Lava flows at the foot of Mistretta Crater

06 March 2014

These images, acquired by the High Resolution Stereo Camera (HRSC), operated by the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) on board the European Mars Express spacecraft, show the extent to which volcanism has shaped the surface of Mars. Mistretta Crater and the surrounding highland plateau of Daedalia Planum were flooded by lava flows originating from Arsia Mons – a volcano almost 18 kilometres high, 900 kilometres to the northwest.

The lava flows that covered the region – flood basalts – are a very low viscosity type of volcanic rock that can spread out over wide areas. The HRSC images show flood basalts that advanced into the region of Mistretta Crater during two different eruption phases. First, they formed a very smooth surface, visible on the left side of images 1, 3 and 4. Erosion and the deposition of sand and dust by the wind have smoothed out most of the irregularities. Later, tectonic stresses gave rise to numerous grabens.

On the right side of the images, an extensive, younger lava flow can be seen that advanced into the area following the period of tectonic change. The surface of this solidified lava flow has a somewhat flatter structure and is covered by a rough, wrinkled pattern. The flow front of the lava flow is especially striking; it can be seen particularly well in the false colour topographical image map (image 3).

Several wrinkle ridges can be seen running parallel to the edges of the lava flow. Such structures are caused by lava flowing at different speeds – it has cooled more at the edges and so is flowing significantly more slowly there than in the centre of the lava flow. The elevated region surrounding Mistretta Crater also forms a natural obstruction. The lava has flowed around this and, in some places, even 'surged' and piled up as a result. This can be seen particularly well in the centre of the images, on the western edge, and in the north of the Mistretta area.

Image processing

The images were acquired by the High Resolution Stereo Camera (HRSC) on 28 November 2013, during Mars Express Orbit 12,593. The image resolution is about 14 metres per pixel. The images show an area around Mistretta Crater, which is located in the boundary region between Claritas Fossae and Daedalia Planum. The colour image (image 1) was acquired using the nadir channel of the HRSC, which is directed vertically down onto the surface of Mars; the perspective oblique view (image 2) was computed from the HRSC stereo channels. The anaglyph image (image 4), which creates a three-dimensional impression of the landscape when viewed with red/blue or red/green glasses, was derived from the nadir channel and one stereo channel. The false colour plan view (image 3) is based on a digital terrain model of the region, from which the topography of the landscape can be derived.

The HRSC experiment on the Mars Express mission

The High Resolution Stereo Camera was developed at the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; 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 over 40 co-investigators from 33 institutions and 10 countries. The camera is operated by the DLR Institute of Planetary Research in Berlin-Adlershof. The images presented here were created by the Planetary Sciences Group at the Freie Universität Berlin.

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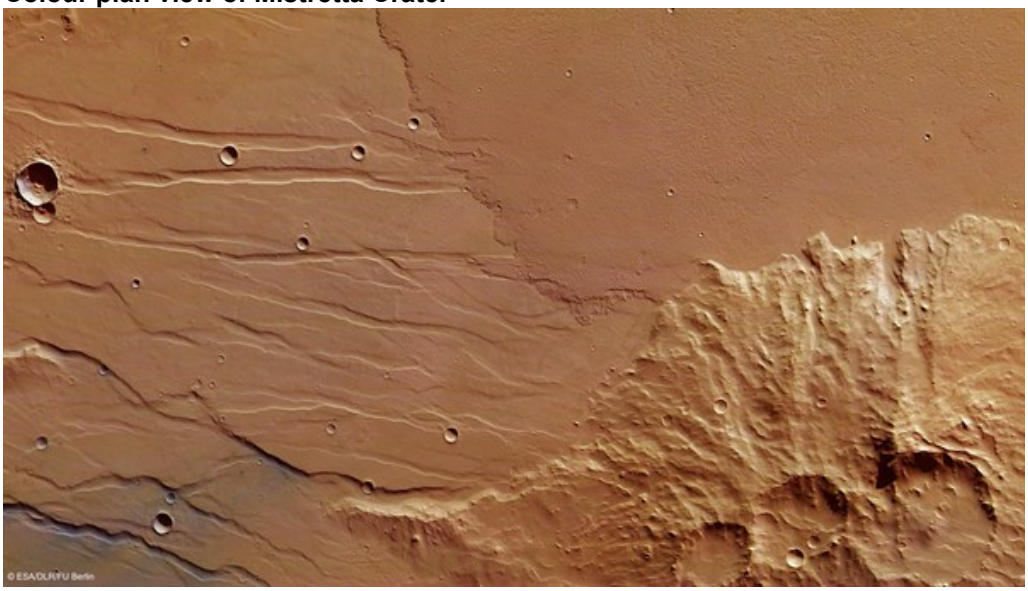
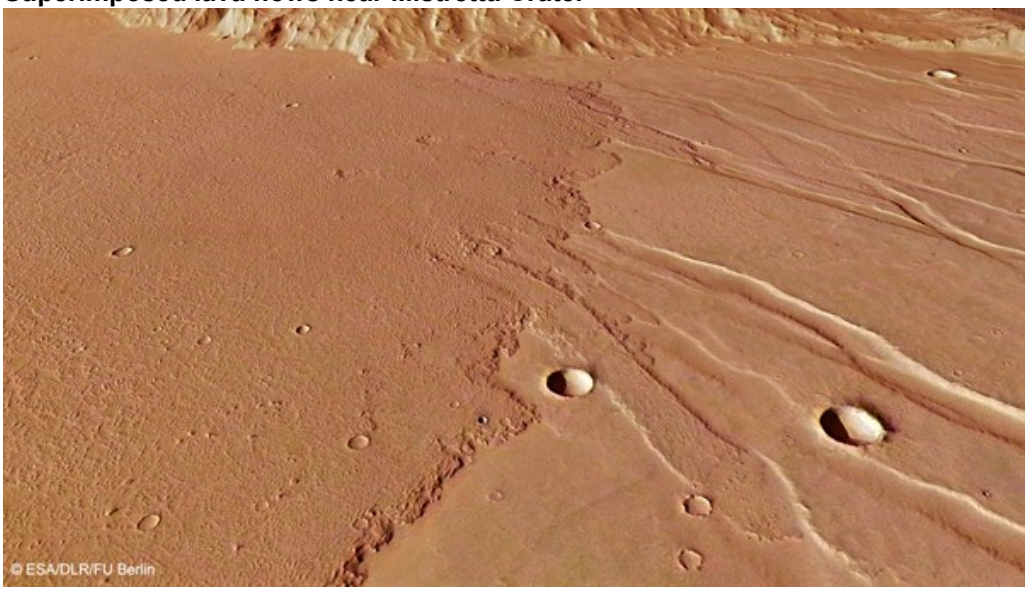
Colour plan view of Mistretta Crater



Mistretta Crater and the highland plateau of Daedalia Planum that surrounds it were flooded by lava flows originating from the volcano Arsia Mons on two separate occasions. The image was acquired by the High Resolution Stereo Camera (HRSC) on 28 November 2013, during Mars Express Orbit 12,593. The image resolution is about 14 metres per pixel. The images show an area around Mistretta Crater, which is located in the boundary region between Claritas Fossae and Daedalia Planum. 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.

Credit: ESA/DLR/FU Berlin, CC BY-SA 3.0 IGO.

Superimposed lava flows near Mistretta Crater



Stereo images from the High Resolution Stereo Camera operated by DLR on Mars Express can be used to show the landscape from various angles. In this image, two different, ancient lava flows can be seen. 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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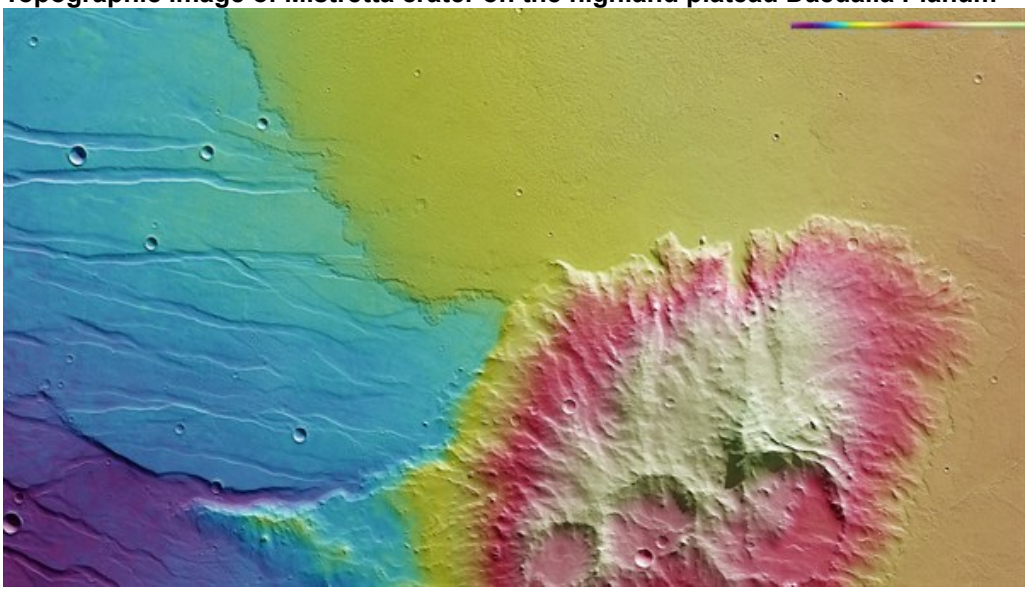
Topographic image of Mistretta crater on the highland plateau Daedalia Planum



Topographical terrain models can be computed using stereo image data from the HSRC camera system, which is operated by DLR. In the absence of 'sea level', the elevation data is referenced to an areoid – a modelled equipotential surface on which everything experiences the same gravitational attraction towards the centre of the planet. Mistretta Crater and the highland plateau of Daedalia Planum that surrounds it were flooded by lava flows on two separate occasions. In this false colour image (elevation key at top right), the flow front of the younger lava flow (light green) is strikingly distinct. 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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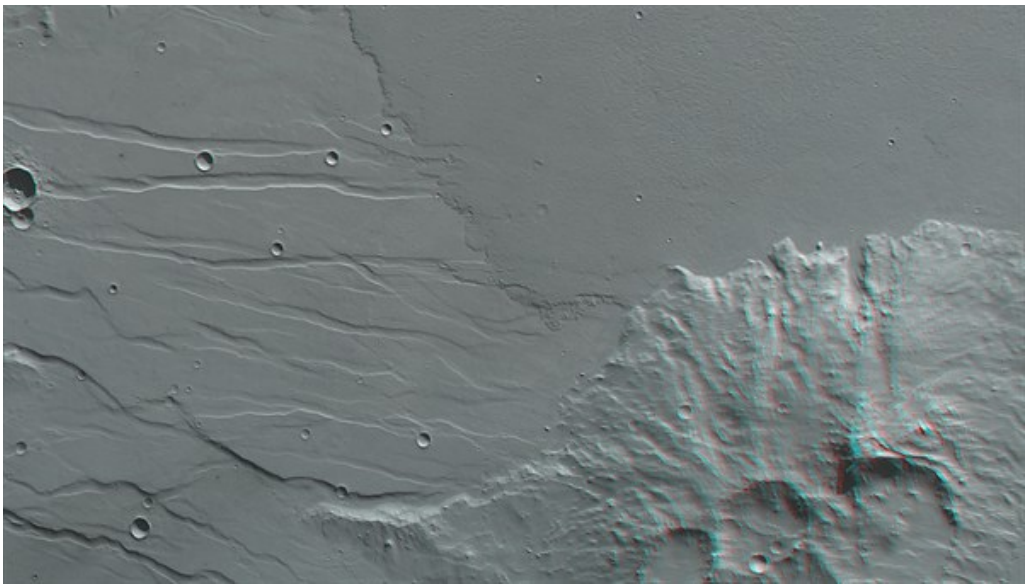
3D view of Mistretta Crater and solidified lava flows



The nadir channel, which is directed vertically down onto the surface of Mars, and one of the four stereo channels in the DLR-operated HRSC camera system, can be used to create anaglyph images, which produce a realistic, three-dimensional view of the landscape when viewed with red/blue or red/green glasses. 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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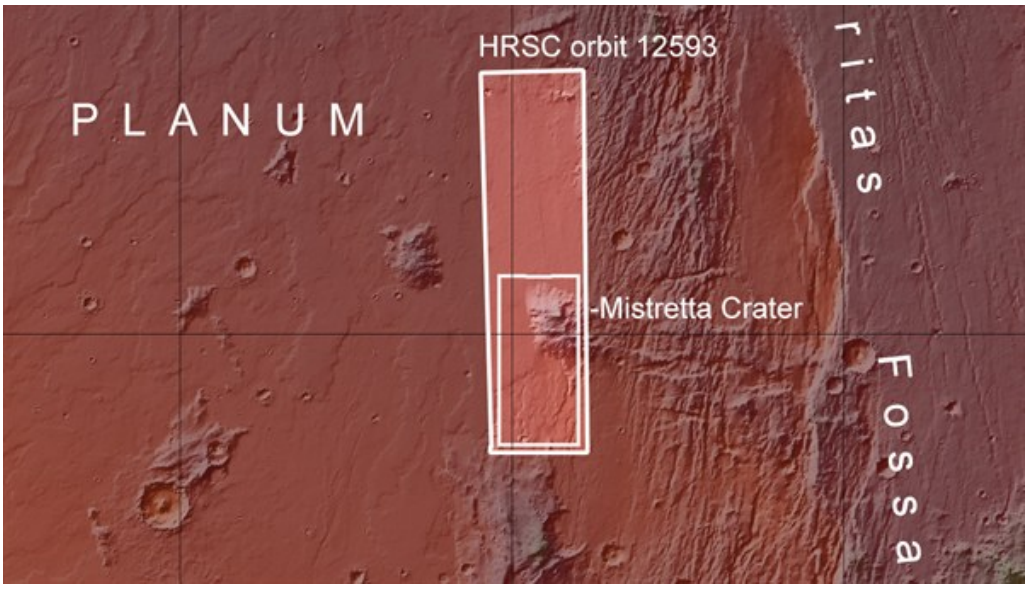
Topographic context map of the border area between Claritas Fossae and Daedalia Planum with Mistretta Crater



This topographic map shows the border area between Claritas Fossae and Daedalia Planum on Mars, where Mistretta Crater is located. The images presented in in this article are located in the small, inner rectangle within the lower third of the strip imaged by the High Resolution Stereo Camera (HRSC) on 28 November 2013.

Credit: NASA/JPL/MOLA; FU Berlin.

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