

How Have Hominids Adapted to Past Climate Change?

Scientists attempt to understand how human ancestors adapted--or not--to previous periods of climate change

By [Gayathri Vaidyanathan](#) and [Climatewire](#) | April 13, 2010 | 11

The plaster face cast of a large-nosed Neanderthal stares out into space. The extra cavities in his sinus helped trap air, which was subsequently humidified. There's nothing quite like having a warm pocket of air close to the brain to keep away the chill of the ice age, says [Rick Potts](#), head of the [Human Origins Program at the Smithsonian National Museum of Natural History](#). The skulls of our closest ancestors tell the tale of human origins and the closeness of our [evolutionary history to climate change](#), Potts said. The Smithsonian exhibit at the Hall of Human Origins, of which Potts is curator, explores the idea that defining evolutionary events like the discovery of fire or migration out of Africa could be direct results of a changing climate.



CLUES FROM THE PAST: Our ancient ancestors can offer insight into our species' ability to survive and adapt over millions of years, scientists say. *Image: National Science*

"Climate is certainly complex, and atmospheric carbon dioxide is higher than at any other time since the origin of our species," Potts said. "This is setting up for conditions that are equal to conditions our ancestors faced in terms of novelty. We want people to contemplate how well a species is equipped to deal with true novelty."

Fossils of hominids -- all two-legged species related to human beings -- document a history of [human evolution](#) from the ape-like [Lucy](#) (the first known *Australopithecus afarensis*) to the hand axe-carrying *Homo erectus* to the climate-changing masters of the planet that we are today. Now, at the

outset of another climatic change triggered by human behavior, scientists say, the past can offer clues about our species' ability to survive and adapt over millions of years.

"People think, we're such a successful species, nothing can happen to us," said Potts. But, he pointed out, most of our ancestors sooner or later went extinct. *Homo erectus*, the forerunner of modern humans, lived for 1.5 million years, he said. *Homo sapiens*, by comparison, has been around for only 200,000 years. Yet even they decreased in population size to between 600 and 10,000 breeding pairs when hit with [mega-droughts, heavy monsoonal rains and the eruption of a volcano near Sumatra about 70,000 years ago](#).

A growing body of work in [paleoanthropology](#) is showing that at least some of these evolutionary events occurred together with drastic and periodic changes in African and Eurasian climate.

"The idea that human evolutionary changes happen in response to static environments doesn't hold [water](#) anymore," Potts said.

Learning from a once-wet Africa

Studying past changes could provide clues about future evolutionary adaptations as humans address anthropogenic [global warming](#), according to scientists who spoke on a panel about human evolution earlier this month at the Smithsonian. Researchers have named this epoch the Anthropocene, a period in geologic time when human activity has had an impact on the Earth's climate and ecosystem. Earlier climate events were equally drastic, as recorded in layers of the Earth. Scientists correlate them with a sometimes sparse fossil record to draw correlations between climate and evolution.

They then create climate models similar to the ones used in global warming research. The crossover could make them more accurate at modeling future climate, said [Andrew Cohen](#), a professor of geosciences, ecology and evolutionary biology at the University of Arizona.

Currently, the human fossil record shows a correlation with climate patterns in Africa. About 5,000 to 10,000 years ago, the Earth's axis of tilt shifted (a process called precession), which changed the amount of rain that Africa received.

"It is not true that the Sahara Desert has been a permanent feature for millions of years," said [Peter deMenocal](#), a professor at the [Lamont-Doherty Earth Observatory at Columbia University](#). Africa

oscillated between wet and dry every few thousand years, and each shift induced adaptation in the creatures that lived in the region.

About 3.35 million years ago, Ethiopia was forested and Lucy's species thrived with its ape-like features. The climate changed and the habitat switched to woodland, and then to the African savannah. Then, about 2.95 million years ago, it switched back to woodland. Unable to adapt, Lucy's species went extinct around this time after 900,000 years.

'Plastic' civilizations

About 2 million to 2.5 million years ago, an intense dry period led to the first migration of *Homo erectus* out of Africa into Southeast Asia, according to scientists. About 5,000 years ago, with the creation of the Sahara Desert, humans migrated into the Nile Delta, creating an urban settlement, according to deMenocal.

"Civilizations and populations can be very plastic that way," said deMenocal. "Climate change alters ecological landscapes, creates unnatural selection pressures, and promotes genetic selection to fit the pressures."

A more visible effect of climate change on human morphology was the development of large nasal cavities in Neanderthals, the most recent relative of the modern human displayed at the Smithsonian.

"We used to think of environment as a backdrop, but now, with the development of environmental records, we are more in tune to the consequences of environmental dynamism," said deMenocal.

Scientists at the Smithsonian panel called for greater field exploration to create a larger record of our past. Gaps in the fossil record make it difficult to closely relate particular adaptations to climate change. Better climate modeling is also necessary, according to deMenocal.

The recent discovery of *Australopithecus sediba*, a new species of hominid from about 2 million years ago, in Malapa, South Africa, provides a new link that is yet to be correlated with past climate. "All human species face questions about adaptation, long-term perspectives versus short-term gains," said Potts at the Smithsonian. "I'm hopeful because we are a species that's emerged from a long history of adaptation."

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