DNA Turning Human Story Into a Tell-All

By ALANNA MITCHELL
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The tip of a girl's 40,000-year-old pinky finger found in a cold Siberian cave, paired with faster and cheaper genetic sequencing technology, is helping scientists draw a surprisingly complex new picture of human origins.

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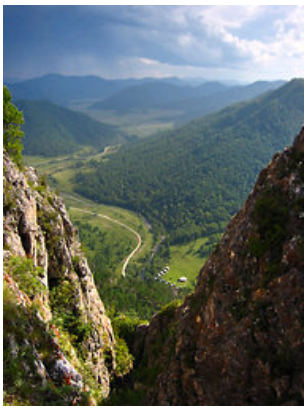


Johannes Krause

EARLY LAIR A view above the Denisova cave, where clues to prehistoric interbreeding were found. Faster technology is aiding research.

The new view is fast supplanting the traditional idea that modern humans triumphantly marched out of Africa about 50,000 years ago, replacing all other types that had gone before.

Instead, the genetic analysis shows, modern humans encountered and bred with at least two groups of ancient humans in relatively recent times: the Neanderthals, who lived in Europe and Asia, dying out roughly 30,000 years ago, and a mysterious group known as the Denisovans, who lived in Asia and most likely vanished around the same time.

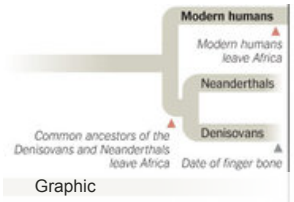
Their DNA lives on in us even though they are extinct. "In a sense, we are a hybrid species," Chris Stringer, a paleoanthropologist who is the research leader in human origins at the Natural History Museum in London, said in an interview.

The Denisovans (pronounced dun-EE-suh-vinz) were first described a year ago in a groundbreaking paper in the journal Nature made possible by genetic sequencing of the girl's pinky bone and of an oddly shaped molar from a young adult.

Those findings have unleashed a spate of new analyses.

Scientists are trying to envision the ancient couplings and their consequences: when and where they took place, how they happened, how many produced offspring and what effect the archaic genes have on humans today.

Multimedia



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Humans as Hybrids

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Other scientists are trying to learn more about the Denisovans: who they were, where they lived and how they became extinct.

A revolutionary increase in the speed and a decline in the cost of gene-sequencing technology have enabled scientists at the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, to map the genomes of both the Neanderthals and the Denisovans.

Comparing genomes, scientists concluded that today's humans outside Africa carry an average of 2.5 percent Neanderthal DNA, and that people from parts of Oceania also carry about 5 percent Denisovan DNA. A study published in November found that Southeast Asians carry about 1 percent Denisovan DNA in addition to their Neanderthal genes. It is unclear whether Denisovans and Neanderthals also interbred.

A third group of extinct humans, Homo floresiensis, nicknamed "the hobbits" because they were so small, also walked the earth until about 17,000 years ago. It is not known whether modern humans bred with them because the hot, humid climate of the Indonesian island of Flores, where their remains were found, impairs the preservation of DNA.

This means that our modern era, since H. floresiensis died out, is the only time in the four-million-year human history that just one type of human has been alive, said David Reich, a geneticist at Harvard Medical School who was the lead author of the Nature paper on the Denisovans.

For many scientists, the epicenter of the emerging story on human origins is the Denisova cave in the Altai Mountains of Siberia, where the girl's finger bone was discovered. It is the only known place on the planet where three types of humans — Denisovan, Neanderthal and modern — lived, probably not all at once.

John Hawks, a paleoanthropologist at the University of Wisconsin-Madison, whose lab is examining the archaic genomes, visited the cave in July. It has a high arched roof like a Gothic cathedral and a chimney to the sky, he said, adding that being there was like walking in the footsteps of our ancestors.

The cave has been open to the elements for a quarter of a million years and is rich with layers of sediments that may contain other surprises. Some of its chambers are unexplored, and excavators are still finding human remains that are not yet identified. The average temperature for a year, 32 degrees Fahrenheit, bodes well for the preservation of archaic DNA.

Could this cave have been one of the spots where the ancient mating took place? Dr. Hawks said it was possible.

But Dr. Reich and his team have determined through the patterns of archaic DNA replications that a small number of half-Neanderthal, half-modern human hybrids walked the earth between 46,000 and 67,000 years ago, he said in an interview. The half-Denisovan, half-modern humans that contributed to our DNA were more recent.

And Peter Parham, an immunologist at the Stanford University School of Medicine, has used an analysis of modern and ancient immune-system genetic components — alleles — to figure out that one of the Denisovan-modern couplings most likely took place in what is now southeastern China. He has also found some evidence that a Neanderthal-modern pair mated in west Asia.

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He stressed, however, that his study was just the first step in trying to reconstruct where the mating took place.

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