

How glacial biomarkers can hone the search for extraterrestrial life

July 16 2018, by Sarah Wild, Astrobiology Magazine



Laguna Negra in the Chilean Andes is a glacial lake that contains the remains of ancient life and is exposed to ultraviolet light. Credit: Wamba Wambe/Wikimedia Commons

Detecting biomarkers in glacial lakes on Earth could pave the way for astrobiologists to detect evidence for life on other worlds, and also unravel the properties of the environments in which that life lived.

High in the Andes Mountains in Chile, unrelenting ultraviolet (UV) radiation blasts the nutrient-poor waters of Laguna Negra and Lo Encañado, two lakes fed by rapidly melting glaciers. In this hostile and remote environment, researchers are trialling [life](#)-detection technology to see if we can use it on other planets.

Understanding these [lake](#) systems will help scientists to interpret biomarkers in ancient lakes both on Earth or other planets. Although the organisms themselves are long dead, the traces and history of their deaths are encoded in the biomolecules that litter the lakes' sediments.

The implications of these biomolecules extend far beyond the boundaries of these lakes: they could help scientists to recreate the evolutionary history of extraterrestrial life. The scientists' findings were described in a recent article in *Astrobiology*.

"Once a microbe dies, different physiochemical factors – such as humidity, temperature, oxygen, or the presence of metals – affect the degradation or chemical alteration of its structures and molecular components," says lead author Victor Parro, based at the Centro de Astrobiología, in Madrid, Spain.

Certain biomarkers are characteristic of certain groups of microbes and even particular metabolisms, he says. "From this information it is possible to infer what the environment where they developed was like."

Crater lakes

In the Andes, this can tell us about the paleoclimate of the mountains

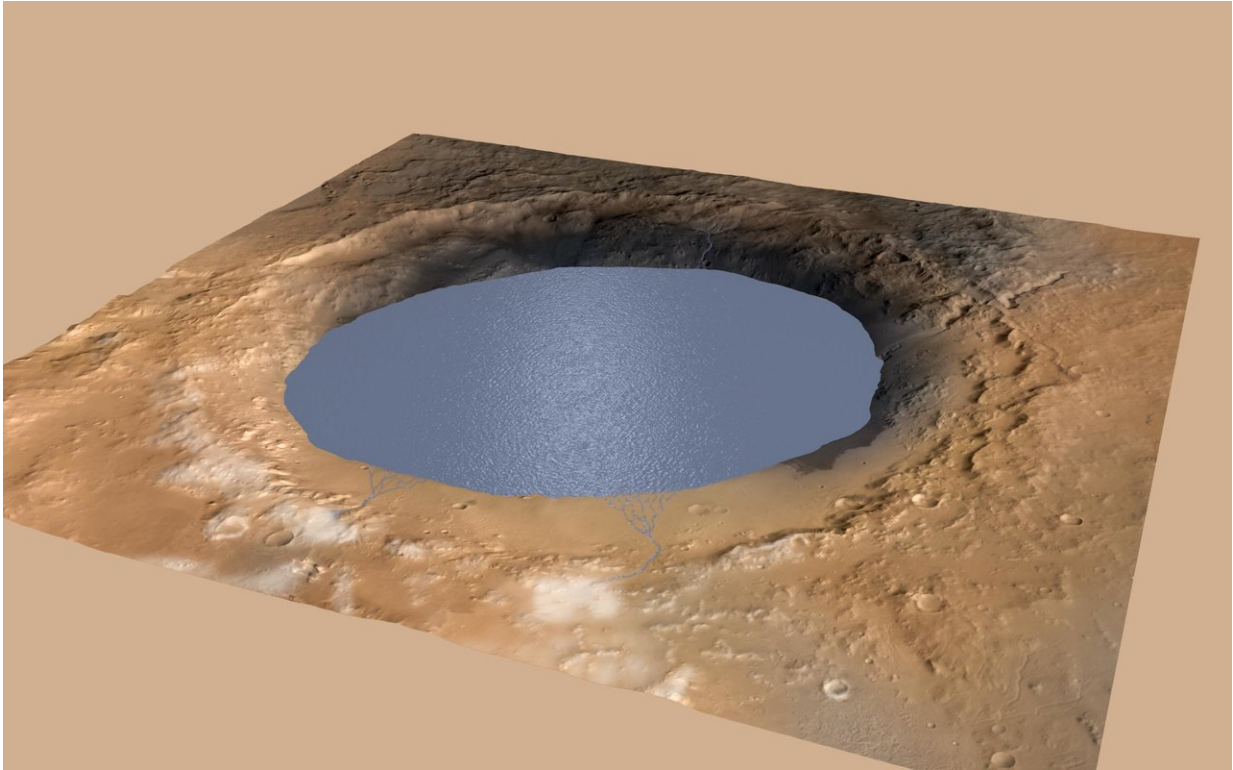
and their rapidly thawing glaciers. But it could possibly unravel the geochemical and atmospheric histories of other worlds, such as Mars and Saturn's moon Titan.

"These high-altitude lakes in the Andes mountains are interesting for astrobiology because they are exposed to high levels of ultraviolet radiation," says Lewis Dartnell, an astrobiologist at the University of Westminster, in London, who was not involved in the research.

"Understanding how microbial life in the lake copes with these UV levels is important for the search for life beyond Earth – on Mars, for example, where there are believed to have once been [crater lakes](#) but also very high UV levels. "

The researchers used a Life Detector Chip (LDChip) to hunt for these fragments of life. An LDChip is a biosensor that can detect the presence of life (recent or ancient) from protein fragments and other biomolecules.

"An LDChip doesn't need entire living microbes, it just needs biological material, whether it is alive or dead, recent or ancient, free or as part of large polymers or even organo-mineral particles [which are mineral by-products of life]," Parro says. The chip needs between four and ten amino acids to identify the protein or family of proteins that the amino acids came from.



Gale Crater on Mars, which NASA's Curiosity rover is exploring, used to contain a lake that was exposed to the ultraviolet radiation incident on the surface of the red planet, and which may contain evidence for past life. Credit: NASA/JPL-Caltech

Testing for life in situ

The LDChip is the core of the Spanish Signs Of Life Detector (SOLID), an instrument that can liquidize up to two grams of solid rock, soil or ice, which can then be screened for biopolymers.

Importantly, especially when viewed through the lens of astrobiology, it can test for life in situ.

Researchers can treat these extreme environments as proxies for the

remote and harsh conditions on other planets, allowing them to test their theories and technologies on Earth. Astrobiologists often view Laguna Negra as a stand-in for the lakes of Titan.

Understanding water, glaciers and ice is a fundamental part of astrobiology. "Ice and glaciers were and are common in other planetary bodies, such as Mars, and they must have played a critical role in the hydrogeology of those planets, the formation and behavior of ancient lakes, as well as in the development and evolution of potential Martian microbiology," says Parro.

In their study, Parro's team investigated the shallow sediments of the lakes. They reported the presence of sulphate-reducing bacteria, methanogenic (methane producing) archaea, and exopolymeric substances (polymers, such as biofilms, secreted by organisms) from Gammaproteobacteria.

Proof of life

Don Cowan, a professor of microbial ecology at the University of Pretoria, in South Africa, says that their presence is unsurprising and "just what one would expect in a glacial lake sediment".

Asked if they were significant biomarkers, he says that "All are important, in a general sense, in that identification of any of these biomarkers (which are examples of many possible biomarkers) in an 'astrobiological' sample, such as from Mars, would be definitive evidence of life."

A library of biomarkers is the next step in Parro's research. "We need further studies and understanding of what biomarkers we can expect to find in different planetary environments," he says. This involves identifying the most universal ones, discovering how they are preserved

and how they respond to radiation and other environmental conditions, and then using that information to hone their tests for the presence of life.

The end game is to see the SOLID instrument with its LDChip on extraplanetary missions to test for biomarkers or assist astronauts in biohazard detection. Until then, the researchers plan to deploy it in as many terrestrial environments as they can, from extreme environments to the veterinary sector, Parro says.

More information: Víctor Parro et al. Biomarkers and Metabolic Patterns in the Sediments of Evolving Glacial Lakes as a Proxy for Planetary Lake Exploration, *Astrobiology* (2016). [DOI: 10.1089/ast.2015.1342](https://doi.org/10.1089/ast.2015.1342)

This story is republished courtesy of NASA's Astrobiology Magazine. Explore the Earth and beyond at www.astrobio.net .

Source: Astrobiology Magazine

Citation: How glacial biomarkers can hone the search for extraterrestrial life (2018, July 16) retrieved 19 April 2024 from <https://phys.org/news/2018-07-glacial-biomarkers-hone-extraterrestrial-life.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.