COMPARISON OF TERRESTRIAL CINDER CONES AND CANDIDATE VOLCANIC CONES IN THE NORTHERN CIRCUMPOLAR REGION OF MARS.

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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 origin are among them. Be-low 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 m^3 and their spatial density varies between 0.03-0.5 cone/km^2.

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 topogra-phy 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, height/width ratio, and slope angle decreases through time. Using the data of the freshmost cones we compared their parameters to the martiancandidates.

Results:

Basic morphometric parameters were de-termined for the following structure groups (for de-tailed description see [1]): IC impact craters, CC cra-tered 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 com-pared the morphometric data of the martian features to cinder cones at 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.

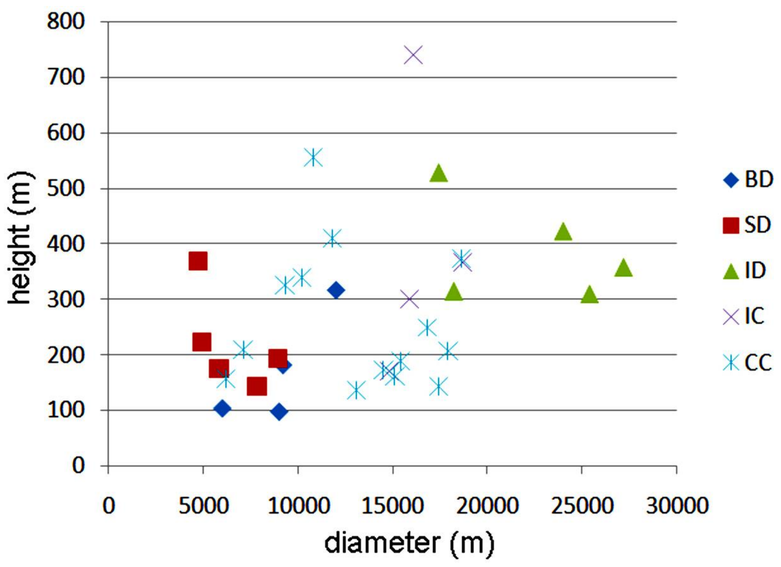

Figure 5. The planned (left) and the final (right) robotic controller

Figure 3. shows locations of structures and Figure 4. presents example images for the 100 m scale morphology observed for three analyzed structures (BD2, BD5 and CC14). The following characteristics can be easily noticed:

- their positive topographic structures are clearly visible by the distribution of dunes around them
- all show several sharp peaks at their central region
- this central region is smaller than 5 km, and is lo-cated at the center of the broad rise.

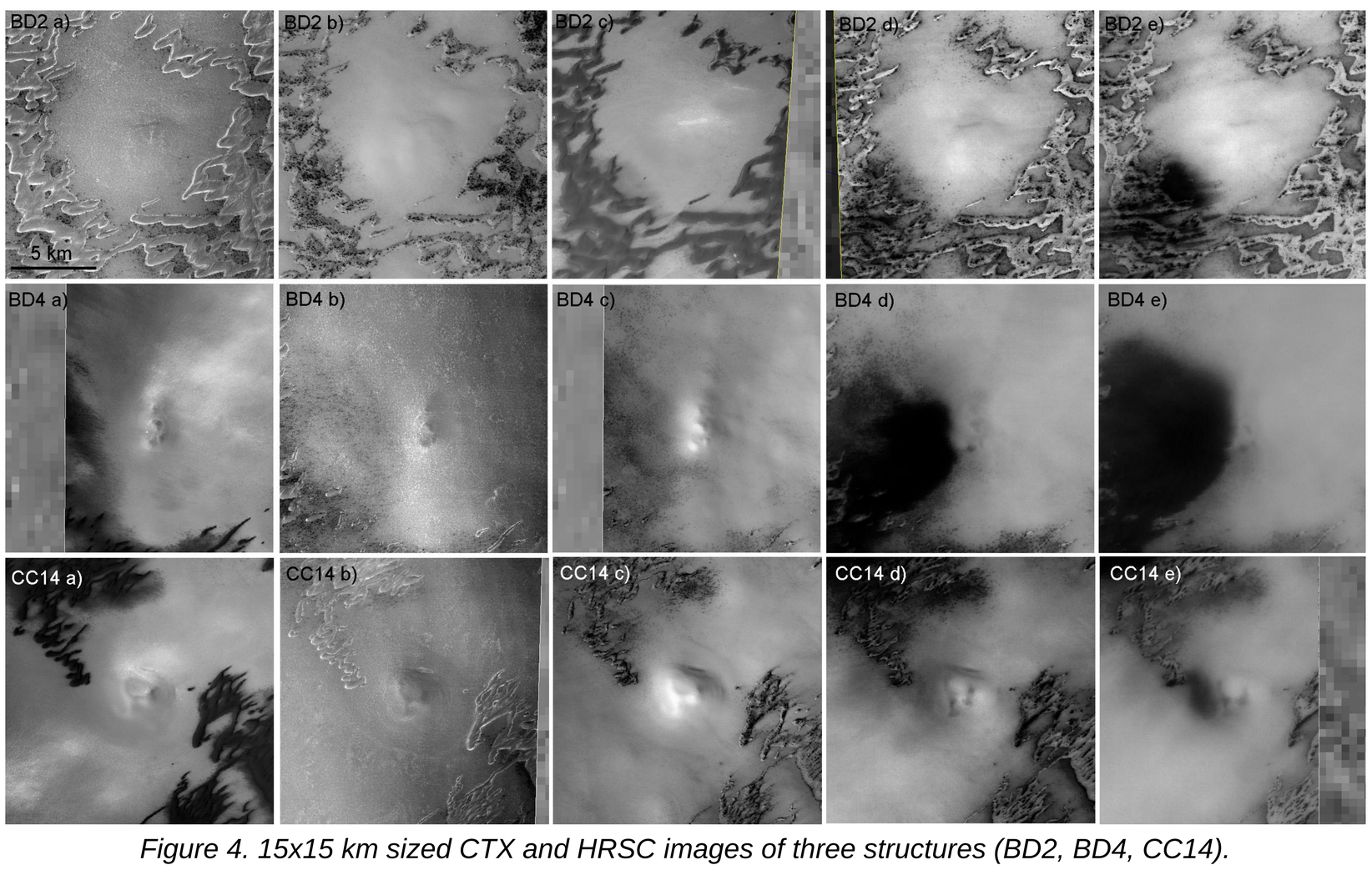

Figure 4. 15x15 km sized CTX and HRSC images of three structures (BD2, BD4, CC14).

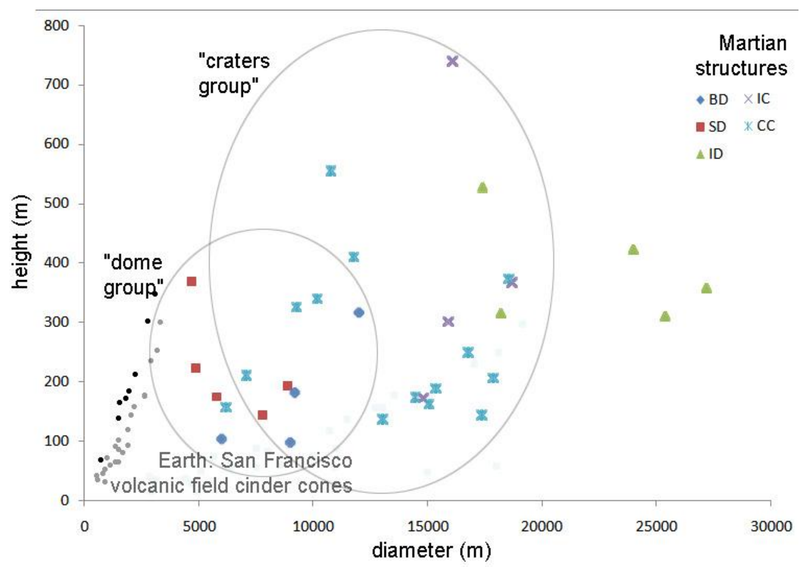

Figure 2. Morphometric parameters for the Martian structures (coloured) and for the analog ones on the Earth (grey dots and shaded area)

Table 1. Image id. no. for Figure 4.

id no., subset in Fig, 4.	CTX or HiRISE image id. no.	id no., subset in Fig.. 4.	CTX or HiRISE image id. no.
BD2 a)	P13_006260_2593	BD4 c)	P17_007697_2597
BD2 b)	P17_007618_2594	BD4 d)	H5582_0000_ND3
BD2 c)	P22_009833_2577	BD4 e)	H5618_0000_ND3
BD2 d)	H5582_0000_ND3	CC14 a)	P02_001671_2586
BD2 e)	H5618_0000_ND3	CC14 b)	P13_006194_2607
BD4 a)	P02_001671_2586	CC14 c)	P17_007697_2597
BD4 b)	P13_006194_2607	CC14 d)	H5582_0000_ND3
		CC14 e)	H5618_0000_ND3

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 struc-tures can be drawn:

- The martian structures separated by their mor-phology differ from each other in morphometric properties too.

- The martian structures seem to be substantially larger but less steep than their possible counter-parts on the Earth.

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

References

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