ANOMALOUS DEPRESSIONS ON THE CIRCUM-HELLAS CRATER FLOORS AS SEEN IN THE FIRST YEAR MEX HRSC IMAGES. J. Korteniemi[1] , H. Lahtela[1], J. Raitala[1], G. Neukum[2] and the HRSC Co-Investigator Team, [1]Division of Astronomy, Department of Physical Sciences, P. O. Box 3000, University of Oulu, FI-90014 Finland, (jarmo.korteniemi@oulu.fi), [2]Freie Universität Berlin, Institute for Geosciences, Germany.

Introduction: The surface of Mars is divided into smooth northern lowlands and cratered southern highlands. The cratering record indicates the age of the surface [e.g. 1,2], while the original morphology of individual craters hints to the target material [3]. Furthermore, craters provide a natural basin for later deposits, thus showing glimpses of the regional evolution.

The 2000 km Hellas impact basin dominates about half of the southern hemisphere of Mars. The region has numerous volcanic, tectonic, glacial, fluvial and aeolian features [e.g. 4-6], as well as a multitude of large and small impact craters.

Fresh large (>5 km) Martian craters have typically raised rims, a central peak and/or a peak ring and a generally flat floor with slumping on the inner walls [3,7]. The additional central or summit pits are common features on Martian craters, and generally related to high volatile content of the target material. These features are subsequently modified and smoothened by later geological processes characteristical for the area, e.g. erosion, sedimentation and impact cratering. One type of post-impact modification is the creation of depressions on the crater floor. Such features include pits, large scale fractures and, in some cases, more complex depressions such as honeycomb-like ridges with intervening pits [8]. Continuing our study of these anomalous crater floors [8-10], we map the structures in the Hellas region using the High Resolution Stereo Color (HRSC) [11] images obtained in 2004. HRSC provides multiple channels and improved accuracy (10-60m/pix) compared to the previous data sets with related areal coverage.

Previous Work: The crater floors with depressions have been earlier mapped globally and categorized into three rough groups [9,10] which overlap and, in some cases, are conjoined. Each group is concentrated to certain regions on the planet.

1) Crater-independent collapses. These are caused by large scale regional deformations and are not related to the crater; e.g. grabens and associated features cross-cutting and deforming both crater rims and floors. These are mainly found in tectonic regions such as Claritas and Memnonia Fossae and Tempe Terra.

2) Floor-fractured craters. These exhibit narrow fissures restricted strictly to the crater floor, causing both concentric and radial depressions and a web-like appearance of the floor. This type is usually seen close to the dichotomy boundary, on its southern highland side. Some examples are also seen in the fluvially deformed regions near Valles Marineris. These features are studied in more detail in [12] and may be the result of local volcanic activity made possible by fracturing driven by the impact event [13].

3) Craters with isolated pits; these are generally small (width < 10% of crater diameter) irregular collapse pits found only in parts of the crater floor. The collapses are sometimes crater-concentric but more often exhibit straight parallel walls indicating some sort of tectonic control of the collapse [10]. There are indications [14] that this control is mainly regional and not associated with the crater itself. The pits are most common in craters in the Hellas rim region (with 78 identified crater floors), with a clear concentration (70%) on the W side of the basin. Some individuals are located sporadically around Mars' southern hemisphere. Usually no other deforming features such as grabens or fluvial channels are associated with the pits or the parent craters. Many collapse walls exhibit layering, suggesting sedimentary deposits.

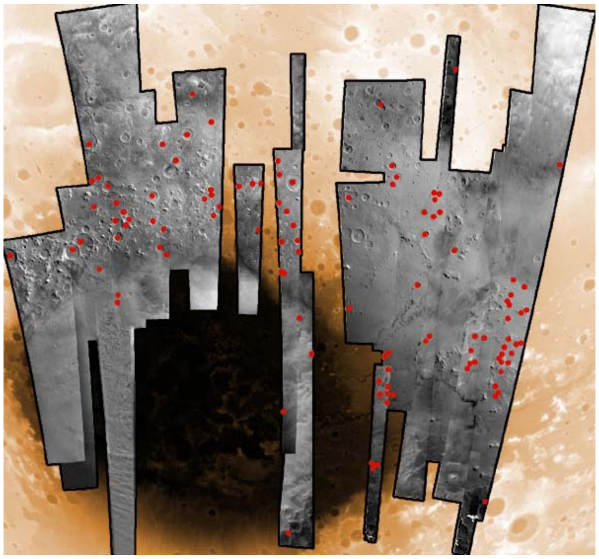

Figure 1. The locations of crater floors with anomalous depressions (red dots) plotted on HRSC nadir mosaic from the Hellas region. MOLA topography background.

HRSC view of the depressions: The HRSC data set includes images only from the N and E rim region of the Hellas basin, with a total covered area of over $4x10^6$ km^2 (Fig. 1). Although we do not see most of the features identified in our earlier study, some very interesting findings were already made:

A) It is evident that many more features are identifiable when using HRSC data. Preliminarily 113 craters were registered, in contrast to the 23 examples found from Viking data in the same area.

B) A new depression type was categorized, i.e. *rugged depression* (Fig. 2) with a characteristically knobby, pitted or etched surface. The pits in question are significantly smaller than in the previously described collapse pits and create vast floor units within the craters. The knobs and other associated features of higher elevation are of different albedo (usually darker) than the pit floors and lower levels. The rugged terrain is often characterized by typical erosion marks, e.g. yardangs. The terrain type is explained by a layered structure on top of the original crater floor. Many craters in the region are associated with fluvial or lacustrine activity [e.g. 15,16] and, therefore, harbor vast amounts of deposits. Subsequently, the friable materials are eroded away, leaving the harder surface in place.

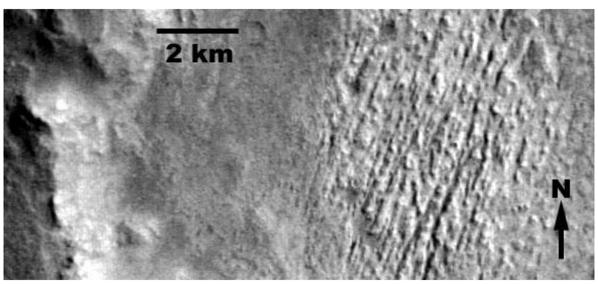

Figure 2. Example of N(E)-S(W) etched "rugged depression" features on a 55 km crater floor from HRSC orbit 506 nadir image. The crater rim is seen on the left side of the image.

C) Type 2 (described above) web-like fissure depressions were identified in the craters on the basin floor (Fig. 3). This indicates that the craters in question were subjected to similar conditions as in the fluvially highly deformed regions east of Tharsis.

Conclusions: The HRSC has greatly improved our ability to see the big picture in Martian geological record. The large images with high resolution provide perfect means to study small scale structures such as the collapses on crater floors. The amount and diversity of collapse and depression features in craters in the Hellas rim region compared to the surrounding highlands indicate major differences in surface processes. Most probably, this relates to a higher rate both in sedimentation and in subsequent erosion around Hellas.

Future Work: We are in the process of analyzing several examples of the depressions, collapses and fractures in the craters around Hellas. They are found in similar areas as possible ancient crater lakes [17], and thus their relation to fluvial and lacustrine processes will also be evaluated. Further work will include statistical analysis of the features, and compare the results to findings in other parts of the globe.

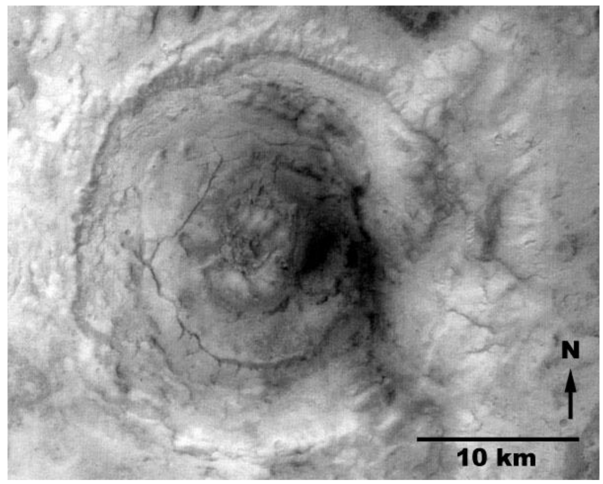

Figure 3. Floor-fractured crater on the Hellas basin floor is seen in the HRSC orbit 047 images.

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