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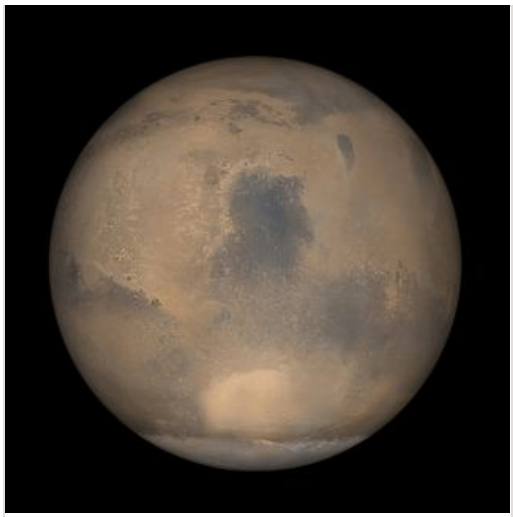
Methane on Mars: Is Something Organic Brewing on the Red Planet?

Localized gas plumes may point to biological or geologic activity
By John Matson



BELCH BALL: The Mars Global Surveyor captured this image of the Red Planet in northern summer, the season in which researchers spotted a significant release of methane on the planet in 2003. The source of the gas, which on Earth is primarily biological in origin, remains a mystery.
NASA/JPL/Malin Space Science Systems

On Earth, methane is something of a villain—a powerful greenhouse gas that is far more effective than carbon dioxide at trapping heat. But it is also a marker of life that emerges by and large from biological processes, such as the digestive systems of cows and termites. So when methane was identified on Mars in 2003 and 2004, efforts were rekindled to seek out life there, either historical or extant.

A team of researchers today announced another milestone in determining the source of methane on Mars, along with the best next steps to ascertain whether the gas is connected to life or to geologic activity on the Red Planet.

Michael Mumma, a senior planetary scientist at the NASA Goddard Space Flight Center in Greenbelt, Md., and his colleagues report in the online edition of *Science* that they used ground-based telescopes to spot a significant belch of methane that appears to have emerged from localized regions on Mars in summer 2003.

At a news conference this afternoon telecast from NASA's Washington, D.C., headquarters, Sushil Atreya, a professor of atmospheric and space science at the University of Michigan at Ann Arbor who did not contribute to the study, noted two significant observations made by Mumma's team: that Mars hosts active hot spots of methane and that the gas appears to be destroyed rapidly by chemical processes, indicating the presence of powerful oxidizing agents. (Atreya wrote a 2007 feature for *Scientific American* discussing the implications of methane on Mars and on Titan, a moon of Saturn.)

Specifically, observations made by Mumma and his colleagues showed a relative dearth of methane on Mars in spring 2006, implying seasonal fluctuations of the gas's release. The levels were so low that they did not account for the methane released in the summer 2003 event, even if it were a freak one-time occurrence. (Photochemistry, which breaks down methane over time, acts too slowly to explain the rapid disappearance of the gas.)

Assuming that the methane is produced by internal processes on Mars, Atreya said that the source could be "geology, in which case it's the reaction between water and rock, or it's biology, in which case the microbes are producing the methane." (Even the former explanation could be intriguing, as Mars is not thought to be very geologically active.) In either case, the discovery of individual methane plumes points to the existence of localized aquifers (water-bearing rock layers) under the surface, he said.

Atreya cautioned that the methane could also be a relic, somehow sequestered and then released, of past processes rather than a marker of activity today.

In an interview, Mumma said that his team is already working to pin down the origin of the gas. In 2006 the group began observing Mars at the Keck Observatory on Mauna Kea in Hawaii. "With that, we can search for a dozen different molecular trace species in the atmosphere simultaneously," Mumma says. "So that's the next step: to actually test the abundance of those species, because their abundances should depend on the origin of the material." And the Mars Science Laboratory, now scheduled for a 2011 launch, will conduct an isotopic analysis that will provide an independent assessment of the gas's origin.

Mumma is careful not to overstate the significance of his new study, calling the discovery "the next step in a long-term campaign to really identify whether biology ever arose on Mars, whether it still exists on Mars, [and] if the geochemistry [is] still active on Mars."

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