AI reveals which predators chewed ancient humans' bones – challenging ideas on which 'Homo' species was the first tool-using hunter

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If *Homo habilis* was often chomped by leopards, it probably wasn't the top predator.
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Almost 2 million years ago, a young ancient human died beside a spring near a lake in what is now Tanzania, in eastern Africa. After archaeologists uncovered his fossilized bones in 1960, they used them to define Homo habilis – the earliest known member of our own genus.

Paleoanthropologists define the first examples of the genus Homo based largely on their bigger brains – and, sometimes, smaller teeth – compared with other, earlier ancestors such as the australopithecines – the most famous of these being Lucy. There were at least three types of early humans: Homo habilis, Homo rudolfensis and the best documented species, Homo erectus. At least one of them created sites now in the archaeological record, where they brought and shared food, and made and used some of the earliest stone tools.

These archaeological sites date to between 2.6 to 1.8 million years ago. The artifacts within them suggest greater cognitive complexity in early Homo than documented among any nonhuman primate. For example, at Nyayanga, a site in Kenya, anthropologists recently found that early humans were using tools they transported over distances of up to 8 miles (13 kilometers). This action indicates forethought and planning.

Traditionally, paleoanthropologists believed that Homo habilis, as the earliest big-brained humans, was responsible for the earliest sites with tools. The idea has been that Homo habilis was the ancestor of later and even bigger-brained Homo erectus, whose descendants eventually led to us.

This narrative made sense when the oldest known Homo erectus remains were younger than 1.6 million years old. But given recent discoveries, this seems like a shaky foundation.

In 2015, my team discovered a 1.85 million-year-old hand bone at Olduvai Gorge, the same place the original Homo habilis had been found. But unlike the hand of that Homo habilis juvenile, this fossil looked like it belonged to a larger, more modern, fully land-based rather than tree-based human species: Homo erectus.

Over the past decade, new finds have continued to push back the earliest dates for Homo erectus: about 2 million years ago in South Africa, Kenya and Ethiopia. Taken together, these discoveries reveal that H. erectus is slightly older than the known H. habilis fossils. We cannot simply assume that H. habilis gave rise to H. erectus. Instead, the human family tree looks far bushier than we once thought.

What do all these finds suggest? Only one Homo species is our likely ancestor, and probably only one can be responsible for the complex behaviors revealed at the Olduvai Gorge sites. My colleagues and I hit on a way to test whether Homo habilis was top dog at Olduvai Gorge, so to speak, based on whether they were the hunters or the hunted.

Who was hunting who?

At Olduvai Gorge, there is overwhelming evidence that early humans were consuming animals as big as a gazelle or even a zebra. Not only did they hunt, but they repeatedly brought these animals back to the same location for communal consumption. This is the concept of a "central provisioning place," much like a campsite or home today. Dating to 1.85 million years ago, this is the oldest evidence of frequent meat-eating – and of early humans regularly acting as predators rather than prey.

All animals occupy a position on a food web, from top to lower ranks. Top-ranking predators, such as lions, are usually not preyed upon by lower ranking carnivores, such as hyenas.

If Homo habilis was acquiring large animal carcasses, either by hunting or by chasing lions away from their own kills, it seems logical that these hominids could effectively cope with predation risks. That is, a hunter usually isn't hunted.

In African savannas, apex predators like lions do not usually die from other predator attacks. Humans today also occupy a top predatory niche: For example, Hadza hunter-gatherers in Tanzania not only hunt game, but also fend off lions from their kills, and successfully defend themselves from attacks by other predators, such as leopards.

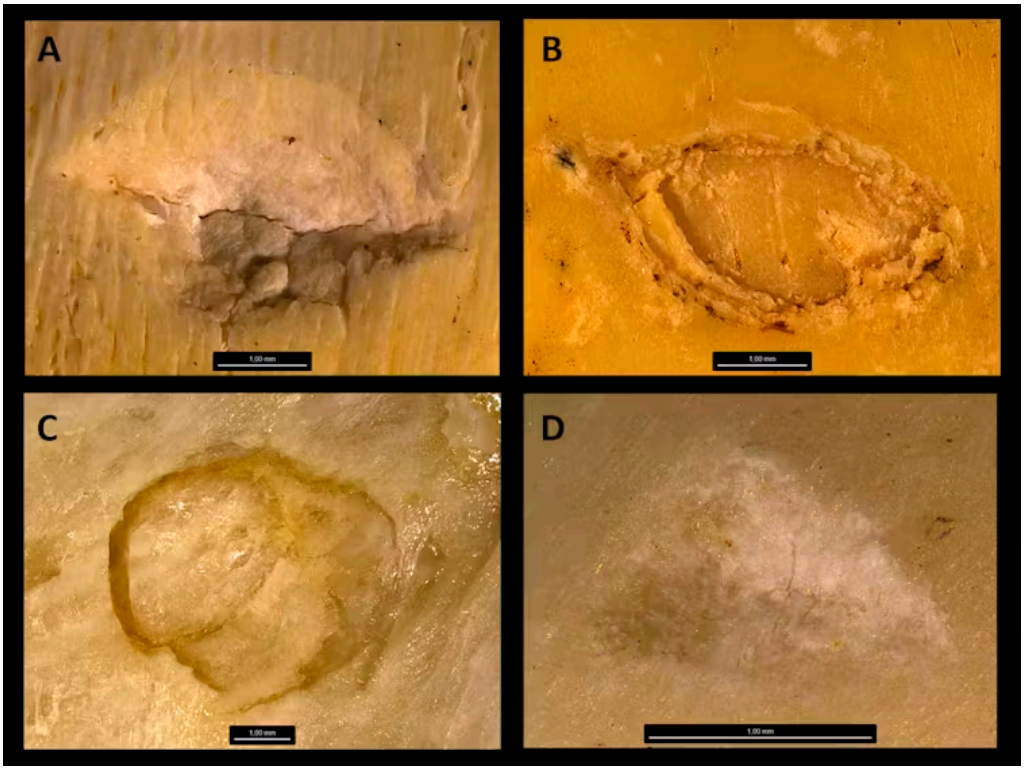
But, if Homo habilis was not yet a top predator, then you would expect them to have occasionally been prey to lower-on-the-food-chain carnivorous cats – such as leopards – who often hunt primates.

Most known human fossils at this stage of evolution do bear traces of carnivore damage, including the two best preserved H. habilis fossils from Olduvai Gorge. Was it caused after death, by a scavenging carnivore? Or did a big cat at the top of the food chain kill these early humans?

My colleagues and I set out to address the question of which predators were getting their teeth on H. habilis and presumably whether before or after the ancient humans died.

AI suggests H. habilis wasn't an apex predator

Here's where artificial intelligence comes in. Using computer vision, we trained AI on hundreds of microscopic images showing tooth marks left by the main carnivores in Africa today: lions, leopards, hyenas and crocodiles. The AI learned to recognize the subtle differences between the marks made by the different predators and was able to classify the marks with high accuracy.



Tooth marks left by the four types of carnivores recorded. A: crocodile tooth pit; B: hyena tooth pit; C: lion tooth pit; and D: leopard tooth pit.

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When we combined different AI approaches, they all pointed to the same result: The tooth marks on the Homo habilis bones matched those made by leopards. The size and shape of the marks on the fossils from those two early Homo habilis individuals line up with what leopards leave today when feeding on prey.

Our discovery challenges the long-standing view of Homo habilis as the first skilled toolmaker, hunter and meat-eater.

But maybe it shouldn't be too surprising. The only complete skeleton of this species found at Olduvai Gorge belonged to a very small individual – just about 3 feet tall (less than 1 meter) – with a body that still showed features suited for climbing trees. That hardly matches the image of a hunter able to bring down large animals or steal carcasses from lions.

If it wasn't Homo habilis performing these feats, maybe it was Homo erectus, a species with a larger body and more modern anatomy. But that opens up other mysteries for future researchers: What was Homo habilis doing at the archaeological sites of Olduvai Gorge if it was not responsible for the tools and signs of hunting we find there? Where exactly did Homo erectus come from, and how did it evolve?

My team and others will be returning to places like Olduvai Gorge to ask these questions in the years to come.

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