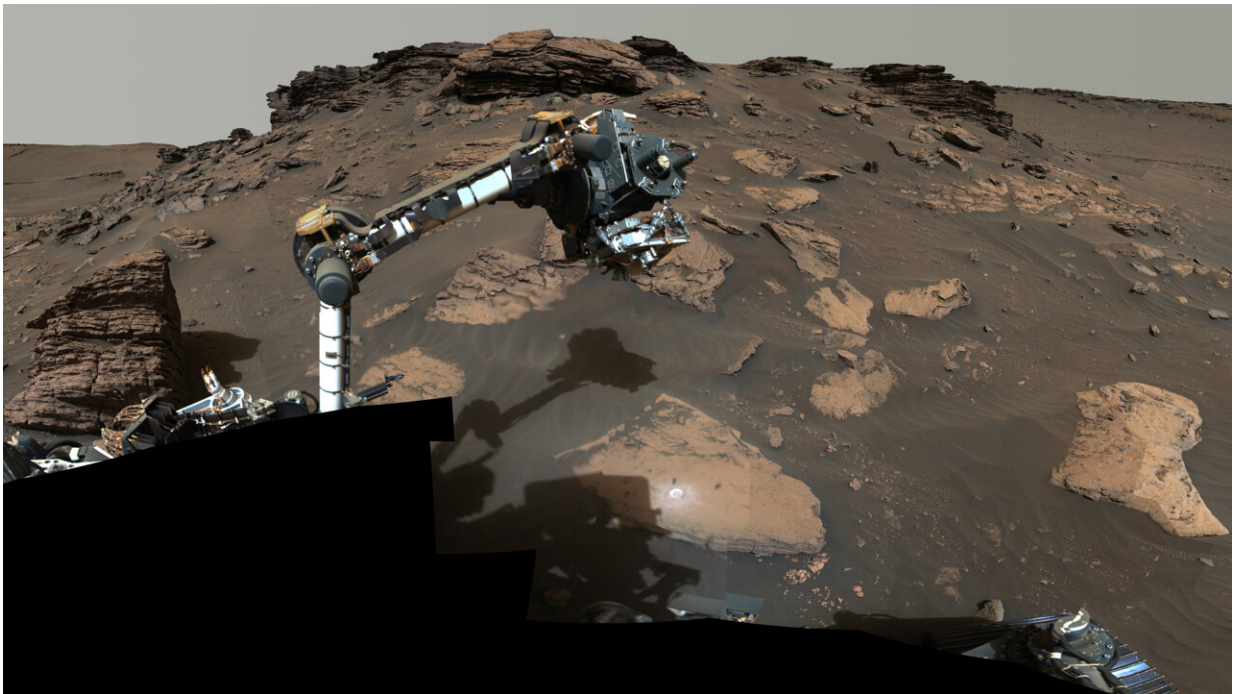


# NASA's Perseverance rover investigates geologically rich Mars terrain

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NASA's Perseverance rover puts its robotic arm to work around a rocky outcrop called "Skinner Ridge" in Mars' Jezero Crater. Composed of multiple images, this mosaic shows layered sedimentary rocks in the face of a cliff in the delta, as well as one of the locations where the rover abraded a circular patch to analyze a rock's composition. Credit: NASA/JPL-Caltech/ASU/MSSS

NASA's Perseverance rover is well into its second science campaign, collecting rock-core samples from features within an area long

considered by scientists to be a top prospect for finding signs of ancient microbial life on Mars. The rover has collected four samples from an ancient river delta in the Red Planet's Jezero Crater since July 7, bringing the total count of scientifically compelling rock samples to 12.

"We picked the Jezero Crater for Perseverance to explore because we thought it had the best chance of providing scientifically excellent samples—and now we know we sent the [rover](#) to the right location," said Thomas Zurbuchen, NASA's associate administrator for science in Washington. "These first two science campaigns have yielded an amazing diversity of samples to bring back to Earth by the Mars Sample Return campaign."

Twenty-eight miles (45 kilometers) wide, Jezero Crater hosts a delta—an ancient fan-shaped feature that formed about 3.5 billion years ago at the convergence of a Martian river and a lake. Perseverance is currently investigating the delta's sedimentary rocks, formed when particles of various sizes settled in the once-watery environment. During its first science campaign, the rover explored the crater's floor, finding igneous rock, which forms deep underground from magma or during volcanic activity at the surface.

"The delta, with its diverse sedimentary rocks, contrasts beautifully with the igneous rocks—formed from crystallization of magma—discovered on the crater floor," said Perseverance project scientist Ken Farley of Caltech in Pasadena, California. "This juxtaposition provides us with a rich understanding of the geologic history after the crater formed and a diverse sample suite. For example, we found a sandstone that carries grains and rock fragments created far from Jezero Crater—and a mudstone that includes intriguing [organic compounds](#)."

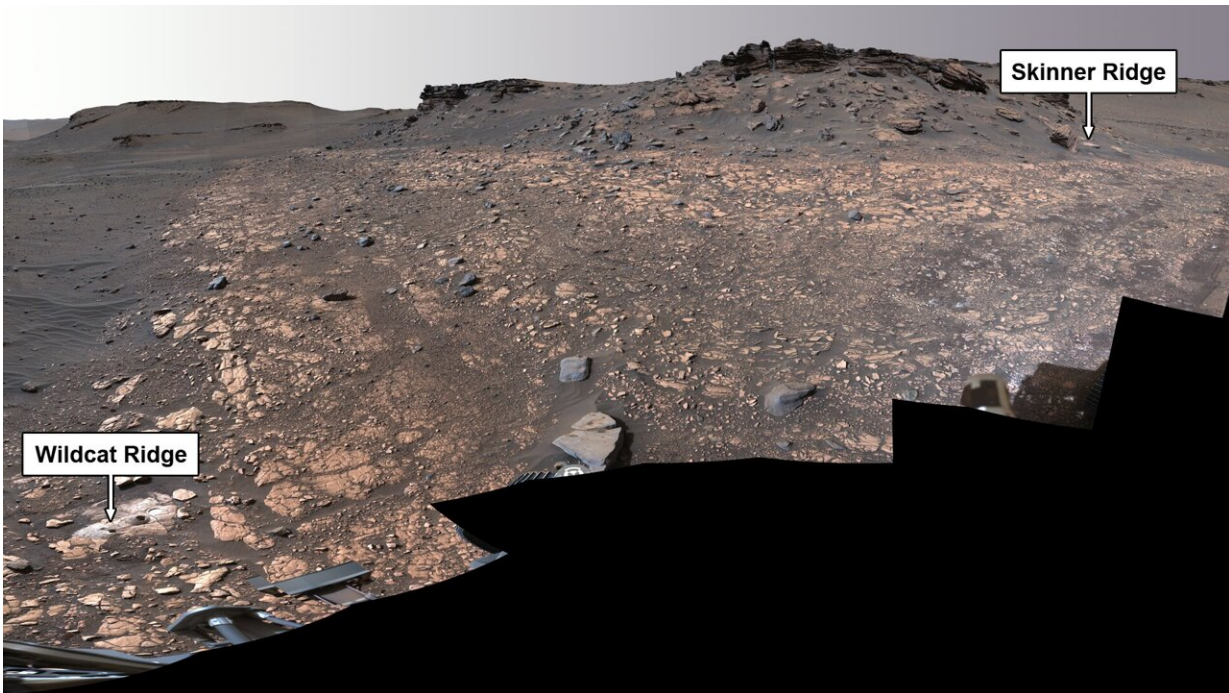
"Wildcat Ridge" is the name given to a rock about 3 feet (1 meter) wide that likely formed billions of years ago as mud and fine sand settled in an

evaporating saltwater lake. On July 20, the rover abraded some of the surface of Wildcat Ridge so it could analyze the area with the instrument called Scanning Habitable Environments with Raman & Luminescence for Organics & Chemicals, or SHERLOC.

SHERLOC's analysis indicates the samples feature a class of [organic molecules](#) that are spatially correlated with those of sulfate minerals. Sulfate minerals found in layers of sedimentary rock can yield significant information about the aqueous environments in which they formed.

## What Is Organic Matter?

Organic molecules consist of a wide variety of compounds made primarily of carbon and usually include hydrogen and oxygen atoms. They can also contain other elements, such as nitrogen, phosphorus, and sulfur. While there are [chemical processes](#) that produce these molecules that don't require life, some of these compounds are the chemical building blocks of life. The presence of these specific molecules is considered to be a potential biosignature—a substance or structure that could be evidence of past life but may also have been produced without the presence of life.



NASA's Perseverance rover collected rock samples for possible return to Earth in the future from two locations seen in this image of Mars' Jezero Crater: "Wildcat Ridge" (lower left) and "Skinner Ridge" (upper right). Credit: NASA/JPL-Caltech/ASU/MSSS

In 2013, NASA's Curiosity Mars rover found evidence of organic matter in rock-powder samples, and Perseverance has detected organics in Jezero Crater before. But unlike that previous discovery, this latest detection was made in an area where, in the distant past, sediment and salts were deposited into a lake under conditions in which life could potentially have existed. In its analysis of Wildcat Ridge, the SHERLOC instrument registered the most abundant organic detections on the mission to date.

"In the distant past, the sand, mud, and salts that now make up the Wildcat Ridge sample were deposited under conditions where life could

potentially have thrived," said Farley. "The fact the [organic matter](#) was found in such a sedimentary rock—known for preserving fossils of ancient life here on Earth—is important. However, as capable as our instruments aboard Perseverance are, further conclusions regarding what is contained in the Wildcat Ridge sample will have to wait until it's returned to Earth for in-depth study as part of the agency's Mars Sample Return campaign."

The first step in the NASA-ESA (European Space Agency) Mars Sample Return campaign began when Perseverance cored its first rock sample in September 2021. Along with its [rock](#)-core samples, the rover has collected one atmospheric sample and two witness tubes, all of which are stored in the rover's belly.

The geologic diversity of the samples already carried in the rover is so good that the rover team is looking into depositing select tubes near the base of the delta in about two months. After depositing the cache, the rover will continue its delta explorations.

"I've studied Martian habitability and geology for much of my career and know first-hand the incredible scientific value of returning a carefully collected set of Mars rocks to Earth," said Laurie Leshin, director of NASA's Jet Propulsion Laboratory. "That we are weeks from deploying Perseverance's fascinating samples and mere years from bringing them to Earth so scientists can study them in exquisite detail is truly phenomenal. We will learn so much."

Provided by Jet Propulsion Laboratory

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