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The most detailed look yet at how early humans left Africa

Same pioneering ancestors
Mario Tama/Getty

By **Emily Benson**

All non-Africans living today can trace the vast majority of their ancestry to a group of pioneers who left Africa in a single wave, tens of thousands of years ago.

We still don't know the exact timing of that migration, precisely where it began, nor the details of movements and how individual populations developed within Africa.

But the discovery of a single exit is a major advance in illuminating the earliest days of humanity's global sprawl, says Joshua Akey at the University of Washington in Seattle.

"The more we understand about this particular event in human history, the more it provides a complete picture of our past," he says.

Modern humans arose in Africa, but where and when our earliest ancestors went next has been fiercely debated. Did they leave that continent in just a single wave, between 40,000 and 80,000 years ago, or in multiple pulses, beginning tens of thousands of years earlier?

Successful explorers

Archaeological finds show that humans were living outside Africa more than 100,000 years ago, Akey says, but many of these groups died out. The migrants who survived, however, passed their DNA to their descendants. To track those successful explorers, scientists turned to the genetic evidence buried in the cells of modern humans.

Developing a fuller picture of our ancestry requires the study of a range of diverse human populations. Collectively, the authors of three new studies took on that challenge by analysing the genomes of 787 people from more than 270 populations scattered across the globe.

Genetic similarities between populations show clear evidence for a single exit from Africa, says David Reich at Harvard University. Reich and his colleagues also determined that our African

ancestors had already begun diverging into separate groups 200,000 years ago.

The researchers also looked for a mutation that might have occurred between 50,000 and 80,000 years ago, when human technology and culture took off, with advances in art, burial rituals and tool use.

But the team failed to find a genetic smoking gun, suggesting that progress was instead propelled by an environmental or lifestyle change, Reich says.

“This genetics study sort of unseats genetics as a driving force behind the big changes,” he says.

Climate factor

Environmental conditions, such as temperature and plant growth, may have prompted some early human migrations (see box below). And geographical barriers such as mountains and deserts may have kept populations separate, perpetuating genetic differences around the world, according to another of the genetics studies, led by Luca Pagani and Mait Metspalu at the Estonian Biocentre in Tartu.

Pagani and Metspalu and their colleagues also concluded that most modern non-Africans are descended from a single, out-of-Africa migration. But about 2 per cent of the genome of people from Papua New Guinea comes from an earlier exodus, Pagani says.

“We see vestiges of an earlier out-of-Africa expansion,” Metspalu says. But, in the end, the main migration almost completely overwhelmed that small, early wave, he adds.

In the first comprehensive study of genetic diversity among Indigenous Australians, Eske Willerslev at the University of Copenhagen in Denmark and his colleagues found that different indigenous groups within Australia are genetically quite distinct, but that they are all descended from a single, founding wave of people from Africa.

Diabetes clues

Because Indigenous Australians are prone to diabetes, studying their DNA could explain the genetic drivers behind the disease, Willerslev says.

“They could potentially hold the key as to why other non-Africans also have diabetes,” he says.

That kind of medical insight is one reason to delve into humanity’s genetic history, says Akey.

Another is simple curiosity about where we came from. But solving that riddle will require contributions from fields outside genetics, too, Akey says, such as archaeology and ecology.

“People are just inherently interested in their past,” he says.

Journal references: *Nature*, DOIs: 10.1038/nature18299; 10.1038/nature18964; 10.1038/nature19792; 10.1038/nature19365

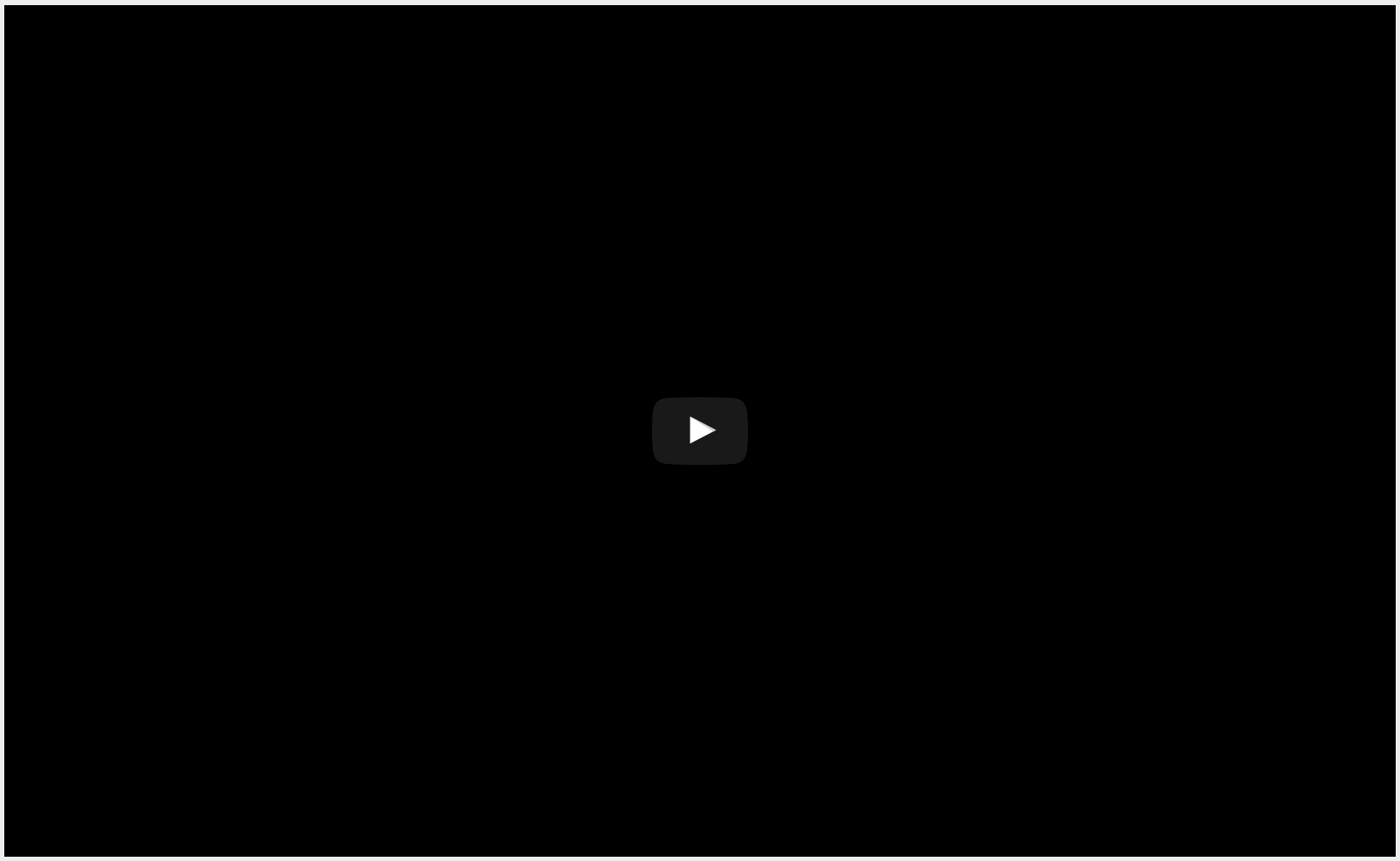
Greening of deserts opened up routes out of Africa

Three new papers suggest that most, if not all, modern non-Africans originate from a single out-of-Africa migration (see main story, above). But they do not exclude the possibility of other, earlier migrations of people who subsequently went extinct.

Another study published today suggests that climate change may have driven four distinct waves of early human migration out of Africa in the past 125,000 years.

The ancient explorers followed vegetation-rich “green” routes across regions of the Middle East that today largely consist of desert.

But the migrants could only leave when long-term variations in Earth’s orbit led to warm, wet conditions along these corridors. During intervening arid, glacial periods, they were trapped.



As a result, early humans may have ventured out across Europe and Asia in four “pulsed” migrations linked to climate change events that boosted monsoon rains.

The researchers used a computer model to study how past climate and sea-level change may have affected global migration patterns over the past 125,000 years.

They identified waves of migration across the Arabian Peninsula and Levant region during four periods: between 106,000 and 94,000 years ago; 89,000 to 73,000 years ago; 59,000 to 47,000 years ago; and 45,000 to 29,000 years ago.

In each of these “windows”, climate change led to wetter conditions in the Arabian and

Sinai Peninsulas, opening the gates for the migrants.

“The model simulates the overall dispersal of *Homo sapiens* in close agreement with archaeological and fossil data and features prominent glacial migration waves across the Arabian Peninsula and the Levant region,” write Axel Timmermann at the University of Hawaii at Manoa and his team. The findings show that changing climate related to periodic shifts in Earth’s orbit played a key role in shaping global population distributions, they say.

By Press Association