A tooth fossil shows *Gigantopithecus*' close ties to modern orangutans

Proteins help clarify how the giant ancient ape evolved

A massive ape that lived in Southeast Asia between around 2 million and 300,000 years ago, represented here by a roughly 15-centimeter-long lower jaw, was a close relative of orangutan forerunners, researchers say.
WEI WANG

An ancient ape that was larger than a full-grown male gorilla has now revealed molecular clues to its evolutionary roots.

Proteins extracted from a roughly 1.9-million-year-old tooth of the aptly named *Gigantopithecus blacki* peg it as a close relative of modern orangutans and their direct ancestors, say bioarchaeologist Frido Welker of the University of Copenhagen and his colleagues.

Protein comparisons among living and fossil apes suggest that *Gigantopithecus* and orangutan forerunners diverged from a common ancestor between around 10 million and 12 million years ago, Welker's group reports November 13 in *Nature*.

Since it was first described in 1935, based on a molar purchased from a traditional Chinese drugstore in Hong Kong, *G. blacki* has stimulated debate over its evolutionary links to other ancient apes. Almost 2,000 isolated teeth and four partial jaws of *G. blacki* have since been found in southern China and nearby parts of Southeast Asia. *G. blacki* fossils date

from around 2 million to almost 300,000 years ago. The sizes of individual teeth and jaws indicate that *G. blacki* weighed between 200 and 300 kilograms.

Proteins preserve better in teeth and bones than DNA does, but both molecular forms break down quickly in hot, humid settings. “We were surprised to find any proteins this old at all, especially in a fossil from a subtropical environment,” Welker says. Proteins consisting of chains of amino acids can be used to sort out living and fossil species of various animals, including hominids (*SN: 5/1/19*).

Researchers generally regard *G. blacki* as an orangutan relative that evolved to live in forests and eat fruits, leaves, stems and possibly tubers. But that assumption has rested on thin evidence, says biological anthropologist Terry Harrison of New York University.

“This new [protein] analysis provides the first compelling evidence that *Gigantopithecus* was more closely related to the orangutan than to any other ape,” Harrison says.

In this illustration, the ancient Asian ape *Gigantopithecus* looks much like an orangutan. Proteins from a *Gigantopithecus* tooth point to a close evolutionary link between the extinct ape and orangutan ancestors.IKUMI KAYAMA/STUDIO KAYAMA LLC

Welker’s team retrieved amino acid sequences from six proteins in a *G. blacki* molar previously found in southern China’s Chuifeng Cave. Five of those proteins are commonly found in living chimps, bonobos, gorillas,

orangutans and humans, enabling comparisons of accumulated differences in the amino acid arrangements between *G. blacki* and those five present-day primates. Orangutans displayed the fewest protein disparities with *G. blacki*, signaling a particularly close evolutionary link between living red apes and the ancient Asian ape. Using those protein comparisons, the age of the *G. blacki* tooth and previous estimates of when various living apes diverged from common ancestors, Welker's group calculated the timing of a common ancestor for orangutans and *G. blacki*.

The sixth protein has been linked to a process by which minerals are produced to harden bones and teeth. That protein may have contributed to the formation of especially thick tooth enamel in *G. blacki*, the researchers speculate.

No attempt was made to remove DNA from the ancient ape tooth. Even in colder regions than southern China, only much younger fossils have yielded DNA (*SN: 3/14/16*).

Ancient proteins from other Asian fossil apes dating to between around 12 million and 6 million years ago are needed to further clarify the evolutionary position of *G. blacki*, says paleoanthropologist Russell Ciochon of the University of Iowa in Iowa City. Ciochon suspects that *Indopithecus giganteus*, a fossil ape that inhabited what's now northern India and Pakistan during that period, was a potential ancestor of *G. blacki*.

Protein analyses of fossil orangutans that lived in Southeast Asia at the same time as *G. blacki* may also help untangle how and why red apes died out in China after approximately 126,000 years ago, but still live on two Indonesian islands, Ciochon says. Such research could provide insights into how best to save endangered orangutans today (*SN: 2/15/18*).