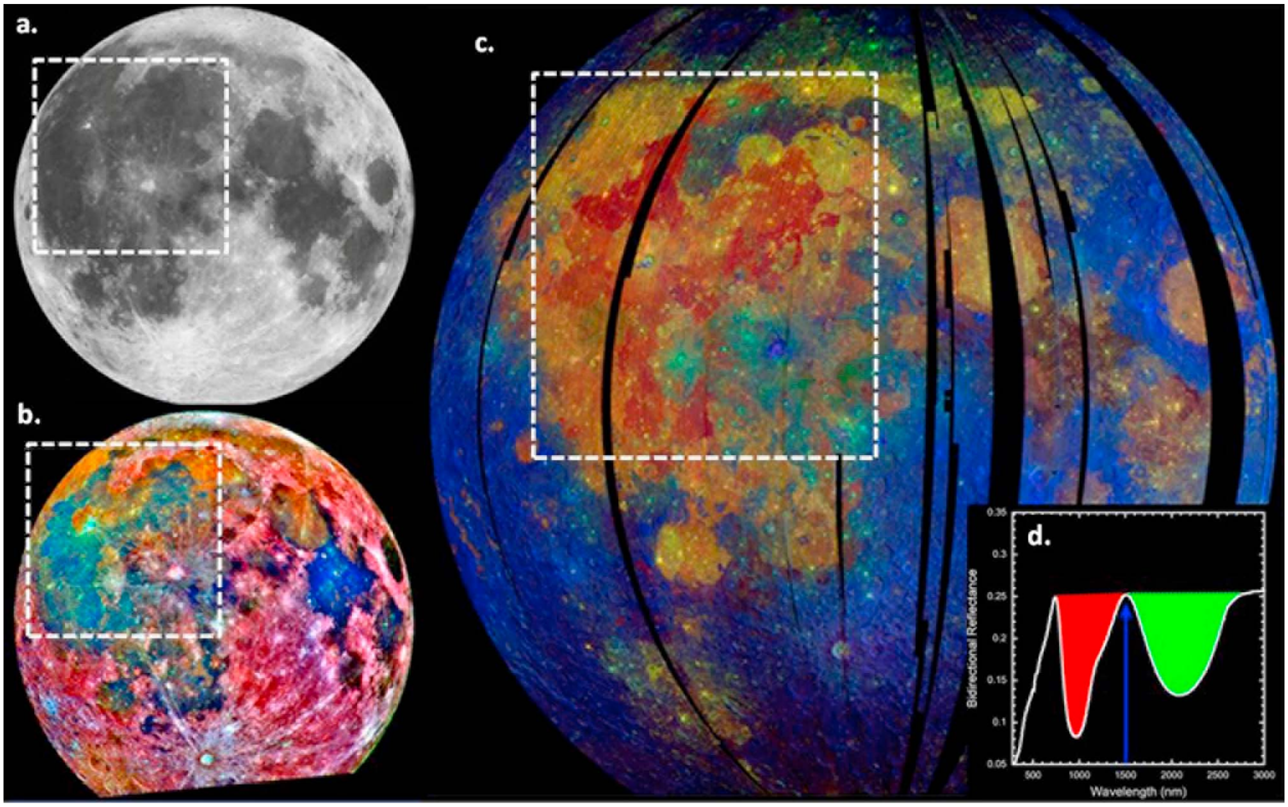

Figure 1. Late stage lunar volcanism on the western nearside appears as a distinct red hue in this M^3 color composite. (a and b) Western high-titanium basalts appear dark and spectrally blue in Galileo SSI 0.56 μm albedo and standard color ratio images (0.41/0.56 μm, 0.76/0.99 μm, 0.56/0.41 μm). (c) M^3 integrated band strength color composite in which these western basalts are red due to a strong 1 μm integrated band depth and weak 2 μm band (red for 1 μm IBD, green for 2 μm IBD, blue for reflectance at 1.58 μm). (d) A schematic of the M^3 IBD parameters used in Figure 1c. Dashed white lines in Figures 1a–1c indicate location of the study area shown in Figure 2.

Imbrium basin. Within Mare Imbrium, the basaltic flows flood small and large Eratosthenian craters and cover older Imbrian deposits, providing a context for their stratigraphic age [*Wilhelms*, 1987]. Flow fronts within the Mare Imbrium deposits can be seen in low-Sun Apollo orbital photographs and individual stratigraphic sequences of these basalts were mapped by *Schaber* [1973b]. In northern Oceanus Procellarum, some areas of the high-Ti flows have been dated as young as twice the age of Copernicus, or 1.6–2.0 Ga [*Young*, 1977] and even Copernican in age (<1 Ga) [*Schultz and Spudis*, 1983]. More recent crater counts of large areas of Oceanus Procellarum and Mare Imbrium by *Hiesinger et al.* [2000, 2003] and for Mare Imbrium by *Bugiolacchi and Guest* [2008] together date exposed high-Ti volcanism on the western nearside from >3 Ga to as recently as 1.1 Ga.

[10] The late stage western basalts are spectrally distinct from the older, high-Ti compositions on the eastern nearside of the Moon. Though the ultraviolet to visible reflectance properties of these basalts are similar to those sampled by Apollo 11, *Pieters* [1978] classified the western maria into separate spectral classes based on differences in the strength and shape of the mafic band near 1 μm. Since telescopic spectra of both mare soils share similar weak 2 μm bands, but younger western maria were observed to have a stronger and broader absorption centered near 1 μm, *Pieters et al.* [1980] interpreted these basalts to have an additional ferrous absorption from olivine and/or iron-bearing glass.

[11] Subsequent studies of these basalts using higher spatial resolution Clementine UVVIS and NIR data [*Staid and Pieters*, 2001; *Staid et al.*, 2002] examined fresh mare craters and associated soils within the high-Ti Procellarum deposits and Imbrium flows. These studies determined that the strong and asymmetric 1 μm absorptions within the mare soils and relatively weak 2 μm ferrous absorptions were also present for crystalline materials excavated from varying depths throughout these flows by optically immature craters. Based on the strength and pervasive nature of the asymmetric and strong 1 μm absorption, *Staid and Pieters* [2001] concluded that the presence of abundant olivine within the emplaced basalts was the most likely explanation for the unique spectral properties of these basalts. This study also concluded that the young high-Ti basalts were very iron rich (>20 wt % FeO) based on a comparison of mare craters and soils from the western high-Ti deposits to the basalts sampled by Apollo 11 in Tranquillitatis. Examination of individual flow sequences of these basalts in Mare Imbrium [*Schaber*, 1973b] further suggested that olivine content was increasing in subsequent eruptions within those flows [*Staid and Pieters*, 2001]. Other studies of Clementine data based on the FeO-mapping approach of Lucey also predicted high-