Ancient humans may have paused in Arabia for 30,000 years on their way out of Africa

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Credit: AI-generated image (disclaimer)

Most scientists agree modern humans developed in Africa, more than 200,000 years ago, and that a great human diaspora across much of the rest of the world occurred between perhaps 60,000 and 50,000 years ago.

In new research published in *Proceedings of the National Academies of Sciences*, we have uncovered dozens of distinctive historical changes in the human genome to reveal a new chapter in this story.

Our work suggests there may have been a previously unknown phase of humanity's great migration: an "Arabian standstill" of up to 30,000 years in which humans settled in and around the Arabian Peninsula. These humans slowly adapted to life in the region's colder climate before venturing to Eurasia and beyond.

The legacy of these adaptations still lingers. Under modern conditions, many genetic changes from this period are linked to diseases including obesity, diabetes, and cardiovascular disorders.

History in our genomes

Since the first human genome was published in 2000, the amount of human genomic data available has grown exponentially. These rapidly growing datasets contain traces of key events in human history. Researchers have been actively developing new techniques to find those traces.

When ancient humans left Africa and moved around the globe, they likely met new environments and challenges. New pressures would have led to adaptation and genetic changes. These changes would subsequently have been inherited by modern humans.

Previous research on genomic data shows ancient humans most likely left Africa and spread across the planet between 60,000 and 50,000 years ago.

However, we still don't know much about genetic adaptations during this crucial time period.

Ancient adaptation events

Our team of evolutionary and medical researchers has shed new light on this period. By studying both ancient and modern genomes, we have shown genetic selection was probably an important facilitator of this ancient human diaspora.

Using ancient human genomes makes it possible to recover evidence of past events in which specific genetic variants were strongly favored over others and swept through a population. These "hard sweep" events are surprisingly rare in modern human genomes, most likely because their traces have been erased or distorted by subsequent mixing between populations.

However, in earlier work we identified 57 regions in the human genome where an initially rare beneficial genetic variant effectively replaced an older variant in ancient Eurasian groups.

In our new study, we reconstructed the historical spread of these genetic variants. We also estimated the temporal and geographical origins of the underlying selection pressures.

Further, we identified the gene in each hard sweep region most likely to have been selected for. Knowing these genes helped us understand the ancient pressures that may have led to their selection.

Coping with cold

Our findings suggest early humans went through a period of extensive adaptation, lasting up to 30,000 years, before the big diaspora between 60,000 and 50,000 years ago. This period of adaptation was followed by rapid dispersal across Eurasia and as far as Australia.

We call this period the "Arabian standstill." Genetic, archaeological and climatic evidence all suggest these ancient humans were most likely living in and around the Arabian Peninsula.

The genetic adaptations involved parts of the genome related to fat storage, nerve development, skin physiology, and tiny hair-like fibers in our airways called cilia. These adaptations share striking functional similarities with those found in humans and other mammals living in the Arctic today.

We also detected similar functional similarities with previously identified human adaptive genes derived from historical mixing events with Neanderthals and Denisovans. These distant relatives of humans are also thought to have adapted to cold Eurasian climates.

Overall, these changes seem likely to have been driven by adaptation to the cool and dry climates in and around prehistoric Arabia between 80,000 and 50,000 years ago. The changes would also have prepared the ancient humans for the cold Eurasian climates they would eventually encounter.

Old adaptations, modern diseases

Many of these adaptive genes have links to modern diseases, including obesity, diabetes, and cardiovascular disorders. The adaptations around the human expansion from Africa may have established genetic variations that, under modern conditions, are associated with common diseases.

As we have suggested in another study, genes that were adaptive in the past might contribute to modern human susceptibility to various diseases. Identifying the genetic targets of historical adaptation events could help the development of therapeutic approaches and preventive

measures for contemporary populations.

Our findings contribute to a new but growing literature highlighting the importance of adaptation in shaping human history. They also show the growing potential of evolutionary genetics for medical research.

More information: Raymond Tobler et al, The role of genetic selection and climatic factors in the dispersal of anatomically modern humans out of Africa, *Proceedings of the National Academy of Sciences* (2023). DOI: 10.1073/pnas.2213061120

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