

## NASA Rover Finds Evidence of a Once Wet and Habitable Mars

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NASA's Opportunity rover has found strong evidence that a rock outcrop in Mars' Meridiani Planum region once was a wet and habitable environment, rover science team members announced at a 2 March news briefing at NASA headquarters in Washington, D.C.

"We have concluded that the rocks here were once soaked in liquid water," said Steven Squyres, Mars Exploration Rover principal investigator and astronomy professor at Cornell University. He said it was not yet possible to indicate how long ago or for how long the rocks were wet.

"We believe that at this place on Mars, for some period of time, it was a habitable environment," capable of supporting life as we know it on Earth, he said.

"That doesn't mean life was there. We don't know that," he added.

Squyres said analysis for possible signs of biochemistry would need to wait for a future Mars mission. He said, though, that there is clear evidence that the examined rocks were altered by liquid water. He noted that it is still unclear whether they were laid down in liquid water, though the team has some clues and may soon be able to make a further announcement.

The Opportunity rover set down on Mars on 24 January near the outcrop of layered bedrock. "For the last two weeks, we have attacked this outcrop literally with everything we have. Every single piece of our payload has been brought to bear on this," Squyres said. "The last puzzle pieces fell into place a few days ago."

The science team said that several different pieces of evidence led them to their conclusion.

Gray spherules several millimeters in size, which the scientists roughly compared to "blueberries in a muffin" were found embedded and scattered in outcrop rocks. These spherules, they said, are not volcanic hailstones or droplets of volcanic glass, but instead probably are concretions which formed from minerals in liquid water.

Also, the outcrop is pocked with 1–2-mm-long holes, or "vugs," which Squyres said "probably were the molds of crystals once there."

### *Sulfate Salt and Jarosite*

The rover's alpha particle X-ray spectrometer found sulfur in the outcrop in such concentrations that the likely explanation is that the rock has sulfate salt. The infrared spectrometer also found evidence of sulfate salt. Squyres said this is "a tell-tale sign of liquid water."

In addition, the Möessbauer spectrometer, which measures minerals that are present, found evidence of jarosite, an iron sulfate hydrate that Squyres said requires water around it to be formed.

John Grotzinger, a sedimentary geologist on the Mars Exploration Rover team from the Massachusetts Institute of Technology, noted that ubiquitous layering throughout the outcrop also is an important clue of a possible watery past. He said there appears to be a pattern suggestive of crossbedding on Earth, with layers inclined to the principle bedding point.

Grotzinger said that if this is crossbedding, it would require sediment particles to be moved, and that they would flow in a current. He stressed that scientists need to resolve whether

this current is water, air, or volcanic gasses. "It is a tantalizing hint of something that might be consistent with water. But I want to emphasize that it doesn't have to be," he said.

Joy Crisp, Mars Exploration project scientist with NASA's Jet Propulsion Laboratory in Pasadena, California, noted that the rovers currently have "no operational limitations," and could continue on their missions for several more months.

"By putting the rover wheels to good use, we plan to determine the extent of the water history on Mars all across this region," Crisp said, noting other likely Opportunity rover targets, including the 160-m-wide Endurance crater 740 m east of the outcrop where the rover is now.

[In related news, NASA announced on 5 March that its other rover, Spirit, has found some clues that a 60-cm-high volcanic rock, dubbed "Humphrey," has bright material that might indicate minerals that have been crystallized out of water. Spirit currently is operating in Gusev Crater about halfway around the planet from Opportunity.]

Squyres said the outcrop currently being probed by Opportunity is just the first rock observed since the rover became operative on the Martian surface. "We are just getting started," he said.

James Garvin, NASA lead scientist for Mars and the Moon, said the rover results would help to provide target areas for further exploration during upcoming Mars missions, including the Mars Reconnaissance Orbiter and a sample return mission. Garvin added, "Now we finally have one example of stuff we really want to bring home to Earth."

—RANDY SHOWSTACK, Staff Writer

## University of Connecticut Geology Department Faces Dissolution

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The University of Connecticut's board of trustees is expected to vote in favor of dissolving the school's department of geology and geophysics at its 23 March meeting.

The board has been prompted to act for several reasons, including a perceived lack of cohesion and direction within the department. An Internet petition drive to save the geology department had garnered nearly 3,800 signatures by 6 March. However, some individuals, including department chair Raymond Joesten, view dissolution as a potentially positive measure that would allow geology and geophysics studies in the university to move forward.

The university's provost already has accepted a recommendation for dissolution made on 22 January by Ross MacKinnon, the dean of the College of Liberal Arts and Sciences. The board of trustees is expected to finalize this. In anticipation of the trustees' decision, the university suspended admissions to the geology

graduate program in late January. Re-assignment of faculty to other departments is expected to be completed and in effect in time for the upcoming fall semester, according to MacKinnon.

He cited several reasons for the dissolution, including overall budget constraints, as well as difficulty and delay by the department—by about 18 months—in formulating a strategic vision and a response to a June 2002 external review of the department. That review, which found many positive elements within the department, was nevertheless critical of the department's lack of cohesion and direction, and lack of focus for the graduate program. The review was initiated through the office of the chancellor.

MacKinnon has established a geosciences planning committee to explore future options for geosciences education at the university. In a 24 February memorandum to department faculty and staff, MacKinnon noted, "The purpose of this committee is to make a recommendation, within the broad umbrella of geosciences,

of a realistic geosciences program for the College of Liberal Arts and Sciences that builds on the resources within the college, as well as within the university broadly."

He stated that the committee's recommendations would provide an important opportunity to make the university more academically competitive in its geology and geophysics research and teaching programs, and also to provide undergraduate and graduate students with "the most contemporary, interdisciplinary preparation with in their geoscience disciplines, particularly the Earth and ocean sciences, that we can provide."

MacKinnon charged the committee with identifying what disciplines might be within the geosciences, and with demonstrating how they can help to build a stronger program; linking other university programs with geoscience ties, including the schools of agriculture and engineering; and recommending an administrative structure for a new program.

### *Timing of Dissolution Vote Questioned*

Robert Sernoffsky, a graduate student in hydrogeology, said MacKinnon's memorandum gives him optimism that the geology department

will continue to exist in some form. However, he said the timing of the establishment of the planning committee—which probably will not meet prior to the trustees' 23 March meeting—is “bizarre.”

“Why didn't the administration create this committee before recommending the dissolution of the department?” Sernoffsky questioned. “My hope is that at the board of trustees meeting, there will be enough support to table this until the [planning] committee comes up with something.”

The Internet petition, which Sernoffsky wrote, and which he has been instrumental in organizing, labels the department's likely dissolution as an “extremely short-sighted decision” that “represents a contemptuous affront to the future of geology.” The petition also notes that the dissolution “betrays the very future of the Connecticut public's well-being.” A large percentage of graduates from the department go on to work in the groundwater and environmental engineering fields, two important concerns within the state.

James Gregory McHone, former adjunct professor in the department, and currently a visiting assistant professor at Trinity College in Hartford, called the dissolution “draconian.” He said faculty in the department are divided between some who are “traditional” and are displeased about the study of geology being “watered down,” and others who are more accepting of having interdisciplinary linkages with other related studies such as environmental

science. However, he said that branching out “is the future” for geology departments, and that it has been done successfully at other universities.

#### *A Way to Move Forward?*

Donna Jurdy, one of the external review committee members, said that either a traditional or interdisciplinary approach to geology and geophysics can work out. However, Jurdy, chair of the department of geological sciences at Northwestern University in Evanston, Illinois, said the committee “did not see cooperation and unity of vision and goals” among faculty in the department.

“When people are divided and unwilling to compromise, you can't move on,” she said. “Sometimes a department can be less than the sum of the individuals when they are having these types of disagreements.” Jurdy noted that there is a lot of potential for geological and geophysics studies within the university, and said she hopes the university “will pull it together.”

Department chair Joesten said a trustees' decision to dissolve the department prior to receiving recommendations from the geosciences planning committee “does defy normal logic.”

However, he said that Dean MacKinnon is “enthusiastically” behind a plan to develop an interdisciplinary geosciences program.

Joesten said the department's 8 faculty, 30 graduate students, and 24 undergraduate students—a student body that he said has averaged

roughly the same size over the past several decades—have responded to the dissolution in several ways. Some, he said, have expressed disbelief, while others have looked at the decision as an opportunity for the department to move forward.

Joesten said he views dissolution, and some sort of academic restructuring of the department, as a positive measure. He said that although there is currently much uncertainty, particularly for graduate students, he believes “there is a real future” for geology and geosciences at the university.

He said that there has been divisiveness and interpersonal conflict within the department between those who support a broader interdisciplinary approach to geosciences and those favoring a more traditional approach. Joesten, who considers himself in the first camp, noted that a recent survey indicated about 40 professors in different departments within the University of Connecticut identified themselves as “geoscientists,” and that a key challenge is determining how to use this information to build a strengthened geosciences program.

“The [planning] committee will solve the divisiveness,” he said, adding that the question now is how to develop a strong interdisciplinary program. “Maybe the only way to get from where we were is to do what was done—dissolution.”

—RANDY SHOWSTACK, Staff Writer

## Back to the Future

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Past Global Changes (PAGES) is a worldwide program that seeks to facilitate international and interdisciplinary collaborations aimed at understanding the Earth's past environment to make sound predictions for the future. PAGES' scope of interest includes the physical climate system, biogeochemical cycles, ecosystem processes, biodiversity, and human dimensions.

PAGES is a core project of the International Geosphere-Biosphere Programme (IGBP) and is funded by the U.S. National Science Foundation, the National Oceanic and Atmospheric Administration, and the Swiss National Science Foundation; and is overseen by a Scientific Steering Committee comprised of members chosen to provide a range of scientific expertise and a balance of nationalities. It is run by a small International Project Office that serves as a critical interface between scientists and science initiatives. The Office manages projects; organizes and supports meetings and courses; aids in synthesizing research results in collaboration with scientists at large; publishes a free, international science newsletter; and provides and maintains a Web site that offers a variety

of additional services. PAGES has over 3000 member scientists in more than 100 countries around the world. Membership is free and open to anyone. The PAGES Web site, [www.pages-igbp.org](http://www.pages-igbp.org), receives over 1500 hits a day.

PAGES' main areas of focus include integrating international paleo-research, encouraging research partnerships, strengthening the involvement of scientists from developing countries, supporting educational programs, engaging with the climate modeling community, and facilitating public access to paleo-data.

PAGES incorporates several research initiatives comprised of groups of scientists with common interests. Its programs and workshops are designed to bring together researchers from a variety of disciplines and countries to share, compare, and synthesize data. An effort is made to include scientists and students from developing countries in these meetings by providing travel funding and assistance in publishing. PAGES also provides a forum for scientists to discuss and interpret ice, ocean, and terrestrial paleo-climate records, and it fosters the development of internationally accessible data archives.

After a decade of work in this area, PAGES is now seeking to re-assess its modus operandi. PAGES is aiming to become a truly bottom-up

organization that is driven by the insights of individual scientists, with activities that lead to clear and tangible societal benefits. To achieve this goal, PAGES seeks your feedback on its existing activities and your suggestions on its future direction. What do you, as a researcher, want from an international organization set up to support paleo-environmental science? What kinds of services do you see as critical to helping the paleo-community enhance the impact of its research? Comments on how to specifically develop PAGES activities in your country are also welcome.

Input would be greatly appreciated before 1 May 2004. Verbatim comments, with full attribution, will be posted for examination on the PAGES Web site after this date. These comments will be used as the basis for ongoing discussions on how PAGES can best serve the needs of the widest possible paleo-research community.

Feedback can be submitted online at <http://www.pages-igbp.org/about/feedback.html>; by e-mail to [leah.christen@pages.unibe.ch](mailto:leah.christen@pages.unibe.ch); by fax to +41-31-312-31-68; or by regular mail, to PAGES IPO, Sulgeneckstrasse 38, 3007 Bern, Switzerland.

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