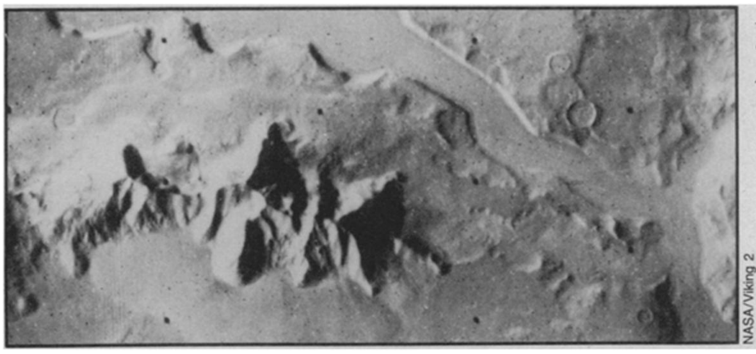
Viking: Still Seeking the Martians



Mars: For a deserted planet, it sure plays a lively game.

The Viking search for life on Mars, contrary to some published accounts, continues apace, with many months of work still in store for the biologists trying to understand the message of their maddeningly provocative experiments. Laboratory studies are just beginning to scratch the surface in attempts to recreate on earth whatever is taking place in the instruments on Mars. Now the latest results from those instruments are again showing exactly what started the excitement in the first tests many months ago: patterns just like those which, on earth, ought to mean the presence of life. Or ought they?

"We've got more results at this present time that look like life responses than ever before," says Frederick Brown of TRW, Inc., "but we still can't rule out abiologic causes." That sounds a lot like what has long been almost a stock comment for members of the Viking biology team—with the important difference that it now comes after numerous tests that ought at least to be pointing strongly in one direction or the other.

The latest round of experiments aboard lander 2 was done with a soil sample taken, after much cautious preparation, from beneath a rock, in hopes of finding a sample that had been long-protected from the harmful effects of solar ultraviolet radiation. It was uncovered and collected in one operation to minimize exposure to sunlight. "It's safe to say," according to geologist Alan B. Binder of Science Applications, Inc., "that the rock has sat there for a very large fraction of Martian history," meaning that it provided its protection for hundreds of millions of years or more. And photos of the sample site show that less than 10 percent if any of the soil in the resultant sample came from areas that had not been covered by the rock. Just, in other words, what the biologists ordered.

When Gilbert V. Levin of Biospherics, Inc., began getting his results from the new sample last week he was still trying to understand the data from the previous run. Levin's labeled-release experiment was designed to seek signs of metabolic activity by monitoring the release of gases containing a carbon 14 "label" provided in a liquid nutrient solution. The first test aboard lander 1 had yielded a quickly rising data curve that then leveled off, reflecting a rapid initial gas release that then petered out. A repeat run with heat-sterilized soil showed a quick burst that then fell sharply before leveling off, apparently indicating that the heat had deactivated whatever process was producing the gas. The puzzling test on lander 2 was run with soil sterilized at a lower temperature, and it produced an odd, oscillating curve that went through several up-and-down cycles (SN: 10/23/76, p. 261). With no instrument malfunction apparent, Levin's team concluded that the pulsating curve might be showing a response to small temperature variations in the instrument—but it nonetheless represents cyclic adsorption and desorption of gas by the sample.

Maybe, says Levin, the temperature changes cause water in the soil (perhaps provided by the nutrient) to change phase, going from liquid to vapor and condensing on the test cell wall, then dripping back onto the soil, simply switching on and off the adsorption potential of the soil. On the other hand, he says, it could be "some weird biology," such as a mixed population of organisms that suffer to different degrees in the heat and take different lengths of time to recover.

Then came the test of the unsterilized soil from beneath the rock. It shows, says Levin, the classic rising curve of the first lander 1 experiment, although it leveled off about 30 percent lower. This suggests that ultraviolet light, at least, was not the dominant factor in producing the early "active" curves.

But, says Vance I. Oyama of the NASA Ames Research Center, UV radiation is only one of the factors that could be contributing to an active, abiologic surface chemistry. Oyama's gas-exchange experiment shows roughly the same initial oxygen release—which most of Viking's biologists agree is not a life-sign—from the under-rock sample that it did in samples exposed to the light. Such factors as atmospheric interactions with the soil (which might not be prevented by the rock's presence) could, he says, play a much more significant role than UV in setting up the observed complex reactions.

On lander 1, meanwhile, results have come in from the latest cycle in the pyrolytic-release experiment of Norman H. Horowitz of the California Institute of Technology. This latest run was added in an attempt to duplicate the "active" results from the lander's first cycle, and in essence, says Horowitz, it did. The instrument seeks signs that possible microorganisms are assimilating a provided atmosphere that includes labeled carbon 14, indicated by the ratio between a pair of successive data peaks. Both peaks were lower in the under-rock run (2,000 and 35 radioactivity counts) than in the first test (7,400 and 96 counts), he says, probably indicating that the radioactive gas supply is running low, but the important ratio between the second peak and the first is even higher. "It's clearly positive," he says. "There's no way it's a negative." Much lower ratios resulted from sterilized soil, and also from soil that had been moistened with water vapor.

"My current theory," he says, "is that the surface of Mars is active in some way in promoting the production of organic compounds from either carbon monoxide or carbon dioxide." Active, that is, within the test cell of the instrument, since neither of the landers have detected organics in the soil itself. Martians, Horowitz believes, are an unlikely cause. But how to be sure?

Early next year, during Viking's post-solar-conjunction "extended mission," Horowitz plans to run a test with a sample that is first moistened with water to trigger whatever reactions may thus take place. Then the soil will be heat-sterilized to drive off any resulting adsorbed gases (and to kill any microorganisms), then moistened again with water to provide a source of hydrogen for possible organic synthesis. If the result is a high second peak and peak-ratio, he says, that will be near-proof that the cause of previous "positive" results was not biological.

Another sample may be taken from *below* the immediate surface, as deep as the scoop-arm can dig—perhaps 25 centimeters. If the gas-exchange experiment shows the same oxygen release there, says Oyama, it will indicate that atmospheric interactions can be at work at such depths. "It will," he says, "look bad for biology."

The problem, however, is being sure. Other tests are also planned. And the work goes on. □