Mars methane linked to meteorites

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Fragment of the Murchison meteorite and isolated individual particles (shown in the test tube).

Tiny amounts of methane in the Martian atmosphere may come not from living things, but from meteorites on the red planet's surface, the latest findings suggest.

An international team of scientists show for the first time that meteorites continually bombarding Mars contain enough carbon compounds to generate methane when exposed to ultraviolet radiation.

The findings could help inform future missions searching for Martian life.

Since the discovery of methane in Mars' atmosphere nearly a decade ago, there has been much discussion of where it comes from. The gas contains carbon – a substance found in all living things – so some

researchers have suggested it may have a biological source.

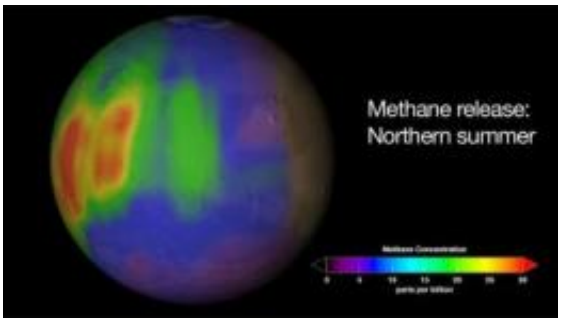
"Methane doesn't persist in the atmosphere, which means there must be some sort of process that continuously produces it," explains Dr. Andy McLeod from the University of Edinburgh, one of the co-authors of the study, published in *Nature*.

"Whether this process is biological or merely chemical or geological has been a subject of intense debate over the years."

A biological source for the methane would imply a possibility of life on Mars.

Previous studies have found that the amount of methane released from meteorites when they vaporise and break-up on entering a planet's atmosphere is negligible. Other researchers have suggested a geological, chemical or biological origin.

"All these ideas have their shortcomings, because the estimates for the amount of methane produced don't explain the level of methane in Mars' atmosphere," says McLeod.



This chart depicts the calculated methane concentrations in parts per billion (ppb) on Mars during summer in the Northern hemisphere. Violet and blue highlights are indications for little quantities of methane, red highlights for larger

ones. Credit: NASA

Until now no-one had thought to check whether exposing meteorites to sunlight would create methane. But McLeod and his colleagues' work on ultraviolet radiation's role in releasing methane from vegetation on Earth led them naturally to question its source in Mars' atmosphere.

"A few years ago, we discovered that methane is released from both living and dead vegetation when it's irradiated with ultraviolet radiation," says McLeod. "So we wondered if we exposed extraterrestrial matter to UV radiation, we'd see methane being produced."

The team used samples from a meteorite that fell on Australia more than 40 years ago in 1969, named the Murchison meteorite after the town nearest where it landed.

They chose it because it has a similar chemical content to the type of meteorite that regularly lands on Mars and is known to contain a small percentage of organic matter.

"If the many meteorites that bombard Mars also contain several per cent organic matter, there is potential to explain some of the methane we see there," says McLeod.

He and colleagues from the Max Planck Institute for Chemistry and the universities of Utrecht and West Hungary exposed meteorite particles to the same levels of ultraviolet radiation expected at the Martian surface. They found that the particles gave off significant methane, and say this could account for much of the gas present in Mars' atmosphere.

"The amount of methane we measured from the meteorite was much

higher than we expected," says McLeod.

"We can't say where this organic matter comes from, but our results show that it definitely has an extraterrestrial origin," he adds.

The researchers say a significant amount of weathering would be necessary to convert any meteoritic organic matter to methane. This is because ultraviolet rays cannot penetrate far into minerals.

They're also keen to add that while meteorites contribute to the production of methane in the Martian atmosphere, this doesn't mean they're the only source.

"We're not ruling out a possible biological origin for some of the methane in the Martian atmosphere, but our results don't add support to that idea," says McLeod.

What the findings do suggest is that the presence of methane isn't enough to say that life exists on Mars.

More information: Frank Keppler, et al., Ultraviolet-radiation-induced methane emissions from meteorites and the Martian atmosphere, *Nature*, published 30 May 2012, doi:10.1038/nature11203