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Curiosity rover's methane result challenges life theory

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The Curiosity rover's failure to detect methane on Mars is a blow to theories that the planet may still host some types of life, say mission scientists.

Telescopes and satellites have reported seeing small but significant volumes of the gas, but the six-wheeled robot can pick up no such trace.

On Earth, 95% of atmospheric methane is produced by microbial organisms.

Researchers have hung on to the hope that the molecule's signature at Mars might also indicate a life presence.

The inability of Curiosity's sophisticated instrumentation to make this detection is likely now to dent this optimism.

"Based on previous measurements, we were expecting to go there and find 10 parts per billion (ppbv) or more, and we were excited about finding it. So when you go to search for something and you don't find it, there's a sense of disappointment," said Dr Chris Webster, the principal investigator on Curiosity's Tuneable Laser spectrometer (TLS).

The Nasa rover's search is reported in a paper published in this week's edition of Science Magazine.

Curiosity has been sucking in Martian air and scanning its components since shortly after landing in August 2012.

From these tests, it has not been possible to discern any methane to within the present limits of the TLS's sensitivity.

This means that if the gas is there, it can constitute no more than 1.3ppbv of the atmosphere - equivalent to just over 10,000 tonnes of the gas.

This upper limit is about six times lower than the previous estimates of what should be present, based on the satellite and telescope observations.

Deep down

The number of 1.3ppbv is very low, and will put a question mark against the robustness of those earlier measurements.

The fact that Curiosity is working at ground level and in one location should not matter, as the Martian atmosphere is known to mix

well over the course of half a year.

Methane at Mars could have a number of possible sources, of course - not just microbial activity.

It could be delivered by comets or asteroids, or produced internally by geological processes.

But it is the link to life that has most intrigued planetary scientists.

Earth's atmosphere contains billions of tonnes of methane, the vast majority of it coming from microbes, such as the bacteria found in the digestive tracts of animals.

The speculation has been that some methane-producing bugs, or methanogens, could perhaps exist on Mars if they lived underground, away from the planet's harsh surface conditions.

This theory was bolstered by the previous observations making their detections in spring-time. It was suggested that the seasonal rise in temperatures was melting surface ices and allowing trapped methane to rise into the atmosphere in plumes.

But in Dr Webster's view, Curiosity's inability to detect appreciable amounts of methane now makes this scenario much less likely.

"This observation doesn't rule out the possibility of current microbial activity, [but] it lowers the probability certainly that methanogens are the source of that activity," he told the BBC's Science In Action Programme.

Or as team-member Sushil Atreya, from the University of Michigan in Ann Arbor, put it: "There could still be other types of microbes on Mars. This just makes it harder for there to be microbes that kick out methane."

'Evolving story'

Dr Geronimo Villanueva is affiliated to the Catholic University of America and is based at Nasa's Goddard Space Flight Center.

He studies the Martian atmosphere using telescopes here on Earth. He cautioned that additional, much more precise measurements were needed from the rover before firm conclusions could be drawn.

"This is an evolving story as we get more numbers," he told BBC News.

"If Curiosity's statistics hold, it's important because it sets a new bound. Methane should last a long time in the atmosphere and the fact that the rover doesn't see it puts a big constraint on possible releases. But I would like to see more and better Curiosity results, and more orbiter results as well."

Dr Olivier Witasse is the project scientist on the European Space Agency's (Esa) **Mars Express** satellite, which made the very first claimed methane detection back in 2003.

He also said much more data was required.

"There is some indication from the Mars Express data - and it has not been published yet because it's a very complicated measurement - that the methane might peak at a certain altitude, at 25-40km. The Curiosity results are interesting but they have not yet settled the issue."

Esa has its **ExoMars Trace Gas Orbiter** launching in 2016, which will be able to make further methane searchers. And the **Indian space agency (Isro)** is due to despatch its Mangalyaan probe to the Red Planet later this year. This, too, has methane detection high on its list of objectives.

Curiosity itself will work to improve its readings, and will shortly deploy an "enrichment" process that will amplify any methane signal that might be present.

"We can lower that upper limit down to tens of parts per trillion, maybe 50 parts per trillion," said Dr Webster.

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