New Oligocene Primates from China Highlight Ancient Climate Change as Possible Evolution Filter

Profound environmental and faunal changes are associated with climatic deterioration during the Eocene-Oligocene transition (EOT) roughly 34 million years ago. Primates are among the most environmentally sensitive of all mammals. Reconstructing how Asian primates responded to the EOT, however, has been hindered by a sparse record of Oligocene primates on that continent.

In a study published May 6 in *Science*, Dr. NI Xijun at the Institute of Vertebrate Paleontology and Paleoanthropology (IVPP), Chinese Academy of Sciences and his team reported the discovery of a diverse primate fauna from the early Oligocene of southern China. In marked contrast to Afro-Arabian Oligocene primate faunas, this Asian fauna is dominated by strepsirhines. There appears to be a strong break between Paleogene and Neogene Asian anthropoid assemblages. Asian and Afro-Arabian primate faunas responded differently to EOT climatic deterioration, indicating that the EOT functioned as a critical evolutionary filter constraining the subsequent course of primate evolution across the Old World. This study provides a deeper understanding of a pivotal moment in the evolution of primates, the group that eventually gave rise to people.

These newly discovered fossil primates were collected via careful excavation and screen washing at the Lijiawa fossil site at the upper part of Caijiachong Formation, Yuezhou Basin, Yunnan Province, China. The Lijiawa fossil site has yielded more than 10 mammal taxa that indicate an early Oligocene age. Researchers described 10 previously unknown primates represented by fossil teeth, jaws and a few other bones, helping to fill the gap in the record of Asian primate evolution.

The primate lineage that led to monkeys, apes and people, called anthropoids, originated in Asia, with their earliest fossils dating from 45 million years ago. Only later, about 38 million years ago, did some anthropoids migrate to Africa. It was on that continent 200,000 years ago that humans arose.

The transition between the Eocene and Oligocene periods was marked by distinct cooling. This change in climate drove a retraction of primates globally. Comparing the composition of the early Oligocene primate faunas from Yunnan and Pakistan with later Eocene Asian primate faunas known from China, Myanmar and Thailand, researchers revealed that surviving this Eocene-Oligocene evolutionary filter entailed a high degree of taxonomic and ecological selectivity.

Later Eocene primate assemblages in China, Myanmar, and Thailand tend to be dominated,

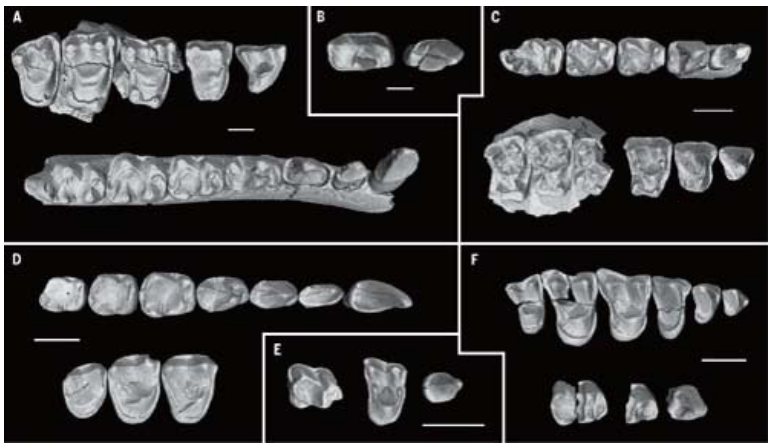

Fig. 1 Diverse primates from the early Oligocene of Yunnan Province, China. (A) *Yunnanadapis folivorus*, (B) *Yunnanadapis imperator*, (C) *Laomaki yunnanensis*, (D) *Gatanthropus micros*, (E) *Oligotarsius rarus*, (F) *Bahinia banyueae*. (Image by NI Xijun)

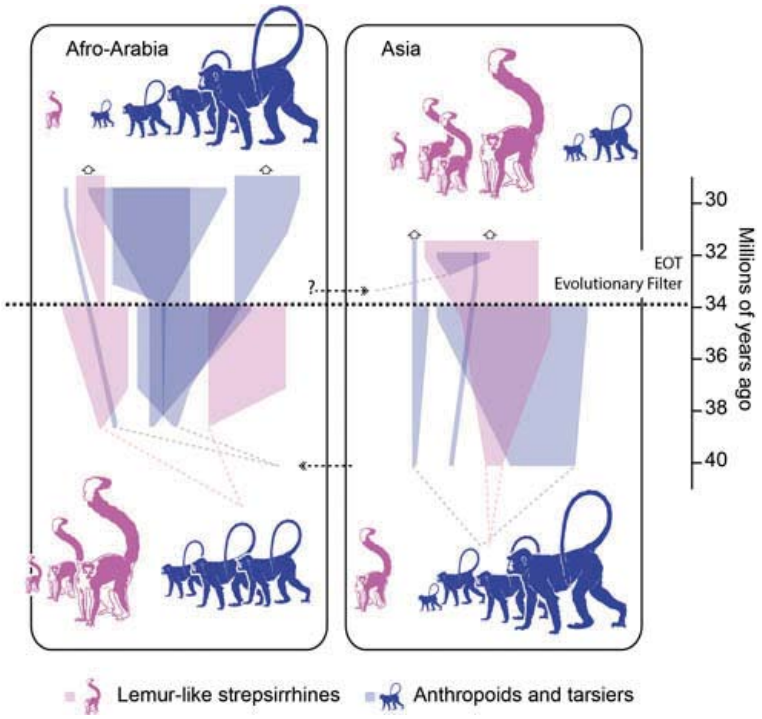

Fig.2 The Eocene-Oligocene transition (EOT) functioned as a critical filtering episode during the evolutionary history of primates, leading to more lemur-like primates in Asia, and driving more anthropoids to emerge in Afro-Arabia. (Image by NI Xijun)

both in terms of taxonomic richness and numerical abundance, by stem anthropoids belonging to the families Eosimiidae and Amphipithecidae. In stark contrast, only one of the six primates known from the early Oligocene of Yunnan is anthropoid. Three of five primate species documented from the late early Oligocene of Pakistan are anthropoids, but even in this case, the anthropoid taxa known from Pakistan differ from their contemporary African relatives in being relatively small-bodied.

However, Late Eocene–early Oligocene primates from Afro-Arabia show a very different pattern of taxonomic selectivity in response to the EOT. There, very few strepsirhines (none of which were large) survived the EOT, whereas anthropoids diversified both taxonomically and ecologically, and became dominant in Afro-Arabian regions.

"The EOT functioned as a critical evolutionary filter during the evolutionary history of primates," said lead author NI Xijun of IVPP: "Before the temperatures dropped, Asia's primates were dominated by anthropoids. Afterward, they were dominated by lemur-like primates, with the monkey-like ones decimated." The EOT climatic deterioration may be the reason why apes and people emerged in Africa even though anthropoids first appeared in Asia.

"We had a lot of evidence previously that the earliest anthropoids originated in Asia. The Eocene-Oligocene climate crisis virtually wiped out Asian anthropoids, so the only place where could they have evolved to become later monkeys, apes and humans was Africa," said Christopher Beard, senior curator at the University of Kansas' Biodiversity Institute and co-author of the study.

Dynamic changes to the Asian physical environment during the interval spanning the EOT included progressive retreat of the Paratethys Sea from central Asia, continued uplift of the Tibetan-Himalayan orogen, and opening of the South China Sea. "Africa was not immune to global climatic changes across the EOT, but it did not experience the dramatic tectonic and paleogeographic alterations that characterized Asia at this time", said LI Qiang of IVPP, also co-author of the study: "It is tempting to attribute the different patterns of turnover in Asian and African primate faunas across the EOT to local changes in vegetation and paleoenvironment, but current evidence is not sufficient to rule out the possibility that random processes may have also played a substantial role."

"We have so many primates from the Oligocene at this particular site in China 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," said Beard. They crowded into the limited space that remained available to them. Like most of today's primates, they were tropical tree-dwellers. The lone anthropoid in the group, a small, monkey-like primate named *Bahinia banyueae*, probably resembled some of today's smaller South American monkeys such as marmosets, and its teeth suggest its diet was mainly fruits and insects.

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(By CHEN Pingfu)