12 February 1965, Volume 147, Number 3659

SCIENCE

EDITORIAL CORRESPONDENCE: 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Phone: 202-387-7171. Cable: Advancesci, Washington. Copies of "Instructions for Contributors" can be obtained from the editorial office. ADVERTISING CORRESPONDENCE: Rm. 1740, 11 W. 42 St., New York, N.Y. 10036. Phone: 212-PE 6-1858.

The Martian Environment

The United States is in process of committing itself to an expanded space program. The Space Board of the National Academy of Sciences, which has provided many of the goals of the program, recently stated, "The new goal for the period 1971–1985 should be scientific exploration of Mars. . . . Mars is of great scientific interest first because it offers the best opportunity in our solar system for shedding light on extraterrestrial life. . . ." A search for life on Mars is thus one of the major scientific justifications given for a program that is likely to cost as much as $100 billion during the next two decades.

Our present knowledge of Mars is incomplete, but the facts available provide little basis for thinking that life will be found there. Mars is arid. The total condensable water in a column from the surface of the planet to the top of the atmosphere is about 14 microns (0.00055 inch). White polar caps grow and shrink with the seasons. An average cap thickness of 1 centimeter has been estimated. Considering the small amount to be vaporized and the aridity of the atmosphere, it seems unlikely that liquid water ever exists on the planet. Mars is cold. The average temperature is 230°K. At midday the temperature at the subsolar point can be as high as 298°K, but at night the temperature drops far below freezing, to about 220°K. Recent work indicates a thin atmosphere with a surface pressure of about 25 millibars. In addition to the trace of water, the only constituent known to be present is carbon dioxide (about 5 percent). Oxygen, if present, accounts for no more than about 0.1 percent of the atmosphere. Toxic carbon monoxide, produced by irradiation of CO_2, could be a constituent.

The severity of the Martian environment does not seem to have been realistically taken into account in plans for the exploration of Mars. Exobiologists are very apprehensive lest space probes carry earth-type organisms to Mars. Extensive and expensive precautions are being taken in an effort to guarantee that there be not one chance in 10^4 of a single organism's being carried to the planet. Because of the precautions, many years and billions of dollars could be added to the space program. Before spending large sums on sterilization the space agency should determine whether sterilization is necessary, by encouraging relatively inexpensive studies here on earth. A few laboratory experiments have been performed in so-called Martian environments. Workers have usually failed to control the water content properly and to test the effects of compounds likely to be produced by solar radiation.

In most proposals for detecting life on Mars it is tacitly assumed that life there would be similar to that on earth. Some experiments call for the culturing of possible Martian organisms in media brought from earth. The hypothetical organisms are to be the beneficiaries of an unaccustomed luxurious environment. Two proposed experiments make more sense. In these, gas-liquid chromatography and mass spectrometry would be used. A sample of Martian soil would be pyrolized under controlled conditions, and the off-gases analyzed. By this means compounds suggestive of terrestrial life could be identified. In addition, compounds derived from bizarre forms of life could be observed, as well as unexpected chemicals in the atmosphere and on the surface. In looking for life on Mars we could establish for ourselves the reputation of being the greatest Simple Simons of all time. A few inexpensive experiments to probe the nature of the atmosphere and surface of Mars might save us from considerable eventual disappointment.—PHILIP H. ABELSON