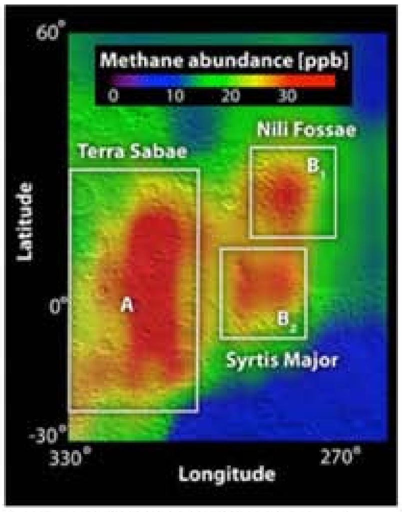
NEWS by Kelly Beatty

The Curious Case of Martian Methane

Those of you old enough to have lived through the 1960s might remember comedian Bill Dana's routine involving "Jose Jimenez," the first astronaut in space. When asked whether there might be life on Mars, the reluctant space pioneer replied, "Maybe . . . if I land on a Saturday night."

Be honest: deep down inside, don't you wish that life of some kind exists (or at least once existed) on Mars? Whether you do or don't, the news today out of NASA's Washington headquarters would really have piqued Jose's interest.



Red areas indicate where in 2003 ground-based observers detected concentrations of methane in the Martian atmosphere, measured in parts per billion (ppb). Click on the image to see this view compared with a map of the Martian surface.
NASA / M. Mumma & others

Mars, it seems, occasionally burps sizable volumes of methane gas. This, in itself, isn't exactly fresh news. Both ground-based telescopes and Europe's Mars Express orbiter detected whiffs of Martian methane several years ago.

However, since then Michael Mumma (NASA-Goddard Space Flight Center), Geronimo Villaneuva (Catholic University), and others have reanalyzed their 2003 spectroscopy with a new technique that's more sensitive to the methane signature — and in doing so they've found that broad, relatively concentrated plumes of methane were floating over the planet's northern hemisphere at that time. Details appear in a paper published online today in *Science Express*.

Not only is this the "first definitive detection of methane on Mars," as Mumma notes, but he and his team have a fairly good idea of where it came from. The plumes appeared to the east of Arabia Terra, the Nili Fossae region, and the southeast section of Syrtis Major. All three locales appear to have been saturated with liquid water long ago, and in fact the team found water vapor in the plumes as well.

Methane shouldn't exist in the thin Martian atmosphere — it's easily destroyed by exposure to the ultraviolet-rich sunlight that streams onto the planet. So where did these plumes come from? The team offered three possibilities during today's press briefing.

First, it might have come from an impacting comet. Some comets do contain methane, at an abundance of about 1% relative to their water, and a recent impact can't be entirely ruled out. But atmospheric specialist Sushil Atreya (University of Michigan) says that's really unlikely, because it'd take a comet a couple of miles across to generate so much methane.

Now, I ran the numbers myself and found that a comet less than 1,000 feet (300 meters) across could deliver the 19,000 tons of methane detected in the plumes. But, as Atreya points out, "The problem with this scenario is that it does not take into consideration the loss [due to combustion during atmospheric entry, for example], which is staggering." Besides, even the crash landing of such a smallish comet would have left a crater so fresh that it would've been very obvious to Mars-orbiting cameras.

Second, Mars might literally have burped up methane stored in its interior. It wasn't from a volcano, Mumma notes, because then the methane would have been joined by gases like sulfur dioxide that weren't seen. Instead, buried deposits of iron oxide might have undergone a geochemical reaction (known as *serpentization*) that releases methane. Then a recent shifting of the crust provided the trapped methane with an escape route to the surface.

Finally, there's the "life card." The methane could represent, as noted by geologist Lisa Pratt (Indiana University), the "exhaled breath" of deep-seated colonies of microorganisms. These putative critters — past or present — would feed on hydrogen gas created by the proximity of water to traces of radioactive isotopes and give off methane as a waste product. Again, since the telltale plumes weren't seen before 2003 or since, the methane would have accumulated in some kind of underground reservoir before being released.

Pratt adds that some organisms feed on methane rather than excrete it, so either way the gas's detection ups the prospects for Martian biology. But she notes that there's nothing in the observation to tip the scales toward biology versus geochemistry. An experiment on the forthcoming Mars Surface laboratory has the power to deduce the methane's isotopic mix and thus narrow the choices. But NASA recently postponed MSL's launch until 2011 — so all you Marsophiles will just have to be patient.

Mumma agrees that it's still a coin flip, but he and Villanueva plan to resume observations to try to make more sense of it all. "We have a total search strategy beginning in August for other molecules," he explains, along with more work to extract the evidence for water from their existing spectra. "We want to pursue both opportunities — what do we expect to see for serpentization or biology? That's the scientific method, and that's how we'll make progress."

Interestingly, most of the methane was gone when the team looked again in 2006 — and that's almost as intriguing as finding it in the first place. Exposure to sunlight couldn't have eradicated it so quickly, so some other process was at work. NASA's Phoenix lander discovered the presence of a mildly reactive compound known as perchlorate, and results from the Viking landing in 1976 suggest hydrogen peroxide in the surface dust. Either of these could do the trick.

And just for the record, Jose, the plumes were detected on a Wednesday, Thursday, and Sunday.

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