Beauty from catastrophe – Osuga Valles on Mars

25 April 2014

With its gently curving channels and teardrop-shaped islands, it is easy to forget that highly destructive events gave rise to the attractive landscape of Osuga Valles on Mars. Multiple gigantic flood events formed this dendritic network of floodwater valleys. The images shown here, acquired by the High Resolution Stereo Camera (HRSC), operated by the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) and carried on board ESA's Mars Express spacecraft, show the central part of the Osuga Valles outflow channel.

At 164 kilometres in length, the valley is relatively short, but its width (up to 20 kilometres) and depth (up to 900 metres) suggest that massive, catastrophic floods occurred here. The strongly erosive force of the water flowing through has left behind distinctive landscape features: teardrop-shaped islands that the floodwaters streamed around, flow patterns on the valley floor in the form of rilles, and terraces along the valley walls and streamlined islands. The rilles on the valley floor give an indication of the high flow rate of the water; streamlines encircle the islands, proving that the water flowed towards the northeast (lower right in images 1, 3 and 4). Elevation differences in the valley floor and intersecting/overlapping valleys indicate that a number of separate flooding events took place.

Did a lake once exist at the end of the valley?

Osuga Valles lies around 170 kilometres to the south of Eos Chasma, which is at the eastern end of the vast Valles Marineris canyon system. Osuga Valles arose in a chaotic region that stretches into the Eos valley at the outlet of the Valles Marineris. The water that carved out Osuga Valles is thought to have drained away in another chaotic region, which can be seen in the lower section of images 1, 3 and 4. It is possible that the mass of water in this large region, which is up to 2.5 kilometres deep, formed a lake that existed there for an extended period of time.

Image processing

The images were acquired by the High Resolution Stereo Camera (HRSC) on 7 December 2013, during Mars Express orbit 12,624. The resolution is about 17 metres per pixel. They show the central region of the outflow channel in an area south of Eos Chasma. The colour plan view (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 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 false colour plan view (image 4) 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 Osuga Valles

View of the central part of Osuga Valles on Mars. The valley is relatively short at 164 kilometres long, but its width (up to 20 kilometres) and depth (up to 900 metres) suggest that massive, catastrophic floods have occurred here. The strongly erosive force of the water flowing through has left behind typical landscape features: teardrop-shaped islands that the floodwaters streamed around, flow patterns on the valley floor in the form of rilles, and terraces along the valley walls and streamlined islands. The rilles on the valley floor give an indication of the high flow rate of the water; streamlines encircle the islands, proving that the water flowed towards the northeast (lower right). Elevation differences in the valley floor and intersecting/overlapping valleys indicate that a number of separate flooding events took place. The High Resolution Stereo Camera (HRSC) acquired this image on 7 December 2013, during Mars Express orbit 12,624. The resolution is about 17 metres per pixel. 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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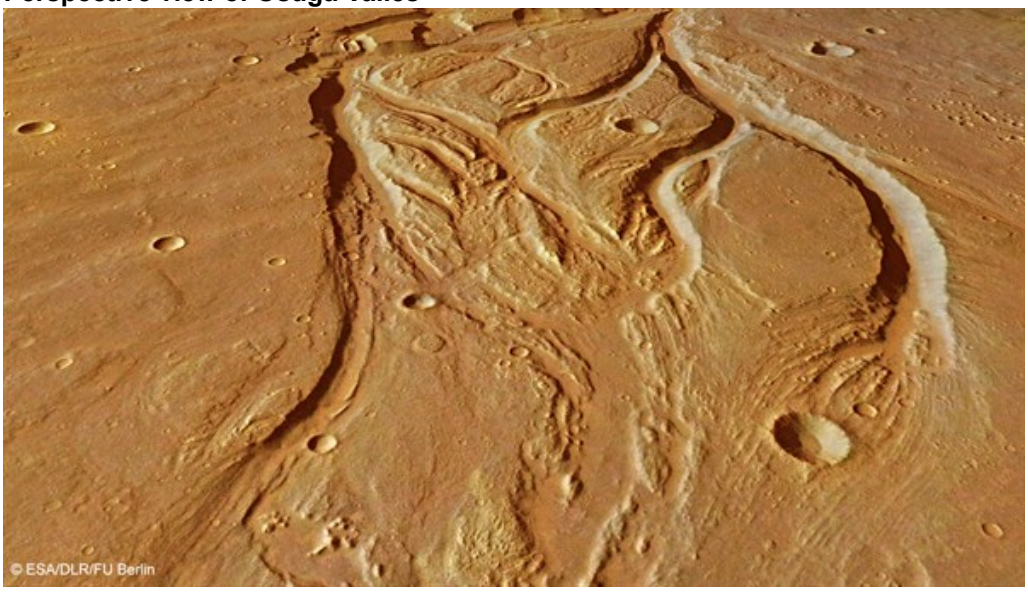
Perspective view of Osuga Valles



Stereo images from the High Resolution Stereo Camera operated by DLR on the Mars Express spacecraft can be used to show the landscape from various angles. This image shows Osuga Valles, which was created by several large flooding events. The image data was acquired on 7 December 2013, during Mars Express orbit 12,624. The resolution is about 17 metres per pixel. Copyright note: As a joint undertaking by DLR, ESA and FU Berlin, the Mars Express HRSC

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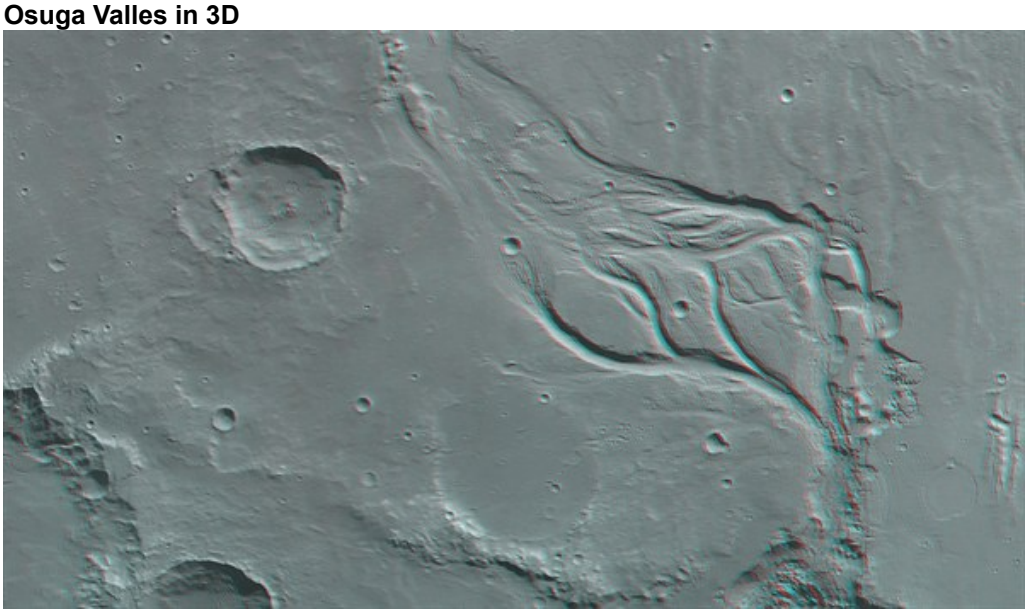
Osuga Valles in 3D



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 image data was acquired on 7 December 2013, during Mars Express orbit 12,624. The resolution is about 17 metres per pixel. 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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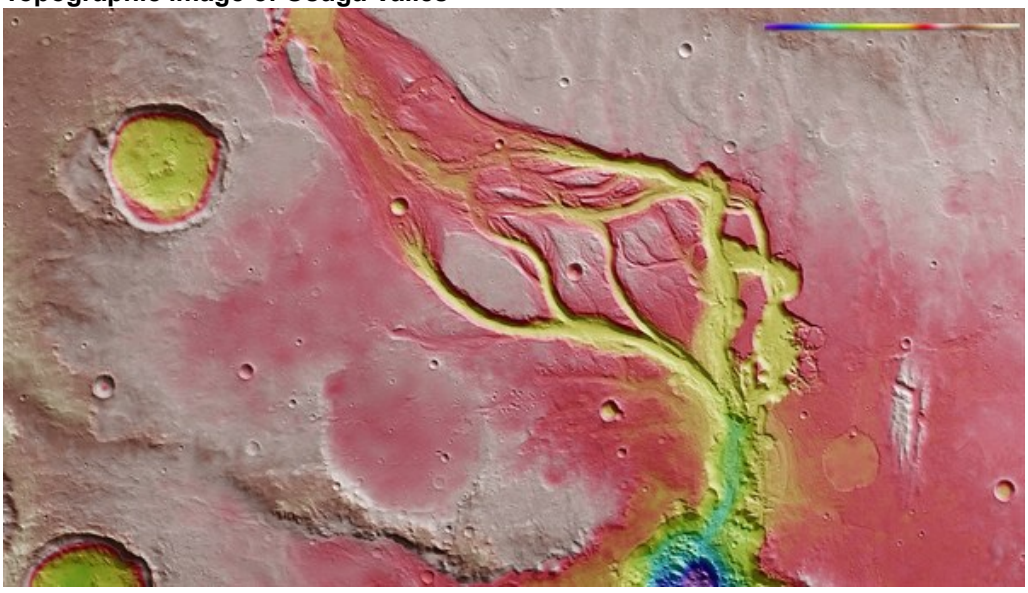
Topographic image of Osuga Valles



Topographical terrain models with an elevation accuracy of 10 to 20 metres can be computed using stereo image data from the HSRC camera system operated by DLR on board Mars Express. 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 grey and red areas are highest; the dark blue and purple coloured areas are the lowest. The image data was acquired on 7 December 2013, during Mars Express orbit 12,624. The resolution is about 17 metres per pixel. Copyright note:

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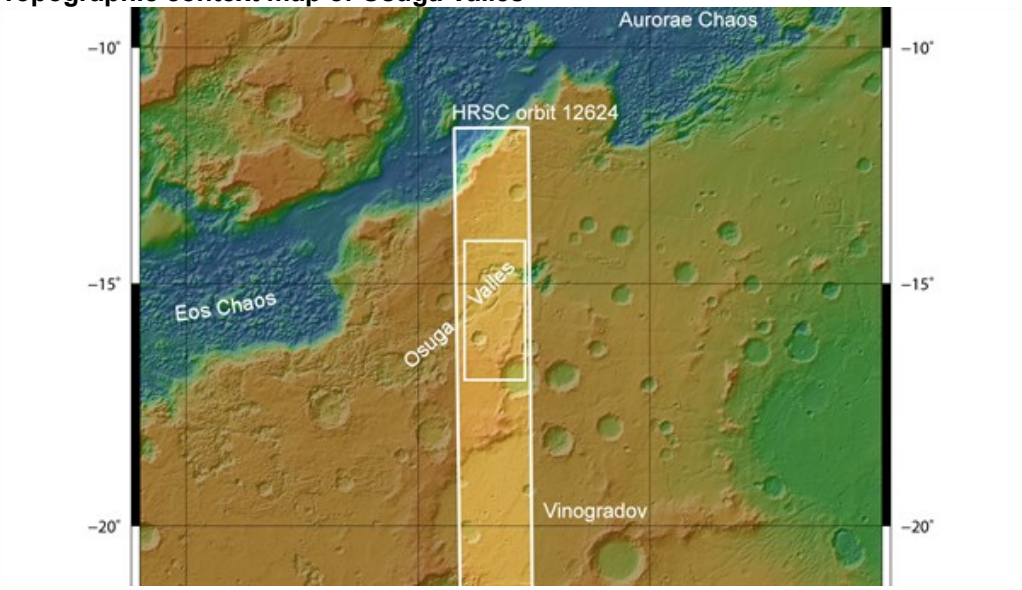
Topographic context map of Osuga Valles



This topographic map shows the Osuga outflow valley on Mars. Osuga Valles, named after a Russian river, is located around 170 kilometres to the south of Eos Chasma, which is at the eastern end of the vast Valles Marineris canyon system. The images presented in in this article are located in the small, inner rectangle within the strip imaged by the High Resolution Stereo Camera (HRSC) on 7 December 2013.

Credit: NASA/JPL/MOLA; FU Berlin.

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