does." McKay and the other American members of the team proposed that even if the Martian climate today is unsuited for life, based on what they discovered in Siberia, the frozen soil could be a treasure trove, because it is "ideal for preserving frozen samples."

Teams of scientists have also made trips to one of the coldest place on Earth—Antarctica—in search of Martian conditions that could shed light on the possibilities of life on Mars. The largest ice-free expanses on the continent are the dry valleys, where the average temperature is –4°F, and where there is less precipitation than in the Gobi Desert. Several years can go by without there being as much as snow flurries. Nothing lives on the surface.

Although there did not initially appear to be any life in this region, closer inspection has revealed that below the surface, in crevices on the north-facing (sunny) side of sandstone rocks, there are layers of lichen and bacteria that receive sunlight through the translucent rocks. Minute amounts of water, generated from occasional snows, get trapped in the pores of the rock, and are used by the organisms.

The other major habitat for life in the Mars analogue in the Antarctic, is below the perennial 13- to 16-foot-thick ice cover of the floors of the dry valleys. The dry valley floor is ice, 60 to 120 feet thick, but under its surface are lakes that are 90 to more than 200 feet deep. Here, algae, diatoms, and other microbial life forms live in the water, under the ice, where they are protected from the cold, dry conditions above.

Microbes on Earth have been found living in boiling hot springs, on the sides of active volcanoes, in hydrogen sulfide-rich geothermal springs, in acidic pools of mine-tailings, in the depths of the oceans near hot vents, in deep aquifers under the Savannah River Nuclear Plant in South Carolina, and other extreme environments, which, until recently, would have been excluded from consideration in a search for life.

In October 1995, the Pacific Northwest Laboratory issued a press release titled, "SLiME at Hanford Hints at Potential for Microbes on Mars." It reports on the discovery of a microbial ecosystem, called a "subsurface lithoautotropic microbial ecosystem," or SLiME, found in groundwater samples, thriving on chemical energy in basalt rock, more than 3,000 feet below the surface, at the Department of Energy's Pacific Northwest Laboratory.

Commenting on the find, Chris McKay described these organisms, which use carbon dioxide and hydrogen as an

Pathfinder could find signs of a warmer Mars

In an interview with the editor of the German-language Fusion *magazine, Dr. Jonathan Tennenbaum, on July 18, Pathfinder project scientist Matthew Golombek described the region of Mars the Pathfinder rover will explore, after it arrives there on July 4, 1997:*

This will be the first rover to be on the surface of a different planet. There have been rovers on the Moon, of course, but never on Mars. The two previous [Viking] landers just had little arms that poked out, but no mobility.

The main goal of our mission is "ground truth." Imagine seeing a cornfield from orbit. In order to really know that it is corn, you need to go down there and look at it. We are going to go down, and we have a rover with a suite of instruments, designed to look at the rocks, basically. You may not think rocks are very interesting, but, in fact, rocks are like old blueprints of how they formed; what the environment was when that material formed. And so, we're landing at the mouth of a giant catastrophic outflow channel, [Ares Vallis], that could have a whole variety of rock types.

This is a location where enormous volumes of water coursed through the surface in a very short period of time. An analogy would be to take all the water in the Great Lakes and rush it to the ocean in about a two-week period. . . . This has happened on Earth, where large lakes have been dammed by loads of the ice sheet in the last ice age, and when the ice dam broke, the water drained in a very short period of time.

The idea is that there could be a whole variety of rock types there, and we have instruments [on the rover] that will go and look at the rocks and determine the environment, and how they formed. The areas that this channel came from is all the ancient heavily cratered terrain on the planet, and actually a whole variety of different terrains that we've seen from orbit. And the idea is that [on] early Mars, the environment could have been much more suitable—both warmer and wetter—for the formation of life.

We hope to learn about the environment early on in the planet's history—how the planet differentiated, how the crust formed, how the weathering products have developed.

And if we find evidence of liquid water, that would be quite amazing, because it would indicate that at a time on the Earth when life got started, about 4 billion years ago, there could have been a similar environment on Mars. . . . Pathfinder won't give us all the answers, right away, but we're going to be able to address those questions, and, hopefully, over a series of missions, we can begin to address them and learn about it.