NASA's Curiosity rover finds surprise clues to Mars's watery past

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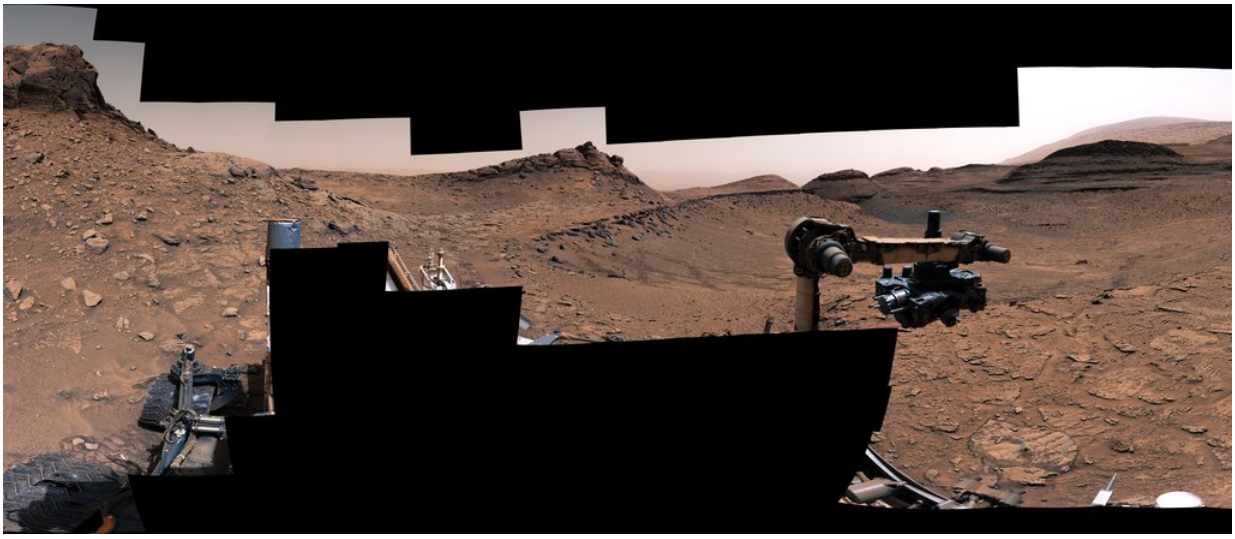


NASA's Curiosity used its Mastcam to capture this 360-degree panorama of Marker Band Valley on Dec. 16, 2022. Rippled rock textures found in this area are the clearest evidence the rover has seen of water and waves from Mars' ancient past. Credit: NASA/JPL-Caltech/MSSS

Among other discoveries made by the Curiosity rover, rippled rock textures suggest lakes existed in a region of ancient Mars that scientists expected to be drier.

When NASA's Curiosity rover arrived at the "sulfate-bearing unit" last fall, scientists thought they'd seen the last evidence that lakes once

covered this region of Mars. That's because the rock layers here formed in drier settings than regions explored earlier in the mission. The area's sulfates—salty minerals—are thought to have been left behind when water was drying to a trickle.

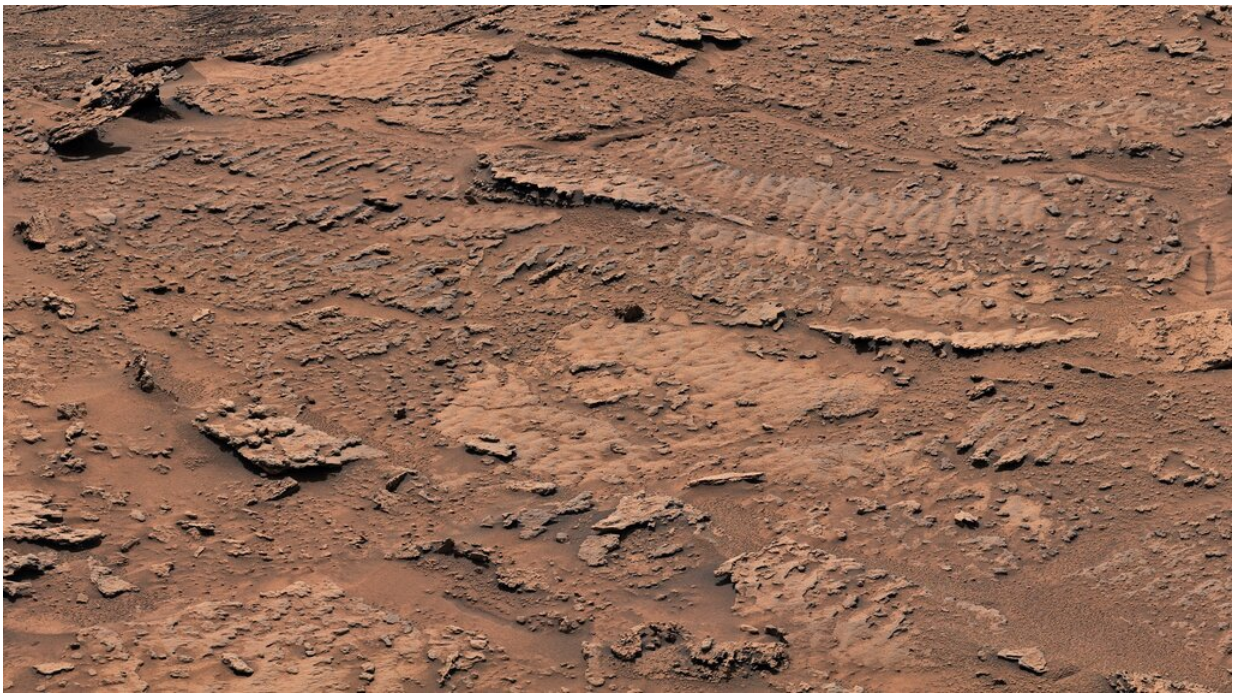
So Curiosity's team was surprised to discover the mission's clearest evidence yet of ancient water ripples that formed within lakes. Billions of years ago, waves on the surface of a shallow lake stirred up sediment at the lake bottom, over time creating rippled textures left in rock.

"This is the best evidence of water and waves that we've seen in the entire mission," said Ashwin Vasavada, Curiosity's project scientist at NASA's Jet Propulsion Laboratory in Southern California. "We climbed through thousands of feet of lake deposits and never saw evidence like this—and now we found it in a place we expected to be dry."

Layers of history

Since 2014, the rover has been ascending the foothills of Mount Sharp, a 3-mile-tall (5-kilometer-tall) mountain that was once laced with lakes and streams that would have provided a rich environment for microbial life, if any ever formed on the Red Planet.

Mount Sharp is made up of layers, with the oldest at the bottom of the mountain and the youngest at the top. As the rover ascends, it progresses along a Martian timeline, allowing scientists to study how Mars evolved from a planet that was more Earth-like in its ancient past, with a warmer climate and plentiful water, to the freezing desert it is today.



Billions of years ago, waves on the surface of a shallow lake stirred up sediment at the lake bottom. Over time, the sediment formed into rocks with rippled textures that are the clearest evidence of waves and water that NASA's Curiosity Mars rover has ever found. Credit: NASA/JPL-Caltech/MSSS

Having climbed nearly a half-mile above the mountain's base, Curiosity has found these rippled rock textures preserved in what's nicknamed the "Marker Band"—a thin layer of dark rock that stands out from the rest of Mount Sharp. This rock layer is so hard that Curiosity hasn't been able to drill a sample from it despite several attempts. It's not the first time Mars has been unwilling to share a sample; lower down the mountain, on "Vera Rubin Ridge," Curiosity had to try three times before finding a spot soft enough to drill.

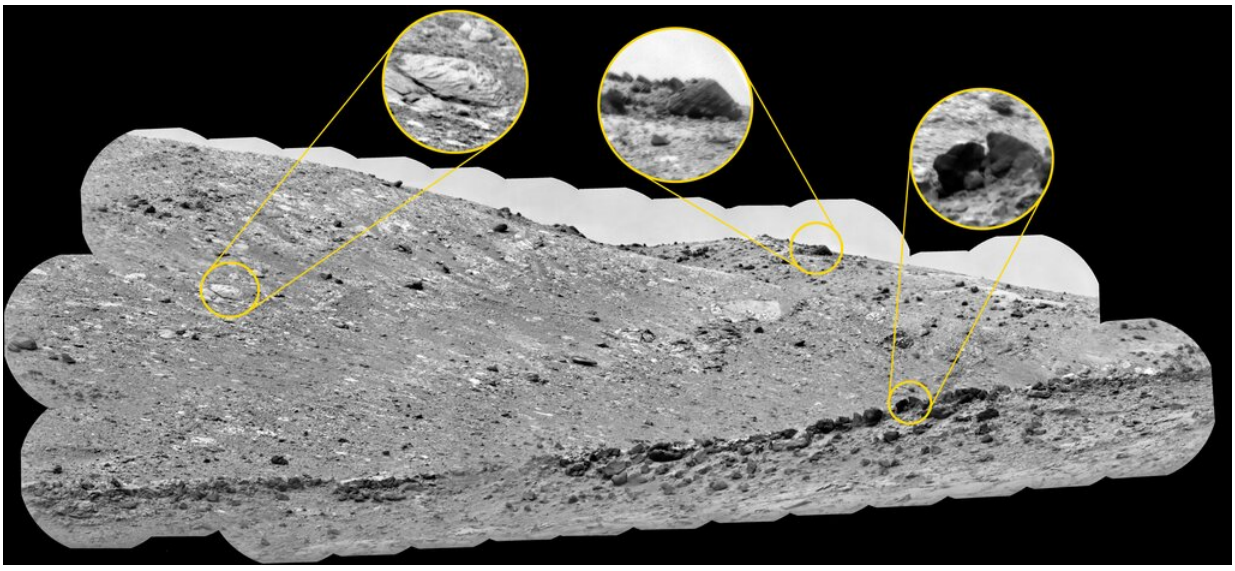
Scientists will be looking for softer rock in the week ahead. But even if they never get a sample from this unusual strip of rock, there are other

sites they're eager to explore.

Martian clues

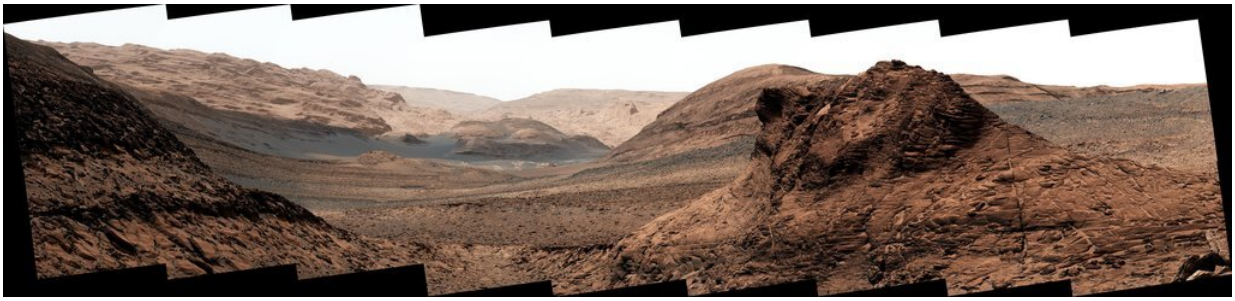
Far ahead of the Marker Band, scientists can see another clue to the history of Mars's ancient water in a valley named Gediz Vallis. Wind carved the valley, but a channel running through it that starts higher up on Mount Sharp is thought to have been eroded by a small river. Scientists suspect wet landslides also occurred here, sending car-size boulders and debris to the bottom of the valley.

Because the resulting debris pile sits on top of all the other layers in the valley, it's clearly one of the youngest features on Mount Sharp. Curiosity got a glimpse of this debris at Gediz Vallis Ridge twice last year but could only survey it from a distance. The rover team hopes to have another chance to view it later this year.



Curiosity used its ChemCam instrument to view Gediz Vallis Ridge, spotting boulders that are thought to have been washed down in an ancient debris flow.

One reason scientists are interested in this ridge is because it includes boulders like these, which originated much higher up on Mount Sharp, where Curiosity won't be able to reach. Credit: NASA/JPL-Caltech/LANL/CNES/CNRS/IRAP/IAS/LPG



At the bottom of this valley, called Gediz Vallis, is a mound of boulders and debris that are believed to have been swept there by wet landslides billions of years ago. The rover team hopes to get a closer look at this evidence for flowing water. Credit: NASA/JPL-Caltech/MSSS

One more clue within the Marker Band that has fascinated the team is an unusual rock texture likely caused by some sort of regular cycle in the weather or climate, such as dust storms. Not far from the rippled textures are rocks made of layers that are regular in their spacing and thickness. This kind of rhythmic pattern in rock layers on Earth often stems from atmospheric events happening at periodic intervals. It's possible the rhythmic patterns in these Martian rocks resulted from similar events, hinting at changes in the Red Planet's ancient climate.

"The wave ripples, debris flows, and rhythmic layers all tell us that the story of wet-to-dry on Mars wasn't simple," Vasavada said. "Mars's ancient climate had a wonderful complexity to it, much like Earth's."

Provided by Jet Propulsion Laboratory