SPACE SCIENCES

Mars: Hydrocarbon channels?

The diverse channels of Mars, which in orbital photos range from lacy traceries to features evocative of vast riverbeds, are among the planet's chief bones of contention. Different channel types have been variously attributed to flowing water, subsurface permafrost collapse, wind erosion, sandblasting and lava—and there is even disagreement as to which types may stem from which sources. Now a pair of researchers has added yet another possible genesis to the list: hydrocarbons.

It has been suggested that the early Mars had a reducing (hydrogen-rich) atmosphere rather than an oxidizing one. If so, according to Y. L. Yung of California Institute of Technology and J. P. Pinto of the Goddard Institute for Space Studies, such an atmosphere could have been polymerized by solar ultraviolet radiation to produce a variety of higher hydrocarbons. "These compounds," the scientists report in the June 29 NATURE, "are low-viscosity liquids at today's temperature on Mars, and could contribute to the formation of channels."

Using water (from an assumed 50 percent relative humidity) as a catalyst, the authors suggest a variety of chemical reactions that might have taken place in the primitive Martian atmosphere, and conclude that the resulting alkanes (a hydrocarbon family) above C_7H_{16} would condense into liquid. Judging from the alkane production rates of their model, in fact, the researchers estimate that "a major fraction of the atmosphere could be polymerized in less than 10 million years, giving rise to a layer of liquid alkanes as thick as 1 meter if uniformly spread over the planet's surface." And that conclusion is based on an assumed total atmospheric pressure of only 100 millibars, including about 90 percent (by volume) methane. "If we had started with 1 bar of methane," says the report, "the amount of liquid would be 10 meters."

Where, if this model is correct, has the alkane flood gone? Yung and Pinto maintain that, given an initial but no longer extant methane-rich atmosphere on a low-mass planet such as Mars, hydrogen escape into space would be "inevitable." Since the initial hydrogen reservoir would have been bound up by the polymerization, further escaping hydrogen must have come from the dissociation of water, leaving free oxygen to oxidize the hydrocarbons out of existence. "Thus," say the scientists, "all the alkanes could be destroyed in perhaps as short a time as it had taken to make them."

The researchers do not maintain that running alkanes were the only or even the primary source of the Martian channels, but merely that they could have been one possible contributor. A partial test, they propose, would be to measure the deuterium/hydrogen ratio in present-day Martian water (which is known in the atmosphere and polar caps) as an indicator of the amount of hydrogen that has escaped, a key factor in judging whether an early reducing atmosphere might indeed have existed.

Solar array funded for space test

An extendable "wing" of solar cells, 32 meters long and 4 wide, is now being developed for a late-1980 orbital test that NASA calls "the first concrete step toward producing large amounts of power in space." The solar array, being developed under a $2.7 million contract to Lockheed Missiles and Space Co. in Sunnyvale, Calif., is to be carried into orbit folded in the cargo bay of the space shuttle, from which it will then be opened and closed several times in the course of the test.

The test is primarily to verify the structural and dynamic characteristics of the array, so only three of its 82 panels will be equipped with solar cells—just enough to confirm basic electrical performance. With a full complement of cells, according to NASA, the array would produce 12.5 kilowatts of power.

The earliest practical outgrowths of the demonstration are likely to be similar arrays used to extend mission durations for the shuttle and its scientific workshop module, Spacelab. It may also be the basis for large panels that provide electric power for low-thrust solar-electric propulsion systems in such long-duration missions as a cometary encounter.

Landsat 3 has eye trouble

The primary sensor aboard each of the Landsat earth-resources satellites is a multi-spectral camera that monitors the planet in several different wavebands or channels, which can be used individually or in combination to bring out a variety of surface features. One of the key differences between Landsat 3, launched on March 5 (SN: 3/11/78, p. 149), and its predecessors is the addition of a fifth channel to cover thermal infrared emissions that can indicate crop conditions, urban heat islands, power-plant effluents and other phenomena.

Landsat 3's new "eye," however, has been having its problems. For the last month, in fact, it has been half blind.

Following the satellite's arrival in orbit, the sensor was not turned on for about 15 days, thus leaving time for moisture and other "outgassed" substances to be cleared from the system. As it turned out, according to project manager Ron Browning of the NASA Goddard Space Flight Center, 15 days apparently were not enough. The fifth channel's optical system still contained what analysts believe to be moisture, causing the two detectors behind the optics to perceive the earth's thermal emissions as weaker than their true level. An "outgassing cycle" (consisting of closing a door on the sensor, activating a heater to bring forth the vapors, and re-opening the door to let them out) was run periodically, but on July 12 the problem worsened.

On that day, when the sensor was turned on following such a cycle, one of the channel's two detectors refused to respond. Late last week it was still mute, with the result that every other scan line is missing from the channel's data, cutting the sensor's resolution in half in the "cross-scan" direction. The sensor thus can pinpoint sources as small as 240 meters along a scan line, but is limited to those twice that size across the scan. The moisture is believed to be a factor.

On April 26, NASA launched its Heat-Capacity Mapping Mission satellite (SN: 5/6/78, p. 292), which also monitors thermal infrared emissions, but the HCMM, says Browning, is limited to about 500-meter resolution. A special ad hoc review board is investigating Landsat 3's malaise.

Mars: Cosmic ray museum?

The Martian atmosphere, according to isotope data from the Viking landers, has about 62 percent more nitrogen 15, relative to nitrogen 14, than does the atmosphere of earth. The enrichment has been ascribed to preferential escape of the lighter isotope, but two Japanese scientists offer an alternative: the ^{15}N excess, suggest Shohei Yanagita and Mineo Imamura of the University of Tokyo, may stem from nuclear reactions with intense cosmic rays in the early solar system. The necessary cosmic-ray flux and speculations on cosmic-ray sources available at the time are a reasonable match, the researchers report in the July 20 NATURE, adding that variations in other isotope ratios (argon, xenon, oxygen, neon) do not rule out the conclusion. Galactic cosmic rays that pass through the present thin "air" would have been attenuated by an early, thicker atmosphere, and the integral irradiation effects may remain. Cosmic-ray data on conditions more than 2 billion years ago are unknown, the researchers maintain, and the Martian atmosphere may thus provide an "invaluable" record.