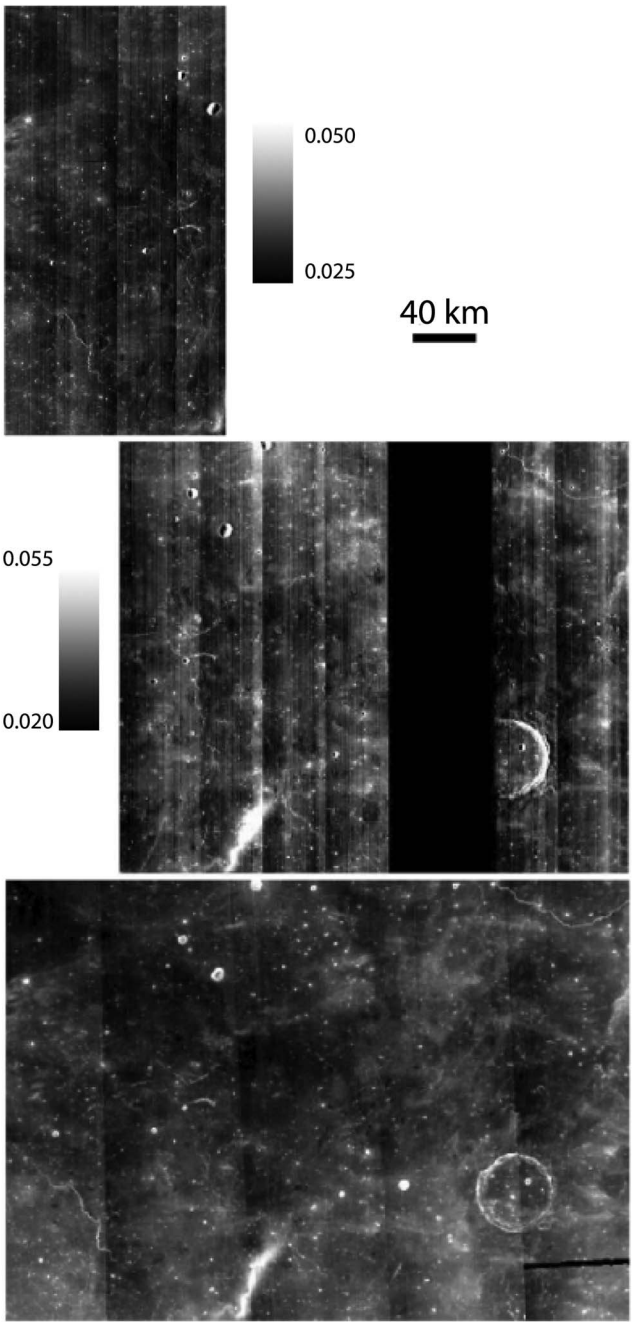

Figure 4. Three different observations of the Marius Hills volcanic complex by M^3. (top) OP1B only observed the west part while (middle) OP2A missed the central part of the plateau and the extreme west part. Both have a resolution of 140 m/pix. (bottom)The entire plateau is visible with OP2C at a degraded resolution of 280 m/pix. The photometric effect between strips is much more important for OP1B and OP2A because of a much higher phase angle (see section 2.2 for details). These 750 nm images are vertically aligned with respect to OP2C.

band was not possible with previous data, and thus prior studies of the MHC do not fully constrain the spectral properties of the volcanic features of the MHC. The aim of this article is to define the mineralogical composition of the mare basalts on the MHC and the spatial variability of the different mineralogical units. Ultimately, the better spectral resolution of M^3 will define new mare units and areas that will be different to those proposed by *Heather et al.* [2003]. A better understanding of the composition (i.e., olivine and pyroxenes) and distribution of the mare units will give us a better understanding of the MHC history and facilitate their integration into the context of Oceanus Procellarum as a whole. In this study, we will examine the MHC at spatial resolutions of 140 and 280 m/pix using M^3 images with spectral resolutions of 20 and 40 nm between 0.43 and 3 μm. Spectral signatures of lunar terrains are strongly impacted by space weathering and maturity. Therefore, we compare units that have similar maturity and carefully select the spectra to avoid maturity effect.

2. Instrument, Data, and Calibration

2.1. The Moon Mineralogy Mapper (M^3) on Board the Chandrayaan-1 Spacecraft

[9] M^3, a guest instrument aboard India's Chandrayaan-1 mission to the Moon, is a 0.43 to 2.97 μm imaging spectrometer. The spacecraft was launched 22 October 2008 and M^3 started to acquire data on 19 November. After more than nine months of lunar observations, the spacecraft stopped sending radio signals on 29 August 2009. During the Chandrayaan-1 mission, M^3 mapped more than 95% of the Moon [*Boardman et al.*, 2011] with resolutions of 140 and 280 m/pix with 85 spectral channels in global mode.

[10] The large spectral range and the performance of M^3 has already led the team to new discoveries on the surface of the Moon [*Pieters et al.*, 2009, 2011; *Sunshine et al.*, 2010] and emphasizes the importance of extending the spectral range of observations of the Moon.

2.2. Data Used in This Study

[11] The MHC was observed at three different times during the mission resulting in three different coverages, observation conditions, and resolutions. The different times of observation are referred to as Optical Periods (OP). There are five different sets of observations: OP1A, OP1B, OP2A, OP2B and OP2C as discussed by *Boardman et al.* [2011]. Most of the time, the detector was above its nominal operating temperature, which degrades the signal-to-noise ratio and contributes to vertical stripes visible in the images presented in this paper (see Figures 5 and 6).

[12] A summary of all the observations of the MHC is presented in Figure 4. Initial coverage of the MHC during OP1B and OP2A was incomplete, with a resolution of 140 m/pix and a phase angle of 45°–62° for OP1B, and 44°–68° for OP2A. The midwest part of the plateau was observed during OP1B. The mosaic of these observations was produced from five individual strips. The coverage with OP2A was less extensive to the west, but the central part of the plateau was better covered and the eastern part of Marius crater was available. The mosaic of these observations consists of seven individual strips. During OP2C, the altitude of the spacecraft was raised from 100 to 200 km due to thermal and other technical issues with the spacecraft. Consequently, the entire plateau was observed at a degraded resolution of 280 m/pix. The phase angle was also much lower in OP2C, between 11° and 19°. The mosaic of OP2C observations