Viking's Life Experiments: Pointing Toward Biology

The eyes of all the scientists, stargazers and Mars watchers of history seemed to look down more closely on the biologists of Project Viking this week, as they confronted the most impressive evidence yet in the search for life on the Red Planet. It does not answer the question—indeed, it is possible that Viking's instruments will not provide proof-positive either way—but for the first time, the scales have been tipped toward the idea that biology, rather than inanimate chemistry, may be the easier explanation for the data.

The center of attention was an experiment on the Viking 1 lander that looks for life by exposing a soil sample for five days to an atmosphere containing carbon-14-labeled carbon dioxide, then incinerating the soil to see whether the resulting gases indicate that resident microorganisms had incorporated the tracer into their bodies. The first of the instrument's two data peaks merely indicates the residual $^{14}CO_2$ being flushed from the system; it's the second, much smaller peak that counts. Two weeks ago, the instrument's initial soil test caused a stir when its second peak of 96 radioactivity counts per minute was more than six times the amount predicted from the 7,400-count first peak (SN: 8/14/76, p. 99). No simple nonbiologic explanation suggested itself even then, but the vital next step was a repeat run using another sample, sterilized this time, from the same scoopful of soil. If microorganisms had been responsible for the high second peak in the original run, presumably their death from the sterilization process would cause a lower second peak in the control experiment. A second peak from nonbiologic causes would be more likely to be the same both times.

This week the results came in. There was a bit of tense melodrama when, after the first peak reading was received in the Viking control center at the Jet Propulsion Laboratory, some spurious electronic "noise" threatened to make the anxiously awaited second peak unreadable. Soon, however, scientists and engineers had diagnosed the problem and were taking the first look at the provocative results.

The first peak was within 3 percent of that in the original, nonsterile, run. And the second peak—perhaps the most tensely awaited datum since the signal that the spacecraft had landed safely more than a month before—was *low*, about 21 counts per minute when corrected for the background radiation of the lander's nuclear power plant.

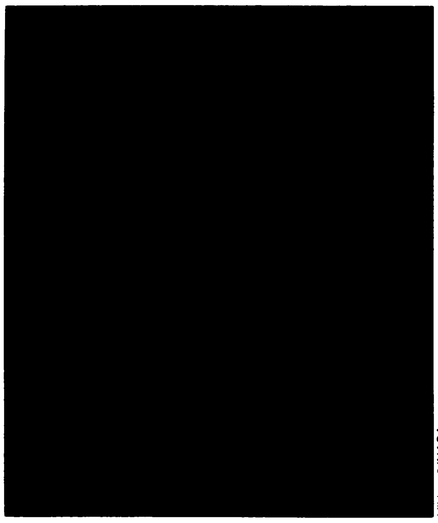
The instrument's chief experimenter, Norman H. Horowitz of the California Institute of Technology, was excited but careful. The peak was certainly low, but perhaps not so low as it might have been to make the strongest case. It did virtually rule out a number of possible technical malfunctions of the device itself, but an exotic chemical explanation is not out of the question on a never-before-sampled world, particularly one as chemically active as Mars. Perhaps, for example, the heat of the sterilization process destroyed some surface-catalysis capability of the soil. If such an ability were activated by light, the sample's 19-day wait in a dark hopper before being tested might have allowed its catalytic potential to "run down." The significance of the new data, however, is that theories are having to become increasingly strained to explain it. Next week, results will come in for a second nonsterile sample, in hopes that a high second peak will give added weight to the Martians.

Time after time, Horowitz was asked whether the odds of life in his instrument have improved. "In my opinion," he said, "it certainly increases the chance." He pointed out, however, that even the exotic chemical series must first be ruled out. "As long as there are credible alternative hypotheses," says chief Viking biologist Harold P. Klein, "they have to be tested."

Another of the biology instruments, a labeled-release experiment that seeks gaseous compounds containing a carbon 14 tracer released from a nutrient-treated soil sample, created its own stir last week. Its first run, two weeks before, had produced a sharply rising $^{14}CO_2$ curve. But the repeat version with sterile soil showed a plumeting one—much as though microorganisms had been alive the first time and dead the second, but also perhaps due to heat-released oxidants in the soil. The Viking lander's organic chemistry instrument by this week had pushed its detection limits down into the parts-per-billion range without finding any organics, but the signs of finding whole Martians keeps theories hopping to account for it.

Horowitz maintains that if there is life at the lander 1 site without a detectable residue of organic material, then the living microorganisms would have to have come from some other region where organic chemistry does exist. Project chief scientist Gerald Soffen points out that the instruments do appear to be looking at an "airborne-type" sample, suggesting that such transport is at least feasible. Also, he says, one might reasonably expect the more northerly site chosen for lander 2 to have a higher organic "inventory," since volatile-deposition processes may favor the near-polar regions. □

A Landing Site for Viking 2



Viking 2/NASA

Viking 2 landing site: Rough ground and impact craters are blanketed by thick dust.

Once upon a time, the plan for choosing Viking's two landing sites was fairly straightforward. Lander 1: safety first. Lander 2: water first. But it hasn't been so easy. Getting the first spacecraft down in one piece was tricky enough. And though the second one was sent up to the northern 40s in latitude as planned, a search of millions of square kilometers of Mars left the mission's site-selection team desperate for almost any spot large enough to attempt a landing, let alone one tailored to specific conditions. The prime site, a region known as Cydonia, was rated "unacceptable" by Project Manager James Martin—too rough. The backup site, west of Alba Patera, was hard to verify because of its uninviting terrain. Clouds occluded the photographs from orbit, and temperature data—apparently very sensitive to surface variations, time of day and other factors—were available only near, not at, the tentative touchdown point. And last week, after a brief look at the first 20 photos of the last-resort third site spanning the plains of Utopia, Martin commented, "They don't look so hot either." Flight officials at the Jet Propulsion Laboratory were working themselves into the ground, pursuing parallel planning options for all these sites and four possible landing dates.

The choice—albeit a controversial one—has at last been made. The winner is in site 3—the "backup backup," says one geologist—up near Utopia's northeast corner at around 46°N and 226°W, about 200 kilometers south-southwest of a large crater named Mie. The deciding factors, says Martin, were the difficulty of parallel