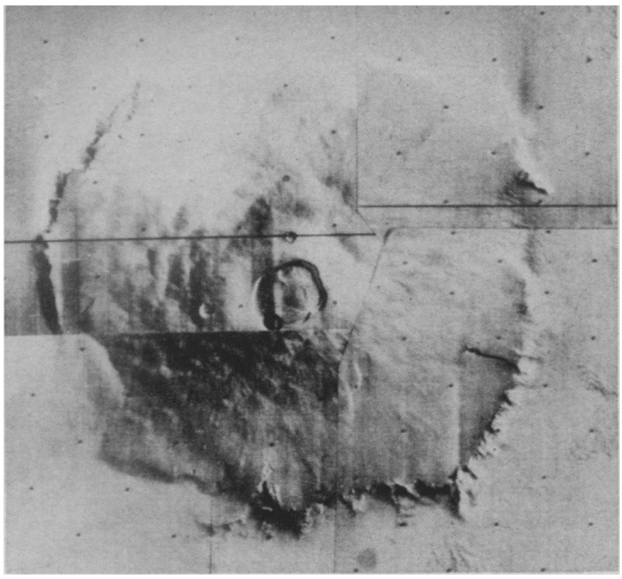
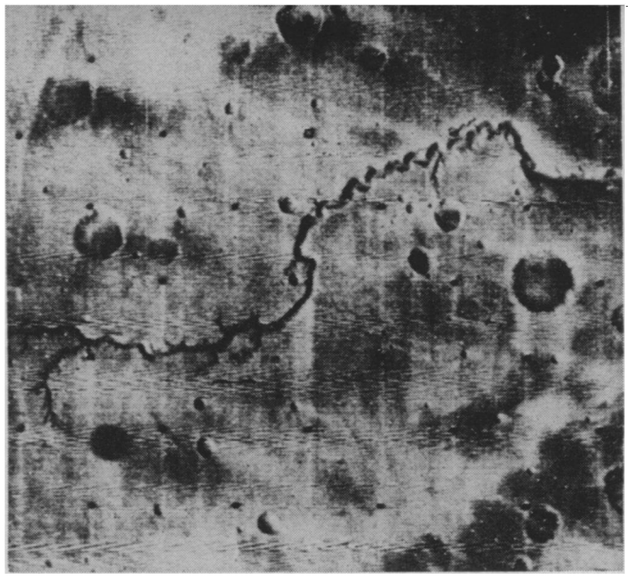


Nix Olympica: A summit crater atop a huge volcanic pile.



A 400-kilometer-long sinuous valley: A watercut gully?

Mariner views a dynamic, volcanic Mars

by Everly Driscoll

The views of the Martian surface being transmitted back to earth by the Mariner 9 orbital spacecraft in recent weeks call for at least a partial reevaluation of some preexisting concepts about Mars.

The planet described by seven Mariner scientists at a briefing last week in Washington is, in the words of Harold Masursky of the U.S. Geological Survey, "very, very different indeed" from the 1969 Mariner fly-by images of a heavily cratered, dead, very primordial planet that was the product of accumulated cosmic debris. Instead, Mars now has to be considered as a dynamic, geochemically evolved planet still in the midst of some change.

Pictures reveal great volcanic piles as large or larger than anything seen on earth and geologically very young. There are enormous fault zones that show the crust has frequently been broken. There are chasms stretching hundreds of kilometers and features that look as though they had been eroded by water and glaciation.

Nix Olympica, which appeared during the dust storm as a great dark spot (SN: 12/11/71, p. 387), has turned out to be a great volcanic pile twice as big as the one that forms the Hawaiian Islands. The Hawaiian pile is about 225 kilometers across and 9 kilometers high —the largest on earth. The crater at the top of Nix Olympica is 65 kilometers in diameter. At the base of the pile is a great cliff and a bright colored ring 500 kilometers across. So far, says Masursky, the pile has been partially measured and is six kilometers high. He believes more complete measurements will show it to be as high or higher than the Hawaiian pile. At the top is the summit crater with scalloped edges. "The flat, or nonraised rims indicated to us that this was a multiple volcanic vent."

Not as easily explained are areas that look like riverbeds. "If water weren't so hard to come by [on Mars], we would think that these were water channels." If they had been formed by gaseous eruptions, there would be little vents at the head of each, and there aren't. Wind erosion could possibly have formed the features, Masursky adds, but that's also difficult to understand.

Similar features show up in other places. A great chasm 100 kilometers wide winds along the Martian equator for more than 5,000 kilometers. Parallel to it is a fault along which are craters believed to be volcanic vents. But there are additional fractures—subsidiary valleys, "partially formed by faulting, and volcanic eruptions. But there is an additional complication there—something unexplained," says Masursky.

Mariner 9 television cameras have found many fault systems that extend for hundreds of kilometers. One lies across a "turtle back crater" that on earth is called a lava lake.

Near the south pole are formations of a far different origin—a flat plateau covered with striations. "We think these are the outcropping edges of layered rocks . . . related to glacial processes," says Masursky.

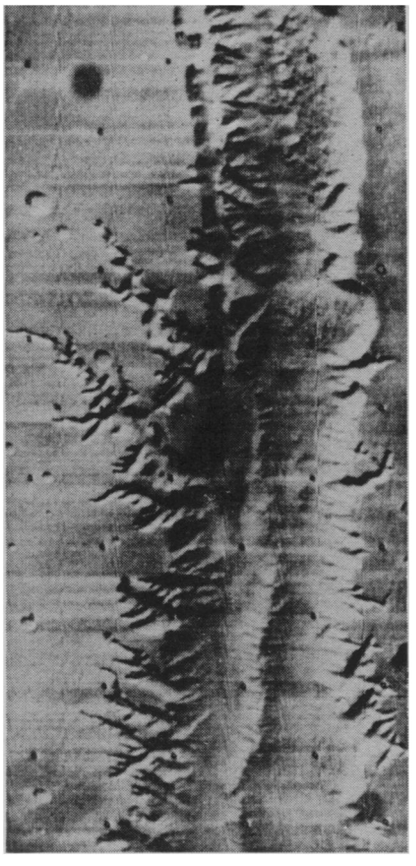
Far from the south polar cap is a formation in the floor of a crater that looks in shape just like the south polar cap. "It's not bright enough to be ice, but anything else we can think of that might form this kind of capping is even less probable," he adds.

Mars is now clear of dust, said Bradford Smith of New Mexico State University. But the rate of clearing suggests the dust particle size was larger (10-micron size) than had been expected. This raises another problem. "The conclusion has a consequence that is a little difficult to accept—that the dust must have been continuously stirred up for three months on a planet-wide scale," says Smith.

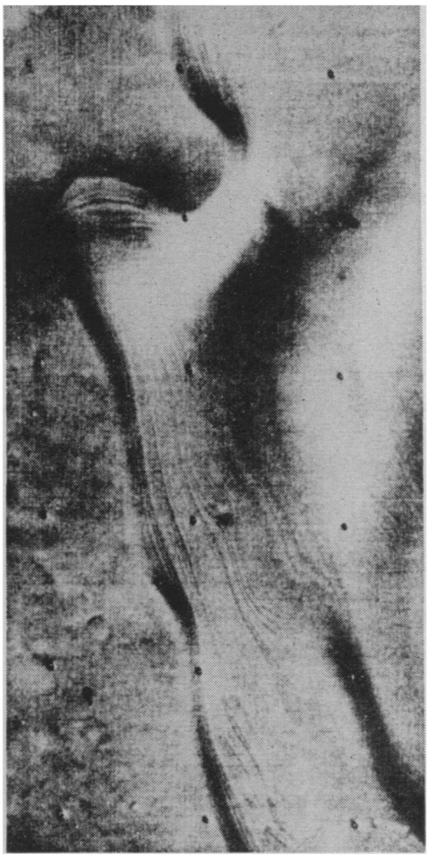
Smith has been looking at the formation of afternoon clouds on Mars for years through telescopes. "We have found about four or five calderas now, simply by targeting at points where we have seen these afternoon clouds (SN: 11/20/71, p. 339). "It is an intriguing possibility that these calderas might still be degassing and that water vapor may be emitted. . . . On the other hand, it may be nothing more than orographic clouds that form over high places."

But, according to Charles A. Barth of the University of Colorado, Mars is losing into space about 100,000 gallons of water per day. Most is probably

It looks like a polar cap but isn't.



A chasm with branching canyons.

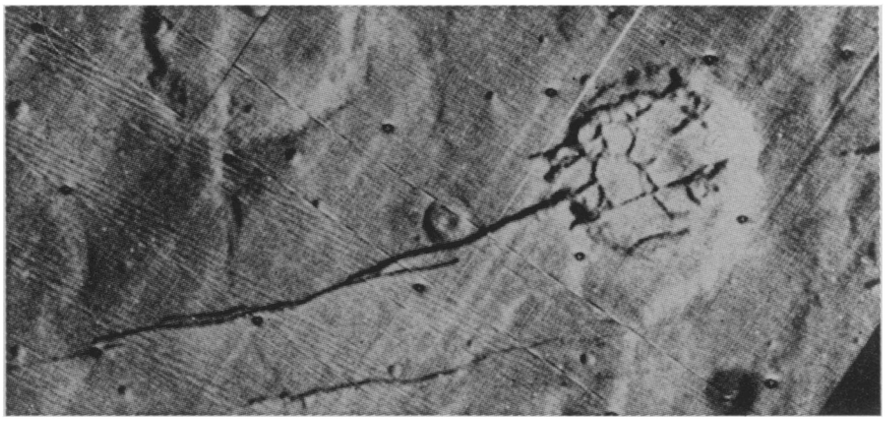


Striations: The result of glaciation?

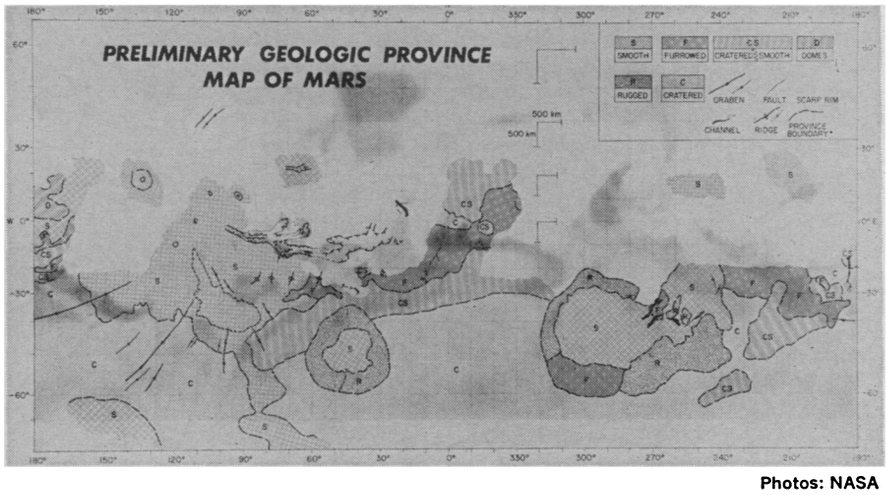
from the south polar cap, but some could be from degassing. "At present," says Rudolph Hancl of the Goddard Space Flight Center, "there is no liquid water on Mars." But Masursky described circumstances involving the precession of Mars' axis in a 50,000-year cycle that could bring about periods in which relatively large amounts of water might be released from the polar caps. There might have been enough water at those times to have caused erosion. But that's all speculation.

Mars has other differences. "It is basically much rougher gravitationally than either the earth or the moon," says Jack Lorell of the Jet Propulsion Laboratory. And, says Aryvdas Kliore, also of JPL, "the physical shape of Mars does not conform to the shape of the gravity field. It is a lot more squashed physically than it should be." He suggests two possibilities for the excess flattening at the poles: either when the surface of Mars solidified, the planet was rotating faster than it is now, and as it slowed down it retained its figure, or the density structure of Mars is not uniform. This would mean it would have to be denser at the poles than at the equator.

In view of these differences from the view in 1969, what do the possibilities for finding life on Mars look like now? "The chances are enormously improved," says Masursky. It's still a long shot. "But it's maybe slightly less a long shot now." □



A fault zone extending for hundreds of kilometers and "turtle-back crater."



Photos: NASA

The geologists have started to classify certain types of Martian features.