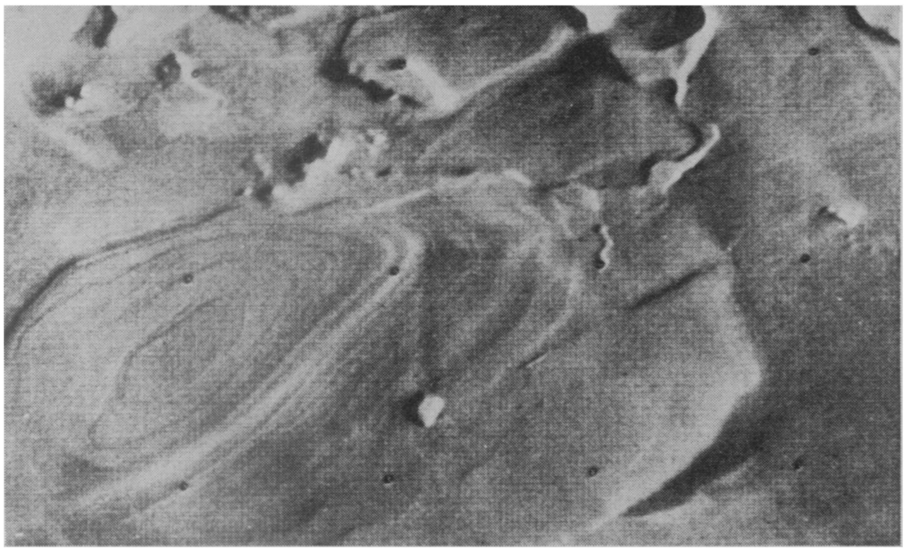
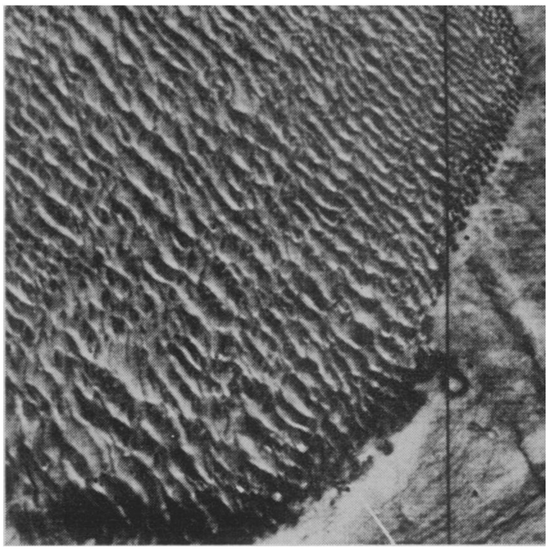
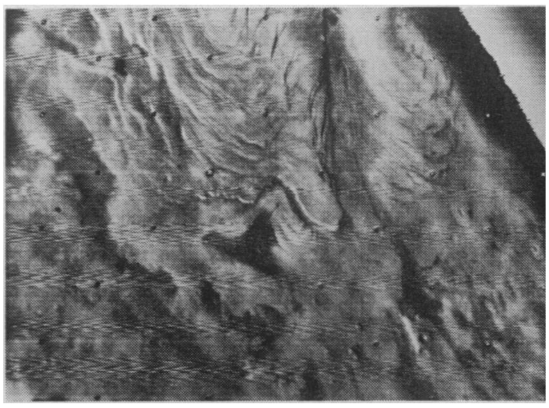


Photos: NASA

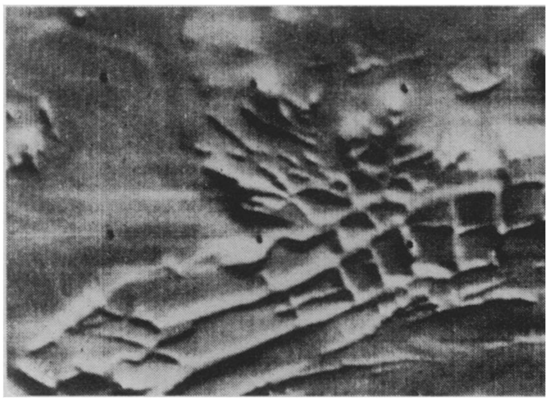
This oval tableland is believed to conceal massive amounts of water ice.



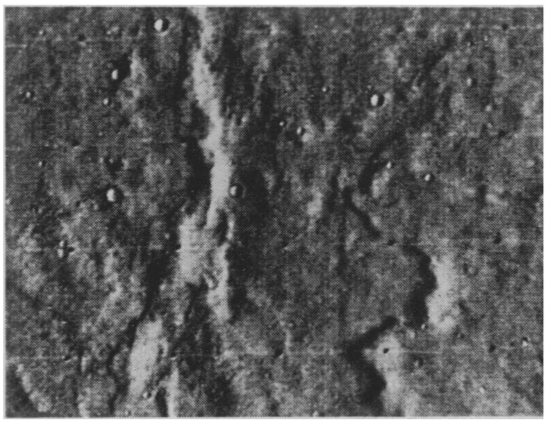
A sand dune field in Hellespontus.



Circular forms in north polar area.



Faults, ridges and erosion features.



Ridges look like lunar basalt flows.

Martian variety: Channels, sand dunes, glaciation

Mars is like a neighbor earthlings have been peering out the window at for years; what they couldn't see, they surmised. Even the three fly-bys were misleading because the spacecraft photographed only an old cratered region, says Robert H. Steinbacher of the Jet Propulsion Laboratory (JPL) in Pasadena, Calif.

Now after seven months of the orbital visit by Mariner 9 (SN: 2/12/72, p. 106), scientists are describing the actual characteristics of Mars: differentiated geochemically with evidence of past volcanism, extensive tectonic activity, and erosion from wind, water and thermal effects. From its surface temperature to the atmosphere, to surface pressure and to the wind field, Mars has an internally consistent environment. Wind patterns are observed to rotate—toward the north at morning, south at noon, northwest at midnight.

The ubiquitous channels on Mars seem to indicate an erosion by water in the past. Harold Masursky of the U.S. Geological Survey offers two explanations for conditions that could cause the release of water. One is related to the precession cycles. Every 50,000 years the ice cap may be big in the north; then the next 50,000 years, big in the south. In between these periods, weather on Mars would be unstable, producing lots of rain. Another explanation is that water may be trapped and frozen in the form of permafrost and released episodically into the atmosphere. Calculations by Rudolph Hanel of the Goddard Space Flight Center reveal that if all the water vapor now in the atmosphere were extracted and condensed, it would form a layer only 10 to 20 microns thick. Geoffrey Briggs of JPL believes water ice is present in two other areas: in the clouds that appear during the afternoon over the large volcanic structures (believed caused by the movement of warm air up the flanks of the volcanoes), and in the two layers of haze over the planet. The first layer is at an altitude of about 15 kilometers; the second, 45 kilometers.

Surface temperatures of Mars range from 81 degrees above zero F. in the equatorial zone to 189 degrees below zero F. at the poles. But there are temperature differences all over the surface. Ellis D. Miner of JPL attributes these to slopes (where differences of 20 to 30 degrees F. have been seen), reflectivity of surface features, material differences and the thermal inertia of the material.

According to Dan L. Cain and Jack Lorell of JPL the dynamic oblateness (the amount of polar flattening that ought to be caused by the planet's spin) and the actual topographic oblateness differ by eight kilometers, indicating the crustal material is rigid enough to support such a difference in shape. Strong gravitational anomalies also imply that large stresses are at work on the planet's crust. Lorell thinks that the distortion of Mars' shape could have been caused by a synchronous companion that existed sometime in the past.

Geologists have now divided Mars into four regions. The first is the Nix Olympica-Tharsis volcanic region with volcanoes up to 8 kilometers high and 500 kilometers wide at their bases. The second is the Ophir-Eos equatorial plateau region with faults and rifts 4.5 kilometers deep. The third includes cratered and smooth terrains in both hemispheres. Large circular basins (Argyre 1 and Hellas) resemble impact basins, such as the Imbrium basin on the moon. The region is the polar cratered terrain blanketed by glacial sediment layers up to 100 meters thick. □