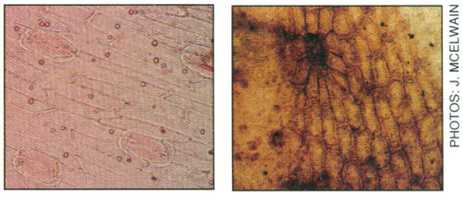
RANDOM SAMPLES

edited by JOCELYN KAISER

Poring Over Ancient CO_2 Levels

Paleobotanists may have discovered an ingenious technique for comparing present and past levels of carbon dioxide—clues to whether CO_2 drives Earth's cycles of warming and cooling. The density of pores in fossilized plants mirrors changes in these levels, say two British teams, and can help them test the leading model of ancient CO_2 levels—if other factors don't confound their method.



PHOTOS: J. MCELWAIN

Gas meter? Stomatal cells in a modern plant *(left)* and a stoma in a 395-million-year-old fossil. Cell densities suggest CO_2 levels in the ancient atmosphere were 10 times higher than today.

The CO_2 model, developed by Yale University's Robert Berner, holds that levels have fluctuated with highs and lows in global temperature (*Science*, 12 February 1993, p. 908). And the British scientists think they've found the first direct biological test. Experiments with living plants have shown that the density of stomata, the pores on leaf and stem cuticles through which plants exchange gases, is lower in plants grown in higher atmospheric CO_2 levels.

As they report in this winter's *Annals of Botany*, Jenny McElwain and Bill Chaloner of Royal Holloway College in London have compared stomata in modern plants and four ancient species, and found support for the dip in Berner's curve 300 million years ago and the peak 95 million years earlier. But in subsequent work, they've also found a point 50 million years ago where fossils suggest CO_2 levels were twice what Berner predicts. McElwain now hopes to shed light on the Triassic, 240 million years ago, for which CO_2 models conflict. Another team, led by David Beerling at Sheffield University, plans to see if 65-million-year-old plant fossils support a theory that a meteor hitting Earth at that time caused a jump in CO_2 levels, helping kill off the dinosaurs.

Cambridge University geochemist Harry Elderfield says he'll be "very interested" to see the stomatal test results. But plant scientists caution that conditions such as salinity levels can also affect stomatal density, and it can vary within a single plant. More work is needed, notes University of Dundee plant physiologist John Raven, "before we can be sure exactly what we are measuring."

Hard Times at Renewables Lab

Darker days have returned for researchers working on solar energy and other projects at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. This week officials at the lab, on a budgetary roller coaster since its creation, completed efforts to slash NREL's staff by about 200—over one fifth of the total.

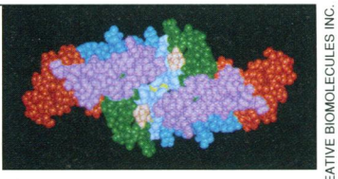
The latest bloodletting stems from recent cutbacks at the Department of Energy (DOE), which funds NREL. DOE's support for NREL will likely drop from $237 million in 1995 to $165 million this year. (That figure "could still change some," says NREL spokesperson Robert Noun, as about 20% of DOE funding for NREL comes from a spending bill that's currently stalled in the U.S. Congress.) This isn't the first downturn for the 19-year-old lab (*Science*, 25 June 1993, p. 1889). The Reagan Administration cut its budget roughly in half to $59 million in 1982. But the numbers rebounded in the Bush years and had continued to swell under Clinton.

Morale at this point "is not the best," says physical chemist Thomas Milne, an 18-year NREL veteran who recently accepted a voluntary retirement package. "There's a lot of turmoil. People here really believe in renewable energy." And the cuts "are definitely going to slow down the development of long-term projects." Among the hardest hit research areas: biofuels, photovoltaics, hybrid vehicles, and wind energy, each of which will lose 12% to 29% of their budgets.

Feelings on Fossils

Imagine finding an exotic-looking fossil in your backyard, or on federal land during a camping trip. Should you dig up the fossil? And if you do, who should keep it? A group of scientists surveyed the public on these questions and found that grassroots respect for fossils is greater than they had thought.

The Society of Vertebrate Paleontologists (SVP) commissioned the poll last fall in reaction to a proposed U.S. law that would permit amateur and commercial collectors to dig for fossils on federal land and to keep finds not deemed "scientifically unique" (*Science*, 8 December 1995, p. 1559). Many paleontologists oppose the bill, and the poll results suggest that the public does too. About 80% of 300 respondents contacted by telephone agreed that it should be illegal to collect, sell, destroy, or export fossils found on public lands. And 88% agreed that only "people with appropriate skills" and permits should be allowed to collect fossils on public lands, and that all their finds should go to museums or universities. Staffers for Representative Tim Johnson (D–SD), the bill's main sponsor, aren't sure if he has seen the poll results, but say the measure could change in response to input from scientists.



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Bone maker. Structure of Op-1 protein shows possible binding sites *(red)*.

Cracking Bone Repair

Osteogenic proteins (OPs), which appear to activate bone growth, promise a break with past methods of speeding the repair of fractures and treating osteoporosis, if researchers can develop drugs that mimic their action (*Science*, 21 January 1994, p. 324). Now scientists think they have identified the so-called "binding region" that locks one such protein onto specific receptors on cell surfaces; drug designers may be able to use this region in the design of molecular imitators.

In the 23 January issue of the *Proceedings of the National Academy of Sciences*, cardiologist William Carlson of Boston's Brigham and Women's Hospital, crystallographer Diana Griffith, formerly of Brandeis University, and three researchers at Creative BioMolecules Inc. of Hopkinton, Massachusetts, report x-ray crystallography data showing that each of the two halves of this protein, OP-1, looks like a curled left hand, with a structure called an α helix as the heel of the palm and β strands as its fingers. A related protein, a cell-growth regulator called TGF-β2, has nearly the same form—with one crucial difference: The fingers of OP-1 possess a near-reversal of electric charge compared to TGF-β2. This charged region, Griffith suspects, "plays an important role in determining the specificity of these proteins to their receptors."

Armed with this knowledge, biologists can now study how OP-1 spurs progenitor bone cells to develop into permanent bone cells called chondrocytes and osteoblasts. Says Joan Massagué of Memorial Sloan Kettering Cancer Center in New York, who studies the TGF-β family of proteins: "The odds are that this is ... possibly a ligand-receptor region. ...It leads to some exciting possibilities."