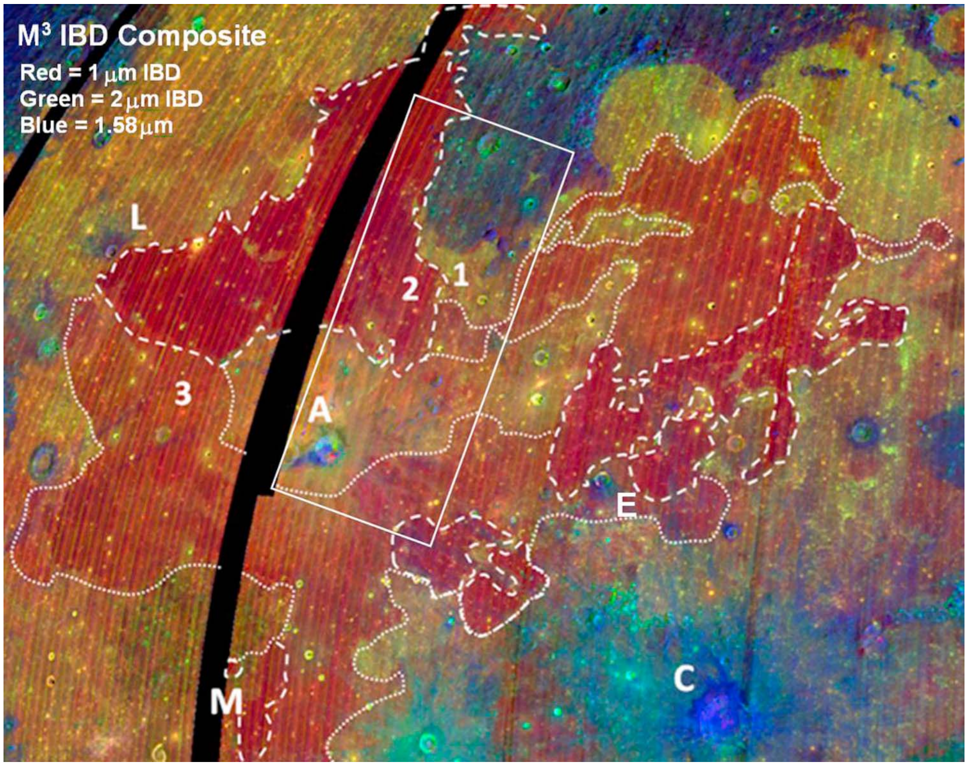


**Figure 2.** Subset of the spectral parameter image shown in Figure 1 centered over the mare deposits of northern Oceanus Procellarum and Mare Imbrium. The extent of Figure 3 is outlined as the white rectangle, and the approximate locations where the reflectance properties of fresh mare craters were sampled from different spectral units (Figure 4) are indicated with numbers. Letters refer to named craters on the Moon: L, Lichtenberg; A, Aristarchus; C, Copernicus; E, Euler; M, Marius.

collections that occurred over the western nearside of the Moon prior to loss of Chandrayaan-1. The $M^3$ targeted data of Lichtenberg have been processed to apparent reflectance in the same manner as the global mode data and were further thermally corrected based on the approach of *Clark et al.* [2011]. $M^3$ data of the crater and surrounding regions were examined in spectral parameter images, and spectra of mare units surrounding Lichtenberg were compared after sampling fresh mare craters identified in $M^3$ images. Additional discussion of the processing associated with the targeted data and the results of mare unit comparisons are presented in section 4.3.

## 4. Results

### 4.1. $M^3$ Mosaics and Spectral Parameter Images

[21] A subset of the global IBD mosaic centered on northern Oceanus Procellarum and Mare Imbrium is shown in Figure 2. Several large and contiguous areas within the maria are observed to be relatively homogeneous within this $M^3$ spectral parameter. Mare basalts that predate the western high-Ti flows have a yellow hue in this color composite due to strong ferrous absorptions at both 1 and 2 $\mu$m. Highland regions are primarily blue due to higher near-infrared reflectances and lower mafic band strengths; however, localized variations in mafic band strength are observed in association with fresh craters (greenish blue in the composite image). White outlines in Figure 2 provide the approximate boundaries of the late stage high-Ti basalts within this region. These deposits are distinct from earlier basalts and range from light red to dark red within the IBD mosaic. Within the high-Ti basalts, large regions appear as coherent groups based on their integrated 1 and 2 $\mu$m band strengths. These groupings are roughly mapped in Figure 2, by further separating the high-Ti basalts into two broad spectral groups based on the relative strengths of their 1 and 2 $\mu$m mafic absorptions (dashed versus dotted lines). More subtle spectral variations occur southwest and southeast of Aristarchus that are not distinguished in Figure 2. These areas may represent additional spectral and stratigraphic boundaries within the high-Ti basalts that are not captured by the two broader spectral groups.

[22] Comparison with crater age estimates for the mare basalts [e.g., *Hiesinger et al.*, 2003] shows strong associations between the basalts with the strongest 1 $\mu$m versus 2 $\mu$m integrated band depths (dark red in Figures 1c and 2) and the youngest-dated basalts. However, these age units appear to be less contiguous than the spectral groupings observed in the $M^3$ IBD parameter image. The mare age maps of *Hiesinger et al.* [2000, 2003] were based on representative areas within spectral units defined by differences in Clementine and Galileo color ratio images (based on UV/VIS and 1 $\mu$m band depth ratios). In addition to distinguishing mare compositional units, the Clementine and Galileo ratio composites are sensitive to spectral variations resulting from local mixing with nonmare materials and