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WEEKLY May 30 - June 5, 2026 No3597 US \$9.99 Canada CAN\$11.99

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Solar system

Mercury may have gained all of its unexpected water in a single day

Leah Crane

AROUND 100 million years ago, the surface of Mercury suddenly underwent a dramatic change. Before then, the planet was relatively dry and ice-free – not surprising, as daytime temperatures there can reach upwards of 430°C (806°F) – but over the course of one Mercurian day, all that changed.

The poles of Mercury are home to craters whose bottoms never see sunlight, known as permanently shadowed regions. Thanks to NASA's Messenger spacecraft, which orbited Mercury between 2011 and 2015, we know that those craters contain deposits of ice several metres deep. But how that ice got there is puzzling.

Previous research has suggested that it may have been brought there by a comet-like body around 17 kilometres across that smashed into Mercury at a speed of about 30 kilometres per second.

Now, new simulations from Parvathy Prem at the Johns Hopkins Applied Physics Laboratory in Maryland and her colleagues suggest that it may have been a larger, slower collision.

"We've known for a while that Mercury's poles have ice. The idea that those ice deposits might have been laid down by an impactor is also not new, but this is the first time we've really modelled that process and visualised what might have gone on from the start to the end," says Prem. "It's the first time we've looked in detail [at] how exactly the movie plays out."

That movie starts with a huge

Craters at Mercury's poles contain deposits of ice several metres deep

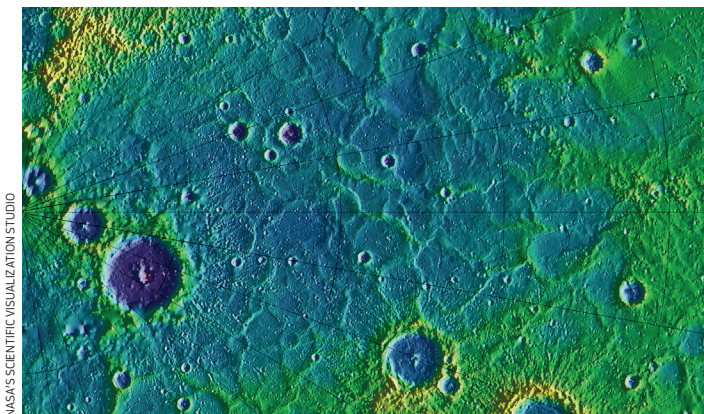
chunk of ice and rock slamming into Mercury, creating the enormous Hokusai crater that we see on the planet's surface today. As the impactor hit the ground, it would have vaporised almost completely, leaving Mercury with an extremely tenuous, but water-rich, atmosphere.

While most of the atmosphere would have been quickly destroyed by powerful radiation from the sun, the researchers found that just over one-fifth of the water vapour from the impactor could have migrated

to the poles and found shelter in permanently shadowed regions. This is more than many earlier calculations found, which better matches Messenger's measurements, says Prem. A larger impactor coming in at a slower speed than has previously been suggested would be an even better match, trapping more water on the surface.

If the researchers are correct, all of this would have happened over the course of one Mercurian day, which is 176 Earth days (*Journal of Geophysical Research: Planets*, doi.org/q7kj). "This would certainly have been the most eventful day in the last billion years of Mercury's history," says Emily Costello at the University of Hawai'i.

This could answer the long-standing question of why Mercury has so much ice in its polar craters and Earth's moon doesn't, despite the two being remarkably similar in nearly every way. In short: "Mercury recently experienced a large-scale water delivery. The moon didn't," says Costello. ■



Psychology

g Political anger and disgust have unique effects on the body

IF THE emotional rollercoaster of global politics feels overwhelming, the findings of a new study might help to explain why. Emotions evoked by political issues seem to be felt differently in the body than when the same emotions are experienced in everyday life.

Manos Tsakiris at Royal Holloway, University of London and his colleagues asked nearly 1000 people to mark on a body-outline

diagram where, and how intensely, they felt emotions including anger, disgust and hope. Then, they were asked to do the same, but while reading words associated with emotionally laden political issues, such as terrorism and crime.

Their responses were used to create a digital heat map, which covered where in the body each emotion was felt, how intensely, and whether the sensation was linked to feeling spurred into action or demotivated and detached (PNAS, doi.org/hb3qzb).

Previous research suggests many emotions are experienced similarly in

the body in different people, and the patterns of activation or demotivation seem to be universal across cultures.

The new study largely reflected these past findings, except when some emotions were evoked by politics. "People usually feel that their whole body is deactivated when they're depressed, but politically linked depression is more mobilising," says Tsakiris, with more intense sensations experienced throughout

"Political disgust was felt across the upper body, while non-political disgust clusters around the gut"

the torso and limbs.

Political disgust was also felt as a higher-energy sensation across the upper body, compared with non-political disgust, which clusters around the gut. When compared with non-political emotions, "political disgust more closely resembles anger", says Tsakiris.

He speculates this might be because political issues feel too big to tackle on our own, so we might feel motivated to join a wider cause to effect change. "The sense of agency that we have in politics is quite different," he says. ■
Caroline Williams