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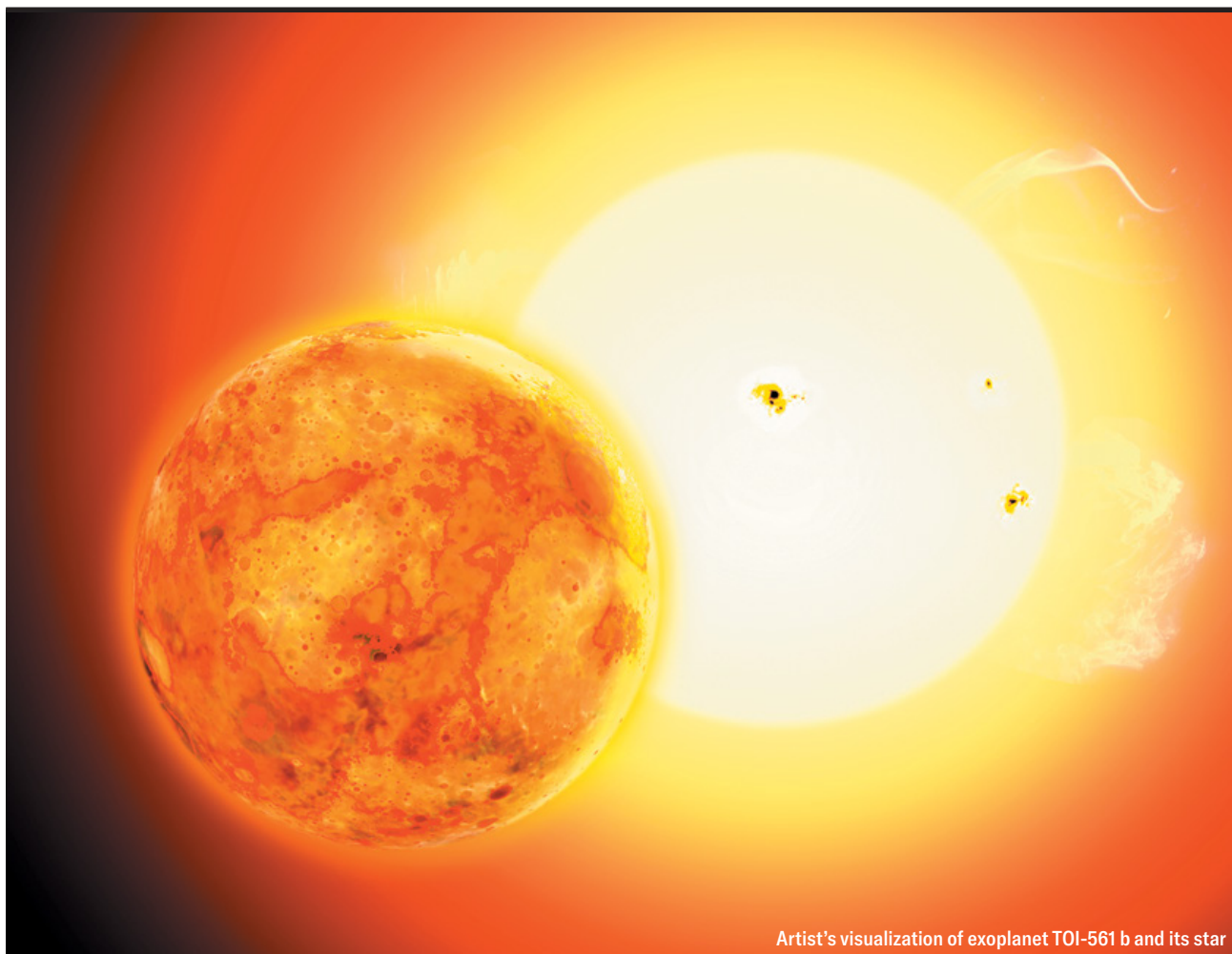
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Artist's visualization of exoplanet TOI-561 b and its star

PLANETARY SCIENCE

Dramatic Atmosphere

Exoplanet TOI-561 b has air where none should persist

ASTRONOMERS HAVE FOUND an atmosphere where they least expected it: clinging to an exoplanet that's too small, too hot and too old to have air, at least in theory.

Observations by the James Webb Space Telescope (JWST) of the blazing-hot lava planet TOI-561 b suggest not only that it cultivates a thick atmosphere but also that it might have had one for billions of years. This evidence is the strongest yet on a hot, rocky world for

air that isn't just a temporary veil of hydrogen and helium left over from planetary formation. The paper reporting the discovery, [posted on the preprint server arXiv.org](#), will soon appear in the *Astrophysical Journal Letters*.

"It's super old and ultrahot. It's the worst conditions," says study co-author Tim Lichtenberg, a planetary scientist at the University of Groningen in the Netherlands. "This planet should not have an atmosphere. And it has one."

Planetary scientist Joshua Krissansen-Totton of the University of Washington, who wasn't involved in the study, agrees. "It is definitely surprising and exciting to find a substantial atmosphere on this hot, rocky planet," he says.

In our solar system, atmospheres obey a simple rule: bigger, cooler worlds hold on to their air, and smaller, warmer

ones don't. But TOI-561 b weighs in at just two Earth masses and is very, very hot; the planet orbits so close to its yellow dwarf star that its year lasts less than an Earth day, and its estimated temperature is a rock-melting 2,300 kelvins. TOI-561 b is also about twice as old as our solar system, so its radiation-blasted atmosphere would have had plenty of time to escape. But researchers suspected the planet might be more than a bare ball of magma because of its unusually low density. And scientists previously spotted air on a bigger, hot super-Earth called 55 Cancri e, although the data were "messy and weird," Krissansen-Totton says.

To check for alien air, the research team used JWST to take TOI-561 b's temperature. The planet is tidally locked, so one side bakes in ceaseless radiation while

Ron Miller

the other is always dark. The scientists found that TOI-561 b's light-soaked day-side was cooler than they would expect for a naked rock—most likely because gas was there to spread the heat around.

The team is “confident” that an atmosphere is the best explanation for the data, says exoplanet astronomer and study lead author Johanna K. Teske of Carnegie Science in Washington, D.C. But finding an unexpected atmosphere “is the kind of result that generates more questions than it answers,” she adds.

For one, scientists don't know what TOI-561 b's air is made of or how it survived eons of hellish heat. Lichtenberg thinks the atmosphere probably bubbled up from the planet's magma ocean. Every planet in our solar system was once molten like TOI-561 b, he points out; this unexpected atmosphere could have a lot to teach us about the origins of our own.

—Elise Cutts

ARCHAEOLOGY

Vulture Culture

Human artifacts turn up in ancient scavengers' nests

IT TURNS OUT the bearded vulture—also called the *quebrantahuesos*, or bonebreaker—isn't just a carrion scavenger. It's also a keen collector of human ephemera.

This habit has given researchers in southern Spain a unique boon: “time capsules” of human activity that stretch back more than 600 years in the vultures' remote cliffside nesting caves. The raptors often reuse sites for generations.

Sifting through centuries' worth of eggshells, sticks and broken bones, scientists have found a wealth of remark-

ably preserved historical artifacts—among them a crossbow bolt, part of a slingshot and a piece of leather with red decorations that archaeologists say could be a “very peculiar mask.” The vultures seem to be particularly fond of footwear; so far in excavating the upper layers of 12 nesting sites, the researchers have found 25 shoes made from woven esparto grass.

With low humidity and protection from the elements, these cliffside caves create the perfect setting for preserving traces of human history and past environmental conditions. “These are the most inaccessible places you can imagine,” says Sergio Couto, a biologist at the University of Granada and co-author of a paper on the discoveries published recently in *Ecology*. “It's impossible to enter if you cannot fly.” (Or, in the researchers' case, rappel down from the cliffs.)

These finds are just the beginning, says study co-author Ana Marín-Arroyo,

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The Forces Within You

The 4 forces are feeling, reasoning, language, and perceiving; and the 4 brain structures that process these are respectively the amygdala, thalamus, cerebral cortex, and insula.

THE FOUR
FORCES OF
HUMAN
NATURE:
A UNIFYING
THEORY

Roberto
Treviño
Peña

“If we can identify the parts of the brain and their associated behaviors that process these forces, we can modify those behaviors to reduce chronic illness.”

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“Treviño-Peña . . . presents the science with authority, precision, and a strong sense of what readers will find fascinating.”

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“Just as physicists seek to unify the four fundamental forces of nature (strong, weak, electromagnetic, and gravity) into a singular theory, so too has Treviño-Peña, a medical doctor with research interests in brain physiology.”

— Kirkus Book Reviews

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