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Indications of volcanic activity on Venus

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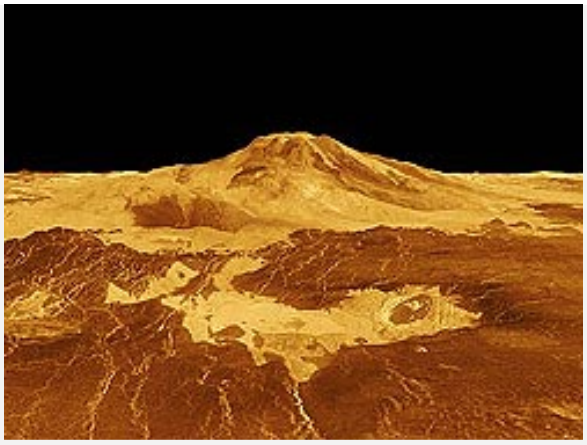
DLR scientists evaluate data from the VIRTIS infrared spectrometer



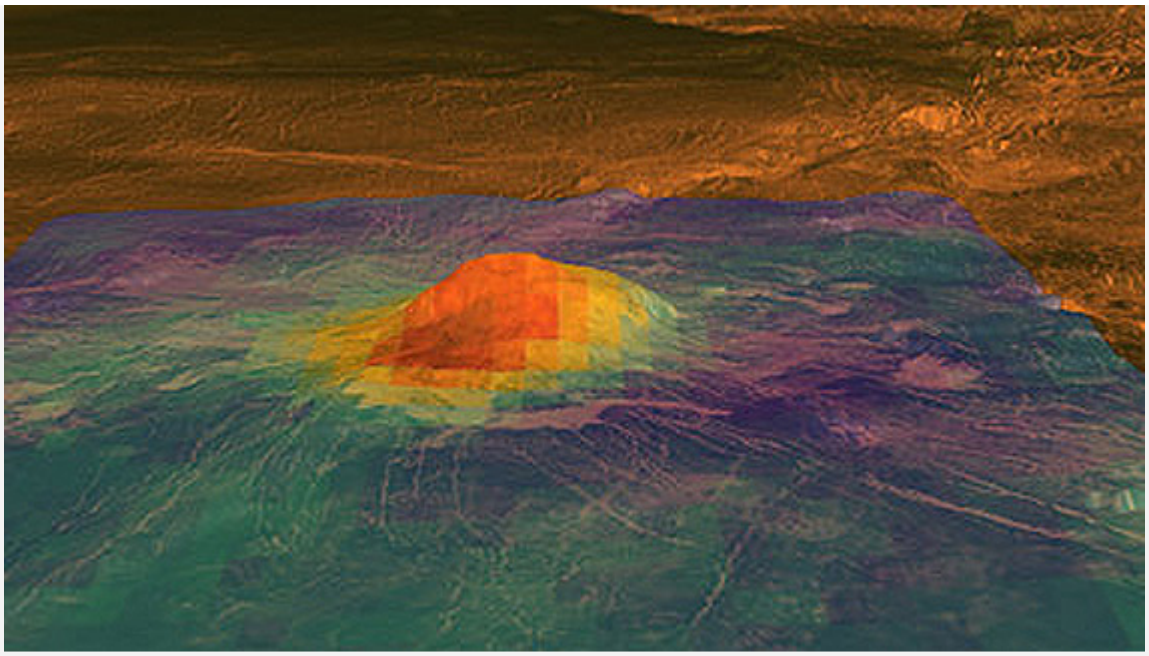
3-D radar image of the Maat Mons volcano on Venus

Although some uncertainty remains, the most recent infrared data from VIRTIS (Visible and Infrared Thermal Imaging Spectrometer) seem to confirm it. "We are pretty sure that Venus still has volcanic activity," say Jörn Helbert and Nils Müller from the DLR Institute of Planetary Research (Institut für Planetenforschung) – members of the VIRTIS team.

The European Space Agency's (ESA) Venus Express orbiter has been circling the planet, which is constantly obscured by thick cloud cover, since 11 April 2006. The spacecraft travels around the planet in an elliptical orbit at an altitude that varies from 300 to 66 000 kilometres. It carries VIRTIS, the only instrument that can look through the atmospheric windows onto the surface of Venus and record its infrared radiation patterns at a variety of heights. "At certain infrared ranges we can clearly see that the surface is glowing," says planetary physicist Helbert.

Solidified lava flows radiate heat

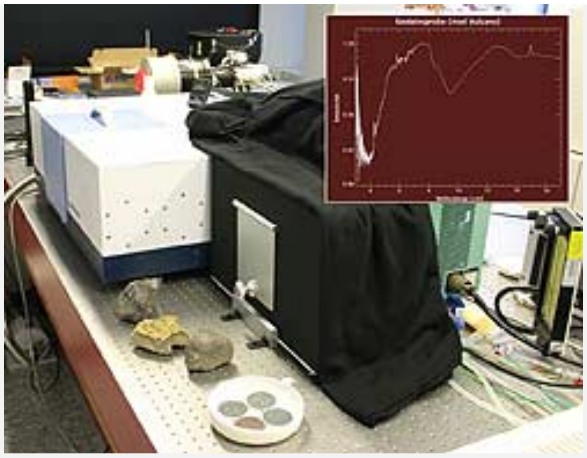
According to the VIRTIS data, there are nine hotspots, areas over underground magma chambers, which are very likely volcanically active. "The solidified lava flows, which radiate heat from the surface, seem hardly weathered. So we can conclude that they are younger than 2.5 million years old – and the majority are probably younger than 250,000 years," added Helbert. "In geological terms, this means that they are practically from the present day." It is also possible that there are smaller volcanic vents and lava flows that cover very restricted areas. Nils Müller and Jörn Helbert are co-authors of a paper on volcanic hotspots that appears in the latest edition of *Science*.



Volcanic peak Idunn Mons

Like on Earth, Venus's valleys are warmer than its mountains. But the venusian atmosphere is so dense that it completely determines the temperature of the planet's surface. This enabled the scientists to predict surface temperatures with computer models. Data obtained from VIRTIS last year shows that certain areas deviate from the predictions by as much as two or three degrees. "This may because there are different types of rock, which have different thermal properties." VIRTIS has shown that the Imdr, Themis and Dione region are hotspots, which rise 0.5 to 2.5 kilometres above the plain and are the most likely candidates for the presence of active volcanism. But it is not easy to evaluate the data: "the cloud coverage obstructs the view of the surface, and we have to include its effect in our calculations. Even then, it’s like looking through frosted glass."

Research in the Planetary Emissivity Laboratory



The DLR planetary emissivity laboratory: Measurements at 500° Celsius

The researchers are still unable to say which materials are responsible for the radiation emitted from Venus's surface. The next step will be for Jörn Helbert to build a special laboratory – the Planetary Emissivity Laboratory – at the DLR Institute of Planetary Research, in which a variety of rocks will be heated to venusian temperatures of 500 to 600 degrees Celsius. He will then measure their emissions at a range of wavelengths, just as VIRTIS does from space. By comparing the results with the VIRTIS data, the researchers will be able to answer the open question about the composition of the planet's surface.

About 25 missions have surveyed Venus before Venus Express, so researchers have been able to rely in part on tried-and-tested systems. For instance, they incorporated technologies from ESA's Mars Express spacecraft. VIRTIS itself was originally constructed at DLR Berlin for ESA's Rosetta comet chaser. One important predecessor mission was NASA's Magellan probe, which mapped Venus with its radar,

indicating the presence of hundreds of volcanoes. But it was thought that they were all extinct. Along with VIRTIS, another six instruments on Venus Express are studying the planet to determine the composition of its atmosphere and its temperature, among other things.

Learning from Venus

If further analysis confirms that Venus is volcanically active, making it the first geologically active planet after Earth itself, it would certainly affect our understanding of our own planet. While Earth and Venus are very similar in size and structure, they have had very different histories. So when and why did their development take such distinct paths, such that waterless Venus, at 500 degrees Celsius, is completely hostile to life, and Earth is so suited to it? "Perhaps Venus can tell us why Earth is so special," added Jörn Helbert.

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