Slug: Perspective

Hed: To Keep on Looking

Hed(alt. suggestion): Thinking Outside the Box

Dek: As we explore Mars, our neighbor planet forces us to imagine otherworldly evolution, and redefines our own sense place in the Solar System

Pq: As we bring Mars closer to us through the explorations of our robotic and remote vehicles, the planet will continue to work its way into the big picture of human experience.

WC: 1045

Before NASA's Mars Global Surveyor stopped calling home in November, the satellite—which had been orbiting our neighbor planet since 1997 and was the source for the Google Mars data—captured a compelling image. Relayed back to Malin Space Science Systems in San Diego, CA, was a photograph of what looked like a newly-formed stream bed that flowed down a gully into the base of a crater.

Researchers were stunned, because the exact same location had been photographed five years prior by Surveyor, and had revealed no such feature. The image itself is remarkable: it shows the flow—which appears lighter against the darker, older terrain around it—emerging from the Martian surface several hundred meters up a steep incline along the inside edge of a crater. It traces a course downhill until reaching the nearly flat bottom, where it spreads out like the fingers of the Mississippi delta.

Mike Malin, the chief investigator and President of Malin Space Systems that built and operated Surveyor's Mars Observer Camera, authored a paper in Science hypothesizing that what Surveyor had captured was in fact evidence of a brief, explosive flow of liquid water. It could only have been brief, because while the surface of Mars is around minus sixty-three degrees centigrade, the atmospheric pressure is so low that water boils even at that temperature. Malin suggested that water forcibly erupted out onto the surface and raced down the

slope before evaporating and leaving only the visible etching of shifted dust and rock.

It is a suggestion of water that leads to the suggestion of life. But the question is begged: do we know what we're looking for? In January, we heard an hypothesis that gave us a new reason to look up in anticipation: scientists at the American Astronomical Society meeting suggested that the Viking Landers of 1976 may have overlooked a form of microbial life that could, perhaps, exist on Mars.

When the Viking missions were conceived, we had yet to find and identify here on our own planet forms of life that exist in almost unimaginably harsh environments: extreme cold, extreme pressure, extreme heat, extreme acidity. Conditions that approach the sort found on Mars have been colonized here on Earth by these extremeophiles. Dirk Schulze-Makuch of Washington State University and Joop Houtkooper of Justus-Liebig University of Giessen in Germany looked back at the Viking missions and pointed out that the landers' experiments (designed to find H_2O-based life forms) would have failed to find signs of life that evolved the ability to use a water-Hydrogen peroxide (H_2O_2) mixture—which could be well suited to Mars' harsh climate. Extremeophiles here on Earth have adapted to use Hydrogen peroxide—one organism, Acetobacter peroxidans, for instance, uses it as part of its metabolism. Schulze-Makuch and Houtkooper argued that if H_2O_2 biochemistry evolved on Mars, it wouldn't have been detected by the Viking landers—in fact, the Viking experiments would have destroyed H_2O_2 biochemistry in whatever sample they collected. Which means, of course, that we now need to go back and look again; this time better armed with theories of extraterrestrial evolution and alien forms of life.

Shortly after Schulze-Makuch and Houtkooper's presentation, investigators at NASA's Mars Phoenix mission (which is due to launch this August) started looking into whether its existing experiments could also be used to search for Hydrogen-peroxide based life. In April, the National Academies "Weird Life" group is expected to present their "Astrobiology Strategy for the Exploration of Mars" paper, bringing together everything that has so far been learned about

potential Martian astrobiology and presenting a plan for the search for life on Mars. The Mars Science Laboratory mission, which is scheduled to deliver the next-generation rover to Mars in late 201 0, will carry with it a suite of tools and experimental capabilities that will drag Mars further still into the limelight of human understanding. Within a decade, NASA is planning the Astrobiology Field Laboratory, a full-scale lander program whose only mission will be to uncover whatever traces of life Mars may harbor.

Of course, amidst all of these leading pictures and suggestive notions, there is the very real possibility that Mars is dead, and always has been. But as an exploratory species, we humans are also resolutely optimistic; we've spent billions of dollars and rubles and euros getting to Mars and exciting ourselves with the possibility of what may lie waiting for us there. There is hope in these missions. It suggests that our drive to seek out new life runs hand in hand with a desire to uncover new civilization… or, at the very least, a colony of acidic bacteria.

Mars is no longer the ominous Red Planet of crisscrossed canals, and yet the more we know about it, the more we seem to want to find those canals there after all. As we bring Mars closer to us through the explorations of our robotic and remote vehicles, and as revelations continue to emerge about its atmosphere, its surface, its craters and ice cap, the planet will continue to work its way into the big picture of human experience. It is becoming a more real and more exciting and more accessible place; not least as a physical and theoretical environment into which we can postulate some of our most novel scientific theories.

When we think of evolution, for instance, we think about single-celled organisms evolving to complex organisms to fish, to amphibians, to birds, or early primates, to hominids to humans. We think of the Triassic to the Jurassic to the Cretaceous. We think of plate tectonics and old growth forests. We don't think of Mars. Mars isn't part of our rather Earth-centric world-view of evolution. Not yet.

Incorporating Martian evolution—or that of any other world, for that matter—in our understanding of life, is one of the most profound paradigm-shifts we are likely to experience in the biological sciences. It would put our own impressive and diverse natural history on a parallel existence with another entire category of life. And it would bring with it a virtually unending series of new questions and new scientific endeavor. That we will have to continue to think outside the box of Planet Earth in order to conceive of ways to look for life is surely one of the greatest challenges that Mars, and the rest of the Universe, has presented us.