

deaths probably would occur in smaller buildings already known to be seismically unsafe.

Highway bridges should ride out a magnitude 7 shaker without major damage, says James E. Roberts of the California Department of Transportation in Sacramento. Although several freeway bridges collapsed in January, strengthened bridges survived and should withstand stronger jolts, he says.

Officials have less optimism about the city's ability to fight quake-sparked fires, which traditionally cause much of the damage during such disasters. Robert Canfield, emergency preparedness coordinator for Los Angeles, noted that the city devoted half its fire-fighting resources to save one burning high-rise in 1987. Should several such blazes break out, the city could rescue people, but it could not save those buildings.

"We are going to have to walk away from them and devote our first efforts to saving lives," Canfield says.

He and others stressed that Northridge claimed so few lives in part because it struck at 4:30 a.m. on a holiday, a time when the garages and freeways that collapsed were nearly empty.

Although the scenario involved a hypothetical earthquake, seismologists say Los Angeles sits on several faults that could produce quakes of magnitude 7 or greater. What's more, the city has not had enough Northridge-size quakes in its history to relieve the strain building underground, says James F. Dolan from Caltech. Magnitude 7 shocks, if they occurred every few hundred years, could release this pressure. But the city has not seen such a killer in at least 2 centuries, a fact that sets seismologists on edge.

—R. Monastersky

Asian link proposed for primate evolution

Excavations in southeastern China have yielded an array of fossils suggesting that Asia played an important role in the early evolution of primates, according to a report in the April 14 NATURE.

Annual fieldwork since 1992 in caves along the face of a limestone quarry near the village of Shanghuang has unearthed about 75 primate fossils, mainly teeth and jaw fragments, and thousands of other mammal bones. Chinese investigators discovered the fossil deposits in 1987.

No volcanic rock for dating exists at the site, but comparisons to North American fossil mammals dated in this way place the Chinese finds at 45 million years old, assert paleontologists K. Christopher Beard and Mary R. Dawson of the Carnegie Museum of Natural History in Pittsburgh and Tao Qi and his coworkers of the Academia Sinica in Beijing.

"The site at Shanghuang has, at a stroke, revolutionized our appreciation of the involvement of Asia in the early evolution of primates," comments anthropologist Robert D. Martin of the University of Zurich in the same NATURE.

Other researchers view the new finds as too fragmentary to support any sweeping revisions of how primates evolved.

Beard and his colleagues identify five new fossil primate species at the Chinese site. These belong either to the lemurlike adapids, the tarsierlike omomyids, or the early simians, forerunners of monkeys, apes, and humans.

Only adapids and omomyids have turned up at North American and European sites of comparable age; several African simians dating to about 40 million years ago have been discovered since 1988.

The proposed Chinese simian, dubbed *Eosimias sinensis*, displays several jaw

and tooth features that distinguish it from adapids and omomyids, Beard argues.

"*Eosimias* shows that early relatives of monkeys lived in Asia about the same time that they lived in Africa," the Pittsburgh researcher maintains. "Whether monkeys first evolved in Africa or Asia cannot be established now."

Various investigators have promoted either omomyids or adapids living between 55 million and 36 million years ago as simian ancestors (SN: 1/12/91, p.20). Beard's group argues that, given the new Chinese evidence, the first simians had appeared by 55 million years ago and derived neither from omomyids nor from adapids.

Dawson notes that some scientists who study fossil primates doubt that the *Eosimias* specimens come from a monkeylike higher primate. In the absence of a more complete skull, the evolutionary identity of *Eosimias* remains unclear, asserts Elwyn L. Simons, an anthropologist at Duke University in Durham, N.C.

"Beard will have a difficult time gaining widespread acceptance of his argument for an important radiation of early [higher primates] in Asia based on such fragmentary evidence," contends Simons, who directs excavations at an



Preliminary reconstruction of *Eosimias*.

Egyptian primate site.

In another controversial assessment, Beard's group assigns several fossil teeth from Shanghuang to *Tarsius*, the genus that includes living tarsiers. No other modern primate genus is even half as old as the age proposed for *Tarsius* by the U.S.-Chinese team.

Ancient Chinese tarsiers lived in tropical forests much like those inhabited by modern tarsiers, Dawson holds. "They apparently found a habitat they liked and stuck with it," she says.

But to claim such an ancient age for *Tarsius* based only on fossil teeth "is going way out on a limb," Simons argues. Comparisons with the distinctive faces and limbs of modern tarsiers must also be made, he notes.

Beard and his coworkers assign some Shanghuang fossils to an adapid that resembled an extinct European primate and identify others as an omomyid with anatomical ties to a North American primate of comparable age. Early primates migrated between Asia and other continents 45 million years ago, they suggest.

Early simians may have originated more than 65 million years ago, Martin concludes. But Simons disagrees, noting that the oldest well-established higher primates lived about 40 million years ago.

—B. Bower

Sizing up a smoker's risk of lung cancer

Black smokers run a greater risk of developing lung cancer than white smokers. Although the mechanism underlying that racial difference remains a mystery, scientists now suggest that black smokers may have a greater metabolic predisposition to the malignancy.

The new research may also provide more ammunition for those battling the tobacco industry. Many scientists believe that cigarette manufacturers aggressively target blacks in advertising campaigns designed to draw in new smokers.

John Richie Jr., a biochemist at the American Health Foundation in Valhalla, N.Y., and his colleagues knew that tobacco contains NNK, a nicotine-derived compound that causes lung cancer in mice. The team wanted to find out whether they could detect any differences in the way smokers metabolize this chemical.

They started their investigation by recruiting 25 white and 31 black smokers. The researchers analyzed urine samples from each smoker, homing in on two breakdown products of NNK: NNAL and NNAL-Gluc. NNAL also causes lung cancer in mice. When the body detoxifies NNAL, NNAL-Gluc results.

The researchers hypothesized that smokers whose bodies transformed NNAL into NNAL-Gluc more efficiently

would face a reduced cancer risk. Their findings revealed that, on average, blacks in the study tended to detoxify NNAL less effectively than whites who smoked the same number of cigarettes.

The researchers speculate that many black smokers are less able than white smokers to detoxify NNAL.

Yet averages don't tell the whole story. The research showed that 6 percent of the black smokers detoxified NNAL aggressively and thus were at less risk of lung cancer than most other black smokers. By contrast, 30 percent of white smokers metabolized NNAL aggressively.

Additional metabolic differences may exist in the way blacks and whites handle the carcinogens in cigarette smoke. For example, compared with white smokers, black smokers run less risk of developing bladder cancer. If scientists can elucidate

such differences, they may someday devise tests that give smokers individual portraits of their cancer risks.

"That information would be extremely useful in getting people to quit smoking," Richie says. "If you know you're at especially high risk for cancer, that might be all that much more incentive to give it up."

The researchers say that confirming the finding will require more research. "If it holds up, it's going to be very exciting," comments Steven Tannenbaum, a toxicologist at the Massachusetts Institute of Technology.

The question of whether an individual smoker gets lung cancer remains a highly complex one, Tannenbaum says. Some people may inherit a vulnerability to such cancers. However, many other factors go into the lung cancer and smoking equation, he adds.

—K.A. Fackelmann

Rare supernova brightens April Fool's Day

"I thought that the message on my [answering] machine about a new supernova was an April Fool's joke at first," says Robert P. Kirshner. Once reassured that it wasn't, Kirshner, of the Harvard-Smithsonian Center for Astrophysics, spent much of the weekend alerting his fellow astronomers to the explosion of the dying star.

Amateur astronomers first spotted Supernova 1994I—the ninth discovered this year—on April 1. It exploded in a spiral galaxy known as M-51, or the Whirlpool Galaxy. The supernova itself lies about 18 million to 20 million light-years away and should soon reach its peak brightness, says Richard A. Sramek of the National Radio Astronomy Observatory (NRAO) in Socorro, N.M. The supernova can be seen through a telescope.

"We get one about this bright every 10 years or so," says Kirshner. There was an equally bright supernova last year, he adds, but "once in a while, you get the once-in-a-decade supernova twice."

Astronomers detected radio signals the next day, an unusual occurrence. Only radio waves from supernova 1987A, which exploded in a neighboring galaxy, have been detected as quickly. "And compared to this one, 1987A was a real wimp," says NRAO astronomer Michael P. Rupen. "You would never have seen anything [from it] at this distance."

All stars continuously shed their skin, releasing particles that form a so-called stellar wind. When a supernova explodes, it flings off its outer layers of gas. To recreate the last moments of a dying star, astronomers look at the light and ultraviolet emissions produced in the heat of the star's explosion and the radio waves created as the star's outer layers slam into its stellar wind.

Because they saw so many different radio waves, astronomers hypothesize that 1994I's stellar wind included a narrow, but dense, band of particles. "If you

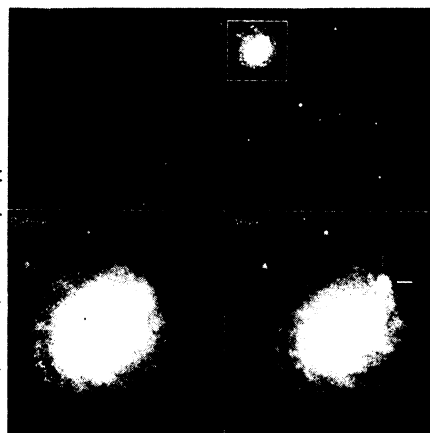
throw a brick through the air, you don't hear much of anything," Rupen says. "But if you throw it into a wall, it goes 'Bang.'" Yet it must have been a narrow band, he adds, because otherwise the radiation couldn't have "eaten away at the curtain to let you see in."

Supernova 1994I resembles a select group of 5 to 10 known supernovas. Astronomers speculate that they formed from the collapse of a large star that had already lost its outer layers of hydrogen and helium.

"We're still guessing on that," Kirshner says, "and it may be that this one is going to give us the chance to sort it all out." One speculation is that supernova 1994I may have formed from the collapse of a blue Wolf-Rayet star that was up to 40 times more massive than our sun.

"Presumably, the fate of a star has much to do with its mass," says Kirshner, "but we don't know what path in its life brings it to this colossal moment of destruction. By sorting out this one's biography, we may be able to sort out some of the factors."

—D. Christensen



New supernova in spiral galaxy M51 (above). Close-ups before (left) and after (right) the explosion.

P. Challis, O. Kuhn, B. Schmidt/Whipple Obs.

Riding a plasma wave toward high energies

With the cancellation last fall of the Superconducting Super Collider, high-energy physicists are paying closer attention to alternative, potentially less costly schemes for accelerating electrons and other particles. One possibility involves the use of powerful electric fields generated by waves traveling through plasmas of charged particles at nearly the speed of light.

Last year, electrical engineer Chan Joshi and his team at the University of California, Los Angeles, demonstrated that they could boost the energy of electrons injected into waves in a laboratory plasma. Now, the same group has shown that a plasma wave can trap injected electrons, allowing the electrons to gain additional energy as they move along with the wave.

This is "a necessary condition for obtaining the maximum amount of energy theoretically possible for such schemes," the researchers report in the April 7 NATURE.

Although the idea of plasma-wave particle accelerators originated 15 years ago, researchers have only in recent years overcome tough technical problems and gained the expertise required to make plasma waves of sufficiently high quality for acceleration experiments.

Joshi and his coworkers focus a pair of beams from a carbon dioxide laser—operating at two slightly different frequencies—and a beam of electrons on the same point in a chamber filled with hydrogen. The hydrogen breaks down into a low-density plasma consisting of electrons and hydrogen nuclei, or protons.

The overlapping laser beams interfere with each other, creating a sequence of pulses of light. These pulses, in turn, exert a force on the electrons in the plasma, thus altering electron distribution. The result is a rapidly propagating plasma wave at a frequency equal to the difference of the two laser frequencies. Injected electrons race along with the plasma disturbance like surfers riding an ocean wave.

The researchers found that they could increase the energy of injected electrons from 2 million to 30 million electron-volts over a distance of about 1 centimeter. This represents "the largest coherent man-made accelerating field yet produced," Robert Bingham of the Rutherford Appleton Laboratory in Chilton, England, notes in the same issue of NATURE.

Joshi and his collaborators are now aiming for higher electron energies, while other groups continue to work on somewhat different strategies for plasma-wave acceleration. "It is... gratifying to see that some of the ideas on alternative acceleration schemes proposed more than a decade ago are coming to fruition," Bingham comments.

—I. Peterson