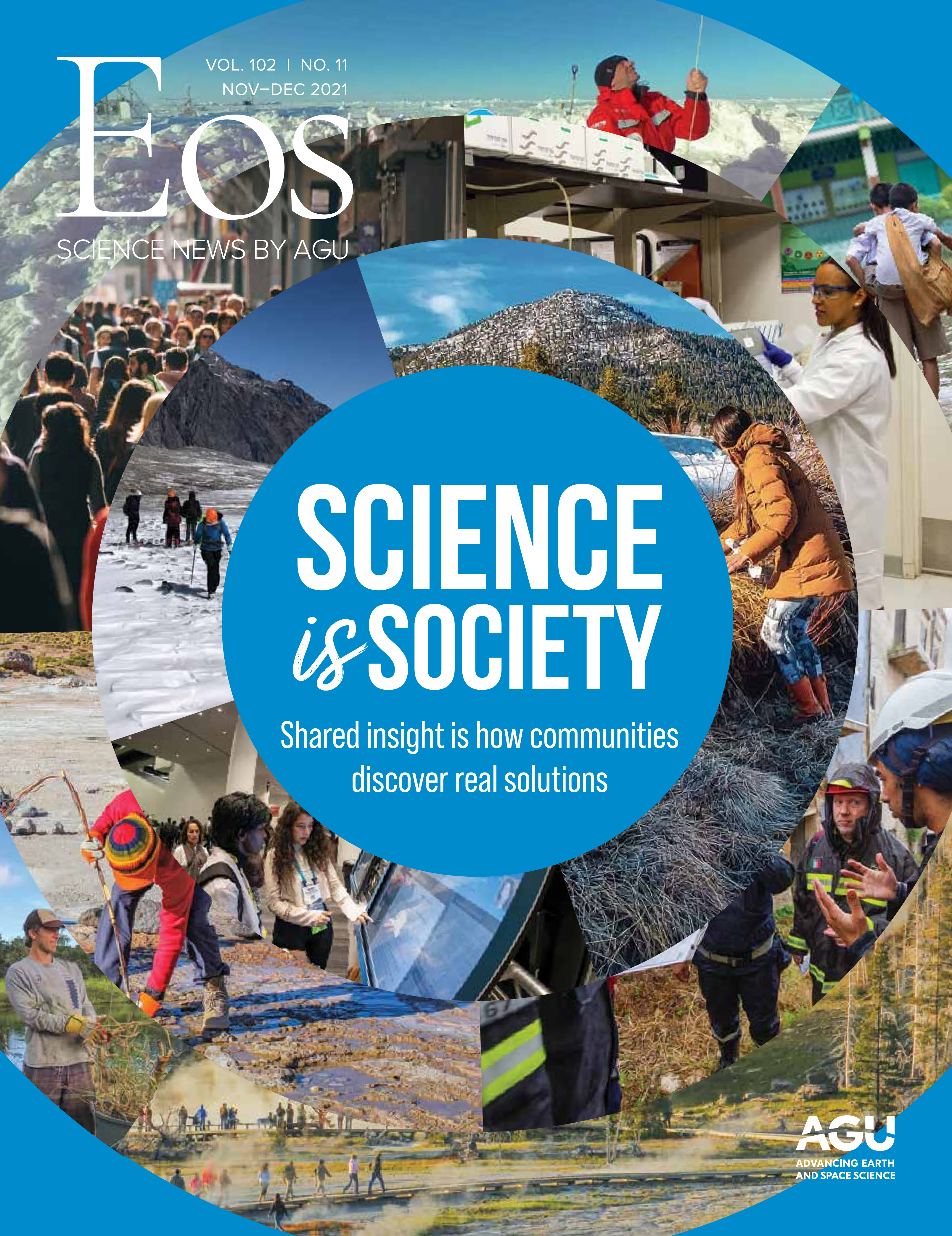
Eos

VOL. 102 | NO. 11
NOV–DEC 2021

SCIENCE NEWS BY AGU

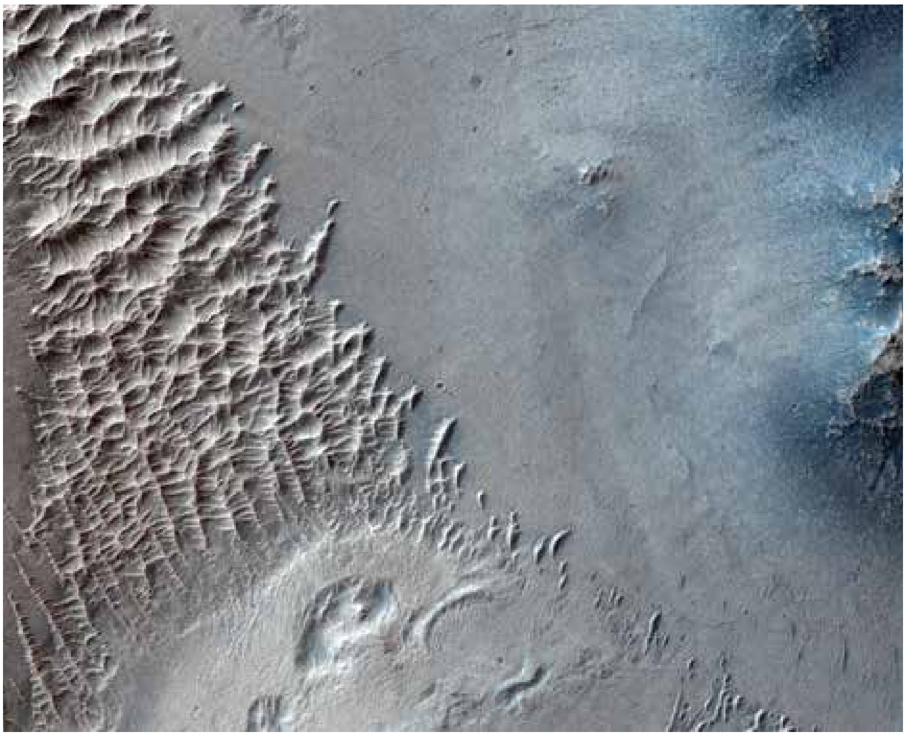


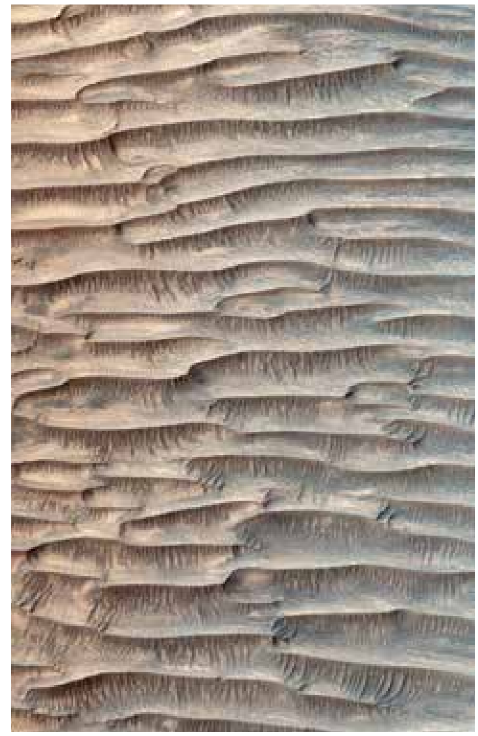
SCIENCE *is* SOCIETY

Shared insight is how communities discover real solutions

AGU
ADVANCING EARTH AND SPACE SCIENCE

Megaripples on Mars: How to Name Wind-Shaped Features on the Red Planet





Straight-crested transverse aeolian ridges in the lower part of the left image give way to more complex star-shaped sand dunes in this terrain southwest of Schiaparelli Crater on Mars. Credit: NASA/JPL-Caltech/University of Arizona. Two types of aeolian landforms are visible in the right image: large transverse aeolian ridges and the smaller ripples that run perpendicular to them. Credit: NASA/JPL-Caltech/University of Arizona

Spacecraft on Mars have captured images of barren, desertlike landscapes complete with dunes of sand. But the windswept features are not identical to their terrestrial counterparts. The surface of the Red Planet is dotted by mid-sized sand masses not found on Earth. These features go by a variety of names: megaripples, sand ripples, sand ridges, and the less melodic transverse aeolian ridges (TARs) chief among them. But the nomenclature is inconsistent, causing confusion that hampers scientific advancement. Now new research has proposed an official naming scheme for Mars's wind-formed features.

"Because we're seeing new things on Mars, people have adapted what they are calling things," said Mackenzie Day, a researcher at the University of California, Los Angeles. Day and James Zimbelman of the Smithsonian Institution coauthored the new paper, published in the journal *Icarus* (bit.ly/mars-megaripples). "People have adapted in slightly different ways."

Broadly based, the new system classifies aeolian, or wind-created, features by size and geomorphology.

"As we're getting new information, having a standard nomenclature makes sure everybody is on the same page," Day said. "If we're all talking about the same thing in the same way, it makes it easier as a scientific community to move forward in understanding what's going on."

Blowing in the Wind

Aeolian bedforms are piles of moving sand brushed across the planet's surface by the wind. On Earth, the largest of these features are sand dunes, which can stretch for tens to hundreds of meters in length. Small ripples only a few tens of centimeters long can be carved on top of these dunes.

"Bedforms are really amazing interactions between the atmosphere and the surface," said Serina Diniega, a research scientist at NASA's Jet Propulsion Laboratory who was not associated with the new paper. "If you see one, you immediately have a whole bunch of information about the environment."

In addition to dunes and ripples, Mars has a third type of bedform: transverse aeolian ridges. TARs appear to have been created by the wind but move on much slower timescales than their fellow bedforms and seem to be coated with a layer of fine-grained dust.

Day and Zimbelman proposed a broad frame of terminology for ripples, TARs, and dunes that relies first on the size and geomorphology of the features. As surface observations (anticipated soon from Curiosity and Perseverance) allow scientists to classify grain size and dust cover, the terminology can be further constrained.

Small ripples, for instance, are measured on centimeter scales in height and are classified as straight crested. Megaripples are measured at less than a meter in height and may be straight crested or sinuous. Unlike small ripples, megaripples may include coarse grains. TARs are classified as larger than a meter in height and straight crested. Dunes, the largest aeolian bedforms on Mars, are classified as taller than 3 meters and have wildly varying geomorphologies: from straight crested or sinuous to radially symmetrical stars.

“Using a classification based on looking at both Earth and Mars is better than a classification system based only on Earth.”

According to Ryan Ewing, a geologist at Texas A&M University who was not involved in the new study, the biggest challenge of a settled nomenclature will be agreeing on the processes that created TARs. “I think as we uncover more about how sediments move on Mars by wind, that will help the community refine their definitions of these [features],” he said.

“I really like this paper because it’s attempting to apply some sort of structure around these terms,” said Diniega. “Using a classification based on looking at both Earth and Mars is better than a classification system based only on Earth.”

Sand Through the Solar System

Bedforms aren’t limited to Earth and Mars. They’ve been spotted on Venus and on Saturn’s moon Titan, and there have been signs of them on Pluto and Comet 67/P.

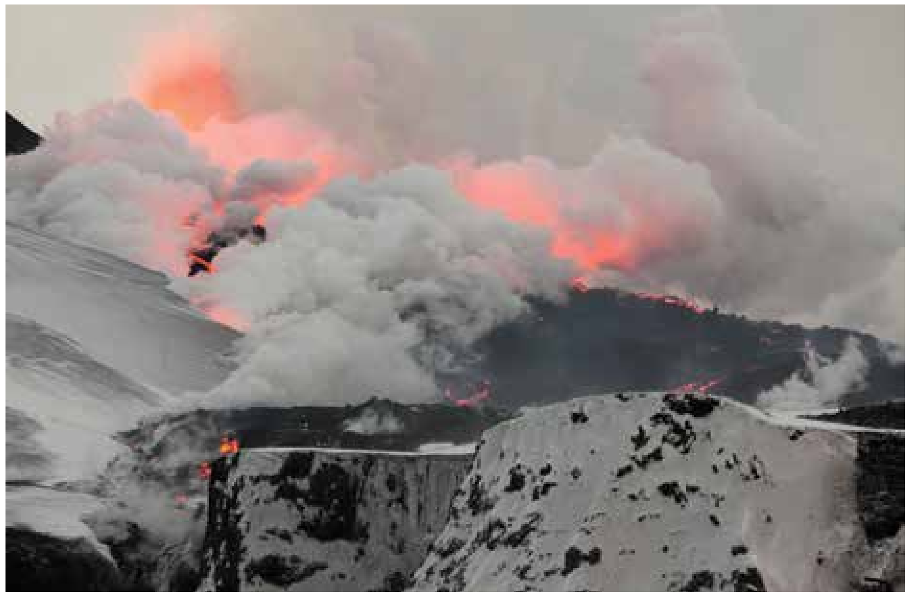
“Every place that has an atmosphere—and even places that don’t have an atmosphere—we see an example of these bedforms,” Diniega said.

The new classification system should work on these bodies as well.

“As we start exploring the solar system more, like sending Dragonfly to Titan, it would be nice to have a nomenclature that could be applied independent of what planet you’re on,” Day said.

By **Nola Taylor Tillman** (@NolaTRedd), Science Writer

The Understudied Risks of Low-Magnitude Eruptions



A minor eruption on Fimmvörðuháls (close to Eyjafjallajökull in Iceland) could have major repercussions for international communications and economics. Credit: Boaworm/Wikimedia, CC BY 3.0 (bit.ly/ccby3-0)

Lara Mani grew tired of hearing about the Yellowstone supervolcano. Every so often, another news story would appear, proclaiming that the Yellowstone caldera system could erupt with such ferocity that the impacts could cascade into a global catastrophe. “Yes, there’s plausibility in that,” said Mani, a research associate at the University of Cambridge’s Centre for the Study of Existential Risk, “but that’s not the only mechanism. There’s another way that can happen.”

Smaller eruptions, depending on where they occur, could also have catastrophic impacts, Mani thought. Historically, researchers have focused largely on the physical risk—the magnitude of potential eruptions. That’s at least in part because the vulnerability side—the transport routes, communication networks, and other infrastructure that if disrupted would affect societies around the globe—has become a problem only more recently.

“Most of the vulnerability is a relatively new (late 20th–21st century) product of how we humans have changed our technologies, economies, and flow of services,” said Chris Newhall of the Earth Observatory of Singapore. But we’ve already seen how small eruptions can lead to major disruptions. Consider the 2010 eruption of Eyjafjallajökull volcano in Iceland, which grounded more than 100,000 flights and cost the global economy upward of $5 billion.

“That should never have reached the global platform that it did; it was such a small eruption,” Mani said. “Why? What’s the mechanism behind that? What does this mean? That’s where it started.” In a new study in *Nature Communications,* Mani and her colleagues brainstormed identifying areas where smaller eruptions could combine with human-made vulnerabilities with catastrophic results (bit.ly/lower-magnitude). The new knowledge could lead to risk assessments and changes to preparedness.

Pinch Points

Mani and her colleagues began by looking at choke points along shipping routes—a focus that was highlighted this year when a container ship ran aground in the Suez Canal, bringing a major global trade route to a halt. They also looked at air traffic routes and other critical infrastructure like underwater cables and manufacturing hubs. The team identified seven “pinch points,” where