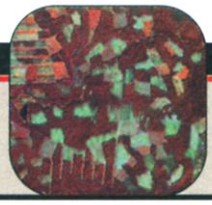


consortium and Celera are expecting to hold a joint conference next year to share information on their different methods of sequencing the genome. Eric Lander, director of the Whitehead Institute/MIT Center for Genome Research in Cambridge, Massachusetts, called this an "exciting" prospect, because the approaches were "complementary," producing "two different looks" at the genome.

No one can say at this time where or when any of the data will be published. Patrinos hopes it will appear "back to back" in the same journal this fall. But Venter, who's closer to having results in publishable form, says he has no idea where the manuscript will go: "We haven't decided yet."

The scientists did agree on one thing, though: The president was right when he said that "today's historic achievement is only a starting point. There is much hard work yet to be done." –ELIOT MARSHALL

PLANETARY SCIENCE

Making a Splash With a Hint of Mars Water

It began as a whisper on the Web a week ago Monday evening, grew to a noisy torrent of media babble by Wednesday, and on Thursday morning crashed onto the front pages. Moving at the light-speed pace of modern media, a wave of chatter about water and therefore possible life on Mars swept a paper at *Science* into headline news a week before its scheduled publication.

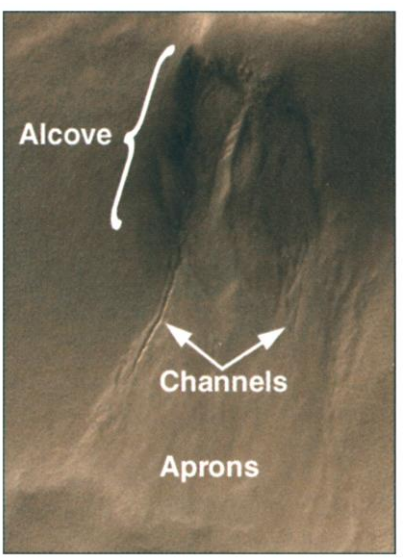
The paper, on page 2330 of this issue, features high-resolution pictures of muddy-looking gullies on the sides of martian craters, suggesting the prospect of liquid water on, or at least near, the surface of the planet. That prospect has thrilled planetary scientists who have been scouring a seemingly bone-dry planet for 30 years. "It's the smoking gun that says there's liquid water and Mars has all the requirements for life," astrobiologist Bruce Jakosky of the University of Colorado, Boulder, told a packed NASA press conference last Thursday, at which the paper was released early. Not so fast, caution a number of planetary scientists. "I'm skeptical just because of how difficult it is to have liquid water on or near the surface of Mars," longtime Mars geologist Michael Carr of the U.S. Geological Survey (USGS) in Menlo Park, California, told the press conference. "It's just simply too cold, incredibly cold." Carr and others are already coming up with alternative explanations for the rivulet-ridden piles of debris that exclude stores of liquid water and therefore readily accessible life.

Opening the press conference, planetary geologist Michael Malin of Malin Space Science Systems Inc. (MSSS) in San Diego warned that "the actual science may pale before the science fiction that has been written." The fiction grew out of an accurate, if vague, item on the independent watchdog Web site, NASA Watch (www.nasawatch.com), late afternoon on 19 June. It reported, apparently from sources in the astrobiology community, that NASA had briefed the White House (presidential science adviser Neal Lane, as it turned out) on a major discovery involving water on Mars. Other Web sites added details through Tuesday, 20 June; *USA Today* put a Web-sourced story at the top of its front page Wednesday morning. The information gleaned anonymously from NASA headquarters personnel and researchers around the country ranged from on target—signs of recent spring activity—to unlikely: ponds and even the possibility of geysers. Although no reporters appeared to have seen the paper (by Malin and his MSSS colleague Kenneth Edgett), *Science* decided to stem the flow of misinformation by releasing it.

Fiction aside, the reality proved enticing enough. The evidence for water flowing on the surface of Mars comes from Malin's high-resolution camera orbiting the planet on Mars Global Surveyor for the past 2 years. In about 200 of the 65,000 images returned so far, Malin and Edgett found places where water appears to have emerged from a crater wall or valley side. All the sites are above 30° latitude, mostly in the southern hemisphere. It looks as though the emerging water ate away at these steep slopes, the water and debris flowing down to form a channel-riddled pile or apron. "Had this been seen on Earth, there would be no question water is associated with it," said Malin. And these "aproned alcoves" are so devoid of impact cratering and other ravages of time that they must be "very, very young," said Edgett. They could have been active yesterday, he said, but conceded that, given the difficulties of gauging time on Mars, they could be as old as 1 million or 2 million years.

No one doubts that a fluid emerging from the martian rock formed these stunningly Earth-like features. And, by analogy with Earth, the likely fluid is water draining from an aquifer—a permeable, water-filled layer of rock—cut by a crater or valley. "That water has to be kept warm somehow," said Malin. "I don't know how. There has to be some geothermal component" to the warming. Because there are no volcanic heat sources apparent, as are found at Yellowstone or in Iceland, Malin considers the possibility that "our idea of what [the inside of] Mars is like thermally is all wrong."

However liquid water makes it as far as a crater wall, Malin and Edgett then draw on the warmth of sunlight to explain an oddity of the geographical distribution of seep sites. They find that sites occur about two and a half times more often on pole-facing slopes—the most shadowed and therefore coldest surfaces at a given latitude—than they do on warmer, equator-facing slopes. They argue that the sun's warmth on equator-facing slopes keeps aquifer water flowing out of the surface by rapidly evaporating it, avoiding any obvious erosion. On colder, pole-facing slopes, the water freezes to form an icy barrier. That barrier eventually breaks, perhaps after pressure builds in the aquifer, wasting away the wall face and releasing a burst of pent-up liquid water to form the aprons.



A leaky Mars? Springlike seeps (0.5 km across) may dot the Red Planet.

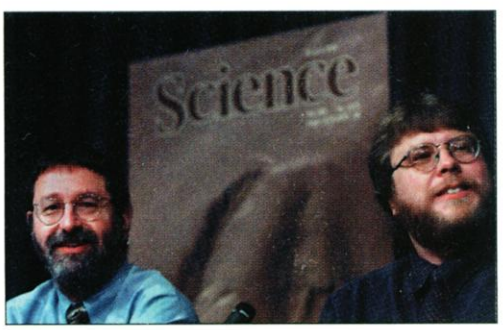
This scenario of continuously liquid water doesn't sit well with some planetary scientists. "It's simply not credible to create a near-surface aquifer" on Mars, says planetary scientist Stephen Clifford of the Lunar and Planetary Institute in Houston. The surface of Mars is so cold—on average –70° to –100°C—and the internal fires of the planet

CREDIT: NASA/JPL/MSSS

so feeble that any water within 2 or 3 kilometers of the surface should be permanently frozen solid, Clifford notes. Yet the apparent martian seeps spring from rock exposed at the now-frigid surface, and they presumably flowed through layers as little as 150 meters below to get there.

These drawbacks have many researchers reaching for alternatives. Carr, Clifford, and others are considering clathrates. These ices of water and a second component, such as carbon dioxide, form at low temperatures and high pressures but decompose to gas when warmed or depressurized. Clathrates of carbon dioxide, the most abundant gas in the martian atmosphere, may have formed in the crust, Carr noted, and could burst from rock walls to form fluid masses of gas and debris that would flow down like water, the way streams of hot gas and ash flow down from volcanic eruptions.

A less exotic explanation is water ice frozen into rock layers that melts only on geologically rare occasions. Clifford and hydrologist Victor Baker of the University of Arizona, Tucson, each independently suggested the same mechanism to *Science* that Mars geologist Kenneth Tanaka of the USGS in Flagstaff, Arizona, presents in his Perspective on page 2325. All three were struck by how the seeps prefer pole-facing slopes. Although among the coldest spots on Mars today, they note, such slopes would have been among the warmest 4 million or 5 million years ago. Planetary dynamicists calculate that back then a wobbly Mars was temporarily tipped over as far as 45° compared to its current 25° obliquity or inclination of its spin axis. That would have warmed Mars generally by sending part of the water ice in the southern polar cap into the atmosphere, strengthening the greenhouse effect. The tilt would have warmed high-latitude, pole-facing slopes even more, by putting them in full sun through long summers. "I'm more and more persuaded that what they're seeing is a reflection of what happens during high obliquity," says Clifford. "It's the most plausible explanation."



Bleary-eyed pair. Michael Malin (left) and Kenneth Edgett found 200 examples of seeps among 65,000 recent images of Mars.

CREDITS: (LEFT TO RIGHT) H. SMITH GARRISON/AP; DEVERE PATTON

Whatever happened, researchers are excited. Signs of near-surface water, whether liquid or solid or clathrates, "is an important result," says Baker. The muddy rivulets, whether a day or a million years old, "show the ground ice is there today," says Baker. That the water got loose in some way recently calls into question that Mars has been "cold, dry, and inactive since early times." –RICHARD A. KERR

OSTEOPOROSIS

Cholesterol Drugs Show Promise as Bone Builders

For the millions of people worldwide with osteoporosis, one tumble can break a hip, and a hug can crack a rib. Drugs called bisphosphonates can prevent many fractures by stopping the body from breaking down bone. But even today's best drugs prevent only about half the fractures, and none of them do much to spur the body to rebuild healthy bone.

That could soon change. Not only do statins, a group of drugs used by millions to head off heart disease, seem to prevent fractures, but they may also trigger significant bone regrowth in older people, according to four studies reported in the 28 June issue of *The Journal of the American Medical Association* (*JAMA*) and the 24 June issue of *The Lancet*. And another promising treatment, a recombinant fragment of human parathyroid hormone called rhPTH, is even closer to the clinic: Two clinical trials reported at meetings in the past 2 weeks show that the compound builds bone and lowers the risk of fracture by more than half. "These are really quite striking reductions in fractures," says endocrinologist Conrad Johnston of Indiana University School of Medicine in Indianapolis, president of the National Osteoporosis Foundation.

Like a work crew repairing an aging street, the body normally maintains bones by digging holes, then refilling them with fresh material. Osteoporosis, which afflicts 10 million Americans, most of them postmenopausal women, occurs when the body breaks down bone faster than it can replace it, rendering the bones thin and brittle. Bisphosphonates such as alendronate and risedronate, as well as estrogen replacement therapy, all slow bone loss by blocking cells called osteoclasts, which dig the holes. But none of these drugs stimulates the cells, called osteoblasts, that fill in the holes. As a result, treatment works best on people diagnosed early, while they still have most of their bone mass. But because many patients have already lost 20% to 30% of their bone mass by the time of diagnosis, Johnston says, "we want something that will build it back."

In a surprising finding last December, a team led by endocrinologist Greg Mundy of

ScienceScope

Relishing Victory The human genome wasn't the only organism whose sequence earned the spotlight this week. Plant geneticists are hailing the imminent completion of work on the wispy, ankle-high mustard plant called *Arabidopsis* (*below*), a model system for plant biologists.

As of last Saturday, 108 million of the plant's 120 million nucleotide bases had been sequenced and made publicly available, Anthanasios Theologis of the University of California, Berkeley, told the International Conference on *Arabidopsis* Research meeting in Madison, Wisconsin. The five participating international groups hope to finish the job by the end of July, well ahead of the original 2004 target date.

Government funders and sequencers boast that the *Arabidopsis* genome is extremely accurate, with only 1 error in every 20,000 bases, says Theologis, and contains few gaps. "It's probably the best done of all genomes," he adds. And although its completion will mark the first detailed genetic record of a plant, the real value will be as a template for the rice genome, some four times larger. "Nobody eats *Arabidopsis*," notes John Quakenbush, a researcher with the *Arabidopsis* group at The Institute for Genomic Research in Rockville, Maryland.

Hear Our Plea The honeymoon may be over between French scientists and their new research minister, Roger-Gérard Schwartzenberg. Schwartzenberg, who took over in March from sacked predecessor Claude Allègre (*Science*, 31 March, p. 2387), promised to boost several fields, particularly the life sciences. But on 15 June, three leading French biologists decried an "extremely serious" lag in French biology in a letter to Schwartzenberg, Prime Minister Lionel Jospin, and Finance Minister Laurent Fabius. France hasn't kept pace with major budget increases for biological research in the United States and Japan, notes the appeal, which seeks more funds and has been signed by nearly 400 biologists.

"Life sciences have an ambiguous position in France," says Henri Korn of the Pasteur Institute in Paris, who launched the campaign with Pierre Chambon of the Collège de France and Alain Prochiantz of the basic research agency CNRS. "On one hand they are given almost mythical status, [but] on the other no one really cares." The petitioners hope their plea will change things, but so far neither Schwartzenberg, Jospin, nor Fabius has responded.