Mars craft finds evidence of a past ocean

Icy rivers thunder through steep canyons. Floodwaters spill out of lakebeds. Rushing streams drag house-size boulders and carve long, sinuous channels. To these images of what Mars may have looked like some 2 billion years ago, when it was warmer and wetter than today, scientists can now add a seascape.

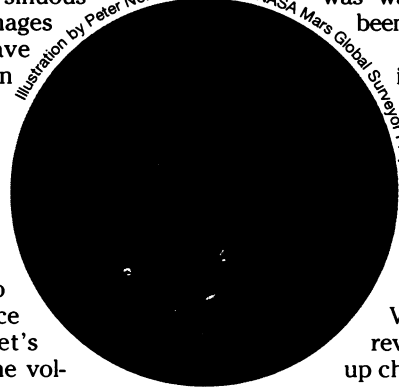

Illustration by Peter Neivert, Brown U./NASA Mars Global Surveyor Project

Mars as it may have looked more than 2 billion years ago, with an ocean (blue) filling the northern lowlands. The area occupies one-third of the planet's surface.

Last week, researchers reported their strongest evidence to date that an ocean once filled the Red Planet's northern lowlands. The volume of water was so large that it would have formed a 100-meter-deep sea if spread over the entire planet, says study coauthor James W. Head III of Brown University in Providence, R.I. He adds, where there was water, there could have been life.

The findings, described in the Dec. 10 SCIENCE, support an ocean model independently proposed by two teams of scientists in 1989 and 1991. Both teams based their proposal on Mars images taken in the mid-1970s by the Viking spacecraft. Viking revealed an array of dried-up channels and valleys that could have been carved by flowing water. The teams suggested that if ancient Mars did harbor large amounts of water, much of it would have emptied into the northern lowlands and formed a vast sea.

To test the hypothesis, Head's team mapped the lowlands using an altimeter aboard the Mars Global Surveyor spacecraft, which has orbited the Red Planet since late 1997. By measuring the time taken for laser light pulses to bounce back from the Martian surface, the craft measures the planet's high and low points.

A team including Head reported evidence last year that the northern lowlands represent a dried-up ocean basin (SN: 4/4/98, p. 218). Four new lines of data support that notion, Head and his collaborators now say.

The researchers found that a border region surrounding the lowlands has nearly constant elevation, reminiscent of the level surface of a shoreline. In addition, the low-lying area adjacent to this border is unusually smooth, as if sediment had settled on an ocean floor.

Parallel to the possible shoreline, the altimeter revealed a series of terraces—irregular layers of material that remain after water recedes. Moreover, the volume of water suggested by the findings matches previous estimates of water on ancient Mars, Head notes.

"If you believe that Mars once had an ocean, it's a slam dunk" for corroborating that idea, says R. Stephen Saunders of NASA's Jet Propulsion Laboratory in Pasadena, Calif.

Michael H. Carr of the U.S. Geological Survey in Menlo Park, Calif., agrees, but he notes that combined with other data, the findings present a puzzle.

Imaging a few patches along the boundary of the northern lowlands, Surveyor's camera failed to find the distinctive shoreline now indicated by the topographic data. Michael C. Malin and Kenneth S. Edgett of Malin Space Science Systems in San Diego, Calif., reported these results in the Oct. 1 GEOPHYSICAL RESEARCH LETTERS. Analyzing other images, Carr also saw no shoreline.

The two sets of images, however, comprise less than 1 percent of the possible shoreline, notes Carr, who suggests a way out of the conundrum. The Martian ocean may have vanished as many as 3.8 billion years ago, he says. The Red Planet's wind would then have had plenty of time to erase shoreline features—particularly at the fine scale recorded by Surveyor's camera. Carr notes that wind erosion would have little effect on the height of the landscape, however.

Farther back in time the planet was considerably warmer than it was 2 billion years ago, Carr notes. Under these conditions, an ocean could more easily disappear, he says. For instance, warm temperatures could promote the seepage of water into the ground. Carr presented his model this week at a meeting of the American Geophysical Union in San Francisco. —*R. Cowen*

Bacteria offer lessons to drug makers

Many bacteria produce poisons that slay microbial competitors while leaving their friends and family—and people—unharmed. In probing one such toxin, scientists believe they've uncovered clues that could lead to better antibiotic drugs.

The toxin they focused on, nisin, belongs to a group of small proteins known as bacteriocins. Food scientists routinely make cheeses and yogurts using starter cultures containing bacteria that produce nisin. As the microbes grow, nisin protects these products from germs causing spoilage or food poisoning, including those responsible for botulism and listeriosis (SN: 2/7/98, p. 89).

Though nisin's germicidal prowess was discovered 71 years ago, the means by which the protein kills bacteria has remained a mystery. In the Dec. 17 SCIENCE, Dutch and German researchers reveal new clues to nisin's potency.

In a series of experiments, Eefjan Breukink of Utrecht University in the Netherlands and his colleagues have demonstrated that the bacteriocin targets an oily substance known as lipid II. Produced inside bacteria, lipid II ferries a pair of sugars through the bacterial membrane to sites where they become building blocks for the microbes' outer cell wall.

By attacking lipid II, Breukink explains, nisin unleashes a double whammy. It not only disables the lipid, an action that alone can kill bacteria, but also creates pores in the cell membrane through which vital ions hemorrhage. This combination of independent effects on lipid II explains nisin's power, Breukink says. In his team's tests, nisin was 1,000 times as toxic to target bacteria as was magainin, a natural antibiotic produced in animals (SN: 3/18/95, p. 166).

"We now need to know exactly where nisin binds to lipid II and what part of nisin binds it," he says. Such knowledge, he maintains, could lead to novel antimicrobial drugs. They're needed to cope with the growing resistance of bacteria to current antibiotics (SN: 6/5/99, p. 356).

Nisin's targeting of lipid II "is a breakthrough finding that sheds totally new light on many aspects of bacteriocin action," says Thomas J. Montville of Rutgers University in New Brunswick, N.J.

The finding indicates that nisinlike compounds "could have important pharmaceutical applications," adds Todd R. Klaenhammer of North Carolina State University in Raleigh. Not only are bacteriocins too small to trigger allergic reactions, but they're also very selective, he notes. That means they can be unleashed against an infectious agent without fear that they would also kill microbes beneficial to a person.

While Montville agrees, he still "would really hate to see [bacteriocins or synthetic versions] used in medicine" because work by several labs, including his own, shows that bacteria develop resistance to these substances. "We have many serious bacterial problems in foods," he notes, arguing that bacteriocins therefore should be reserved for fighting spoilage and food poisoning.

"Though they remain a big gun for protecting foods," he asserts, "they would only become another BB shooter in the medicinal arsenal." —*J. Raloff*