

sized crystal," Hillner notes. The researchers can control the rate of crystallization or dissolution by slightly varying the solution concentration.

The resulting images reveal surprisingly complex processes taking place as ions shuttle between solution and crystal surface. Layers grow by the formation of broad steps spiraling outward from surface outcroppings. These steps, each only 0.3 nanometer high, give the crystal surface a distinctive, terraced appearance. In contrast, dissolution produces sharply etched pits.

"Calcite grows by adding material right at a step," Gratz says. The researchers find scant evidence of ions landing on a flat surface, then diffusing to their final resting places at edges.

And there's much more to see. "It's its own little world," Hillner says. "There's so much going on, it's hard to figure out what to attack next." Hillner and Gratz are now putting together an apparatus that would allow them to study calcite growth and dissolution at elevated temperatures.

"Carbonate minerals exhibit a rich surface chemistry that creates hundreds of crystalline forms in nature," they conclude. "It may now be possible to relate each form not only to the natural environment in which it grows, but also to its detailed growth mechanism."

— I. Peterson

When refrigerator fare turns foul

Think back to the last time you cleaned out your refrigerator. If you're like many people, it's not a pretty sight.

Two new studies now implicate bacteria-contaminated food as the source of many cases of listeriosis, a rare, but potentially lethal, illness that can strike pregnant women, the elderly and people with damaged immune systems. *Listeria monocytogenes* can cause flu-like symptoms, blood poisoning, complications of pregnancy and stillbirths. In severe cases, it can lead to meningitis, an infection of the membranes surrounding the brain and spinal cord.

During the last decade, scientific teams traced several listeriosis epidemics to widespread ingestion of foods fouled with the bacterium, found in soil, animals and vegetation. While epidemiologists blamed these large outbreaks on soft cheeses, pasteurized milk (SN: 3/2/85, p.141) and the cabbage in coleslaw, the cause of sporadic listeriosis cases remained mysterious.

Anne Schuchat and Robert W. Pinner of the Atlanta-based Centers for Disease Control (CDC) and their colleagues took a closer look at these infrequent cases. In the first study, the team identified listeriosis patients in parts of California, Tennessee and Georgia, and in the entire

Nuclear site flooding hazard dismissed

Federal plans to store high-level nuclear waste inside a Nevada mountain gained a boost this week when a panel of eminent geoscientists dismissed a controversial theory that the proposed site faces a risk of flooding from rising groundwater.

The prospective site of the repository, Yucca Mountain, lies about 150 kilometers northwest of Las Vegas. The Department of Energy (DOE) is assessing whether the site is suitable for storing roughly 70,000 tons of spent fuel rods for nuclear power plants.

The groundwater issue is critical. The planned repository is designed to remain dry and must be built in rock far above the water table. Should hot fluids rise into the repository during the 10,000 years that the waste will remain harmful, they could carry radioactive material into the environment.

In the late 1980s, DOE geologist Jerry S. Szymanski reported that rising fluids presented a very real risk. Plans for the repository call for excavating the storage rooms about 200 to 400 meters above the current water table, but Szymanski concluded that groundwater had reached much higher levels in the past. He proposed that extensive mineral deposits found near the surface were formed when tectonic stresses from earthquakes or other geological events forced warm water to rise and then precipitate dissolved minerals in cracks and pores in the volcanic rock of the area.

Most scientists working on the project have dismissed this theory, but a few vocal supporters have backed Szymanski's hypothesis, prompting the

DOE to ask for an outside investigation from the National Academy of Sciences.

After two years of study, a 17-member panel convened by the academy concluded that "there is no compelling evidence for the repetitive flooding of the environment by expulsion of groundwater," says chairman C. Barry Raleigh, of the University of Hawaii in Honolulu. Instead, the evidence strongly supports the idea that the near-surface mineral deposits resulted from percolating rainwater, which carried soil minerals down into rock fractures.

The panel based its conclusions primarily on field observations and isotopic investigations of elements found in the mineral deposits. Federal and university scientists had previously reported that the isotopic evidence supports the percolating rainwater theory (SN: 10/26/91, p.262).

Panel members stressed that they did not judge the much broader question of whether Yucca Mountain would make a suitable site. They pinpointed other concerns about the region that the Energy Department must now address.

Szymanski, who released his own 600-page report this week, stands by his theory. Not surprised by the new report, he accused the panel of "blowingsmoke."

Federal scientists involved in the project say they hope to get beyond the Szymanski controversy and start addressing other pressing questions about Yucca Mountain. "A lot of time has gone into going places and collecting data that at least in hindsight could have been used more effectively elsewhere," says Joseph F. Whelan of the U.S. Geological Survey in Denver. — R. Monastersky

state of Oklahoma.

With those reports, as well as population estimates from the U.S. Bureau of the Census, the team calculated the annual incidence of listeriosis in the regions studied as 7.4 cases per million persons. Nationwide, the statistics translate to about 1,850 infections and 425 deaths every year, the researchers estimate.

Next, the team focused on 165 listeriosis patients and 376 healthy controls. A statistical analysis revealed that compared with controls, patients were 2.6 times more likely to have eaten a soft cheese, such as feta or some types of Mexican cheese, and 1.6 times as likely to have bought foods from a delicatessen counter. Eating such foods accounted for 32 percent of the listeriosis cases, the team reports in the April 15 *JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION*.

In the second study, reported in the same journal, the team collected food from the refrigerators of 123 listeriosis patients. Foods such as lunch meat,

cheese and leftovers were packed in sterile bags and shipped on ice to CDC headquarters.

Although they can't prove that any individual food caused a patient's illness, *L. monocytogenes* grew from at least one edible item taken from 79 (64 percent) of the refrigerators sampled. Furthermore, 26 of the 79 refrigerators (33 percent) had food samples that contained the same strain of *L. monocytogenes* that had infected the patient.

Most people with a healthy immune system don't have to worry about listeriosis, Schuchat says. However, she suggests that pregnant women, the elderly and people with damaged immune systems might want to avoid deli-counter foods and certain soft cheeses. In addition, she says, all Americans should adopt safe food-handling practices, such as washing raw vegetables; fully cooking beef, poultry and pork; and reheating leftovers until they are steaming hot.

— K.A. Fackelmann