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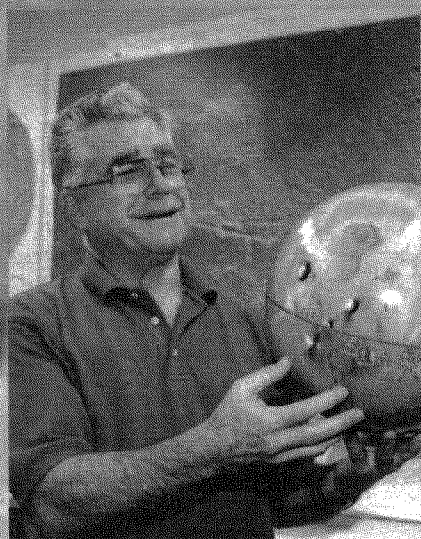
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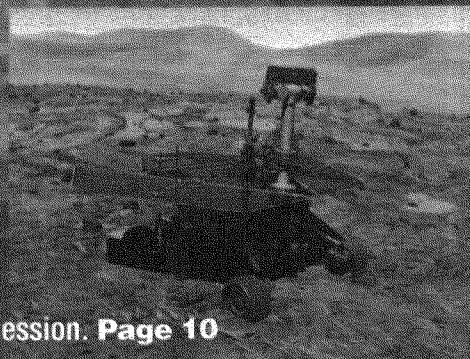
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CARR ON MARS

<PAGE 14



Mike Carr of Woodside
will be guiding rovers
Spirit and Opportunity
as they probe the surface
of Mars for signs of water
— key to life



News
This
Week

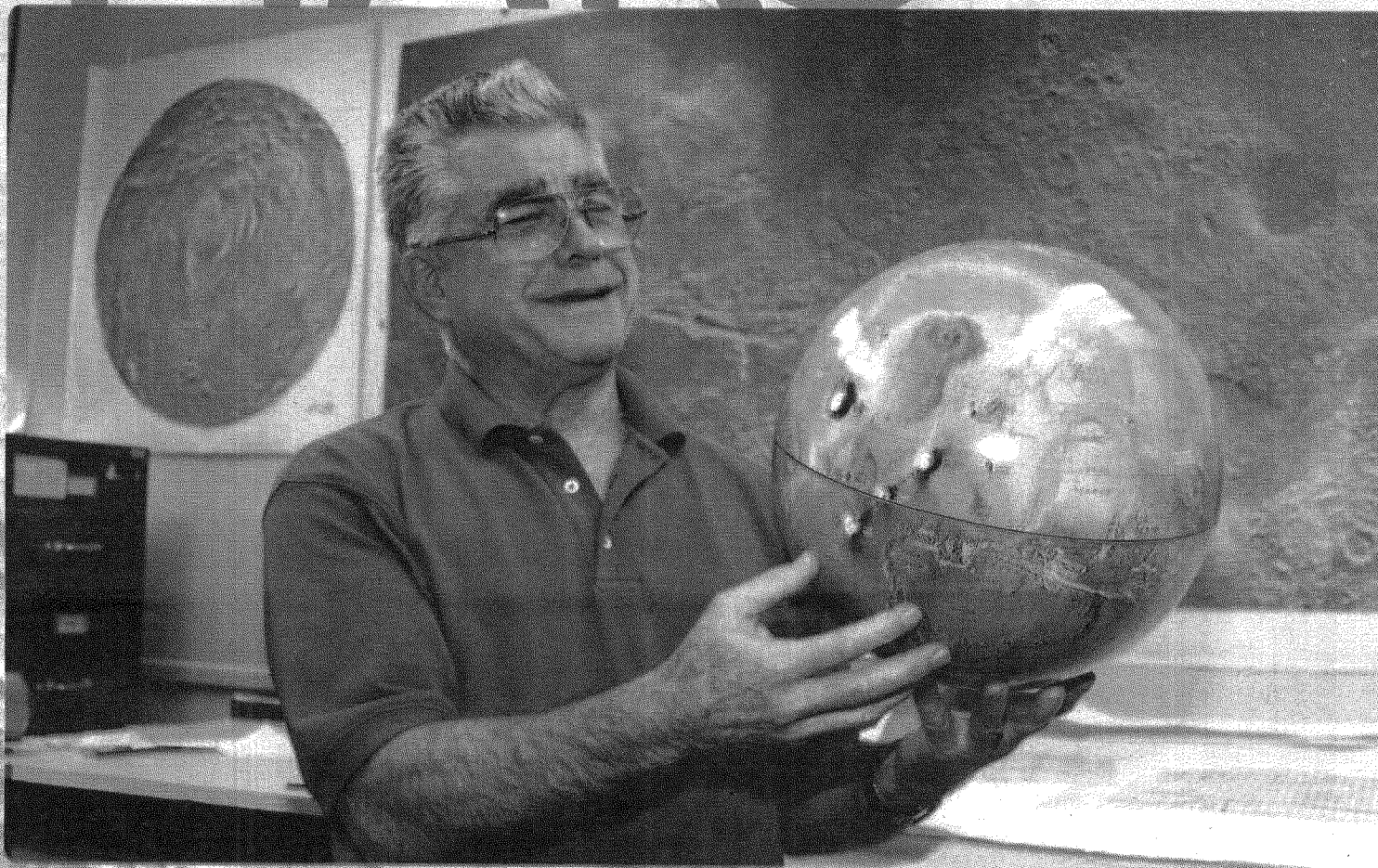
- **Portola Valley** | Town may create master plan for town complex in four-day session. **Page 10**
- **Pedestrian death** | Police probe pedestrian traffic death. Witness says body was dragged 50 feet. **Page 5**
- **Hospitals** | Two groups race to buy land for hospitals. Sequoia, medical foundation trying to edge each other out. **Page 5**
- **Health & Fitness** | Cardiac therapy program focuses on exercise and education — with "TLC." **Cover, Section 2**

>CARR ON MARS<

By Marion Softky
Almanac Staff Writer

>WOODSIDE
GEOLOGIST
AND MASTER
HORSEMAN
MIKE CARR
IS HELPING
PLAN THE
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[COVERSTORY]



Astrogeologist Mike Carr of Woodside holds a globe of Mars at his office at the U.S. Geological Survey in Menlo Park. He will spend the next months in Pasadena helping guide the scientific exploration of rovers Spirit and Opportunity in their quest for signs of water — and life. Photo by Ca

As the world thrills to images of a barren rock-strewn plain 100 million miles away — a rare inspiration in a time of earthly troubles — Mike Carr of Woodside is staying up nights in Pasadena.

Dr. Carr is a key member of the scientific team that will guide the Spirit rover, and its soon-to-be companion, Opportunity, as they crawl the surface of the red planet, seeking signs of water and conditions that may have spawned life in ancient times.

A veteran geologist who has been studying Mars for 32 years at the U.S. Geological Survey in Menlo Park, Dr. Carr is already wearing a special wristwatch set to Mars time. Starting this week, he is one of the team leaders who plans the rover's daily schedule, and directs Spirit what to do each day. "I can't wait until we get out there and do science," he says.

Just about the time this paper comes out, Spirit should enter a new mode. When the golf cart-sized rover trundles off its lander onto the rock-studded center of the

Gusev Crater, it will leave behind the spectacular engineering feat that put it on the surface of Mars, and start doing day-to-day science.

And the excitement that provoked cheers at Spirit's triumphant bounce landing, and generated a billion hits at

'THE FACTS ABOUT MARS HAVE ALMOST AS BIZARRE AS THE

Internet sites, may dwindle. There will be less glamour as Spirit starts collecting photos and spectra and analyses of soil, rocks and atmosphere over several months — until the shorter days of Martian winter shut down the solar collectors that power the rovers. "It's going to be slow," Dr. Carr warns. "People will get frustrated and bored because it's going to be slow."

So far, Dr. Carr has been impressed with how flat the

[COVERSTORY]

surface is and how sparse the rocks are — unlike the more dramatic sites of the three previous US. Mars landings. “I have no idea what it is; it could be sedimentary,” he said last week.

Of particular interest in this search for signs of ancient water is a dust-lined depression dubbed “Sleepy Hollow,” which could be an impact crater or a wind-gouged hole. “I’m anxious to go there,” says Dr. Carr. “It’s a chance to look at the layers, and study the vertical profile.”

Gusev Crater, 95 miles wide, was selected as a landing site because it looked like an ancient lake bed fed by a river and possible delta — and because it was relatively safe for the difficult landing. Dr. Carr, who was one of the team that selected the landing sites, still hopes that Spirit will find evidence of water — which is considered key to the possibility of life on Mars. “I hope we find evidence of a former lake,” he says. “I doubt it, but I hope.”

The next chance to find evidence of water will start January 24 when Spirit’s companion rover, Opportunity, lands in the Meridiani Planum, where scientists hope to find gray hematite, a mineral normally formed in a wet environment. “We hope to find evidence of alteration of rock by water,” says Dr. Carr.

The romantic planet

Ever since the Romans named our brother planet after their god of war, Mars has sparked the imagination with tales of little green men, canals, War of the Worlds, and the hope of life.

The realities of Mars, sent back by photos from space missions dating back to 1965, are — in some ways — more exciting. They show a cold, bleak, windswept, dead planet with spectacular scenery. Volcanoes 15 miles high, and giant flood channels 70 miles wide and a mile deep, suggest that some time, eons ago, volcanic heat met liquid water and — perhaps — produced life.

Again, perhaps, microbes still persist in water buried deep under the frozen surface now being prowled by rovers.

“The facts about Mars have turned out to be almost as bizarre as the fiction,” says Dr. Carr.

**TURNED OUT TO BE
FICTION! —DR. CARR**

Mars fascinates us because it is so much like earth, says Dr. Carr. The fourth planet from the sun is about two-thirds the size of Earth, and one-third its weight. The Mars day is 24 hours plus four minutes; its year is 687 days, almost two Earth years. While the red planet averages a frigid minus 67 degrees Fahrenheit at the equator, the temperature

swings wildly as the sun shifts over the thin atmosphere. “In mid-day, your feet could be warm, but your head would be cold,” he says.

The water puzzle

While thousands of photos returned from Mars by orbiting cameras appear to show the geological effects of massive floods, recent data cast doubt on the theory that Mars was once warm, wet, and ideal for establishing life. “Since 1997, there is increasing skepticism that Mars once had a climate like Earth,” says Dr. Carr.

Contrary evidence has appeared in the absence of weathered rocks, and minerals formed by water like limestone and clay. Dr. Carr explains: “People are struggling to reconcile the presence of valleys, which seem to be carved by liquid water, and the lack of weathering.”

Yet water is clearly present on Mars, which has three kilometers of water ice over the poles, under seasonal caps of dry ice. Also, hydrogen has been measured by space craft, Dr. Carr says.

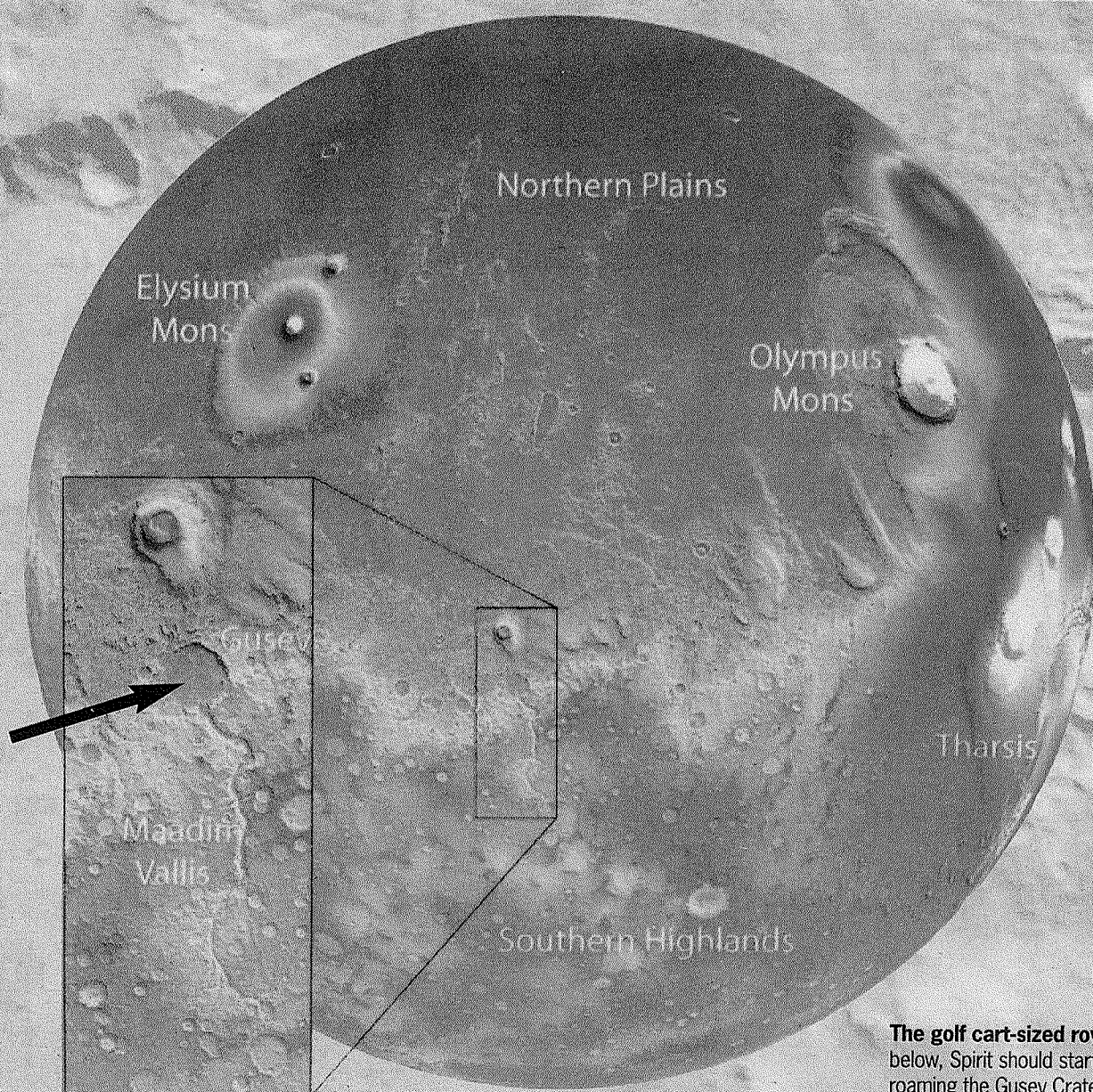
Scientists are now trying to conceive of a way that snow cover could produce enough flowing water to carve the valleys. Dr. Carr speculates

that snow might melt under the snow pack, either from the sun above, or by volcanic heat below. “Those valleys certainly were produced by water,” he stresses.

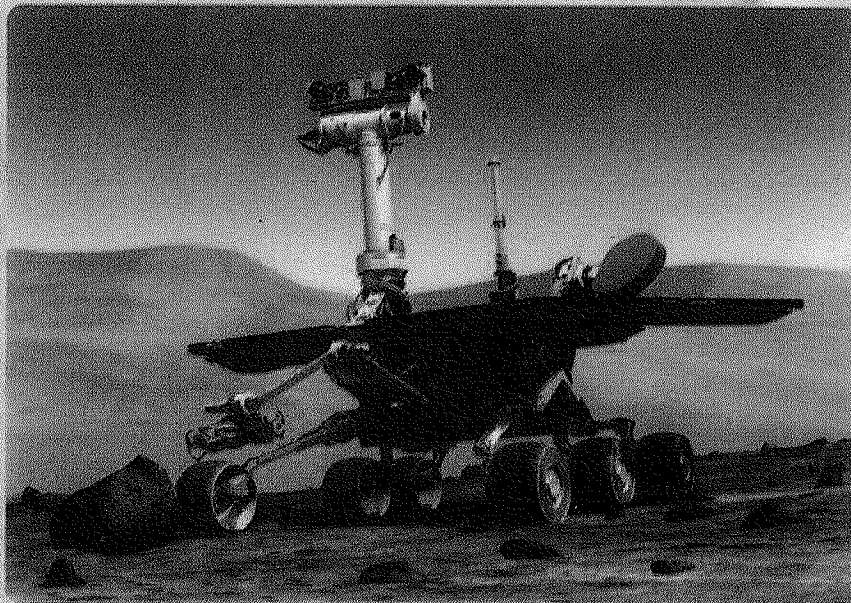
Career climax

For more than 30 years, Dr. Carr’s career has been aiming toward this climax as a key player in one of the world’s great scientific endeavors: the exploration and search for life on Mars.

See **CARR ON MARS**, page 16



The golf cart-sized rover, below, Spirit should start roaming the Gusev Crater this week. Scientists chose the 95-mile-wide crater, above, as a landing site in hopes that Spirit would be able to find evidence that it was once a lake bed fed by a large river. Colors represent surface elevation, with blue the lowest and white the highest. The white volcano, Olympus Mons, is 15 miles high. The white pole is covered by three kilometers of water ice topped by a seasonal cap of dry ice.



life and greater range than Spirit, which can go a total distance of 600 meters, maybe one kilometer, and depends on summer sun for power.

Eventually scientists want to bring back samples from the surface. "Getting samples back from Mars is very expensive," Dr. Carr notes. "It keeps getting pushed back; it remains beyond the horizon."

What about putting people on Mars?

Dr. Carr replies cautiously, questioning whether the scientific value would justify the cost, many times more than the \$850 million for the current two missions.

"That's decades away," he says. "It's extremely costly, and could not be justified by science alone. There must be another reason to go."

Life?

"I'm not that optimistic we'll find life," Dr. Carr reflects. "It's a long shot, but by God, we're going to try, because it would be revolutionary."

Discoveries of weird forms of life on Earth have spurred interest in ways that life could start on Mars. Scientists have found living creatures in hydrothermal vents in the deep ocean and hot springs like Yellowstone that exist at high temperatures, involve different chemistry, and don't rely on photosynthesis for energy.

"Some quite prominent biologists believe that life on Earth started in hydrothermal vents," Dr. Carr says. "Life started very quickly after the era of huge meteorite impacts 3.8 billion years ago."

"On Mars there's lots of water and lots of volcanic action. If you put two and two together, you could have hydrothermal vents — and life — on Mars."

Another deep question is whether life started in one place — on Earth or Mars — and somehow seeded to the other planet.

"It's so difficult to imagine how life started, but it did," Dr. Carr reflects. "Did it start only in one spot? Or did it evolve wherever you have the right conditions?"

"We don't know." ■

■ INFORMATION

NASA-Ames Research Center in Mountain View is sponsoring a Mars Center with interactive exhibits for children and adults through June. From U.S. 101, take Moffett Field exit and go to the NASA-Ames main gate. For information and daily schedule, call 604-6274, or go to www.arc.nasa.gov. Other Web sites: For pictures, www.msss.com. For progress of the mission, <http://marsrovers.jpl.nasa.gov>.