Frost-covered chaos on Mars

November 27 2014

Hellas Chaos, in the southern central part of the giant Hellas basin, stretches roughly 200 km north–south and for about 500 km in an east–west direction. It shows a variety of landforms, from large impact craters containing wind-blown dunes or flat-topped mesas, to ridges and troughs with rough knobs of material protruding from the surface. The region is also dusted with carbon dioxide frost. In the right-hand portion of the image, the curved outlines of large sublimation pits are interspersed with polygonal-patterned terrain. These features are typical of 'periglacial' terrain, and develop as a result of contraction and relaxation during freeze–thaw cycles as the seasons change. The image was acquired by the High Resolution Stereo Camera on ESA's Mars Express on 23 January 2014 during orbit 12 785. The image is centred on 46ºS / 69ºE. The ground resolution is about 18 m per pixel. North is to the right and west is at the top. Credit: ESA/DLR/FU Berlin

Thanks to a break in the dusty 'weather' over the giant Hellas Basin at the

beginning of this year, ESA's Mars Express was able to look down into the seven kilometre-deep basin and onto the frosty surface of Hellas Chaos.

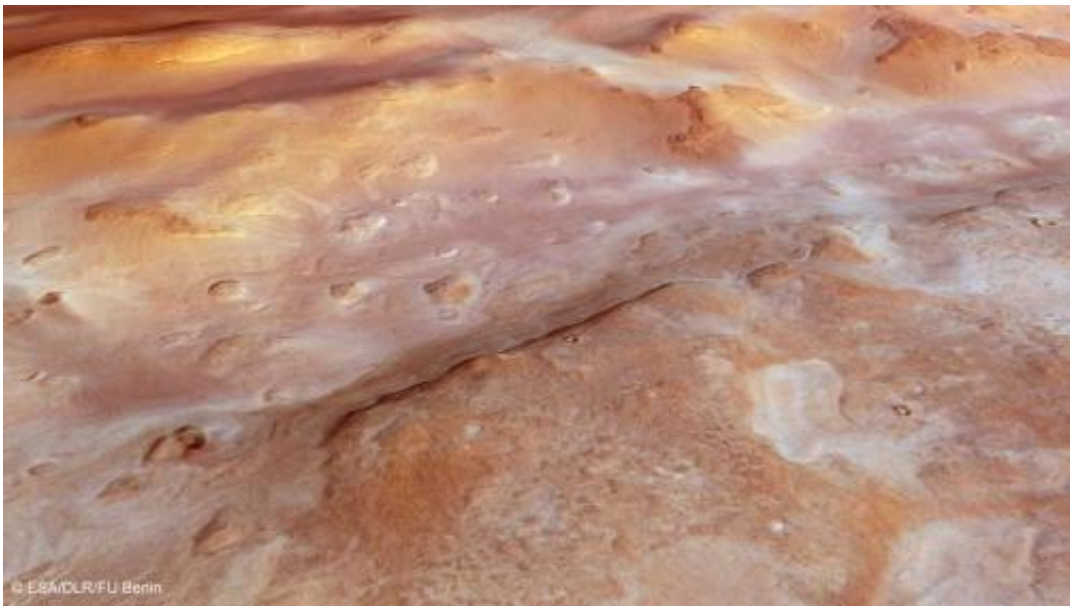
Hellas Basin sits in the southern highlands of Mars and is one of the Solar System's largest impact basins, with a diameter of 2300 km. It is thought to have formed some 3.8–4.1 billion years ago, during the heavy bombardment that subjected all the inner Solar System planets to a heavy rain of asteroids and comets.

Since its formation, Hellas has been sculpted by wind, ice, water and volcanic activity. It is also where most global dust storms on Mars originate.

The region presented here, known as Hellas Chaos, lies in the southern central part of the basin. The high-resolution stereo camera on Mars Express captured it on 23 January.

Much of the scene is dusted with carbon dioxide frost, although in places the underlying surface is exposed. In contrast to the frosty terrain, the ridges running through the centre of the image appear golden, probably from the low Sun angle of around 25°. Flows of sediments are also visible on some portions of their flanks.

Immediately to the north (right) of the ridges, the elevation drops down into a large east–west trough (best seen in the topography map), the floor of which displays many small knobs with a rough surface.



Close-up of a trough-like depression that runs in an east–west direction through Hellas Chaos on the floor of the vast Hellas Basin in the southern hemisphere of Mars. The trough is punctuated with small raised knobs of rough-textured material. This region was imaged by the High Resolution StereoCamera on ESA's Mars Express on 23 January 2014 during orbit 12 785. The main image is centred on 46ºS / 69ºE with a ground resolution of about 18 m per pixel. Credit: ESA/DLR/FU Berlin

To the right again, the curved outline of large sublimation pits can be seen, interspersed with polygonal-patterned terrain. These features develop as a result of the contraction and relaxation during freeze–thaw cycles as the seasons change.

A few distinct impact craters can also be seen in this scene. For example, at the bottom right, one with a layered rim exhibits some dark internal streaks that could be dunes shaped by prevailing winds.

In the top-right corner, a large flat-topped 'mesa' rises from the surface. The flanks of the mesa are covered with dust that seems to flow down

into the surrounding depression. Here, the material is pushed together, presumably from successive flows producing parallel ridges of piled sediment layers.

Smaller craters can also be seen in the right-hand part of the image, some with debris blankets that appear fluidised, indicating the presence of subsurface ice that melted during the impacts that created the craters.

In the left-hand portion of the image, there are also two large, noteworthy features. At the lower left, there appear to be the remains of two overlapping craters, with the eroded rim of the smaller one sitting inside a larger crater. Both display eroded walls and host interesting internal features.

Meanwhile, in the top-left corner of the image, a region of lower elevation is littered by curious ridges and blocks of material that exhibit the same rough textures as the knobs in the central part of the image.

The origin of the Hellas Chaos region in general is widely debated. One idea is that large amounts of sediments were deposited inside the Hellas Basin and later eroded by wind and water.

Another idea suggests that volcanic activity might be the cause. The context map shows extensive lava flows around the 'chaos', perhaps related to the nearby volcano Amphitrites Patera.

Alternatively, floods of lava inside the Hellas Basin, following the formation of the basin itself, could have given rise to the structures seen in this region today.

Provided by European Space Agency