and doctors, was the question before the Supreme Court earlier this week. The case, *Kumho Tire Co.* v. *Carmichael*, involves a minivan that crashed after a tire blew, killing one person; Carmichael, the victim's family, presented an engineer who claimed the tire was defective. Kumho's lawyers won in a trial court, which found that the testimony failed to meet *Daubert* tests. An appeals court reversed the decision, however, finding that technical testimony based on experience should not have to meet scientific standards (*Science*, 11 September, p. 1578).

In the hearing, justices expressed a range of views. Several agreed it would be impossible to scientifically test, say, an art expert's assertion that a color in a painting was deep magenta. On the other hand, Justice Antonin Scalia echoed Kumho's argument that the tire expert's testimony should have met scientific standards because it was based on a methodology: process of elimination. The engineer had asserted that because the tire did not appear to have several indications of abuse, its failure must have been due to a defect. The court's ruling, if it issues one, is expected next summer.

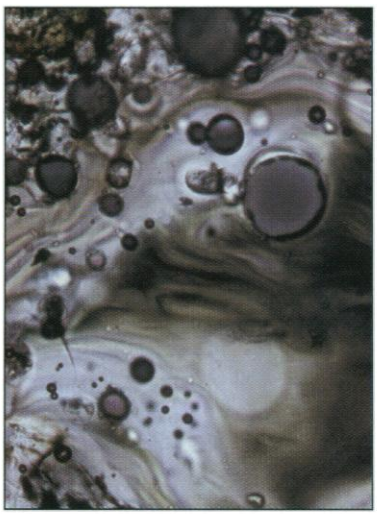
Clarifying how courts should evaluate expert opinion of all stripes will not be easy, says Berger, who co-authored an amicus brief for the Carmichael side. "I'm not sure you can come up with a magic formula."

–JOCELYN KAISER

PLANETARY IMPACTS

Argentina, and Perhaps Its Life, Took a Hit

The 10-kilometer-wide asteroid that wiped out the dinosaurs and many other species 65 million years ago was just one of a steady stream of debris of all sizes that has splattered the planet. Some impacts were small, leaving no more trace than a shooting star, while other, larger ones presumably could have triggered near-global crises. On page 2061 researchers suggest that a lesser impact showered coastal Argentina with blobs of molten glass 3.3 million years ago, perhaps cooling climate and driving some of the region's mammals to extinction. But other researchers say that although the impact looks real, its connection to climate change or extinctions is doubtful.



Sign of a killer? The impact that forged this 2-millimeter blob of molten glass in Argentina 3 million years ago may also have caused mammal extinctions.

CREDITS: (BOTTOM) SCHULTZ *ET AL.*

Cratering specialist Peter Schultz of Brown University in Providence, Rhode Island, got his first clue to the impact 5 years ago on a visit to Argentina, when an interpreter mentioned odd green glass she had picked up as a child. Schultz eventually explored sea cliffs of windblown dust deposits called loess near the coastal town of Miramar, working with geologist Marcelo Zarate of the Regional Center of Scientific and Technical Investigations in Mendoza, Argentina. The cliffs expose a layer of glassy, bubble-filled slabs 0.5 to 2 meters across; called escorias locally and first reported in 1865, these rocks had been attributed to everything from lightning strikes to ancient human-tended fires.

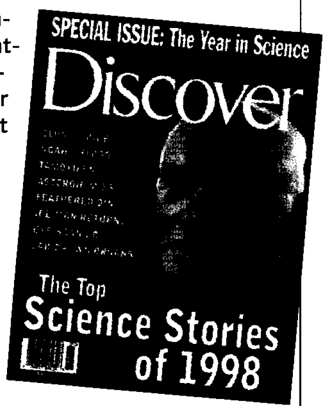
But after close study, Schultz, Zarate, and their colleagues conclude that an impact had fused loess into glassy slabs and flung them across at least 50 kilometers of the central coast of Argentina. The glass has streaky flow patterns typical of rapidly cooled impact glass, mineral breakdown products that require temperatures even hotter than those of lightning and volcanoes, and a chemical composition resembling that of the local loess. "It's fascinating stuff," says meteoriticist and cratering specialist Theodore Bunch of NASA's Ames Research Center in Mountain View, California. "I think [the impact] interpretation is probably correct." Schultz presumes that a body perhaps a kilometer in diameter hit just offshore, producing a now-buried crater perhaps 20 kilometers in diameter.

Radiometric dating of the glass showed that the object struck 3.3 million years ago. The date of the glass layer will give paleontologists studying the region's abundant mammal fossils a long-sought benchmark in time. But Schultz and his colleagues suggest a more provocative role for the impact. Based on the glass's radiometric age and its position in the record of Earth's flip-flopping magnetic field, they establish that the impact happened within about 100,000 years or so of an abrupt, temporary 2°C cooling of ocean bottom waters recorded in Atlantic and Pacific sediments. What's more, they say, a major, sudden extinction at about this time wiped out 36 genera of mammals, mostly kinds known only from that region. They suggest that the impact either

ScienceScope

DISCOVER EDITOR OUSTED

The heavy hand of Mickey Mouse descended on *Discover* magazine today, ousting Editor-in-Chief Marc Zabludoff. Insiders say Zabludoff was bounced after banging heads with the new head of publishing at Walt Disney Co., which bought *Discover* in 1991.



Disney managers have tightened their control of late over decisions about the design and content of the magazine, which has a circulation of 1.2 million. Staff members were irked by Disney Senior Vice President Steve Murphy's insistence that John Glenn grace the cover of their year-end January issue, which will feature the top science discoveries of 1998. Glenn's flight "didn't seem like one of the top stories of the year," says one editor. Murphy could not be reached for comment.

Zabludoff was looking on the bright side. "I get to replace frustration with mere anxiety," he says, "and that's probably a step up." His successor will be Stephen Petranek, editor-in-chief of *This Old House* magazine.

CLAMPING DOWN ON HUMAN CLONING

Britain may have discovered how to clone mammals—to wit, Dolly the sheep—but its biotechnicians should never use these skills to reproduce a human being, according to a new report from the Human Genetics Advisory Commission and the Human Fertilization and Embryology Authority.

The report says the government should enact a law outlawing reproductive cloning of humans. At the same time, it says, the law should permit scientists to clone human cells and even produce human embryos for certain types of research. After gathering comment on its proposals, "there was very little support" among the public for cloning individuals, says commission member Sir Colin Campbell, vice chancellor of the University of Nottingham. But the report noted that people did not object to cloning human cells, if aimed at treating serious illnesses.

blasted the local fauna into extinction or induced global climate change that then triggered extinctions in southern South America. "Right now we only regard this as a coincidence," says Schultz, but an intriguing one.

Other researchers are less intrigued, noting the large uncertainties in the relative timing of the impact and its possible effects and saying that the apparent correlation could be meaningless. "Any particular moment would show quite a few extinctions" simply because the extinction rate in that geologic interval is high, says paleontologist David Webb of the University of Florida, Gainesville. "To claim [the extinctions] are sudden or unique is naïve." The coincidence with an ocean cooling is likewise "a nonstarter," says paleoceanographer Nicholas Shackleton of Cambridge University. Something big hit Argentina 3 million years ago, researchers agree, but to find out if it had any lasting effects on animals may take another decade of work. –RICHARD A. KERR

MATERIALS SCIENCE

Insulator's Baby Steps To Superconductivity

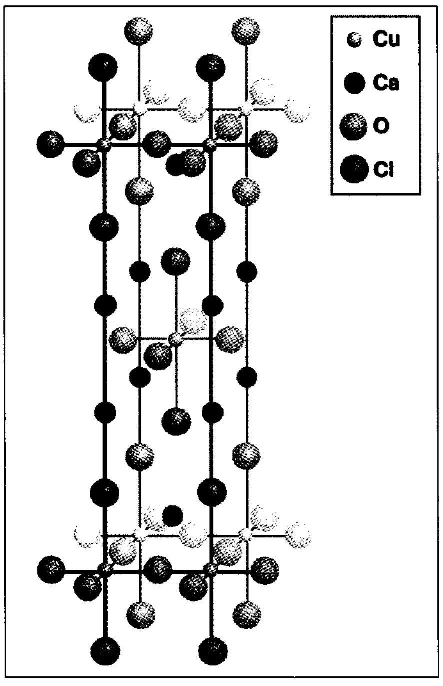
Even high-temperature superconductors—the wunderkinds of the material world—can't escape modern family dynamics. The superconductors' parent materials are seemingly conservative types, layered ceramic insulators that are unable to conduct electricity. Yet their offspring, which are spiked with small amounts of other elements, are as racy and rebellious as teenagers. They conduct electricity without any resistance whatsoever, and at temperatures far above the maximum predicted by the traditional theory of superconductivity. Like psychologists trying to sort out family traits, physicists have been struggling to understand how such staid parents give rise to such unruly children. Now an experiment reported on page 2067 reveals a distinctly postmodern result: The parents aren't as conventional as once thought. In fact, they harbor an electrical signature reminiscent of a metal, a property never seen before in any insulator.

"This is a very interesting result," says Princeton University physicist Nai-Phuan Ong. "Normally you would not expect an insulator to have any hints of [metallic behavior]." Tantalizingly, the ceramic insulator that the researchers studied also reveals hints that it may be influenced by some of the same factors that give rise to superconductivity in the offspring. "Is this just a coincidence" that related electrical signals are produced in both? asks Ong. For now, nobody knows, but the new results give physicists a deepening family mystery. "It challenges our ability to understand solids," says Z.-X. Shen, a physicist at Stanford University who led the new work.

The latest twist to the high-temperature superconductivity mystery centers on the way electrons behave in different materials. In all materials, electrons act a bit like marbles: Just as no two marbles can occupy the same space, two electrons in a material cannot have the same energy state. So the multitude of electrons in a material pile up in a range of different energy states, like marbles filling a jar. These states are organized in bands, with the valence band containing lower energy electrons with restricted movement and the conduction band containing higher energy, mobile electrons.

In metals these two bands overlap. This allows valence band electrons to hop easily into the conduction band, where they can whiz around and conduct electricity through the material. In semiconductors, a gap of forbidden energy levels separates the two bands, so a slight energy kick is needed to boost valence electrons into the mobile conduction band. In insulators, this gap is much larger, for the most part preventing any conduction.

Researchers also have ways to understand conducting and insulating materials based on the momenta—a function of the direction and speed—of electrons within them, relying on an equation from quantum mechanics called a wave function. When the range of different momenta of electrons in a metal is mapped out, the wave function always shows a specific



Postmodern parent. This insulating ceramic has metal-like properties, linking it to its superconducting offspring.

shape—for example, a sphere, a shape implying that electrons have an equal chance of traveling in any direction at the same speed. Conventional insulators, by contrast, show no pattern whatsoever.

Many research groups have studied the way electron energies pile up in the ceramic parents of high-temperature superconductors and shown them to be insulators. Yet, when Shen's group at Stanford, together with colleagues at Iowa State University in Ames and Varian Associates of Palo Alto, California, used a different technique to test the momentum behavior of one of these insulators, they got a very different and perplexing response. In what is called angle-resolved photoemission spectroscopy, the researchers blasted the surface of the material, a flat crystal composed of calcium, copper, oxygen, and chlorine ($Ca_2CuO_2Cl_2$), with x-rays at precisely controlled energies. When the high-energy photons slammed into the sample, they evicted some of its electrons, launching them out of the material. Detectors then counted these homeless electrons and measured their energy and direction of travel. Much to their surprise, Shen's team found patterns reminiscent of a metal. "This is a new kind of insulator that has a sign it could be a metal," says Shen.

And that's not all. Another plot—this one showing how the energy of the electrons varies depending on the direction they are traveling—bore a striking resemblance to a pattern found in their superconducting offspring. Superconducting electrons, which always travel in pairs, can only move within planes of copper and oxygen atoms and only along the two axes of the crystal, not along the 45-degree diagonals. This gives the wave function a cloverleaf pattern, known as *d*-wave symmetry. To their surprise, Shen and his colleagues saw the same *d*-wave pattern in the energy of electrons in different directions, a fact that raises both eyebrows and questions.

"We believe there must be a connection" between the *d*-wave pattern in the insulating and superconducting ceramics, says Shen. This common shape "doesn't come out of the blue," adds Juan Campuzano, a physicist at the University of Illinois, Chicago, and Argonne National Laboratory. Just what the connection is, the new experiment does not say. "But this raises speculation as to whether electrons are taking the first baby steps toward superconductivity," perhaps briefly pairing up and then separating again, says Ong.

As with any attempt at explaining the physics of these materials, this explanation is "very contentious," says Campuzano, a sentiment with which Ong agrees. For now, at least, the petulant high-temperature su-