Biologist suggests carbon monoxide as an energy source for microbes on Mars

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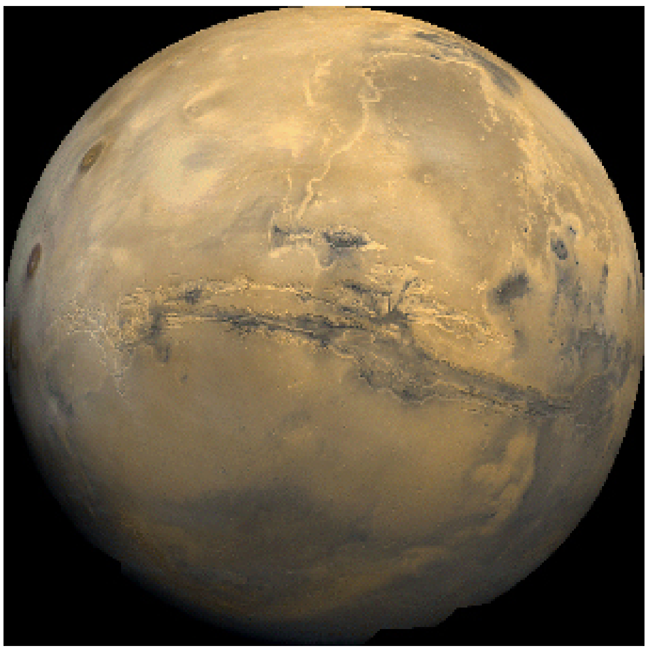

Valles Marineris, Mars. Credit: NASA

(Phys.org)—Gary King, a biologist at Louisiana State University has put forth the idea that if life did exist on Mars, it very possibly could have survived by using carbon monoxide. In his paper published in *Proceedings of the National Academy of Sciences*, he discusses his study of microbes in soil samples collected here on Earth that are able to pull in carbon monoxide and why it might relate to life on Mars.

In order for life to have existed on Mars (or if it still does in a place we have not found yet) it would have to have an energy source of some kind. Prior research has suggested such a source might be nitrogen, the same energy source for most plants here on Earth—a recent report by researchers studying data from Curiosity rover, describes nitrates found in the soil. In this new effort, King takes a different approach, he believes that carbon monoxide may hold the key to life on Mars.

King took soil samples from three places here on Earth that have very dry climates and very salty soil, the Atacama desert in Chili, the Bonneville Salt Flats in Utah and a part of the big island in Hawaii. In studying the samples, he found that the soil did indeed pull carbon monoxide out of the air and held onto it. He suggests the same process could occur on Mars, as its atmosphere has more carbon monoxide in it than does ours. He goes further to suggest that the mysterious, recurring slope lineae—dark streaks that change color seasonally on Mars, might be due to carbon monoxide being pulled into the soil. He believes that carbon monoxide could represent the missing piece in the search for life on Mars: the energy source. As evidence of the possibility, he points out two microbes (*Halorubrum str. BV1* and *Alkalilimnicola ehrlichii MLHE-1*) that live on Earth that use carbon monoxide as an energy source, one of which has also been shown able to tolerate salt concentrations that are similar to those found in Martian soil.

Unfortunately, there is no mechanism for testing King's ideas, neither of the rovers on Mars has the equipment needed for that kind of test. He will have to wait until 2021, when NASA plans to send a probe to the Red planet that is capable of detecting microbes in the soil.

More information: Carbon monoxide as a metabolic energy source for extremely halophilic microbes: Implications for microbial activity in Mars regolith, Gary M. King, *PNAS*, DOI: 10.1073/pnas.1424989112

Abstract

Carbon monoxide occurs at relatively high concentrations (≥800 parts per million) in Mars' atmosphere, where it represents a potentially significant energy source that could fuel metabolism by a localized putative surface or near-surface microbiota. However, the plausibility of CO oxidation under conditions relevant for Mars in its past or at present has not been evaluated. Results from diverse terrestrial brines and saline soils provide the first documentation, to our knowledge, of active CO uptake at water potentials (−41 MPa to −117 MPa) that might occur in putative brines at recurrent slope lineae (RSL) on Mars. Results from two extremely halophilic isolates complement the field observations. Halorubrum str. BV1, isolated from the Bonneville Salt Flats, Utah (to our knowledge, the first documented extremely halophilic CO-oxidizing member of the Euryarchaeota), consumed CO in a salt-saturated medium with a water potential of −39.6 MPa; activity was reduced by only 28% relative to activity at its optimum water potential of −11 MPa. A proteobacterial isolate from hypersaline Mono Lake, California, Alkalilimnicola ehrlichii MLHE-1, also oxidized CO at low water potentials (−19 MPa), at temperatures within ranges reported for RSL, and under oxic, suboxic (0.2% oxygen), and anoxic conditions (oxygen-free with nitrate). MLHE-1 was unaffected by magnesium perchlorate or low atmospheric pressure (10 mbar). These results collectively establish the potential for microbial CO oxidation under conditions that might obtain at local scales (e.g., RSL) on contemporary Mars and at larger spatial scales earlier in Mars' history.

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