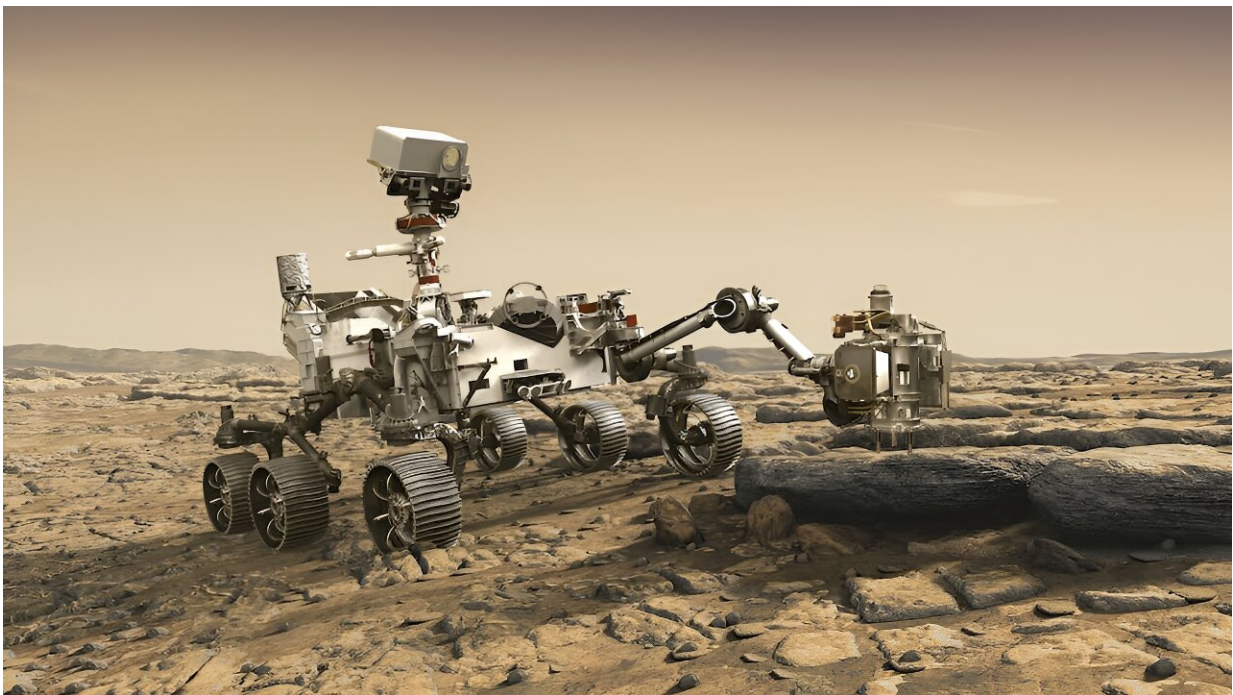


Studying lake deposits in Idaho could give scientists insight into ancient traces of life on Mars

February 6 2024, by Robert Patalano



The Perseverance Rover is collecting samples to learn more about Mars' environment. Credit: NASA/JPL-Caltech

Does life exist elsewhere in the universe? If so, how do scientists search for and identify it? Finding life beyond Earth is extremely difficult, partly because other planets are so far away and partly because we are

not sure what to look for.

Yet, astrobiologists have learned a lot about [how to find life](#) in extraterrestrial environments, mainly by studying how and when the early Earth became livable.

While research teams at NASA are [directly combing](#) the surface of Mars for signs of life, our [interdisciplinary research group](#) is [using a site here on Earth](#) to approximate ancient environmental conditions on Mars.

Contained within northern Idaho's [Clarkia Middle Miocene Fossil Site](#) are sediments that preserve some of Earth's most diverse biological marker molecules, or [biomarkers](#). These are remains of past life that offer glimpses into Earth's history.

An ancient lake

About 16 million years ago, a lava flow in what would one day become Clarkia, Idaho, dammed a local drainage system and created a deep [lake](#) in a [narrow, steep-sided valley](#). Although the lake has since dried up, weathering, erosion and [human activity](#) have exposed sediments of the former lake bed.

For nearly five decades, research teams like ours—being led by [Dr. Hong Yang](#) and [Dr. Qin Leng](#)—have used [fossil remains](#) and [biogeochemistry](#) to reconstruct past environments of the Clarkia Miocene Lake region.

The lake's depth created the [perfect conditions](#) for protecting microbial, plant and animal remains that fell to the lake's bottom. In fact, the sediments are so well preserved that some of the fossilized leaves still show their autumn colors from when they sank into the water millions of years ago.

Today, ancient lake beds on Earth are becoming [important settings](#) for learning about habitable environments on other planets.

Biological marker molecules

Clarkia's lake sediments [contain a suite](#) of ancient biomarkers. These [compounds](#), or classes of compounds, can reveal how organisms and their [environments functioned](#) in the past.

Since the discovery of the [Clarkia fossil site in 1972](#), multiple research teams have used various [cutting-edge technologies to analyze](#) different biomarkers.

Some of those found at Clarkia [include lignin](#), which is the structural support tissue of plants, [lipids like fats and waxes](#), and possibly [DNA and amino acids](#).

Understanding the origins, history and environmental factors that have allowed these biosignatures to stay so well preserved at Clarkia may also allow our team to predict the potential of organic matter preservation in ancient lake deposits on Mars.

Studying life signatures on Mars

In 2021, the [Mars Perseverance Rover](#) landed on top of lake deposits in Mars' [Jezero Crater](#). Jezero is a meteorite impact crater believed to have once been flooded with water and home to an ancient river delta.

Microbial life may have lived in Jezero's crater lake, and their biomarkers might be found in lake bed sediments today. Perseverance has been drilling into the crater's surface to collect samples that could contain ancient signs of life, with the intent of [returning the samples to Earth in 2033](#).

Clarkia has many similarities to the Jezero Crater. Both Clarkia and Jezero Crater have ancient [lake deposits](#) derived from silica-rich, [basaltic rock](#) that formed under [a climate with](#) higher temperatures, high humidity and a carbon dioxide-rich atmosphere.

At Clarkia, these conditions preserved microbial biomarkers in the ancient lake. Similar settings could have [formed lakes](#) on the surface of Mars.

The samples [Perseverance is collecting](#) contain the geologic and climate history of the Jezero Crater landing site and may even contain preserved biomarkers of ancient life.

While Perseverance continues its mission, our group is [establishing criteria](#) for biomolecular authentication. That means we are developing ways to figure out whether ancient biomarkers from Earth, and hopefully Mars, are true echoes of life—rather than recent contamination or molecules from nonliving sources.

To do so, we are studying biomarkers from Clarkia's fossil leaves and sediments and developing laboratory experiments using [Martian simulants](#). This material simulates the chemical and physical properties of Jezero Crater's lake sediments.

By deciphering the sources, history and preservation of biomarkers connected with Clarkia's ancient lake deposits, we hope to develop new strategies for studying the Perseverance Rover samples once they are back on Earth.

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