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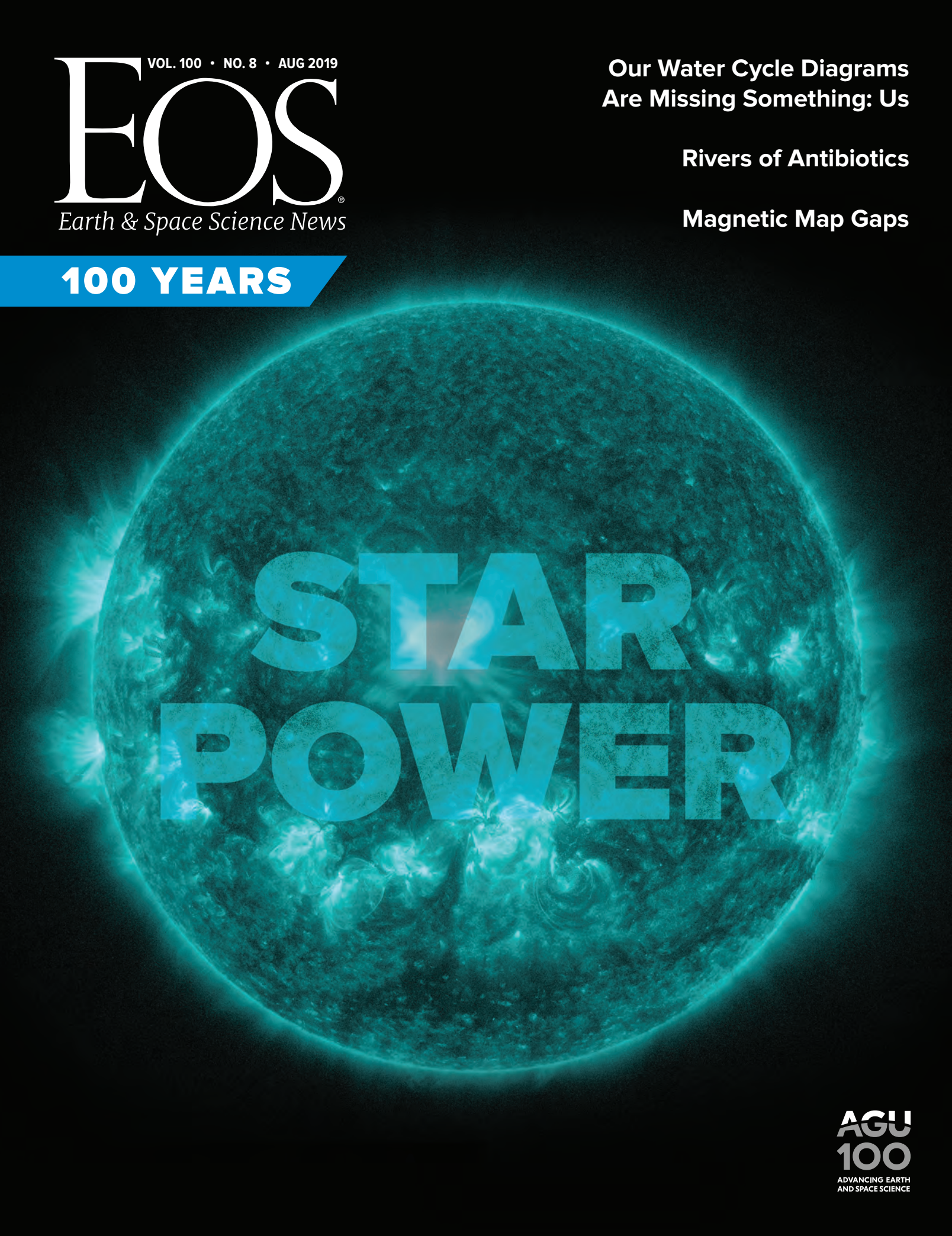

# STAR POWER

AGU 100

ADVANCING EARTH AND SPACE SCIENCE

# World's Oldest Meteorite Collection Found in World's Oldest Desert

*One of the larger chondrites found in the Atacama Desert sits among smaller, lighter rocks and a rock hammer for scale. Credit: Jérôme Gattacceca, CEREGE*

Each year, millions of meteors intersect with Earth. Most of these burn up on entering our atmosphere, but some larger space rocks survive the journey and land on Earth's surface.

A study looking at a sampling of more than 300 meteorites collected in Chile's Atacama Desert is shedding some light on the rate and variety of meteor strikes over the past 2 million years.

Meteorites can land anywhere on Earth, but those that fall in deserts and on ice sheets are more likely to be preserved and recovered, said Alexis Drouard, an astrophysicist at Aix-Marseille University in France and lead author of the study, published in *Geology* in May (bit.ly/oldest-desert).

But both locations have drawbacks: Most deserts on Earth are only a few thousand years old, and meteorites that land on ice sheets are often transported and concentrated by glacial processes, making it difficult to determine how many meteors might have fallen in a given time period, a statistic known as the meteorite flux.

"We wanted to see how the meteorite flux to Earth changed over longer timescales, over millions of years," said Drouard.

To find evidence of older meteorites in a stable environment, Drouard and his colleagues turned to a collection of over 300 meteorites found in Chile's Atacama Desert. "The Atacama is the oldest desert on Earth," Drouard said. "The Sahara was green 5,000 years ago, but the Atacama has been arid for at least 7 million years and maybe for as long as 20 million years."

The team subjected a sample of 54 rocky meteorites to cosmogenic age dating using the chlorine-36 isotope and found that the oldest samples fell to Earth between 1 million and 2 million years ago, with a mean age of 710,000 years, making this the oldest meteorite collection found to date on Earth's surface.

*A systematic search of Chile's Atacama Desert turned up hundreds of meteorites, many of which date back to over 1 million years. Credit: Katherine Joy, University of Manchester*

"This confirms the long-term, multimillion-year stability of the Atacama Desert surfaces and offers a unique opportunity to study the meteorite flux to Earth and meteorite weathering over the million-year timescale," the team wrote in *Geology*.

Being able to study the meteorite flux sheds some light on cosmic processes and events, such as collisions, that may produce more meteorites or change the type of debris. The team found that the flux of meteorites remained constant over a 2-million-year time span, with 222 meteorites more massive than 10 grams falling per square kilometer every million years.

"It's extremely rare to find a record like this that spans such a long, continuous chunk of time," said Philipp Heck, a meteorist at the Field Museum in Chicago who was not involved in the new study.

The team also found that the type of meteorite that fell on the Atacama changed over the time period studied. All 54 meteorites studied were ordinary chondrites, the most common type of rocky meteorite, but the collection falls into three groups: high iron (H type; 25 meteorites), low iron (L type; 26 meteorites), and low iron, low metal (LL type; 3 meteorites). The team detected a sharp increase in the proportion of H chondrites over L chondrites between 1 million and 0.5 million years ago.

"This confirms the long-term, multimillion-year stability of the Atacama Desert surfaces and offers a unique opportunity to study the meteorite flux to Earth."

"It's an interesting and important result that they found an overabundance of H chondrites between 1 million and 0.5 million years ago," Heck said. "When one type of meteorite dominates, it's most likely related to an event such as a collision that released those objects from the parent body."

For a follow-up study, Drouard's team could use cosmic ray exposure dating to determine how long the meteors traveled through space before entering Earth's atmosphere, Heck said. "This can tell us something about where they came from and the trajectory they were traveling before they intersected with the Earth."

By **Mary Caperton Morton** (@theblondecoyote), Science Writer