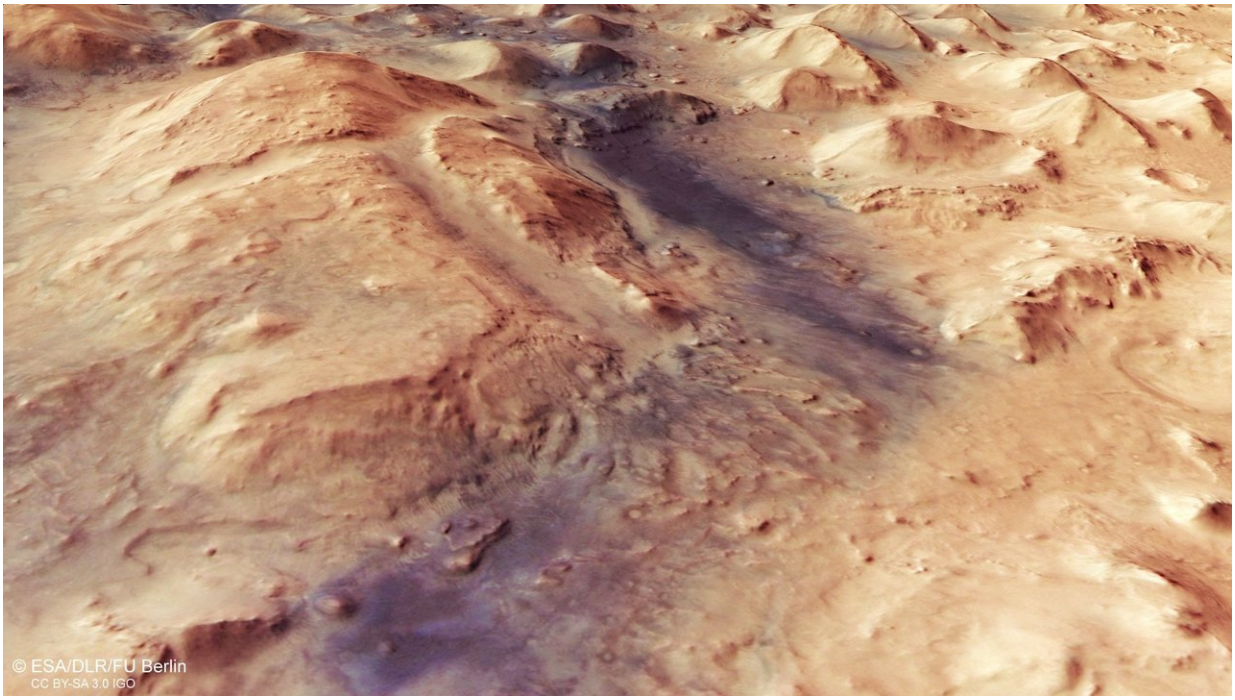
Shaping the surface of Mars with water, wind and ice

November 23 2018



This perspective view shows Nili Fossae, an escarpment sitting between the northern lowlands (lower right) and southern highlands (upper left) of Mars. This oblique perspective was generated using data from ESA's Mars Express High Resolution Stereo Camera (HRSC). This scene is part of a region imaged during Mars Express orbit 17916 on 26 February 2018, with the gathered data combined to form a detailed mosaic. The image covers a part of the martian surface centred on 78°E, 28°N. This view looks across the feature from south to north. Credit: ESA/DLR/FU Berlin, CC BY-SA 3.0 IGO

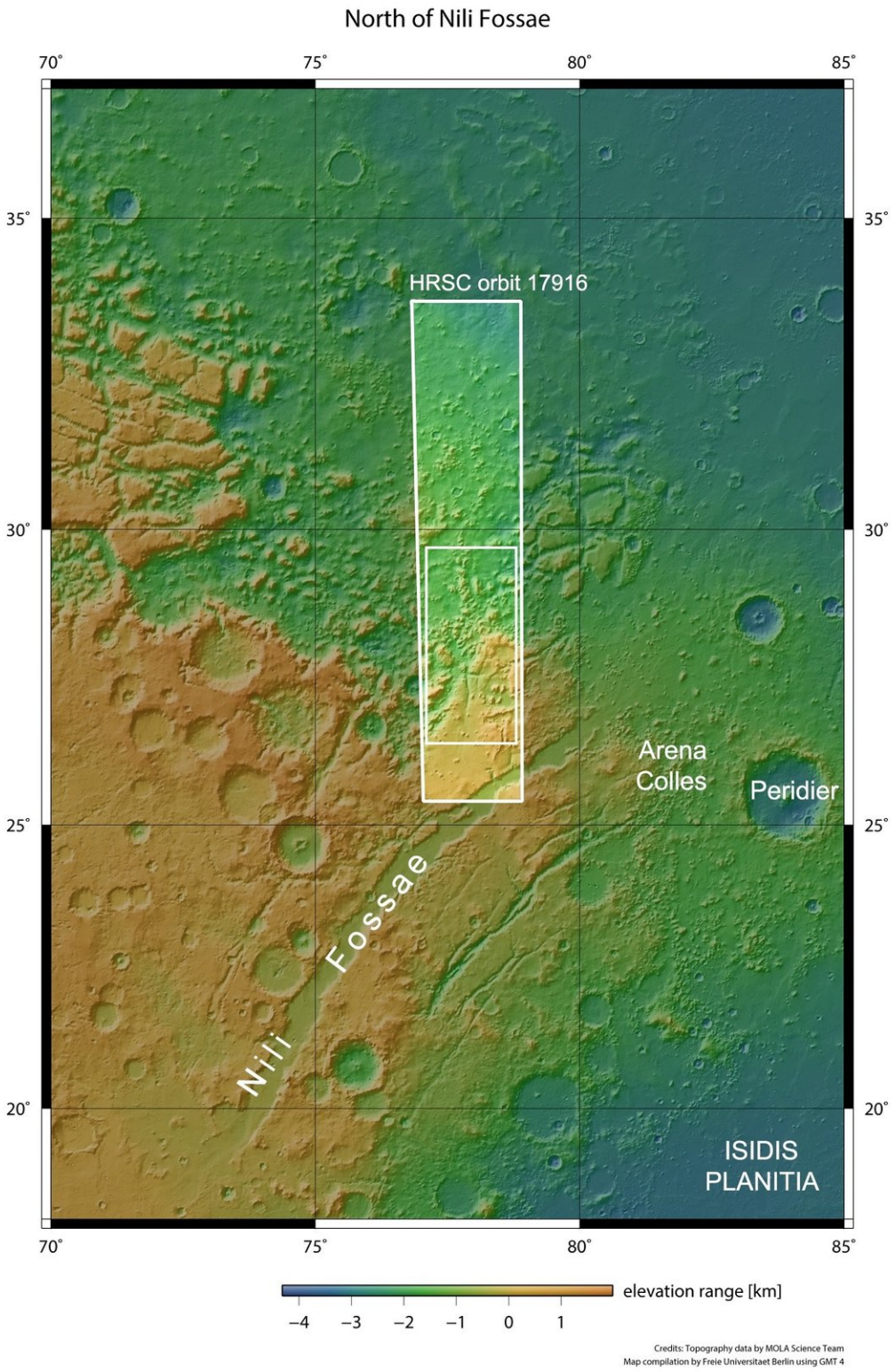
ESA's Mars Express has imaged an intriguing part of the Red Planet's surface: a rocky, fragmented, furrowed escarpment lying at the boundary of the northern and southern hemisphere.

This region is an impressive example of past activity on the planet and shows signs of where flowing wind, water and ice once moved material from place to place, carving out distinctive patterns and landforms as it did so.

Mars is a planet of two halves. In places, the northern hemisphere of the planet sits a full few kilometres lower than the southern; this clear topographic split is known as the martian dichotomy, and is an especially distinctive feature on the Red Planet's surface.

Northern Mars also displays large areas of smooth land, whereas the planet's southern regions are heavily pockmarked and scattered with craters. This is thought to be the result of past volcanic activity, which has resurfaced parts of Mars to create smooth plains in the north – and left other regions ancient and untouched.

The star of this Mars Express image, a furrowed, rock-filled escarpment known as Nili Fossae, sits at the boundary of this north-south divide. This region is filled with rocky valleys, small hills, and clusters of flat-topped landforms (known as mesas in geological terms), with some chunks of crustal rock appearing to be depressed down into the surface creating a number of ditch-like features known as graben.

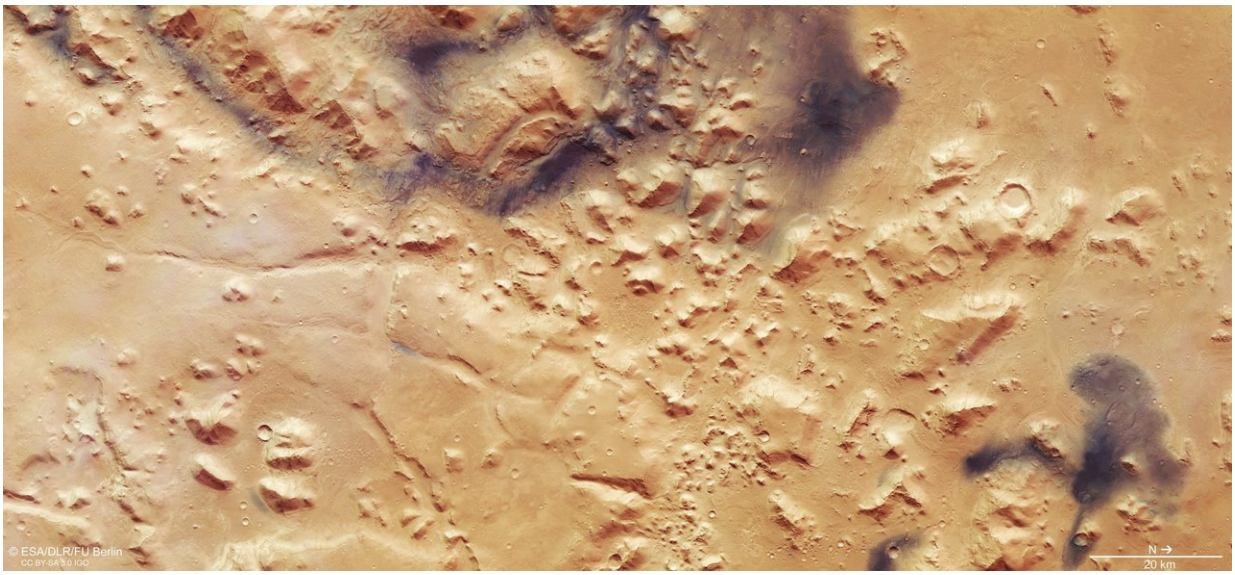

North of Nili Fossae
70°
75°
80°
85°
35°
30°
25°
20°
HRSC orbit 17916
Arena
Colles
Peridier
Nili
Fossae
ISIDIS
PLANITIA
elevation range [km]
−4
−3
−2
−1
0
1
Credits: Topography data by MOLA Science Team
Map compilation by Freie Universitaet Berlin using GMT 4

Nili Fossae, an escarpment sitting between the northern lowlands and southern highlands of Mars, shown in a wider context. The region outlined by the larger white box indicates the whole area imaged during ESA's Mars Express orbit 17916, while the smaller box shows the area displayed in this image release. In this context image, north is up. Credit: NASA MGS MOLA Science Team

As with much of the surrounding environment, and despite Mars' reputation as a dry, arid world today, water is believed to have played a key role in sculpting Nili Fossae via ongoing erosion. In addition to visual cues, signs of past interaction with water have been spotted in the western (upper) part of this image – instruments such as Mars Express' OMEGA spectrometer have spotted clay minerals here, which are key indicators that water was once present.

The elevation of Nili Fossae and surroundings, shown in the topographic view above, is somewhat varied; regions to the left and lower left (south) sit higher than those to the other side of the frame (north), illustrating the aforementioned dichotomy. This higher-altitude terrain appears to consist mostly of rocky plateaus, while lower terrain comprises smaller rocks, mesas, hills, and more, with the two sections roughly separated by erosion channels and valleys.

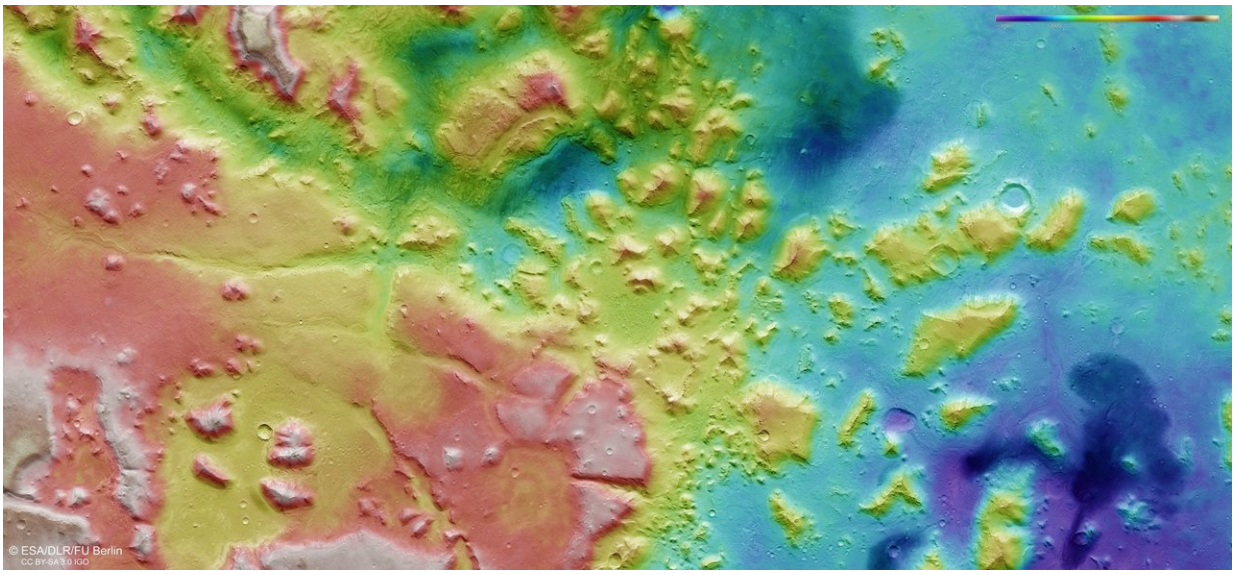
This split is thought to be the result of material moving around on Mars hundreds of millions of years ago. Similar to glaciers on Earth, flows of water and ice cut through the martian terrain and slowly sculpted and eroded it over time, also carrying material along with them. In the case of Nili Fossae, this was carried from higher areas to lower ones, with chunks of resistant rock and hardy material remaining largely intact but shifting downslope to form the mesas and landforms seen today.



This colour view shows the landscape around Nili Fossae, an escarpment sitting between the northern lowlands and southern highlands of Mars. It was created using data from the nadir channel of the High Resolution Stereo Camera (HRSC) on ESA's Mars Express orbiter, the field of view which is aligned perpendicular to the surface of Mars, and the camera's colour channels. The data were acquired during spacecraft orbit 17916. The ground resolution is about 18 m/pixel and the images cover a part of the martian surface centred on 78°E, 28°N. North is to the right. Credit: European Space Agency

The shapes and structures scattered throughout this image are thought to have been shaped over time by flows of not only water and ice, but also wind. Examples can be seen in this image in patches of the surface that appear to be notably dark against the ochre background, as if smudged with charcoal or ink. These are areas of darker volcanic sand, which have been transported and deposited by present-day martian winds. Wind moves sand and dust around often on Mars' surface, creating rippling dune fields across the planet and forming multi-coloured, patchy terrain like Nili Fossae.

The data comprising this image were gathered by Mars Express' High Resolution Stereo Camera (HRSC) on 26 February 2018.



This image shows the relative heights of the landscape in and around Nili Fossae, an escarpment sitting between the northern lowlands and southern highlands of Mars. Lower parts of the surface are shown in blues and purples, while higher-altitude regions show up in whites, browns, and reds, as indicated on the scale to the top right. The colour-coded topographic view is based on a digital terrain model of the region, from which the topography of the landscape can be derived. It comprises data obtained by the High Resolution Stereo Camera (HRSC) on ESA's Mars Express during spacecraft orbit 17916. The ground resolution is about 18 m/pixel and the images cover a part of the martian surface centred on 78°E, 28°N. North is to the right. Credit: ESA/DLR/FU Berlin, CC BY-SA 3.0 IGO

Provided by European Space Agency