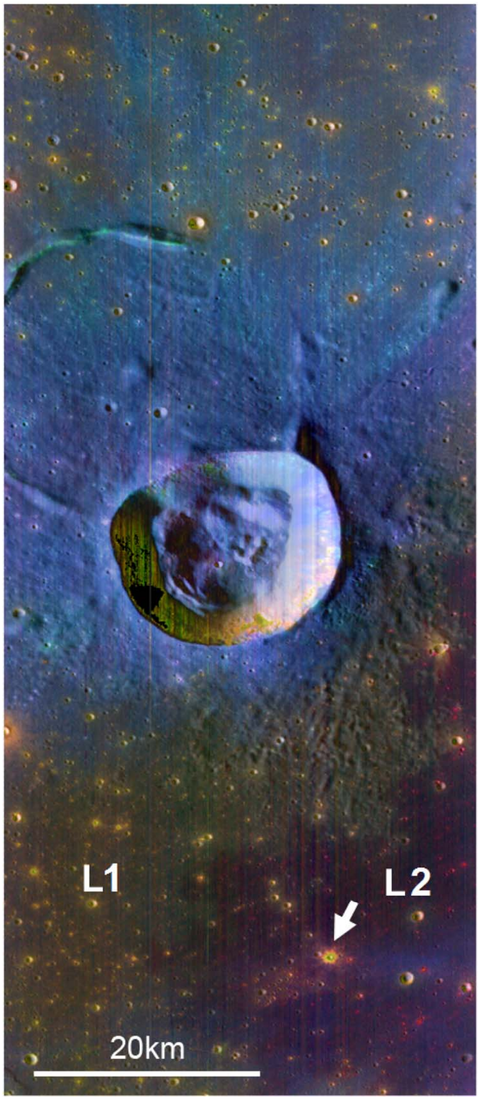

Figure 5. IBD composite of M^3 target mode data of Lichtenberg crater (20 km) and surrounding mare deposits. The IBD color composite has been overlaid on a thermal channel at 2.78 μm (as brightness) to show mafic band variations in relation to the morphology of the crater and surrounding topography. Older low-titanium basalts (L1) can be seen to the southwest and north of Lichtenberg crater and appear yellow in this color composite image. The younger high-titanium unit (L2) appears red due to weaker 2 μm band strengths and can be seen on the eastern side of the image embaying older basalts and topographically higher regions east of Lichtenberg. A white arrow locates a small crater that appears to be excavating through the thin high-titanium basalts to expose the underlying low-titanium deposits.

relatively thin in many locations, targeted data may provide the best opportunity to examine small fresh craters from the youngest flows. Targeted data over Lichtenberg crater were acquired during the second optical period and were processed to apparent reflectance as described in section 3.2. These data were acquired at a higher illumination angle than the global mode data studied for areas 1–3, resulting in phase angles of ~60° near Lichtenberg. In addition to a local high-order EFFORT correction used to smooth band-to-band noise [*Boardman*, 1998], the 0.705 μm channel was removed and interpolated with surrounding channels at 0.695 and 0.715 μm due to residual noise at that wavelength. Although calibrations of the targeted data are still preliminary, the spectral properties of this data complement the global-mode data results and provide additional spectral detail for mineral interpretations.

[30] M^3 data of Lichtenberg crater and surrounding regions is presented in Figure 5 as an IBD color composite overlaid on a thermal channel at 2.78 μm (as brightness) to show mafic band variations in relation to the morphology of the crater and surrounding topography. Older low-Ti basalts can be seen to the southwest and north of Lichtenberg crater and appear yellow in this color composite image, particularly in the ejecta of small craters that have strong mafic absorptions at both 1 and 2 μm. The younger high-Ti unit appears red due to weaker 2 μm band strengths and can be seen on the eastern side of the image embaying older basalts and topographically higher regions east of Lichtenberg. In Figure 2, these flows can be seen as a contiguous spectral unit with the youngest stratigraphic units sampled in area 2 and units to the north dated as young as 1.3 Ga by *Hiesinger et al.* [2003]. Bright ejecta, presumably rich in feldspathic materials, can be seen as blue rays crossing the low-Ti units to the north of Lichtenberg and portions of the low-Ti units southwest of the crater. Small fresh craters within areas L1 and L2 were sampled and averaged together to obtain the reflectance spectra presented in Figure 6. Even relatively small craters (<1 km diameter) appear to be excavating through the high-Ti basaltic flows in some areas, as indicated by anomalously orange ejecta blankets compared to other small fresh craters in Figure 5. One of the most visible examples of a crater excavating an underlying unit is marked by a white arrow in Figure 5 and has a diameter of ~600 m. Since depth of excavation scales with diameter (1:10 for simple craters) [*Melosh*, 1989], the thickness of the high-Ti flows are estimated to be less than ~60 m in this area. In order to isolate the most diagnostic signature of a potential olivine component in these basalts and to avoid sampling the underlying unit, only locations within small craters that displayed the strongest 1 μm versus 2 μm ferrous band strengths were averaged for these comparisons (red craters in Figure 5). As a result, the reflectance properties presented are more likely to represent an end-member of potentially olivine-rich compositions within these basalts rather than the average spectral properties of all fresh small craters sampling the unit.

[31] Spectra obtained from several fresh mare craters within each unit are presented for comparison in Figure 6a. Figure 6b presents these each spectrum after normalizing the reflectance data to a straight-line continuum fit to visible and near-infrared peaks on either side of the 1 μm band. For the low-Ti units, the continuum was fit at 0.74 μm and 1.54 μm, while the continuum for the high-Ti basalts was fit to the 0.74 μm and 1.82 μm target mode channels.

[32] The crater spectra of the low-Ti unit southwest of Lichtenberg crater have strong absorptions near 1 and 2 μm that are consistent with high-Ca pyroxenes. Band centers for these absorptions appear to occur at ~0.98 and 2.1 μm.