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Space

Earth once had a ring like Saturn's, hint crater sites

James Woodford

OLIVER HULL

What Earth might have looked like encircled by a ring of debris

AFTER a near miss with an asteroid 466 million years ago, Earth may have developed a Saturn-like ring of debris that lasted for tens of millions of years – and perhaps altered the planet's climate.

That is according to Andy Tomkins and his colleagues at Monash University in Melbourne, Australia, who have identified 21 crater sites around the world created by falling meteorites during a period known as the Ordovician impact spike 466 million years ago. The researchers say these crater sites were the result of larger objects in a previously unidentified ring being pulled out of orbit and crashing into Earth.

Taking into account the movement of the continents since then due to plate tectonics, all the sites would have been located close to the equator, say the researchers, which is consistent with a ring because these typically form above the equators of planets.

In addition, the team was guided by previous research that had observed a consistent meteorite signature in limestone deposits that were near the equator at that time.

The likelihood of all these crater sites being positioned close to the equator if they were the result of unrelated, random impacts is just 1 in 25 million, says Tomkins.

But where did this ring come from? The researchers propose that an asteroid, perhaps more than 12 kilometres in diameter, passed so close to Earth that it was torn apart by the planet's gravitational pull, creating a ring of debris.

The shadow created by the ring may have led to global cooling and the iciest

466

million years ago Earth could have had its own ring

conditions experienced by Earth in the past 500 million years, but its exact nature is still unclear (*Earth and Planetary Science Letters*, doi.org/nh4h).

"We don't know how the ring would have looked from Earth or how much light it would have cut out or how much debris there would have had to be in the ring to lower the temperature on Earth," says Tomkins.

It is thought that Earth pulls a kilometre-scale object into temporary orbit about once every 10 million years.

Much rarer for the smaller planets like Earth and Mars is for a large asteroid to pass within what is known as the Roche limit – the point at which the tidal forces of the larger body tears apart the smaller one.

The exact distance depends on the characteristics of the two bodies. For a solid asteroid approaching Earth, the Roche limit may be just over 3000 kilometres, while an asteroid made up of loosely compacted rubble would disintegrate at 15,800 kilometres.

Aaron Cavosie at Curtin University in Perth, Australia, says such a disc could explain the 40-million-year duration of impacts and meteorite debris in sedimentary rocks during the Ordovician impact spike, as well as the equatorial distribution of impact craters at the time. It also explains why a spike in similar age impact craters isn't seen on Mars and the moon, he says. ▮

Technology

An AI can beat internet CAPTCHA tests every time

Chris Stokel-Walker

AN ARTIFICIAL intelligence can solve the CAPTCHA puzzles used by websites to distinguish whether users are humans or bots 100 per cent of the time.

Andreas Plesner at ETH Zurich in Switzerland and his colleagues fine-tuned an AI model nicknamed YOLO (You Only Look Once) to solve reCAPTCHA v2 challenges – developed by Google – to verify identities on websites. These ask users to identify objects such as traffic lights among a set of images.

The researchers fed about 14,000 pairs of images with corresponding labels to the model to train it on what the objects look like. Overall, reCAPTCHA v2 focuses on about 13 types of object, such as cars, buses and road crossings. The narrow range of objects, all in the context of a road, made it easier for YOLO to be trained, says Plesner.

They then tested YOLO, looking at factors such as whether it moved the mouse as a human might and if there were browser histories and cookies installed on the test device. This is because it is believed Google's bot-detection algorithms look at these factors – known as device fingerprinting – in addition to the answers given in the CAPTCHA. The AI succeeded at the tests 100 per cent of the time (arXiv, doi.org/nh9t).

"We have a very large focus on helping our customers protect their users without showing visual challenges, which is why we launched reCAPTCHA v3 in 2018," a Google Cloud spokesperson said in a statement. "Today, the majority of reCAPTCHA's protections across 7 [million] sites globally are now completely invisible. We are continuously enhancing reCAPTCHA."

Device fingerprinting may become more important now it is clear image recognition can be done by AIs, says Eerke Boiten at De Montfort University, UK. ▮