Early human ancestors had a wobble in their walk

February 8 2006

A new study of fossil foot bones across human history suggests that some of our very early ancestors had a rather peculiar way of walking.

Anthropologists Dan Gebo of Northern Illinois University and Gary Schwartz of Arizona State University analyzed heel and anklebone casts of five separate species of human ancestors to understand how human walking changed over time. The study identifies the earliest foot bones belonging to the genus Homo, the same grouping of species that includes Homo sapiens, and highlights intriguing differences found among even earlier human ancestors.

“Most people have argued that the foot bones of our human ancestors aren't all that different, but that's not the case,” said Gebo, a world authority on hominid foot bones. “The pattern of biomechanical changes that leads to the way modern humans walk today clearly took millions of years.

“With the earlier species of human ancestors that we analyzed, it's clear that their feet didn't work exactly like ours. This implies subtle gait changes over time.”

Gebo and Schwartz will report their findings in an upcoming edition of the *American Journal of Physical Anthropology*.

The beginning of upright walking, or the origin of bipedalism, is perhaps the most singular evolutionary event in human history since it separates

humanity from its African ape ancestry. Foot anatomy must have played a key role.

African apes, such as gorillas and chimpanzees, have mobile and muscular feet with long toes and a grasping big toe. This anatomy allows apes to grasp branches with their feet and move easily over curved surfaces. Modern humans have little muscle mass in their feet and lack a grasping big toe. Instead, human feet act as platforms, allowing us to walk or run great distances without tiring.

The foot anatomy of early human ancestors studied by the researchers is clearly more in line with modern humans than African apes, but vestiges of evolutionary history remain apparent, the researchers said.

Robust australopithecines, an extinct side branch of human evolution, roamed Africa 1.4 million to 2.5 million years ago. Members of these species are well known for their large teeth and distinctive facial features. But something odd was afoot as well, the researchers said.

“The anatomy of the ankle suggests that robust australopithecines had knees that wobbled inward when walking,” Gebo said.

“This gait worked but would have appeared slightly different from the walk of modern humans and would have been less efficient,” he added. “Robust australopithecines put their weight on the instep and wouldn't have enjoyed as much for-and-aft range of motion at the upper ankle joint because of an unusually short joint surface for the tibia, or leg bone.”

“Scientists have long been fascinated with robust australopithecines because they were so distinctive from the neck up,” added Schwartz, a research associate at the Institute of Human Origins at ASU. “Now we have evidence that they were unique and interesting from the knee down

as well."

Another species of early human ancestors, Australopithecus afarensis, possessed more mobile foot joints than modern humans and would have relied on its foot muscles to stabilize its foot joints while walking. Muscle crests on the bones are large when compared to modern humans. The most famous example of Australopithecus afarensis is the celebrated Lucy skeleton. Discovered in Ethiopia in 1974, Lucy stood about 3 1/2 feet high and lived about 3.2 million years ago.

"The early australopithecines, such as Lucy, are in the evolutionary process of adapting their feet for movement on the ground instead of in trees," Gebo said. "Although they were good at walking on two feet, the early australopithecines haven't locked up their foot joints as modern humans have. Their gait would have appeared similar to our own, but muscle fatigue would be a concern and long distance travel far less efficient. Later human ancestors would bioengineer bony surfaces to stabilize their feet, replacing this earlier emphasis on musculature."

Gebo and Schwartz also analyzed the casts of two foot bones from a famous archaeological site along the Omo River in Ethiopia. The fossils, dating back 2.2 million years and 2.36 million years respectively, were previously described by researchers as half ape, half human. Gebo and Schwartz came to a different conclusion.

"The Omo fossils represent the earliest foot bones within the genus Homo," Gebo said. "They are very human-like and must have walked in a very similar fashion to the way we do today."

The researchers conclude the Omo fossils probably belong to the species of either Homo habilis or Homo rudolfensis. They demonstrate a remarkable pattern of evolution occurring over time.

“In a relatively short span of time, less than 1 million years, we see all the peculiarities of the Lucy-like species becoming much more like modern humans,” Schwartz said.

Some evolutionary scientists have speculated that the adaptation of upright walking may have occurred independently in separate species, but both Gebo and Schwartz believe the origins of bipedalism arose but once.

“One camp of scientists theorizes that different lineages of our fossil human ancestors acquired the adaptation of walking upright independently of each other,” Schwartz said. “But Dan Gebo and I belong in the other camp. We believe the origins of bipedalism arose once, but our research shows different lineages had variations on that theme, perhaps adapting to unique lifestyles or environmental conditions.”

Source: Northern Illinois University