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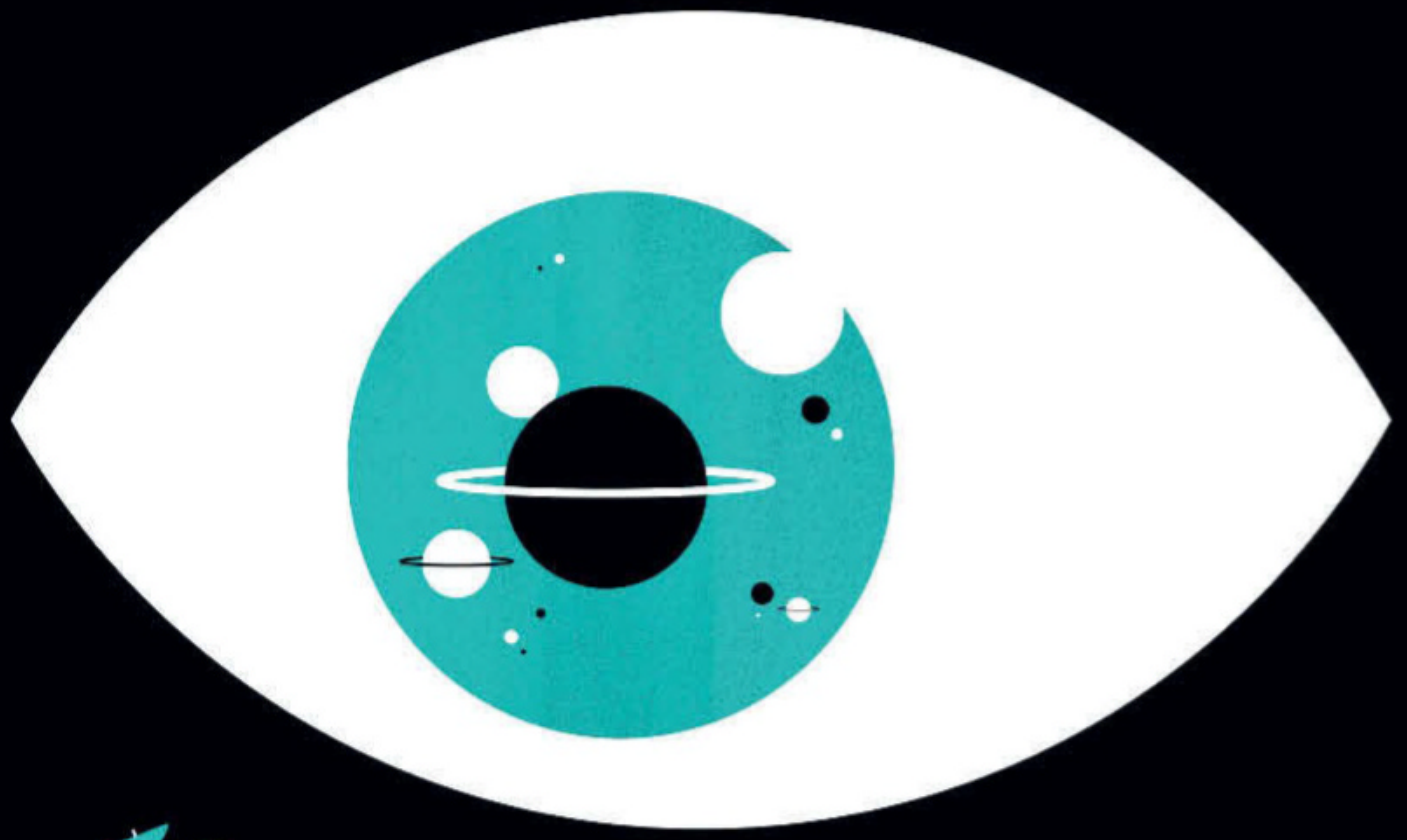

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Planets

Giant pumice raft on ancient Mars

A mysterious geological feature may have floated across an early Martian ocean

Jonathan O'Callaghan

A HUGE floating raft of volcanic rock called pumice may have drifted across an ancient Martian ocean and created one of the most mysterious features we can see on the planet's surface today.

The Medusae Fossae Formation (MFF), found near Mars's equator, comprises about 5000 kilometres of rolling hills and mounds. Scientists have suggested that it was made of volcanic ash from the nearby Olympus Mons or Elysium Mons volcanoes.

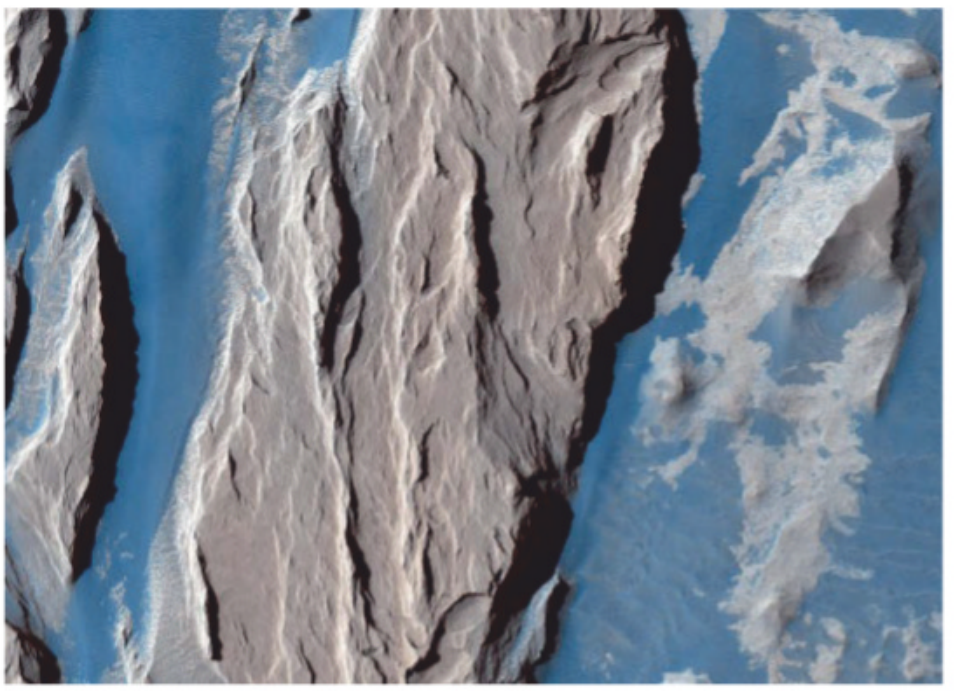
However, the size of the MFF poses some problems for this hypothesis. "It's enormous, over a million square kilometres of land area covered by [an estimated] million cubic kilometres of ash," says James Zimbelman at the Smithsonian Institution in Washington DC. "That's many orders of magnitude larger than the largest volcanic eruptions we know here on Earth."

Instead, Zimbelman and Peter Mouginis-Mark at the University of Hawaii looked at whether a raft of pumice rather than ash could have created it. Mouginis-Mark first proposed the idea in 1993, before subsequent images from Mars-orbiting spacecraft provided new evidence.

Pumice is a light and porous volcanic rock produced when lava interacts with water and rapidly cools, trapping bubbles of gas in it. On Earth, it can build up to form vast floating rafts, such as one covering 150 square kilometres seen on the Pacific Ocean in 2019.

Evidence of landslides on Olympus Mons suggests a similar process could have happened on Mars, say the researchers. The pumice would have built up before breaking away, drifting across a theorised ancient Martian ocean and coming to rest at a shoreline.

The Medusae Fossae Formation covers over a million square kilometres



NASA/JPL-CALTECH/UNIV. OF ARIZONA

"There isn't a volcano nearby that appears to have exploded with the volume of material [needed for the volcanic ash idea]," says Mouginis-Mark. "So we started to talk about, well, if you've got these rafts of pumice floating around on a palaeo-Martian ocean, where would they go?"

Evidence for such an ocean is debated, but if it did exist, it would probably have been at least a few hundred metres deep, spanning Mars's northern hemisphere. A strong wind, possible due to the thicker atmosphere at the time, from the south-west could have transported a floating pumice raft 4000 kilometres from Olympus Mons to where the MFF is found today (*Icarus*, doi.org/dsv9).

Kevin Lewis at Johns Hopkins University in Maryland, who wasn't involved in this research but previously worked on the volcanic ash origin of the MFF, says the pumice raft idea is "not totally outlandish" and is worthy of further investigation. "It's certainly an interesting and creative new hypothesis," he says.

If true, it could sway the debate on the presence of ancient large oceans on Mars, and potentially its previous suitability for life. "The rafted pumice proposal really requires an open, unfrozen body of water," says Lewis. "It would certainly provide some pretty interesting information about the Martian palaeoclimate in terms of water abundance and maybe habitability." ▮

Military technology

US Navy has scheme to make 'ghost planes' in mid-air

AT OVER 600°C, a jet engine's exhaust stands out like a beacon when seen in infrared, making it a target for heat-seeking missiles, but a US Navy device might be able to thwart such missiles with ghost images projected in mid-air.

The traditional defence has been to eject hot flares to draw missiles away from a plane. This new method uses lasers. When focused to a point, a laser can produce a spot or filament of ionised gas, known as a laser-induced plasma.

Alexandru Hening at the Naval Information Warfare Center Pacific in California is using lasers to create an array of plasma columns in the air. These are rastered like the beam in an old cathode-ray screen to create two or three-dimensional images in mid-air of ghost aircraft that can distract incoming missiles.

The patent describing the work was published in February, although it was filed in 2018. The exact status of the work and how close it is to operational deployment are unknown. The US Navy didn't respond to requests for comment.

In principle, by tuning the plasma, any desired wavelength could be made, from radio to gamma rays, so the device could be adapted to fool future sensors. The challenge

"Lasers focused to a point produce ionised gas that can be displayed in 2D or 3D images in the air"

is likely to be producing a stable plasma with a powerful enough infrared output to be effective.

Gianluca Sarri at Queen's University Belfast in the UK believes the plasma decoy is plausible in theory. He says the mechanism is well known and widely used in laser-plasma applications. Existing high-power lasers work at shorter wavelengths, which would be unsuitable, but a powerful mid-infrared laser could create a suitable plasma column, he says. ▮

David Hambling