Six new fossil species form 'snapshot' of primates stressed by ancient climate change

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A left lower jaw of *Yunnanadapis folivorus*, one of six new fossil species found in southern China. Credit: University of Kansas

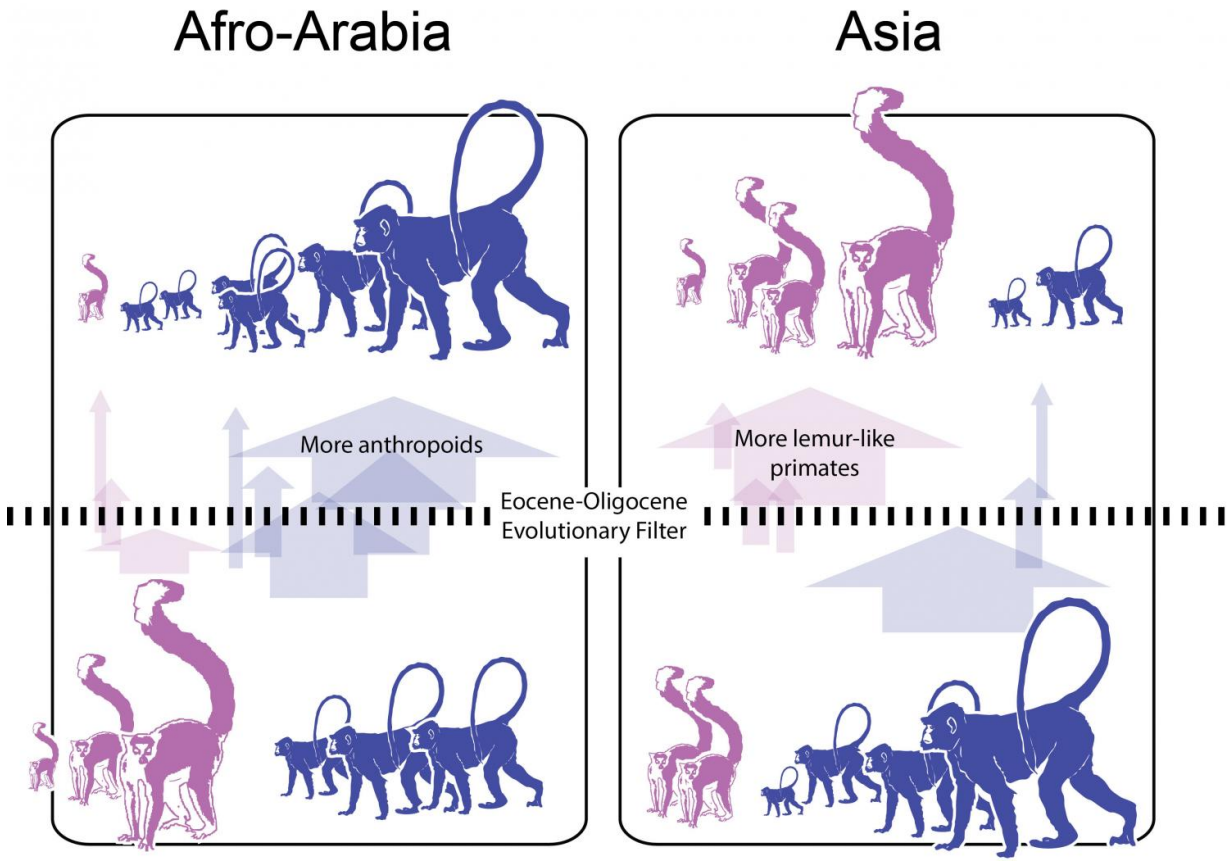
In a study to be published this week in the journal *Science*, researchers describe unearthing a "mother lode" of a half-dozen fossil primate species in southern China.

These primates eked out an existence just after the Eocene-Oligocene transition, some 34 million years ago. It was a time when drastic cooling made much of Asia inhospitable to primates, slashing their populations and rendering discoveries of such fossils especially rare.

"At the Eocene-Oligocene boundary, because of the rearrangement of Earth's major tectonic plates, you had a rapid drop in temperature and humidity," said K. Christopher Beard, senior curator at the University of Kansas' Biodiversity Institute and co-author of the report. "Primates like it warm and wet, so they faced hard times around the world—to the extent that they went extinct in North America and Europe. Of course, primates somehow survived in Africa and Southern Asia, because we're still around to talk about it." Because anthropoid primates—the forerunners of living monkeys, apes and humans— first appeared in Asia, understanding their fate on that continent is key to grasping the arc of early primate and human evolution.

"This has always been an enigma," Beard said. "We had a lot of evidence previously that the earliest anthropoids originated in Asia. At some point, later in the Eocene, these Asian anthropoids got to Africa and started to diversify there. At some point, the geographic focal point of anthropoid evolution—monkeys, apes and humans—shifted from Asia to Africa. But we never understood when and why. Now, we know. The Eocene-Oligocene climate crisis virtually wiped out Asian anthropoids,

so the only place they could evolve to become later monkeys, apes and humans was Africa."



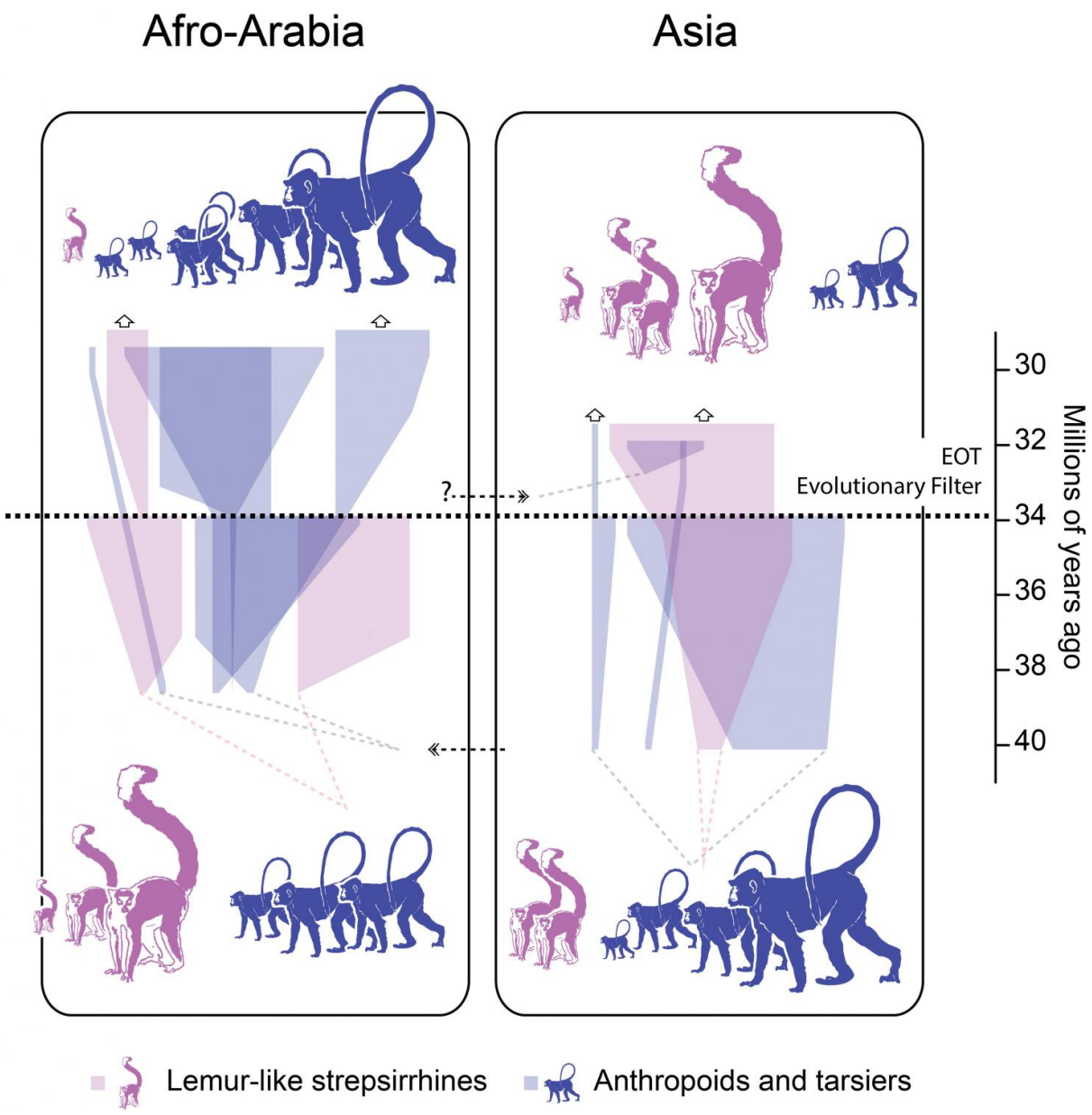
The Eocene-Oligocene transition (EOT) functioned as a critical filtering episode during the evolutionary history of primates. Comparing the composition of the early Oligocene primate faunas from Asia reveals that surviving this Eocene-Oligocene evolutionary filter entailed a high degree of taxonomic and ecological selectivity: later Eocene primate assemblages tend to be dominated, both in terms of taxonomic richness and numerical abundance, by stem anthropoids, whereas the Oligocene primate tend to be dominated by lemur-like strepsirrhine primates. A similar comparison of the late Eocene-early Oligocene primates from Afro-Arabia shows a very different pattern of selectivity in response to the EOT: very few strepsirrhine primates survived the EOT, whereas anthropoids diversified both taxonomically and ecologically. The divergent responses shown by Afro-Arabian and Asian primates across the EOT evolutionary filter

constrained the subsequent course of primate macroevolutionary pattern across the Old World. Africa became the geographic nexus of anthropoid evolution, whereas Asia shows a strong break between Paleogene and Neogene anthropoid assemblages. Credit: Xijun Ni

The paper is the product of a decade's worth of fieldwork at a site in southern China, where the primates likely sought warmer temperatures. Beard and his colleagues Xijun Ni, Qiang Li and Lüzhou Li of the Chinese Academy of Sciences' Institute of Vertebrate Paleontology and Paleoanthropology describe the six new species from jaw and tooth fragments, which survived the ages due to their tough enamel surfaces and serve as "fingerprints" to identify ancient animals.

"The fossil record usually gives you a snapshot here or there of what ancient life was like. You typically don't get a movie," Beard said. "We have so many primates from the Oligocene at this particular site because it was located far enough to the south that it remained warm enough during that cold, dry time that primates could still survive there. They crowded into the limited space that remained available to them."

Like most of today's primates, the KU researcher said the ancient Chinese primates were tropical tree-dwellers. One of the species, which the research team has named *Oligotarsius rarus*, was "incredibly similar" to the modern tarsier found today only in the Philippine and Indonesian islands.



Credit: Xijun Ni

"If you look back at the fossil record, we know that tarsiers once lived on mainland Asia, as far north as central China," Beard said. "The fossil teeth described in this paper are nearly identical to those of modern tarsiers. Research shows that modern tarsiers are pretty much living

fossils—those things have been doing what they do ever since time immemorial, as far as we can tell."

Beard said that if not for the intense global cooling of the Eocene-Oligocene transition, the main stage of primate evolution may have continued to be in Asia, rather than transitioning to Africa where *Homo sapiens* eventually emerged. Indeed, the team's findings underscore a vulnerability to climate change shared by all primates.

"This is the flip side of what people are worried about now," he said. "The Eocene-Oligocene transition was the opposite of global warming—the whole world was already warm, then it cooled off. It's kind of a mirror image. The point is that primates then, just like primates today, are more sensitive to a changing climate than other mammals."

More information: "Oligocene primates from China reveal divergence between African and Asian primate evolution," *Science*, DOI: 10.1126/science.aaf2107

Provided by University of Kansas