

Review

A Short Review on the Origin and Migrations of Modern Humans (*Homo sapiens*)

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Approximately 200,000 years ago, early modern humans (*Homo sapiens*) appeared somewhere in Africa, and approximately 60,000 years ago, a few members of the early modern humans migrated from Africa to the rest of the world. Finally approximately 10,000 years ago, they were distributed almost all land surfaces of the globe. In the course of expansion, modern humans drove off pre-modern *Homo* that existed in various regions. However, recent genomic analysis of the nuclear DNA extracted from pre-modern *Homo* fossils revealed that some pre-modern *Homo* interbred with some modern humans and left their genes in our genomes.

Key words: human evolution, *Homo sapiens*, fossil, migration, interbreeding, DNA

Introduction to the Evolution of Hominid

Recent fossil and genetic evidences roughly agreed on the outline of hominid evolution as follows (1–4). Six or seven million years ago, the earliest hominin, *Sahelanthropus* evolved in Africa from the last common ancestor of chimpanzees and humans (5), (Fig. 1). They lived in forests, mainly ate fruits, moved on the trees using grasping hands and feet, and sometimes stood upright (Fig. 2).

Later, approximately five million years ago, the *Ardipithecus* appeared in Africa (6). They lived in open woodlands and developed occasional bipedal walking for collecting foods from widely scattered habitats, keeping the grasping ability of hands and feet for tree climbing. Approximately four million years ago, the *Australopithecus* appeared in Africa (7). They lived in open wood- and grasslands, and developed large molars to eat hard dry foods. They also developed facultative bipedal walking using arched feet and wide pelvis, resembling those of the later *Homo*. Their brain size was almost same as or a little larger than those of modern chimpanzees, one third of our own. They might have lost thick hair covering in order to evaporate sweat.

Approximately two million years ago, *Homo erectus*

appeared in Africa. They lived in open grasslands and developed long distant running ability, using elongated legs and regulation of body temperature through perspiration on naked skins. They not only collected various types of foods but also hunted animals, using simple stone tools. Later, they migrated from Africa to the temperate areas of Eurasia. Their brain capacity was about two thirds of modern humans. Although, their jaws and teeth were variable in size, their masticatory apparatus gradually decreased.

Further, approximately six hundred thousand years ago, *Homo heidelbergensis* appeared in Africa. They migrated from Africa to even cooler to colder areas of Eurasia. Their brain size was a little less than or almost same as those of modern humans. They used specialized stone tools and fire and the size of jaws and teeth were decreased.

Modern Human Evolution in Africa

Early modern humans or *Homo sapiens* evolved from *Homo heidelbergensis* approximately 200,000 years ago in Africa. Evidence of this evolutionary step can be found in the fossils of *Homo sapiens idaltu* discovered in Ethiopia, which were dated approximately 160,000 years ago (8). Among them, an adult male skull possessed a stout but orthognathic face and a large brain capacity of 1,450 cm³ and is considered as one of the representative ancestors of later modern *Homo sapiens*. Early modern humans in Africa probably had a slender body and dark skin, which is similar to present day Africans.

Archeological evidence, such as shell beads and pieces of engraved ocher unearthed from 80,000 years old soil layers at the Blombos Cave in South Africa, indicates that the behavior of present day humans was already almost fully developed in that age.

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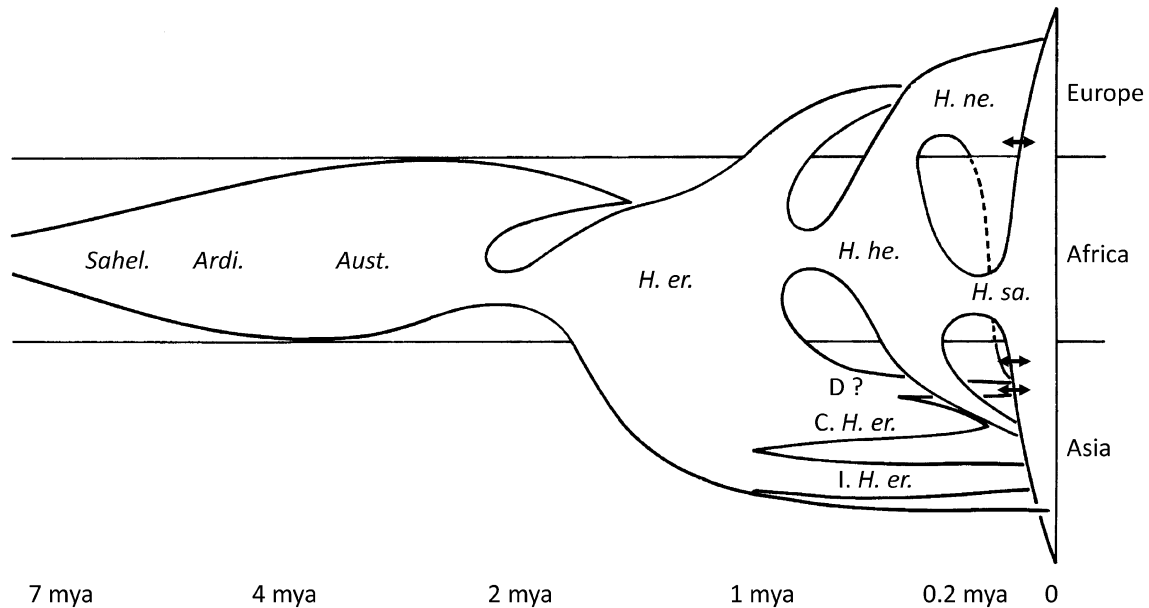


Fig. 1. Scheme of hominid evolution and dispersals. Chronological ages from 7 million years ago to present are indicated below. Areas were divided into three, Europe (upper), Africa (middle), and Asia including Australia and Americas (lower). Arrows indicate interbreeding between pre-modern *Homo* and *Homo sapiens* (modern humans). *Sahel.*, *Sahelanthropus*; *Ardi.*, *Ardipithecus*; *Aust.*, *Australopithecus*; *H. er.*, *Homo erectus*; *H. he.*, *Homo heidelbergensis*; *H. ne.*, *Homo neanderthalensis*; *H. sa.*, *Homo sapiens*; *D?*, ancestors of Denisovans; *C. H. er.*, Chinese *Homo erectus*; *I. H. er.*, Indonesian *Homo erectus*.

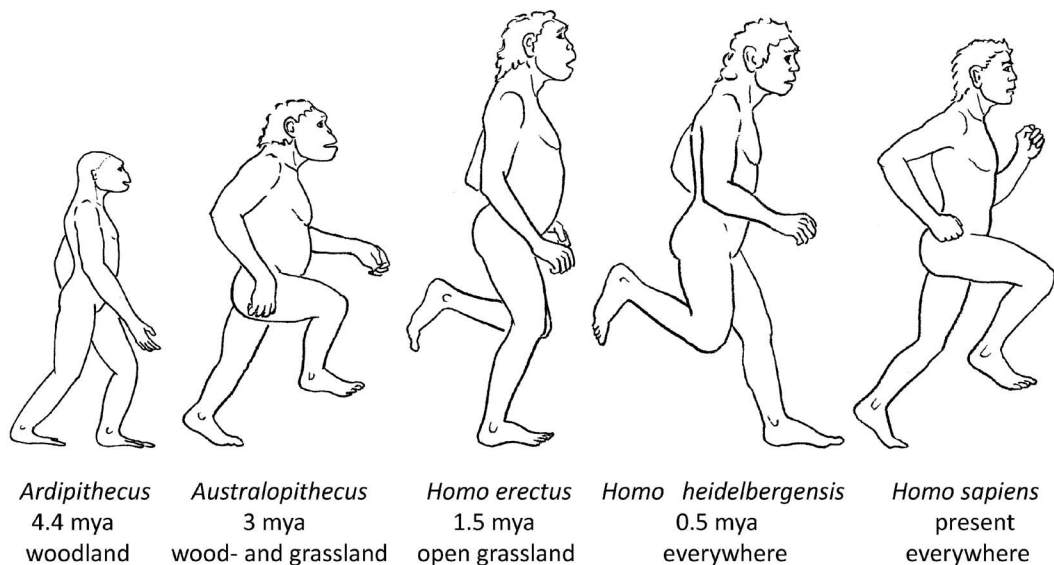


Fig. 2. Reconstructed images of hominid evolution. Representative genus and species are illustrated. Chronological ages (million years ago) and main habitats are indicated below.

Modern Human Dispersals in the World

Approximately 60,000 years ago, a few groups of early modern humans migrated from Africa to Eurasia, subsequently to the rest of the world (Fig. 3). They had a creative and strategic mind and invented new technologies (e.g., sophisticated stone tools, needles, and tight clothes), which made their survival possible in various

harsh environments of the world (9).

They first migrated eastward to South and Southeast Asia and reached Australia and adjacent areas approximately 40,000 or 45,000 years ago and probably retained the same physical features they had in Africa (3). Then, approximately 40,000 years ago, the people in Southeast Asia moved to East Asia, including the

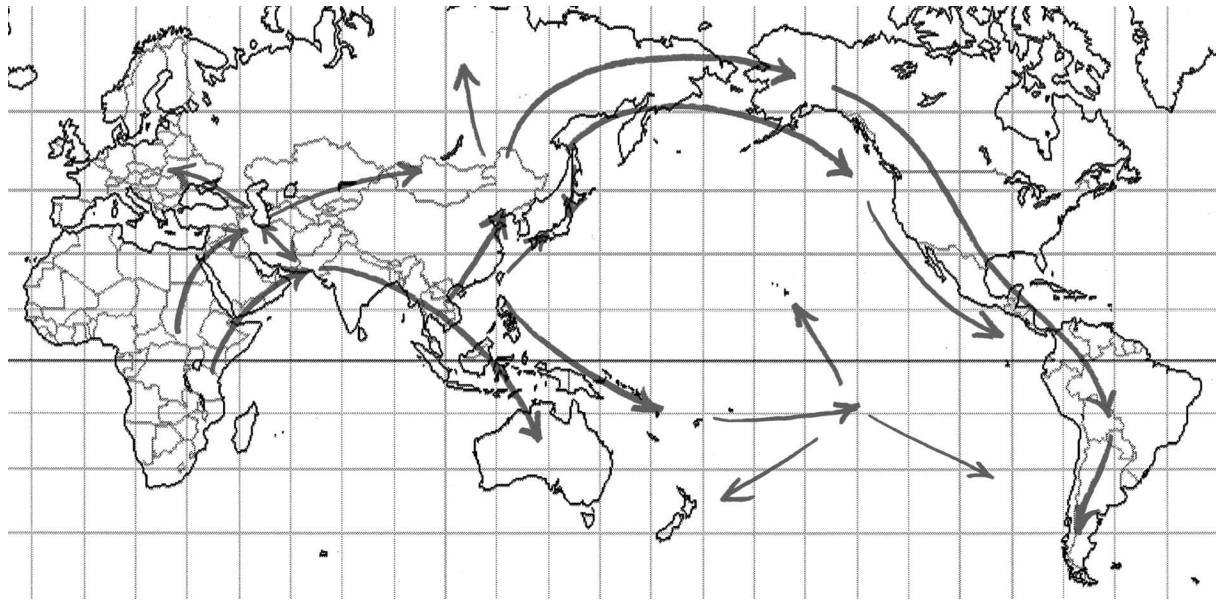


Fig. 3. Migrations of modern humans. Approximately 60,000 years ago, *Homo sapiens* or modern humans migrated from Africa to the rest of the world. Arrows indicate supposed migration routes.

Japanese islands. They gradually developed lighter skin color and stocky body. Early modern humans also migrated westward to Europe approximately 45,000 years ago. Later, they developed very light skin color and more or less stocky body.

During the migration, modern humans drove off pre-modern *Homo* populations living in various regions of Eurasia, e.g., Asian *Homo heidelbergensis*, Indonesian *Homo erectus*, and European *Homo neanderthalensis* (3). Approximately 15,000 years ago, modern humans in Northeast Asia migrated to North America and finally reached the southern end of South America approximately 10,000 years ago.

Interbreeding between Modern Humans and Pre-modern *Homo*

Most anthropologists believed that interbreeding between two populations of different species did not occur during the course of human evolution. However, it is now known that Neanderthals and early modern humans interbred tens of thousands of years ago.

Mitochondrial DNA extracted from Neanderthal bones indicates that Neanderthals and modern humans diverged approximately 500,000 years ago, and there were no clear evidence of interbreeding between Neanderthals and modern humans (10).

However, in 2010, the nuclear DNA extracted from a piece of Neanderthal fossil found in the Vindija cave in Croatia indicated that Neanderthals shared 1–4% of their DNA with Asian and European modern humans (11). This means that some of the people that spread out from Africa to Eurasia tens of thousands years ago

(Asians, Australians and Europeans) interbred with Neanderthals, whereas the people that remained in Africa (sub-Saharan Africans) did not interbreed with Neanderthals.

Furthermore, there is evidence that interbreeding occurred between older pre-modern *Homo* and modern humans. This was revealed by the discovery of a human bone approximately 40,000 years old unearthed from Denisova Cave in the Altai Mountains of Central Asia. Nuclear DNA extracted from the bone indicates that the people of Denisova Cave (Denisovans) have diverged from the ancestor of modern humans approximately 800,000 years ago (12). That is, the Denisovans could be an older pre-modern *Homo* distinct from Neanderthals.

It is, however, more astonishing that the comparison of the nuclear DNA of Denisovans with modern human groups revealed that modern Melanesians share 4–6% of their genome with the Denisovans. Therefore, when modern humans were migrating from Africa to Asia, the ancestor of Melanesians interbred with the Denisovans surviving in Central Asia.

If we could acquire some Neanderthal DNA by interbreeding, it would be most interesting to know which characteristics present in modern humans were influenced by Neanderthals.

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