MEETING BRIEFS

Paleoanthropologists Launch A Society of Their Own

Paleoanthropologists are a breed apart from other anthropologists. These independent-minded researchers are primarily interested in human evolution–and now they have formed their own society, called the Paleoanthropology Society, so they can focus on those topics. The new society was launched at a gathering in Pittsburgh on 7-8 April, just before the annual meeting of the Society for American Archeology. More than 120 archeologists, physical anthropologists, geologists, and other scientists listened to three dozen papers, including two that described new methods for dating archeological sites and reconstructing the diet of early human ancestors.

Extinct Hominid Did Not Veg Out

When anthropologists first got a look at the flattened face and large cheek teeth of *Australopithecus robustus*, those features convinced them that this early member of the human evolutionary family must have been a vegetarian, relying on its powerful jaws to grind nuts and seeds. Indeed, a hypothesis dating from the 1950s held that diet was the downfall of *A. robustus*—one reason why it went extinct 1 million years ago, while other early human ancestors thrived by opting for a more varied and flexible diet that included meat. But the bones tell a different tale, University of Cape Town anthropologist Andrew Sillen argued at the Pittsburgh meeting.

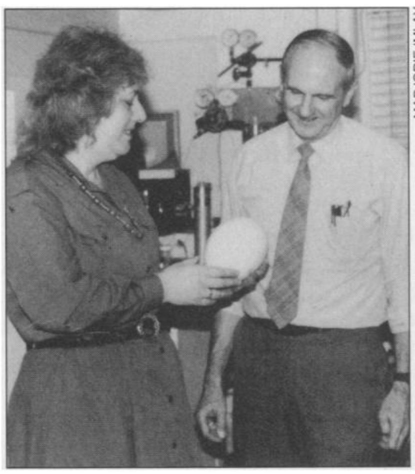
A newly developed technique for reconstructing the diet of humans and animals from the ratio of two elements—strontium and calcium—in their bones has convinced Sillen that *A. robustus* had a taste for meat. The new evidence, coupled with earlier reports that the teeth of specimens from the Swartkrans caves in South Africa show chips apparently produced by gnawing on bones and a new study of carbon isotope ratios in *A. robustus* tooth enamel, is also getting other researchers to rethink the australopithecine diet. "These as a group were not the strict vegetarians we thought they were," says University of Illinois archeologist Stanley Ambrose, who studies isotopic ratios in plants and animals. And that suggests they must have gone extinct for reasons other than their choice of cuisine, Ambrose says.

Sillen's technique embodies the adage that you are what you eat. In a nutshell, animals that eat more plants, which are rich in strontium, tend to have a higher ratio of strontium to calcium in their bones than those that eat meat—a trend Sillen and his colleagues confirmed by analyzing the remains of plant- and meat-eating animals from museum collections and road kills. The picture gets more complicated in fossils, where exposure to water and acids in the soil can change the levels of strontium and calcium over time. Sillen, however, reports that he has come up with a novel way of preparing fossil bones so that he can reconstruct accurately the original balance of strontium and calcium. The result: relatively low ratios of strontium to calcium in the bone from nine specimens of *A. robustus*, indicating that they ate meat along with plant matter.

Having challenged one traditional view, Sillen is taking the obvious next step: testing the idea that meat-eating was the norm along the *Homo* line that leads directly to humans. Sillen has looked at strontium-calcium ratios in one specimen, and the results surprised him: He found a higher ratio of strontium than in *A. robustus*, prompting him to wonder if it wasn't the human ancestors who shunned red meat. It's still too early to say for sure, but vegetarians no doubt will stay tuned.

Following a Trail of Old Ostrich Eggshells

When George Washington University anthropologist Alison Brooks took her graduate students on a routine field trip 10 years ago, she made a surprising discovery herself—one that changed the course of her research. The class was visiting organic geochemist Edgar Hare, who told Brooks to bring along some artifacts to his lab at the Carnegie Institution of Washington so he could show how to estimate their age from the proportions of left- and right-handed amino acids they contained. "I figured she would bring bone or mollusk shells," recalls Hare. "Instead, she brought ostrich eggshells." Much to the surprise of both researchers, the ancient eggshells contained such well-preserved organic material that they promised to be a valuable new archeological dating tool.


MARJORIE IMLAY

Eggheads. Brooks and Hare have turned eggshells into a valuable dating technique.

As Brooks reported at the Pittsburgh meeting, the ostrich eggshells are now starting to deliver on that promise: They are providing a powerful technique for probing the Middle Stone Age, 40,000 to 180,000 years ago, when anatomically modern humans were emerging. That period lies beyond the reach of radiocarbon dating, and many sites lack the volcanic rocks needed for other radioactive dating techniques. But sites in Africa and the Middle East are littered with ostrich eggshells—the remains of eggs used for food and shells used as containers and other implements. And in the hands of Brooks, Hare, and Carnegie predoctoral researcher Julie Kokis, the eggshells have hatched what University of Chicago paleoanthropologist Richard Klein calls "some very nice dates." Among other things, the eggshell dates are bolstering the case that the first modern humans originated in Africa, and they are revealing that later populations spent an unexpectedly long sojourn in the Middle East.

At first, the work seemed to be a bit of a gamble, because the amino-acid technique had proved sometimes unreliable for dating fossilized bones. The technique is based on the fact that amino acids trapped in bone or other organic materials gradually racemize after death—they change from the left-handed form characteristic of living things to a mixture of left- and right-handed forms. The racemization takes place at a steady rate, so the ratio of the left- to right-handed forms should clock the specimen's age. But bone is so porous that moisture and acids from the soil can leach out the amino acids, making the clock inconsistent. In eggshells, though, as Hare and Brooks discovered, the acids are locked up in such a tight mineral matrix that they are preserved for millennia. By anchoring the eggshell timescale to radiocarbon dates, Hare and Brooks have turned the shells into a more accurate dating system stretching back at least 200,000 years—and up to 1 million years in colder climates.

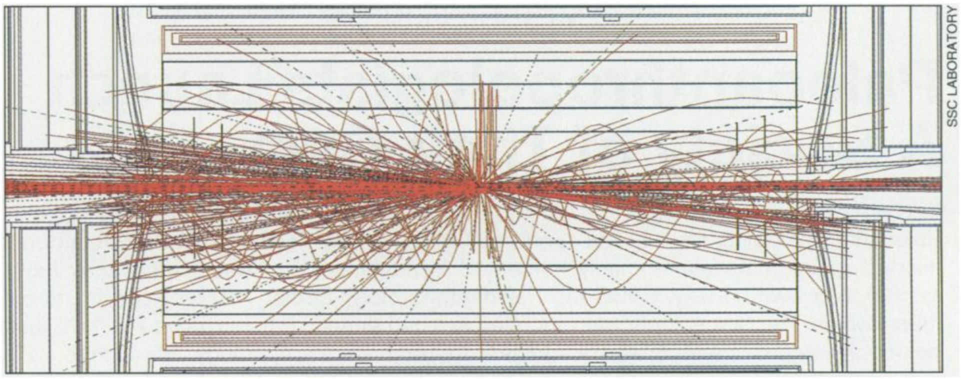
The trail of ancient eggshells has already led the researchers to new evidence that anatomically modern humans first appeared in Africa. At Klasies River Mouth on the South African coast, the eggshells are helping Brooks, Hare, and Kokis push back the dates for modern humans in South Africa to between 105,000 and 125,000 years ago—well before the earliest dates on other continents. "Those dates make great sense to me," says Klein. "They are entirely consistent with other lines of evidence," such as signs of climate change in the geologic record. The dates also dovetail nicely with results from another South African site, Border Cave, reported by University of Colorado geochemist Gifford Miller, who worked on racemization in mollusk shells as a postdoctoral researcher in Hare's lab at Carnegie. Miller and his graduate student Beverly Johnson have dated ostrich eggshells associated with a modern human adult and infant to earlier than 105,000 years, although Klein questions whether the human remains are as old as the eggshells associated with them.

Not long afterward, anatomically modern humans appear in the Middle East, and the eggshells suggest they weren't just passing through. By dating shells at Qafzeh cave in Israel, Brooks has found that these humans occupied the caves intermittently for at least 20,000 to 30,000 years. That pleases Harvard University archaeologist Ofer Bar-Yosef, who had already observed that the layers of sediment associated with humans at the site must have built up slowly. And although this site has no good specimen for calibrating the eggshell dates with radiocarbon, thermoluminescence and electron-spin resonance methods have suggested that the occupation was under way 90,000 years ago.

The ostrich eggshells are also giving the anthropologists a better picture of what human populations were doing in those early days. At another site in South Africa called Boomplaas, the dating has confirmed that unusually sophisticated tools—known as the Howieson's Poort industry—were made as early as 80,000 years ago. And about the same time, or a little later, early humans were using the same technology at Klasies River Mouth and at Border Cave. "We're beginning to see more advanced technology and more advanced work in bone and shell at earlier dates," remarks Brooks. It wasn't long before the eggshells themselves became part of that technology, in the form of ostrich-eggshell jewelry. At the Mumba shelter in Tanzania, Brooks has dated a level that yielded flat ostrich eggshell beads with holes in the center to between 40,000 and 50,000 years ago.

All of which might be enough to make anthropologists working in ostrich-free zones feel they are missing out. But Brooks and Hare are holding out hope for researchers in other regions. Their team and Miller's are studying eggshells from other birds, such as owls, cranes, and emu, and so far those shells appear to be equally good timekeepers. Says Brooks: "Apparently, an eggshell is an eggshell, however thin and fragile it may appear."

–**Ann Gibbons**



Find the Higgs. In this simulated tangle of tracks, it will take smart electronics to spot the particle.

HIGH-ENERGY PHYSICS

Neural Nets: A New Way to Catch Elusive Particles?

Any day now, Germany's latest high-energy accelerator, HERA, will start drowning its creators in data. Located at the DESY laboratory near Hamburg, this machine will collide electrons and protons 10 million times a second. Each collision will spray bursts of other particles into HERA's two detectors, which will turn it all into electronic blips—10 megabytes of them every second. That's enough data to stretch to the limit the electronic analyzers sifting the information in search of the one-in-a-trillion event that might signal a new discovery, says HERA scientist Bill Haynes. And yet it's only a trickle compared to the torrent of data predicted for the next generation of accelerators: CERN's Large Hadron Collider (LHC) and the United States' Superconducting Super Collider (SSC).

Anticipating the onslaught, physicists are turning HERA and other accelerators into testbeds for a computer technology known as the neural network: a web of simple processors, interconnected rather like the neurons in a brain, that can be "trained" to spot novel events in a morass of background data. For now, HERA and the other high-energy accelerators rely on ordinary switches and computer algorithms that pick out interesting events according to preset criteria. But in tests over the next few years, scientists will take signals collected by detectors at HERA and other accelerators and feed them into neural networks to see how efficiently they can learn to recognize the signatures of exotic particles. If the results are promising, neural networks might serve as the basis for a new generation of faster, more flexible detector electronics—just the thing, advocates hope, to snare a Higgs particle or a Top quark.

The most difficult and important job in particle detectors, says Roger Barlow, a physicist at the University of Manchester in England, is recognizing the difference between interesting and boring events. And in an accelerator, he points out, "there are 10^9 times as many boring ones as interesting." That's where the powerful pattern-recognition ability of neural networks comes in, the physicists say. The signature of a rare particle or event often consists of thousands of secondary particles flung out in all directions from the point of impact. The "connectedness" of a neural network, says Barlow, should enable it to gather data from all parts of the detector and "tie it all together to make a global decision."

What's more, neural networks, unlike conventional computers, can learn to make distinctions their creators couldn't anticipate. With a neural network you don't have to figure out how to recognize a pattern yourself and then wire up hardware or program software to do it, says Barlow. Instead, you "train" the neural network to recognize the pattern, without giving it a formula. The "training" is a little like teaching a person to recognize a letter or pattern, he says. "You show the network a set we know is [one kind of] quark, and ones we know are not, and adjust it until it knows which is which." The network adapts to the task on its own, changing various weighting factors that influence the relationship between input and output. The human user doesn't need to know the functions or formulas the network invents to make distinctions, says Caltech physicist Thomas Gottschalk. "If I'm willing to take forever to train it, the network has the flexibility to find whatever the best function is even if I don't have a clue."

To put that promise to the test, Barlow and other detector physicists are working to incorporate neural networks throughout the data sifting process. At accelerators such as