Finding life on Mars and outer space begins by examining Earth's inner space

February 1 2006

Clues to finding current or past life on Mars now or at some point in the past begins with an examination of Earth's most extreme environments and the adaptable microscopic life that thrives there, according to a group of researchers on an international broadcast science expedition January 30 through February 4 with The JASON Project.

By investigating "unlifelike" places on Earth where conditions would kill most creatures, scientists can determine the kind of energy and nutrients that may be available to microbial life found under similar conditions beneath the surface of Mars. Extreme environments on Earth that serve

as Mars analogs – or models – include places that reach the outer limits of hot or cold, are arid or have ultra-high or -low pH.

"One of the biggest questions we face as scientists is: are we alone? Most people think of finding life on other planets as locating intelligent life forms elsewhere in our galaxy. But astrobiologists are approaching this question by looking for simple, microbial life forms in the backyard of our own Solar System," said Jack Farmer, Ph.D., an astrobiologist at Arizona State University. "Most intensely, we have been exploring Mars for evidence of past environments that might harbor fossil signatures preserved in ancient rocks, or living organisms that might be hiding in safe places beneath the surface where water could be abundant. The exploration for a Martian fossil record is being approached in the same way paleontologists explored for the earliest fossils of life on our own planet. The biggest challenge has been adapting these methods for robotic explorers to use."

"Earth is the laboratory for future discoveries on Mars. Without examining Earth's extreme environments, we wouldn't understand how processes worked to shape the landscape, chemistry and life at the limits. Without that understanding, we couldn't draw conclusions about how life can develop on other planets, " said Jim Garvin, Ph.D., chief scientist for NASA Goddard Spaceflight Center. "By examining these windows to Mars, scientists step out of the vicarious and into real features on Earth that function similarly to those on Mars.

Working with scientists from NASA, Arizona State University and the University of Hawai'i, the expedition broadcast links recent findings of the Mars rovers to research conducted at California's Mono Lake, Hawai'i Volcanoes National Park, Meteor Crater in Arizona and NASA Jet Propulsion Laboratory to create a comprehensive scientific comparison of Earth and Mars.

"Looking for life on Mars is such a big task that we really had to start by building a knowledge base," said Garvin. "We started exploring Mars with Viking by asking some tough questions, which led to more complicated questions and more exploration. We have to think of it like school. We start in kindergarten learning the alphabet and build from there. In kindergarten, we don't jump right into calculus."

"Mono Lake provides an excellent example of an extreme environment on Earth, a living laboratory that scientists can use to develop and test ideas about how to explore for life elsewhere. Mono Lake is found in the dry, rain shadow desert located just east of the Sierra Nevada Mountains in California. Mono is referred to as a terminal lake basin. That means the water flowing into the lake only leaves by evaporation," said Farmer. "Since the last ice age, the desert climate has progressively evaporated Mono Lake, concentrating the salts so that now the lake has a salinity more than three times that of the Pacific Ocean. In addition, the lake is highly alkaline, having a pH of between 10 and 11, comparable to a strong detergent. Such intense evaporation leads to the deposition of salt deposits called evaporites. Scientists believe that the Mars Exploration rover, Opportunity, landed on an evaporite deposit, making evaporative lakes like Mono, an excellent analog for Mars."

"Despite the harsh conditions, Mono Lake is a highly productive biological environment, basically a microbial 'factory' that supports many other species. For example, Mono Lake is one of the most popular migratory bird stops in the West, all sustained by microbes. And the way the microbiology of Mono Lake interacts with salt deposition, it's also a great place for capturing and preserving fossil signatures of microbial life," said Farmer.

The research is part of The JASON Project, a middle-grades program that inspires and excites students about learning by connecting them to real scientists. Using satellite broadcasts and Internet technology,

JASON scientists are linked to classrooms and educational institutions across the country for students to interact with JASON researchers in real time and see how they worked in the field.

"The expedition engages students by having them learn directly from the scientists," said Caleb M. Schutz, president of The JASON Project. "We're trying to change the way science is taught by stepping out of the textbooks and making students a part of the research. We aim to create moments when the light bulb goes off in a student's head, and he or she is moved to jump in the game of science. It's important not only for future generations, but for our entire country as we move into a more scientific and technological literate society."

"The students that are learning about Mars through this expedition are understanding the tools and technology to ask the right questions and get the right answers," said Garvin. "They're the ones who will be traveling to Mars and making the great discoveries. They'll do the fun stuff."

To follow The JASON Project's exciting research, visit www.jason.org. The JASON Project is working collaboratively with NASA, National Oceanic and Atmospheric Administration, the National Park Service, the National Geographic Society, EDS, Arizona State University, Jet Propulsion Laboratory and the University of Hawai'i.

The JASON Project is a subsidiary of the National Geographic Society dedicated to providing standards-based, multimedia science curricula and professional development to one million middle-grades students and 20,000 teachers in 41 states and around the world. Combining technology-rich tools, access to leading scientists and an inquiry-based approach to learning with standards-based content, JASON inspires students and teachers to become lifelong learners in science through active participation in real scientific expeditions around the world.

Source: JASON Foundation for Education