Earth Science

Salty lakes hide deep in Mediterranean

Geoscientists have discovered three lakes of extremely salty brine lying in pockets on the floor of the Mediterranean Sea, southwest of the island of Crete. Such lakes could help explain why the Mediterranean is saltier than typical ocean water.

The three brine lakes, situated more than 3,300 meters below the sea surface, were discovered in 1993 and 1994 by a team of European scientists conducting the Mediterranean Ridge Fluid Flow (MEDRIFF) project. Oceanographers had previously identified two other brine lakes in the Mediterranean during expeditions a decade ago.

MEDRIFF researchers found the lakes using echo sonar, which sends down pulses of sound to probe the seafloor. The boundary between the dense brine fluids and the normal seawater above creates a flat lake surface that stands out amid the rougher surrounding seafloor. The density contrast prevents the brine from mixing easily with the seawater.

The scientists focused attention on a horseshoe-shaped lake, called Urania, which had an average depth of 80 meters. At one end, the lake reached 200 meters deep. The chloride content in the Urania brine measured about 5 times that of Mediterranean seawater. The lakes formed when seawater dissolved deposits of salt-rich rocks along the seafloor.

If many such lakes exist at the bottom of the Mediterranean, they could add salt to the seawater, perhaps explaining the Mediterranean's unusually high salt content, say the scientists. Current theories hold that high rates of evaporation produce the Mediterranean's extra salty waters.

EOS

Sonograph shows smooth surface of brine lake (in blue).

USGS fires more than 500 employees

Squeezed by ever tightening budgets, the U.S. Geological Survey (USGS) has terminated almost one quarter of the staff in its geologic division. Known as a "reduction in force," or RIF, the firings will cut into almost all elements of the geologic division, which investigates earthquakes and other geologic hazards, assesses mineral and energy resources, and maps the geology of the nation, both on land and off shore.

USGS officials said the downsizing became necessary because years of restricted budgets had eaten away at its funds for conducting field research. "We've had at least a decade in which any [budgetary] increase we have had has not matched inflation," notes William Cannon, a USGS researcher who coordinated the RIF.

Over the past two years, the USGS had trimmed 400 jobs from the geologic division by offering "buyout" packages for employees willing to retire early. But the buyouts and other belt-tightening measures did not reduce costs enough, says Cannon. Because of budget constraints, the funding available for field work had dwindled to between 5 and 10 percent of the current budget, whereas 20 to 25 percent is needed for a healthy program, according to the USGS. "It was our last resort, but it was our only way of getting back in the business of doing the things we need to do," says Cannon.

Materials Science

Richard Lipkin reports from Chicago at a meeting of the American Chemical Society

Fiber optic sensor probes a cell

A tiny probe, just one-thousandth the diameter of a human hair, now offers a window on the chemistry inside living cells.

Raoul Kopelman, a physical chemist at the University of Michigan in Ann Arbor, has made a set of fiber-optic biochemical probes that can detect specific molecular activities occurring in a cell's liquid interior. He fashions a fine tip from the end of an optical fiber, then coats it with aluminum. He then pierces a cell, shines a laser beam through the fiber, and monitors how the light's intensity and wavelength change. These reveal details of the chemistry at work inside the cell.

Kopelman

A fiber optic probe pierces a cell.

Kopelman reports assaying glucose, oxygen, sodium, calcium, and potassium ions, plus the cell's pH. A probe can detect changes occurring in as little as one-hundredth of a second, permitting him to track chemical processes "in a single cell, as they occur." Equivalent investigations today require slabs of tissue or live animals observed over days or weeks.

Kopelman says the probe could measure activity inside live rat embryo cells "without affecting the cells' metabolism or growth." It also could probe the chemistry of poisoning—revealing "drastic chemical changes inside the cell, occurring within seconds, as the embryo is dying."

Studied cells hardly notice the probe, since it takes up as little as one hundred-thousandth the volume of a red blood cell. "It's like a mosquito bite," Kopelman says.

He suspects the probe could prove useful for testing the effects of drugs on particular cells, identifying gene sequences, or checking embryos for birth defects.

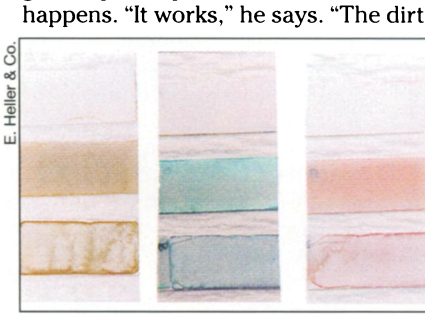
Coating self-cleans glass and paints

A deliverance for moms who must continually wipe tiny hand prints off white walls? An end to insect-smeared windshields?

Adam Heller and Yaron Paz, chemical engineers at the University of Texas at Austin, have devised a chemical coating for glass surfaces that automatically clears away most types of dirt and grime. The thin-film titanium dioxide coating functions as a photocatalyst. Reacting with sunlight, it breaks down and strips away deposits of organic debris. It's an adaptation of the catalyst-coated glass beads that Heller developed to break down spilled crude oil (SN:5/22/93, p.322).

Working with 1-inch squares of glass in the laboratory, the researchers have found that the "self-cleaning" coating rids itself of just the kind of organic scum that tends to accumulate on walls and car windows. In a distinctly nonscientific test, Heller said that he has been driving around town with coated glass squares pasted onto his car windows—just to see what happens. "It works," he says. "The dirt comes off."

E. Heller & Co.



Coffee and green or red food coloring stain white latex paint (bottom panels). When catalyst-coated (middle panels), the paint sheds stains in sunlight (top panels).

Because the coating works as effectively on painted surfaces as on glass, Heller envisions new kinds of latex paints for household walls that would clean themselves of fingerprints and food stains when illuminated.

Details of these photocatalytic coatings will appear in an upcoming JOURNAL OF MATERIALS RESEARCH.