Archaeologists discover an ancient Neanderthal lineage that remained isolated for over 50,000 years

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Fossilized Neanderthal Thorin. Credit: Ludovik Slimak

A fossilized Neanderthal discovered in a cave system in the Rhône Valley, France, represents an ancient and previously undescribed lineage

that diverged from other currently known Neanderthals around 100,000 years ago and remained genetically isolated for more than 50,000 years.

Genomic analysis indicates that the Neanderthal, nicknamed "Thorin" in reference to the Tolkien character, lived between 42,000–50,000 years ago in a small, isolated community.

The discovery, published September 11 in the journal *Cell Genomics*, could shed light on the still-enigmatic reasons for the species' extinction and suggests that late Neanderthals had more population structure than previously thought.

"Until now, the story has been that at the time of the extinction there was just one Neanderthal population that was genetically homogeneous, but now we know that there were at least two populations present at that time," says first author and population geneticist Tharsika Vimala of the University of Copenhagen.

"The Thorin population spent 50,000 years without exchanging genes with other Neanderthal populations," says co-first author and discoverer of Thorin, Ludovic Slimak, CNRS researcher of Université Toulouse Paul Sabatier.

"We thus have 50 millennia during which two Neanderthal populations, living about ten days' walk from each other, coexisted while completely ignoring each other. This would be unimaginable for a Sapiens and reveals that Neanderthals must have biologically conceived our world very differently from us Sapiens."

Thorin's fossilized remains were first discovered in 2015 in Grotte Mandrin—a well-studied cave system that also housed early Homo sapiens, though not at the same time—and he is still being slowly excavated.

Based on Thorin's location within the cave's sediment, the team's archaeologists suspected that he lived around 40,000–45,000 years ago, making him a "late Neanderthal." To determine his age and relationships with other Neanderthals, the team extracted DNA from his teeth and jaw and compared his full genome sequence to previously sequenced Neanderthal genomes.

Surprisingly, the initial genomic analysis suggested that Thorin was much older than the archaeological age estimate because his genome was very distinct from other late Neanderthals and much more closely resembled the genomes of Neanderthals who lived more than 100,000 years ago.

"We worked for seven years to find out who was wrong—archaeologists or genomicists," says Slimak.

To solve this riddle, the researchers analyzed isotopes from Thorin's bones and teeth to gain insight into what type of climate he lived in—late Neanderthals lived during the Ice Age, while early Neanderthals enjoyed a much warmer climate. The isotopic analysis showed that Thorin lived in a very cold climate, making him a late Neanderthal.

"This genome is a remnant of some of the earliest Neanderthal populations in Europe," says population geneticist and senior author Martin Sikora of the University of Copenhagen. "The lineage leading to Thorin would have separated from the lineage leading to the other late Neanderthals around 105,000 years ago."

Compared to previously sequenced Neanderthal genomes, Thorin's genome most closely resembled an individual excavated in Gibraltar, and Slimak speculates that Thorin's population migrated to France from Gibraltar.

"This means there was an unknown Mediterranean population of Neanderthals whose population spanned from the most western tip of Europe all the way to the Rhône Valley in France," says Slimak.

Knowing that Neanderthal communities were small and insular could be key to understanding their extinction because isolation is generally considered to be a disadvantage for population fitness.

"It's always a good thing for a population to be in contact with other populations," says Vimala. "When you are isolated for a long time, you limit the genetic variation that you have, which means you have less ability to adapt to changing climates and pathogens, and it also limits you socially because you're not sharing knowledge or evolving as a population."

However, to really understand how Neanderthal populations were structured and why they went extinct, the researchers say that more Neanderthal genomes need to be sequenced.

"I would guess that if we had more genomes from other regions during this similar time period, we would probably find other deeply structured populations," says Sikora.

More information: Long genetic and social isolation in Neanderthals before their extinction, *Cell Genomics* (2024). DOI: 10.1016/j.xgen.2024.100593. www.cell.com/cell-genomics/ful … 2666-979X(24)00177-0

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