New scientific study suggests

Water, flash floods and new possibilities for life on Mars

Peter Symonds
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Mars has long held a special fascination for scientists, science fiction writers and laypersons alike. For more than a century there has been speculation concerning the existence of life on the planet. In the late 1870s, the American businessman Percival Lowell interpreted observations of canali or channels on Mars by the Italian astronomer Giovanni Schiapparelli as a proof of an advanced civilisation.

More sophisticated observations, particularly since the 1960s when spacecraft first began to visit the planet, have ruled out the prospect of finding a society of intelligent beings on Mars. The planet is covered by a very cold, bleak desert with very little atmosphere. But new findings released on Thursday by a pair of scientists demonstrate that Mars is still capable of some startling surprises—water, flash floods and new possibilities for Martian life.

Using high resolution photographs taken from NASA's Mars Global Surveyor spacecraft, the researchers—Dr. Michael Malin and Dr. Kenneth Edgett—have identified the existence of a number of deep gullies that appear to have been formed by flowing water carrying rocks and debris to the bottom of craters.

The most intriguing aspect of the discovery is that the ravines seem to have formed relatively recently—a few hundred, thousand or perhaps million years ago. Unlike other older formations, the gullies have not been newly pockmarked by craters nor covered with dark Martian dust. “These features appear to be so young that they might be forming today,” Dr. Malin told a news conference.

“Twenty-eight years ago the Mariner 9 spacecraft found evidence—in the form of channels and valleys—that billions of years ago the planet had water flowing across its surface,” said Dr. Edgett. “Ever since that time, Mars science has focused on the question, ‘Where did the water go?' The new pictures from Global Surveyor tell us part of the answer—some of that water went under ground, and quite possibly it's still there.”

But how the underground water could form such gullies is still problematic. With an average temperature of 60 degrees below zero, any water near the surface of Mars would freeze solid. Furthermore the atmospheric pressure of the planet is so low that any water that reached the surface would immediately evaporate.

Edgett and Malin have posed a possible explanation. They theorise that liquid water, warmed underground by an unknown source at a depth of between 100 to 400 metres, could travel to the surface along channels or cracks. At the surface most water would evaporate but some could freeze forming a plug. Behind the ice dam, pressure would continue to mount eventually leading to a violent, geyser-like eruption of water—enough to fill several swimming pools—that would carve out a gully and channels before evaporating.

The two researchers, who will publish their findings next week in *Science* magazine, found the gullies in only 150 of the 65,000 photographs taken by the Mars Global Surveyor over the last two years. The locations are in the coldest parts of the planet—in the southern hemisphere—and usually on slopes that get the least amount of sunlight during each day.

Their interpretation of the photographs is certain to set off a debate. Michael Carr, a planetary scientist with the US Geological Survey who has studied Mars for 30

years, commented: “We have a problem. We have conditions which seem to forbid there being liquid water close to the surface.” While describing the water theory as “very compelling,” he has already suggested an alternative explanation. He has postulated that the gullies were formed not by water but by dry avalanches or rock flows lubricated by carbon dioxide emissions from the planet.

The gullies will no doubt become the focus of further scientific research and space probes. If the water does exist then it greatly enhances the possibility that some forms of life—perhaps primitive microbes—exist, or at least existed in the near past, on Mars. Over the last two decades, biologists have found a number of different bacteria that are able to live on Earth in extreme conditions of heat and cold.

In 1996 a US research team announced that it had evidence of ancient fossil microbes embedded in a meteorite believed to have originated from Mars. Other scientists claimed, however, that the “fossils” were formed by non-biological processes. While the interpretation was disputed, the findings further fueled the debate over the existence of life on Mars.

Commenting on the latest results, Christopher Chyba, the Carl Sagan Chair for the Study of Life in the Universe, said: “One of the most exciting prospects, but until now little more than a hope, has been that there might still be places on Mars where liquid water reaches the surface. These Martian springs, if they existed on the surface, would immediately become the new focus of Mars exploration, they would be the first place to go to look for signs of life.”

The existence of such springs of Martian water would also reduce the difficulty of manned space flight to Mars. “I think one of the most interesting and significant aspects of this discovery is what it could mean if human explorers ever go to Mars,” said Malin. “If water is available in substantial volumes in areas other than the poles, it would make it easier for human crews to access and use it—for drinking, to create breathable air, and to extract oxygen and hydrogen for rocket fuel or to be stored for use in portable energy sources.”

NASA has already indicated that its future plans will include a closer investigation of the formations identified by Malin and Edgett. Dr. Jim Garvin, Mars Program Scientist at NASA Headquarters, said: “To follow up on this discovery we will continue the search with Mars Global Surveyor and its rich array of remote sensing instruments, and in 2001, NASA will launch a scientific orbiter with a high spatial resolution middle-infrared imaging system that will examine the seepage sites in search of evidence of water-related minerals.”

The latest findings from the Mars Global Surveyor, launched in 1996, come after a number of disasters in NASA's Mars exploration program—the most recent being last year's failure of the Mars Polar Lander. One of its key experiments was to have been to test for signs of water and life beneath the Martian surface.

Mars Global Surveyor photographs are available at: http://mars.jpl.nasa.gov/mgs/msss/camera/images/june2000/index.html