IANI CHAOS IN THREE SCALES – A TOPOGRAPHIC IMAGE MAP MARS 1:200,000 AND ITS SUBDIVISIONS. S. Gehrke[1], H. Lehmann[1], R. Köhring[1], M. Wählisch[2], J. Albertz[1], G. Neukum[3] and the HRSC Co-Investigator Team. [1]Technische Universität Berlin, Germany (stephan@fpk.tu-berlin.de). [2]German Aerospace Center (DLR), Berlin, Germany. [3]Freie Universität Berlin, Germany.

Introduction: During the past two years, the High Resolution Stereo Camera (HRSC) on board of the Mars Express orbiter covered more than half of the Martian surface, approximately 27% of it in resolutions better than 20 m/pixel. Color orthoimages, Digital Terrain Models (DTM), and – based on these data – high quality topographic and thematic maps are generated, mainly in standard scale 1:200,000. To illustrate both the quality of HRSC images and DTMs as well as the sophisticated cartographic concept and the flexibility of the Topographic Image Map Mars 1:200,000 series, a regular map sheet and two of its subdivisions in larger scales of 1:100,000 and 1:50,000 are presented.

The Topographic Image Map Mars 1:200,000 is the standard map series of the Mars Express mission [1,2,4]. In general, all map sheets are based on HRSC orthoimages, supplemented by contour lines derived from HRSC DTMs, topographic names, grids, and marginal information (Figure 1). The compilation of such a map is an automatic process using the cartographic software package Planetary Image Mapper (PIMap), developed at TU Berlin [3]. However, interactive finalization, e.g. regarding label placement, is necessary.

Altogether, Mars is covered by 10,372 individual sheets, 10,324 within the ±85° latitude zone in sinusoidal projection and 24 around the poles in Lambert azimuthal equal-area projection. While each quadrangle spans 2° in latitude, longitudinal extents increase from 2° near the equator up to 360° towards the poles in order to keep the mapped area approximately constant. Further information is given by *Albertz et al.* [1,2].

The sheets of the standard series can be subdivided into quarters and sixteenths for systematic mapping in larger scales 1:100,000 and 1:50,000 respectively. In principle, the cartographic concept perfectly meets all requirements for both mapping features or regions of special interest as well as particular HRSC orbits that don't fit with the sheet line system.

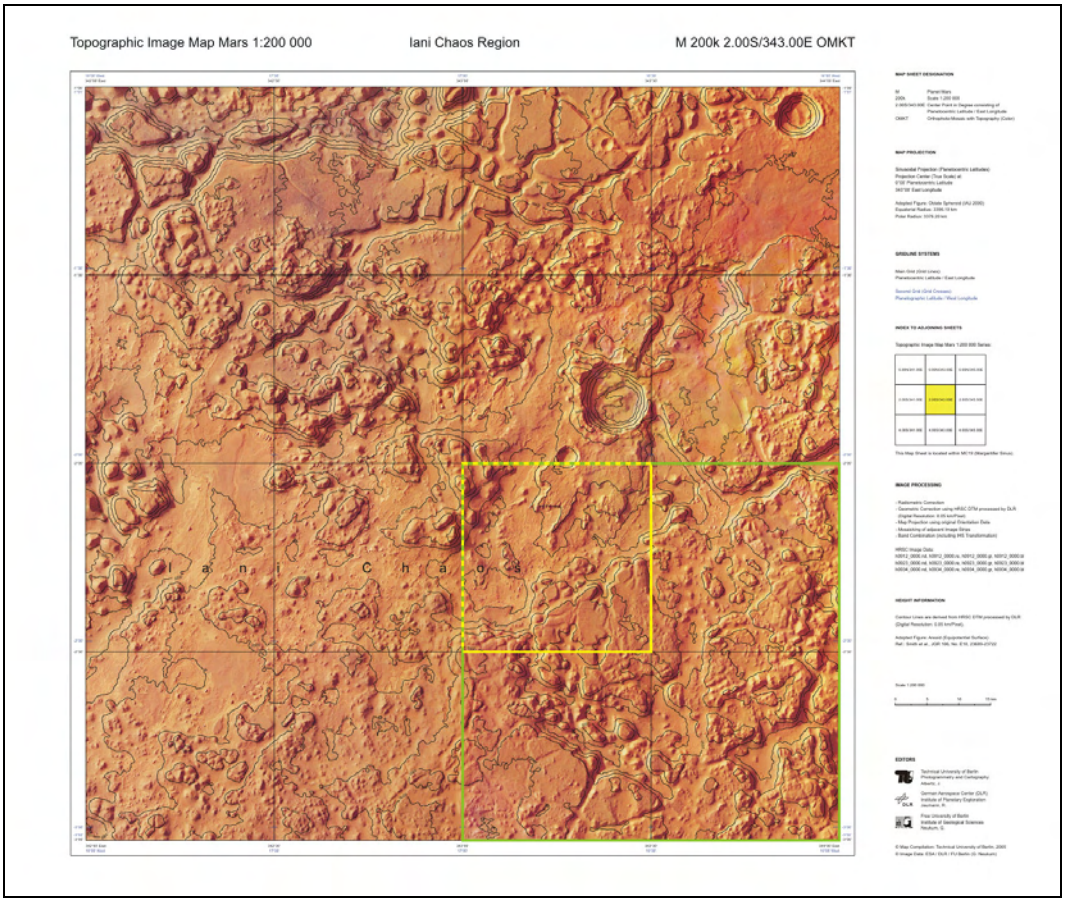

Figure 1: *A down scaled example of the Topographic Image Map Mars 1:200,000 series, sheet "M 200k 2.00S/343.00E OMKT, Iani Chaos Region". Within the map surface, the neat lines of both the 1:100,000 and the 1:50,000 subdivisions are shown in green and in yellow respectively.*

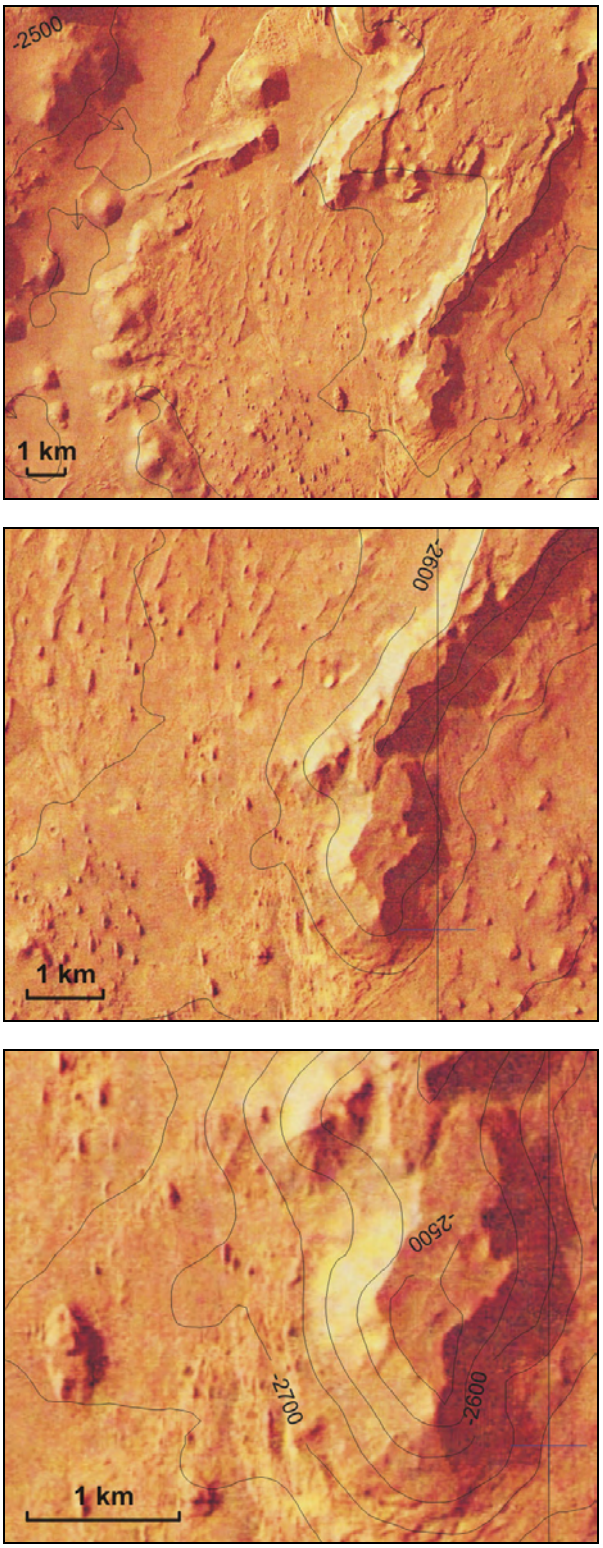

Figure 2: *Subsections of the three Topographic Image Maps Mars of Iani Chaos Region, "M 200k 2.00S/343.00E OMKT" (top), "M 100k 2.50S/343.50E OMKT" (center), and "M 50k 2.25S/343.25E OMKT" (bottom) – all images in true scale.*

Iani Chaos in Three Scales: Iani Chaos is a large depression of 180 km length and 200 km width, located at 2.5° south and 342.5° east. Individual blocks of rock and hills form a disrupted, knobby pattern in an apparently "chaotic" distribution – the surface collapsed after cavities had formed beneath it [6]. Due to the hints of water having formed it, such a landscape is of special geologic interest and also well suited to present the design and the potential of the map series. The region was covered in HRSC orbits 912, 923, and 934 with best possible resolutions, i.e. 11.9-12.5 m/pixel in nadir (color channels: 4x4 macropixels). Photogrammetric processing including pan-sharpening of color channels and mosaicking was carried out at DLR [5]. The HRSC DTM provides a spatial resolution of 50 m.

At TU Berlin, a triplet of topographic image maps, a standard product within the regular sheet lines of the series, "M 200k 2.00S/343.00E OMKT", and two derived maps, "M 100k 2.50S/343.50E OMKT" and "M 50k 2.25S/343.25E OMKT", have been generated (Figures 1 & 2). While the maps feature individual designations, all of them are named "Iani Chaos Region".

The principle layout, following the cartographic concepts as described above, appears very similar for all sheets. Within the mapped surfaces, they differ in image resolution (12.5 m/pixel in the orthoimage mosaic translates to 406 dpi, 203 dpi and 102 dpi respectively) and contour lines. The chosen equidistance of 250 m is common for most sheets in scale 1:200,000 produced so far. In larger scales, a more subtle representation of the topography is achieved by denser contour lines, i.e. an equidistance of 50 m for the 1:50,000 sheet. Although few effects of image compression are recognizable in this scale (e.g. at shadowed slopes), in general more texture details of the Martian surface become visible (Figure 2).

Conclusion: While the Topographic Image Map 1:200,000 was already shown to be a useful and guide lining standard [1,4], the presented sheets of Iani Chaos confirm the flexibility of the mapping concept. Scales up to 1:50,000 could be accomplished in combination with high quality HRSC data, which are both acquired under optimum conditions and adeptly processed. With regard to the contour line appearance that directly depends on DTM quality, further refinements, e.g. shape-from-shading [2], could lead to improvements in parts.

References: [1] Albertz J. et al. (2004) *IAPRS*, 35(B4), 869-874. [2] Albertz J. et al. (2005) *PE&RS*, 71(10), 1153-1166. [3] Gehrke S. et al. (2006) *37th LPSC*, #1322. [4] Kirk R.L (2005) *PE&RS*, 71(10), 1111-1126. [5] Scholten F. et al. (2005) *PE&RS*, 71(10), 1143-1152. [6] HRSC Press Release #182 (2005) *www.geoinf.fu-berlin.de/projekte/mars*.