Chemistry

On ozone and art

Ozone, a reactive product of photochemical smog, can fade or even change the color of certain pigments in artwork, report Cynthia Shaver and Glen Cass of the California Institute of Technology in Pasadena and James Druzik of the Los Angeles County Museum of Art in the December ENVIRONMENTAL SCIENCE AND ENGINEERING. Two Japanese wood-block prints and 17 watercolor-pigment samples were exposed in a dark test chamber for 95 days to ozone at 0.4 parts per million — a level the researchers equate with three to six years exposure to ozone levels typical of Los Angeles' smog. The yellow colors and one blue-green tint in the Japanese prints faded noticeably. So did two crimsons among the watercolors. Another purplish-mauve watercolor sample actually turned blue.

The authors speculate that at least in the case of the crimson watercolors, fading may result from ozone's destruction of that part of those pigments known as the anthraquinone-ring system. The chemical reaction would destroy the chromophore — a chemical group responsible for the color of these pigments.

The problem of fading colors is not just academic, as the researchers' tests for ozone in one Pasadena art gallery showed indoor concentrations to be half the outdoor level. Though galleries usually control indoor-light levels to limit fading, the researchers note that many ignore ozone, whose concentrations in air can be reduced dramatically by cycling air through activated-carbon filters.

Made-to-order enzyme

The ability to deliberately tailor proteins to alter their functions is one of the promises of biotechnology. But so little is known about the detailed action of enzymes that it is hard for scientists to know where in a protein's structure to try to make meaningful changes. In one case, however, scientists at the Agouron Institute of La Jolla, Calif., now have created new versions of an enzyme with predetermined functional changes.

The scientists started with a highly detailed three-dimensional picture of the enzyme dihydrofolate reductase (DHFR). (Such detailed structures have been obtained by X-ray crystallography for only a handful of proteins.) The investigators then made "educated guesses" about how altering subunits of the enzyme might modify its structure and function. They then used a recombinant DNA technique to replace segments of the DHFR gene with new DNA fragments designed and synthesized by the Agouron scientists. The remodeled DNA was inserted into bacteria, which produced new forms of DHFR.

"Preliminary findings indicate that the alterations in the DHFR molecule at selected sites affected the enzyme's activity and stability in precisely the ways which had been predicted by the Agouron scientists, but which had heretofore been untestable by any other approach," the Institute reports. "The result is a bioengineering technology of enormous theoretical and practical importance."

As bitter as they come

The bitterest substance known to date has been reported by Atomergic Chemicals Corp. The Plainview, N.Y., company has applied for a patent on the substance, called denatonium saccharide. It is a white, crystalline powder that has a lingering bitter taste even when diluted to one part in 20 million. The company says that denatonium saccharide, with its vile taste, could be added to poisonous household products to prevent accidental ingestion by children. Atomergic is investigating the new chemical's potential as a repellent for sharks, beavers, woodpeckers and water rates. They are testing the compound when added to plastic garbage bags and plastic sheathing of telephone cables.

Earth Sciences

Rich crusts found in U.S. waters

Robert G. Beauchamp, DOI

Manganese crust from the U.S. Exclusive Economic Zone.

Mineral deposits of greater concentrations than expected were dredged up from the Pacific Ocean floor in December by United States Geological Survey scientists aboard the research vessel *S. P. Lee*, according to a USGS spokesperson. The highest mineral concentrations in the samples were: 32 percent manganese (25 percent expected), 2.5 percent cobalt (1 percent expected) and 0.8 percent nickel (0.5 percent expected).

Such high mineral content could lead to U.S. self-sufficiency for some imported minerals. But thick crusts with high mineral content are difficult to find consistently, say USGS marine geologists on the project. The samples were found about midway between Honolulu and American Samoa in the U.S. Exclusive Economic Zone (EEZ) during a pole-to-pole Pacific cruise. The EEZ, which President Reagan proclaimed last March, extended U.S. jurisdiction to all mineral resources from 12 to 200 nautical miles off the coast of the United States and its island territories.

Besides locating the minerals in such deep water, other stumbling blocks include the mining economy and excavation technology, say industry sources. According to Conrad G. Welling, senior vice-president of Ocean Minerals Company in Mountainview, Calif., "We don't even have the present equipment to do the basic research job. ... Until then industry does not have enough information to go on."

Dim outlook for oil, gas on U.S. lands

In a conclusion that should delight environmentalists and disappoint developers, the United States Geological Survey (USGS) finds that only four percent of 74 million acres of federal wilderness lands in 11 western states stand a high probability of being good drilling sites for oil and natural gas. The recently completed, two-year study ranks as choice drilling locations only 2.7 million acres of the lands already protected or under consideration for wilderness designation. Nearly half of these acres are in western Montana, in Glacier National Park and in three designated wilderness areas to the south. Drilling is forbidden in those areas by federal law. There is a moderate possibility that eight percent of the lands inventoried, or 5.9 million acres, would yield recoverable amounts of oil or gas, while 22 percent, or 16.1 million acres, have a low probability, USGS reports. The remaining 61 percent, or 45.7 million acres, have zero potential or low to zero potential as sources for oil or natural gas.

Tracing pollutants to Antarctica

Pollutants have been detected in the frigid Antarctic air, but the paths they took from the world's industrialized areas are little understood. Five nations are cooperating in a project to trace the movements of an easily identifiable form of methane as it follows wind currents toward the icy continent. The gas, called heavy methane, consists of heavy carbon and hydrogen isotopes, and is rare in nature. It will be released from aircraft this month and again in July over the ocean midway between Christchurch, New Zealand, and McMurdo Station, Antarctica. Then, ground level air samples will be collected at eight Antarctic research sites. Researchers from Los Alamos National Laboratory in New Mexico also will collect air samples during routine plane flights following each gas release. The samples may provide information about the speed at which the trace gas moves, its paths and the methane distribution and concentrations.