NEW INVESTIGATIONS OF POSSIBLE VOLCANIC EDIFICES AT THE MARTIAN NORTH POLE – FIRST RESULTS. T. Kneissl[1], G. Neukum[1]. [1]Institute of Geosciences, FU Berlin, 12249 Berlin, Germany, Thomas.Kneissl@fu-berlin.de.

Introduction: Small-scale volcanic features in the Martian north polar area have been identified and investigated by several authors in the past (e.g. [1 - 4]). These investigations were mostly made on the basis of image data of the Viking mission and topography data obtained by the Mars Global Surveyor (MGS) Mars Orbiter Laser Altimeter (MOLA). New datasets like THEMIS VIS, MOC and HRSC imagery are an excellent basis for a re-investigation of the distribution and characteristics of possible volcanic edifices in that particular area. Until now, mainly two regions of volcanic edifices were described, a field of Martian cratered cones (MCCs) in the dark polar dune field between 250° to 310°E and 75° to 85°N and a field of Martian pitted domes (MPDs) between 190° to 215°E and 72° to 80°N [2]. Domes were generally considered to be broad and flat shield-like constructs often with pancake-like shape, while cones (figure 1) were considered to be steeper volcanic landforms often characterized by a central crater [1]. These volcanic edifices occur in the height-range of several tens of meters up to more than hundred meters with diameters up to more than 20 km.

The general young age as obtained from age determinations on the basis of high-resolution MOC image data suggest recent or even ongoing geologic activity [5]. MOLA data helped to conduct first studies regarding the possible formation mechanisms. Basaltic effusive and explosive volcanism are discussed in connection with the Martian volatile distribution in the subsurface that may play a significant role [1].

Data: 140 HRSC images with a resolution between 12 m/px and 200 m/px have been obtained thus far in the investigated area located between 70°N and 90°N. Many of them were acquired under difficult atmospheric conditions (e.q. dust). Therefore only 57 of these image strips could be used for this survey. Additionally, we utilized many of the approximately 10.000 available THEMIS VIS images with resolutions between 20 m/px and 80 m/px.

MOLA topography data made it possible to distinguish volcanic cones and domes from other features such as impact craters. For first investigations we used a gridded digital terrain model with a resolution of 128 pixels per degree (approximately 463 m/pixel). For the interpretation of smaller features we used HRSC terrain models with a resolution between 150 and 200 m/px and a high-resolution MOLA gridded DTM with a resolution of 150 m/px (512 px/degree).

Methods: For the initial study we preferred to use MOLA and HRSC digital terrain models in conjunction with HRSC image data to identify possible volcanic features, because HRSC data has achieved almost a full coverage of the north polar region in high resolution. Where no HRSC data existed or image quality was affected by atmospheric effects, we used THEMIS VIS data. Features were investigated more closely if they have a positive relief and a circular plan shape. We obtained several profiles per feature to distinguish cones, cratered cones and dome-like features. In the case of cratered cones, we checked the altitude of the crater floor in relation to the surrounding plains to eliminate simple impact craters.

Figure 1: Perspective view of a Mars cratered cone (MCC) with a basal diameter of ~17 km at 77.8°N and 293.4°E. HRSC orbit 1264 with a resolution of 12.5 m/px was draped over a high-resolution MOLA digital terrain model with 512 px/degree. White arrows mark surrounding small-scale volcanic features. Vertical exaggeration is 8.

Preliminary Results and Further Work: 526 possible volcanic edifices have been detected thus far (figure 2). 284 of them were classified as simple cones, 186 as cratered cones and 56 as domes. The features are mostly concentrated in the two regions located in the dark polar dune field between 250° to 310°E and 75° to 85°N and between 190° to 215°E and 72° to 80°N, but we also found comparable morphologies distributed in the rest of the investigation area. Additionally, we observed an elongated feature with a positive relief at 78.8°N and 201.7°E resembling a volcanic dike.

Work is underway to obtain morphometric attributes like volumes, heights, average flank slopes, base diameters and crater diameters in order to compare the major edifices with the newly detected smaller features. Furthermore, the relationship between these parameters, e.g. average flank slope versus volume/diameter, could help to eliminate ordinary impact craters which are filled with dust and/or ice and distinguish different enigmatic features and their eruption styles [1]. Therefore, for certain areas, measurements will be conducted on highest-resolution MOLA gridded data as well as topographic profiles.

References: [1] Garvin, J.B. et al., (2000), Icarus, 145, 648-652. [2] Sakimoto, S.E.H. et al., (2000), LPSC XXXI, Abs.#1971. [3] Wright, H.M. et al., (2000) LPSC XXXI, Abs. #1894. [4] Sakimoto, S.E.H. et al., (2001), LPSC XXXII, #1808. [5] Neukum, G. et al., (2006), EPSC, p.621.

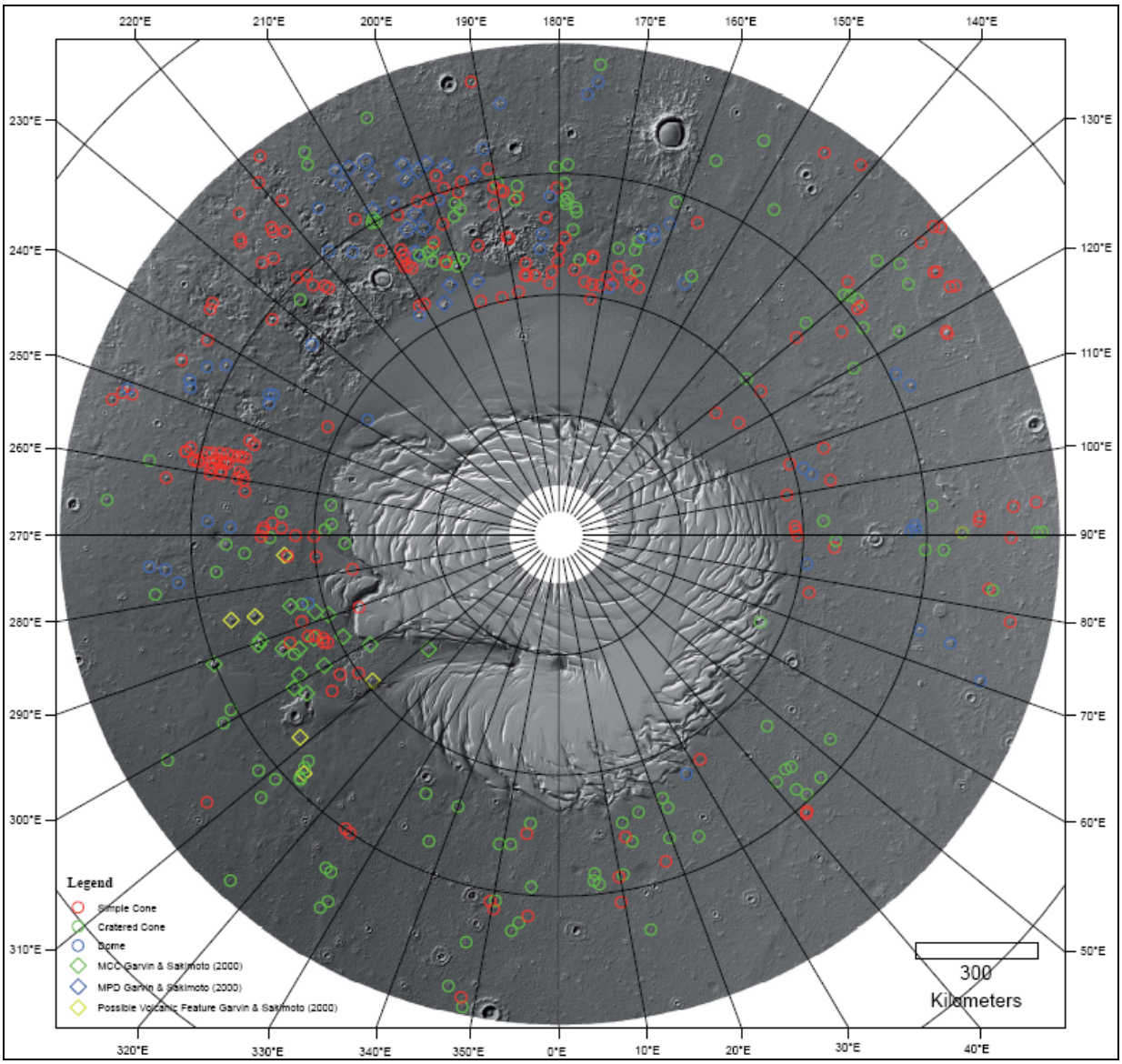

Figure 2: Locations of detected possible volcanic edifices in the Martian circum polar area. Background is a 70° to 90°N section of a shaded relief map of a MOLA DTM.