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Space

Bacteria found in asteroid sample brought back to Earth – but they aren't from space

Alex Wilkins

A ROCK that was brought back from the asteroid Ryugu appears to host microbial life. But these microbes almost certainly came from our planet rather than outer space, say researchers. This contamination serves as a cautionary tale in the search for extraterrestrial life in sample return missions, such as from NASA's Perseverance rover on Mars.

In 2020, Japan's Hayabusa 2 spacecraft returned to Earth with 5.4 grams of rock from the 4.5-billion-year-old asteroid Ryugu. After the sample capsule landed in Australia, it was taken to a facility in Sagamihara, Japan. There, the capsule was opened in a vacuum room, itself located in a clean room, before being moved to a pressurised nitrogen-filled room for longer-term storage. From there, parts of the sample could be put inside nitrogen-filled containers and sent out for study.

One sample was sent to the UK to be studied by Matthew Genge at Imperial College London and his colleagues. Genge's team initially scanned the sample using X-rays and saw no evidence of bacteria.

Three weeks later, the researchers transferred the sample to a resin, and after another week they examined it using a scanning electron microscope (SEM). When they saw what looked like filament-shaped bacteria, Genge's students were almost "falling off their chairs" at the prospect they had discovered extraterrestrial life. "It was an exciting moment, but also in the back of my mind I knew from previous studies how easy it is for bacteria to colonise rocks," he says.

"Students were almost falling off their chairs at the prospect of discovering extraterrestrial life"

By tracking the growth of the bacteria with follow-up SEM measurements, they found the number of bacteria changed in a similar way to known microorganisms (*Meteoritics & Planetary Science*, doi.org/ntfh). Combined with their familiar shape and their absence during the first X-ray scan, it is likely they were terrestrial in origin, says Genge.

He suspects the sample was contaminated when or after it was embedded in resin. This took place in a facility that was also handling terrestrial space rocks, which often contain bacteria that are adapted to living in rock specimens. "When we're preparing meteorite samples, for example, we usually don't see this colonisation occurring, and that's because the chances are really low," says Genge. "In this case, a single bacterium fell on that sample and started to grow," he says. "It only needs one bacterium or one bacterial spore in order for this to happen."

The work should serve as a warning for future sample return missions, adds Genge. "The discovery of microbes within a space return sample really should be the gold standard for discovering extraterrestrial life," he says. "But our discovery really shows that you have to be so incredibly careful about that interpretation, because samples are so easy to contaminate with terrestrial bacteria."

Javier Martin-Torres at the University of Aberdeen, UK, says the findings suggest a terrestrial origin, but this doesn't rule out that the bacteria came from elsewhere. "When you want to determine that those microorganisms are not from an extraterrestrial origin, then you should do some DNA sequencing," he says.

The work also boosts the idea of bacteria surviving elsewhere in the universe. "Microorganisms can utilise organic materials within meteorites in order to sustain themselves – they are dining out on extraterrestrial snacks," says Genge. ▮

Technology

Robotic pigeon reveals how birds fly without a vertical fin

A PIGEON-inspired robot has solved the mystery of how birds fly without the vertical tail fins that aircraft rely on. The prototype could lead to passenger aircraft with less drag, reducing fuel consumption.

Tail fins, also known as vertical stabilisers, allow aircraft to turn from side to side and help prevent unintentional changes in direction. Some military planes, such as the Northrop B-2 Spirit, are designed without a tail fin because it makes them less visible to radar. Instead, they use flaps that create extra drag on just one side when needed, but this is an inefficient solution.

To investigate how birds stay in control without a vertical fin, David Lentink at the University of Groningen in the Netherlands and his colleagues created PigeonBot II. The design includes 52 real pigeon feathers and a bird-like tail – and test flights have been successful.

Lentink says the secret to PigeonBot II's success is in its programmed reflexive tail movements, designed to mimic those known to exist in birds. If you hold a pigeon and tilt it from side to side or back and forward, its tail automatically reacts and moves in complex ways. This has long been thought to be the key to birds' stability, but now it has been proven by the robotic replica.

PigeonBot II, a robot designed to mimic the flying techniques of birds

The researchers programmed a computer to control servomotors in Pigeonbot II. These steer the craft using propellers on each wing, but also automatically twist and fan the tail in response, creating the stability that would normally come from a vertical fin. Lentink says the reflexive movements are so complex that no human could directly fly Pigeonbot II. Instead, the operator issues commands to an autopilot, telling it to turn left or right, and an onboard computer determines the right control signals. After many tests to refine the system, Pigeonbot II was finally able to take off, cruise and land safely (*Science Robotics*, doi.org/g8rjt7).

"Now we know the recipe of how to fly without a vertical tail. Vertical tails, even for a passenger aircraft, are just a nuisance. It costs weight, which means fuel consumption, but also drag – it's just unnecessary drag," says Lentink. ▮

Matthew Sparkes