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Curiosity sniffs the Martian air but no clues yet to life on Mars

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NASA's Curiosity rover sampled the air on Mars this week. At a teleconference on November 2, NASA announced Curiosity had not found any evidence of methane, which is often a sign of life, in the Martian atmosphere.

"At this point we don't have a positive detection of methane on Mars. But that could change,"

Sushil Atreya, a co-investigator for the Sample Analysis at Mars (SAM) instruments said during Friday's teleconference, reports New Scientist. He referred to the possibility of higher levels of methane having existed on Mars in the past but having been eliminated by other gases, such as chlorine, or powerful dust storms on Mars.

Referring to previous results from Earth and orbiter based research which had suggested the existence of methane on the Red Planet, Atreya continued,

> "Everything is open at this point. Since we do not have positive detection, we're not in a position to say what the source of methane would be. Stay tuned. The story of methane has just begun."

NASA's Mars Curiosity rover has been sniffing the Martian atmosphere this week and although no evidence of methane often a tell tale signature of microbial life, was found other

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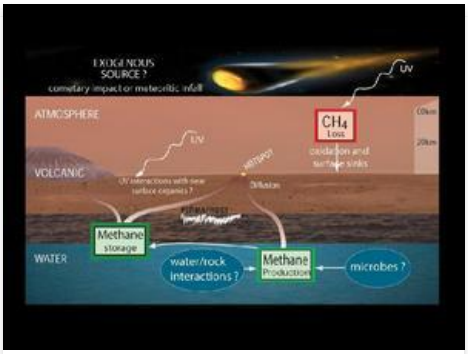
atmospheric experiments conducted by equipment on board Curiosity are giving scientists a greater understanding of what may have happened to Mars' atmosphere.

Curiosity rover is now stopped in an area of the Gale Crater on Mars which NASA has named "Rocknest", as reported earlier in Digital Journal, where onboard equipment has sniffed the Martian atmosphere to gather samples for analysis. As part of the sampling, Curiosity has used its Sample Analysis at Mars (SAM) instruments to carry out the most sensitive measurements to date in searching for methane gas in the Martian atmosphere.

Methane can have geological origins but, equally, it can be given off by living organisms. If methane were found then it would be indicative of the existence of life on Mars, even in microbial form, whether past or present. All living organisms, at least those that are life as we know it, give off methane as they process nutrients. Scientists also believe that the existence of methane is an essential pre-cursor for primitive life forms to evolve in the first place.



NASA/JPL-Caltech, SAM/GSFC

Possible Sources & Sinks of Methane on Mars: Potential non-biological sources include comets, degradation of interplanetary dust particles by ultraviolet light, and interaction between water and rock. A potential biological source would be microbes, if microbes ever lived on Mars. Potential sinks for removing methane from the atmosphere are photochemistry in the atmosphere and loss of methane to the surface.

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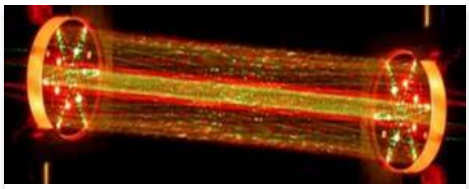
Initial results from Curiosity have revealed little or no methane. The lack of methane has not come as a surprise to NASA scientists since it has been difficult to detect the gas on Mars from Earth-based observatories. Even space-based Mars orbiters have only provided inconclusive evidence detecting the odd trace of methane at some locations on Mars.

There have been tantalising suggestions that methane might exist on Mars since 2003, reports New Scientist. Then, ground based instruments and a European orbiter detected a methane signature in Mars' atmosphere. Later, in 2009, a study conducted with the aid of Hawaiian based telescopes interpreted results as indicating localised plumes of methane at three locations near the Martian equator.

"Methane is clearly not an abundant gas at the Gale Crater site, if it is there at all. At this point in the mission we're just excited to be searching for it," said SAM Tunable Laser Spectrometer lead Chris Webster of NASA's Jet Propulsion Laboratory in Pasadena, Calif. "While we determine upper limits on low values, atmospheric variability in the Martian atmosphere could yet hold surprises for us."



NASA JPL Caltech

Lab demonstration of the measurement chamber inside the Tunable Laser Spectrometer, an instrument that is part of the Sample Analysis at Mars investigation on NASA's Curiosity rover

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The Tunable Laser Spectrometer (TLS) provides the first research conducted 'on site' on Mars for molecules of methane gas. The instrument is capable of detecting minute quantities of the gas – just a few parts methane per billion parts Martian atmosphere. The sensitivity of the instrument is such that, allowing for a tiny margin for error, even an apparent positive result for methane could mean that the actual amount of the gas in the atmosphere is zero, reports JPL/NASA.

During the first three months Curiosity has been on Mars, the rover's suite of scientific instruments has used two methods to analyze samples of the Martian atmosphere. Curiosity's mass spectrometer investigates the atmosphere as a whole, returning data on the various gases present in the Red Planet's wispy atmosphere. The Tunable Laser Spectrometer conducts a more focussed search for traces of carbon dioxide and methane.

A third analysis method, using a gas chromatograph, has still to be used. This third method will, in addition to separating and analyzing gases, also analyze samples of soil and rock. The first solid sample is likely to be examined by the gas chromatograph during the next few weeks. This could lead to some intriguing results as the search will be for organic compounds – the building blocks of life – as well as looking for and analyzing water-bearing minerals and carbonates.

Clues to Mars' loss of atmosphere

The main results from Curiosity rover's SAM instruments this week point to Mars having lost part of its atmosphere. Initial SAM results disclose a 5% increase in heavier isotopes of carbon in atmospheric carbon dioxide compared to estimates of the isotopic ratios present at the time of the planet was formed. An isotope is a variant of the same element with different atomic weights. Carbon, for example, has 16 known isotopes only three of which, Carbon 12, Carbon 13 and Carbon 14 are naturally occurring.

Scientists believe that on Mars a physical process has taken place, possibly involving the loss of Martian atmosphere, which has resulted in the retention of heavier isotopes. The higher proportion of heavier isotopes suggests the top of the Martian atmosphere may have flown off into space. This would account for depletion of the lighter isotopes. As well as the deficiency in lighter carbon isotopes, SAM instruments have also revealed that isotopes of the inert gas argon also show a higher proportion of the heavy isotope, confirming estimates of Martian atmospheric composition sourced from analysis of meteorites, believed to have originated from Mars, on Earth.

The theory is that the environment of Mars' distant past could be wholly different from the present day. Aeons ago, water may have existed on the Martian surface under the protective layer of a thicker atmosphere. Earlier Curiosity findings, as reported in Digital Journal, show pictures of what looks like pebbles in a dried up river bed, suggesting water once flowed on the Martian surface.

NASA will carry out further research on what may have happened to the Martian upper atmosphere when NASA's Mars Atmosphere and Volatile Evolution (MAVEN) mission arrives in Mars orbit in 2014.