Introduction

Small volcanic cones got into the focus of Mars research in the last years [1,2,3,4,5]. They form a diverse group and probably several types of structures with different origins are among them. Below we analyze a special group of them at Olympia Undae in the northern circumpolar region of Mars [6] and compare their morphometric properties to small volcanic cinder cones on the Earth.

Cinder cones are the most common volcanic edifice on the Earth [7,8,9]. Based on a sample of 910 cinder cones, Wood found basal diameters (Wco) ranging from 0.25 to 2.5 km with a median of 0.8 km and a mean of 0.9 km [10]. In this first paper on scoria cones, Wood also stated that their volume ranges between 40 and 106 m³ and their spatial density varies between 0.03–0.5 cone/km².

Scoria cones morphometry is based on that, in principle, fresh scoria cones crater to cone diameter relation is 0.40, cone height to basal diameter ratio is 0.18, and slope is 30°. These ratios decrease in time.

Methods:

The martian structures were analyzed by THEMIS, HRSC and CTX images and their topography was measured using MOLA data [11] with IAU2000 planetocentric coordinates, referenced to the latest Mars gravity model. The analog structures from the Earth are volcanic cinder cones. Their geometry is often used to estimate morphological effects of lavas and consequences of later degradation.

Because of erosion on the Earth, the height, width ratio, and slope angle decreases through time. Using the data of the freshesmost cones we compared their parameters to the martian candidates.

Results:

Basic morphometric parameters were de-termined for the following structure groups (for detaile description see [1]): IC impact craters, CC cinder cones, SD Split Domes, ID Irregular Domes, BD Big Domes. The diameter/height distribution of the different observed structures indicates that the “dome group” (BD plus SD) on the one hand, and the “craters group” (IC plus CC) on the other adopt similar values while ID structures clearly differ from them. We compared the morphometric data of the martian features to cinder cones on the eastern portion of San Francisco volcanic field [9]. In Figure 2, they are indicated with black and grey solid circles, having the younger (less eroded) ones darker color.

Conclusions

Although the number of the analyzed structures is small to statistical results, their analysis is interesting as because they might be volcanic structures close to the polar cap. The following conclusions based on the comparison of cinder cones and our analyzed structures can be drawn:

• The martian structures separated by their morphology differ from each other in morphometric properties too.

• The martian structures seem to be substantially larger but less steep than their possible counterparts on the Earth.

• The size range of the martian structures is larger than at the San Francisco volcanic field – although the sample is too small for firm conclusion.

References