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## The broken surface of Mars at Claritas Fossae

*13 February 2014*

Recent images acquired with the High Resolution Stereo Camera (HRSC), operated by the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) on board the European Space Agency Mars Express spacecraft, show a portion of the Claritas Rupes escarpment on Mars that surrounds the Claritas Fossae graben system. It forms the eastern boundary of the gigantic Tharsis volcanic region, where the biggest volcanoes on Mars – including Olympus Mons – are located.

The numerous fractures and faults running through the region were formed by stress in the Martian crust during the formation of the Tharsis Bulge, which is up to 10 kilometres high. The effusion of vast amounts of volcanic material onto the surface has caused entire blocks of the Martian crust to slide into the newly created gaps, resulting in a distinctive landscape with conspicuous 'terracing' known to the geologist as horsts and grabens. Similar processes on Earth have given rise to rifts such as the Upper Rhine Valley between Basel and Karlsruhe or the Eger Graben in the Czech Republic.

To the right in the image is a bright hill that appears to be made of relatively soft, easily erodible material. This can also be seen on the escarpment to the right in the lower half of images 1 and 2. This material might contain phyllosilicates (sheet silicates) – clay minerals rich in iron and aluminium and that only occur as a result of the long-term effects of water on volcanic rock. This is supported by observations using the CRISM instrument on board NASA's Mars Reconnaissance Orbiter, which has been investigating bright material nearby.

### **Image processing**

The images were acquired by HRSC on 30 November 2013, during Mars Express Orbit 12,600. The image resolution is about 14 metres per pixel. The images show a section at 27 degrees south and 254 degrees east.

These image products were created by the Planetary Sciences Group at Freie Universität Berlin. The colour image (image 1) was acquired using the nadir channel of 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 3), 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 colour coded aerial view (image 5) 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.

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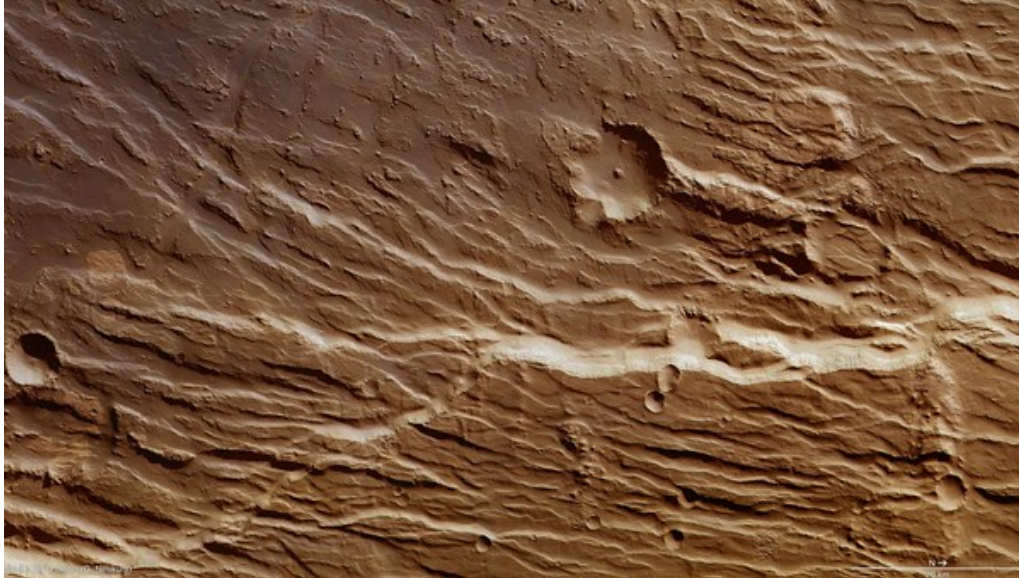
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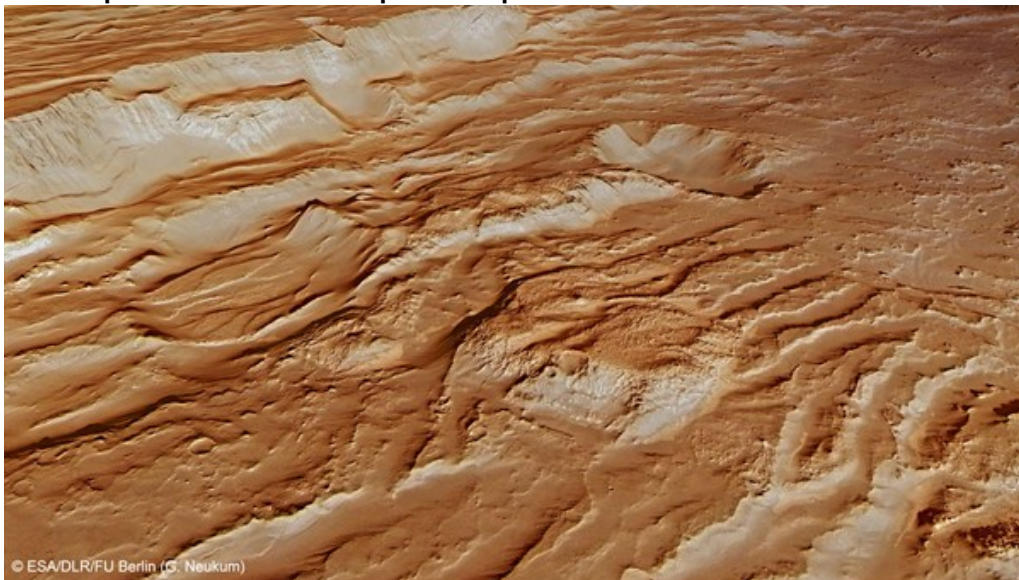
### Part of the Claritas Rupes escarpment on Mars



The Claritas Rupes escarpment on Mars surrounds the Claritas Fossae graben system, which forms the eastern boundary of the gigantic Tharsis volcanic region. This is where the majority of volcanoes on Mars are located, including Olympus Mons. It is believed that the numerous fractures and faults running through the region were formed by stress in the Martian crust during the formation of the Tharsis Bulge, which is up to 10 kilometres high. The images were acquired by the High Resolution Stereo Camera (HRSC) on 30 November 2013, during Mars Express Orbit 12,600. The image resolution is about 14 metres per pixel. The images show a section at 27 degrees south and 254 degrees east. 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.

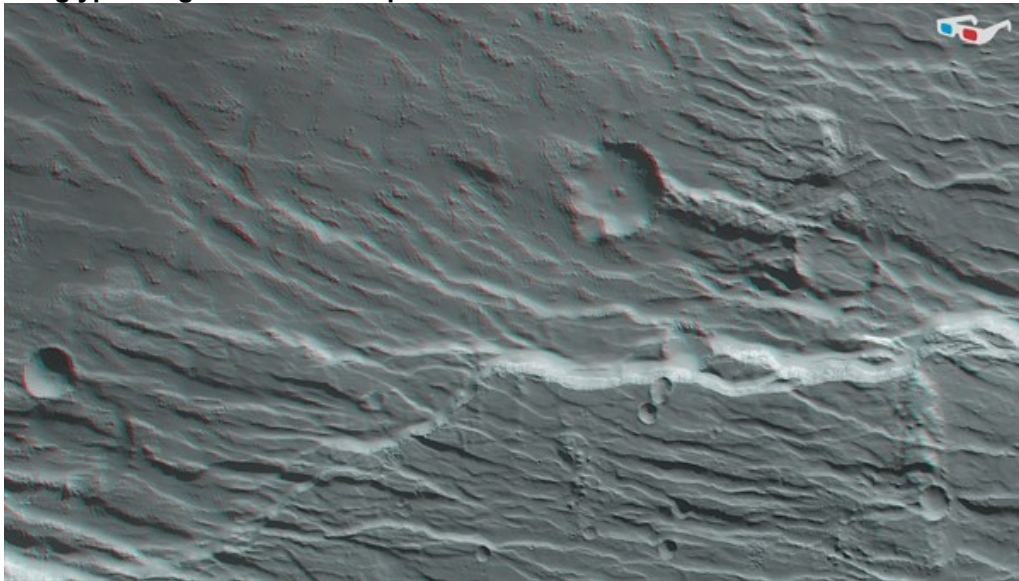
Credit: ESA/DLR/FU Berlin, CC BY-SA 3.0 IGO.

### View of part of the Claritas Rupes escarpment



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, bright material can be seen on the scarp, which probably contains phyllosilicates (sheet silicates). These are clay minerals rich in iron and aluminium and that only occur as a result of the long-term effects of water on volcanic rock. 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.

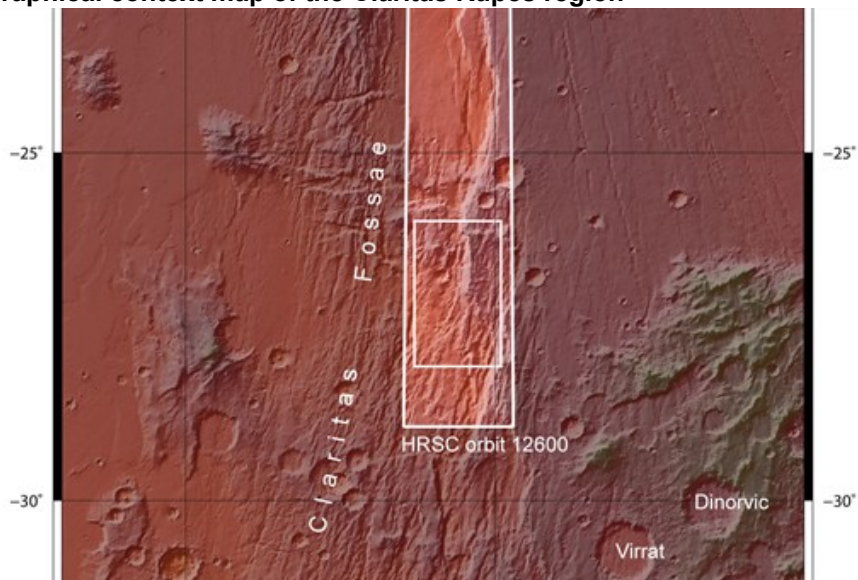
### Anaglyph image of Claritas Rupes



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. The massive, steep Claritas Rupes escarpment looks particularly impressive in 3D. 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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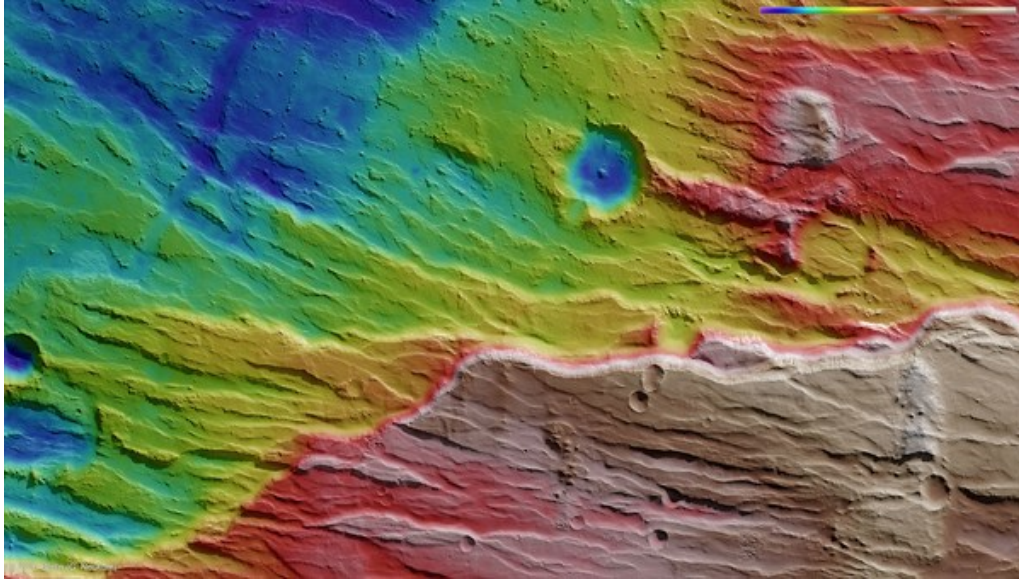
### Topographical context map of the Claritas Rupes region



The topographical outline map shows a portion of the Claritas Rupes escarpment on Mars that surrounds the Claritas Fossae graben system. It forms the eastern boundary of the gigantic Tharsis volcanic region, where the biggest volcanoes on Mars – including Olympus Mons are located. The images in this article are located in the rectangular section in the lower third of the HRSC image strip.

Credit: NASA/JPL/MOLA; FU Berlin.

## Topographical image of Claritas Rupes



Topographical terrain models are computed using stereo image data from the HRSC 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. The impressive Claritas Rupes escarpment can be seen in this false colour image (image key at upper right). 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. 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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