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Microbe Goo Could Help Guide the Search for Life on Mars

Sticky substances secreted by microbes may help create landforms on Earth. And new research shows that these substances are more preserved in iron-rich sediment. Mars is decidedly iron-rich (it's the Red Planet, after all), so the new study adds to evidence that microbe goo could help researchers explain landform creation there.

"I think this is going to open up a new direction for astrobiology," said Alicia Rutledge, a researcher on the project and a geologist at Northern Arizona University.

Microbes secrete extracellular polymeric substances, or EPSs, which have high cohesive strength. These substances serve mainly as a protective layer for microbes and a way to dispose of metabolic waste. "If you think of a slug leaving behind a trail of mucus, little microbial organisms will do that too," said Natalie Jones, a doctoral student at Northern Arizona University leading the research. Those sticky microbes exist within virtually all sediment types on Earth.

And that stickiness may be important in landform creation. Meandering rivers, for example, have strong banks. Scientists have generally thought that plant roots make these riverbanks stronger, but recent research has shown that the banks of some meandering rivers don't have vegetation (bit.ly/river-plants). EPSs could be one of the materials that stabilizes the sediment, Jones said.

EPSs are known to influence the formation of landforms on the scale of millimeters to meters, said Jaco Baas, a process sedimentologist at Bangor University in the United Kingdom who was not involved in the research. For example, Baas's experiments indicate that EPSs change the dimensions of how ripples form in riverbeds (bit.ly/cohesion-bedform).

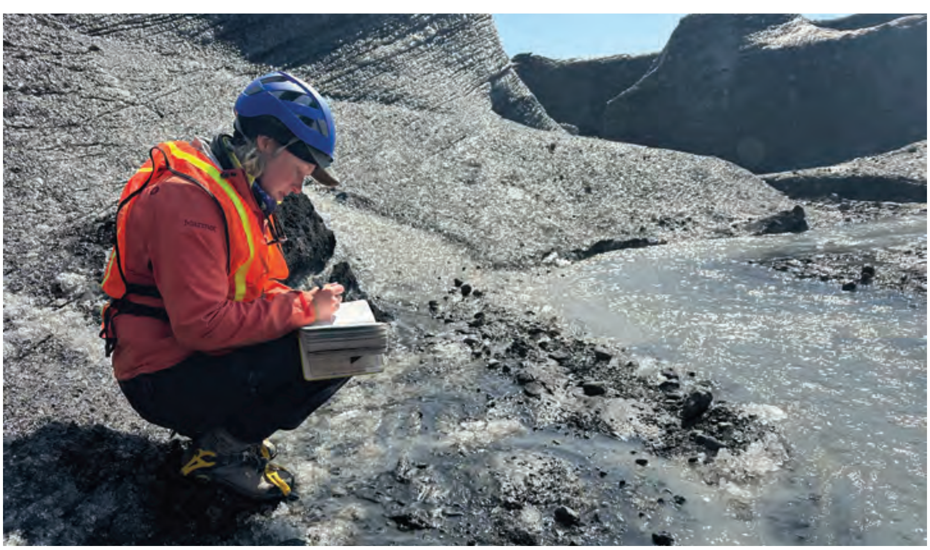
Jones and her colleagues are working to understand how EPSs may influence larger landforms on the scale of hundreds of meters to kilometers, such as meandering rivers, dunes, and shores or floors of lakes and oceans. Their studies in Iceland, New Mexico's White Sands National Park, and other locations have identified correlations between the presence of EPSs, erosion, mineralogy, and other factors.

Preliminary results show that landforms with mafic mineralogy (those rich in iron oxides) contain more EPSs. Jones and her team presented their results at AGU's Annual Meeting 2023 in San Francisco (bit.ly/AGU23-microbes).

Stickiness in Space

The findings suggest that the presence of EPSs could be particularly relevant for understanding landform development on Mars—a planet covered in red, iron-rich minerals.

Further research into EPSs could also aid in the search for life on the Red Planet. With better knowledge of how EPSs influence landform development, scientists could use images of ancient landforms on the surface of Mars to estimate the chances that EPSs existed in Martian sediment when those landforms were created. Those estimates could then help determine where a rover could look for other evidence of life, Jones said.



Natalie Jones collected water quality measurements and sediment sample data next to a supraglacial stream on the surface of the Breiðamerkurjökull glacier in Vatnajökull National Park in Iceland. Credit: Alicia Rutledge

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"We've got sand dunes on Mars, and people have been trying to figure out for a while why so many seem frozen," said Rutledge. "Are they frozen because there's ice? Are they cemented with salts? There's lots of theories out there and lots of hypotheses actively being tested. We're going to throw another one in there: How could microbial communities have stabilized these dunes in the past?"

Before it's possible to answer that question, scientists need "a lot more" evidence about where EPSs are present on Earth, what factors influence the presence of EPSs, and what sediment conditions must exist for EPSs to influence sediment transport, Jones said.

Because of Mars's reduced gravity, the cohesive strength of EPSs relative to the weight of sediment particles would be greater than on Earth, meaning that even small amounts of EPSs could be a significant factor in Martian landform creation, Jones said. "It's entirely possible that even if we see no effect on landscapes here on Earth, that we could potentially see an effect on Mars," she said.

EPSs could also offer direct evidence of past life on Mars, but current remote sensing tools aren't sensitive enough to detect EPSs in Martian sediment. "There is quite a big gap between doing this type of research on Earth and trying to do it remotely on another planet," Baas said. "But it's exciting nonetheless."

By **Grace van Deelen** (@GVD__), Staff Writer