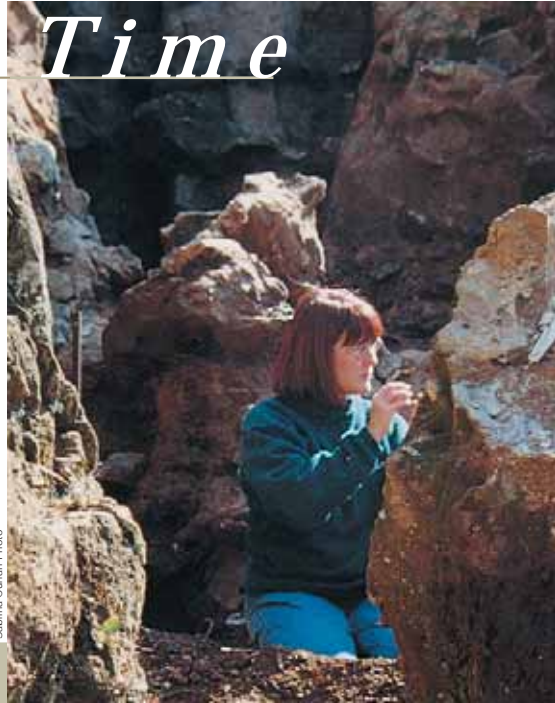


by Diane Boudreau

**K**AYE REED is following in the footsteps of her ancestors. Literally.

Each summer, Reed trades her comfortable office at Arizona State University for a tent in the African wilderness. There, she and her colleagues spend their days plucking ancient fossils from cave walls and riverbeds. Some of these fossils have waited for almost 4 million years to be discovered. The fossils are providing scientists with clues to the mystery of human origins.

## A Walk Through Time



Sabrina Curran Photo

### SCHOOL OF HARD ROCKS



During the summers of 1998 and 1999, ASU anthropologist Kaye Reed traveled to South Africa, where she runs a field school for undergraduate students. The group worked at two cave sites. In the Makapansgat Valley, the team dug for 3-million-year-old fossils of *Australopithecus africanus*. The other site, called

Buffalo Cave, contains 2-million-year-old fossils. As yet, no hominids have been found there.

"In 1998, we got 3,500 new fossil specimens from the first cave [Makapansgat] alone," says Reed. The count is not yet complete for the second site.

The fossils are encased in a substance called breccia—cave silt held together by calcium carbonate. To get the bones out, the researchers soak chunks of cave wall in acetic acid, or concentrated vinegar.

Cave walls are a good source of ancient pollen, according to Reed. Millions of years ago, the pollen

blew into the cave and was mixed in the breccia. Reed and her graduate students brought back several chunks of cave wall for pollen analysis.

"When you take a pollen sample you want the pollen to be encased. That way, when you open it there's less risk of contamination," she says.

Lab studies at ASU are the easy part of Reed's work, physically speaking. Life on site in the field is rough. For example, at the Hadar site in Ethiopia, Reed walked an average of 10 kilometers each day under the blazing African sun.

"The average temperature is between 115 and 120 degrees Fahrenheit," she says.

Sounds like Arizona? Sure. But out in the field, the researchers lack conveniences that Arizonans take for granted, like air conditioning.

"There are times when we would kill for a Diet Coke—with ice!" laughs Reed.

The 40 or so people at camp wake at 6:30 a.m. and start work by 7. The team returns to camp at noon to conduct "lab" work in a huge tent. At around 3 p.m., as the hottest part of the day

"You lie there and listen to hyenas in the distance and hear hippos in the river."

Reed is an assistant professor of anthropology at ASU and a research associate at the Institute of Human Origins. Her specialty is paleoecology, the study of prehistoric ecosystems. By examining the fossils of early animal communities, she can draw conclusions about the people who lived alongside those animals.

Currently, Reed is studying fossils from the Hadar region of Ethiopia. To find the fossils, Reed and her colleagues walked for miles under the scorching Ethiopian sun, scouring the banks of the dried-up Awash River.

Three million years ago, another woman



**Why do humans walk upright? That is a very big question. The answer has to be somewhere in that environmental shift.**

KAYE REED

passes, the researchers return to the field.

Back in camp, the group takes solar showers before dark. "Otherwise, the scorpions will run all over our feet," Reed explains. Then comes dinner, often followed by more work on computers.

"Or we can sit and look at the stars—you cannot believe how gorgeous they are! We go to bed around 9:30. You lie there and listen to hyenas in the distance and hear hippos in the river."

Starry skies and splashing hippos sound picturesque, but danger also lurks in the African wilderness. Scorpions and snakes are common threats, and other creatures occasionally give the scientists a scare as well. One year a lion walked right into the cook tent.

Fortunately, the scientists at camp are accompanied by a group of local Afar people who know the area well.

"They are very good at knowing where we are at all times," says Reed. "And because they understand the environment, they see snakes and things before we do." —DIANE BOUDREAU

walked the banks of the same river—and died there. Lucy, as she is fondly called, became an international celebrity when her bones were discovered in 1974 by Institute of Human Origins founder Donald Johanson. Lucy belonged to a previously unknown hominid species called *Australopithecus afarensis*, one of the earliest ancestors of modern humans.

As the 21st century looms, Reed traces the steps of Lucy's kin and their descendants. By reconstructing the environment that surrounded these hominids—or human precursors—she hopes to learn what life was like before the dawn of recorded history.

Reed works to reconstruct environments that surrounded early humans. "I want to reconstruct habitat across time and then trace the evolution of various species," she says.

The Hadar site is important to anthropologists because it contains fossils of two hominid species from different time periods. *Australopithecus afarensis*—Lucy's species—dates back from 3.9 to 3 million years ago. *Homo habilis*, a more evolved hominid, roamed the area 2.5 to 1.6 million years ago.

The Awash River did most of the hard excavation work for Reed and her colleagues.

"We don't have to dig down to find things. We just walk," Reed explains. "In general, the older stuff is found along the river. It gets newer as you walk away. I'm looking at the different fauna from what we call the lower section and the upper section, to see the shift in mammalian communities between *Australopithecus* and *Homo*."

Some of the animals she finds are rather surprising, like a six-foot-long otter. She also has found evidence of bears, which are rare in Africa. Determining what animals lived during a particular period can provide clues about how the hominids lived.

"Along the timeline, when you go from *Australopithecus* species to *Homo* species, you find a larger supply of grassland antelope," Reed says. "These animals lived on the open grassland. There were lots of them, which meant more to hunt."

The scientist says that more available game may have led to more cooperative hunting among hominids.

Mammal communities can provide clues about hominid communities in less direct ways, as well. By looking at animal fossils, Reed can make deductions about the vegetation and climate of the surrounding region. All are interdependent.

"All of these animals have teeth," she explains. "And based on what they eat, their chewing design is different." By making specific measurements, Reed can determine whether an animal ate grass, leaves, both, or

whether it ate meat, meat and bones, or insects.

An animal's bones hold even more clues. Bone structure can reveal how certain creatures moved. This in turn can provide information about the landscape. For example, tree climbing primates have different elbow structure than their earthbound cousins. When Reed finds the bones of tree-dwellers, she knows that the area once supported forests. She also knows that the area needed plenty of rain to support all those trees.

"The percentage of arboreal animals in modern sites can predict rainfall within a few hundred millimeters," she says. "The thing I'd really like to know is the seasonality. In other words, how many months a year did it rain and not rain? The seasons in Africa are different than they are here. They're defined by rain and no rain. The length of the non-rainy season must be very important for the animals."

Armed with this information, Reed tackles broader questions about human evolution. For instance, why did primates begin walking on two legs? She believes climate is the key.

From 23 million to 5 million years ago, Africa was covered with forests populated by great apes. Somewhere during that period, the climate began to dry, and the forests began to shrink.

"Many of the apes that lived in these forests became extinct. One, at least, somehow developed the ability to go between forest patches on two legs and became an upright walker. Why do humans walk upright? That is a very big question. The answer has to be somewhere in that environmental shift," Reed says.

Scientists have several hypotheses. One idea is that four-legged grassland apes began walking upright in order to hold tools. Reed disagrees. "My research has shown that in fact, there wasn't any open grassland until about 1.8 million years ago. People were on two legs by 4.2 million years ago.

"In my own personal view, the ape that eventually became a biped was an arboreal animal, not a terrestrial quadruped. In other words, I don't think the animal just stood up, because it was not advantageous to be on the ground and not run on four legs."

Instead, Reed believes that an ape was forced, through loss of habitat, to come down from the trees and walk upright. In fact, some modern arboreal primates do walk on two legs when they are on the ground.

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