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## Across the mountains, into the wide world. Evidence of human expansion

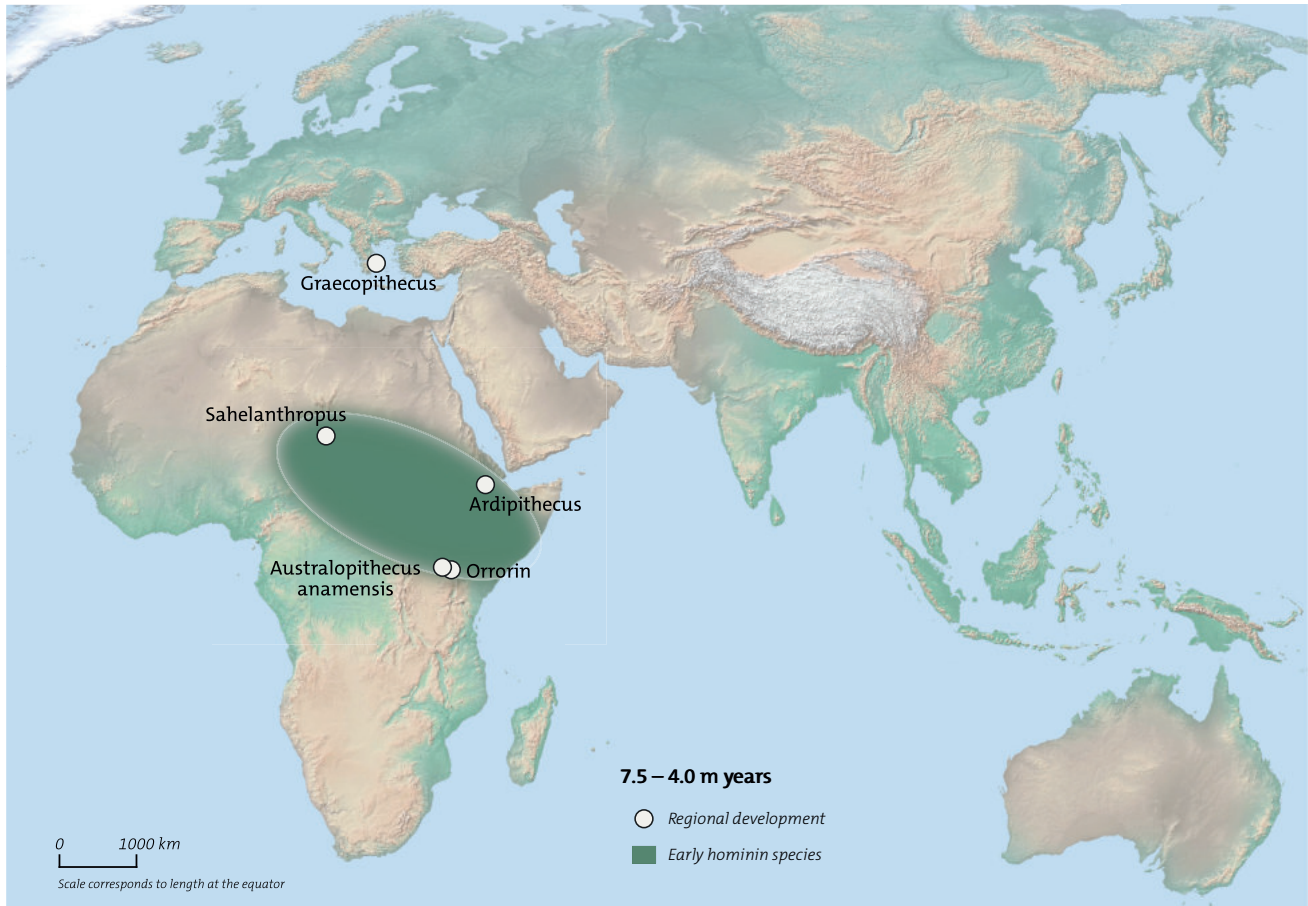
### Origin and expansion ideas

Just like the history of human cultural behavior, the associated history of human expansion across the world is subject to major changes. On the one hand, there have been many changes throughout the course of history: neither the cultural capabilities and their expression nor the course and speed of diffusion have remained the same. On the other hand, new discoveries and different approaches have shifted the perspective on the processes, so that the stories themselves had to be rewritten.

Charles Darwin's theories about the evolution of species and the recognition of the first fossil human remains in the Neander Valley near Düsseldorf about 150 years ago first allowed people to think about the possibility of pre-forms of modern humans from pre-biblical times. At the beginning of the 20<sup>th</sup> century, different forms from Asia (*Homo erectus*) and Europe (Neanderthals and *Homo heidelbergensis*) were known. However, when Raymond Dart presented the australopithecine child from Taung in 1925, the first hominin find from Africa as previously predicted by Darwin, no one wanted to believe in it. The idea of an early African origin of humankind was only accepted after the discovery of numerous additional finds from South and East Africa in the 1960s and 1970s. It was assumed that, following a worldwide dispersal, regional preforms evolved into *Homo sapiens*, the modern humans living today. In the 1980s, Africa came into focus as the singular region of origin of modern humans. Based on a new synopsis of the existing fossils, Günther Bräuer came to the same conclusion as Rebecca Cann and her colleagues based on initial genetic investigations: the common ancestors of our species, the genetic Eve, lived in Africa 200,000 years ago. In a second major expansion, Out-of-Africa II, between 60,000–40,000 years

**1** Around 3.5 million years ago, humans were walking upright:

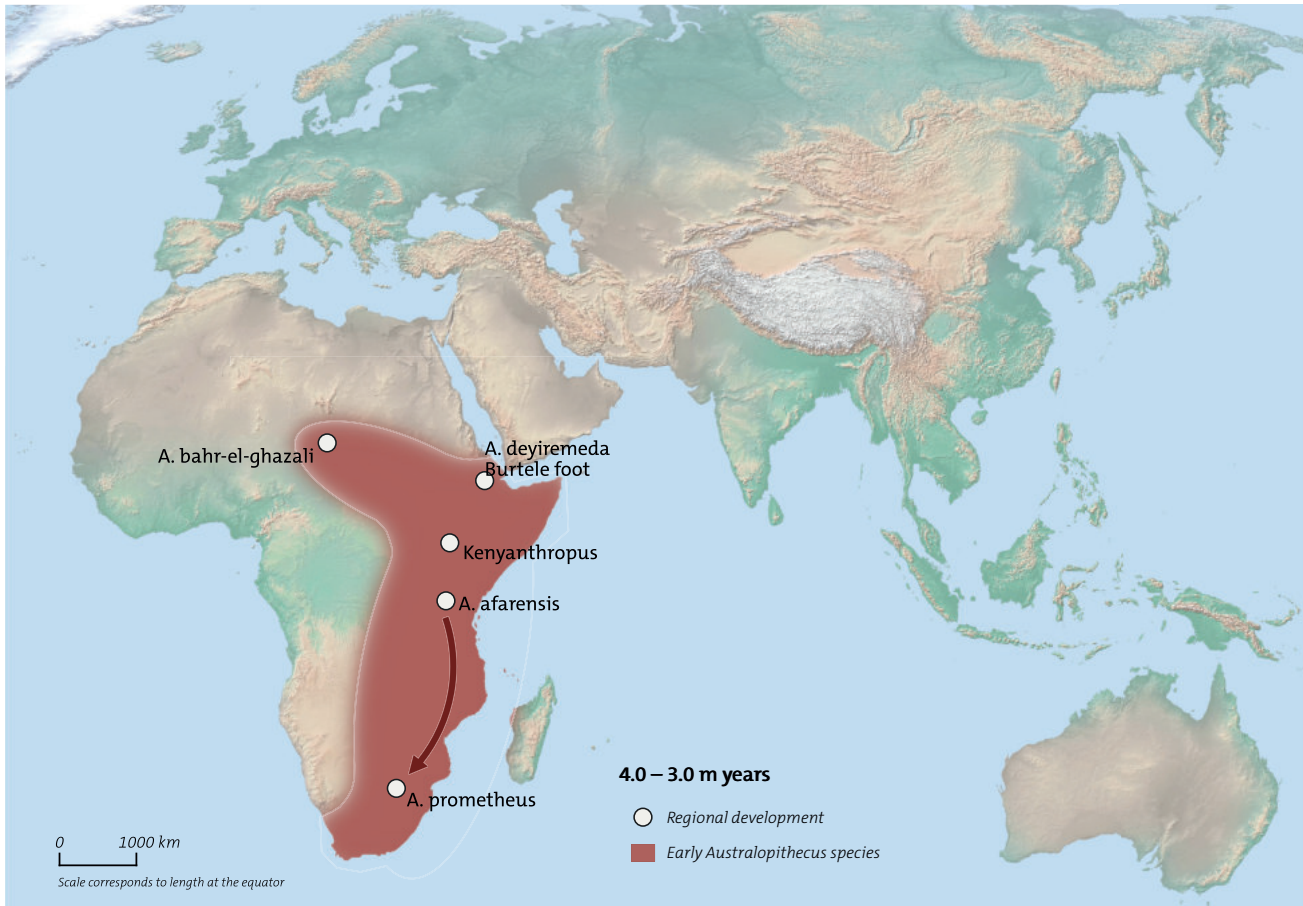
The cast of the Laetoli footprints clearly shows that the big toe was already aligned along the axis of the foot, as it is among humans today.



**2** Various forms of bipedal hominins are documented primarily from East Africa between 7.5 and 4 million years ago.

ago, anatomically modern humans displaced the original Neanderthal populations in Europe and *Homo erectus* in Asia. The first genetic studies on Neanderthals in the 1990s and 2000s seemed to confirm this picture.

Since 2010 our perception has changed yet again. Numerous fossil finds of known and newly discovered human species, improved dating methods, and more detailed genetic examinations of fossils indicate diverse expansion movements, regional origins of species, but also mixture of different human forms. Our species' past is much more complicated than previously believed.



## Beyond the known

Dispersal is not just dispersal. The geographic distribution of a species can change due to spatial shifts of the habitat. If the savanna grassland expands and pushes the forest back, savanna dwellers can spread out while forest dwellers retreat. Another possibility is the expansion into new habitats beyond the usual living conditions. This is not exclusive to humans but is a typical feature of the later human expansions. Targeted migrations, such as waves of emigration from Europe to America in the 19<sup>th</sup> century, are a relatively recent human phenomenon that is associated with the idea of a geographic destination.

As far as we can grasp them today, the early expansions of hominins and humans are not clearly defined events, but rather long-term processes, the exact courses of which are difficult to reconstruct. Early hominins inhabited a diverse habitat as early as 6 to 7 million years ago with patches of forests, palm groves, and grassy areas. A large part of their life took place on the ground and less and less in the trees. In the area of hominin distribution, a long-term trend towards

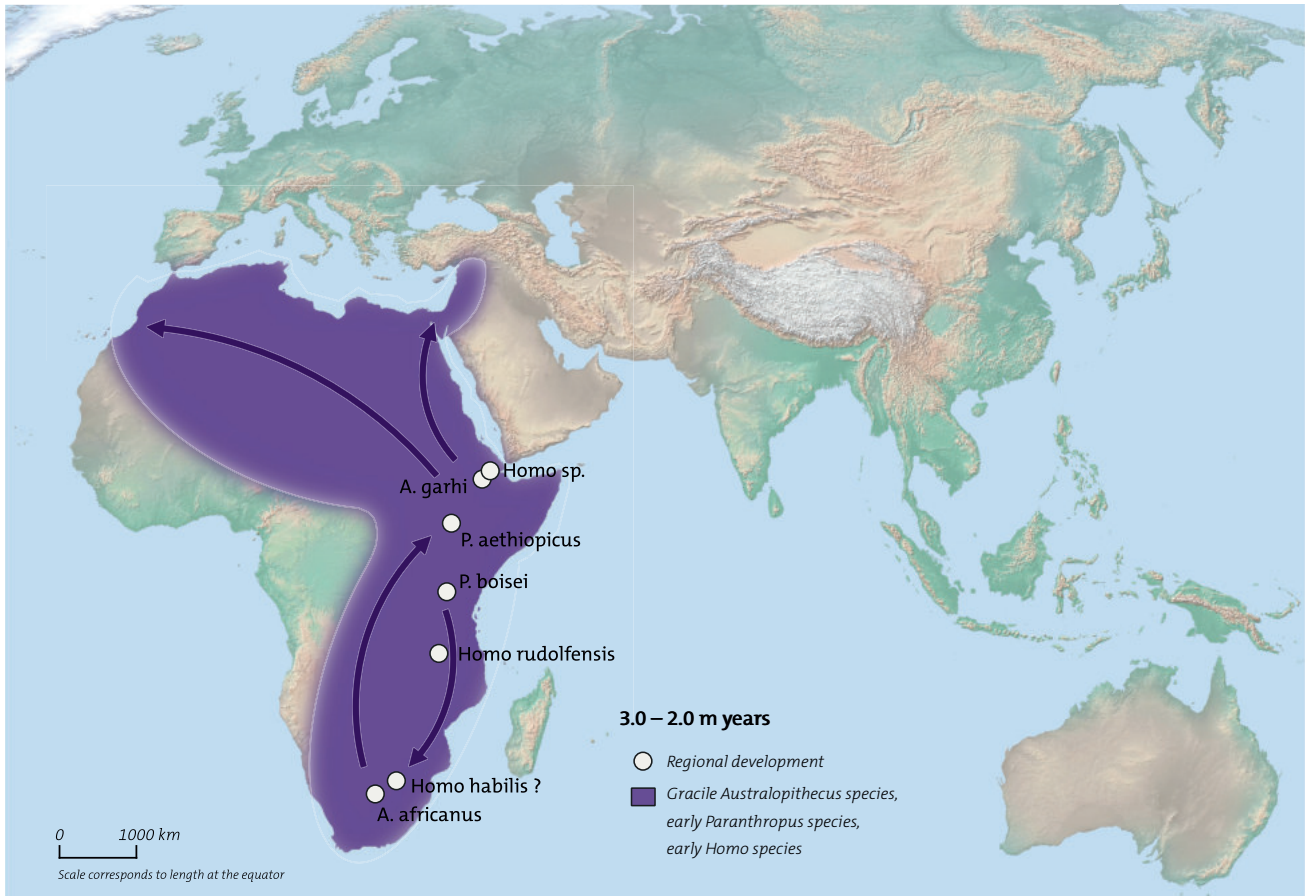
**3** The australopithecines developed and spread to South Africa between 4 and 3 million years ago.

*Fig. 2* a more open form of vegetation took place. The habitats became increasingly variable and localized with more as well as less dense tree cover, bush vegetation, and grasslands. We have too few finds from this early period to be able to retrace the expansions. But the early hominins already had properties that allowed them to cope with these environmental changes and thus to adapt to life in the changing habitats. *Graecopithecus freybergi*, *Sahelanthropus tchadensis*, *Orrorin tugenensis*, and *Ardipithecus kadabba* probably were not part of a single evolutionary line, but rather represented different parallel variations of bipedal locomotion. The function of the hands gradually changed in two ways: first, their role in locomotion, and thus their support function decreased. Secondly, improved fine motor skills in manipulating objects became more important—e.g., for the handling of tools and their manufacture.

### Various adaptations and a corridor to the south

Between 4 and 3 million years ago the climate continued to cool and seasonal differences increased. East Africa became increasingly dry, and the grasslands expanded. During this period, the genus *Australopithecus*, in which bipedalism generally prevailed, developed in East and Central Africa. Different behaviors and food preferences made it possible for different forms to survive in one habitat. The first *Australopithecus* finds from South Africa are dated up to 3.67 million years ago. It is assumed that the australopithecines were able to spread south from East Africa due to their increased flexibility.

*Fig. 3* Evidence from 3.3 million years ago points to a cultural innovation that brought about an expansion of the use of resources and shaped the whole of human history that followed. By using stone tools with sharp edges hominins were able to obtain parts of animal carcasses more easily and work on plants in different ways. It became easier to make use of different food options and thus to try out new methods. With the new technologies, the relationships with fellow hominins as sources of knowledge and experience also became more important. Both were beneficial as the environment continued to become drier and the variability of climatic conditions increased again around 2.8 million years ago. The continuous development of the East African rift system, with a lowering of the rift in a southerly direction and an uplifting of the rift shoulders, led to strong climatic differences between different regions. At times corridors opened or barriers formed, impacting the migration of animals and hominins between East and South Africa.



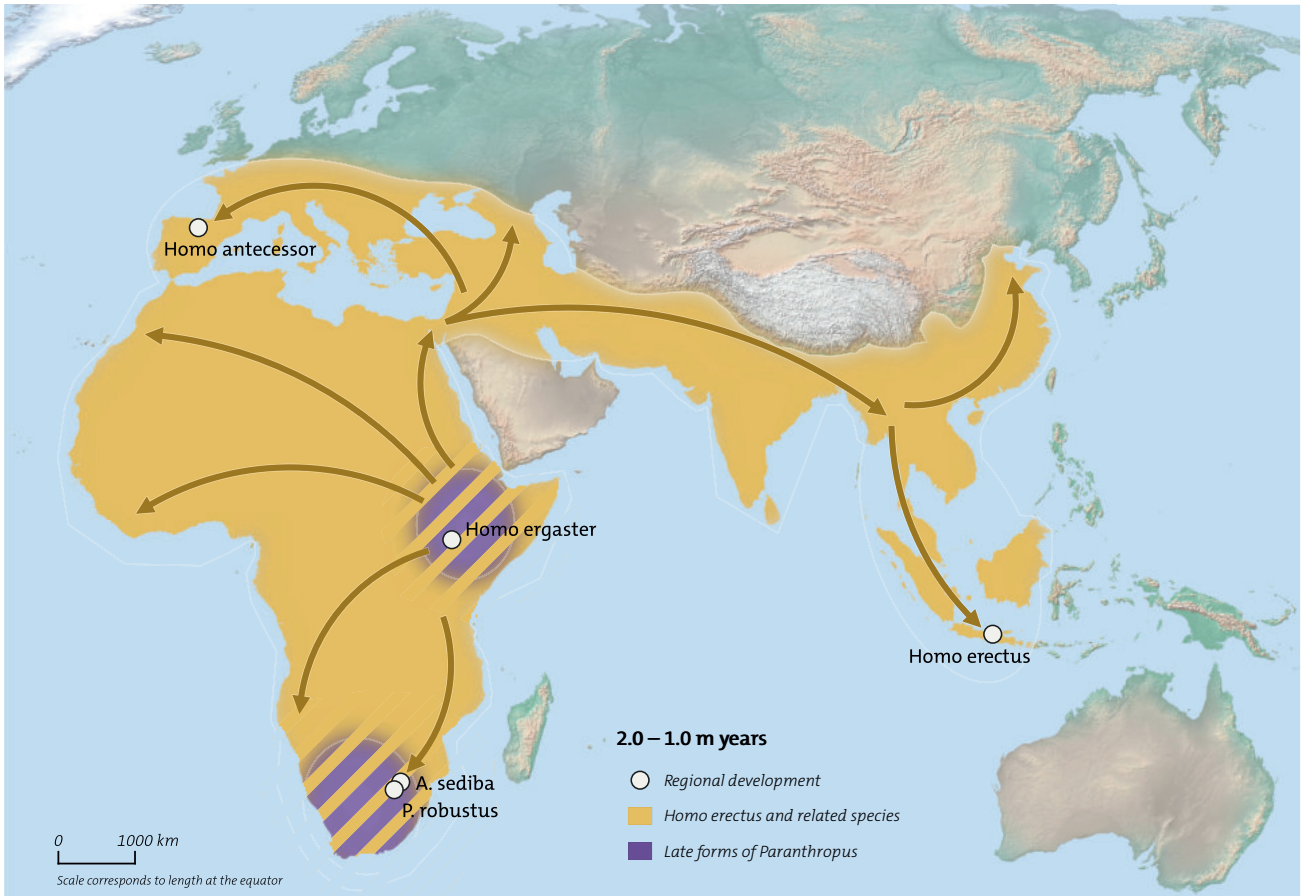
## Into uninhabited lands

In addition to the australopithecines, two new genera developed between 3 and 2 million years ago. While *Paranthropus* included robust specialists for chew-intensive plant foods such as grasses and sedges, *Homo* increasingly specialized in “non-specialization” with smaller teeth, flatter faces, a slightly enlarged brain,—and above all, an intensified use of tools. Representatives of the species *Homo* possessed everything that facilitated the spread into new habitats. Their physical characteristics allowed flexible locomotion for prolonged running as well as climbing. Due to the diversity of their diet, the requirements for a suitable habitat were lower. With their dexterity in handling various materials and tools, their social interactions, their increasing intellectual abilities, and, as a result of all this, their growing cultural possibilities, they were able to quickly adapt to new conditions. It was thus possible to advance into areas that did not exactly correspond to the African environment, and curiosity spurred them on to look over the next mountain.

**4** Between 3 and 2 million years ago, two new genera evolved: *Paranthropus* and *Homo*. Some of them spread to northern Africa.

Fig. 4



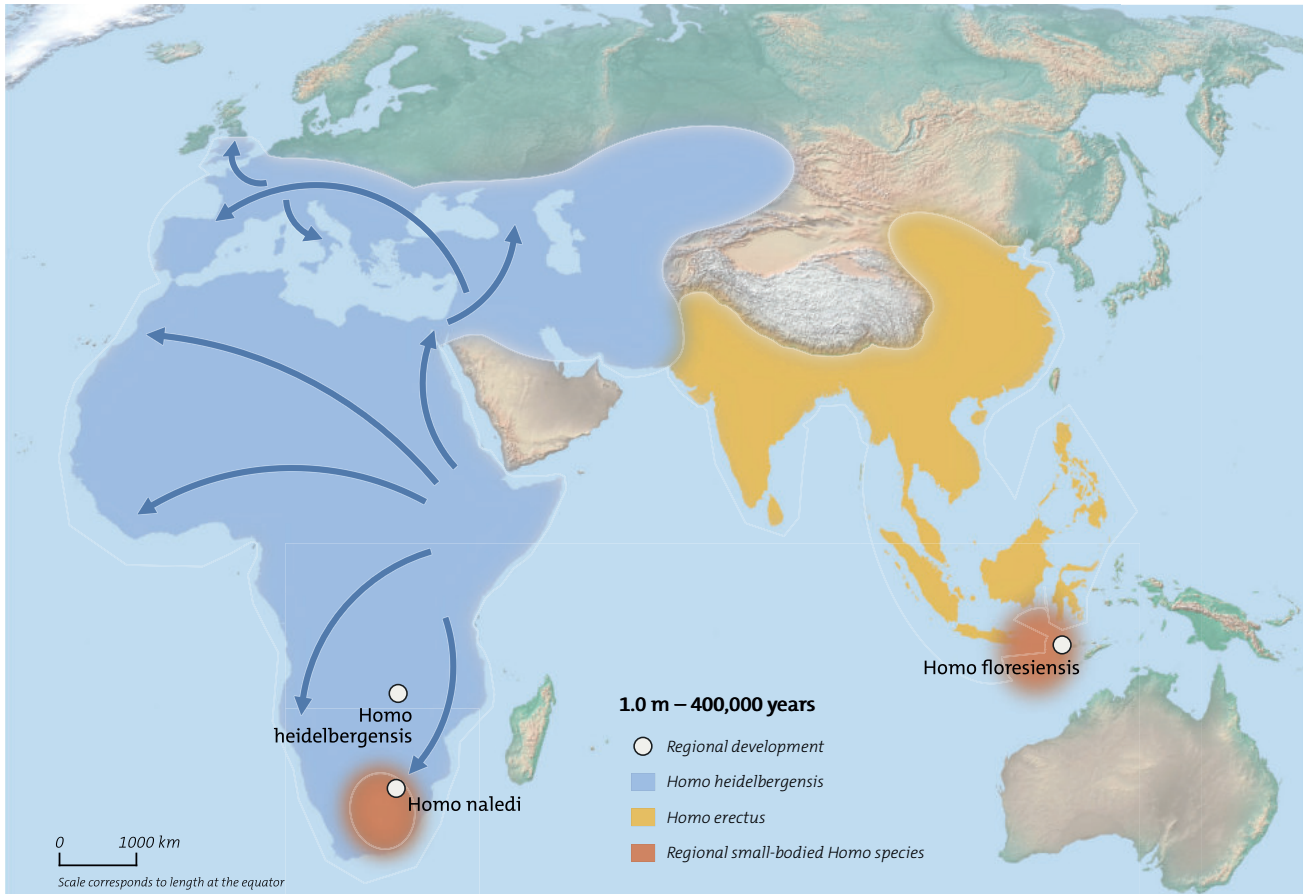


**5** Between 2 and 1 million years ago, *Homo erectus* and related species reached East Asia and Europe. *Australopithecus* and *Paranthropus* species still inhabited East and South Africa.

Recent archeological developments illustrate how dependent we are on individual finds and their dates when writing the history of human expansion. For almost 30 years, the 1.8 million-year-old Dmanisi site in Georgia with simple stone tools and human fossils was considered to represent the oldest evidence of the first spread of humans outside of Africa. Since 2018, the evidence for a much earlier expansion of *Homo* from their African core area is piling up: to North Africa with the up to 2.4-million-year-old Algerian site Ain Boucherit, to the Levant with the up to 2.48 million-year-old finds from the Jordanian Zarqa Valley, and—hardly later—to East Asia with the up to 2.1 million-year-old site of Shangchen in central China.

Due to the small number of finds and the approximate dating, it is difficult to say how fast humans spread into the areas outside of Africa that were previously uninhabited by humans. If we calculate an average shift in the explored territory of only 1 km per generation (approx. 20 years) in one direction, then it is easily possible to bridge 10,000 km in 200,000 years. Fossils and tool finds indicate a settlement of Java and northern China by *Homo erectus* from around

Fig. 5



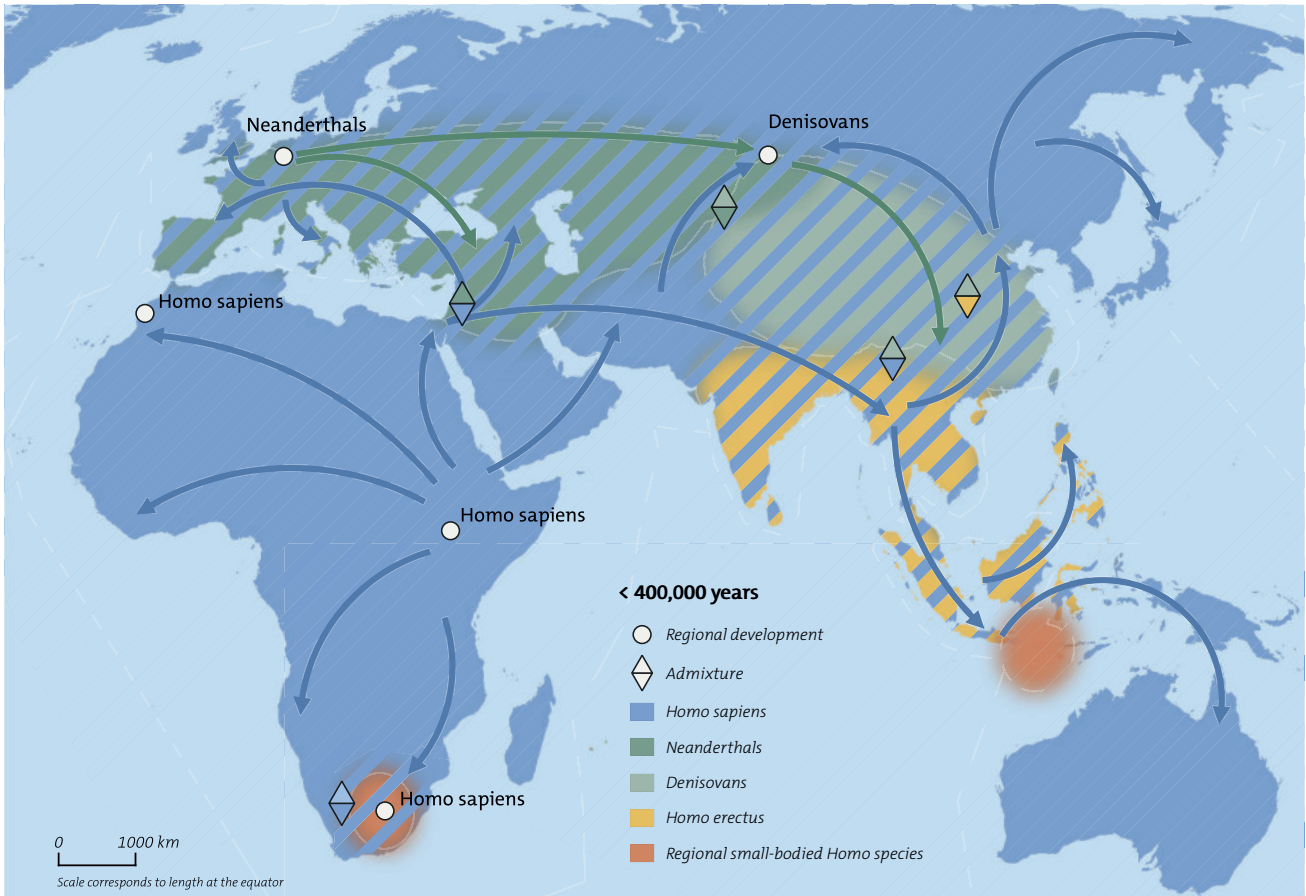
1.6 million years ago. The first finds in Europe come from the Mediterranean area from a time up to 1.2 to 1.4 million years ago. It was probably not a single expansion, but a gradual process of several spreading and retreating episodes. For East Asia, as for Europe, it remains unclear whether the finds are evidence for permanent settlements or only indications of recurring advances in times of favorable environmental conditions.

**6** Between one million and 400,000 years ago, *Homo heidelbergensis* spread from Africa to Europe and parts of Asia. Regional small-statured *Homo* species emerged in southern Africa and on the island of Flores in Southeast Asia.

## Diverse migrations

The spread into previously uninhabited areas is relatively easy to grasp using both fossils and artifacts. But once humans reached a specific region, it becomes more difficult. Do the later remains belong to a newly immigrated group or descendants of the first settlers? Were the new tool forms developed over time or were they imported from another region of origin? The first finds of a new stone tool technology in East Africa are around 1.75 million years old. With bifacial





**7** From 400,000 years ago Neanderthals developed in Europe, Denisovans in Asia, and *Homo sapiens* in Africa. Due to the different waves of expansions, it was not uncommon for them to mix. Today modern humans inhabit the whole earth.

Fig. 6

retouch of large blanks, *Homo* created easily manageable tools with coarse but stable edges: handaxes. Although this new, bifacial technique was used 1.5 million years ago at individual sites in the Levant and possibly in India, it only seems to have caught on around 600,000 years later in Asia and Europe. If this new technology was not invented independently in many places, the finds suggest a second and possibly also a third wave of expansion after one million years ago.

Global climatic fluctuations have intensified over the past one million years. Pronounced ice ages and warm periods alternated. The constantly changing conditions could hinder but also facilitate migrations. Deserts became impassable or greened, ice barriers arose and later gave way to dense forests, and vast cold steppes in Eurasia temporarily fed herds of large mammals. In many regions of the world, new human forms emerged that, like *Homo naledi* and *Homo floresiensis*, remained confined to small areas or spread, as is assumed for *Homo heidelbergensis* from Africa to Europe. Around 500,000 years ago, groups of people separated who later developed into Neanderthals in Europe and Denisovans somewhere in Asia. In Africa, *Homo sapiens* developed in parallel. New finds

from North Africa are more than 300,000 years old and include a mixture of old and new features, which suggest a slow development of our species, intertwined with the entire African continent.

## Africa again and again

The history of the spread of *Homo sapiens* was probably not as short and linear as was long thought. Early genetic influences on European Neanderthal groups and fossil finds from Greece and Israel already indicate their presence outside Africa around 200,000 years before today. The further spread probably took place in several waves. Around 120,000 years before today there is evidence from the Arabian Peninsula, around 80,000 years before today they may have reached China via India, finds from Southeast Asia date to around 70,000 years before today. On their journey through a world inhabited by other species, *Homo sapiens* mixed with these groups again and again. From around 40,000 years ago, anatomically modern humans became the predominant human form in Eurasia. And more than 50,000 years ago they began to develop the remaining uninhabited areas for themselves: Australia, the Subarctic and Arctic, then North and South America, and finally the Pacific Island world.

Fig. 7

The complex history of humankind can only be understood from a global perspective. Each continent made own contributions and all tie into the overall development. Africa, however, stands out. The first human colonization of Eurasia came from Africa, all of today's humans have origins in Africa, and many impulses came from there. Why does Africa play this special role? Paul Bons and colleagues have an amazing mathematical answer to this. Without any special environmental or other external factors, their model demonstrates how large, relatively densely populated areas can develop into large waves of expansion, which are accompanied by numerous smaller waves of migration. For millions of years, Africa was the largest region with relatively dense human settlement, which statistically makes it the most likely place of origin of today's humans. It could have been that simple.

#### Further reading

- Bellwood, P. (Hg.) 2013** The global prehistory of human migration (Chichester 2013).
- Bons, P. D./Bauer, C. C./Bocherens, H./de Riese, T./Drucker, D. G./Francken, M./Menéndez, L./Uhl, A./van Milligen, B. P./Wißing, C. 2019** Out of Africa by spontaneous migration waves. *PLoS One* 14(4), 2019, e0201998.
- Groucutt, H. S./Petruglia, M. D./Bailey, G./Scerri, E. M. L./Parton, A./Clark-Balzan, L./Jennings, R. P./Lewis, L./Blinkhorn, J./Drake, N. A./Breeze, P. S./Inglis, R. H./Devès, M. H./Meredith-Williams, M./Boivin, N./Thomas, M. G./Scully, A. 2015** Rethinking the dispersal of *Homo sapiens* out of Africa. *Evolutionary Anthropology* 24, 2015, 149–164.



# Homo sapiens neanderthalensis

## Discovery

In 1829, Philippe-Charles Schmerling discovered fossils in a cave near Engis near Liège (Belgium). But it was not until 1856 that William King identified them as a unique human species based on the remains from the Feldhofer Grotto in the Neander Valley near Düsseldorf. This discovery, together with Charles Darwin's 1859 publication on the theory of evolution, called the Christian creation myth into question.

## Sites

Europe: Belgium, Germany, France, Georgia, Italy, Croatia, Portugal, Spain, Czech Republic, Hungary, Poland, Romania.

Central Asia: Uzbekistan, Russia.

Middle East: Israel, Iraq, Syria, Turkey.

## Finds

nearly complete skeletons, especially skulls, spinal column, shoulder blade, arm and leg bones.

## Age

circa 175,000–30,000 years.

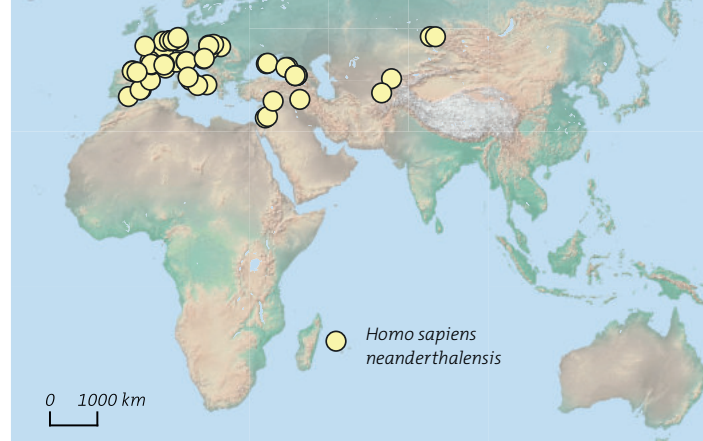
## Brain size

circa 1,200–1,740 cm<sup>3</sup>.

## Characteristics

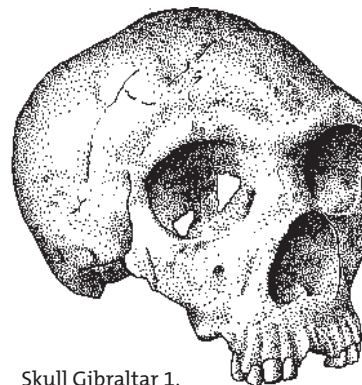
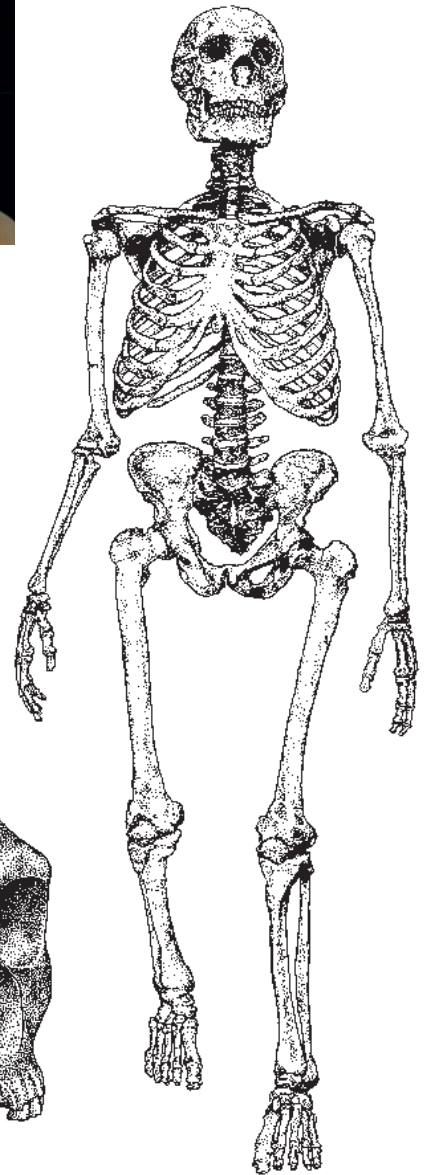
Neanderthals are the best known fossil humans due to the recovered remains of more than 300 individuals. Anatomically, they differ little from humans today. Overall, they were of somewhat stronger and stockier. Their skulls were large and relatively long, they had heavy brow ridges over the eyes, a relative wide nose, and no chin. The shape of the hyoid bone is evidence that they had the anatomical prerequisites that would enable them to speak. Their diet was very variable: based on isotope analyses of teeth, researchers generally assumed a very high proportion of meat. Tests on dental tartar from Spanish fossils provided evidence of a rich vegetable diet. Neanderthals used a wide range of tools. They created wooden handles for stone tools using birch pitch, were probably able to make fire, and used red ochre dye. There is evidence that they buried their dead. Genetic studies show that Neanderthals mixed with both *Homo sapiens* and Denisovans.

## Profile



Facial reconstruction

Reconstruction of the Skeleton, under use of La Ferrassie 1 (France) and Kebara (Israel)



Skull Gibraltar 1, Great Britain