**Galaxias Chaos, Mars: Characteristics from topography, HRSC and THEMIS.** G. B. M. Pedersen[1], E. Hauber[2] and P. Nørnberg[1], [1]Department of Earth Sciences,University of Aarhus, Denmark. [2]German Aerospace Center (DLR). Email: gro.birkefeldt@geo.au.dk

**Introduction:**

Galaxias Chaos is a mosaic of mesas situated on the northern slope of Elysium rise west of Hecates Tholus. Chaotic terrain is characterized by irregular jumbles of angular blocks of various size, many preserving remnants of the upland surface and they might be controlled by linear features [1]. The terrain consists of alcove-like depressions that commonly have a subcircular shape and can be divided into cells [2,3].

Several formation models have been proposed. The close spatial connection between chaotic terrain and outflow channels has resulted in suggestions that chaotic terrains are agents for channel formation. Debris flow mechanisms have been proposed to account for the development of chaos [4,5] while Carr suggested outflow from a confined aquifer resulting in collapse in adjacent areas[6]. Several other hypotheses have suggested removal of a subsurface layer either as a result of dissotiation of carbon dioxide hydrate [6,7], melting of ground ice [1,8] excavation of magma [1] or magma-ice interactions [2].

Here we discuss suggested models of chaos formation with reference to Galaxis Chaos in the light of MOLA , HRSC and THEMIS VIS data.

**Geological Setting and Background**

Galaxias Chaos covers an area of approximately 14000km$^2$ and is bounded to the east by Hecates Tholus and to the west by the Elysium/Utopia flows. Located in the transition zone between Elysium Mons and Utopia Planitia, Galaxias Chaos is emplaced in a region, where enhanced $H_2O$ content has been proposed based on studies of crater ejecta [9] and results from the Mars Odyssey Neutron Spectrometer [10]. Furthermore, Galaxias Chaos is close to the shoreline contact 2, which is the best approximation to an equipotential line of suggested shorelines having a surface elevation of -3760m [11]. Chapmann suggests an ice cover in the same region reaching an elavation of minimum -3753m, based on evidence of table mountains [12], while Russel and Head estimate that -3100m reflects a minmum elevation of subsurface saturated ground based on observations of maximum elevation of lahar and water source fossae in the region of the Elysium/Utopia flows [13].

**Morphology of Galaxias Chaos**

Galaxias Chaos is situated at the foot of a regional topographic minimum and is a complex jigsaw of polygonal blocks varying between 2-15km in size, except a few large, less pronounced blocks which are several tens of kilometers across (figure 1). The blocks are developed at -3.6km to -3.7km height and individual blocks have sizes in the range 100m-200m, reaching a maximum around -3.5km. The topographic characteristics of Galaxias Chaos thereby deviate from other described chaotic regions where the blocks lie 1-2km below the surrounding surface [6, 14], whereas some of the blocks in Galaxias Chaos are higher than the adjacent slope (figure 2). There is a general decrease in block size away from Elysium rise, however the height of the blocks is of the same range.

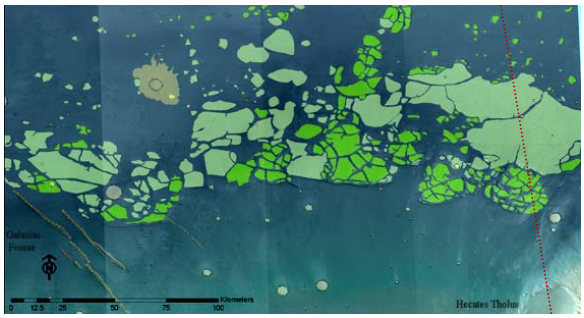


**Figure 1.** Galaxias Chaos region . The figure encompasses the area: 32°3-35°2, 144°3-149°6. The green blocks are well defined, while the light green are more difficult to distinguish. The red line is the MOLA profile ap19875 displayed in figure 2. The background is a HRSC mosaic made of h3299, h1262, h1284, h1295 & h1317 and shaded by MOLA topography.

HRSC and THEMIS VIS reveal a huge morphological diffence between the eastern and western end of Galaxias Chaos. To the east the depressions are well defined displaying block surfaces preserving remnants of the upland surface. The depressions can be divided into subcircular cells with nearly subparallel and suborthogonal incised valleys indicating a structural or tectonic control (figure 3A & 3B). To the west and

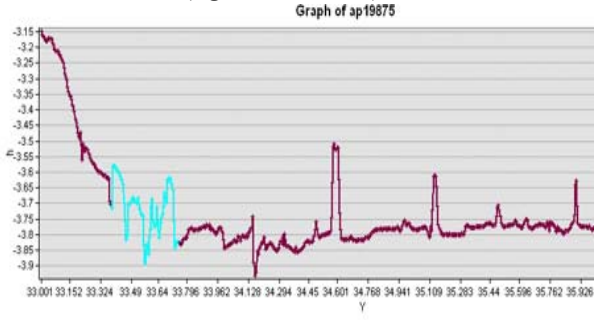


**Figure 2.** Topographic profile (for location see figure 1) . The light blue segment displays the topography in Galaxia Chaos in the area of figure 3A. View. Notice that some of the blocks are higher than the adjacent slope. Section of MOLA profile ap19875.

north the morphology has been modified. Close to Galaxias Fossae a flow-like unit embays and seems to degrade the blocks and other existing landforms (figure 3C). The unit is very characteristic with flow lines, breached folds and distinct craters that are similar to thermally distinct craters and low-relief quasi-circular features described by Morris and Mouginis-Mark [15]. North of Galaxias Chaos irregular jumbles of blocks are widespread on a smooth, weakly, bulging plain with rows of craters (figure 3D). The blocks are modified, and some blocks indicate that slumping has taken place. Impact craters of approximately 5 km diameter develop a characteristic ejecta pattern of breached folds similar to those found close to the flow unit (figure 3E).

**Conclusions and Implications**

Galaxias Chaos reveals a complex geological history which, based on the topographic evidence, seems to deviate from other described chaotic terrains. The fact that some of the blocks are higher than the adjacent slope shows that the formation process must include elevation of the blocks. Formation of Galaxias Chaos by removeal of a subsurface layer alone is not plausible.

The flow unit needs further investigation, but it is striking that both the crater ejecta and the flow unit evolve breached folds. This indicates that heating might have been involved in the process due to the close relationship between the crater and the ejecta pattern with breached folds.

Further studies of THEMIS IR, HRSC DEMs and MOC imagery are required.

**References**

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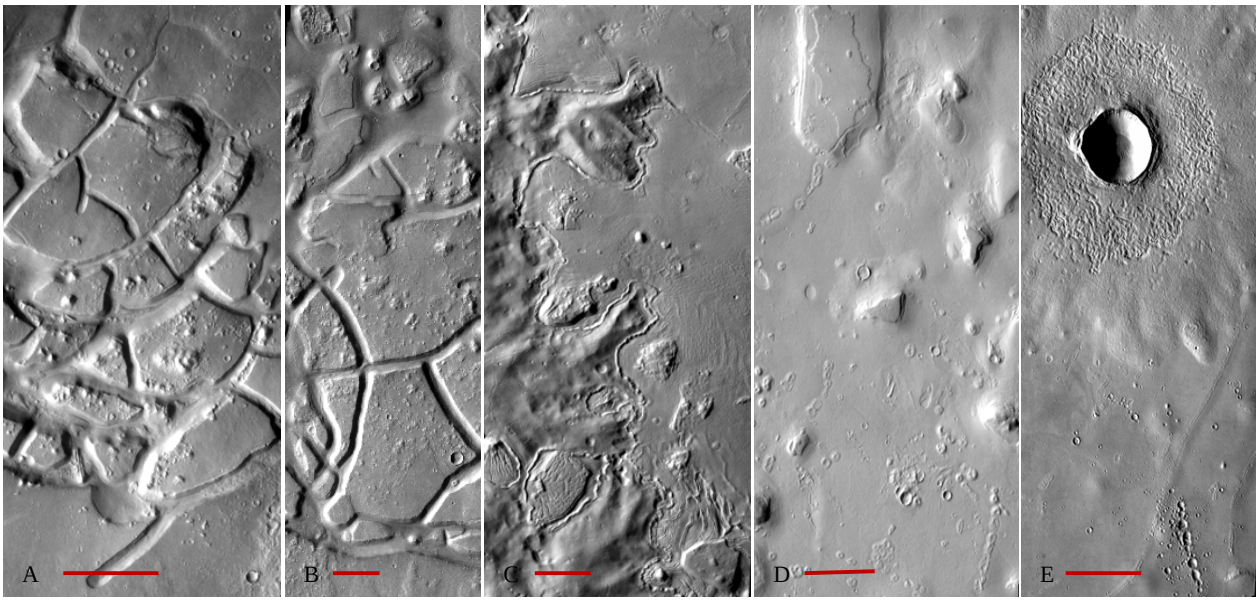


**Figure 3**. Five different sections of THEMIS VIS displaying the variable morphology observed in the region of Galaxias Chaos. The red scalebar is 5 km and north is upwards. A & B) Angular blocks incised by subparallel and suborthogoal valleysthat approximately 1 km wide. Sections of V18255016 and V19528011, respectively. C) Smooth region embayed by a characteristic flow -like unit in the western end of Galaxias Chaos.The two different units are clearly separated by a ridge. Section of V11591005. D) North of Galaxias Chaos blocks are widespread. The plain is regionally covered with crater-like features, which tend be aligned. Section from V11878007. E) The ejecta of an impact crater display a pattern of breached folds close to the crater rim, while the ejecta farther away from it seem to smoother and bulging. To the south, two rows of craters are situated on a ridge with a NE-SW direction. Section from V18280011.