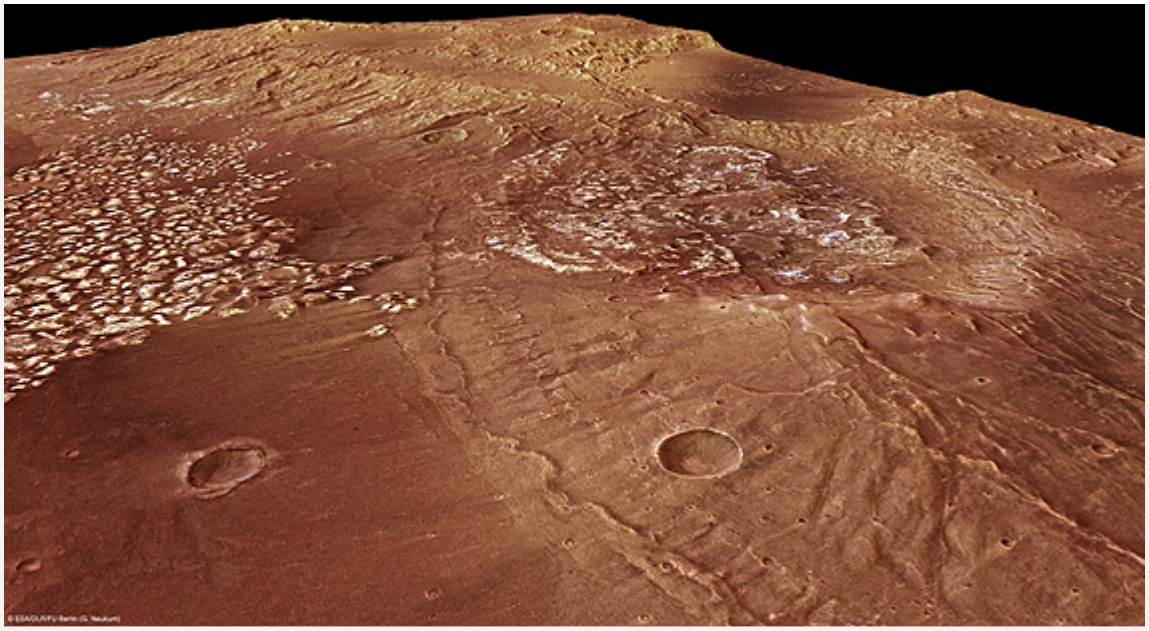
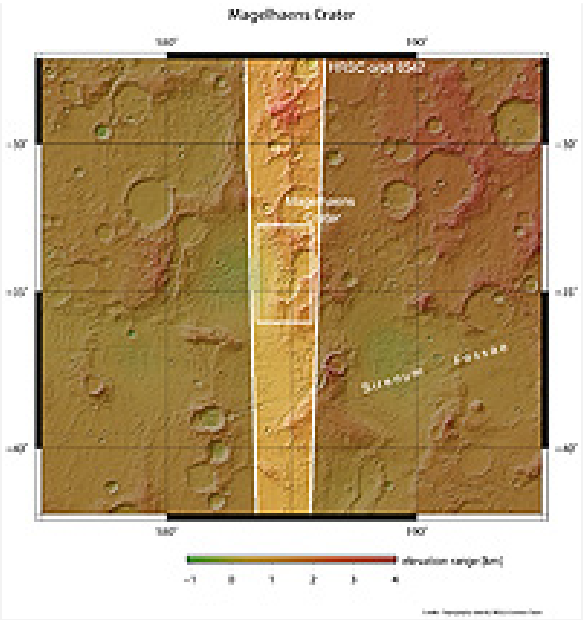
News Archive 2010

Seven years of Mars Express – unusual structures at Magellan Crater

28 June 2010



View from southwest to northeast across the region at the northern edge of Magellan Crater

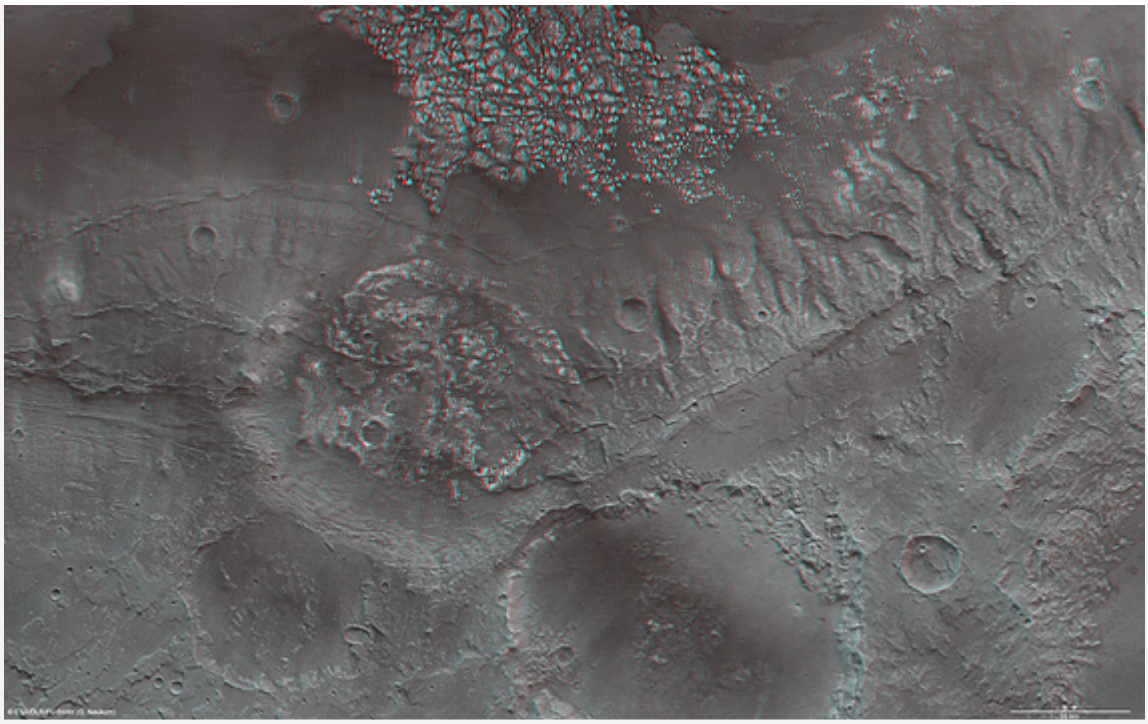


Magellan crater in context

In the southwest of the Tharsis volcanic region on Mars is the large impact crater Magellan, named after the Portuguese explorer Ferdinand Magellan (1480-1521). The High Resolution Stereo Camera (HRSC), carried by ESA's Mars Express orbiter and operated by the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR), acquired images of unusual structures on the southern edge of the crater. The process by which these structures developed is not fully understood.

216 GB of raw image data from HRSC to date

The European Space Agency (ESA) Mars Express mission began seven years ago, on 2 June 2003, with the liftoff of a Soyuz launcher from Kazakhstan's Baikonur Cosmodrome. Originally, ESA planned its first mission to another planet to last for one martian year, or two Earth years. Because of its enormous scientific yield, ESA has extended the Mars Express mission three times, with the most recent extension lasting until the end of 2012.



Magellan Crater in three dimensions

Six and a half months after its launch, Mars Express reached its destination and was placed in orbit around the Red Planet, as planned, on 25 December 2003. One of the seven experiments on board is HRSC, which was developed at the DLR facilities in Oberpfaffenhofen and Berlin-Adlershof and built in partnership with German industry. Since its arrival, the orbiter has circled Mars about 8300 times and HRSC has been working flawlessly since the 16 January 2004. It has acquired a total of 216 gigabytes of raw image data, which has been converted by data processing at the DLR Institute of Planetary Research into multiple terabytes of topographic images.

By 2012 – a map of Mars at high resolution, in colour and in 3D

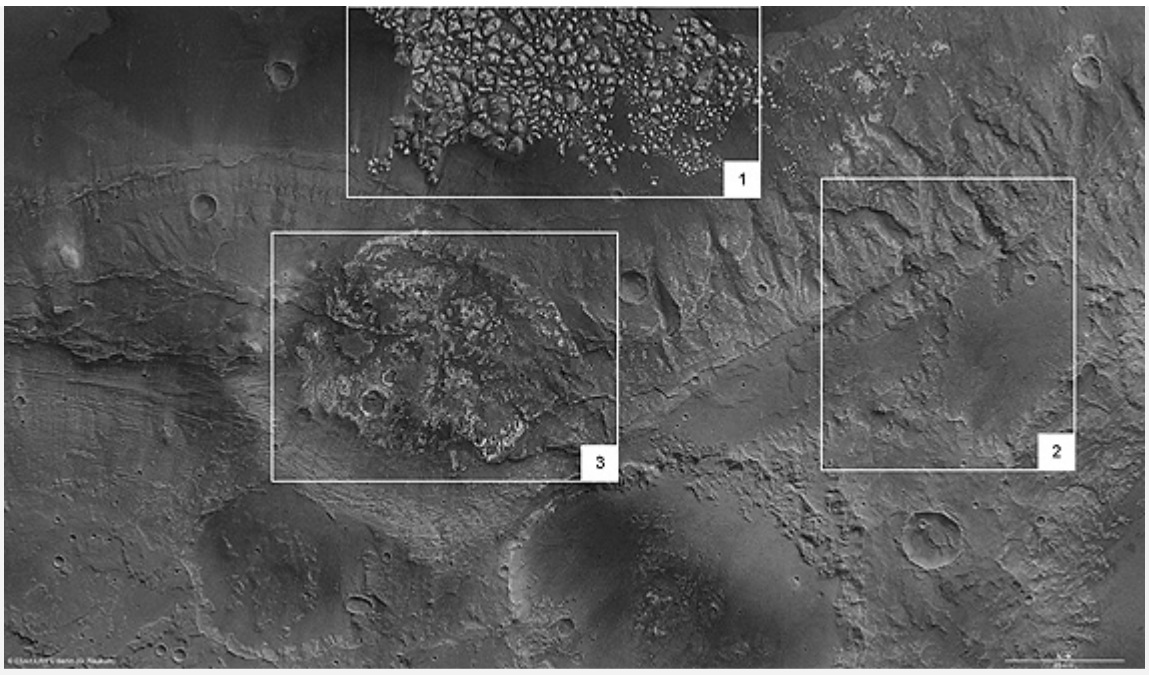
View of the region at the northern edge of Magellan Crater from vertically overhead

The objective of the HRSC, with Professor Gerhard Neukum of the Free University of Berlin as the Principal Investigator and in which several DLR scientists are involved, is the mapping of Mars. By the end of the mission, the stereo camera will have imaged almost the entire Martian surface – about 150 million square kilometres – allowing the generation of high-resolution topographic maps in colour. At the time of writing, about two-thirds of this has been accomplished.

The scene shown here, from the northern edge of the Magellan Crater, was acquired from an altitude of 500 kilometres on 6 February 2009 during orbit 6547 and has a resolution of about 25 metres per pixel. The images show an area at 34°S and 185°E. Measuring about 190 kilometres by 112 kilometres, the area shown covers about 21,280 square kilometres, which is about the size of Slovenia.

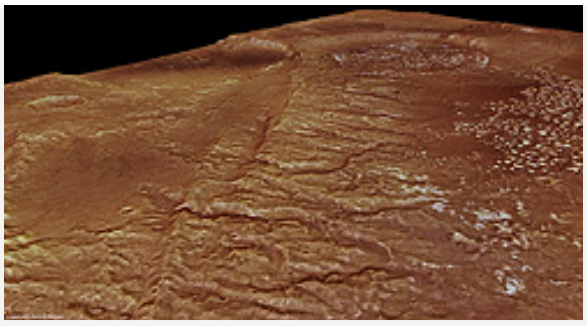
Sign of subrosion and tectonic stresses in the martian crust

In the west of the area (on the upper edge of the topmost image – north is to the right) conspicuous, irregularly shaped light-coloured blocks are visible. These features are up to two kilometres in size and are probably large rock fragments or mounds of rock. However, the mechanism by which they were formed is still being debated. One possibility is that the top layer of rock was shattered by the shockwaves from an impact.



Features in the region at the northern edge of Magellan Crater

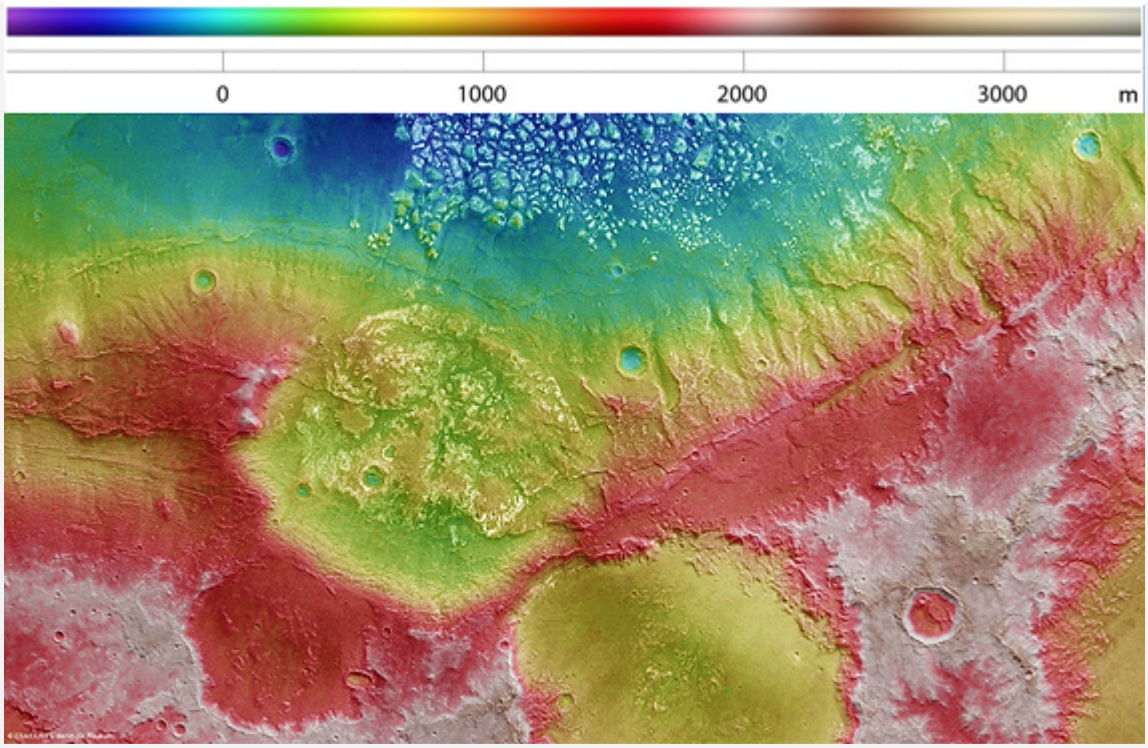
Another possible explanation would be a process known as subrosion, where material is removed from layers beneath the surface. On Mars, subrosion is widely observed when rising magma heats frozen ground water, which melts and removes subsurface material as it flows away. This leads to a honeycomb of cavities that eventually collapse due to the weight of the overlying rock layers, leaving the irregular mounds standing. The bright surface is probably due to the fact that wind has removed the overlying dust and sand and exposed the bare rock surface.



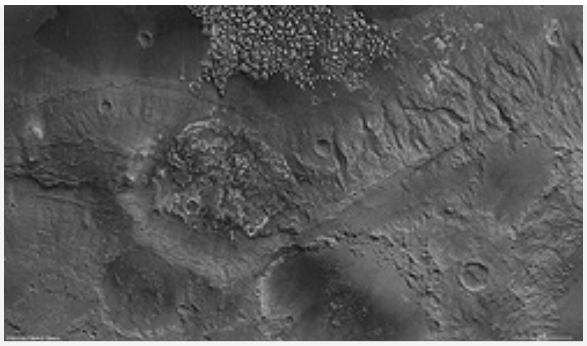
Perspective view from northwest to southeast across the region at the northern edge of Magellan Crater

The northern part of the region (to the right) displays linear features with a preferential northwest–southeast orientation. These eventually lead to deep, well-defined valleys and are likely to be faults, formed during either an impact event or the upsurge of the Tharsis region, which created enormous stresses in the planet's crust. Examining the geometry of fault zones offers clues to the level and the direction of the stress exerted on the rock.

A rather smooth, barely fractured plateau is located almost in the centre of the image. It is possible the plateau is made up of the same material as the fractured mounds in the west. Fine trails run from southwest to northeast across here. These could be an indication of erosion by fine dust particles carried on the wind, sandblasting the plateau smooth.



Topographic map of the region at the northern edge of Magellan Crater



High-resolution view of the region on the northern edge of Magellan Crater (nadir channel)

The High Resolution Stereo Camera (HRSC) experiment on the European Space Agency's Mars Express mission is led by the Principal Investigator (PI) Prof. Dr Gerhard Neukum, who was also responsible for the technical design of the camera. The science team of the experiment consists of 45 Co-Investigators from 32 institutions and 10 nations. The camera was developed at the German Aerospace Center (DLR) under the leadership of the PI, G. Neukum, and built in cooperation with industrial partners (EADS Astrium, Lewicki Microelectronic GmbH and Jena-Optronik GmbH). The experiment on Mars Express is operated by the DLR Institute of Planetary Research, through ESA/ESOC. The systematic processing of the HRSC image data is carried out at DLR. The scenes shown here were processed by the PI-group at the Institute for Geosciences of the Freie Universität Berlin in cooperation with the DLR Institute of Planetary Research, Berlin.

Contact

Henning Krause
German Aerospace Center
Corporate Communications
Tel: +49 2203 601-2502
Fax: +49 2203 601-3249
E-Mail: henning.krause@dlr.de

Prof.Dr. Ralf Jaumann
German Aerospace Center
Institute of Planetary Research, Planetary Geology
Tel: +49 30 67055-400
Fax: +49 30 67055-402
E-Mail: Ralf.Jaumann@dlr.de

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