 2010], we obtained 50 spectra for each instrument, where each spectrum is an average of several pixels from (what can be spatially resolved as) a single lithology.

[17] Spectra shown in Figures 3f–3i were obtained using SCREP to extract compositional information from pixels on the rims and proximal ejecta of small, immature craters (1–25 km in diameter). This was done to explore the idea that these craters can be used see through the mature regolith, and observe the spectral character of the underlying lithology that is exposed in their ejecta [*McCord and Adams*, 1973; *Staid and Pieters*, 2000]. Analysis is focused on the rims and proximal ejecta of the craters because it is thought that this location best exposes the pristine bedrock while simultaneously avoiding uncorrected photometric effects due to steep slopes [*Kramer et al.*, 2008; *Kramer*, 2010]. This area represents the thickest part of the crater ejecta, and thus consists of the most concentrated, or highest proportion of native material compared to foreign material that collectively make up the regolith [e.g., *Arvidson et al.*, 1975; *Melosh*, 1989; *Li and Mustard*, 2000]. Furthermore, the rim and proximal ejecta suffer the least amount of postimpact regolith buildup [*Kramer*, 2010]. For each selected crater, SCREP defines and extracts spectral information from pixels that describe a ring, the inner circumference of which delineates the crater rim and the outer circumference such that the ring thickness is ~1/10 of the crater diameter. These data are then averaged to obtain a single spectrum for each crater that is meant to closely approximate the composition of the pristine,