**An ancient affair: Neandertal woman and Denisovan man had a daughter together**

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*We sequenced the genome of a ~90,000-year-old individual and discovered that she had a Neandertal mother and a Denisovan father. This shows that people from different prehistoric hominin groups occasionally met, interacted, and had children together.*

In prehistoric times, at least two groups of hominins inhabited Eurasia: Neandertals, who lived throughout Europe and the Near East, and Denisovans, who likely lived in Asia. Genetically, Neandertals and Denisovans were more different from each other than any two people living today are, and both groups were distantly related to early modern humans, our own ancestors. Denisova Cave, an archaeological site in southern Siberia, is so far the only place in the world where fossils of both Neandertals and Denisovans have been found. In fact, it is the only place where Denisovans fossils have been found at all - making it a fascinating place to study these ancient hominins. Fortunately, ancient DNA tends to preserve well in this cave. Indeed, it has already been possible to reconstruct the complete genomes of a ~120,000-year-old Neandertal and a ~70,000-year-old Denisovan from bones excavated at the site.

One of the challenges of ancient DNA research is that fossils of ancient hominins are hard to come by. Thousands of bone fragments are excavated each year at Denisova Cave, but only about 5% of them are intact enough to potentially be identified as hominin bones based on their morphology. To circumvent this problem, one can use a method based on characterizing the proteins in ancient bones to tell apart human from animal remains. This method was applied to ~2,000 bone fragments from the site, out of which one, “Denisova 11”, was identified as part of a hominin skeleton. Based on its size, it was likely part of an arm or a leg bone of someone who was at least 13 years old. We sequenced the genome of this individual - first to determine whether the bone came from a Neandertal or a Denisovan, as these groups can be distinguished best based on their DNA, and then to explore what could we learn from it about the ancient population this individual came from.

The first step in the analysis was to check whether the DNA of Denisova 11 carried mostly Neandertal-like or mostly Denisovan-like genetic variants, to attribute the fossil to one of these two groups. To our surprise, we found that the genome contained both types of variants in almost equal proportions, indicating that Denisova 11 had both Neandertal and Denisovan ancestry. Such a signal of mixed ancestry could either be because Denisova 11’s parents were from a mixed population, or because one parent was a Neandertal, and the other, a Denisovan. To tell these apart, we compared the observed distributions of Neandertal-like and Denisovan-like variants to our expectations under these two possible scenarios, and noted that the second one, in which the parents originated from different groups, fitted the data best. We then added two more pieces of information to reconstruct Denisova 11’s “family tree”: first, that she was a female; and second, that her mitochondrial DNA - the small part of the genome that only mothers pass on to their offspring - was of the Neandertal type. We concluded that Denisova 11 was the daughter of a Neandertal mother and a Denisovan father.

We could then make use of Denisova 11’s mixed ancestry to investigate both her Neandertal side and her Denisovan side. We found that her mother, who lived ~90,000 years ago, was more closely related to a Neandertal that lived ~55,000 years ago in Croatia than to the ~120,000-year-old Neandertal from Denisova Cave. This indicates that Neandertals migrated between eastern and western Eurasia at least at one point in their history. We also discovered that her Denisovan father had small traces of Neandertal DNA in his genome, which we inferred came from at least one Neandertal ancestor that lived 300-600 generations before him.

In other words, in the genome of Denisova 11, we found evidence for multiple instances of mixing between Neandertals and Denisovans: once between her parents, and at least once in the genealogy of her father. Notably, such events could not have been too frequent, otherwise we would not be able to distinguish the two groups genetically. It is likely that the overlap between them was restricted, in space and in time, so that most individuals never had the opportunity to interact with someone from the other group during their lifetime. But when they did meet - the two groups clearly mixed. Taken together with previous evidence that Neandertals and Denisovans also mixed with ancient modern humans, the picture that emerges is that throughout history, different groups of humans have always mixed.

*Original article:*

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