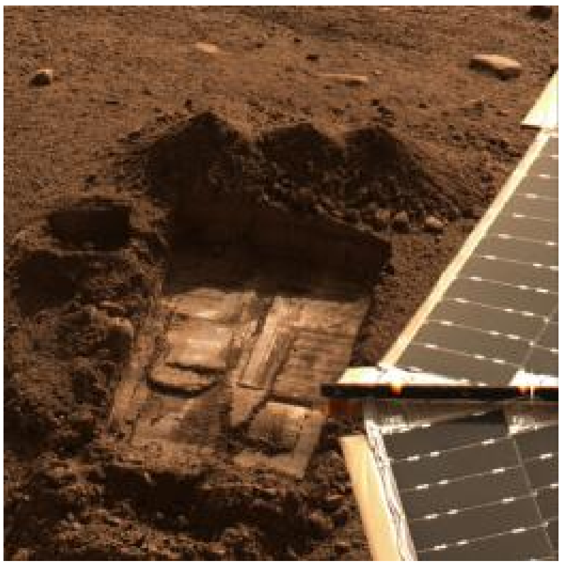
Searching for life on Mars

November 11 2010, By Charles Q. Choi



The Mars Phoenix mission dug into the soil of Mars to see what might be hidden just beneath the surface. Samples from this trench were delivered to the Wet Chemistry Laboratory, which was part of Phoenix's Microscopy, Electrochemistry, and Conductivity Analyzer (MECA). Credit: NASA/JPL-Caltech/University of Arizona/Texas A&M University

The first and only attempts to search for life on Mars were the Viking missions launched in 1975. Now scientists are suggesting the next decade of robotic probes sent to the red planet should make the search for life the highest priority.

After the Viking missions, the general consensus was that cold, radiation , hyper-aridity and other environmental factors ruled out the chances for microbial activity on or near the surface of Mars. This assumption -- based largely on how Viking's instruments did not detect organic compounds that would have indicated martian life — has been reinforced by each follow-up mission since then.

The Mars Science Laboratory, scheduled for launch in 2011, is dedicated to searching for evidence that the martian environment was once capable of supporting life on the red planet. However, some scientists argue the strategy for Mars exploration should center on the search for life itself -- "extant" life that is either active today or is dormant but still alive.

"There is no human task more significant and profound than testing if we are alone or not in the universe, and Mars must be the first place to look, as it is just facing our front yard," said astrobiologist Alberto Fairen at the SETI Institute and NASA Ames Research Center. "Finding life on Mars would be the most important scientific achievement of this century."

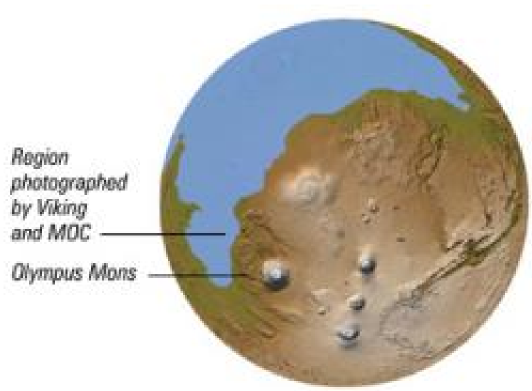
The Viking landers had detected organic molecules such as methyl chloride and dichloromethane, but these had been dismissed as terrestrial contamination – namely, cleaning fluids used to prepare the spacecraft when it was still on Earth.

The Phoenix lander spotted magnesium perchlorate in the soils, which can destroy organic residues. This discovery has caused scientists to rethink the Viking assumptions. Because Viking heated its samples, it could have caused a chemical reaction between perchlorate and any organics present, thereby destroying the organics.

The recent detection of methane on Mars has also revived the possibility of past or even extant life just below the surface, since life is one of the primary producers of methane on Earth.

As hostile as Mars might be for life, numerous examples exist of life surviving in extreme environments on Earth. For instance, microbes are seen in cold, dry soils of the Antarctic Dry Valleys. These soils are arranged into a layer of dry permafrost overlying ground ice, a structure similar to some soils on Mars. Debris-rich ice layers in glaciers trap water films and mineral dust that can serve as a basis for life on Earth, and similar layers are seen at Mars' northern polar deposits.

Microbes even live in salt knobs in the hyper-arid Atacama Desert in Chile, which is often described as similar to martian soils.



A number of studies suggest the lowlands of Mars's northern hemisphere were once covered in water. A possible shoreline near the giant volcano Olympus Mons was photographed in detail by the Viking spacecraft and by the Mars Orbiter Camera. Credit: NASA

These analogs of Mars on Earth suggest there are relatively few areas on Mars that could support life: ice-cemented ground, massive ice deposits and certain porous salts.

"Probes have been sent to regions of Mars where ice-cemented ground is common — this was the case of Phoenix, in the northern plains," Fairen said. "Other environments, such as hundreds of regional accumulations of chloride salts, have been discovered very recently, only three years ago, and are dispersed on the ancient southern highlands. In any case, there have been no attempts to analyze any of these environments with modern biological instruments to search for life, extant or extinct."

Fairen and his colleagues recommend a new strategy for the next decade of robotic investigations on Mars, one in which the search for extant life is the first priority.

Comparison of Mars Science Laboratory and Mars Exploration Rover. The Mini Cooper-sized MSL rover is twice as long (about 2.8 meters, or 9 feet) and four times as heavy as the Spirit and Opportunity rovers. Credit: NASA

"We call for a long-term architecture of the Mars Exploration Program that is organized around three main goals in the following order of priority — the search for extant life, the search for past life, and sample return," Fairen said.

The researchers envision probes targeting the kinds of areas where life might be found, and carrying instruments that can provide indisputable evidence – such as actual microbes -- for the presence or absence of life. Robotic missions in search of spores, dormant life or organic remains could, for instance, drill a few yards down to reach ice-rich layers shielded from the high levels of radiation at the surface and use microscopes to examine their finds.

A mission aimed at looking for extant life would also be ideal for finding any extinct life, since dead organisms likely would be found in the same places as live ones would. Since soil bacteria in the Atacama Desert are spread out in a patchy manner, any new missions to search for life on Mars should incorporate a rover. Landers should also be used to return samples, if at all possible.

"The technology is ready," Fairen said. "We only need a new impulse and more ambition."

More information: The scientists detailed their strategy online Oct. 7 in the journal *Astrobiology*.

Source: Astrobio.net