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Life could exist on Mars today, bacteria tests show

Life could exist on Mars, tests on microbes have revealed, but finding it will be no easy task.

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Early research results show that microbes could in theory withstand the harsh conditions on Mars.

‘Most microbes can grow in different types of extremes and the extremes that we are looking at, things like radiation, perchlorate salts and also sulphate salts (found on Mars), they will grow in that,’ said Professor Charles Cockell, from the University of Edinburgh, UK, who is coordinating the work as part of the EU-funded MASE project.

The researchers collect microbes from oxygen-free environments on earth, such as the 1.4 kilometre-deep Boulby salt mine in north-eastern UK, and then put them under conditions similar to those on Mars to see if

they can survive.

‘It’s just a question of trying to determine what the limits are and that’s the work we're doing at the moment,’ Prof. Cockell said.

The first stage of the European Space Agency’s (ESA) ExoMars mission left for the Red Planet on 14 March, and the objective is to look for signs of life on earth’s nearest neighbour.

Many scientists believe the conditions for widespread life on Mars – abundant water – did exist billions of years ago, and the MASE project is also looking for ways to pick out fossilised bacteria in the Martian rock.

However, if life still survives today, it’s likely in small residues of salty water underground where it can shelter from the extreme temperatures and harsh solar radiation on the surface.

Habitable environments

‘Anywhere where we’ve gone to the deep subsurface (on earth) today, where there is liquid water, there is a high chance that environments are habitable,’ said Prof. Cockell, who is also director of the UK Centre for Astrobiology.

‘Simply because Mars is a planet of volcanic rock, and when volcanic rock weathers that provides an environment for microbes to grow and reproduce, I think we can already say there is a high chance there are habitable environments.’

To find out, they’ll need to drill into the Martian surface and test the samples they find there for the tell-tale signs of life.

That’s the idea behind the ExoMars mission. The first stage will search out a place to land a rover. The second stage, due to launch in 2018, will take the rover, which carries the two-metre long drill.

Dr Victor Parro, from the astrobiology centre at Spain’s National Institute for Aerospace Technology in Madrid, has just come back from the Atacama Desert in Chile – the world’s driest place – where he’s been helping run tests on the next generation of sensors that they hope could be used to test drill samples aboard the proposed *Icebreaker* NASA-Ames mission concept, which could launch in 2021.

While the sensors on board ExoMars will heat samples and check for organic compounds that could be indications of life, Dr Parro and his team are working on a test that they say could provide much more conclusive proof.

‘We are now detecting three-dimensional structures – biochemical structures – that, we believe, are true and direct evidence of present life or recently extinct life,’ he said.

The technology works by using biological molecules known as antibodies that will stick specifically to other molecules – a process used by the immune system to fight disease.

DNA

The idea is to look for molecules that are found right through the tree of life on earth, such as fragments of proteins or even DNA.

As part of the EU-funded PBSA project, which Dr Parro coordinated, researchers have developed a prototype instrument capable of seeing in real time if the antibodies have bound to anything by using changes in light behaviour.

The project finished last year, and now they are working on a system called SOLID, which is based on a common biological test known as ELISA that uses fluorescence to show when one of the antibodies has reacted with something.

Researchers are working to create a smaller version of their SOLID system so it will fit on spacecraft. Image courtes
Researchers are working to create a smaller version of their SOLID system so it will fit on
spacecraft. Image courtesy of SOLID

‘The advantage of this is that the capacity for life detection is much higher,’ he said.

The next stage for this research is to adapt the system so that it is small and robust enough to fit on board a spacecraft.

This kind of technology means that there’s an increasing chance that we’ll find life if it’s present on Mars, or elsewhere in our solar system.

At the same time, the next generation of telescopes, including the James Webb Space Telescope due for launch in 2018, could look out into deep space and analyse the atmospheres of far-off earth-like planets in search of signs of life.

But if we’re still left empty-handed after all these efforts, then it’ll raise another, equally important question.

‘At the moment we just don’t know what the origin of life requires, going from simple chemicals to self-replicating microbe,’ Edinburgh’s Prof. Cockell said. ‘If we looked at many planets, many environments and didn’t find life, then that would tell us that life is extremely rare and that early spark was an unusual event.

‘And then we’d have to try and find out exactly why it was, and what happened in those early stages of life that was unusual on the earth.’

More info

MASE

PBSA