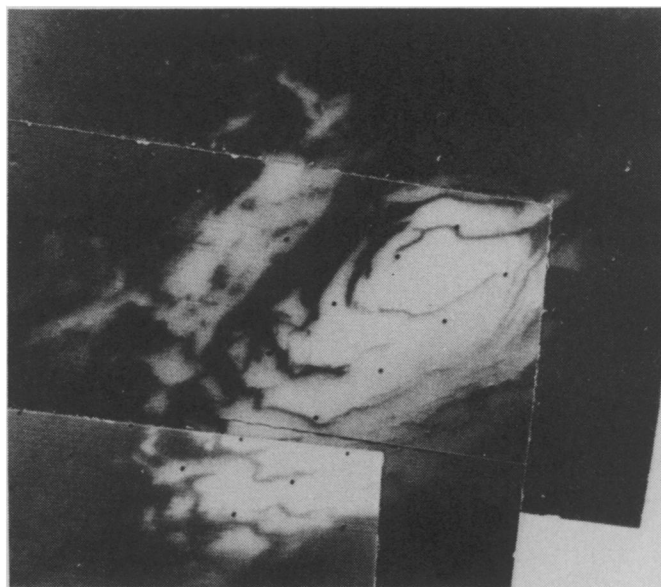


## In orbit around Mars: Into the second week

Despite the continuing dust storm, Mariner 9 is providing data on the shape of Mars, temperatures and gravitational anomalies



Photos: NASA

*Ridges in the polar cap: A glimpse of the surface.*

As Mariner 9 completed its first week in Martian orbit, the spacecraft was functioning as planned, but Mars was still enveloped in a global dust storm (SN: 11/20/71, p. 339) allowing only occasional, but tantalizing glimpses of the surface.

The only investigation not hindered by the dust was radio tracking of the spacecraft. According to Jack Lorell of the California Institute of Technology's Jet Propulsion Laboratory, the tracking determined that Mars is flat at the poles and has an equatorial "bulge" at 110 degrees west longitude causing the planet to be triaxial. In addition, says Lorell, Mars is more irregular gravitationally than expected. Mariner 9 is slowed about five seconds per orbit by gravitational anomalies.

For scientists trying to map Mars with the two television cameras aboard, the going was rougher: "We are looking at new approaches now (to work

through or around the dust)," said Bradford Smith of New Mexico State University. "This is an adaptive mission, and we are making changes." By the end of the week, the dust began to clear slightly in the south polar cap region. The cap appeared similar to glacial landscapes with irregular dark ridges breaking up the frozen carbon dioxide ice. "We now know these to be surface features," says Smith. What scientists are now seeing is the remnant of the cap that never completely disappears. The full-grown cap is frozen CO<sub>2</sub>, but, says Smith, "We can't rule out the possibility that the remnant is frozen water." Pictures also revealed a very thin layer possibly of CO<sub>2</sub> crystals above the dust that shows up best in violet.

Dust also hindered the other instruments aboard. "The experiment we expected to perform has changed in nature," said Arthur L. Lane of JPL, investigator for the ultraviolet spectrometer. "We are not seeing the ground." What the scientists saw were fine powdery particles of one to five microns in size at an altitude greater than 10 kilometers. The instrument measured temperatures in the upper atmosphere (above 40 kilometers) to be 350 degrees K. (Zero degrees C. equals 273 degrees K.; room temperature is about 300 degrees K.)

The infrared radiometer recorded average surface temperatures lower than those obtained from the 1969 Mariner fly-bys. The 1969 average temperature near the equator peaked at 290 degrees K. The 1971 average peak is 260 degrees K. The difference could be attributed to dust preventing solar heat from reaching the surface. Another difference, said Gerry Neugebauer of the California Institute of

Technology, is that in 1969 the hottest part of the Martian day occurred shortly after noon. Now it is occurring about two to three hours later.

Temperatures lower in the atmosphere also appeared to be affected by the storm. "The temperature does not decline as much with altitude as it did in 1969," said Arvydas Kliore of JPL. In 1969, scientists saw a decline in temperature with altitude from 250 degrees K. down to 125 degrees K. Now it ranges only from 260 to 240 degrees K. The possible reason for this, said Kliore, is that the dust is mixing at high altitudes.

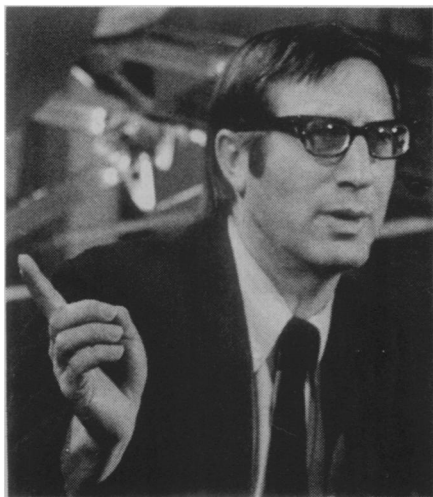
The infrared signatures observed so far showed a wide range of rock compositions from acidic to ultrabasic. The infrared interferometer spectrometer detected small amounts of water vapor in the south polar region. "There could be water vapor elsewhere on the planet as well," said Rudolf A. Hanel of the Goddard Space Flight Center.

The altitude of the dust causing all the problem is at least 9 to 11 kilometers but it could be as high as 30 kilometers, said Lane. "I suspect that there is no clear-cut upper boundary."

"The planet threw us a curve," said Robert Steinbacher, about the storm. But indications this week were that the dust was beginning to clear.

How long the dust will hang around is anybody's guess. In 1877, dust was seen from earth for two months; other estimates of the 1877 storm indicate it took six months for all the dust to clear.

If the planet itself isn't clear, one thing is, said geologist Harold Masursky of the U.S. Geological Survey: "Mars is a dynamic planet with changes coming and going." He hopes the dust is going. □



*Masursky: Studying a dynamic planet.*

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