NASA’s Curiosity Mars rover has not found any definitive evidence of methane in the thin air at the Gale Crater landing site, project scientists said Friday, a finding that could raise fresh questions about whether microbial life might exist on the red planet today.

While methane is commonly produced by living organisms on Earth, low concentrations on Mars could be explained by non-biological processes such as comet impacts, the breakdown of dust particles by ultraviolet light and even the interaction of water and certain types of rock.
Earlier, somewhat controversial observations using Earth-based telescope and satellites in orbit around Mars were interpreted as episodic plumes of methane that are difficult to explain in the absence of biology.

But a sensitive laboratory instrument aboard Curiosity called the Tunable Laser Spectrometer, part of a suite of instruments making up the Surface Analysis at Mars package, found no such evidence during repeated sampling runs.

"For methane determinations, we measure the difference in spectral line depth between a full (sample) cell and empty cell runs, that is, those with Mars air in or out of the sample cell," said Chris Webster, the instrument lead for the Tunable Laser Spectrometer at the Jet Propulsion Laboratory. "We pump the sample cell out and we take a bunch of readings. Then we fill it with Mars air and we take more readings. And finally, we pump it out again to recheck our background levels.

"So how much methane did we see, you ask? A search for methane was made on multiple nighttime runs, but so far we have no definitive detection of methane. We see differences between the full cell and empty cell results of a part per billion or so, but the data uncertainty is larger than this and could accommodate values of no methane at all up to towards 5 parts per billion at the 95 percent confidence limit. We do plan on additional runs, of course, to look for variability."

Variability is a key element in the search for methane. Non-biological processes could result in methane concentrations of a few parts per billion or less and such low levels would be expected to remain relatively constant over time scales of several centuries. But the earlier observations indicated large seasonal changes over much shorter periods.

"In the Gale Crater, at the moment, we don't have a definite detection of methane," said Sushil Atreya, a co-investigator with the SAM instrument package. "On the other hand, the source doesn't have to be at Gale Crater. If there is a source of methane elsewhere, it does not take very long for it to get distributed all over the crust."
the planet. It takes on the order of about three months. That is all we can say at this point."

Pressed on whether Curiosity might happen to be sampling the air during a lull in methane production, Atreya said the team would continue studying the atmosphere over the weeks and months ahead and "we'll monitor that."

"As far as seasons are concerned, methane could have a very long lifetime if the destruction mechanism is conventional and in that case, you would not expect large changes going on in methane over such a short period of time of two years," he said. "But if the observations that exist are correct, that methane comes and goes, it indicates there are very big sinks (methods of removal) on Mars and that's what we'll try to understand as we get more data."

Atreya said the team was not surprised at the initial absence of methane, saying "we went there with no preconceived notions about what we were going to find."

"The (earlier) observations have been published in various papers, they're somewhat controversial," he said. "All we can say is that we're not really surprised. We're there to make measurements, and we'll learn what Mars has to tell us."

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