

Neanderthals may have faced extinction long before modern humans emerged

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Western Europe has long been held to be the "cradle" of Neanderthal evolution, and anthropologists have theorized that climatic factors or competition from modern humans were the likely causes when Neanderthals started disappearing around 30,000 years ago. But new research suggests that Western European Neanderthals were on the verge of extinction long before modern humans showed up.

This perspective comes from a study of ancient DNA carried out by an international research team. Rolf Quam, a Binghamton University anthropologist, was a co-author of the study led by Anders Götherström at Uppsala University and Love Dalén at the Swedish Museum of Natural History, and published in the journal *Molecular Biology and Evolution*.

"The Neanderthals are our closest fossil relatives and abundant evidence of their lifeways and skeletal remains has been found at many sites across Europe and western Asia," said Quam, assistant professor of anthropology. "Until [modern humans](#) arrived on the scene, it was widely thought that Europe had been populated by a relatively stable Neanderthal population for hundreds of thousands of years. Our research suggests otherwise and, in light of these new results, this long-held theory now faces scrutiny."

Focusing on mitochondrial DNA sequences from 13 Neanderthal individuals, including a new sequence from the site of Valdegoba cave in northern Spain, the research team found some surprising results. When they started looking at the DNA, a clear pattern emerged. Neanderthal individuals from Western Europe that were older than 50,000 years and individuals from sites in western Asia and the Middle East showed a high degree of genetic variation, on par with what might be expected from a species that had been abundant in an area for a long period of time. In fact, the amount of genetic variation was similar to

what characterizes modern humans as a species. In contrast, Neanderthal individuals from Western Europe that were younger than 50,000 years show an extremely reduced amount of [genetic variation](#), less even than the present-day population of remote Iceland.

These results suggest that Western European Neanderthals went through a demographic crisis, a population bottleneck that severely reduced their numbers, leaving Western Europe largely empty of humans for a period of time. The demographic crisis seems to coincide with a period of extreme cold in Western Europe. Subsequently, this region was repopulated by a small group of individuals from a surrounding area. The geographic origin of this source population is not clear, but it may be possible to pinpoint it further with additional study.

"The fact that Neanderthals in Western Europe were nearly extinct, but then recovered long before they came into contact with modern humans came as a complete surprise to us," said Dalén, associate professor at the Swedish Museum of Natural History in Stockholm. "This indicates that the Neanderthals may have been more sensitive to the dramatic climate changes that took place in the last Ice Age than was previously thought."

Quam concurs and suggests that this discovery calls for a major rethinking of the idea of cold adaptation in Neanderthals.

"At the very least, this tells us that without the aid of material culture or technology, there is a limit to our biological adaptation," Quam said. "It may very well have been the case that the European Neanderthal populations were already demographically stressed when modern humans showed up on the scene."

The results presented in the study are based entirely on degraded ancient DNA, and the analyses have therefore required advanced laboratory and computational methods. The

research team includes statisticians, experts on modern DNA sequencing and paleoanthropologists from Sweden, Denmark, Spain and the United States.

"This is just the latest example of how studies of ancient DNA are providing new insights into an important and previously unknown part of Neanderthal history," Quam said. "Ancient DNA is complementary to anthropological studies focusing on the bony anatomy of the skeleton, and these kinds of results are only possible with ancient DNA studies. It's exciting to think about what will turn up next."

More information: Love Dalén, Ludovic Orlando, Beth Shapiro, Mikael Brandström Durling, Rolf Quam, M. Thomas P. Gilbert, J. Carlos Díez Fernández-Lomana, Eske Willerslev, Juan Luis Arsuaga, and Anders Götherström. "Partial genetic turnover in neandertals: continuity in the east and population replacement in the west." *Mol Biol Evol.* first published online February 23, 2012 [DOI: 10.1093/molbev/mss074](https://doi.org/10.1093/molbev/mss074)

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