June, according to its chair, Harold Shapiro, the president of Princeton University. But Varmus said he would like to know by March what NBAC thinks of plans to start funding human stem cell research. After hearing from NBAC, researchers, and the public, he hopes to draw up "clear guidelines" describing what can and cannot be done under the law. He plans to distribute the guidelines by midyear, then set up a standing review committee to monitor compliance.

"I am delighted to hear NIH made this decision," said Senator Arlen Specter (R–PA), chair of the subcommittee that approves NIH's appropriation bill, noting that it does not violate the intent of earlier legislation. Specter added that "the last 60 days have seen breakthrough developments on stem cell research," promising "enormous advances" in many areas of disease research.

–ELIOT MARSHALL

PALEOCLIMATE

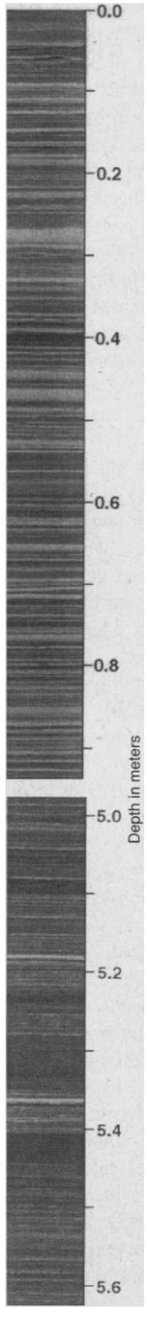
El Niño Grew Strong As Cultures Were Born

El Niño's comings and goings—and the worldwide effects of this tropical Pacific warming—are by now so familiar that they seem to be a permanent fixture of Earth's climate. But in this issue of *Science* (p. 516), a group of researchers reports that a climate record cored from the bottom of a lake high in the Ecuadorian Andes suggests a much-weakened El Niño between 5000 and 12,000 years ago—or even none at all.

Because older climate records show that in even earlier epochs, El Niño operated much the same as today, the new lake record points to an El Niño that waxes and wanes over the millennia. "It's a really interesting record, an important result if correct," says paleoclimatologist Konrad Hughen of Harvard University. Some researchers argue that the onset of the modern El Niño 5000 years ago may have helped shape the emergence of civilizations around the Pacific, and its vacillations may give clues to our climate future in the greenhouse world. But it will take more records like the one from the Ecuadorian lake to fully persuade the cautious paleoclimate community that El Niño sometimes takes a break.

Paleoclimatologist Donald Rodbell of Union College in Schenectady, New York, and his colleagues were actually searching for evidence about the end of the ice age, not El Niño, when they cored the bottom of Laguna Pallcacocha, a lake 4000 meters up in the Andes of southern Ecuador. Although the ice age record they hoped for didn't show up in the 9.2-meter-long core, hundreds of sedimentary "zebra-stripe" layers did.

After chemical and mineralogical analysis, Rodbell concluded that the alternating layers of light, organic-poor sediments and dark, organic-rich sediments record the comings and goings of torrential rains spawned by El Niños. In non–El Niño years, moderate rains apparently wash only a little sediment, heavily laden with the dark debris from vegetation, off the steep, bowl-shaped slopes surrounding the lake. In El Niño years, the unusually warm waters just offshore fuel powerful storms that wash large amounts of sediment unsullied by organic matter into the lake, leaving a lighter colored deposit.



El Niño's mark. Frequent storm deposits (light bands) in younger sediments from a lake core (*top*) suggest that El Niño has strengthened since the time of older sediments (*above*).

A quick look showed a marked shift in the pattern of zebra stripes partway through the record. After Rodbell's team set a time scale for the record with carbon-14 dating and used medical imaging software to count the stripes, they were able to date and quantify the shift. During the past 5000 years or so, the lake recorded extreme rains every 2 to 8 years, following the same rhythm that El Niño has exhibited of late. But before 5000 years ago, that pattern fades away. Extreme rains recurred only at intervals of a couple of decades to 75 years. Only weak El Niños could have persisted in this period, says Rodbell, as they did not spark torrential rains near the lake. But before 12,000 years ago—earlier than could be seen confidently in the lake record—El Niño was going strong, according to new records from western Pacific corals and even Great Lakes sediments.

"It's an interesting story," says Hughen. Still, he says, "this is one record from one lake basin." Although the lake seems to have been a faithful recorder of heavy rains during historical times, changes in the vegetation around the lake, for example, might have obscured the record of earlier strong El Niños. Rodbell and his

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ScienceScope

***JAMA* Editor Gets the Boot** Journal editors are dismayed by last week's sacking of George Lundberg, longtime editor of *The Journal of the American Medical Association* (*JAMA*). Association brass fired the 17-year veteran for his decision to publish a paper on what college kids think of oral sex—just as President Bill Clinton's impeachment trial moved into its second week.

The paper, which appeared in the 20 January *JAMA*, was presented by the authors—June Reinisch, former director of the Kinsey Institute for sex research in Bloomington, Indiana, and Kinsey researcher Stephanie Sanders—as a contribution to "the current public debate regarding whether oral sex constitutes having ... sexual relations." It reported that 59% of 599 students surveyed at a large midwestern university in 1991 did not regard oral-genital contact as having "had sex." The authors conclude there is a "lack of consensus" on the topic.

The timing of the paper did not sit well with AMA executive E. Ratcliffe Anderson, who said it had been rushed to publication. In announcing Lundberg's departure, Anderson said that the editor had threatened the journal's "integrity" by "inappropriately and inexcusably interjecting *JAMA* into a major political debate that has nothing to do with science or medicine." Anderson, who has been at the AMA helm for 7 months, also said other factors had contributed to a loss of "confidence and trust" in Lundberg, but he declined to be specific.

Lundberg's lawyer, William Walsh, branded the firing an "inappropriate intrusion into the historically inviolable ground of editorial independence." And other journal editors were outraged. The board of the Council of Biology Editors said "the firing marked a dark hour for scientific journals worldwide," and that the action "amounts to tacit support for suppression of scientific information that may be politically sensitive." *New England Journal of Medicine* Executive Editor Marcia Angell was surprised by the firing of a "highly successful editor," although she called the Reinisch article "trivial and irrelevant."

Lundberg, 65, has long been at odds with AMA honchos, tackling issues such as the perils of smoking before the association took public stands. Lundberg declined to comment, but according to press accounts Walsh has hinted that litigation might be in the works.

Contributor: Constance Holden

colleagues agree that more records from other areas are needed to confirm that there were no strong El Niño cycles 5000 to 12,000 years ago. One new record in coral—from the other end of the El Niño system in Papua New Guinea—does suggest a much subdued El Niño 8000 years ago, according to work presented last month at the meeting of the American Geophysical Union in San Francisco by paleoclimatologist Sandy Tudhope of Edinburgh University in the U.K.

Cloud-spotting. El Niño–driven clouds often bring heavy rains to this Ecuadorian site.

El Niño's temporary absence also fits into an archaeological scenario for the emergence of complex cultures on the west coast of South America. Using evidence such as the species composition of mollusk shells, which reflects ocean temperature, archaeologist Daniel Sandweiss of the University of Maine, Orono, has long argued that El Niño was shut down between 5000 and at least 8000 years ago. The onset of crop-nourishing El Niño rains by 5000 years ago sparked population increases, temple construction, and more complex societies on the Pacific Coast, he suggests (see his Perspective on p. 499). Critics such as geologist Lisa Wells of Vanderbilt University in Nashville, Tennessee, disputed some of his evidence, but Wells now agrees that the lake core backs his claim about El Niño.

But if El Niño did switch off, no one is sure why—so no one is sure of El Niño's future. From 5000 to 8000 years ago, the world was warmer than today, during the so-called Altithermal regime. If warmth alone had suppressed or eliminated El Niño, then it might again fade with the greenhouse warming of the next century. But if something else was the trigger—such as the changing strength of the seasonal cycle, which was greater at that time thanks to changes in Earth's tilt and orbit—the analogy between the Altithermal and the greenhouse might not hold. "It makes a lot of sense to look back at a previous warm period," says paleoclimate modeler John Kutzbach of the University of Wisconsin, Madison, who has started to model paleo–El Niño, "but it's incredibly tricky." Humans may have been familiar with El Niño for thousands of years, but that doesn't mean we understand it yet.

–RICHARD A. KERR

PALEONTOLOGY

Stunning Fossil Shows Breath of a Dinosaur

Hoping to see the innards of a 100-million-year-old dinosaur, respiratory physiologist John Ruben hauled an 80-watt ultraviolet (UV) lamp from Oregon to an archaeology office in Salerno, Italy. His trouble paid off: The UV light, which can coax out patterns invisible in ordinary light, conjured up the outlines of the juvenile dinosaur's intestines, liver, trachea, and muscles. Now Ruben and colleagues are using the arrangement of internal organs to bolster their idea that dinosaur lungs were structurally simple, most resembling those of living crocodiles. Their analysis, presented on page 514, would imply that these animals were basically cold-blooded.

That's an argument Ruben has made before (*Science*, 14 November 1997, p. 1267), but now he adds a new twist. He thinks these simple lungs were also able to power periods of high metabolism and intense activity. If so, the old question of whether dinosaurs were cold- or warm-blooded would have a hybrid answer. "This is almost better than warm-blooded," he says.

Not everyone is convinced, but many researchers are intrigued. "If they're right, this could represent landmark work suggesting a whole new way to view dinosaur physiology—it could in some sense be bimodal," says anatomist Lawrence Witmer at the Ohio University College of Osteopathic Medicine in Athens. Researchers have suspected dinosaurs of having some sort of hybrid metabolism, adds paleontologist James Farlow at Indiana University–Purdue University in Fort Wayne. The skeletons of theropod dinosaurs—meat eaters like *Tyrannosaurus rex*—suggest that they were highly active like warm-blooded mammals, but their bones lack the signatures of warm-bloodedness. Coupling an economical resting metabolism with a capacity for bursts of activity may have been the best of all possible metabolic worlds. "It's not surprising that they ruled Earth for over 100 million years," Farlow says.

Ruben, of Oregon State University in Corvallis, says the specimen of *Scipionyx samniticus*, a raptor or small meat eater, offers even more dramatic support for his anatomical argument than did a specimen he examined before, a 120-million-year-old Chinese fossil. Under the UV lamp, his team could see *Scipionyx*'s liver, which extended from the top to the bottom of the abdominal cavity, just behind the lung-heart cavity, as well as a muscle next to the pubis bone. In modern crocodiles this muscle runs from the pubis to the liver and helps move the liver back and forth like a piston, causing the lungs to expand and contract. An airtight layer of tissue, the diaphragm, separates liver and lungs.

Finding this arrangement, called a hepatic-piston diaphragm, in theropod dinosaurs rules out the possibility that they breathed with a sophisticated birdlike lung, the kind that supports birds' high metabolism, says Ruben. But because raptors like *Scipionyx* were among the most dynamic dinosaurs, Ruben began to question the assumption that a bird or mammal lung is needed for high metabolism. And recent work by other scientists (*Science*, 3 July 1998, p. 45) showed that a well-ventilated reptilian lung might be capable of unexpectedly high rates of gas exchange. Because most reptiles lack the power of a hepatic-piston diaphragm, relying only on the action of their ribs to ventilate their lungs, Ruben reconsidered the advantages of the diaphragm.

The problem with this logic, says Witmer, is that the only living animals with a hepatic-piston diaphragm are the sedentary crocodiles. But Ruben argues that crocs' sluggish, aquatic lifestyle is a secondary development. He suggests that ancestral crocodilians were dynamic, bipedal land-dwellers who used a hepatic-piston system for vigorous activity—as did dinosaurs.

Ruben further argues that the lack of a bird-type lung in dinosaurs casts doubt on the idea that they gave rise to birds. Some paleontologists disagree, because birds could have evolved their lung later. Indeed, questions remain about the reliability of the fossil itself. "You can't take a squashed specimen and interpret the position and shape of any soft organ inside," says paleontologist Phil Currie of the Royal Tyrrell Museum in Drumheller, Alberta, Canada. Ruben counters that although the fossil is two-dimensional, "nothing is displaced. ... All [organs] are preserved in relation to each other."

Shining through. UV light revealed this young raptor's anatomy.

In any case, there's no doubt that the idea of metabolically hybrid dinosaurs is an appealing middle ground. Says Witmer: "In some ways everyone could be right."

–BERNICE WUETHRICH

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