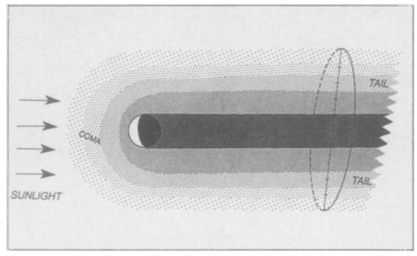
Earth Science

Ivars Peterson reports from Baltimore at an American Geophysical Union meeting

Tracing the glow of a lunar tail



Boston Univ. Center for Space Physics

Earth's moon continues to serve up surprises. In 1988, scientists detected traces of sodium and potassium atoms above the lunar surface, suggesting that the moon has a definite atmosphere, albeit an extremely thin one. Now, by looking specifically for sodium atoms in the moon's vicinity, a team of researchers has discovered that the moon's sodium atmosphere stretches out into a long tail pointing away from the sun.

"The moon has the appearance of a comet," says astronomer Michael Mendillo of Boston University.

To find the moon's tail, Mendillo and his co-workers used a specially modified telescope that can focus on certain wavelengths of light emitted by sodium atoms. They had first used this instrument to determine the size of the sodium cloud surrounding Io, a satellite of Jupiter (SN: 6/9/90, p.359).

One set of images depicting the sunward edge of the bright crescent moon shows sodium extending about 7,000 kilometers above the lunar surface, or five times the moon's radius. Images of the opposite, dark edge reveal much fainter sodium emissions, but these come from a region at least 21,000 kilometers long. Taken together, the observations suggest that the moon's sodium atmosphere qualitatively resembles that of a comet, featuring a bright coma centered on the moon and an extended tail stretching away from the sun (see diagram).

The researchers also found that the intensities of the sodium emissions were lower in the middle of the tail than near its sides. This indicates that the moon casts a shadow down its tail, which reduces the number of sodium atoms present. However, even at its thickest, the moon's evanescent sodium atmosphere probably contains only a few dozen atoms per cubic centimeter – far more tenuous than a comet tail.

Digging for bacterial magnetism

The still waters of the lower Pettaquamscutt River in Rhode Island harbor a remarkable population of bacteria. These microscopic creatures sequester iron from the surrounding water to build up strings of tiny, aligned magnetite crystals in their bodies. Known as magnetotactic bacteria, they may play a significant role in geological processes such as the magnetization of sediments and the cycling of iron in the environment. "These organisms are not just novelties of nature," says biologist John F. Stolz of Duquesne University in Pittsburgh.

Pettaquamscutt River's deep basins provide the kind of stable environment in which various species of free-floating magnetotactic bacteria thrive. They show up at a depth of about 4 meters, where the concentration of dissolved oxygen has declined to zero and iron becomes soluble in water. During their lifetimes, the bacteria process surprisingly large quantities of iron into magnetite crystals, Stolz says. These crystals form a hefty load. "Imagine going around with a 10- or 15-pound weight hanging around your neck," he remarks.

When the organisms die, their magnetite-laden remains drift to the bottom of the river basins. Normally, the water chemistry at this depth would promote the dissolution of magnetite. However, organic membranes surrounding the crystals seem to preserve them for considerable periods of time, Stolz says. Such easily identifiable, sheathed crystals have been found as far as 1 meter down in the sediments, suggesting that biogenic magnetite stored in sediments may have played a role in recording the Earth's magnetic field in times past.

Food Science

Twofold path to saving aging bones

Physicians typically prescribe exercise or a diet rich in dairy products to slow a woman's postmenopausal loss of bone mass. A study of 36 postmenopausal women has now confirmed that exercise and calcium-rich dairy products do help prevent major bone loss. The new findings also hold a surprise: Calcium and exercise bolster different bones.

Half the women in the study agreed to take part in a vigorous, supervised 50-minute walk four times a week. The remainder, who led more sedentary lives, did not engage in any regular exercise regimen during the year-long study. Dietitians helped all the women adjust their diets to provide 800 milligrams of calcium per day. In addition, half the women in each group were randomly selected to receive a daily milk-based supplement containing 831 mg calcium. The rest drank a similar supplement containing only 41 mg calcium.

By the end of the study, trabecular bone mass in the spine had increased by 0.5 percent in the exercising women and decreased by 7 percent in the sedentary women, report Miriam E. Nelson and her colleagues at USDA's Human Nutrition Research Center on Aging, at Tufts University in Boston. The level of calcium supplementation had no effect on the degree of trabecular change, they note in the May AMERICAN JOURNAL OF CLINICAL NUTRITION.

Conversely, the calcium level – but not the exercise – affected a thighbone section called the femoral neck. Here, bone density increased by 2 percent in women drinking the high-calcium supplement and diminished by 1.1 percent in the lower-calcium group.

The team advises healthy women to increase their exercise *and* their calcium intake "at the earliest possible age."

Eat the bread but skip the lead

Many people routinely recycle packaging items, from rubber bands to wrapping paper and tinfoil. But those who reuse plastic bread bags should make sure the printed side never touches food.

Researchers have detected a lead content averaging about 26 milligrams in the printed sections of 17 of 18 different bread bags tested. A weak acid extracted more than 6 percent of this lead in just 10 minutes, report Clifford Weisel and his co-workers at the University of Medicine and Dentistry of New Jersey-Robert Wood Johnson Medical School in Piscataway.

In a survey of 106 parents – mostly "well-educated mothers of young children" – the team found that 41 percent reuse their bread bags. More important, 16 percent turn the bags inside out before storing food in them, "thus putting food in contact with the lead paint," the researchers write in the June AMERICAN JOURNAL OF PUBLIC HEALTH. "We were told of paint flaking from the inverted package onto stored food," they add. Anecdotal information suggested that people invert the bags to dry them out or to remove crumbs that might become moldy.

The researchers estimate that weak acids such as vinegar might leach 0.1 microgram of lead onto an area the size of a slice of bread – double the lead typically consumed in a day, according to EPA estimates. While that amount poses no immediate health threat, Weisel's team nonetheless concludes that leaded printing on such bags should be prohibited as an "unnecessary risk to health."

Herbert L. Needleman, a toxicologist at the University of Pittsburgh, agrees that this previously unrecognized source of lead should be banned – but not for the small risk it poses in food. In an accompanying editorial, he notes that Nelson's report suggests bread bags may add 0.8 metric ton of lead to the U.S. trash stream daily. Incinerated bags will release lead into the air, he says, providing "an incremental dose that we do not need."