The Rosetta lander detects organic matter

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Rosetta deploys the Philae lander to comet 67P/Churyumov–Gerasimenko. ESA/ATG medialab; Credit: ESA/Rosetta/Navcam

Scientists working with data sent back by the now-slumbering Philae lander have announced the discovery of organic molecules on the comet 67P/Churyumov-Gerasimenko.

Finding organic compounds on 67P's surface is not actually particularly surprising. Organic compounds have been detected in material shed by comets before, and have been observed throughout interstellar space.

But we have never before been able to measure them in-situ, and this is where Philae offers something new and exciting.

While the results are preliminary, with researchers still working on a more detailed analysis, they are a tantalising reminder of the role comets played in the origin of life on Earth.

A rough but rewarding ride

Last week, the world watched in awe as the Philae lander departed from the Rosetta spacecraft then hopped, skipped and jumped across the surface of the comet.

European Space Agency's mission of landing on the surface of a comet – a dirty snowball left over from the solar system's birth – is surely one of the greatest technological achievements in the history of mankind.

Unfortunately, Philae's landing wasn't quite as smooth as was hoped, and the lander bounced to a stop leaning against a rock, in a shadowy region of the comet's surface.

The result – Philae currently receives too little sunlight to stay awake, and after a couple of days of frantic activity on the surface, has now gone into hibernation.

Hopefully, as the comet swings towards perihelion (its closest approach to the sun) next August, the amount of light Philae receives will increase and the lander will awake from its slumber – but we can't know for sure.

For now, Philae's work is done, and the baton has been passed to the teams who are now furiously studying the hard-earned data sent back to Earth before Philae fell asleep.

That data was squirted back to the Earth shortly before the lander entered sleep mode – and it is likely that exciting results will continue to appear over the next weeks and months.

The first such results have already been made public, with the scientists confirming the detection of organic molecules on the comet's surface. Not much is currently known – the scientists are still trying to fully disentangle the story of what has been observed – but the result is a tantalising glimpse of what is to come.

Comets and the origin of life

The reason that these results are particularly exciting goes back to two of the great unanswered scientific questions:

1. what was the origin of life?
2. how common is it throughout the universe?

Current theories of planet formation suggest that the Earth should have formed dry – this close to the sun in the proto-planetary nebula that birthed our planet, temperatures would have been too high for water to freeze out.

As a result, Earth required hydration, and it is thought that comets such as 67P would have been one of the main sources of the Earth's water, delivering it in countless comet collisions during the final stages of planet formation.

Beyond the question of the origin of water, though, the origin of complex chemistry, the precursor to life, has long puzzled scientists. Where did the chemical building blocks that make up life as we know it come from?

Were those compounds "cooked" in the early oceans, or in the vast tidal zones that fringed the continents following the formation of the moon?

Or did they come from beyond the Earth, delivered in the collisions that

dominated the process of planet formation?

Organics from space and home

As time goes by, it is seeming ever more likely that the origin of complex organic compounds on Earth is two-fold. Some was almost certainly cooked on our planet's surface, with the rest delivered by comets and asteroids, smashing into our planet.

It is in this context that the Philae observations are so exciting – further evidence that organic compounds are common in the universe.

The result is an important confirmation that such compounds must be abundant. To have detected them after just a "sniff" of the comet suggests that they're everywhere on its surface.

And given that we know comets have crashed into the Earth in vast numbers throughout our planet's history, we must have been repeatedly doused in the kind of compounds that are the direct precursors to life itself.

Panspermia?

Interestingly, the idea that life could have been delivered to Earth by comets has another, more speculative side – a theory known as "panspermia". What if life didn't start on Earth at all, but rather began elsewhere, and was delivered to our planet by rocks (or snowballs) from space?

The idea isn't actually as far-fetched as it sounds. Experiments have shown that bacteria can survive the kind of forces that would be experienced in the collision of a comet or asteroid on a planet such as

Earth.

And we know that impacts can eject solid, complete rocks from the surfaces of planets intact – we have meteorites on Earth that were definitely ejected from Mars. Still other experiments show that bacteria can survive, dormant, in the vacuum of space.

Following all of these results, it is quite possible, and perhaps even likely, that life in our solar system has been scattered back and forth between the planets over the billions of years since the planets formed. So if we do find life on Mars, then perhaps it will share a common origin with life on Earth, thanks to the countless collisions that have wracked both planets since they formed.

Some scientists go further, though, noting that life could be carried in comets from one planetary system to another. We know that they carry a rich organic budget – as demonstrated by Philae's latest exciting result – but what if they carry more than just the precursors to life? Perhaps comets are actually an inter-stellar delivery mechanism, by which youthful planets are seeded with life as they form.

The more extreme versions of panspermia remain both speculative and controversial. Despite this, it is becoming more apparent that comets are, at the very least, a prime source of the precursors to life. They delivered the water on which life thrives, as well as the compounds upon which it is built.

Without comets, it seems, we may well not be here.

Source: The Conversation