Denisovan fossil finger points to the timing of Neanderthal evolution

Enlarge / The two fragments of Denisova 3’s fingertip, reunited in digital form.
Bennett et al. 2019

reader comments

19 with 15 posters participating

Share this story

A group of anthropologists finally put back together a Denisovan finger bone unearthed in 2009, and it pointed to something surprising. Denisovan fingers looked more like ours than like Neanderthals’, even though DNA shows that Denisovans are more closely related to Neanderthals. That suggests Neanderthals evolved subtle differences in the shape of their finger bones (phalanges) sometime after they branched off from Denisovans around 410,000 years ago.

DNA can tell us a lot about how species are related to each other, but we still need to look at the bones themselves to understand how and when particular traits changed. The combination of DNA and skeletal evidence can help us understand the details that differentiated modern humans from our nearest hominin relatives—and the environmental and other forces that shaped those differences.

The fickle fate of a finger

Back in 2010, DNA from one fragment of this finger bone (the proximal end, or the one closest to the body) revealed the existence of another hominin species that we'd been missing all this time. The Denisovans were named for Denisova Cave in Siberia, where anthropologists unearthed the bone. It's the tip of the right pinky finger of a 13-year-old Denisovan girl who died 50,000 years ago. Her DNA sequence has become the source of most of what we now know about her enigmatic people, as fossil finds have been surprisingly rare for such a wide-ranging, long-lived species.

Shortly after exhuming the finger bone, the anthropologists who made the find cut it in half and sent the proximal end to the Max Planck Institute in Germany and the distal end (the very tip of the finger) to the University of California, Berkeley. Sometime in the decade since then, someone lost the only photos of the whole bone, leaving researchers with no idea what the entire finger looked like.

Molecular biologist E. Andrew Bennett of the Institut Jacques Monod in France and his colleagues have now used photos of the distal piece and digital scans of the proximal one to reunite the two fragments.

With a digital (get it? *digit*-al?) reconstruction of the finger bone, Bennett and his colleagues had enough evidence to say that the bone had come from the right hand, and to conclude that the girl now called Denisova 3 was between 13 and 14 years old when she died. The plate of bone at the end of the finger bone, called the epiphysis, had been in the process of fusing with the bone of the shaft when she died. In most modern human girls (and the Neanderthals we have finger bones and age estimates from), that happens between the ages of about 13 and 14 years.

A matter of proportion

The authors carefully measured the proportions of the finger bone, the size of important features, and the distance between key landmarks on the surface of the bone. They used those measurements to compare the shape and proportions (not the absolute size) of the bone to finger bones from a sample of Neanderthal and *Homo sapiens* remains. The Neanderthals and the *Homo sapiens* sorted into two distinct groups, and Denisova 3 clearly fit in with the *Homo sapiens*, not her closer Neanderthal cousins.

- This is the pinky fingertip of a 13-year-old Denisovan girl who died 50,000 years ago.
  Bennett et al. 2019
- Digital scans of the proximal part of the finger bone, viewed from different angles.
  Bennett et al. 2019
- The two fragments of Denisova 3's fingertip, reunited in digital form.
  Bennett et al. 2019
- Side-by-side comparison of Denisova 3's digitally reconstructed finger (right) with the same bone from a recent human (center) and a Neanderthal (left). Notice how wide the tuft (fingertip, toward the top of the image) is on the Neanderthal bone compared with the other two.
  Bennett et al. 2019
- Although there's a little overlap, the Neanderthal and *Homo sapiens* finger bones sort themselves into two clear groups on the chart, and Denisova 3 fits in with the *Homo sapiens*.
  Bennett et al 2019
- The blue shading represents the Neanderthal, Denisovan, and *Homo sapiens* family tree based on nuclear DNA; the red lines represent mitochondrial DNA, which is passed

> down only on the mother's side. It tells a more complicated story of interactions between species.
> Bennett et al. 2019

Neanderthal finger bones are pretty easy to tell apart from *Homo sapiens* finger bones—for paleoanthropologists, anyway. Most Neanderthals had proportionally longer finger bones, with wider ends (called tufts). Bennett and his colleagues say that "seems to be related to functional rather than cold climate adaptations," unlike several of the other anatomical differences between us and Neanderthals. Denisova 3's finger bone looked no different from that of a *Homo sapiens*—but quite different from that of a Neanderthal.

Those differences in Neanderthal fingers must have evolved sometime after Neanderthals and Denisovans had branched off from their last common ancestor 410,000 years ago. Bennett and his colleagues suggest that it must have happened relatively late in the Neanderthals' story. One pinky finger tip from a Neanderthal who lived at the Moula-Guercy site in France (therein hangs a tale) around 100,000 years ago, looked more like *Homo sapiens* than later Neanderthals—but it was the only one in the sample that did. So sometime either around or after that, something about the demands of Neanderthal life must have caused them to evolve longer finger bones with wider ends.

A 160,000-year-old Denisovan jawbone from the Xiahe site in China tells a different piece of that evolutionary story, but one that lines up well with what Denisova 3's little finger tells us. Some of the Denisovan jaw's features are very similar to those of Neanderthals, which suggests that both species inherited those features from their last common ancestor. But some features of Neanderthal jaws don't show up on the Denisovan version, which suggests that those features—like the differences in finger shape—probably emerged later on in response to different evolutionary pressures.

These look like subtle differences, but they’re clues about the kinds of evolutionary pressures that shaped Neanderthals, Denisovans, and our ancestors in small but ultimately important ways during the few tens of thousands of years when all three shared the planet. Someday, they may even reveal why we’re still here while the Neanderthals and Denisovans aren’t.

Science Advances, 2019. DOI: 10.1126/sciadv.aaw3950 (About DOIs).

https://arstechnica.com/?p=1561787