

Discovery of Oldest DNA Scrambles Human Origins Picture

Scientists reveal the surprising genetic identity of early human remains from roughly 400,000 years ago in Spain.



The bones were first thought to belong to European Neanderthals, but analysis showed they are genetically closer to the Siberian Denisovans.

PHOTOGRAPH BY JAVIER TRUEBA, MADRID SCIENTIFIC FILMS
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for [National Geographic](#)
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New tests on human bones hidden in a Spanish cave for some 400,000 years set a new record for the oldest human DNA sequence ever decoded—and may scramble the scientific picture of our early relatives.

Analysis of the bones challenges conventional thinking about the geographical spread of our ancient cousins, the early human species called [Neanderthals](#) and [Denisovans](#). Until now, these sister families of early humans were thought to have resided in prehistoric Europe and Siberia, respectively. (See also: "[The New Age of Exploration](#).")

But paleontologists write in a new study that the bones of what they thought were European Neanderthals appear genetically closer to the Siberian Denisovans, as shown by maternally inherited "mitochondrial" DNA found in a fossil thighbone uncovered at Spain's Sima de los Huesos cave.

"The fact that they show a mitochondrial genome sequence similar to that of Denisovans is irritating," says [Matthias Meyer](#) of Germany's Max Planck Institute

for Evolutionary Anthropology in Leipzig, lead author of the study, published Wednesday in [Nature](#).

"Our results suggest that the evolutionary history of Neanderthals and Denisovans may be very complicated and possibly involved mixing between different archaic human groups," he said.

Neanderthals and Denisovans arose hundreds of thousands of years before modern-looking humans spread worldwide from Africa more than 60,000 years ago. The small traces of their genes now found in modern humans are signs of interbreeding among ancient human groups.

Previously, the oldest human DNA sequenced came from bones that were less than 120,000 years old.

Meyer said stable temperatures in the cave helped preserve the mitochondrial DNA, and credited recent advances in gene-sequencing technology for establishing the basis for the new milestone.

Mixed Up or Mixing It Up?

For humanity's tangled past, the new mitochondrial DNA results raise an unexpected question: How does a Spanish early human species end up with Siberian DNA?

The authors propose several possible scenarios. For instance, Sima hominins could simply be close relatives of the Denisovans. But that would mean they lived right alongside Neanderthals without having close genetic ties to them.

The Sima hominins could also be a completely independent group that mingled with Denisovans, passing on their mitochondrial DNA, but it would be hard to explain why they also have Neanderthal features.

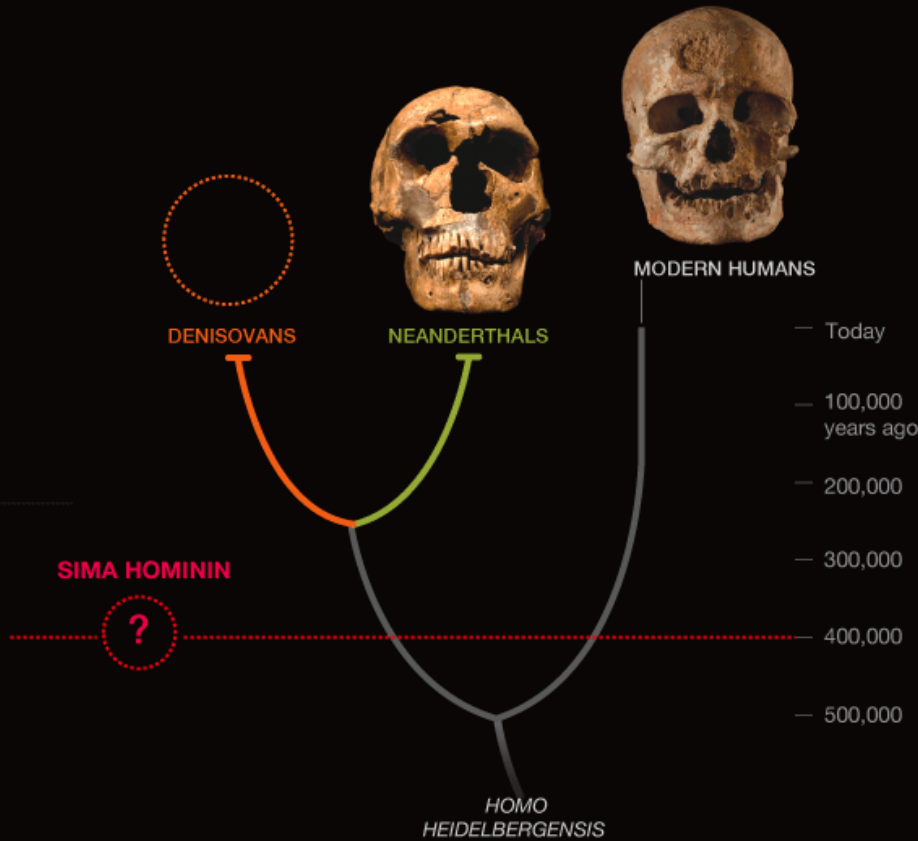
Another possibility, suggested by anthropologist [Chris Stringer](#) of the Natural History Museum in London, is that mitochondrial DNA from the Sima people reached the Denisovans thanks to interspecies sexual adventures among early humans, which introduced the DNA to both the Sima and Denisovans.

In the end, the identity of these ancient people remains a mystery, and further work is needed to clarify their identity. "The current genetic data [mitochondrial DNA] is too limited to conclude much about their population history," Meyer says.

As with the Denisovans, only the decoding of the full genetic map or genome, and not just the mitochondrial DNA, will provide convincing evidence of Sima family history, Meyer says.

The oldest human DNA

400,000-year-old bones found in a Spanish cave have yielded the oldest decoded human DNA. The DNA reveals a close genetic relationship with Denisovans, an archaic human group found in Siberia, rather than with the Neanderthals commonly found in Europe.



Discovered in an unexpected location

After the common ancestor of Neanderthals and Denisovans left Africa, the population split. Neanderthals spread into Europe, Denisovans into Asia. Unexpectedly, the specimen found in Spain appears more closely related to the Denisovans, only found before in Siberia.



New Piece of the Puzzle

In recent years, paleogeneticists have released [surprising reports about such early human species](#), notably [the interspecies breeding](#) that likely occurred among Neanderthals, Denisovans, and modern humans.

Uncovered only in 2010, Denisovans are known solely from a pinkie and a tooth found in 30,000- to 50,000-year-old rock layers in Siberia's Denisova cave. DNA from those Siberian bones first established their owners as genetically distinct from Neanderthals and modern people.

(Read "[The Case of the Missing Ancestor](#)" in *National Geographic* magazine.)

"The fact that the Sima de los Huesos [mitochondrial DNA] shares a common ancestor with Denisovan rather than Neanderthal [mitochondrial DNA] is unexpected in light of the fact that the Sima de los Huesos fossils carry Neanderthal-derived features," says the study.

But paleoanthropologist [John Hawks](#) of the University of Wisconsin, Madison, who was not part of the study, says "there's not really anything very surprising" about the Spanish bones' bearing mitochondrial DNA that is not an earlier version of Neanderthal genes.

Ancient mitochondrial DNA from many other species—"bison, mammoths, cave bears, and others"—doesn't resemble that of more recent species, he notes.

Hawks is more cautious than the study authors about regarding the Spanish genes and younger Denisovan ones as being closely related: "The difference between Sima and Denisova [gene] sequences is about as large as the difference between Neanderthal and living human sequences.

"It would not be fair to say that Denisova and Sima represent a single population, any more than that Neanderthals and living people do."

One reason for caution is that mitochondrial DNA results in the past have pointed scholars in errant directions; for example, some early studies suggested that humans and Neanderthals did not share any common ancestry.

Mitochondrial DNA is a small part of the human genome that is generally transmitted only through the female line, from mothers to offspring. This has important implications for the study of past events.

For instance, ancient interspecies breeding events might not be picked up by mitochondrial DNA.

But mitochondrial DNA can be transferred between species when interspecies mingling events occur. Such scenarios have been observed for other groups, such as polar and brown bears, where it has been found that interspecies breeding led to mixed-up mitochondrial genomes.

The Mountain of Bones

The [Atapuerca Mountains](#), where the human bones were found, is a world-famous archaeological site located in northern Spain; a group of caves there contain some of Western Europe's oldest known human remains.

The most famous of these caves, Sima de los Huesos, has been studied since 1997 and hosts more than 6,000 ancient bone samples belonging to 28 ancient humans that lived roughly 400,000 years ago. The exact origin of the bone pile is unclear.

"Could a natural catastrophe or carnivore activities explain the accumulation of so many bodies?" asks anthropologist Juan-Luis Arsuaga, a co-author of the study and lead excavator at the cave for the past 30 years. "Or were there hominins that accumulated the corpses of their relatives and friends in such a dark and remote place: a pit in a cave?"

"I would like to live to know the answer."

The bones of the Sima people share the features of Neanderthals, notably their thick-browed skulls, as well as the features of a much older group of human ancestors called *Homo heidelbergensis*, which lived about 600,000 years ago.

That species is also considered an ancestor of modern humans, Denisovans, and Neanderthals.