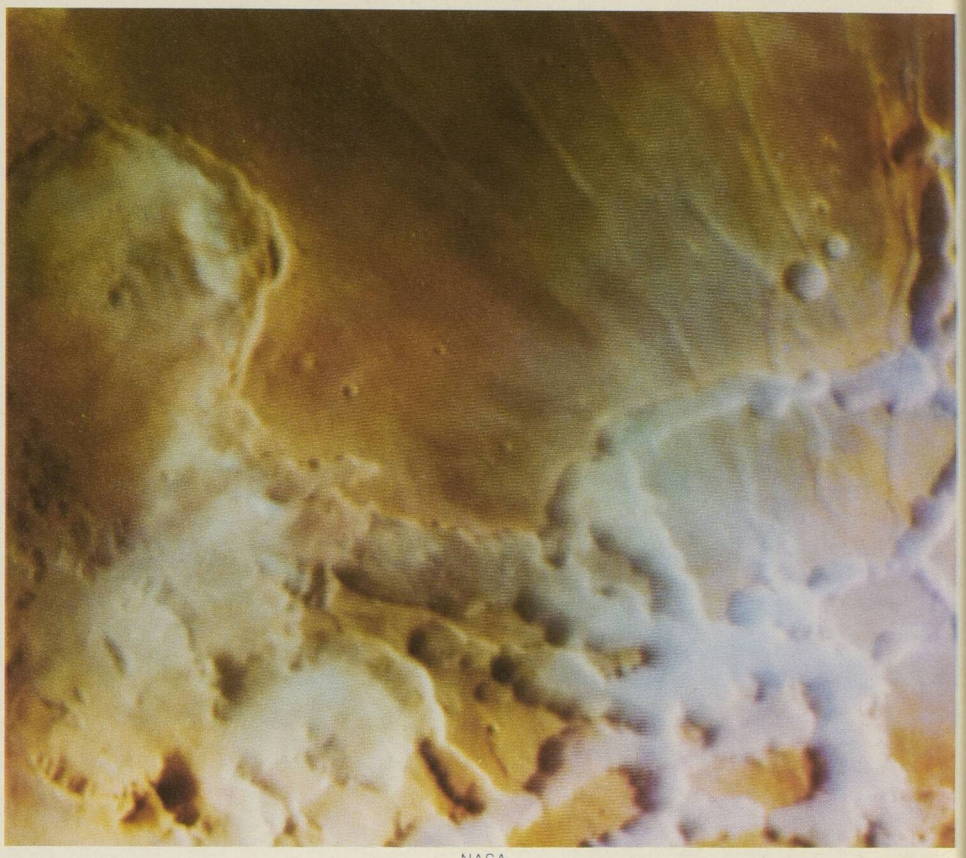
The sands of Mars — Moisture in a radio message

Last winter, astrophysicists at NRC's Algonquin Radio Observatory detected a "hotspot" on the surface of Mars. If their interpretation of the data is correct, they may have detected water under the planetary surface.



NASA

As the sun rises over Noctis Labyrinthus, bright clouds of water ice can be observed in and around the tributory canyons of this high plateau region of Mars. At first glance, the white cloud regions appear to overlay the brown surface areas — but look again. You should see deep canyons veiled in tenuous, ice-water mists. Photographed in color by Viking I on October 12, 1976.

Alors que le Soleil s'élève au-dessus de Noctis Labyrinthus, on peut apercevoir de brillants nuages de cristaux de glace à l'intérieur et autour des canyons qui convergent vers cette région de hauts plateaux. A première vue, les zones nuageuses blanches semblent recouvrir la surface brune du sol mais examinez bien la photo et vous découvrirez de profondes gorges voilées par un léger brouillard constitué de cristaux de glace. Photo couleur de la NASA prise par Viking I le 12 octobre 1976.

The sands of Mars have always held a certain fascination for man. The shifting patterns of color observed with the changes of Martian seasons have been variously interpreted, as windswept ores, extreme changes of temperature — even the Earth-like blooming of greenery that accompanies the intrusion of water onto arid plains.

This last idea was not only promoted in the early 1900's by the American astronomer Percival Lowell, but an observatory was built with the express purpose of showing that the line-like details on the Martian surface were water courses, very likely constructed by intelligent beings seeking to conserve the planet's meager water supply. In 1972, photographs from the Mariner probe changed all that however, revealing the true face of Mars, a world of barren, crater-strewn vistas, mottled by huge volcanoes and cut by gargantuan waterless canyons. The fabled canals were exposed as dry, natural trenches at best, and water, with all its implications for the presence of life, was absent everywhere except in a thin frost film at the planetary poles.

Still, exobiologists hunting for life kept the faith, reasoning that substantial amounts of the life-giving fluid might be lying undetected just under the Martian surface. Last winter, a group of astrophysicists at NRC's Algonquin Radio Observatory gave new hope to the life scientists by announcing that their large radio telescope may indeed have detected subsurface water.

To detect water at all on Mars when it is almost 85 million kilometres away would appear to be an impressive feat, but to identify it below the planetary surface seems impossible.

Not so, according to NRC's Dr. Bryan Andrew, particularly when the nature of the observational technique is understood. "All you need to know is that the radio emissions from Mars can be translated into thermal radiation, or ground temperatures, and the rest is relatively easy." Sharp changes in ground temperatures, so the hypothesis goes, can be related to water content variations in the Martian soil.

"In December 1975," continues Dr. Andrew, "we aimed the 46-metre (150-foot) dish of the Algonquin radio telescope at Mars during a two-week period when the Earth and Mars were in a straight line out from the Sun — astronomers would say that the two planets were in opposition. With the Sun shining over our shoulders so to speak, we began measuring the radio emissions from the planetary surface at Martian high noon. As the planet quite literally turned 'beneath' us (think of the Sun's direction as 'up') we mapped the intensity of radiowave emission at the 2.8 centimetre wavelength over the entire Martian surface."

The radiowaves picked up by the telescope can be considered to originate from a depth of about 15 cm below the surface according to Dr. Andrew. "At Martian midday, there is a heat gradient in the surface soil," he explains. "Due to the direct sunlight, the top layer is hottest, with the temperature tailing off as you go further down. The temperature that our instrument records — the radio emission strength that is — depends upon the distance that it 'sees' into the surface and the distance the heat penetrates. At a first approximation, it is receiving from about 15 cm down."

After measuring the mid-day surface temperature all around the equator of the planet (the telescope was looking directly down on the Martian equator) Andrew and his co-workers Mrs. Gladys Harvey and Dr. Frank Briggs (an American astrophysicist from Cornell University) noted a "hot spot" covering almost 25 per cent of its length.

The hot spot, recorded as an increase in the radio emission strength,