

OTA warning on wastes in coastal waters

The "garbage barge," which has been searching for a landfill to dump 3,100 tons of trash since it left Islip, N.Y., on March 22, has become a pungent symbol of the U.S. waste disposal problem. This problem is not limited to land-based disposal sites. Wastes are channeled into the marine environment as well, and some of the country's estuaries and coastal waters, which are especially vulnerable to marine pollution, have suffered.

"We have enough information to conclude that waste disposal activities are a major contributing source" of a wide range of problems for the marine environment — including millions of dollars of losses in the fishing industry and a rising number of reported human illness from consumption of contaminated shellfish, says Howard Levenson of the Congressional Office of Technology Assessment (OTA) in Washington, D.C. Levenson has been the project director of a three-year OTA study examining the impacts and management of wastes in the marine environment.

In its report, released late last month, OTA found that environmental legislation enacted over the last two decades has helped to cut down on marine pollution in some areas. But it warns that "In the absence of additional measures to protect our marine waters, the next few decades will witness new or continued degradation in many estuaries and coastal waters around the country (including some that exhibited past improvements)."

Levenson says this is because current pollution control programs are not fully enforced and do not adequately address toxic pollutants or runoff and other "non-point"-source pollution. Moreover, he expects that there will be increased pressure to use marine environments for disposal in the future: The Census Bureau anticipates that as much as 75 percent of the nation's population will live along the coasts by 1990, accentuating the already difficult problem of developing land-based disposal, as evidenced by the garbage barge's sojourn. In addition, marine disposal is often less costly than land-based alternatives.

The agency notes that the open ocean appears to be in a better state than coastal waters and estuaries. This is partly because the ocean receives relatively less waste, and the waste that is deposited there tends to be widely dispersed and diluted by the ocean, according to the OTA report.

While most public attention has been focused on dumping of sewage sludge, industrial wastes and dredged material, OTA concludes that agricultural and urban runoff and pollution discharged from pipelines are at least as important in terms of their effects on the marine

environment. According to Levenson, more than 2,000 pipelines discharge directly into estuaries and coastal waters, thousands more are discharged upstream in rivers that carry the pollutants to the coastal waters, and an estimated 100,000 industries dispose of wastes into municipal sewage, which, after treatment, passes into coastal waters.

Levenson says the OTA study confirmed the significance of some of the most publicized problems, such as the low oxygen levels (hypoxia) and excessively high levels of nutrients, metals, organic chemicals and bacteria found in the New York Bight and the Chesapeake Bay. "But we are also raising a red flag about less well publicized areas, along the Gulf of Mexico and along the southern Atlantic coast," he says. For example, periodic hypoxia of an unknown origin is threatening the nation's foremost fish and shellfish catches offshore of Louisiana.

The solution, says Levenson, does not necessarily entail the development of multibillion-dollar programs or major legislative efforts. Instead OTA suggests that the present system of uniform controls be continued and enhanced to provide a minimum level of protection, and that these controls be supplemented by site-specific management to deal with the unique problems of individual water bodies. The congressionally created Chesapeake Bay Program is an example of this latter approach.

"It seems to us that the critical link that's missing," says Levenson, "is that we do not have a systematic framework for deciding when and how to provide the additional types of management needed for water bodies." This framework would identify water bodies in need of additional care, develop management plans and coordinate state and federal activities. "Most of the mechanisms needed to implement this framework are already existing, although many of them are in embryonic form," he says.

Both Reps. Thomas R. Carper (D-Del.) and Mike Lowry (D-Wash.), who were on hand for the official release of the report, praised it highly. Lowry says his Subcommittee on Oceanography will be using the OTA study as a basis for oversight hearings in July, and beginning this week a few other subcommittees will hold hearings on the issue of marine pollution as well.

One program that will help policy makers take the first steps toward identifying marine areas that need attention is the National Status and Trends Program of the National Oceanic and Atmospheric Administration. The intent of this program is to monitor levels of specific toxic chemicals in sediments, bivalve mollusks and bottom-dwelling fish sampled from more than 150 sites along the U.S. coastline. In January, the program published

the first progress report summarizing data collected in 1984, when it began.

"We've applied a common set of approaches and measurements on a nationwide basis," says John A. Calder, who manages the program in Rockville, Md. And it's now clear that "we have an unassailable means for evaluating which parts of the country that we sampled are the most contaminated," he says.

It's still too early in the study to determine whether the health of the marine environment sampled is improving or decaying. But Calder says the preliminary evaluation does at least provide an idea of which places may require the most attention: Boston Harbor (Mass.), Salem Harbor (Mass.), Raritan Bay (N.J.), western Long Island Sound (N.Y.) and San Diego (Calif.).

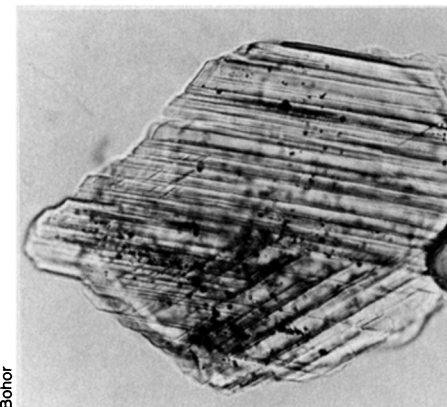
In these, as in other places, the Status and Trends Program sampled toxic trace metals, cancer-causing polychlorinated biphenyls (PCBs), aromatic hydrocarbons, pesticides, sewage and other compounds. "The sites we sampled in those five places," says Calder, "seem to stand out no matter what parameter you look at."

— S. Weisburd

Extinction upon impact?

Pieces of shocked quartz, found around the world, present strong evidence that a large meteorite or asteroid struck the earth 66 million years ago and generated a globe-girdling dust cloud that caused a round of mass extinctions and ultimately the demise of the dinosaurs, report researchers in the May 8 SCIENCE.

The grains of quartz, which were lifted from sediments at the Cretaceous-Tertiary (K-T) boundary, display microphysical features characteristic of grains found at known impact sites, write Bruce F. Bohor and his colleagues from the U.S. Geological Survey (USGS) in Denver. This resemblance indicates that the quartz was shocked, or fractured, by the impact of a large body, and that it was



Shocked quartz grain from Brownie Butte, Mont., displays multiple lamellae.

then lofted into the stratosphere and deposited around the world, says Bohor.

Minerals such as quartz and feldspar develop these features when high-pressure shock waves exert shearing forces on their crystals, leaving behind parallel, fractured planes called lamellae.

The shocked quartz findings represent the latest volley in a series of debates over the cause of the extinctions that ended the Cretaceous period (SN: 4/18/87, p.248). Other geologists contend that an extended increase in volcanic activity at that time precipitated a range of damaging climatic effects — acid rain, atmospheric cooling, stratospheric ozone depletion — that caused the numerous extinctions.

Much of the recent debate has centered on whether the discovery of shocked quartz in clay sediments at the K-T boundary proves the impact theory.

Last year, Neville Carter of Texas A&M University in College Station reported finding shocked quartz grains at Toba, a 75,000-year-old volcanic eruption site in northern Sumatra. With this find, advocates of the volcanism theory claimed that the shocked minerals found by Bohor and others at the K-T boundary could be volcanic in origin.

In the SCIENCE paper, the USGS researchers counter that the volcanically shocked quartz has only single sets of lamellae rather than the multiple lamellae seen in quartz from the K-T boundary and at impact sites. In addition, they say, 25 percent of the quartz at the K-T boundary is shocked, whereas much less than 1 percent of the quartz at Toba is shocked.

For Bohor, these results preclude the possibility that volcanoes played a significant role in the activities at the K-T boundary, and they prove the impact theory. "We've shown that the material [from the K-T boundary] is shocked. We've shown that it's exactly the same as shocked material around craters ... I don't think there's any doubt that there was an impact. There just can't be."

However, Carter and others refuse to end the debate. They claim that volcanic explosions could also have produced the multiple lamellae in the grains that Bohor's group has found.

According to Yale paleontologist John Ostrom, the extinctions of plant and animal life at the end of the Cretaceous were spread out in time. This indicates, he says, that the major cause of extinctions was not the impact of an extraterrestrial body, which would have ended life more quickly. "For dinosaurs, I think the majority of [paleontologists] probably subscribe to general climatic change rather than impact because there does seem to have been a general decline in both numbers and diversity," he says. Both an impact and an increased period of volcanism would have contributed to these changes.

— R. Monastersky

Baby face-off: The roots of attraction

An attractive face may not just be in the eye of the beholder. Infants as young as 2 months old, with little or no exposure to many cultural influences on standards of beauty, show a preference for women's faces that have been rated as attractive by young adults, report psychologist Judith H. Langlois of the University of Texas at Austin and her colleagues.

"For reasons we don't understand, which may include an innate capacity or early learning, there appears to be a predisposition among infants to discriminate attractive from unattractive faces," says Langlois. This conclusion "may seem surprising," she adds, since it is often assumed that attractiveness preferences stem from gradual exposure to television and other cultural forces.

No one can define attractiveness, says Langlois, but studies have shown that children and adults are often confident they know when a face is attractive and largely agree on who is attractive.

The Texas investigators expanded on this work by studying 34 infants who were 6 to 8 months old and 30 infants who were 2 to 3 months old. The 37 boys and 27 girls in the study were all from middle-class families. Infants were shown color slides of 16 adult Caucasian women, half of whom were judged moderately attractive and half of whom were judged moderately unattractive by a sample of several hundred undergraduate men and women.

When pairs of faces, one attractive and one unattractive, were viewed in two 10-second presentations (so that the left-right positioning of the slides could be reversed to control for any tendencies to gaze toward one side), about two-thirds of both older and younger infants looked significantly longer at the attractive faces, report the researchers in the May DEVELOPMENTAL PSYCHOLOGY. In a second

trial, in which pairs of attractive faces were displayed followed by unattractive pairs, nearly the same number of older infants showed a marked preference for the attractive faces. Younger infants, however, displayed no preference for attractive over unattractive faces in the second experiment.

The last finding, says Langlois, is probably due to the fact that, given relatively short trial lengths, younger infants are less able to release their attention from visual stimuli of all types and may find an unattractive face interesting when an attractive alternative is unavailable. There was a good deal of individual variation in attention to and interest in the slides among all the infants, adds Langlois, which may account for the one-third who showed no preference for attractive faces in the first trial.

Nevertheless, it is far from clear why many infants prefer attractive faces. The tendency may be partly influenced by the nature of human vision. Attractive faces may be more curved, less angular and more vertically symmetrical than unattractive faces; these forms are known to be preferred by infants, says Langlois.

When combined with recent evidence that judgments of attractiveness vary far less both between and within a number of diverse cultures than previously assumed, the infant data suggest that a "universal standard of attractiveness" may interact with cultural factors and changing conceptions of beauty over time, suggests Langlois.

At this point, however, "we don't know why infants, or adults for that matter, show consistent preferences for attractive faces," she says. But Langlois adds that the findings "seriously challenge the assumption that attractiveness is merely 'in the eye of the beholder.'" — B. Bower

Shotgun approach to genetic engineering

Researchers have developed a "shotgun" to bombard cells with microscopic tungsten pellets coated with genetic material — either DNA or RNA. In the May 7 NATURE, they report that onion cells pierced by the high-velocity 4-micron pellets not only survived without apparent injury, but also went on to "express" the genes they carried.

Expression of foreign genes suggests but does not prove that the bombarded cells have permanently incorporated the new genetic material, explains principal researcher Theodore M. Klein of Cornell University's horticultural sciences department in Geneva, N.Y. He adds that follow-up studies to prove permanent incorporation "look encouraging." A demonstration of gene incor-

poration would add this technique to the arsenal of genetic engineering tools available for inserting beneficial foreign genes into useful crop species.

Inside their shotgun's cylinder, which is about the size of a .22-caliber rifle barrel, a firing pin detonates a gunpowder-filled blank. This propels a nylon bullet, which doesn't exit the cylinder but instead slams into the pellets of tungsten powder, sending them and the genetic material they carry into 2,000 or more separate cells.

"With this technique," says Klein, "we're going to be able to genetically engineer a lot of crop species [especially cereal grains] that are not amenable to other [gene-insertion] techniques."

— J. Raloff