



# Language Evolution WiSe 2023/2024

## Lecture 2: Human Evolution I Hominin Fossils

26/10/2023, Christian Bentz



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# Overview

## Section 1: Introduction

## Section 2: Taxonomy

- Modern Taxonomy

- Biological Time

- Geological Time

- Exercise

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- Genus Kenyanthropus

- Genus Australopithecus

- Genus Paranthropus

- Genus Homo

- Summary: Hominin Fossils

## Section 4: Classification

- Taxonomic Considerations

## References



## Section 1: Introduction



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<https://www.youtube.com/watch?v=DZv8VyIQ7YU>



## Section 2: Taxonomy



# Modern Taxonomy (as of 2000)

Table 1. *a. A taxonomy of the living higher primates that recognises the close genetic links between Pan and Homo*

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Superfamily Hominoidea ('hominoids')  
  Family Hylobatidae  
    Genus *Hylobates*  
  Family Hominidae ('hominids')  
    Subfamily Ponginae  
      Genus *Pongo* ('pongines')  
    Subfamily Gorillinae  
      Genus *Gorilla* ('gorillines')  
    Subfamily Homininae ('hominines')  
      Tribe Panini  
        Genus *Pan* ('panins')  
      Tribe Hominini ('hominins')  
        **Subtribe Australopithecina ('australopiths')**  
          Genus *Ardipithecus*  
          Genus *Australopithecus*  
          Genus *Paranthropus*  
        Subtribe Hominina ('hominans')  
          Genus *Homo*

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Wood & Richmond (2000), p. 21.

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## Hominoids

*'Hominoids'* (lat. *hominoidae*) refer to all species after our LCA (last common ancestor) with gibbons, orangutans, gorillas, and chimpanzees.



Table 1. *a. A taxonomy of the living higher primates that recognises the close genetic links between Pan and Homo*

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Superfamily Hominoidea ('hominoids')
Family Hylobatidae
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Genus <i>Pongo</i> ('pongines')
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Genus <i>Gorilla</i> ('gorillines')
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Genus <i>Homo</i>

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Wood & Richmond (2000), p. 21.

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## Hominids

'Hominids' (lat. *hominidae*) refer to all species after our LCA (last common ancestor) with orangutans, gorillas, and chimpanzees.

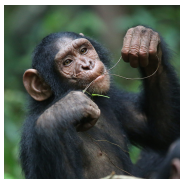


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Wood & Richmond (2000), p. 21.

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## Hominines

‘*Hominines*’ (*lat. homininae*) refer to all species after our LCA (last common ancestor) with chimpanzees (**including** chimpanzees).



Table 1. *a. A taxonomy of the living higher primates that recognises the close genetic links between Pan and Homo*

---

Superfamily Hominoidea (‘hominoids’)
Family Hylobatidae
Genus <i>Hylobates</i>
Family Hominidae (‘hominids’)
Subfamily Ponginae
Genus <i>Pongo</i> (‘pongines’)
Subfamily Gorillinae
Genus <i>Gorilla</i> (‘gorillines’)
Subfamily Homininae (‘hominines’)
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Tribe Hominini (‘hominins’)
<b>Subtribe Australopithecina (‘australopiths’)</b>
Genus <i>Ardipithecus</i>
Genus <i>Australopithecus</i>
Genus <i>Paranthropus</i>
Subtribe Hominina (‘hominans’)
Genus <i>Homo</i>

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Wood & Richmond (2000), p. 21.



## Hominins

*'Hominins'* (lat. *hominini*) refer to all species after our LCA (last common ancestor) with chimpanzees (**excluding** chimpanzees).



Table 1. *a. A taxonomy of the living higher primates that recognises the close genetic links between Pan and Homo*

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Superfamily Hominoidea ('hominoids')
Family Hylobatidae
Genus <i>Hylobates</i>
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Genus <i>Pongo</i> ('pongines')
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Genus <i>Gorilla</i> ('gorillines')
Subfamily Homininae ('hominines')
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Subtribe Hominina ('hominans')
Genus <i>Homo</i>

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Wood & Richmond (2000), p. 21.



## Hominans

‘*Hominans*’ (lat. *hominina*) refer to all species after our LCA (last common ancestor) with australopiths, that is, Genus *Homo*. The earliest representative typically being *Homo habilis*.



Table 1. a. A taxonomy of the living higher primates that recognises the close genetic links between Pan and Homo

---

Superfamily Hominoidea (‘hominoids’)
Family Hylobatidae
Genus <i>Hylobates</i>
Family Hominidae (‘hominids’)
Subfamily Ponginae
Genus <i>Pongo</i> (‘pongines’)
Subfamily Gorillinae
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Subtribe Hominina (‘hominans’)
Genus <i>Homo</i>

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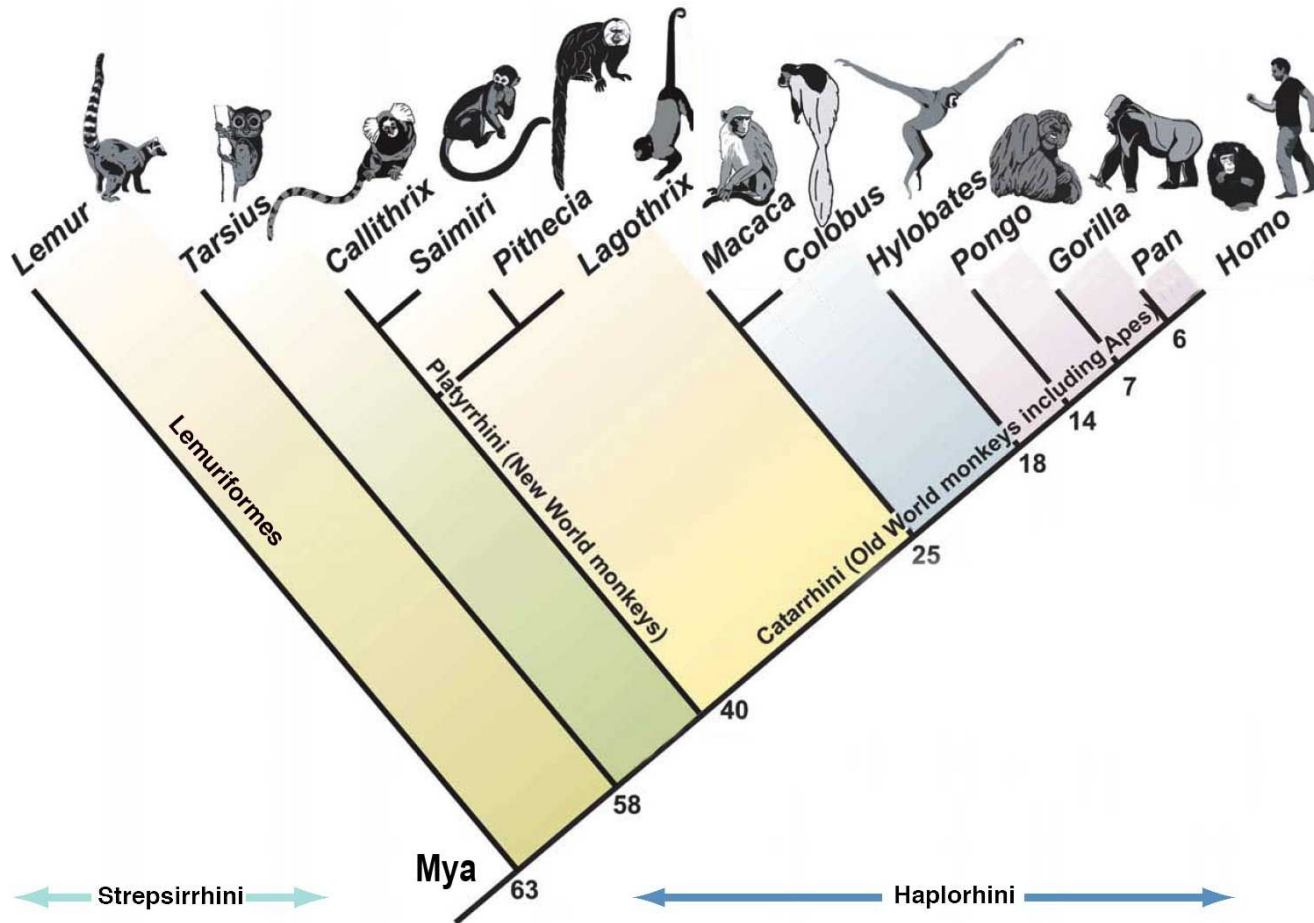
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References

Wood & Richmond (2000), p. 21.



## Biological Time (Primates)



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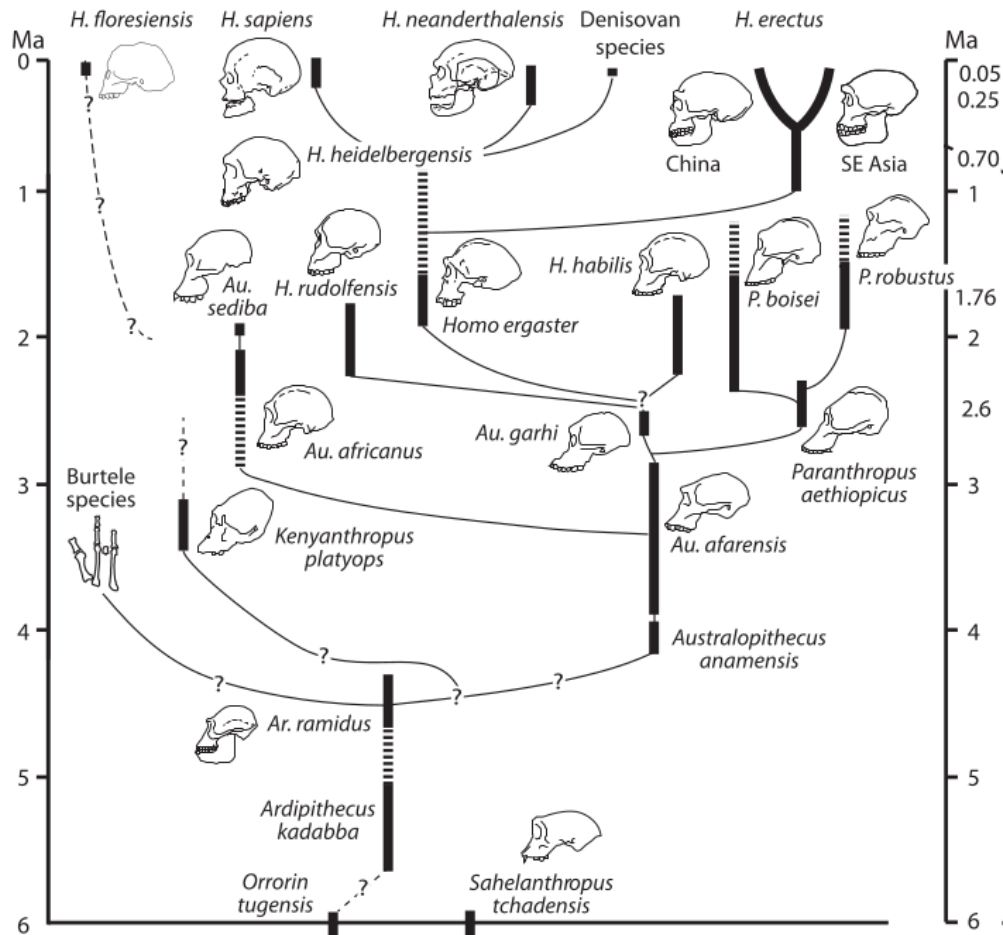
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<http://anthropologyiselemental.ua.edu/osteology.html>



## Biological Time (Hominins)



Klein (2017), p. 206.

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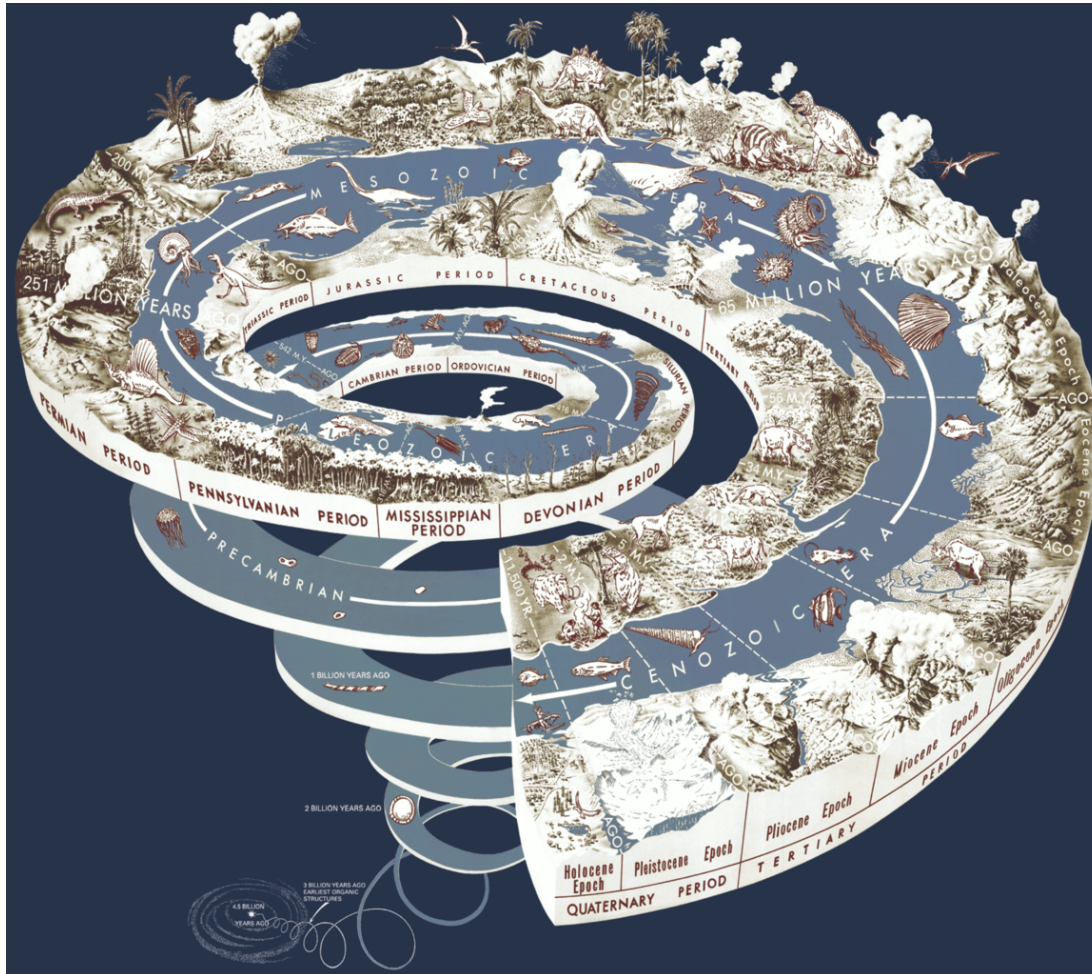
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# Geological Time



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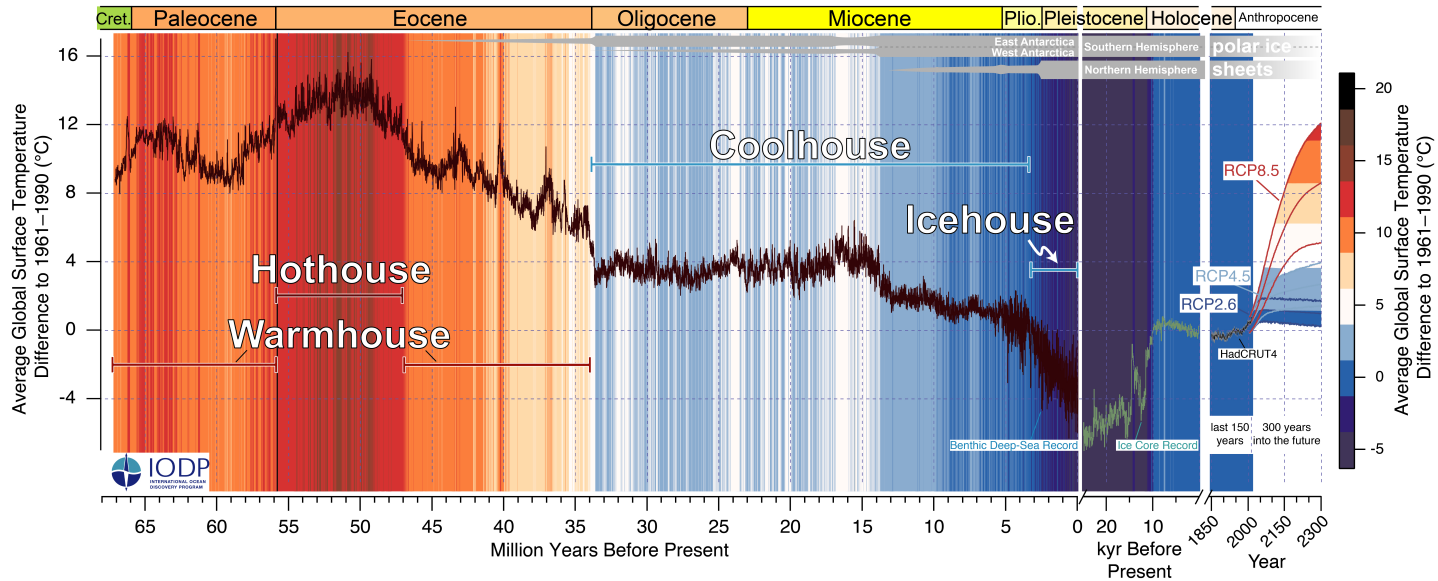
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<https://pubs.usgs.gov/gip/2008/58/>



# Climate



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<https://www.esc.cam.ac.uk/about-us/news/record-earths-cenozoic-climate-reveals-role-of-polar-ice>



# Geological Time

Era	Period	Epoch	Ma	Some Proposed Firsts
CENOZOIC	Quaternary	Holocene	0	0.006 First cities
			0.011 First farmers	
	Pleistocene		0.012 First people in the Americas	
			0.05 First fully modern humans	
			0.20 Oldest firm evidence for fire	
			1.6–1.4 First hominins in Eurasia	
	Pliocene		2.6 Oldest stone artifacts & <i>Homo</i>	
			4.1 Oldest known <i>Australopithecus</i>	
	Miocene		7-5 First hominins (humans <i>sensu lato</i> )	
			23.3 20–17 Oldest known monkeys & apes	
Oligocene			34 35–30 Oldest known higher primates	
	Eocene		50 Oldest known primates of modern aspect	
Paleocene			56.5 65.5 First primates	
	MESOZOIC	Cretaceous		120 First placental mammals
			145.5 160 First birds	
Jurassic			199.5 220 First mammals & dinosaurs	
		Triassic		251 299 300 First reptiles
PALEOZOIC	Permian			359.2 370 First amphibians
			416 443.7 475 First vertebrates (fish)	
	Carboniferous		488.3 550 First chordates	
		Devonian		542 800 First multicellular life (sponges, algae)
	Silurian			1400 First nucleated cells (eukaryotes)
		Ordovician		3500 First unicellular life (prokaryotes)
Cambrian			4000 First complex organic molecules	
	PRECAMBRIAN (= PROTEROZOIC and before)		4600 4600 Origin of solar system & Earth	
		15,000 Origin of the Universe		

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Klein (2009), p. 21.





## Solutions

Given the definitions on the slides above, fill in the following table:

<b>Taxon</b>	<b>Age (in Mya)</b>	<b>Era</b>	<b>Period</b>	<b>Epoch</b>
Hominoid	c. 18 Mya	Cenozoic	Tertiary	Miocene
Hominid	c. 14 Mya	Cenozoic	Tertiary	Miocene
Hominin	c. 6 Mya	Cenozoic	Tertiary	Miocene
Genus Homo	c. 2 Mya	Cenozoic	Tertiary	Pliocene
Homo sapiens	c. 200 Kya	Cenozoic	Quaternary	Pleistocene

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## Section 3: The Hominin Fossils



# Hominin Genera and Species (before genus Homo)

- ▶ Sahelanthropus
  - ▶ Sahelanthropus tchadensis
- ▶ Kenyanthropus
  - ▶ Kenyanthropus platyops
- ▶ Genus Australopithecus
  - ▶ Australopithecus afarensis
- ▶ Genus Paranthropus
  - ▶ Paranthropus boisei

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# Genus *Homo* and its Species

- ▶ Genus *Homo*
  - ▶ *Homo habilis*
  - ▶ *Homo ergaster*
  - ▶ *Homo erectus*
  - ▶ *Homo heidelbergensis*
  - ▶ *Homo neanderthalensis*
  - ▶ *Homo sapiens*
  
- ▶ Newer Discoveries
  - ▶ *Homo naledi*
  - ▶ Denisovans
  - ▶ *Homo floresiensis*
  - ▶ *Homo luzonensis*
  - ▶ *Homo longi*

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# Sahelanthropus tchadensis (Holotype: TM 266-01-060-1)

## Profile

### Genus:

Sahelanthropus

### Species:

Sahelanthropus  
tchadensis

### Age:

c. 6-7 Mya

### Location:

Chad, Central Africa



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Brunet et al. (2002) A new hominid from the Upper Miocene of Chad, Central Africa.



# Kenyanthropus platyops (Holotype: KNM-WT 40000)

## Profile

### Genus:

Kenyanthropus

### Species:

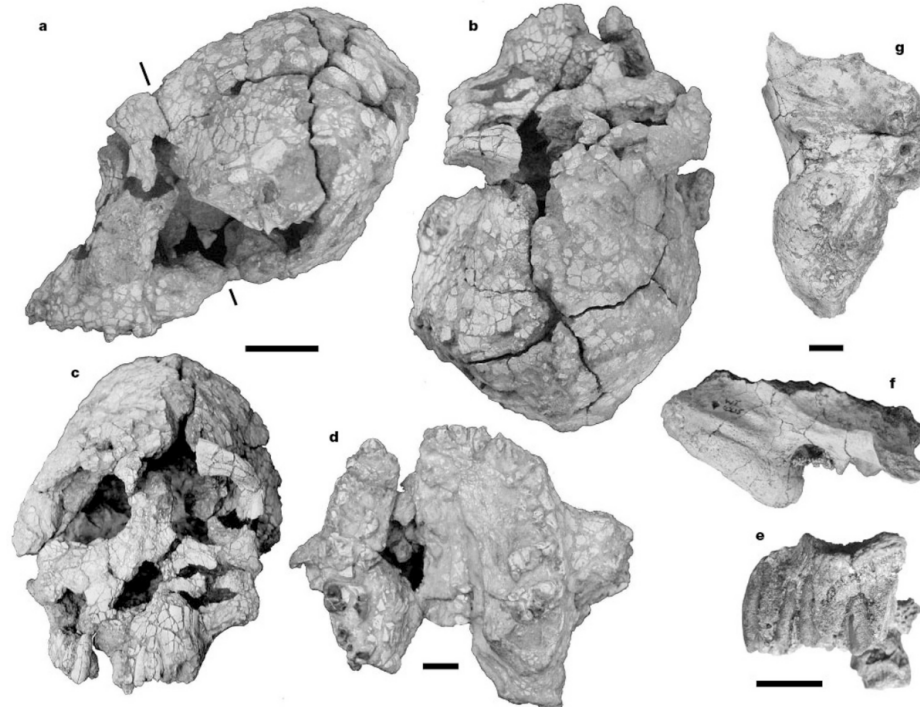
Kenyanthropus  
platyops

### Age:

c. 3.5 Mya

### Location:

Lomekwi 3, Lake  
Turkana, Kenya



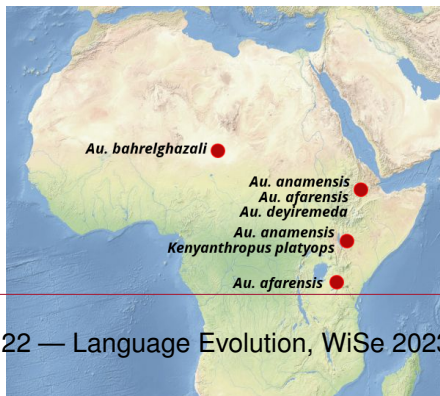
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Leakey et al. (2001) New hominin genus from eastern Africa shows diverse middle Pliocene lineages.



# Australopithecus afarensis (Holotype: LH-4)

## Profile

### Genus:

Australopithecus

### Species:

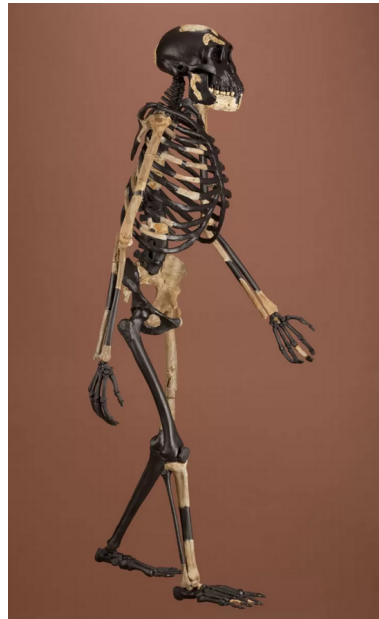
Australopithecus  
afarensis

### Age:

c. 2.9-3.9 Mya

### Location:

Laetoli, Tanzania



Australopithecus afarensis, "Lucy", reconstructed skeleton (Chip Clark, Smithsonian Institution)

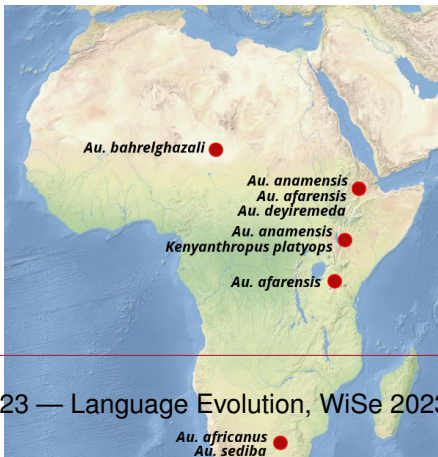
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Johanson, White & Coppens (1978). A new species of the genus australopithecus (Primates: Hominidae) from the Pliocene of Eastern Africa.

Johanson & Edey (1981) Lucy, the beginnings of humankind.



# Paranthropus boisei (Holotype: OH-5)

## Profile

### Genus:

Paranthropus

### Species:

Paranthropus boisei

### Age:

c. 1.15-2.5 Mya

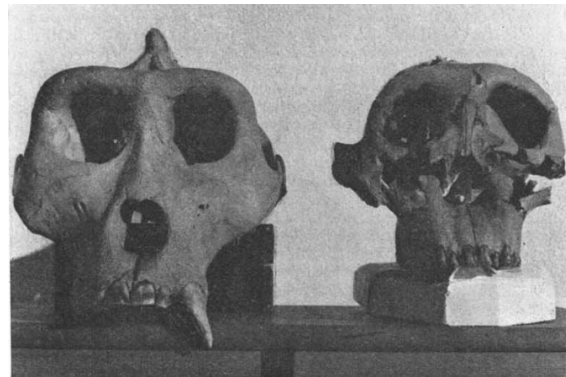
### Location:

Olduvai

Gorge, Tanzania



Exhibit in the Springfield Science Museum, Massachusetts, USA.



Gorilla skull (left) compared to the holotype of *P. boisei* (right).

Leakey (1959). A new fossil skull from Olduvai.

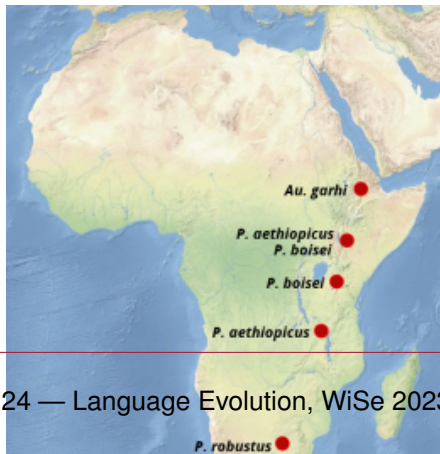
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## Homo habilis (Holotype: KNM ER 1813)

### Profile

**Genus:**

Homo

**Species:**

Homo habilis

**Age:**

c. 2.3-1.6 Mya

**Location:**

Koobi Fora, Kenya



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Leakey et al. (1964). A new species of genus Homo from Olduvai Gorge.

Leakey (1974). Further evidence of Lower Pleistocene hominids from East Rudolf, North Kenya, 1973.



## Homo ergaster (erectus in Africa) (Holotype: KNM ER 992)

### Profile

#### Genus:

Homo

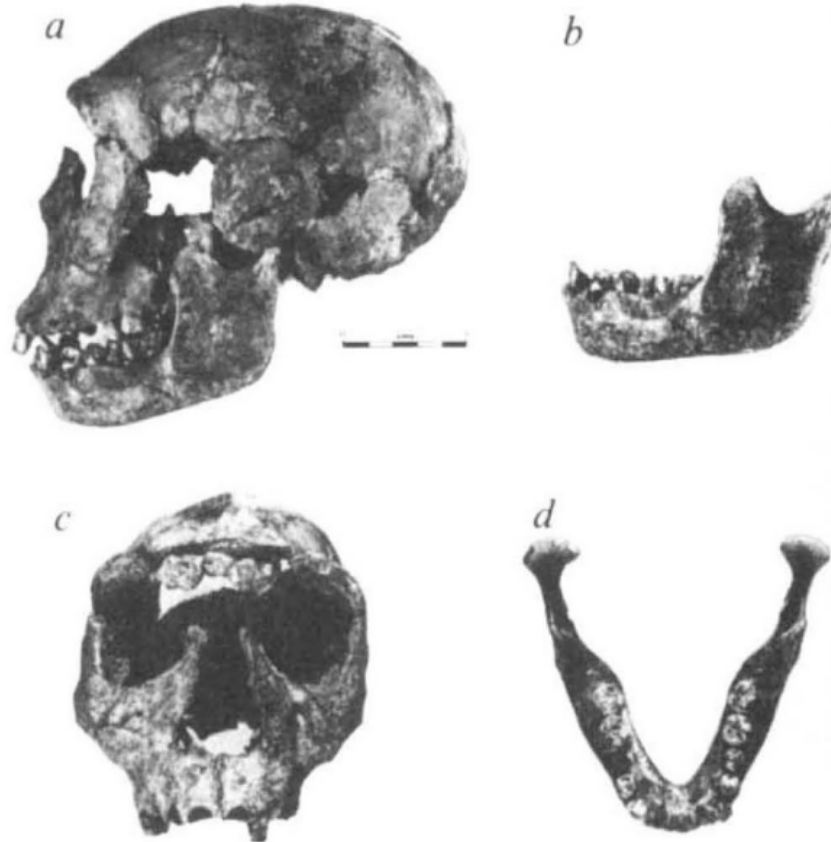
#### Species:

Homo ergaster

#### Age:

c. 1.7-1.4 Mya

**Location:** Lake  
Turkana, Kenya



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Not the holotype but fossil KNM-WT 15000, called “Turkana boy”.

Brown et al. (1985). Early Homo erectus skeleton from west Lake Turkana, Kenya.



## Homo erectus (Holotype: Trinil2 and Trinil3)

### Profile

**Genus:**

Homo

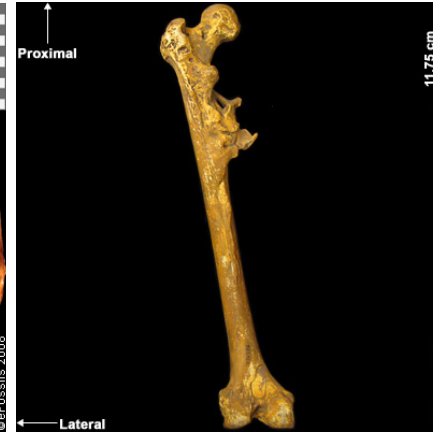
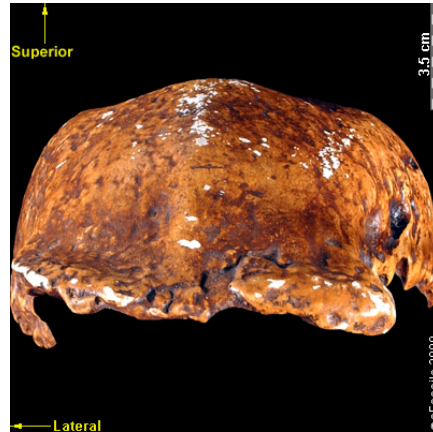
**Species:**

Homo erectus

**Age:**

c. 2 Mya - 100 Kya

**Location:** Trinil, Java



Holotype fossils discovered in 1891, known as “Java Man”. Trinil 2 (right), and Trinil 3 (left).

<https://www.efossils.org/page/specimens/homo-erectus>

For further discussion: Klein (2009), pp. 282.

Map: Joordens et al. (2015).

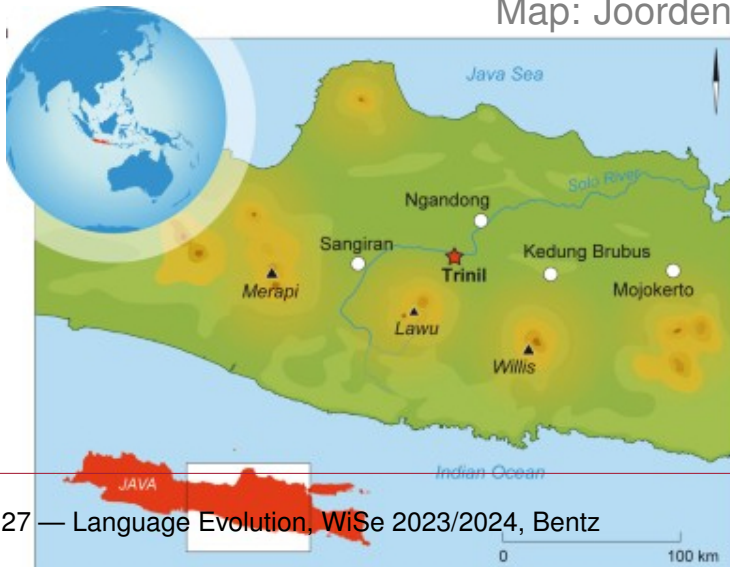
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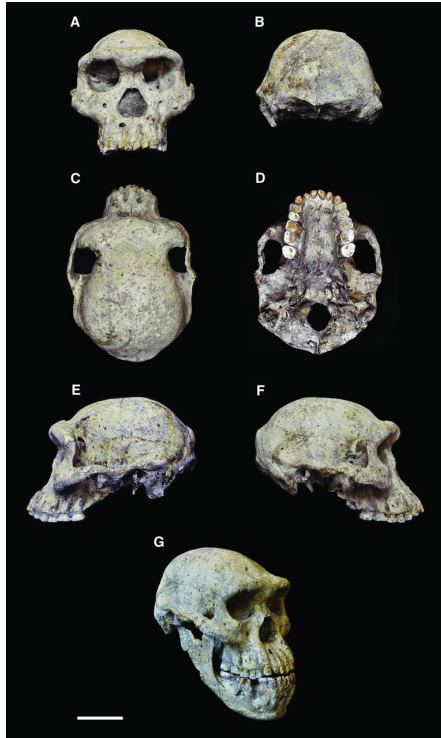
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## Homo erectus (further fossils)



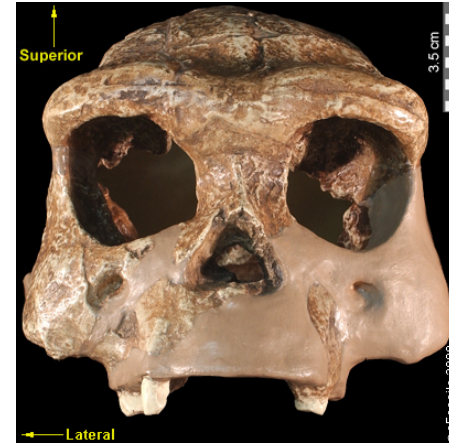
c. 1.85 - 1.77 Mya

Lordkipanidze et al.  
(2013). A complete skull  
from Dmanisi, Georgia,  
and the evolutionary  
biology of Early Homo.



Fossil known as "Peking man" (c.  
800 Ka - 400 Ka)

<https://www.efossils.org>



c. 800 Ka

Sartono S. (1972).  
Discovery of another  
hominid skull at Sangiran,  
Central Java.

<https://www.efossils.org>

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# Homo heidelbergensis (Holotype: Mauer 1)

## Profile

### Genus:

Homo

### Species:

Homo  
heidelbergensis

### Age:

c. 700 - 200 Ka

**Location:** Mauer,  
Heidelberg, Germany



Mandible described by Schoetensack (1908).

Schoetensack (1908). Der Unterkiefer des *Homo heidelbergensis* aus dem Sanden von Mauer bei Heidelberg.

Stringer (2012). The Status of *Homo heidelbergensis*.

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# Homo neanderthalensis (Holotype: Neanderthal 1)

## Profile

**Genus:**

Homo

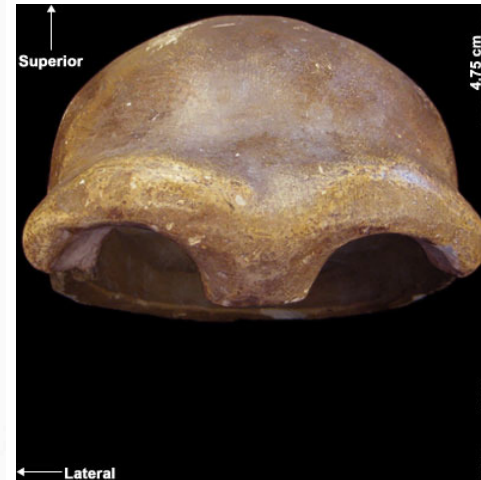
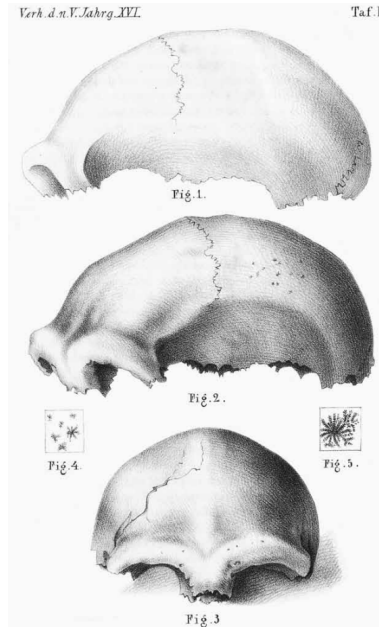
**Species:**

Homo  
neanderthalensis

**Age:**

c. 800 - 40 Ka

**Location:** Mauer,  
Heidelberg, Germany



Left: drawing according to Fuhlrott (1859). Right: <https://www.efossils.org>.

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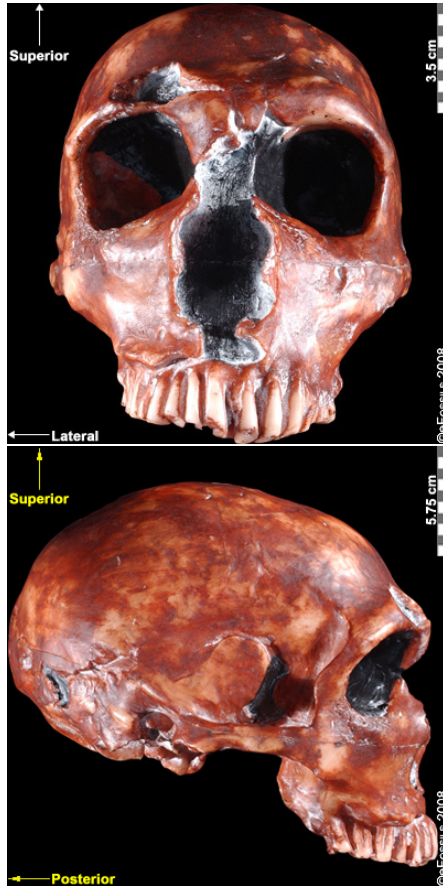
References



Fuhlrott (1859). Menschliche Ueberreste aus einer Felsengrotte des Düsselthals.

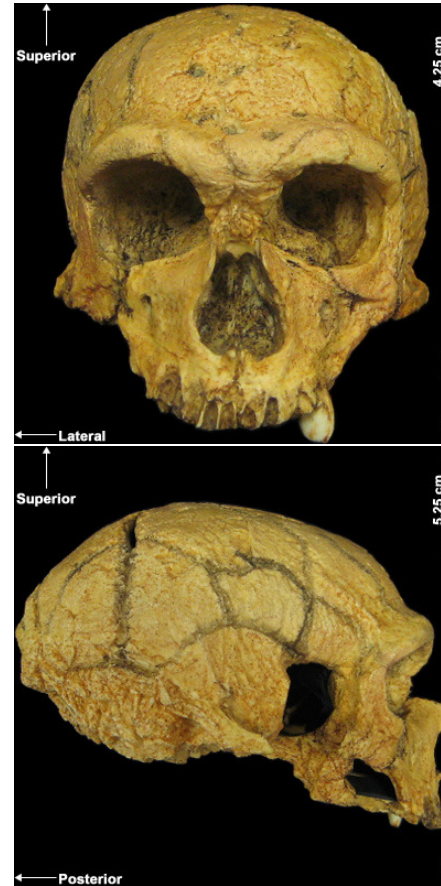


## Homo neanderthalensis (further fossils)



La Ferrassie, Dordogne, France  
(c. 50 Ka)

<https://www.efossils.org>



La Chapella-aux-Saints, France  
(c. 50 Ka)

<https://www.efossils.org>

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# Homo sapiens (Holotype: none)

## Profile

### Genus:

Homo

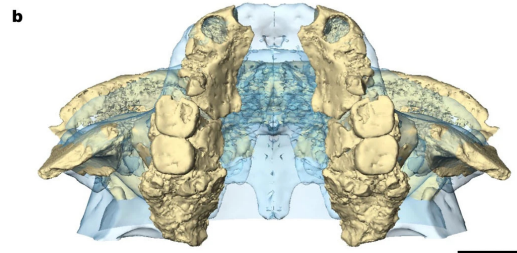
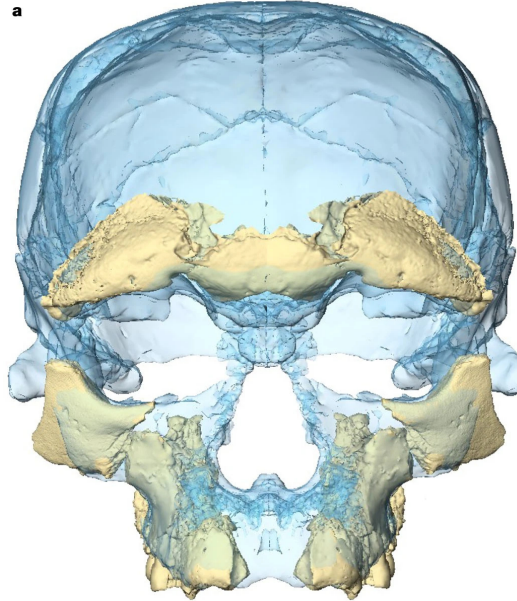
### Species:

Homo sapiens

### Age:

c. 300 Ka - present

**Location:** Jebel  
Irhoud, Morocco



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Hublin et al. (2017). New fossils from Jebel Irhoud, Morocco and the pan-African origin of Homo sapiens.





## Homo sapiens (further fossils)



Homo sapiens (idaltu)  
Herto, Middle, Awash  
(c. 160-154 Ka)

White et al. (2003).  
Pleistocene Homo  
sapiens from Middle  
Awash, Ethiopia.



Skhul 5  
Mount Carmel, Israel  
(c. 120-80 Ka)

<https://humanorigins.si.edu/>



Cro-Magnon 1  
Cro-Magnon, France  
(c. 30 Ka)

<https://humanorigins.si.edu/>

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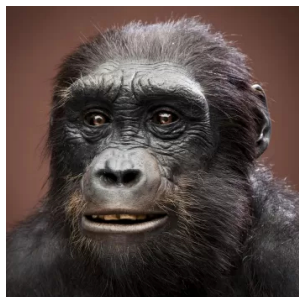
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## Summary: Hominin Fossils (before *Homo*)

Sahelanthropus  
tchadensis



Kenyanthropus  
platyops



Australopithecus  
afarensis



Paranthropus  
boisei



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# Summary: Hominin Fossils (genus *Homo*)

Homo habilis



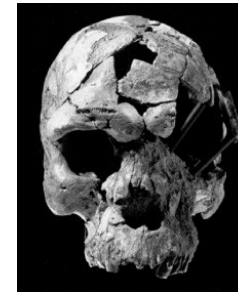
Homo erectus



Homo neand.



Homo sapiens



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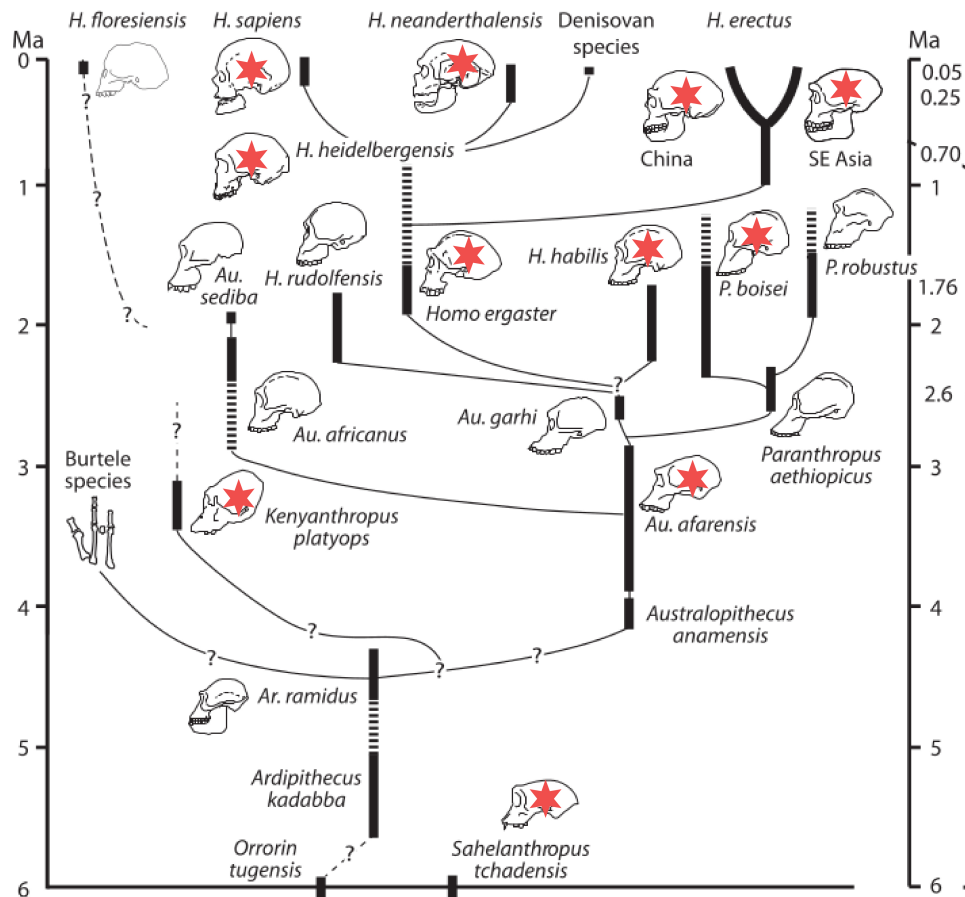
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# Summary: Hominin Fossils in Time



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## Section 4: Classification



# Taxonomic Considerations

How are species classified?

- ▶ **Morphometrics:** Analysing and comparing the morphological shape of fossils.
- ▶ **Behavior:** Analysing archaeological assemblages (mostly stone tools).
- ▶ **Genetics:** Analyses of different parts of the (available) DNA, applying phylogenetic methods from evolutionary biology.

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# Morphometrics

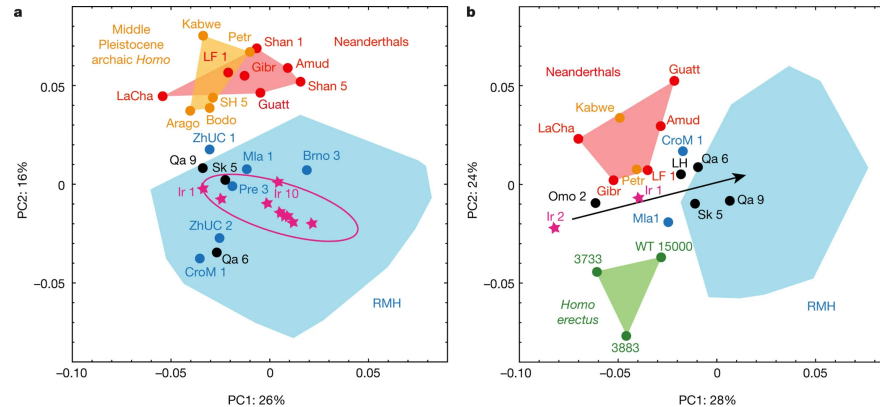
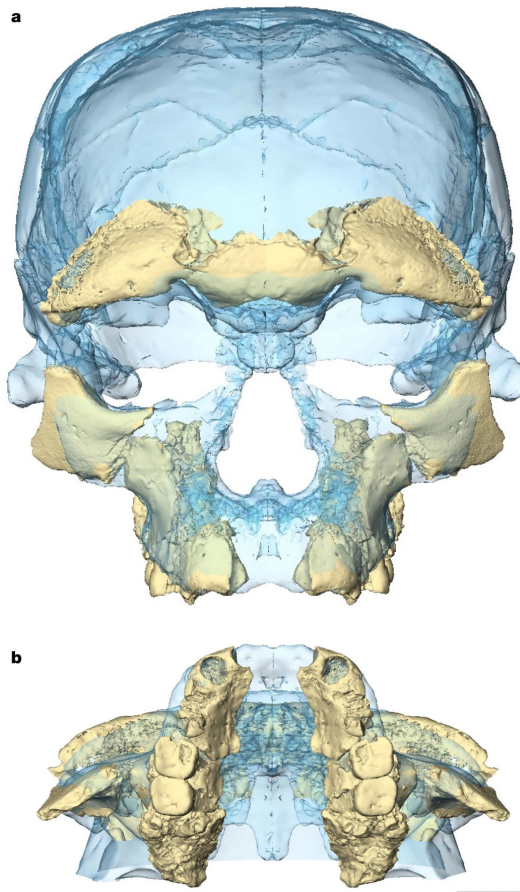


Figure 3. Comparative shape analysis. a, Principal component analysis (PCA) of the facial shape. EMH (black) and RMH (blue) are well separated from Neanderthals and archaic Middle Pleistocene hominins. Irhoud (Ir) 1 and all nine alternative reconstructions of Irhoud 10 (pink stars and pink 99% confidence ellipse, see Methods) fall within the RMH variation. b, PCA of the endocranial shape. RMH (blue), Neanderthals (red) and *Homo erectus* (green) are separated. Archaic Middle Pleistocene hominins (orange) plot with Neanderthals. Irhoud 1 and 2 (pink stars) and some EMH (black) fall outside the RMH variation. Shape differences are visualized in Extended Data Fig. 5a. Sample compositions and abbreviations can be found in the Methods.

Hublin et al. (2017)

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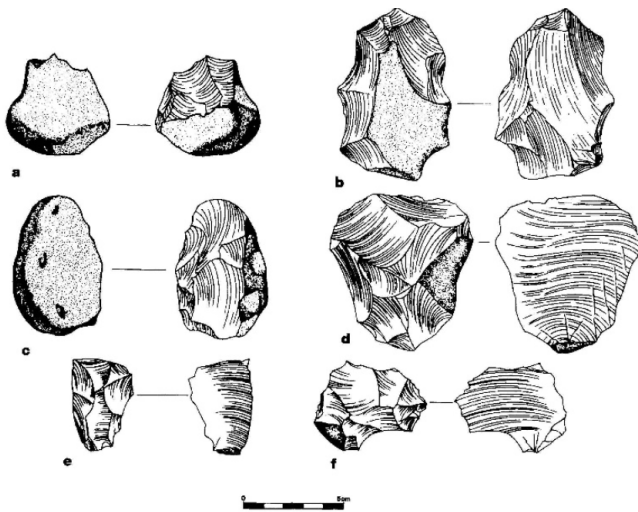
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# Archaeology



**Figure 3** Sketches of a sample of the excavated Gona artefacts. Flaked pieces: **a**, unifacial side chopper, EG12; **b**, discoid, EG10; **c**, unifacial side chopper, EG10. Detached pieces: **d-f**, whole flakes, EG10. Note that the maximum dimension of **d** is as large as some of the flaked pieces.



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Semaw et al. (1997)





# Genetics

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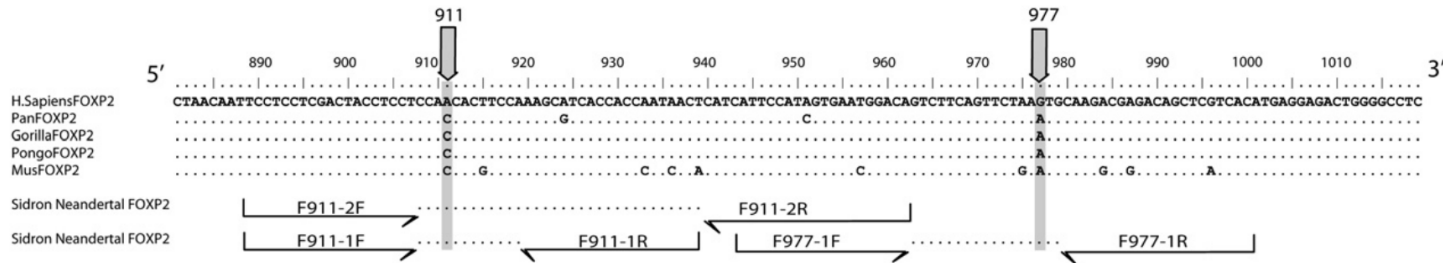


Figure 1. Sequence Alignment of Nucleotide Positions 880–1020 from the *FOXP2* Gene

The two nonsynonymous nucleotide substitutions on the human lineage are indicated by arrows. Identical positions in the alignment are given as dots. The three primer pairs used to retrieve the two substitutions from the El Sidrón Neandertals are indicated by arrows.

Krause et al. (2007)



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# Thank You.

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