SPACE SCIENCES

The reddening of Mars

Long before the two Viking landing craft began sampling the surface of Mars, the color of the "red planet" was generally attributed to a relatively straightforward cause: rust—oxidized iron. When the Martian surface material turned out to stick to magnets, to have a possible catalytic role in the landers' biology experiments and to show other measurable properties, researchers set about trying to narrow down the range of eligible iron oxides to a more specific candidate. Leading suggestions so far have included maghemite (γ-Fe_2O_3) and an iron-enriched form of a group of clays known as smectites. But the Viking data are inconclusive (the landers could determine individual elements, but not mineralogic structures), so there is still room for speculation on just what makes the red planet red.

The latest candidate, proposed in the June 6 NATURE by Roger G. Burns of the Massachusetts Institute of Technology, is δ-FeOOH, an oxide hydroxide polymorph of ferric iron called "feroxyhyte."

Depending on its particle size, he says, feroxyhyte has a saturation magnetization as much as half that of maghemite, so it could have passed the Viking magnet test. Its infrared spectrum shows peaks in the 2.95-to-3.4-micron range that resemble data from remote-sensing measurements. In at least some cases, such as the decomposition of H_2O_2, feroxyhyte has a comparable catalytic efficiency to maghemite (and a 10-fold edge over related minerals goethite and hematite), and might thus have been capable of affecting the Viking biology-experiment results.

On earth, says Burns, feroxyhyte is believed to form on the surfaces of marine sediments by the oxidizing effect of seawater on a product of $Fe(HCO_3)_2$ that has migrated out from the sediment's interior. On Mars, he says, ferrous ions derived from the surface basalt by physical and chemical weathering processes could form stable $Fe(HCO_3)_2$ in the "chloride-sulfate-rich, CO_2-saturated, O_2-depleted brines" believed by some researchers to exist in the Martian permafrost. Slow oxidation of the $Fe(HCO_3)_2$ would then form the feroxyhyte as a thin, red-brown veneer on fractured rock surfaces. The veneer would consist of fine-grained particles that could be readily transported during the fabled Martian dust storms, and whose large specific surface would also make them "effective substrates" for the reversible chemisorption of water vapor from the atmosphere.

Feroxyhyte is not necessarily the answer, Burns points out, only a candidate, and it may be that several different minerals, in fact, are involved. A real answer would require, say, landing an X-ray diffractometer on the Martian surface, or, as many scientists hope, returning a Martian sample to earth.

Last gasp for the Viking 1 orbiter

The Viking 1 orbiter, which has been studying Mars for more than four years as a result of five extensions to its original five-month mission, is getting yet another lease on life—but this one appears to be the last. A few weeks ago it was decided to halt the orbiter's scientific activities on July 14, the day before starting a series of firings of the craft's main engine, designed to study propellant utilization efficiency by burning the fuel right down to the end (SN: 6/21/80, p. 389). The engine is not needed for photography and other science, but the firings will also consume some of the limited remaining gas used by the orbiter's steering jets, essential for aiming the instruments.

Recent analysis suggests, however, that some steering gas may remain after the firings, and NASA has decided to allow additional photography if possible. Even so, tracking stations on earth must soon turn full time to Voyager 1's upcoming encounter with Saturn, dooming the sole surviving Mars orbiter (its companion ran out of gas in 1978) to be shut down on Aug. 15.

SCIENCE & SOCIETY

The fifth amendment and oil spills

Around March 23, 1975, oil escaping from a drilling facility leased by the L.O. Ward Oil and Gas Operations near Enid, Okla., spilled into Boggie Creek, a tributary of the Arkansas River system. Ward notified the Environmental Protection Agency, which in turn notified the Coast Guard. The result was a $500 fine imposed under Section 311(b)(3) of the Federal Water Pollution Control Act (FWPCA). While the government sued to collect its fine, Ward countered with a suit of its own charging that in being required to report its own offense, the government had stripped Ward of its Fifth Amendment right, which provides protection against self-incrimination. On June 27 the Supreme Court reversed an appellate court ruling that had agreed with Ward.

Freedom from self-incrimination only applies in criminal proceedings and the law under which Ward had been cited was civil. But the case was really more complicated than that, because as the Supreme Court noted, "on a number of occasions ... 'Congress may impose both a criminal and civil action in respect to the same act.'" And it so happens that under the Rivers and Harbors Act of 1899, a law enacted 70 years prior to FWPCA, Ward's offense constitutes a criminal penalty. At issue here was whether the dual classification of one offense automatically renders the offense "quasi-criminal" because in 1886 the Supreme Court had ruled that in quasi-criminal offenses, the guilty party may deserve protection against self-incrimination.

In an 8 to 1 ruling against Ward, the Supreme Court essentially found two confounding factors: First, that the Ward case was weaker in regard to demonstrating criminal activity than was the 1886 case. Second, that it appeared the intent of Congress was to dilute the force of the 1899 law.

Attempts to rescue burros begin

Public rescue of Grand Canyon burros slated for slaughter is due to start immediately. On May 19, Assistant Interior Secretary Robert L. Herbst announced his agency's decision to remove all non-native burros from the national park in Arizona. The public has been given 60 days to submit proposals outlining how individuals or groups would capture and remove live animals. To date, some five proposals have been accepted; removal measures for any program must begin by June 19.

A few proposals petition capture of only two or three of the estimated 350 animals now inhabiting the park. Others propose removing all. Among schemes approved so far are ones calling for the roundup and corralling of burros or luring of creatures by means of artificial braying sounds. Actual removal plans vary from driving the creatures through exit paths to airlifting by helicopter. Approved live-removal programs will continue throughout summer and fall, so long as they prove successful. Animals not caught will be shot and killed by the Park Service within six months of the end of public-removal efforts.

The burros descend from a North African species introduced around the turn of the century by prospectors. Lacking natural predators, the once-domesticated animals now flourish at the expense of native plants, small mammals and soil.

Slaughter at NSF

President Jimmy Carter has announced that he will nominate John B. Slaughter, an electrical engineer, to succeed Richard Atkinson as director of the National Science Foundation. Provost and academic vice president at Washington State University, Slaughter formerly headed the University of Washington's Applied Physics Laboratory in Seattle and numerous research-management posts. Atkinson leaves to become chancellor of the University of California at San Diego.