

# **Volcano and impact craters seen in geologically rich new image from ESA's Mars Express**

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Jovis Tholus volcano and surrounds. Credit: ESA/DLR/FU Berlin, [CC BY-SA 3.0 IGO](#)

At first glance, two contrasting circular features jump out of this scene: a volcano that rises gently above the surface with a collapsed caldera system, and an impact crater that digs down below. Both features have different stories to tell.

## Volcano in a lava sea

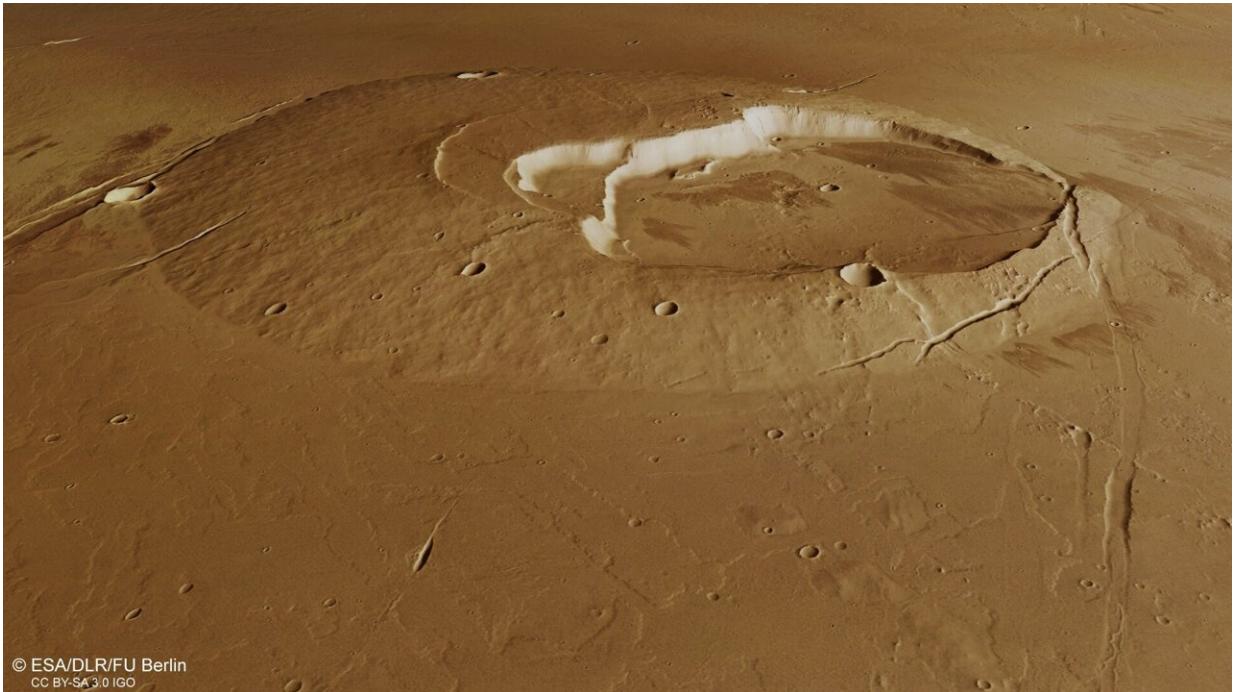
Lying in the shadows of the Solar System's largest volcano, Olympus Mons, the much smaller Jovis Tholus shield volcano bears its own evidence of a long eruptive history.

Its complex caldera system comprises at least five craters. The largest is about 28 km wide, and sits off center, as clearly seen in the plan view images. The calderas step down towards the southwest where the youngest eventually meets with the surrounding sea of even younger lava flows. The lavas create a shoreline around the flanks, obscuring the original relief of the volcano, which now only sits about 1 km above the surrounding plains.

On closer look, individual lava flows can be found all over the plains. These [lava](#) flows have also washed over [fault lines](#), filling in the sets of parallel graben that dominate the north and north east parts of the scene in particular.

Graben are sunken valleys created when the planet's crust stretches apart, such as under the pressure of volcanic and tectonic stresses in this

region.



Second perspective view of Jovis Tholus. Credit: ESA/DLR/FU Berlin, [CC BY-SA 3.0 IGO](#)

A steep scarp of one of these graben cuts right into the eastern flank of Jovis Tholus. Some portions of this graben can be traced for several kilometers further north, in some places more significantly filled in with lavas.

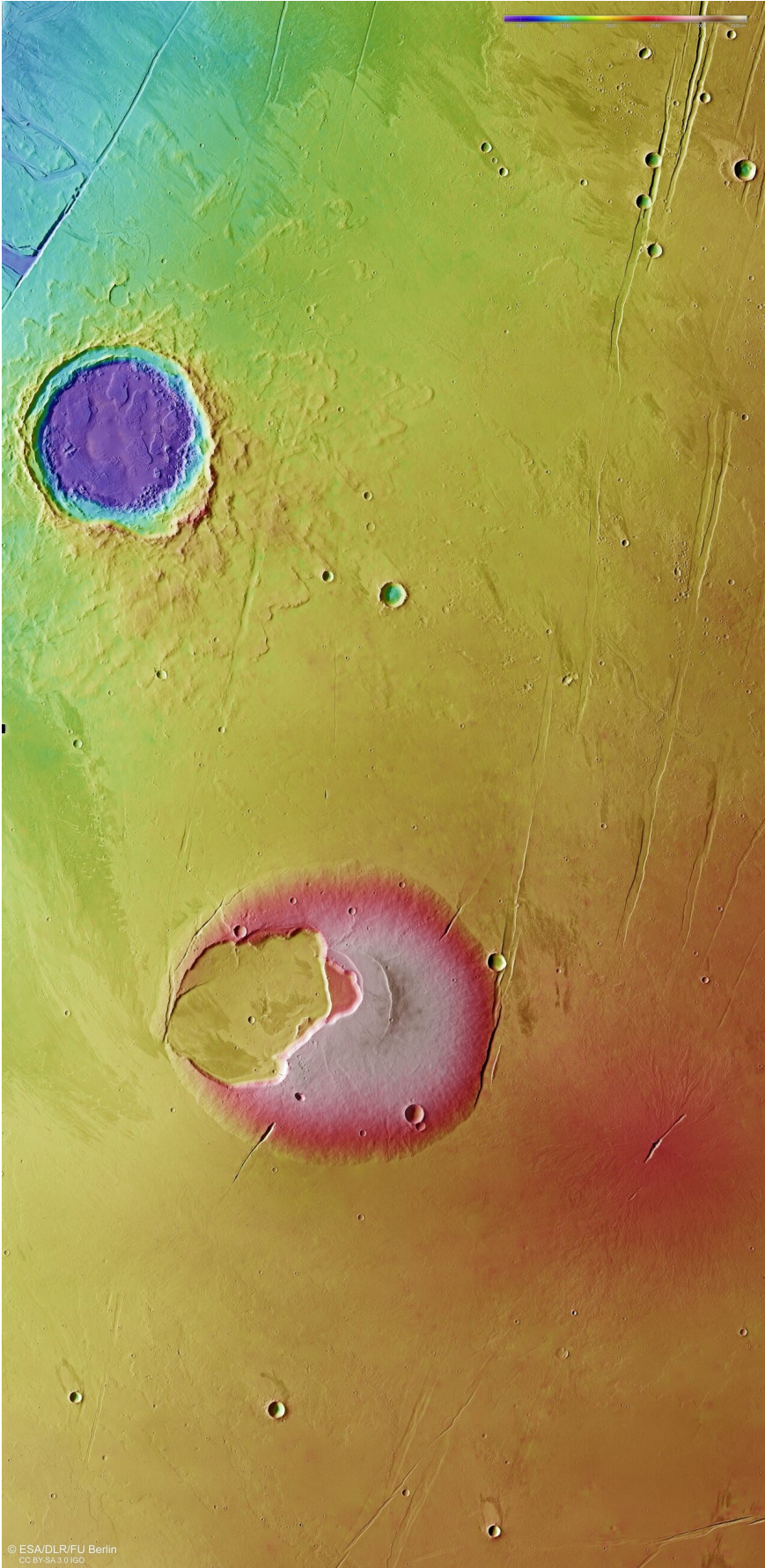
A hidden surprise lies close to the east of Jovis Tholus. Easily missed in the main plan view image, the color-coded topography image gives it away: a less developed [volcano](#) subtly causes the surface to bulge.

Zooming in shows a fissure vent, from which less viscous [lava flows](#) than

at Jovis Tholus once erupted, perhaps in a similar style to the activity seen in Iceland or Hawaii on Earth.

## **Making a splash**

In contrast to the volcanic craters, a very different type of [crater](#) lies to the north of the region. This 30-km-wide [impact crater](#) was created when an asteroid or comet crashed into the surface, penetrating the layers below. Its fractured floor and the fluidised nature of the ejected material around the central crater—giving it the appearance of a flower with many layers of petals—points to the impactor striking a water- or ice-saturated ground.

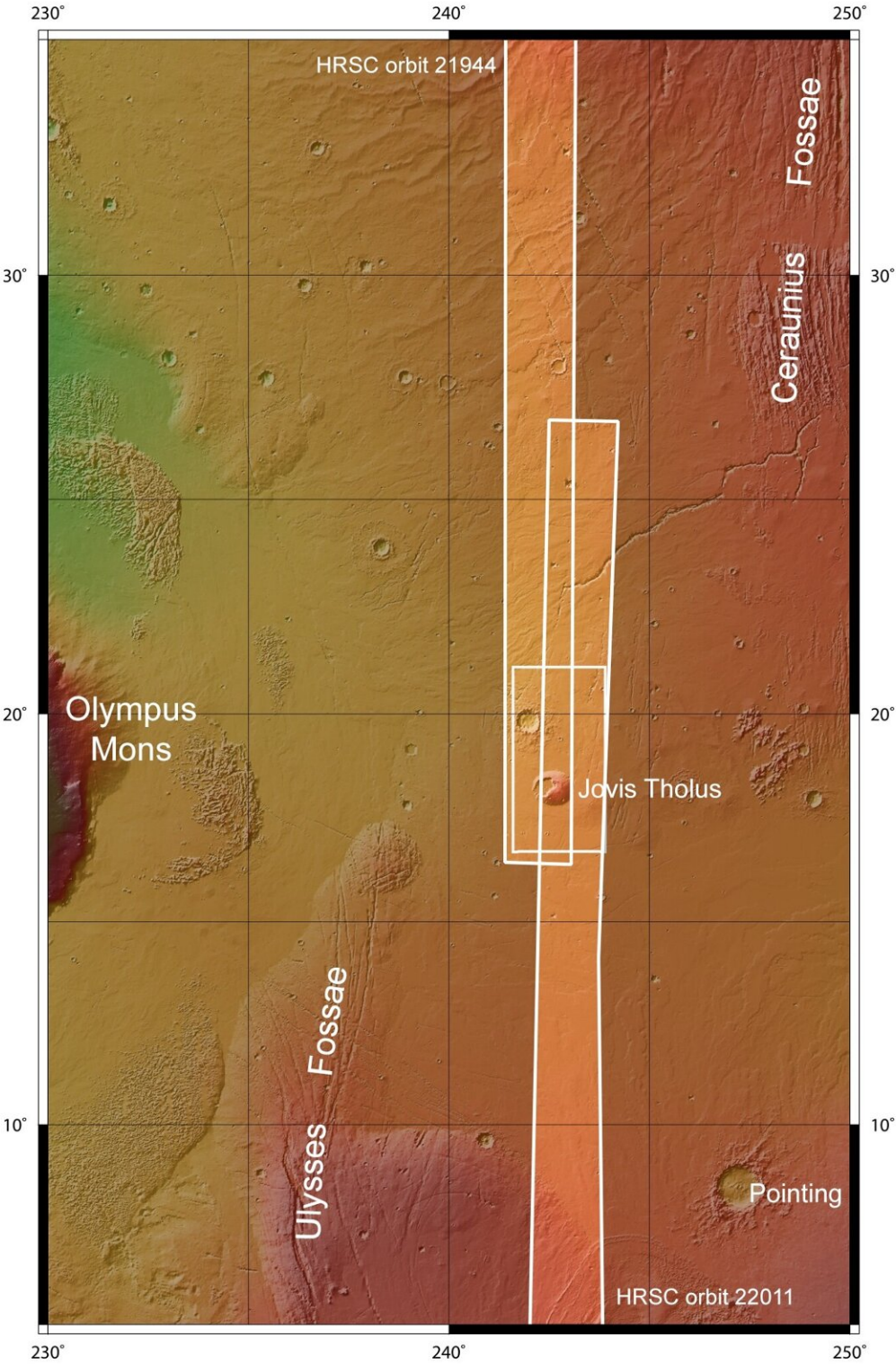


Topography of Jovis Tholus. Credit: ESA/DLR/FU Berlin, [CC BY-SA 3.0 IGO](#)

More evidence of this region's watery past lies to the northwest of the crater. Zooming in to the long fault line that truncates the top left of the plan view images are signs of an outflow channel. Water bursting out from here in the past formed streamlined islands and terraced channel walls.

Some much smaller channels can be found crosscutting the northern ejecta blanket of the large impact crater as well.

Jovis Patera



Credits: Topography data by MOLA Science Team  
Map compilation by Freie Universitaet Berlin using GMT 4



Jovis Tholus shield volcano and surrounding features in wider context, as imaged by ESA's Mars Express. Jovis Tholus is located roughly in the middle between Olympus Mons and Ascreus Mons. It lies on the very northern edge of the lava plains surrounding the Tharsis Montes and is also bordered by the the Ceraunius Fossae fault system to the northeast and the Ulysses Fossae faults to the southwest. The mosaic was compiled from two images taken 13 May and 2 June 2021 during Mars Express Orbits 21944 and 22011. Credit: NASA/MGS/MOLA Science Team

Massive amounts of water were likely purged from underground aquifers over time as a result of volcanic warming melting the ground ice, and as faulting took place, with the water taking the easiest way to the surface through the graben system.

Taken together, this single scene paints the picture of a fascinating and extremely active planetary history.

Mars Express has been orbiting the Red Planet since 2003, imaging Mars' surface, mapping its minerals, identifying the composition and circulation of its tenuous atmosphere, probing beneath its crust, and exploring how phenomena such as the solar wind interacts in the martian environment.

Provided by European Space Agency

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