Looking for life on Mars

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Looking for life on a planet like Mars is like
looking for a needle in a haystack. And, at this point, we're still looking for the haystack.

Life eats and breathes and excretes. Finding one or all of these processes taking place on Mars would be evidence for life. Experiments aboard the Viking landers in the mid-70s, though, remind us to carefully distinguish between true life processes and abiotic (non-living) processes that resemble life (most, if not all, scientists conclude that the effervescence - fizzing - seen in one of the Viking experiments resulted from the same sort of reaction - the break-up of peroxide and superoxide molecules - that you see when you disinfect a toothbrush by soaking it in hydrogen peroxide).

When the Viking mission was still being designed, James Lovelock (author of the Gaia hypothesis, the subject of an upcoming column) realized that we could look for life on Mars without ever landing on the planet.

The atmosphere of Earth is rich in oxygen (20 percent). This is strange. Oxygen combines rapidly with all sorts of things, including the minerals in rocks it should be quickly used up. To keep so much free oxygen in the air, something must be replacing it as fast as it gets bound up. That something is life: green plants, algae, cyanobacteria performing photosynthesis.

Lovelock suggested we could search for life on Mars by looking for a gas in its atmosphere that's similarly out of equilibrium; that should not, by rights, be there.

We may have found it.

I spoke recently with Michael Mooma, an infrared astronomer whose team is now the third to have found methane in the Martian atmosphere.

Methane is a reactive gas - it burns nicely in a cookstove. Any methane released into our atmosphere quickly reacts with oxygen. There would be no methane in our atmosphere were it not continually replaced by bacteria in wetlands and bovine stomachs.

Sushil Atreya, of the University of Michigan, studying the chemistry of the Martian atmosphere, points out that many other reactions can take out methane. Solar ultraviolet breaks up water molecules, and the fragments can react with methane. Another possibility stems from the frequent dust storms that whip around the planet.

Whipped by the wind, sand and dust rub against each other, and, like a balloon you rub across your shirt, become electrically charged. The electric fields that result can rip apart molecules of water; as the fragments re-combine, they form peroxides; further irradiation by UV from the sun can turn these peroxides into even more reactive superoxides. All of these attack methane.

What replenishes the Martian methane? Making the question even more interesting, the methane only shows up in certain parts of the planet - mainly near the equator. And it was near the equator that spacecraft several years ago found evidence for water beneath the ground.

The methane could be biogenic. But before we jump to that conclusion, we must apply the "principle of least astonishment" - we must try our best to show that the methane results from more mundane processes.

Comets sometimes hit Mars. Comets are made of ices, including methane ice. A comet slamming into Mars could release methane into the air for thousands of years.

Perhaps Mars is more geologically active than we've thought. Magma, rising to the surface, could release methane as it neared the surface.

Or, perhaps, we've actually found evidence for microbial life on Mars.

The orbits of Earth and Mars bring the two planets close every two years. The orbiters to be launched during the 2005 close approach are now under construction.

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