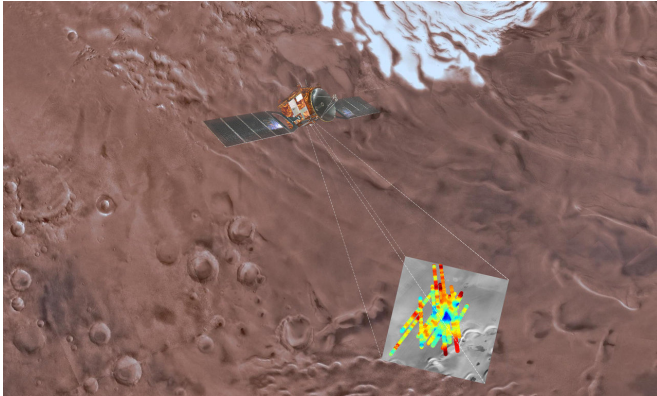


Liquid water is buried beneath Martian landscape, study says

25 July 2018



Artistic impression of the Mars Express spacecraft probing the southern hemisphere of Mars, superimposed to a color mosaic of a portion of Planum Australe. The study area is highlighted using a THEMIS IR image mosaic. Subsurface echo power is color coded and deep blue corresponds to the strongest reflections, which are interpreted as being caused by the presence of water. Credits: USGS Astrogeology Science Center, Arizona State University, ESA, INAF. Credit: USGS Astrogeology Science Center, Arizona State University, ESA, INAF. Graphic rendering by Davide Coero Borga – Media INAF

A massive underground lake has been detected for the first time on Mars, raising hopes that more water—and maybe even life—exists there, international astronomers said Wednesday.

Located under a layer of Martian ice, the lake is about 12 miles (20 kilometers) wide, said the report in the US journal *Science*.

It is the largest body of liquid water ever found on the Red Planet.

"Water is there. We have no more doubt," co-author Enrico Flamini, the Italian space agency's Mars Express mission manager, told a press conference.

Mars is now cold, barren and dry but it used to be warm and wet. It was home to plenty of liquid water and lakes at least 3.6 billion years ago.

Scientists are eager to find signs of contemporary water, because such discoveries are key to unlocking the mystery of whether life ever formed on Mars in its ancient past, and whether it might persist today.

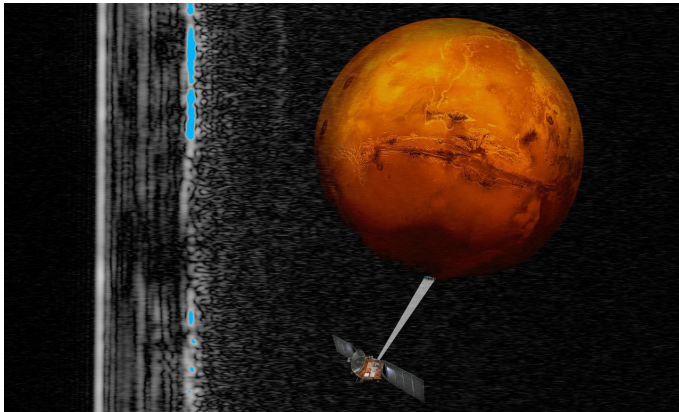
"This is a stunning result that suggests water on Mars is not a temporary trickle like previous discoveries but a persistent body of water that provides the conditions for life for extended periods of time," said Alan Duffy, an associate professor at Swinburne University in Australia, who was not involved in the study.

Being able to access water sources could also help humans survive on a future crewed mission to Earth's neighboring planet, with NASA aiming to send explorers in the 2030s.

This particular lake, however, would be neither swimmable nor drinkable, and it lies almost a mile deep (1.6 kilometers) beneath the icy surface in a harsh and frigid environment.

Whether microbial forms of life could lie within is a matter of debate.

Some experts are skeptical of the possibility since the lake is so cold and briny, mixed with a heavy dose of dissolved Martian salts and minerals.



Artistic impression of the Mars Express spacecraft probing the southern hemisphere of Mars, superimposed on a radar cross section of the southern polar layered deposits. The radar cross section has been tilted 90°. The leftmost white line is the surface radar echo, while the light blue spots along the basal radar echo highlight areas of very high reflectivity, interpreted as being caused by the presence of water. Credit: ESA, INAF. Graphic rendering by Davide Coero Borga – Media INAF

The temperature is likely below the freezing point of pure water, but the lake can remain liquid due to the presence of magnesium, calcium and sodium.

"This is a discovery of extraordinary significance, and is bound to heighten speculation about the presence of living organisms on the Red Planet," said Fred Watson of the Australian Astronomical Observatory.

"Caution needs to be exercised, however, as the concentration of salts needed to keep the water liquid could be fatal for any microbial life similar to Earth's," added Watson, who was not involved in the research.

Radar detection

The discovery was made using a radar instrument on board the European Space Agency's Mars Express orbiter, which launched in 2003.

The tool is called the Mars Advanced Radar for Subsurface and Ionosphere Sounding (MARSIS), and was designed to find subsurface water by sending radar pulses that penetrate the surface and

ice caps.

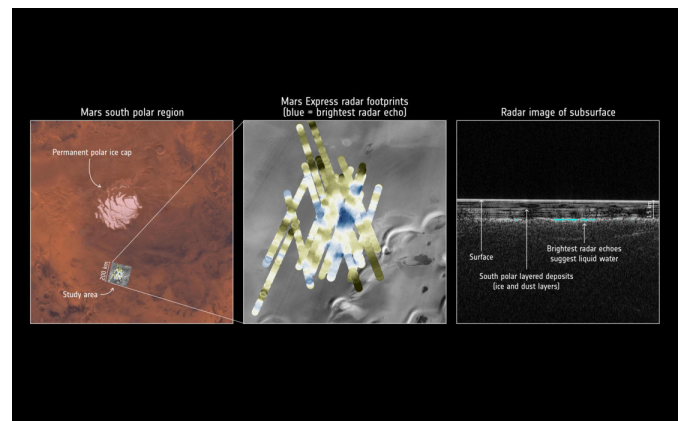
MARSIS "then measures how the radio waves propagate and reflect back to the spacecraft," said the study.

These reflections "provide scientists with information about what lies beneath the surface."

A team of researchers led by Roberto Orosei of the National Institute for Astrophysics in Bologna, Italy, surveyed a region called Planum Australe, located in the southern ice cap of Mars, from May 2012 until December 2015.

A total of 29 sets of radar samplings showed a "very sharp change in its associated radar signal," allowing scientists to map the outlines of the lake.

"The radar profile of this area is similar to that of lakes of liquid water found beneath the Antarctic and Greenland ice sheets on Earth, suggesting that there is a subglacial lake at this location on Mars," said the report.



ESA's Mars Express has used radar signals bounced through underground layers of ice to find evidence of a pond of water buried below the south polar cap. Twenty-nine dedicated observations were made between 2012 and 2015 in the Planum Australe region at the south pole using the Mars Advanced Radar for Subsurface and Ionosphere Sounding instrument, MARSIS. A new mode of operations established in this period enabled a higher quality of data to be retrieved than earlier in the mission. The 200 km square study area is indicated in the left-hand image and the radar footprints on the surface are indicated in the middle image for multiple orbits. The

greyscale background image is a Thermal Emission Imaging System image from NASA's Mars Odyssey, and highlights the underlying topography: a mostly featureless plain with icy scarps in the lower right (south is up). The footprints are colour-coded corresponding to the 'power' of the radar signal reflected from features below the surface. The large blue area close to the centre corresponds to the main radar-bright area, detected on many overlapping orbits of the spacecraft. A subsurface radar profile is shown in the right hand panel for one of the Mars orbits. The bright horizontal feature at the top represents the icy surface of Mars in this region. The south polar layered deposits – layers of ice and dust – are seen to a depth of about 1.5 km. Below is a base layer that in some areas is even much brighter than the surface reflections, highlighted in blue, while in other places is rather diffuse. Analysing the details of the reflected signals from the base layer yields properties that correspond to liquid water. The brightest reflections are centred around 193°E/81°S in the intersecting orbits, outlining a well-defined, 20 km-wide zone. Credit: Context map: NASA/Viking; THEMIS background: NASA/JPL-Caltech/Arizona State University; MARSIS data: ESA/NASA/JPL/ASI/Univ. Rome; R. Orosei et al 2018

Researchers said they are not sure how far down it goes, but that it may be around three feet (one meter) deep.

Confirmation needed

"This is the first body of water it has detected, so it is very exciting," David Stillman, a senior research scientist in the Department of Space Studies at Southwest Research Institute in San Antonio, Texas, told AFP in an email.

However, Stillman, who was not involved in the research, said another spacecraft, or other instruments, need to be able to confirm the discovery.

He noted that a higher-frequency radar instrument made by the Italian space agency SHARAD, on board the Mars Reconnaissance Orbiter launched in 2005, has been unable to detect subsurface water.

"It is strange that SHARAD cannot confirm this discovery. In fact, SHARAD cannot penetrate

through the ice here and no one understands why it can't," Stillman said.

"This suggests that something strange is going on here. Thus, I'm skeptical about this discovery."

But researchers are excited about the potential for future finds, because if liquid water could be found at Mars's south pole, it might be elsewhere too.

"There's nothing special about this location other than the MARSIS radar on the Mars Express spacecraft is most sensitive to that region," said Duffy.

"There are likely similar water deposits below the ground all across Mars."

Canadian astronaut Chris Hadfield said on Twitter that the discovery gets to one of the fundamental questions about existence.

"On Earth, where there's water, there's life. Could be we're not alone."

More information: R. Orosei et al. Radar evidence of subglacial liquid water on Mars, *Science* (2018). [DOI: 10.1126/science.aar7268](https://doi.org/10.1126/science.aar7268)

Anja Diez. Liquid water on Mars, *Science* (2018). [DOI: 10.1126/science.aau1829](https://doi.org/10.1126/science.aau1829)

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