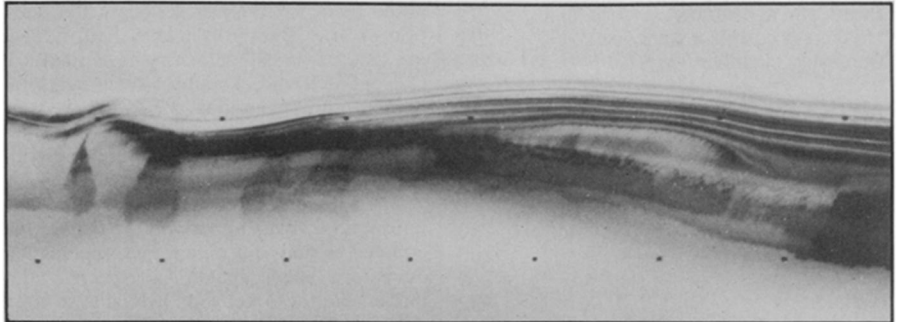


Viking: Polar Dunes and Captured Moons

In the great deserts, instead of finding chaos and disorder, the observer never ceases to be amazed at a simplicity of form, an exactitude of repetition and a geometric order unknown in nature on a scale larger than that of crystalline structure. In places, vast accumulations of sand weighing millions of tons move inexorably, in regular formation, over the surface of the country, growing, retaining their shape, even breeding in a manner which, by its grotesque imitation of life, is vaguely disturbing to an imaginative mind. Elsewhere, the dunes are cut to another pattern—lined up in parallel ranges, peak following peak in regular succession like the teeth of a monstrous saw for scores, even hundreds, of miles without a break and without a change of direction over a landscape so flat that their form cannot be influenced by any local geographic features.

British geophysicist R.A. Bagnold was describing the Sahara Desert when he wrote those lines in 1941, but according to James A. Cutts of Science Applications, Inc., they may be even more applicable to the planet Mars. The Mariner 9 spacecraft revealed a number of dune features in canyons and crater floors on the Red Planet (SN: 7/5-12/76, p. 366), but the Viking 2 orbiter has now driven the point firmly home by revealing a vast belt around the Martian north polar cap that may be, says Cutts, "the largest dune field in the solar system."

The belt spans about 5° of latitude, says Cutts, much of it intermittently but with at least 20 percent consisting of "continuous, coalescing dunes" with sand probably piled 50 to 100 meters thick. It seems to have been formed as part of the complex process by which the polar cap itself evolved into its present form, a process that Cutts tentatively divides into six distinct stages: First came the formation of the primitive polar caps, followed by the deposition of successive layers of ice and dust due to regular climatic cycles caused by changes in Mars's orbital and rotational elements. Then stratification in the rock beneath the caps caused terracing to form



Huge belt of dunes girdles Martian north polar cap (upper photo). Alternating layers of dust and ice (above) indicate climatic cycles on the cap, with the discontinuity in left of photo possibly representing a major climatic change.

in the ice-dust laminate. Additional layers were next deposited over the earlier ones, followed by wind- and thermally-caused erosion that cut through the layering to reveal the dramatic patterns seen in Viking's photographs. (Details in the layering sequences may represent major climatic changes on a time-scale of hundreds of millions of years or longer, SN: 10/23/76, p. 261.) Finally, says Cutts, there may have been a sixth stage that modified the erosion and deposition patterns to bring the caps to their present form.

The huge girdle of dunes, he says, is probably the final resting place for the dust deposits that were freed by melting from their place in the laminated sandwich. It is possible, he adds, that the fine dust particles may have been accreted into sand-sized grains by geochemical processes similar to those which bound surface particles in some parts of the Viking lander sites into a thin crust.

The circumpolar dune belt includes not only the greatest number of dunes, says Cutts, but also the largest individual dunes, many of them measuring hundreds of meters from crest to crest. Together they suggest "a vast sea of parallel ridges," some of which are broken by other, perpendicular ridges apparently formed by a band of winds circling the cap. The edge of the polar cap itself, says Cutts, has surprised Viking scientists by revealing "a very much thicker deposit of permanent glacial ice than we'd expected." Then there are the strange features typified by one that has been dubbed "the searchlight," an area formed by two diverging straight lines between which everything on the surface—dark markings and light ones—looks, well, different. "There appears to be some translucent cover over this region and its difficult furrows," says orbiter imaging team



"The searchlight": A polar oddity.

leader Michael H. Carr of the U.S. Geological Survey, "maybe a discontinuous ice deposit, but it must be extremely thin. And we can see the albedo features through it." Accumulated dust creates a somewhat similar impression in some parts of the equatorial regions, but there the cause seems readily apparent. The polar-cap versions, says Carr, "appear to be a somewhat different animal."

While Viking orbiter 2 has been devoting most of its attention to the Martian north polar region, orbiter 1 has taken another intriguing look at the planet's two tiny moons, Phobos and Deimos. Nearly doubling the width of the spectral band in which Mariner 9 viewed the two satellites, the Viking data have provided strong though preliminary evidence that both bodies were probably formed farther out in the solar system, probably in the asteroid belt between Mars and Jupiter, then captured by Mars. Color photos indicate

that the moons are dark enough to be made of water-rich carbonaceous chondrite material, which probably could not have formed as close to the sun as Mars (although, points out Joseph Veverka of Cornell University, the color distinctions involved are subtle enough that earth's moon, by comparison with a carbonaceous chondrite, is considered "red-dish").

Still stronger evidence may come early next year during Viking's post-solar-conjunction "extended mission," when flight officials hope to send one of the orbiters to within 30 kilometers of Phobos. The satellite's gravitational effects on the spacecraft's orbit should enable precise calculations of its density, revealing whether it is more like the 2.0 grams per cubic centimeter of a carbonaceous chondrite or the 3 to 3.5 grams of basalt.

If Phobos and Deimos were indeed formed elsewhere and captured, says Veverka, it is likely that they were captured while both were still part of a much larger object which later broke up, with the remaining fragments crashing into the planet or escaping into space. It would take a large object, he says, to produce strong enough tidal interactions with Mars to produce the present circular, equatorial-plane orbits that neither moon would be likely to have achieved on its own. If the two have different densities, however, it would suggest either two separate captures of larger objects or that circular, equatorial-plane capture is easier than now believed. □

Swine flu vaccine: Facts vs. fears

On Oct. 1, after extensive birth pains and controversy over its necessity, the swine flu vaccination program got underway throughout the United States. But its success was short-lived. On Oct. 11, three elderly persons died within 48 hours after receiving the vaccine at a Pittsburgh clinic. As a result, vaccination was suspended in a few states. By Oct. 13, some 35 older persons in 17 states had died within 48 hours of receiving the vaccine. The Center for Disease Control in Atlanta attempted to determine whether any of these deaths was due to the vaccine.

By Oct. 18, the CDC concluded that none of the deaths could be blamed on the vaccine, and the vaccination program moved ahead full tilt once again. However, many Americans, particularly older persons, have remained skeptical about the safety of the vaccine. Precisely what are the scientific facts behind the scare?

Although some 35 persons age 65 or older died within 48 hours after getting the vaccine between Oct. 1 and 13, there were almost a million other older Americans who also got the vaccine during that period and suffered no serious effects. Statistics from CDC show that 116 elderly

Americans out of one million usually die every 24 hours under normal circumstances, suggesting that there was no connection between the vaccine and the deaths. In fact, the statistics suggest that there were considerably fewer deaths among those older persons getting the vaccine than among those who did not get it. Or in the words of Robert Webster, a flu vaccine scientist at St. Jude's Children's Research Hospital in Memphis, "If you want to play the numbers game, you can play it the other way around, that is, that the flu vaccine protects you from dying."

Webster doesn't really believe that, though. Then why were there actually fewer deaths among older vaccine recipients than among older nonrecipients? "Because the people who are really sick and in bed are not going to receive the vaccine," Webster suggests.

There is other evidence to exonerate the vaccine. Of the 35 deaths, 20 were the result of heart attacks; seven were the result of miscellaneous cardiovascular problems, and the others the result of diabetes, respiratory failure, lung embolism and lung hemorrhage. None of them were diagnosed as the result of flu, especially swine flu. These findings do not surprise flu vaccine scientists. All the flu vaccines that have ever been commercially available in the United States, including the swine flu vaccine, are made from killed flu viruses. None has ever been known to cause the disease it is supposed to guard against, attest both Webster and Robert Golasso, chief of the Infectious Disease Branch of the National Institute of Allergy and Infectious Diseases. The case is different for vaccines made from attenuated live viruses, such as the polio vaccine. Such vaccines have, on rare occasions, triggered the disease they were supposed to prevent (SN: 10/2/76, p. 213).

Although a killed virus vaccine cannot cause the disease it guards against, it might, of course, contain some chemical contaminant that could trigger disease. But CDC officials were not able to find any evidence of such material in vaccine batches. And whereas vaccines sometimes provoke allergic reactions in persons who are allergic to eggs or egg protein, autopsies of the Pittsburgh vaccine recipients who died did not show evidence of such reactions. Also, allergic reactions to vaccines have never caused a death as far as Webster can recall.

Nor is it likely that the vaccine stressed older persons so badly that they died from the stress. As Robert M. Alden, a CDC spokesman points out, heart attack patients probably get more shots than healthy persons, so it is hard to imagine that a shot of vaccine would stress them anymore than, say, a shot of antibiotic. Golasso, however, concedes that traveling to a clinic for vaccination could be so stressful for sick, elderly people that it

might have triggered some of the deaths that followed vaccination. Indeed, one elderly man died even before he was vaccinated—while reading a vaccination consent form. "No one has ever connected a heart attack with a vaccine," Golasso asserts. "Now stress, that's something else."

So taking these various factors into consideration, it is the consensus of the vaccine authorities both in and out of the CDC that the swine flu vaccine has not caused any deaths to date. □

Brain asymmetry present at birth

The intricate workings of the brain's 10 billion cells will not be explained in the near future, but during the past 10 years there has been an explosion of information relating the workings of the brain's two hemispheres to some basic human behaviors. It is now fairly well established that the left hemisphere functions predominately in language-oriented activities while the right hemisphere possesses superior spatial-perceptual capabilities. When and how does the brain develop this lateralization and specialization of hemispheric functioning? This was among the questions addressed this month at a conference on the evolution and lateralization of the brain sponsored by the New York Academy of Sciences.

In the early 1960s most of the evidence suggested that the two hemispheres are virtually equal in potential with regard to the acquisition of language, at least until the age of two. In other words, the hemispheres start out the same and then differentiate as language is acquired. Juhn A. Wada of the University of British Columbia in Vancouver now says, "It cannot be assumed that the two hemispheres are equally potential for speech at any time." Wada suggests instead that the left hemisphere is prepotent or predisposed for language development at least from birth. This conclusion is based on studies of both the structure and function of infant brains.

It has long been known that adult brains are morphologically asymmetrical, and Wada's examination of more than 100 infant brains now confirms similar asymmetry in infants, with the left side usually larger. These asymmetries are inborn, says Wada, and are not due to environmental or developmental factors after birth. They are present and visible at the twentieth week of gestational age and can be measured objectively by the twenty-ninth week.

What does such morphological asymmetry mean? Are the asymmetries coincidental? Do the larger areas represent underlying speech mechanisms or do they represent capabilities other than speech? "Unfortunately," says Wada, "the extent of our understanding of these perplexing problems is practically zero at this