Ancient Global Warming Drove Early Primates' Dispersal

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The continent-hopping habits of early primates have long puzzled scientists, and several scenarios have been proposed to explain how the first true members of the group appeared virtually simultaneously on Asia, Europe and North America some 55 million years ago.

But new research using the latest evidence suggests a completely different migration path from those previously proposed and indicates that sudden, rapid global warming drove the dispersal.

Researchers from the University of Michigan, Johns Hopkins University School of Medicine and the Royal Belgian Institute of Natural Sciences present their findings in the July 25 issue of the *Proceedings of the National Academy of Sciences.*

Their work focuses on Teilhardina, an ancient genus that resembled the saucer-eyed, modern-day primates known as tarsiers. Like tarsiers, monkeys, apes and humans, Teilhardina was a true primate, or euprimate. In both Asia and Europe, the genus is the oldest known primate; in North America, it appears in the fossil record around the same time as another primate, Cantius. Previously, scientists had come up with four ways to explain the geographic distribution pattern.

The first is that primates originated in Africa and spread across Europe and Greenland to reach North America. Another possibility is that they originated in North America and traveled across a temporary land bridge connecting Siberia and Alaska. A third hypothesis is that primates had

their origins in Africa or Asia and traveled through North America to reach western Europe. Finally, it has been suggested that the group originated in Asia and fanned out eastward to North America and westward to Europe.

In the new research, U-M paleontologist Philip Gingerich and coworkers re-evaluated the four hypotheses by comparing with unprecedented precision the times of first appearance of Teilhardina in Asia, Europe, and North America. To achieve such precision, they used a carbon isotope curve recently documented on all three continents. Carbon in the atmosphere, earth and living organisms differs in the proportion of carbon-12 and carbon-13 present. A flood of carbon-12 is associated with the onset of an event known as the Paleocene-Eocene thermal maximum (PETM), one of the most rapid and extreme global warming events recorded in geologic history. It was during the PETM that modern primates first appeared 55 million years ago. Teilhardina in Asia precedes the maximum flood of carbon-12, Teilhardina in Europe coincides with it, and Teilhardina in North America appears just after the maximum. Based on this evidence, the researchers concluded that none of previously proposed scenarios was likely. Instead, they propose that Teilhardina migrated from South Asia to Europe, crossing the Turgai Straits---an ancient seaway between Europe and Asia---and then spread to North America by way of Greenland.

The whole dispersal event happened within about 25,000 years.

"It is remarkable to be able to study evolutionary events so deep in the past with such precision," said Gingerich, who is the Ermine Cowles Case Collegiate Professor of Paleontology and director of the U-M Museum of Paleontology. "The speed of dispersal and the speed of evolutionary change during dispersal are near the maximum for such rates observed today, and the rapid change and dispersal were almost certainly driven by profound greenhouse warming at the Paleocene-

Eocene boundary."

Gingerich's coauthors on the paper are Thierry Smith of the Royal Belgian Institute of Natural Sciences and Kenneth Rose of Johns Hopkins University School of Medicine. The researchers received funding from National Geographic Society, the Belgian Federal Science Policy Office and the U.S. National Science Foundation.

Source: University of Michigan