

Astronomy[®]

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EVERYTHING WE KNOW ABOUT

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PLUS:

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STARMUS
FESTIVAL
ROCKS
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WEBB
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MOONBOWS?

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MARS ROCK COULD HAVE SIGNS OF LIFE

NASA'S PERSEVERANCE ROVER, which has operated on Mars since February 2021, has found a large rock containing organic compounds that may have been formed by microscopic life in the distant past.

The evidence is far from definitive, so scientists are not ready to proclaim that life once existed on the Red Planet. But the rock, named Cheyava Falls, "is the most puzzling, complex, and potentially important rock yet investigated by Perseverance," said Ken Farley, Perseverance project scientist at Caltech in Pasadena, in a press release.

Perseverance encountered the rock, which measures 3.2 feet by 2 feet (1 meter by 0.6 meter), at the northern edge of Neretva Vallis, an ancient river valley that emptied into Jezero Crater billions of years ago.

The inside of Cheyava Falls features large white calcium sulfate veins. Perseverance also found dozens of tiny off-white splotches, each ringed in black, reminiscent of leopard spots. The rover's onboard X-ray fluorescence spectrometer found that the black material contains iron and phosphate.

"These spots are a big surprise," said David Flannery, an astrobiologist and member of the Perseverance science team from the Queensland University of Technology in Australia. "On Earth, these types of features in rocks are



SPOTTY VISION. Perseverance found potential evidence for microscopic life in Mars' distant past within this rock, named Cheyava Falls. NASA/JPL-CALTECH/MSSS

often associated with the fossilized record of microbes living in the subsurface."

The Perseverance science team thinks Cheyava Falls may have been mud, with organic compounds mixed in, that eventually turned into rock. Later, fluid penetrated the rock, creating the calcium sulfate veins seen today and resulting in the spots.

Further investigation will require samples to be returned to Earth, Farley said. The rover took a core sample from the rock July 21, which could one day be retrieved by the joint NASA/ESA Mars Sample Return mission. However, that mission's development is currently stalled as NASA seeks commercial partners to do it more cheaply. —MICHAEL E. BAKICH

Titan's seas have tiny waves, tidal currents

Planetary scientists studying data from the Cassini spacecraft have uncovered new clues to three hydrocarbon oceans on Saturn's largest moon, Titan.

The research, published July 16 in *Nature Communications*, used data taken between March 2006 and November 2016, at times when the spacecraft was farthest from Saturn. They show not only evidence for tidal activity in Titan's oceans, but hints that their compositions differ as well.

The team used data from Cassini's Radio Science Subsystem to create a bistatic radar system, where the receiver and the transmitter are far apart. In this case, the receiver was NASA's Deep Space Network on Earth, some 930 million miles (1.5 billion kilometers) away. This configuration gives richer data than conventional radar, but it is not easy to set up. Nonetheless, the experiment worked.

Titan is too cold to sustain surface liquid water; instead, it hosts bodies

of liquid ethane and methane. And the results showed that, at least on the surface, Titan's three largest oceans have different proportions of methane and ethane, depending on their latitude.

"We also have indications that the rivers feeding the seas are pure methane until they flow into the open liquid seas, which are more ethane-rich," said lead author Valerio Poggiali of Cornell University in a press release. "It's like on Earth, when fresh-water rivers flow into and mix with the salty water of the oceans."

The team was also able to determine that the seas had surface waves only 0.1 inch (3 millimeters) high. Larger waves appeared where rivers meet the

oceans, though there the waves reached only about 0.2 inch (0.5 centimeter) high. Though small, the changes in wave height could point to tidal currents near these areas.

The study offers a wealth of data for future missions, as NASA has funded studies to explore the use of a submersible to study Titan's seas. Understanding conditions there will pave the way toward designing such a mission. —J.W.

QUIET SEA. Sunlight glints off Titan's largest sea, Kraken Mare, in a near-infrared composite from the Cassini spacecraft. Kraken Mare was one of three polar seas researchers studied to examine composition and wave activity. NASA/JPL-CALTECH/UNIVERSITY OF ARIZONA/UNIVERSITY OF IDAHO

