1265
Mathematicians at the top of their field

LEAD STORY 1268
Achieving diversity without quotas

1270
AIDS vaccines under new management

University last year with the promise of a $5 million-a-year budget for his research and treatment center. Unlike Prockop, who gets half his budget from the National Institutes of Health (NIH), Ozer is heavily dependent on funding from the hospital and is now preparing a slimmed down, $1.2 million budget. He is guardedly optimistic about prospects when the hospitals are taken over by new proprietors; nonetheless, "if I had it to do all over again, I would not have come to this institution."

The financial crisis "should have been seen much earlier, and probably could have been dealt with if it had been," says Ozer. Faber remembers site visitors from a licensing board a year or so ago remarking that "you're the only people who are expanding while the world is contracting."

Indeed, many other U.S. academic medical centers made wrenching adaptations to the managed care economy. Both Stanford University and New York University, for example, have merged their hospitals with other systems. In 1996, restructuring at the University of Southern California's medical school led to a lawsuit by scientists complaining that attendant pay cuts constitute an assault on tenure. And the University of Pennsylvania last month reported that its health system ran a deficit of $100 million in the fiscal year ending in June. Georgetown University Hospital reported losing $27 million last year, but spokesperson Paul Donovan says the hospital expects to turn a profit again next year as a result of management reforms aimed at making the clinical, teaching, and research functions all self-supporting.

Observers are hoping the worst is also over for Allegheny. The bankruptcy court last month approved an emergency $100 million loan to AHERF from Madeleine LLC, an investment consortium, to cover salaries and expenses until a purchaser takes over the hospitals. So far, three national hospital chains are lined up to bid on the eight Philadelphia hospitals that will be sold on 29 September. Last month, Congress passed a measure allowing medical students to continue getting federal student loans worth some $43 million a year. And NIH won't cut off the roughly $56 million in grants Allegheny researchers receive each year, says NIH spokesperson Don Ralbovsky.

"This is a fragile time for us," says Faber, who is a member of the university restructuring committee. But "the hope and expectation is that … we will come out of this as a viable, freestanding university."

–CONSTANCE HOLDEN

CLIMATOLOGY

Did an Ancient Deep Freeze Nearly Doom Life?

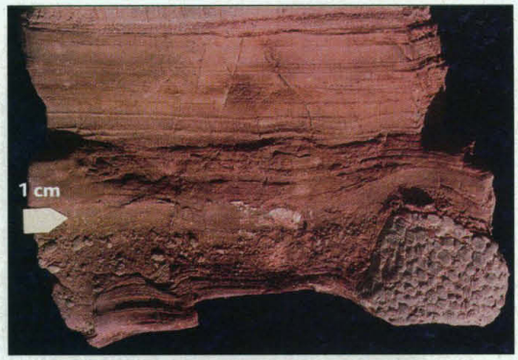
For most of its history, Earth has been a comfortable place for life. Even during the regular ice ages of the past million years and the huge impact 65 million years ago, most organisms either adapted to the new conditions or found refugia and survived. Now, researchers propose that about 700 million years ago Earth suffered a series of enveloping ice ages that nearly snuffed out life. Coated by ice and snow from pole to pole, the planet slept on for millions of years, according to this theory, until it was finally roused by its own volcanic emanations.

On page 1342 of this issue of *Science*, geologists Paul Hoffman and Galen Halverson and geochemist Daniel Schrag, all of Harvard University, and geochemist Alan Kaufman of the University of Maryland, College Park, present isotopic and geological evidence from Namibia for an ancient "snowball" Earth that threatened the diverse but still simple organisms that then constituted life on Earth. "It's mind-boggling that such events may have happened," says Hoffman. While rocks from the time do record at least two ice ages, not everyone is convinced that the glaciation was so extreme. "This is really interesting, but it's really speculative," says geochemist Louis Derry of Cornell University. "There are significant questions about the data."

The data come from rock deposited about 700 million years ago on the edge of a long-vanished ocean, in what is now Namibia in southwest Africa. The rock section under study—carbonate topped by a jumbled deposit of debris dumped into the ocean by glaciers, followed by a distinctive "cap layer" of carbonate—preserves a tracer of ancient life's productivity: two isotopes of carbon in the same ratio as existed in the ancient ocean. Photosynthetic organisms tend to remove more carbon-12 than carbon-13 when they draw in carbon dioxide, causing the ratio of carbon-13 to carbon-12 in the water to rise, while chemical precipitation of dissolved carbonate onto the sea floor removes equal proportions of each isotope, leaving the ratio unchanged.

Other researchers have traced isotopic changes in the Namibian rocks, but Hoffman and his colleagues have the most complete record. Well before the ice age, the isotopic ratio suggests that carbon was removed from the world ocean through about half chemical and half biological processes, says Hoffman. But as the ice age approached, the portion due to biology began to decrease, as would happen if the ice were gradually spreading across the globe. The glacial deposit itself doesn't preserve a faithful isotopic record, says Hoffman. But afterwards, the cap carbonate record suggests that biological productivity had dropped all the way to zero, and recovered only slowly. "It's difficult to imagine any other mechanism that would shut down productivity on that scale other than global glaciation," says Hoffman.

No one knows just why the ice age began, but as highly reflective snow and ice spread to lower latitudes, more sunlight would have been reflected from Earth, chilling the planet further until a runaway glaciation enveloped even the tropics, says Hoffman. He assumes that there were at least a few breaks in the ice or patches of bare ground where microbes and multicellular algae survived to later give rise to all life today. But across most of its surface, he says, "Earth just sat there."



P. HOFFMAN/HARVARD UNIVERSITY

Traces of a snowball? A glacial deposit is abruptly capped by warm-water carbonate rock.

The group suggests that eventually, volcanic carbon dioxide oozing from the interior over millions of years created a greenhouse effect powerful enough to break the ice's grip. Then, this high carbon dioxide level drove the deposition of the cap carbonate.

To find out how long Earth had to wait for this volcanic rescue, Hoffman and his colleagues estimated the duration of the isotopic event by calculating the ancient sedimentation rate. They used the rate at which

tectonic processes formed the Namibian Basin, and assumed that it filled with sediment as it formed. They concluded that the isotopic excursion took at least 10 million years.

This long duration "pretty well destroys" another explanation for the isotopic spike, says Hoffman—that the ocean overturned suddenly. That idea was proposed in 1996 by paleontologist Andrew Knoll, also of Harvard, and his colleagues, who suggested that the cap carbonate was deposited from carbonate-rich waters welling up from the deep sea. But such upwelling would have lasted less than 100,000 years.

Not everyone is ready to accept the idea of a frozen Earth. Prolonged isotopic excursions are unlikely, says Knoll colleague Dick Bambach of Virginia Polytechnic Institute and State University in Blacksburg, and require unusually strong data to back them up. And geochemist Martin Kennedy of the University of California, Los Angeles, also has carbon isotopic data from Namibia, but they show no deep productivity decline before the Namibian glacial deposits. His evidence "is very different than theirs," he says. Snowball Earth "is a novel and creative idea, but I don't think the data support it."

Furthermore, Kennedy argues that if Earth really was a snowball, strontium isotopes should respond too. The ratio of strontium-87 to strontium-86 in the oceans should have dropped as the glaciation cut off rivers enriched in strontium-87 by weathering of the continents, he says. But his unpublished data show that during the carbon excursion, the strontium ratio rose sharply, indicating more continental erosion, not less. "It's one of the greatest shifts in history," he says.

Hoffman offers a rebuttal on all points. Their carbon isotope data resemble other published records, he says. And Schrag says the strontium ratio would have been kept high, first by acid from undersea volcanoes dissolving strontium-bearing carbonate sediments, and later, after the glaciation, by greenhouse-induced weathering of continental rock. But Derry, who has worked with members of both groups, says that if the strontium data hold up, snowball Earth "has a problem." It remains to be seen whether this snowball can take the heat. –RICHARD A. KERR

RICK KOZAK; *FAR RIGHT*: AP PHOTO/KOJI SASAHARA

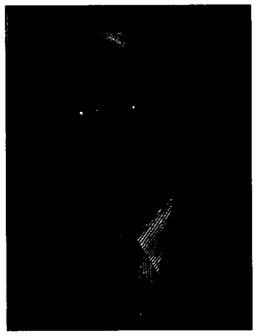
JADAVPUR UNIVERSITY

SHARING REAGENTS

NIH, DuPont Declare Truce in Mouse War

A contentious, 2-year legal wrangle that set molecular biologists against company lawyers ended last week when the DuPont Pharmaceuticals Co. of Wilmington, Delaware, agreed to relax the terms under which it allows scientists to share a popular type of laboratory mouse.

On 19 August, Harold Varmus, director of the National Institutes of Health (NIH), announced at a scientific meeting that NIH has hammered out a memorandum of understanding with DuPont that will make it easier to transfer genetically engineered mice from NIH labs to other nonprofit institutions. (The text is available on the Web at http://www.nih.gov/od/ott/cre-lox.htm.) The agreement lifts several restrictions DuPont had placed on the use of mice created with the company's patented "cre-lox" system—an efficient method of editing DNA at a specific site on the mouse genome. It is used chiefly to explore gene function. Varmus describes the pact as "a milestone in the cooperative relationship between academia and industry." And NIH staffers say they hope other companies will use the model to make patented research tools more accessible.



Just say no. Harold Varmus resisted DuPont's terms.

The flap over cre-lox mice began about 3 years ago. In an effort to tighten control over products on which it holds patents, DuPont began contacting researchers, asking them to sign an agreement that would limit their freedom to use and share the cre-lox technique (*Science*, 4 July 1997, p. 24, and 1 July 1994, p. 26). DuPont asked that anyone using cre-lox methods send the company prepublication copies of their scientific reports. The company also tried to acquire commercial rights to future inventions that might arise from experiments involving a cre-lox animal. In addition, DuPont's lawyers warned researchers not to share cre-lox mice with colleagues unless the recipient agreed in advance to DuPont's terms.

Many scientists balked. For example, Jackson Laboratories of Bar Harbor, Maine, a nonprofit research center that breeds and distributes mice to scientists around the world, negotiated for 2 years, but failed to reach an agreement with DuPont. The impasse prevented Jackson from distributing cre-lox mice, making it difficult for some scientists to acquire animals. Varmus, who had pushed for making new genetic tools widely accessible before coming to NIH, sided with Jackson in 1997 and joined in boycotting DuPont's terms. But after more than a year of negotiations, NIH and the president of DuPont's research labs, Paul Friedman, found common ground in June, according to NIH's director of technology

ScienceScope

NEXT STOP, LOS ALAMOS

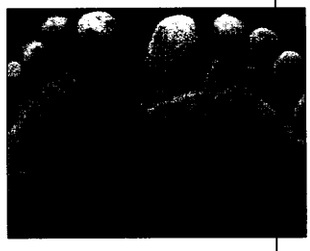
New U.S. Department of Energy (DOE) Secretary Bill Richardson is taking scientific touring seriously. On 11 August, after just one day on the job, Richardson departed Washington on the first of several planned barnstorming tours partly designed to familiarize him with DOE's far-flung, $6 billion research empire, which includes dozens of labs. Early stops will include California's Lawrence Livermore National Laboratory and the Los Alamos lab in Richardson's home state of New Mexico.

Richardson is hitting the road.

Richardson said he wants the public to learn more about "the remarkable research" being done by department scientists and wants DOE to become the government's leader in studying climate change. He admits, however, to being "weak in the science and technology area," and says he will welcome advice from DOE's top science guru, Undersecretary Ernest Moniz, a physicist.

GETTING A GRIP ON ARSENIC

Bangladesh's arsenic pollution problem, which threatens the drinking water of more than 70 million people, will soon have the undivided attention of a new research center. The National Arsenic Mitigation Information Center (NAMIC), to open in Dhaka on 1 October with help from the World Bank and the Swiss government, will spend $1.5 million over 4 years to inform researchers and the public about the problem, which was first detected in 1993 after Bangladesh drilled thousands of deep wells in an effort to tap cleaner water (*Science*, 11 October 1996, p. 174). NAMIC will also fund scientists working to trace arsenic sources and develop new purification methods, efforts that could be key to a planned $44 million program to blunt the threat. The center, says World Bank hydrogeologist Babar N. Kabir, "is going to be critical for tackling the arsenic epidemic."



Arsenic poisoning victim