



## Shimmering gold of the Hellas Basin on Mars

27 November 2014

These images, acquired by the High Resolution Stereo Camera (HRSC) on board ESA's Mars Express spacecraft, show a part of the Hellas Planitia impact basin illuminated in warm bronze and golden hues. The camera is operated by the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) and is being used to systematically image the surface of the Red Planet in 3D and in colour for the first time. In orbit around Mars for 10 years, the HRSC has photographed more than 90 percent of the surface.

In the Hellas impact basin, the largest crater structure found on Mars, there are a variety of periglacial landforms – areas marked by frost. The impact basin measures 2200 by 1600 kilometres and, in places, has a depth of over eight kilometres. A thin layer of carbon dioxide frost covers the surface in the right-hand section of the images (numbers 1, 3 and 4). Its pattern is multiangular, pockmarked by the seasonal thawing and freezing of water-containing layers found beneath the surface.

The north-facing slopes in the right of the images (numbers 1, 3 and 4) shimmer with a golden hue – probably caused by the low Sun, which at the time the image was acquired was only about 25 degrees above the horizon. The area covered by the images is seemingly divided into two sections, where the left-hand section appears far smoother than that on the right.

### **Streams of lava and floods of water**

The chaotic area of Hellas Chaos is located in the southern part (on the left in images 1, 3 and 4) of this section in the Hellas impact basin. These regions are known as chaotic as they exhibit an extremely rugged surface, shaped by erosion, in which individual table mountains, boulders and hills produce a haphazard structure of chaotically arranged canyon buttes. Hellas Chaos extends for roughly 200 kilometres along a north-south axis and 500 kilometres from east to west. As yet, it is not known precisely how this terrain was formed.

Scientists suspect that a large quantity of sediment was deposited in the Hellas impact basin, parts of which were then eroded by the wind, and also by the water that once flowed down from the northeast, passing through the Dao and Harmakhis valleys and spilling out into the Hellas Planitia. However, a glance at the topographical survey map (image 5) shows enormous, expansive streams of petrified lava snaking their way around the chaotic region. It is possible they emerged following impact or were produced by an eruption of the Amphitrites Patera volcano situated on the southern border of the Hellas impact basin.

### **A clear view, at last**

Dust in the atmosphere has, on many occasions since the arrival of the Mars Express spacecraft in 2004 and seemingly whenever it crossed the crater, prevented a clear view of the terrain extending across the massive Hellas Planitia impact basin. But the conditions have improved since the start of the year. The mission team has used the consistently good visibility to acquire as many images of this area as possible.

[//www.youtube.com/embed/BHAGvW6kmLE?list=PLEDWnfmz-B8ELMSI4Mg0OLgM3INWomdSP](http://www.youtube.com/embed/BHAGvW6kmLE?list=PLEDWnfmz-B8ELMSI4Mg0OLgM3INWomdSP)

### **The HRSC experiment**

The High Resolution Stereo Camera was developed at DLR and built in collaboration with partners in industry (EADS Astrium, Lewicki Microelectronic GmbH and Jena-Optronik GmbH). The science team, which is headed by principal investigator (PI) Ralf Jaumann, consists of 52 co-investigators from 34 institutions and eleven countries. The camera is operated by the DLR Institute of Planetary Research in Berlin-Adlershof.

### **Image processing**

These HRSC images were acquired at approximately 46 degrees south and 69 degrees east on 23 January 2014 during Mars Express orbit number 12,758. The image resolution is around 18 metres per pixel.

The colour plan view (image 1) was acquired using the nadir channel, which is directed vertically downwards onto the surface of Mars, combined with the colour channels; the oblique perspective view (image 2) was derived using data from the HRSC stereo channels. The anaglyph (image 3), which conveys a three-dimensional impression of the landscape when viewed through red-blue or red-green spectacles, was computed based on data from the nadir channel and one stereo channel. The colour-coded plan view (image 4) is based on a digital terrain model of the region showing the landscape topography.

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### Colour plan view of Hellas Planitia



Many sections of the plan view of southern areas in Hellas Planitia show traces of the six-month winter prevailing across the southern hemisphere of Mars. 'Frost' made of frozen carbon dioxide is found in many depressions and hollows, largely hidden from the Sun. The low-lying Sun bathes the scenery in a golden-orange hue. Copyright note: As a joint undertaking by DLR, ESA and FU Berlin, the Mars Express HRSC images are published under a Creative Commons licence since December 2014: ESA/DLR/FU Berlin, CC BY-SA 3.0 IGO. This licence will also apply to all HRSC images released to date.

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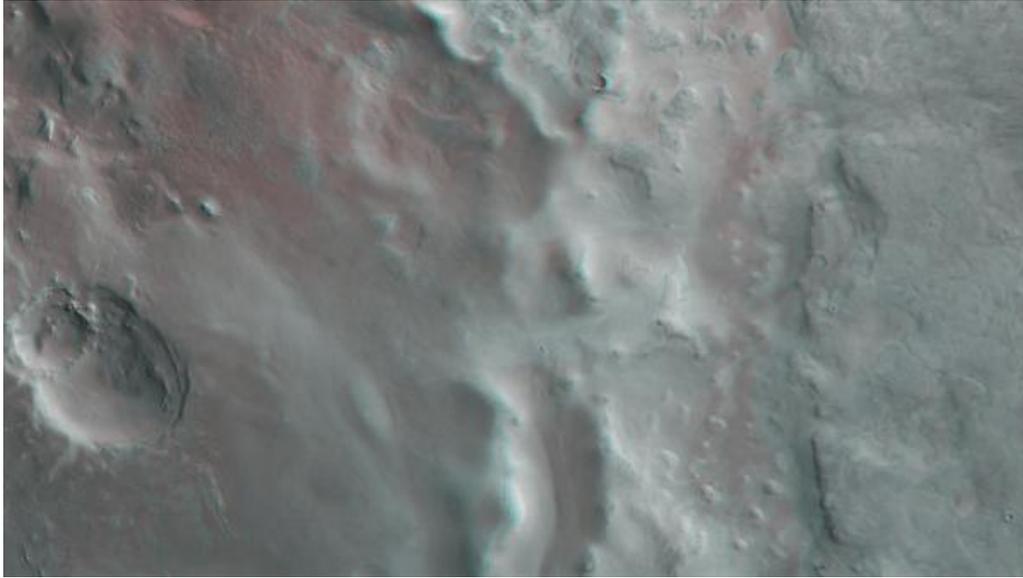
### Perspective view along a valley in Hellas Planitia, extending from north to south



This image shows a variety of landscape forms in the southern section of the Hellas basin; massive quantities of water have hollowed out the valley extending to the mountain ridge located in the foreground of the picture. In many places there are pockets of carbon dioxide frost – traces of winter and the bitterly cold temperatures it brings to the southern hemisphere. Copyright note: As a joint undertaking by DLR, ESA and FU Berlin, the Mars Express HRSC images are published under a Creative Commons licence since December 2014: ESA/DLR/FU Berlin, CC BY-SA 3.0 IGO. This licence will also apply to all HRSC images released to date.

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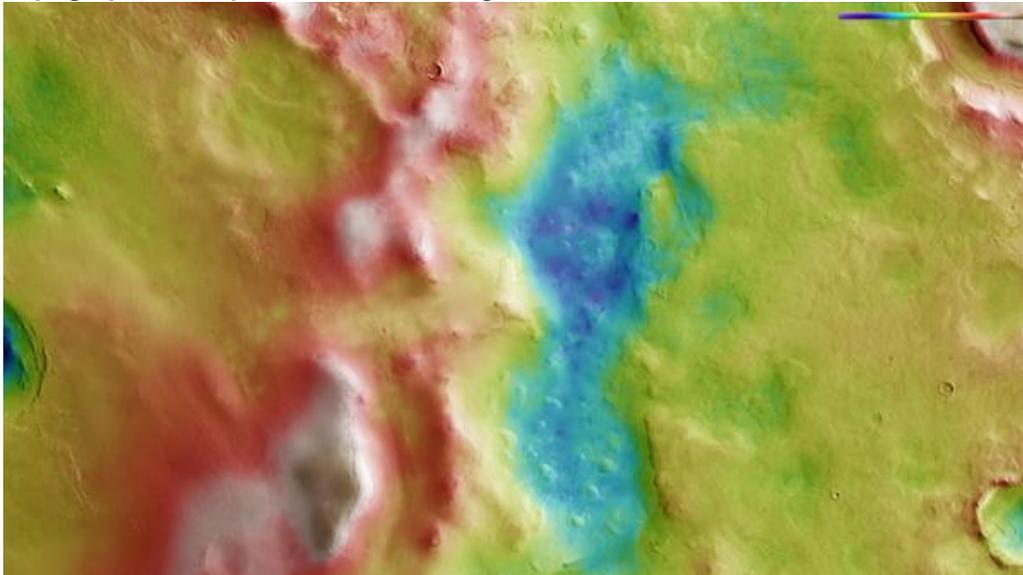
### 3D view (anaglyph) of the southern section in Hellas Planitia



Data from the nadir channel of the DLR-operated High Resolution Stereo Camera (HRSC) and one of the four stereo channels allows the production of anaglyph images, which convey a realistic, three-dimensional impression of the landscape when viewed through red-blue or red-green spectacles. This provides a view of the landscape structures found in Hellas Planitia. Located in the southern reaches (on the left) is the chaotic area of Hellas Chaos, with its rugged landscape shaped by erosion and exhibiting individual table mountains, boulders and hills strewn haphazardly across its surface. Copyright note: As a joint undertaking by DLR, ESA and FU Berlin, the Mars Express HRSC images are published under a Creative Commons licence since December 2014: ESA/DLR/FU Berlin, CC BY-SA 3.0 IGO. This licence will also apply to all HRSC images released to date.

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### Topographical map of the southern regions in Hellas Planitia

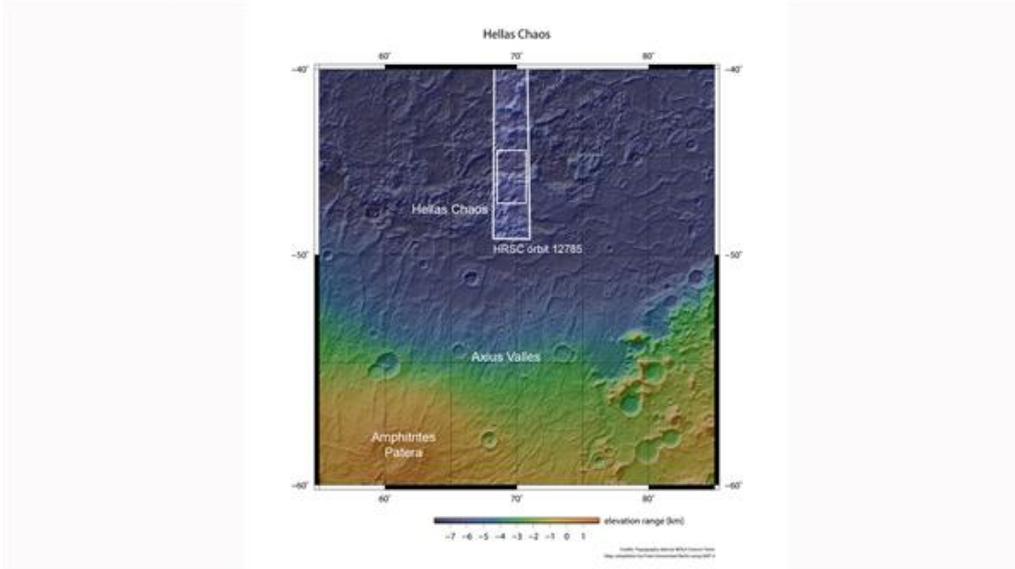


The stereo image data acquired by the High Resolution Stereo Camera (HRSC) can be used to generate digital terrain models showing the elevation relative to an implied reference plane for each point on the surface of Mars. In the south of Hellas Planitia, this procedure clearly shows that over the three and a half billion years that the crater has existed on Mars, erosion and sedimentation processes have produced substantial changes across the original 'plains' (Latin: Planitia) on the interior of the impact structure; more recent, smaller impacts, and also the influence of water and volcanic activity, have carved a new arrangement, creating a landscape profile that differs in elevation by several thousand metres. Copyright note: As a joint undertaking by DLR, ESA and FU Berlin, the Mars Express HRSC images are published under

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### Overview map of the southern section of Hellas Planitia



Hellas Planitia is the largest impact basin on Mars. Its depth of over eight kilometres frequently creates atmospheric conditions that place substantial restrictions on images acquired from Mars orbit. However, in January 2014, the DLR-operated High Resolution Stereo Camera (HRSC) – part of the ESA Mars Express mission – succeeded in capturing unclouded shots of this region, situated at around 48 degrees south.

Credit: NASA/JPL/MOLA; FU Berlin.

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