INTRODUCTION AND OBJECTIVES

The Marius Hills Volcanic Complex (MHVC) (Fig. 1), the largest single concentration of volcanic features on the Moon (~35,000 km²) [1], represents a significant period of lunar magmatism thought to have taken place during the Imbrian (~3.3 Ga) through Eratosthenian (~2.5 Ga) periods [1,2]. Previous studies of the MHVC utilizing Clementine Ultraviolet/Visible (UVVIS) camera, Kaguya Multiband Imager (MI), and Moon Mineralogy Mapper (M3) data have found that the volcanic domes and surrounding mare basalt units are compositionally distinguishable, indicating similar eruption times [1,2], although the domes are emplaced by younger mare basalts [1].

This research utilizes new Lunar Reconnaissance Orbiter Camera (LROC) data to re-evaluate the composition of the volcanic domes and surrounding mare basalt units in the MHVC. Through this, the compositions and relative ages of the domes and the surrounding flows can be determined.

METHODS

1. Color unit boundaries manually mapped using Clementine 5-band color ratio [3] and LROC Wide Angle Camera (WAC) 7-band multispectral [4] base maps (Fig. 2a,b)
2. Boundaries iteratively compared to each other to assess differences between them and were then compared to WAC hillshade and morphology data to assess the quality of correlations between color unit boundaries and topographic features (Fig. 3a)
3. Five LROC Narrow Angle Camera (NAC) featured mosaics along with 30 NAC image pairs were analyzed in order to associate WAC boundaries with morphologies evident in the high-resolution NAC frames (Fig. 3b)
4. Correlated morphologies were mapped and confirmed by taking elevation profiles of NAC Digital Terrain Models (DTMs) (Fig. 4a-e)
5. WAC boundaries compared with Clementine TiO₂, FeO, (Fig. 5a,b), OMT data, and the mare basalt units mapped by [2]

RESULTS

1. Many domes outlined/crosscut by WAC boundaries (Fig. 3a)
2. A large majority of the boundaries mapped from the WAC base map correlate with morphologies that are evident in the NAC frames (Fig. 3b)
3. Evidence of morphology changes were found to correlate with the boundaries near the flanks of the domes that were observed and show possible embayment of the mare basalt flows on the flanks (Fig. 4a-e)
4. Color units derived from WAC base map correlate strongly with units evident in the Clementine TiO₂ and FeO maps (Fig. 5a,b)
5. The boundaries mapped from the WAC also correlated very well with the mare basalt units mapped by [2], but in general are more detailed and complex

DISCUSSION

The morphologies seen in the NAC frames that parallel the boundaries indicate that WAC color data has great potential for identifying mare basalt units. When confirmed with elevation profiles from NAC DTMs, morphologies show embayment of the observed domes, indicating that the mare basalts erupted after dome formation. This implies that the domes are older than the flows and the volcanic activity on the plateau was a complex process [1]. This indicates that not only are the techniques used in this study useful for mapping distinct mare basalt units with WAC data, but will also be helpful in determining relative stratigraphy and ages of the domes and surrounding mare basalts in the MHVC.

REFERENCES