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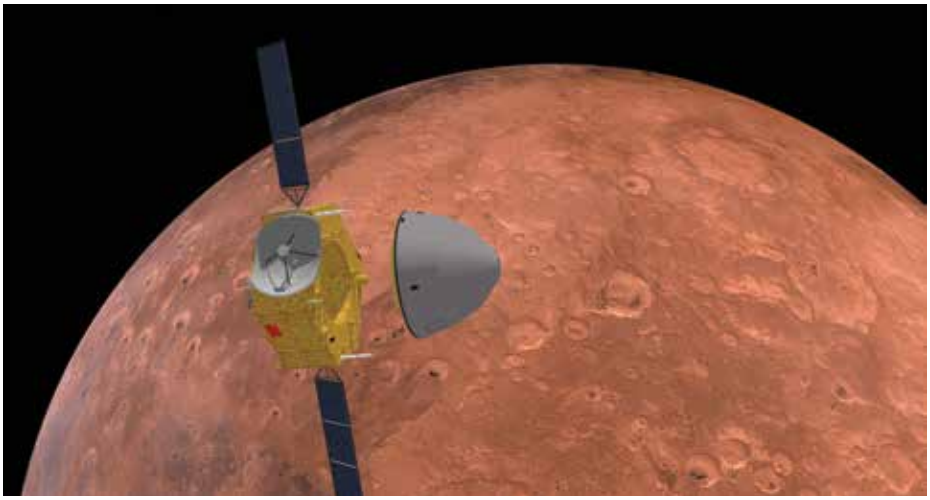
Zhurong Rover Spots Evidence of Recent Liquid Water on Mars

Mars is hardly a verdant world today, yet evidence abounds that liquid water once flowed over the Red Planet. Now, the latest rover to arrive on Mars's surface—Zhurong, part of China's Tianwen-1 mission—has spotted hydrated minerals that point to liquid water having persisted well into the Red Planet's most recent geologic period. These results, published in *Science Advances*, contribute to our understanding of when liquid water flowed on Mars, the research team has suggested (bit.ly/Mars-liquid).



China's Tianwen-1 mission has found evidence that liquid water persisted on Mars until much more recently than previously believed. Credit: Axel Monse/Shutterstock

A Close Look at Martian Plains

Just over a year ago, Zhurong (named for the Chinese god of fire) touched down in Mars's northern hemispheric lowlands. Since then, it has been sampling the morphology and mineralogy of Utopia Planitia, the same wide, sandy plain where NASA's Viking 2 lander arrived in 1976.

Yang Liu, a planetary scientist and member of the Tianwen-1 team at the National Space Science Center, Chinese Academy of Sciences, in Beijing, and his colleagues focused on spectral observations made by the rover's Mars Surface Composition Detector, an instrument designed to analyze minerals and identify sediments. They analyzed some of the data from four roughly fist-sized pieces of sediment that Zhurong passed as it traveled southward.

"We have plenty of evidence of liquid water on Mars before the Amazonian, but since approximately 3 billion years ago, the evidence for liquid water on the surface of Mars is scarce at best."

To determine the types of minerals present within the sediments, the team turned to a technique known as reflectance spectroscopy: When sunlight strikes something, certain wavelengths of light—those that set a substance's chemical bonds vibrating—are preferentially absorbed. The light reflected back is accordingly diminished at particular wavelengths, and a spectrum reveals that, said Liu. "At those wavelengths, there will be a dip [in the reflected light]."

The researchers found absorption features in the sediments' spectra in the near-infrared part of the electromagnetic spectrum at wavelengths of roughly 1.5, 2.0, and 2.2 micrometers. Those spectral fingerprints are characteristic of so-called hydrated minerals, substances like olivine, pyroxene, and feldspar that were altered as they incorporated water into their chemical structures.

Water in the Amazonian

The presence of hydrated minerals implied that liquid water once persisted on Mars, which is not a surprise because surface features like river channels and deltas have been spotted on the Red Planet. But what was unexpected was finding those minerals in terrain just a few hundred million years old. There hasn't been much evidence for liquid water on Mars during the current geologic epoch, the Amazonian, said Alberto Fairén, an astrobiologist at the Center for Astrobiology in Madrid, Spain, and Cornell University in Ithaca, N.Y., who was not involved in the research. "We have plenty of evidence of liquid water on Mars before the Amazonian, but since approximately 3 billion years ago, the evidence for liquid water on the surface of Mars is scarce at best."

Liu and his colleagues believe that the sediments Zhurong spotted are examples of Martian duricrust, a layered material that forms when groundwater evaporates and leaves behind saltlike compounds that in turn cement Mars's regolith. Duricrust has been found elsewhere on Mars, but the sediments near Zhurong appear to be particularly robust. "The duricrust at the Zhurong landing site is much thicker than that at other landing sites, suggesting much stronger water activity," said Liu.

Although it will be exciting to look for more evidence that liquid water existed in Mars's not-so-distant past, said Liu, the Tianwen-1 team might have to be patient. Mars's northern hemisphere is currently entering winter, and the combination of decreased light intensity and increased levels of airborne dust is creating challenging conditions for the solar-powered Zhurong rover. To wait out circumstances, the rover is designed to enter a sleep mode, which it may do in the coming months, the China National Space Administration recently posted on WeChat.

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