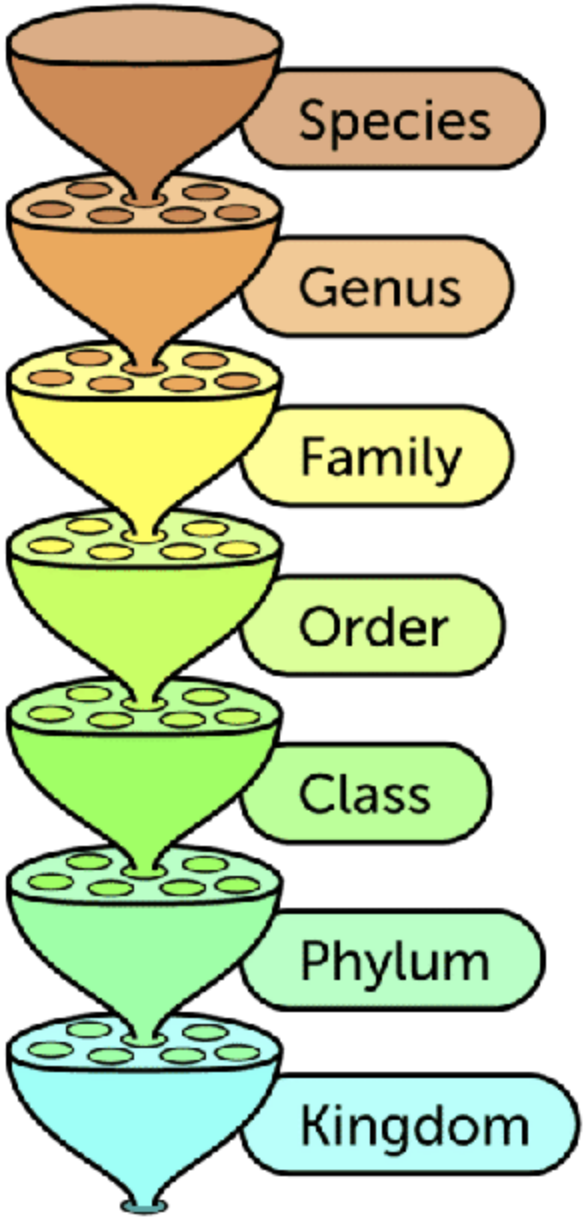
The first hominins

Julie Arnaud
Julie.arnaud@unife.it



Homo sapiens

Homo

Hominidae

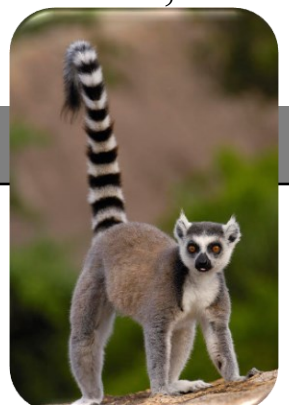
Primates

Mammalia

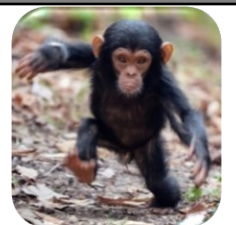
Chordata

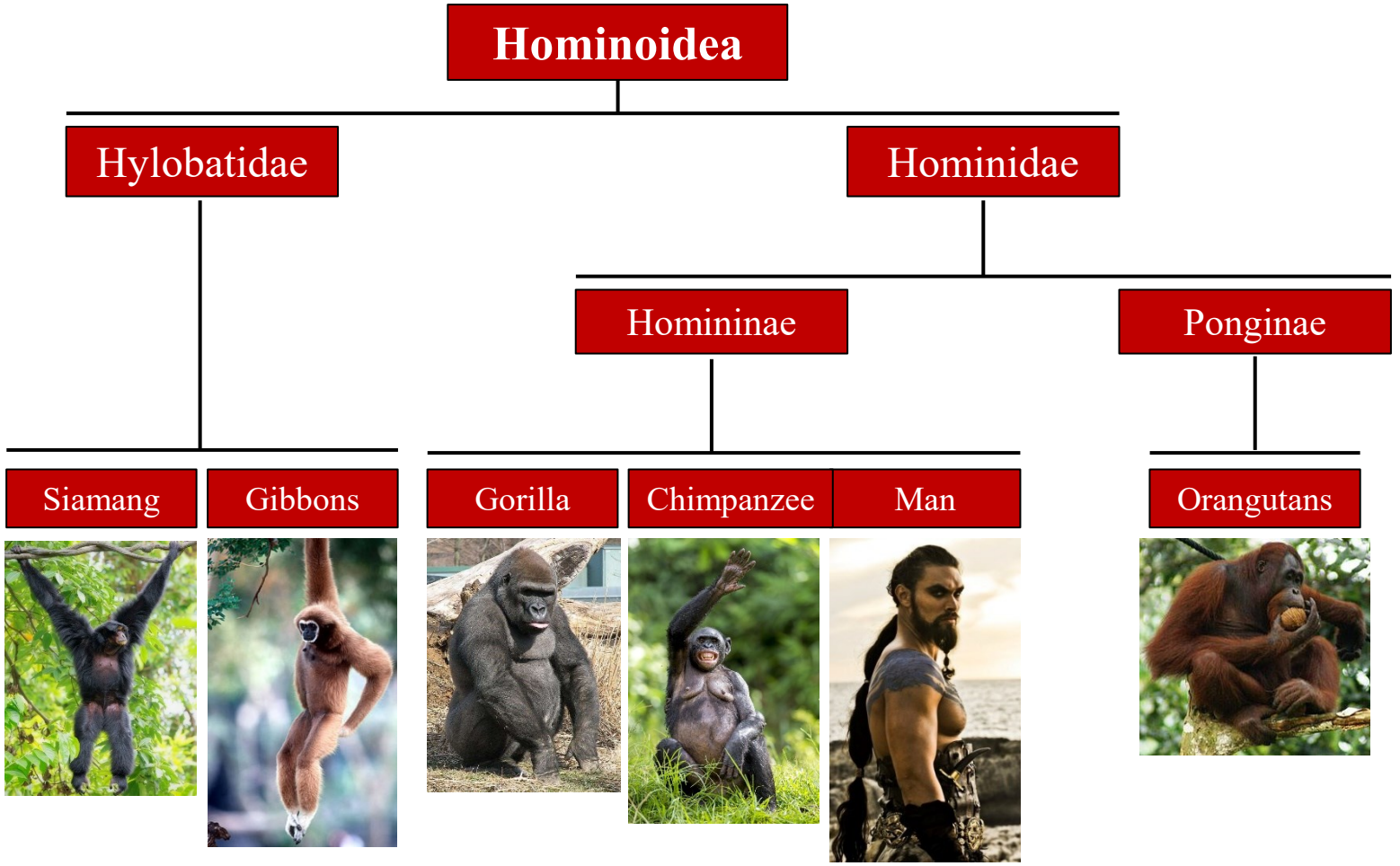
Animalia

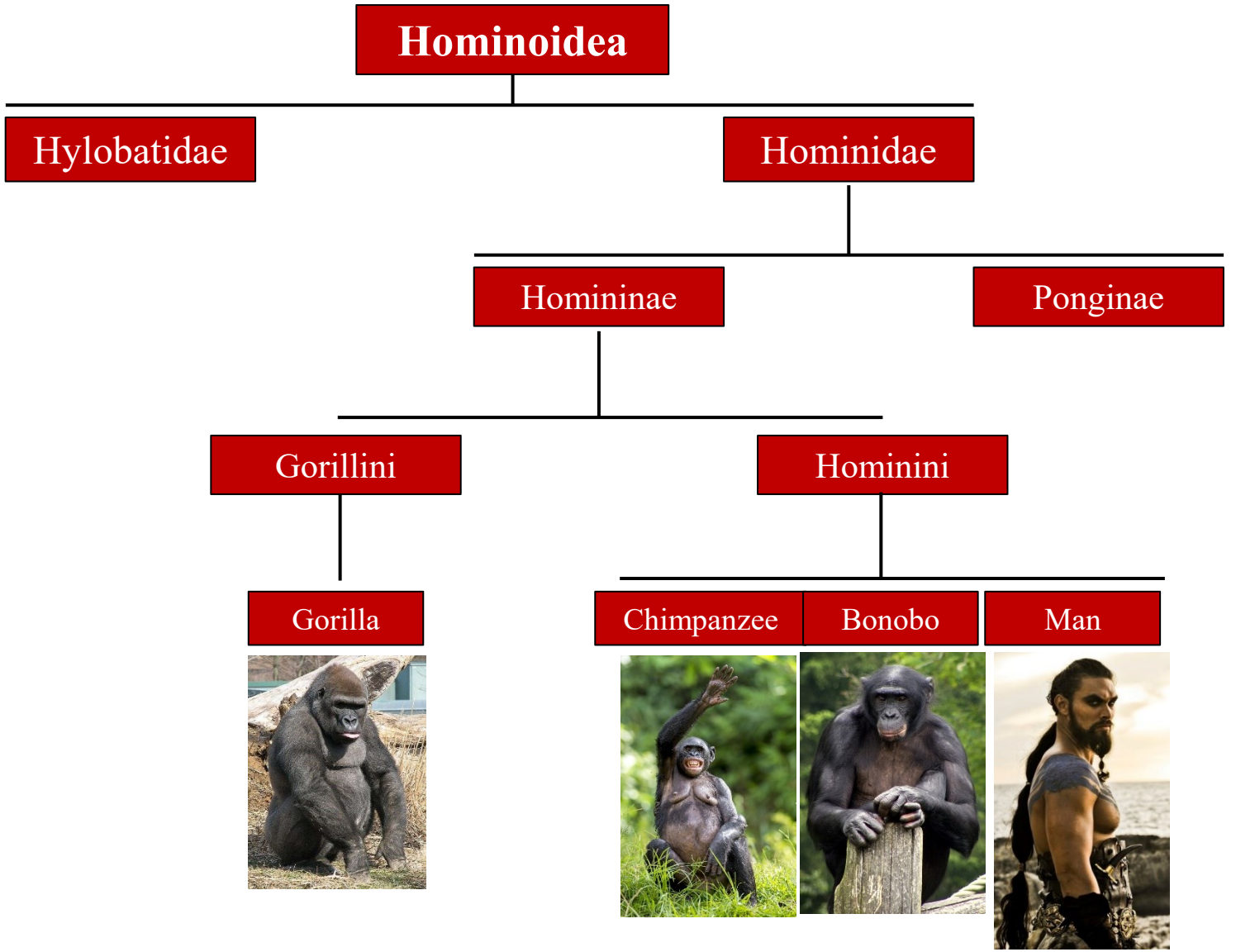
STREPSIRRHINI		HAPLORIHINI				suborder
LEMURIFORM		TARSIIFORMES	SIMIIFORMES (or ANTHROPOIDS)			Infra-order
			Platyrrhini	Catarrhini		
Lemuroidea	*Lorisoidea*	*Tarsioidea*	*Ceboidea*	*Cercopithecoidea*	*Hominoidea*	Super-family
Daubentidae *Indriidae* *Lepilemuridae* *Cheirogaleidae* *Lemuridae*	*Galagidae* *Lorisidae*	*Tarsiidae*	*Cebidae* *Atelidae*	*Cercopithecidae*	*Hylobatidae* *Pongidae* *Hominidae*	Family
36 o 40 teeth (3 or 4 premolars) With or without prehensile tail			**36 teeth** (3 premolars) Prehensile tail	**32 teeth** (2 premolars) Non prehensile tail	**32 teeth** (2 premolars) No tail	Anatomy
Africa, Madagascar and southeast asia			**America**	**Africa – Eurasia**	**World**	Geography
Indri, Lemure	Loris	Tarsi	Howler monkeys, Callithrix (marmose)	Macaca, Baboons	*Homo sapiens*, great apes	Species
PROSIMIAN			SIMIIFORME (O ANTHROPOIDE)			Infra-order

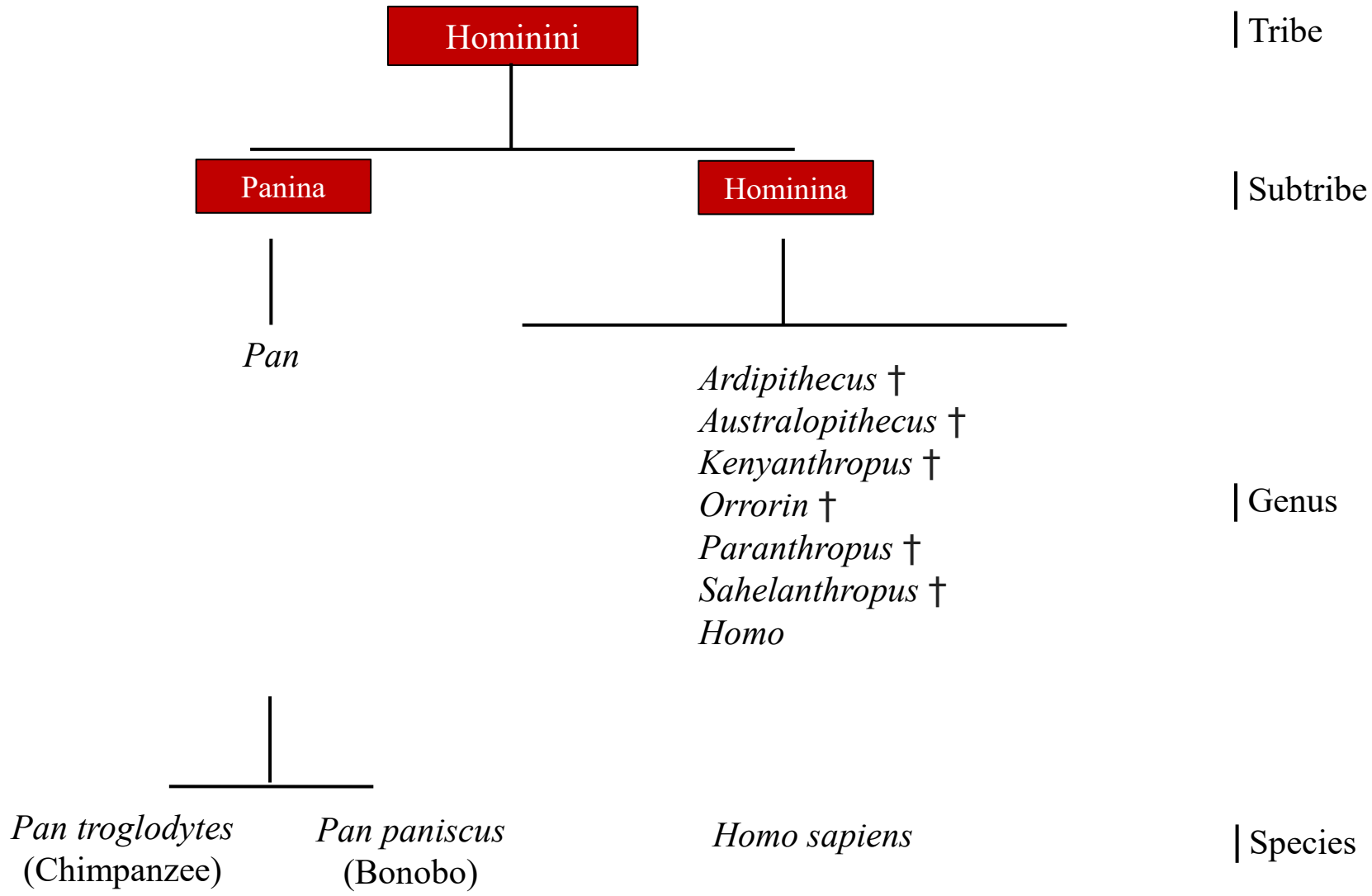


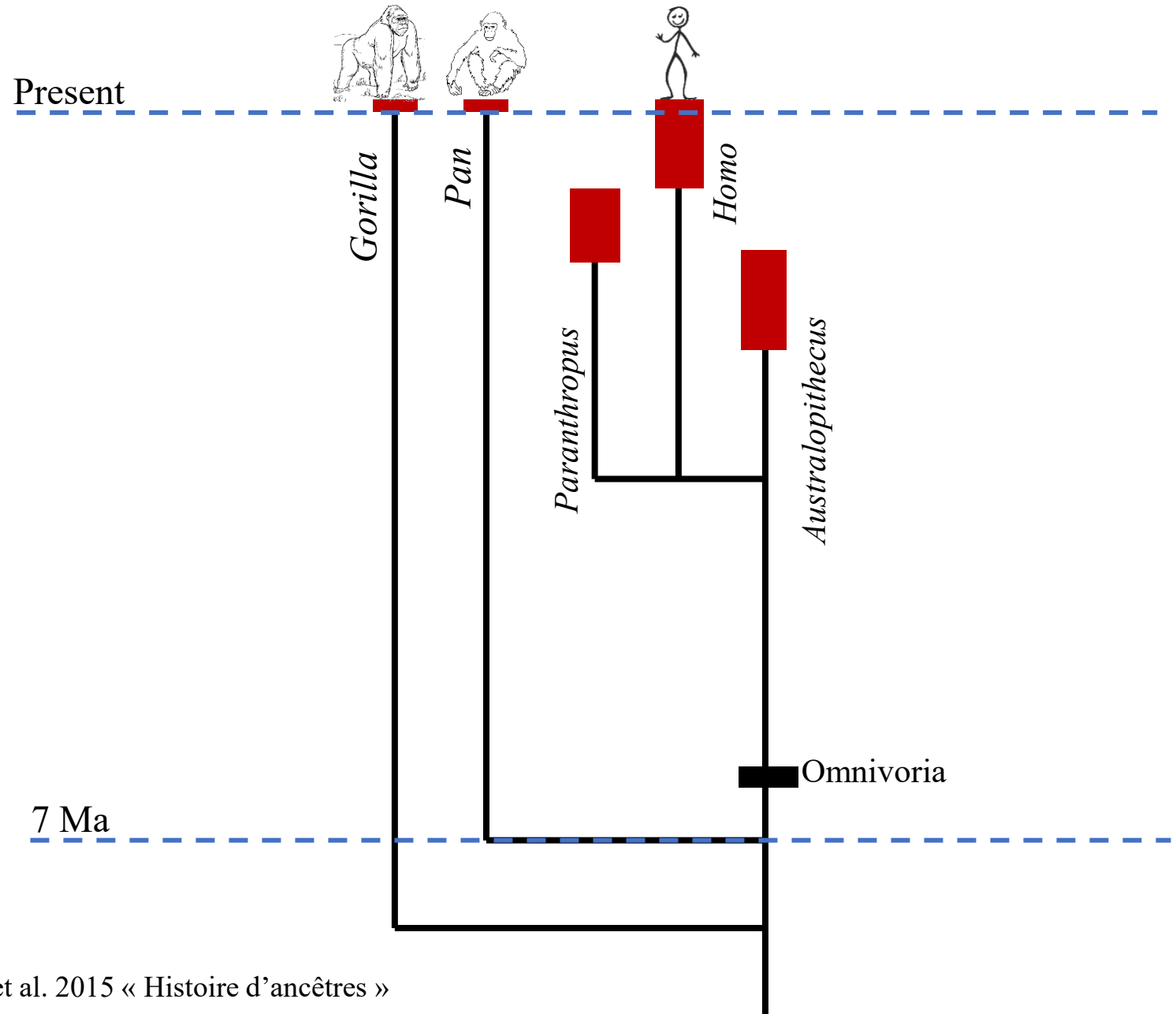


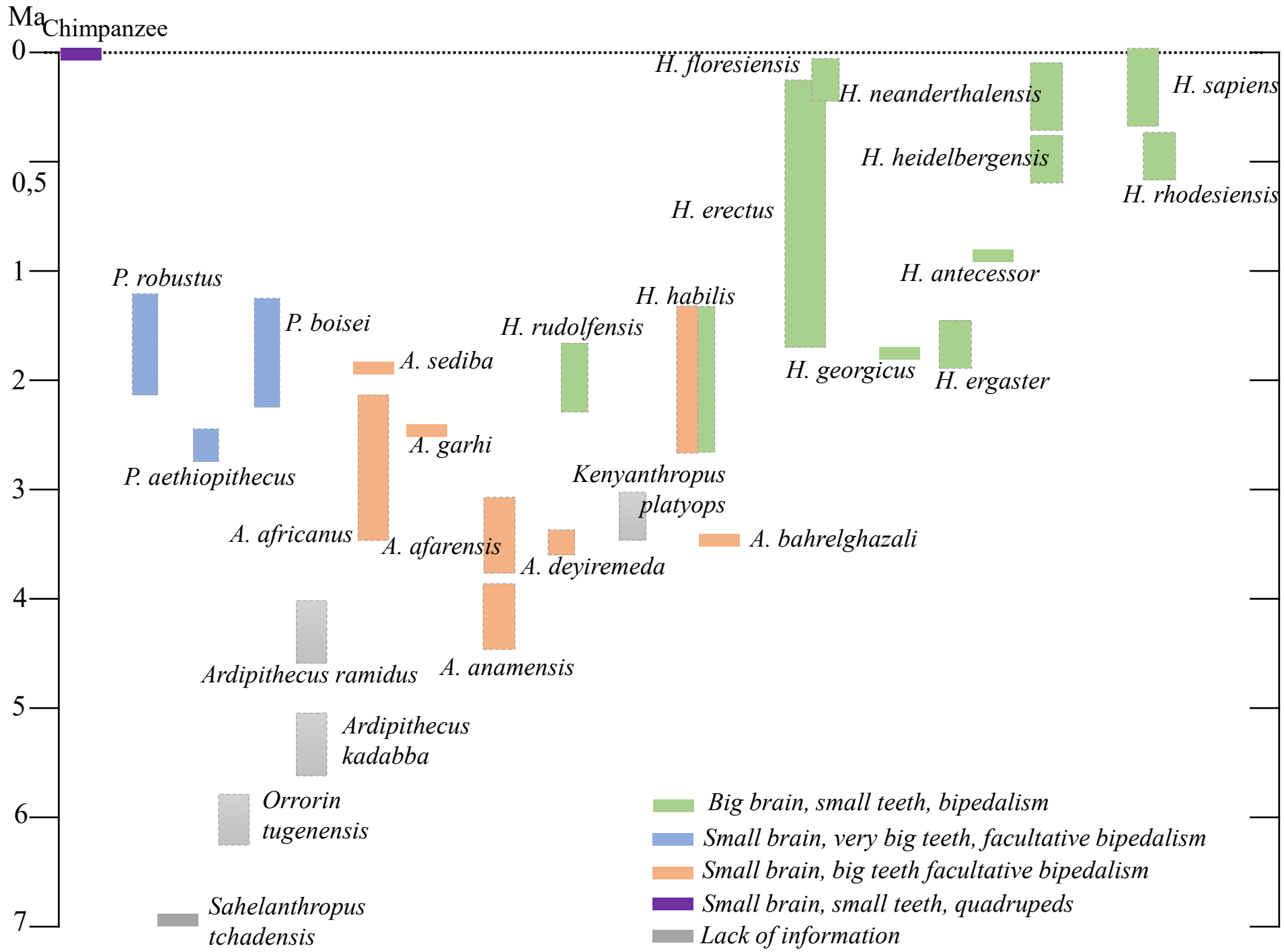

Hominoidea
Hylobatidae
Hominidae
Homininae
Ponginae
Siamang
Gibbons
Gorilla
Chimpanzee
Man
Orangutans
Super-family
Family
Subfamily
Species

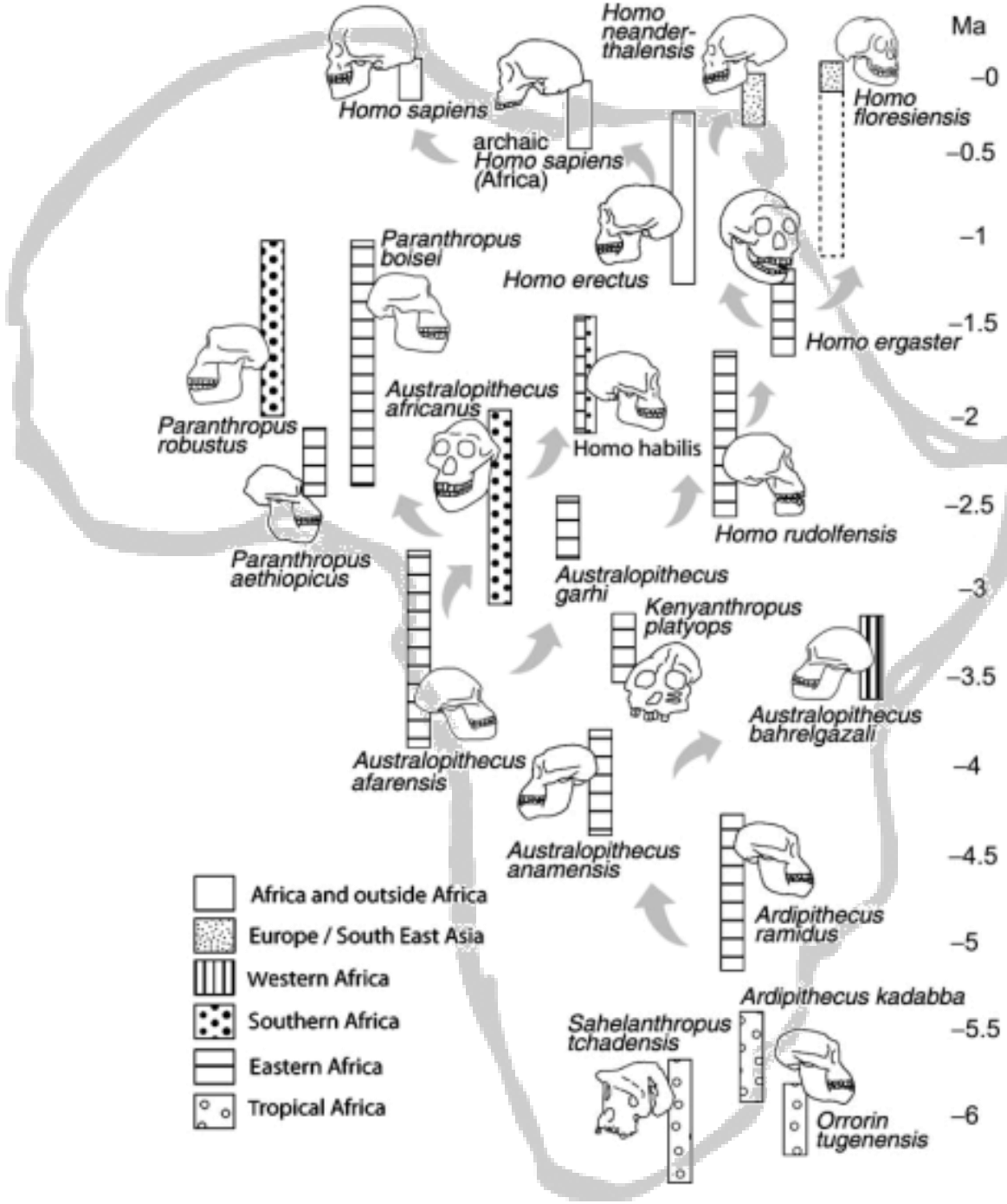

Hominoidea
Hylobatidae
Hominidae
Homininae
Ponginae
Gorillini
Hominini
Gorilla
Chimpanzee
Bonobo
Man
Super-family
Family
Subfamily
Tribe
Species


Hominini
Panina
Hominina
Pan
Ardipithecus †
Australopithecus †
Kenyanthropus †
Orrorin †
Paranthropus †
Sahelanthropus †
Homo
Pan troglodytes
(Chimpanzee)
Pan paniscus
(Bonobo)
Homo sapiens
Tribe
Subtribe
Genus
Species

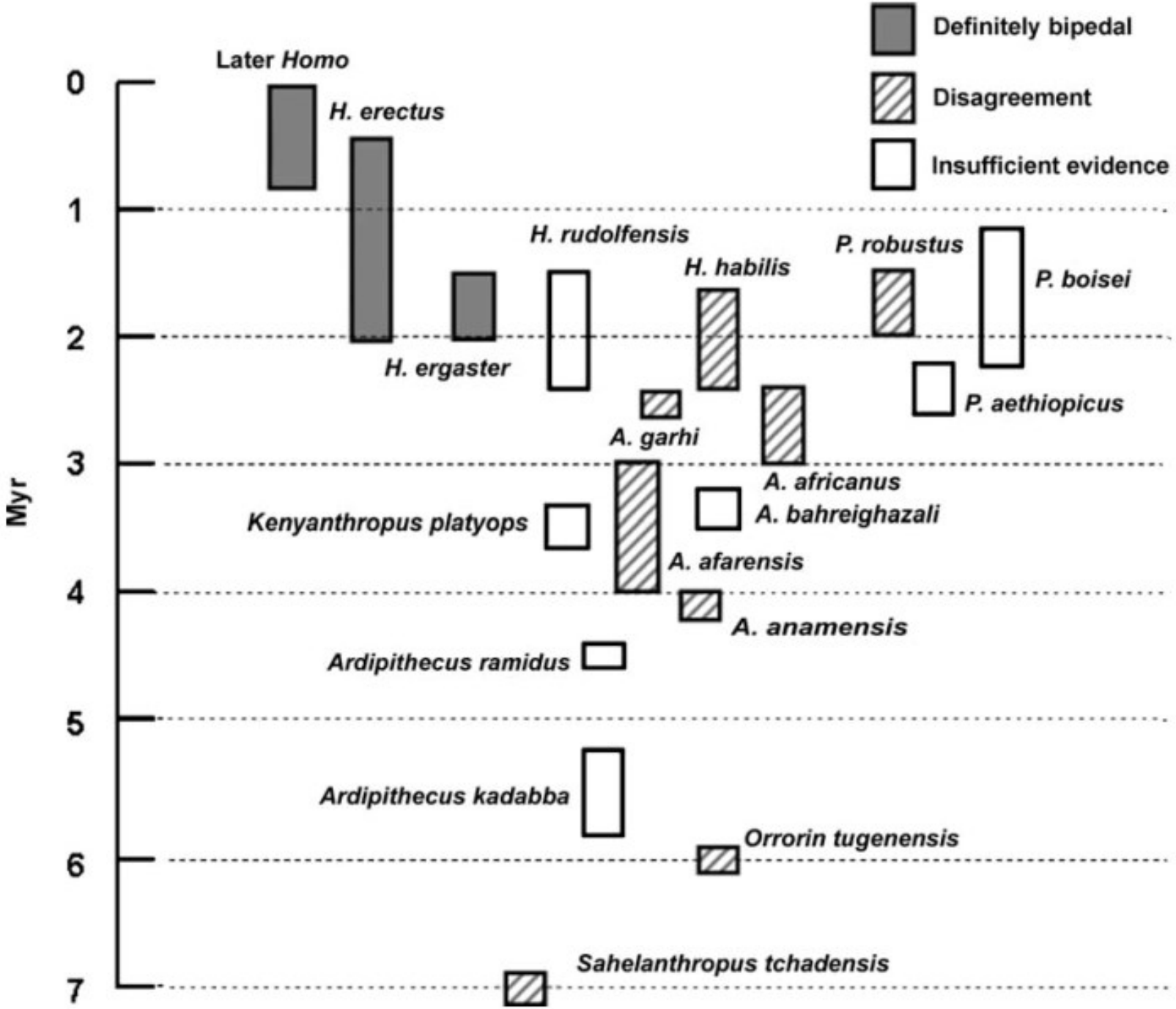


Grimaud-Hervé et al. 2015 « Histoire d'ancêtres »


Ma
Chimpanzee
0
0,5
1
2
3
4
5
6
7
H. floresiensis
H. neanderthalensis
H. sapiens
H. heidelbergensis
H. rhodesiensis
H. erectus
H. antecessor
P. robustus
P. boisei
H. habilis
H. rudolfensis
A. sediba
H. georgicus
H. ergaster
A. garhi
P. aethiopithecus
Kenyanthropus platyops
A. africanus
A. afarensis
A. bahrelghazali
A. deyiremeda
A. anamensis
Ardipithecus ramidus
Ardipithecus kadabba
Orrorin tugenensis
Sahelanthropus tchadensis
Big brain, small teeth, bipedalism
Small brain, very big teeth, facultative bipedalism
Small brain, big teeth facultative bipedalism
Small brain, small teeth, quadrupeds
Lack of information

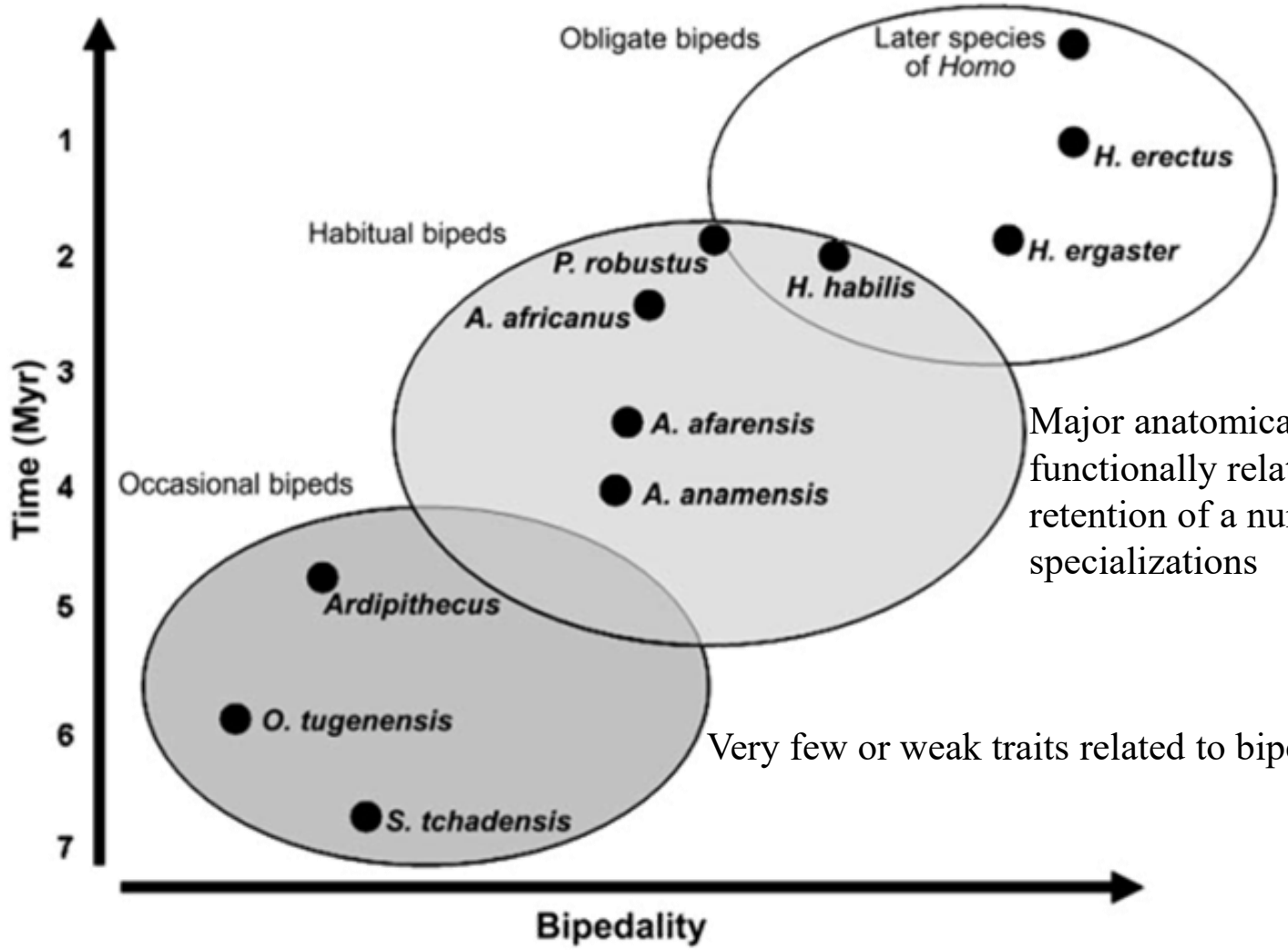


Henke & Tattersall, 2007



Henke & Tattersall, 2007; Wood, 2002

Degree of bipedalism in fossil Hominins through time.
Only well documented correlation between taxa and bipedalism are included.



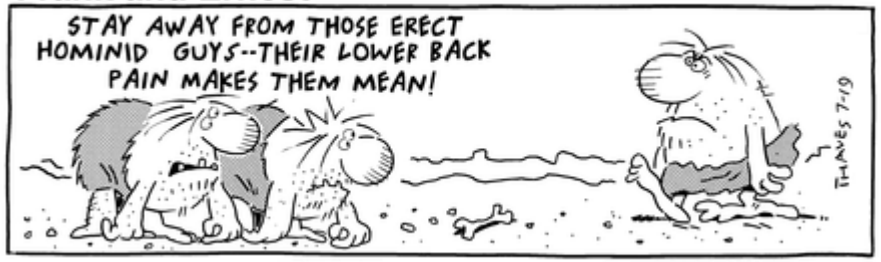
Obligate bipedalism.
H. habilis bipedality being discussed

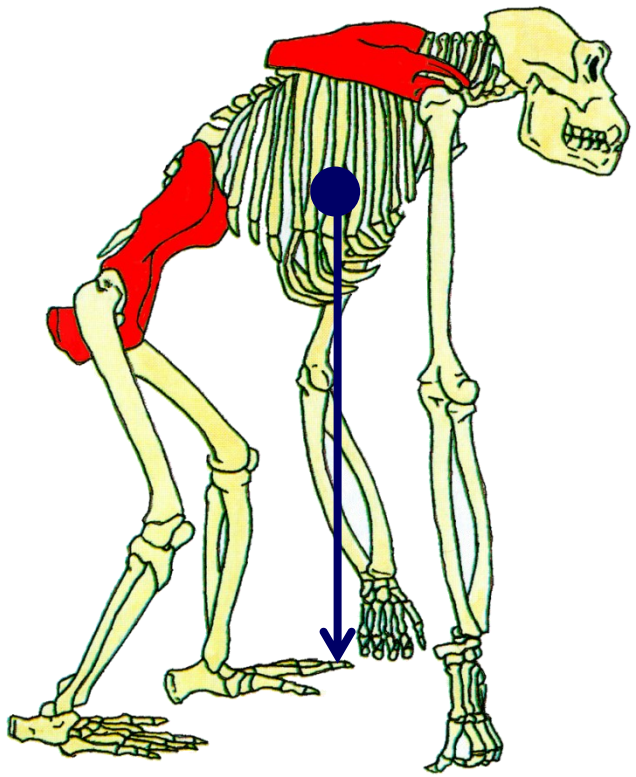
Major anatomical remodeling of structures functionally related to bipedality but retention of a number of apelike climbing specializations

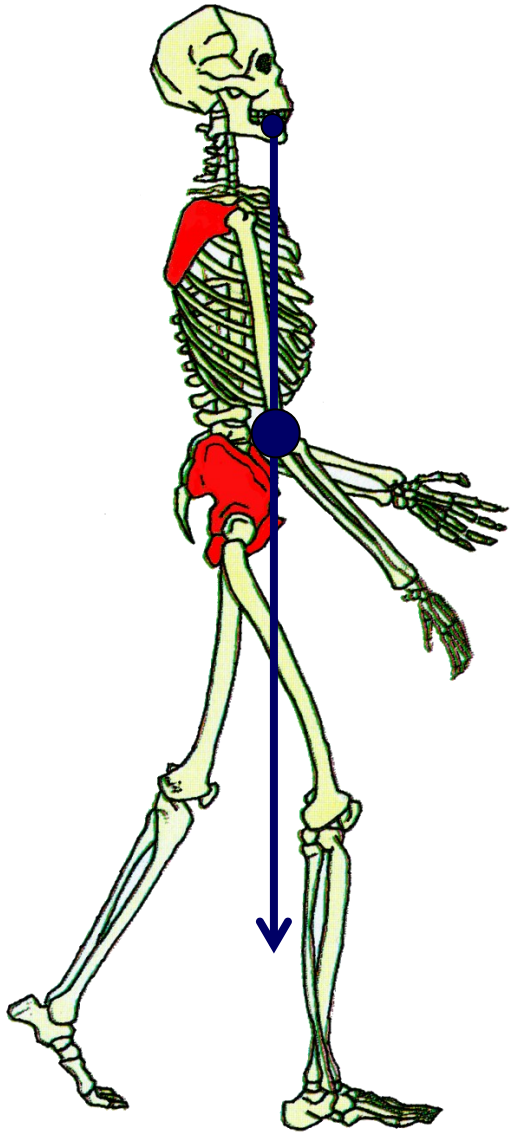
Very few or weak traits related to bipedality

Henke & Tattersall, 2007

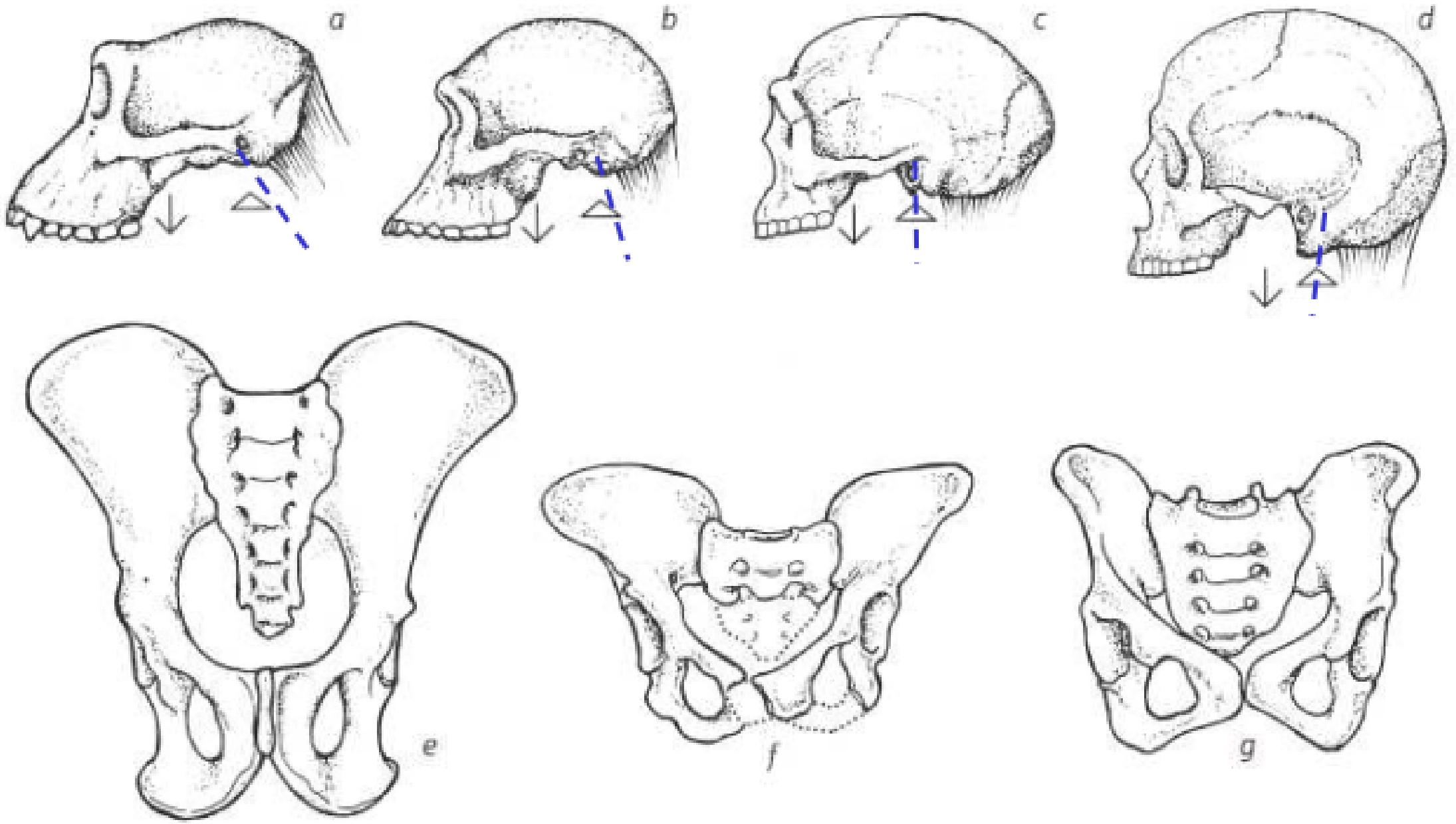
Frank and Ernest







Axe de la colonne vertébrale Point d'appui de la colonne vertébrale « déséquilibre » face / boîte crânienne



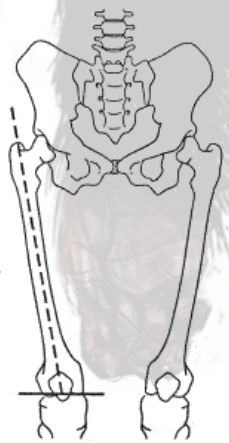
Homme

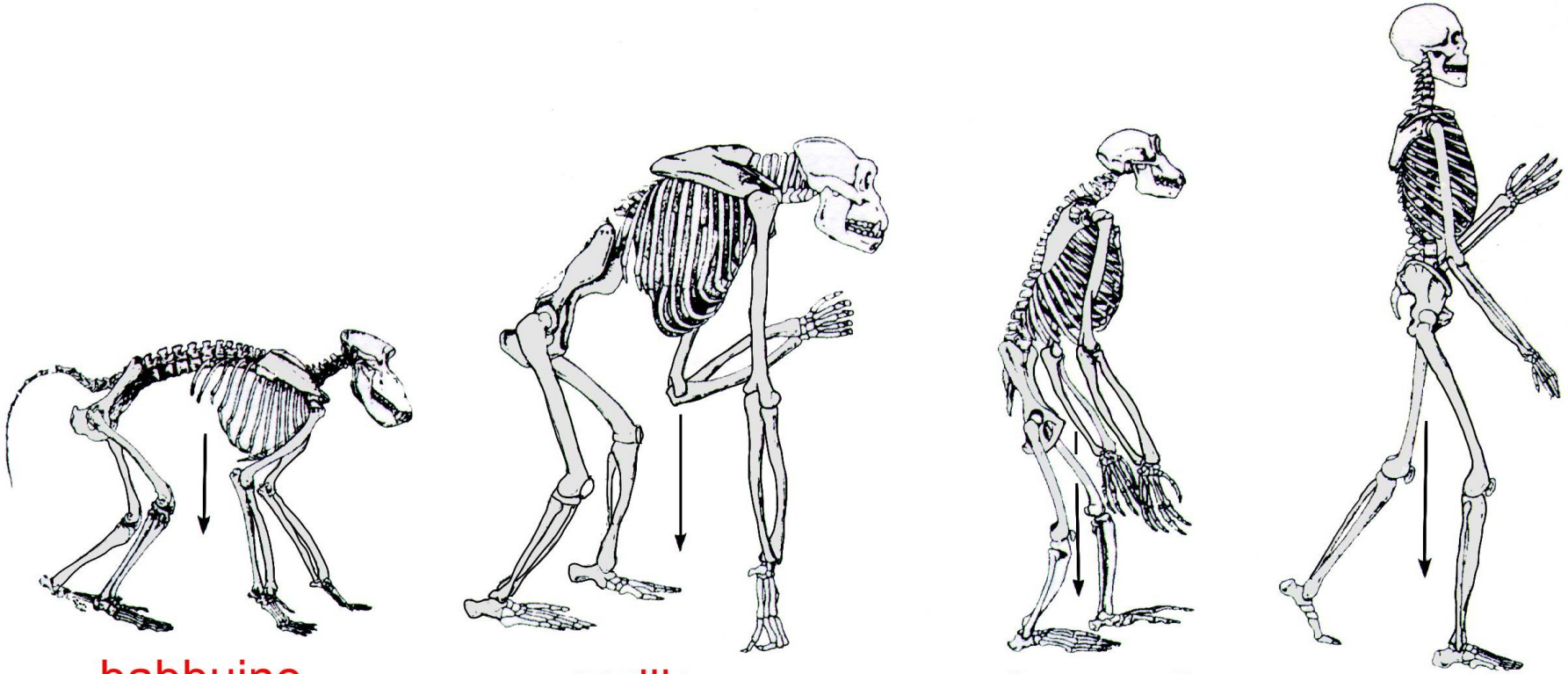
Les échelles ne sont pas respectées.

Chimpanzé

Volume cérébral :
1 300 à 1 500 cm^3

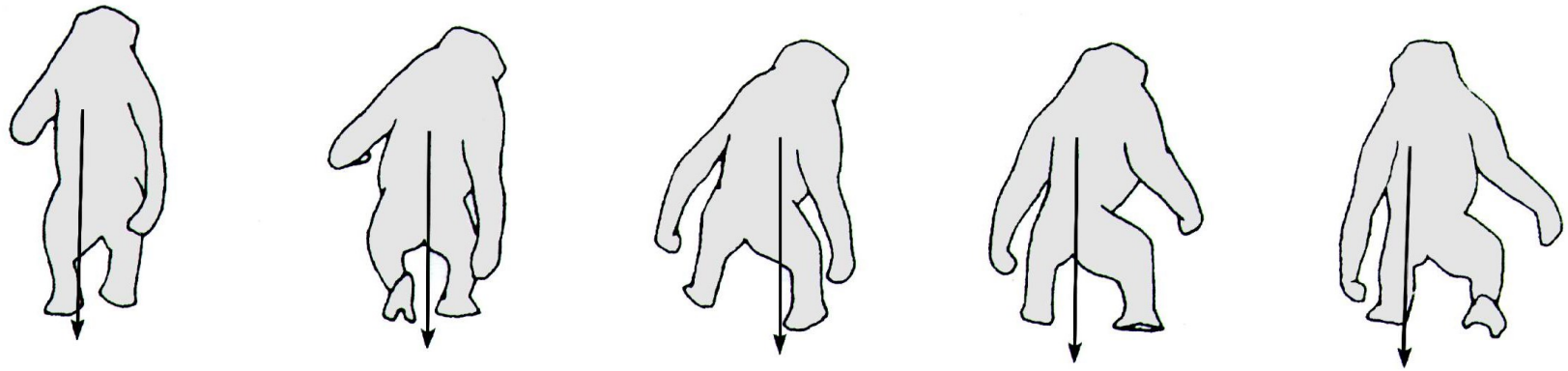
Volume cérébral :
320 à 450 cm^3



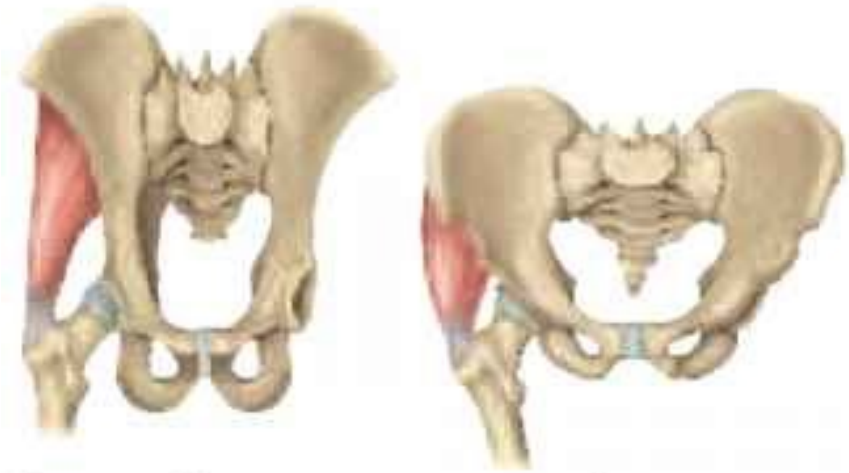


babbuino gorilla scimpanzè uomo

(E)

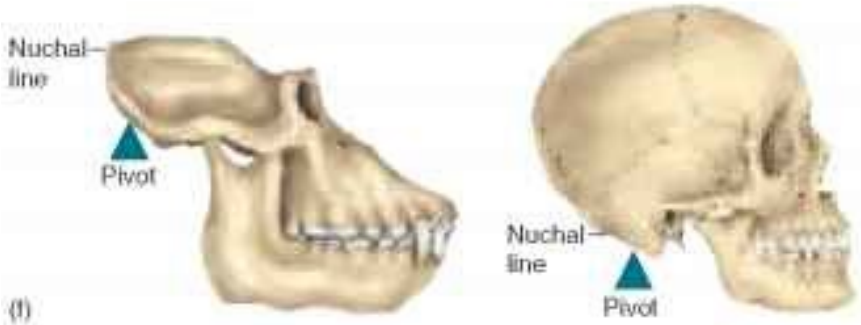


Bipedismo occasionale

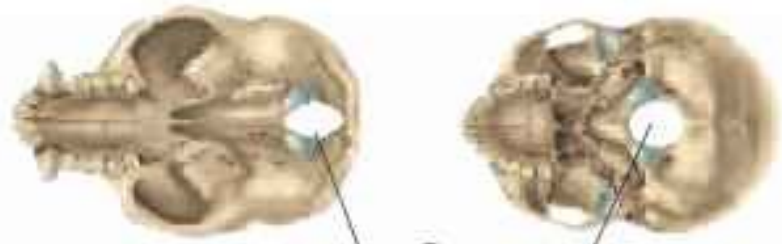


(d) Chimp Human

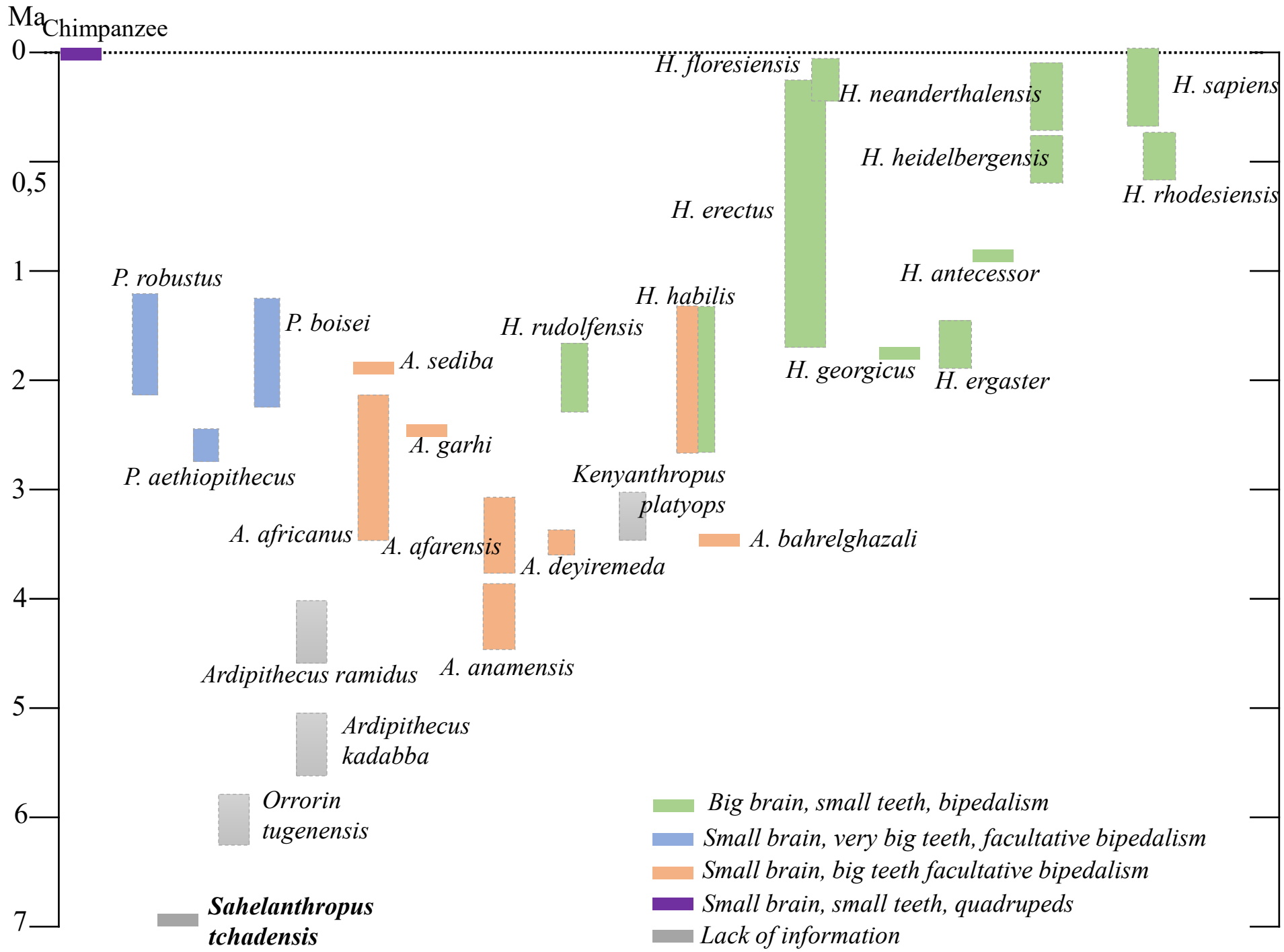
(e) Chimp Human



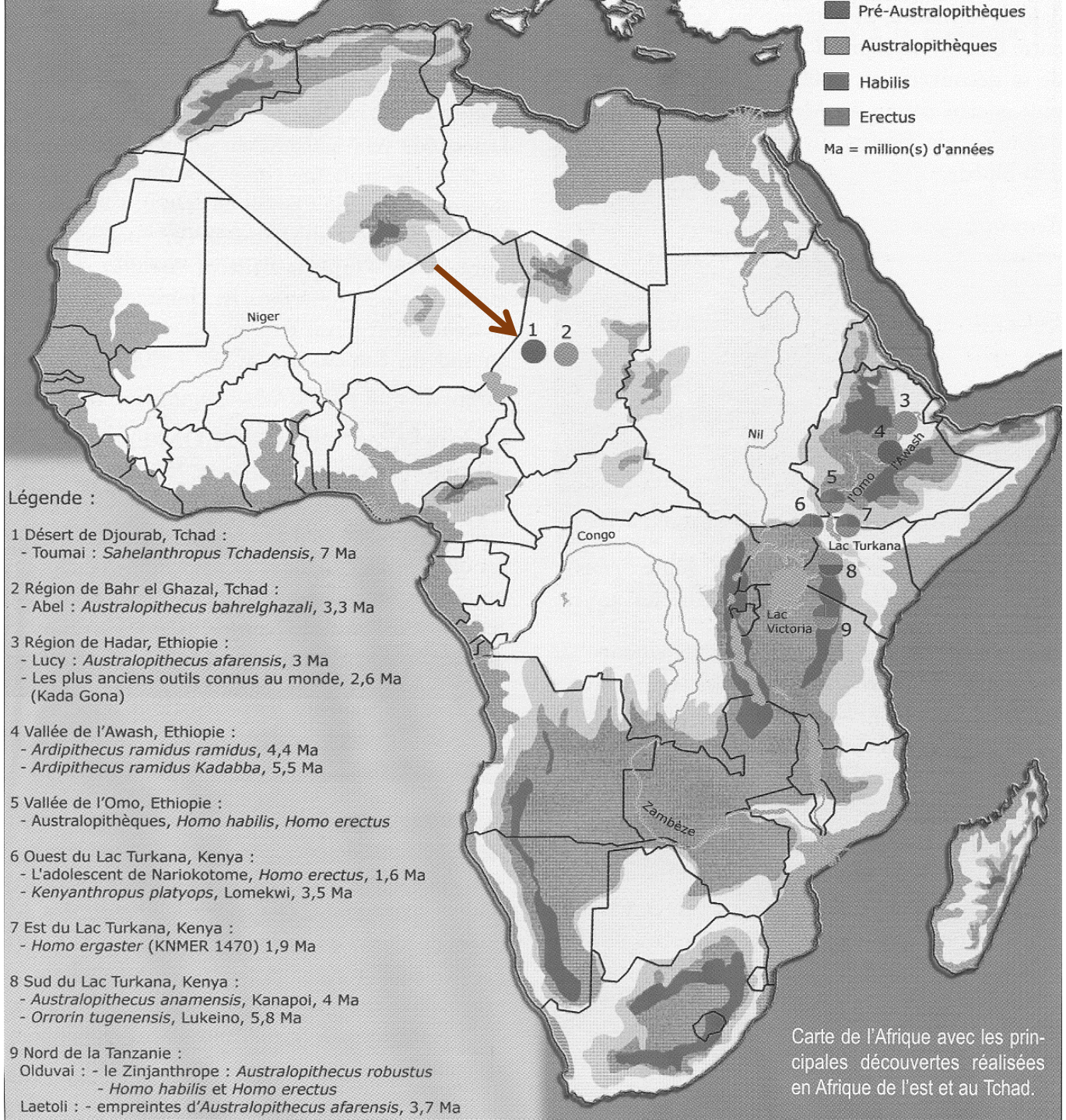
(f)



Chimp Human


Ma
Chimpanzee
0
0,5
1
2
3
4
5
6
7
H. floresiensis
H. neanderthalensis
H. sapiens
H. heidelbergensis
H. rhodesiensis
H. erectus
H. antecessor
P. robustus
P. boisei
H. habilis
H. rudolfensis
H. georgicus
H. ergaster
A. sediba
A. garhi
P. aethiopithecus
Kenyanthropus platyops
A. africanus
A. afarensis
A. bahrelghazali
A. deyiremeda
A. anamensis
Ardipithecus ramidus
Ardipithecus kadabba
Orrorin tugenensis
Sahelanthropus tchadensis
Big brain, small teeth, bipedalism
Small brain, very big teeth, facultative bipedalism
Small brain, big teeth facultative bipedalism
Small brain, small teeth, quadrupeds
Lack of information

Sahelanthropus tchadensis



Légende :

1 Désert de Djourab, Tchad :
- Toumaï : *Sahelanthropus Tchadensis*, 7 Ma

2 Région de Bahr el Ghazal, Tchad :
- Abel : *Australopithecus bahrelghazali*, 3,3 Ma

3 Région de Hadar, Ethiopie :
- Lucy : *Australopithecus afarensis*, 3 Ma
- Les plus anciens outils connus au monde, 2,6 Ma (Kada Gona)

4 Vallée de l'Awash, Ethiopie :
- *Ardipithecus ramidus ramidus*, 4,4 Ma
- *Ardipithecus ramidus Kadabba*, 5,5 Ma

5 Vallée de l'Omo, Ethiopie :
- Australopithèques, *Homo habilis*, *Homo erectus*

6 Ouest du Lac Turkana, Kenya :
- L'adolescent de Nariokotome, *Homo erectus*, 1,6 Ma
- *Kenyanthropus platyops*, Lomekwi, 3,5 Ma

7 Est du Lac Turkana, Kenya :
- *Homo ergaster* (KNMER 1470) 1,9 Ma

8 Sud du Lac Turkana, Kenya :
- *Australopithecus anamensis*, Kanapoi, 4 Ma
- *Orrorin tugenensis*, Lukeino, 5,8 Ma

9 Nord de la Tanzanie :
Olduvai : - le Zinjanthrope : *Australopithecus robustus*
- *Homo habilis* et *Homo erectus*
Laetoli : - empreintes d'*Australopithecus afarensis*, 3,7 Ma

Carte de l'Afrique avec les principales découvertes réalisées en Afrique de l'est et au Tchad.

Sahelanthropus tchadensis (Toumai)

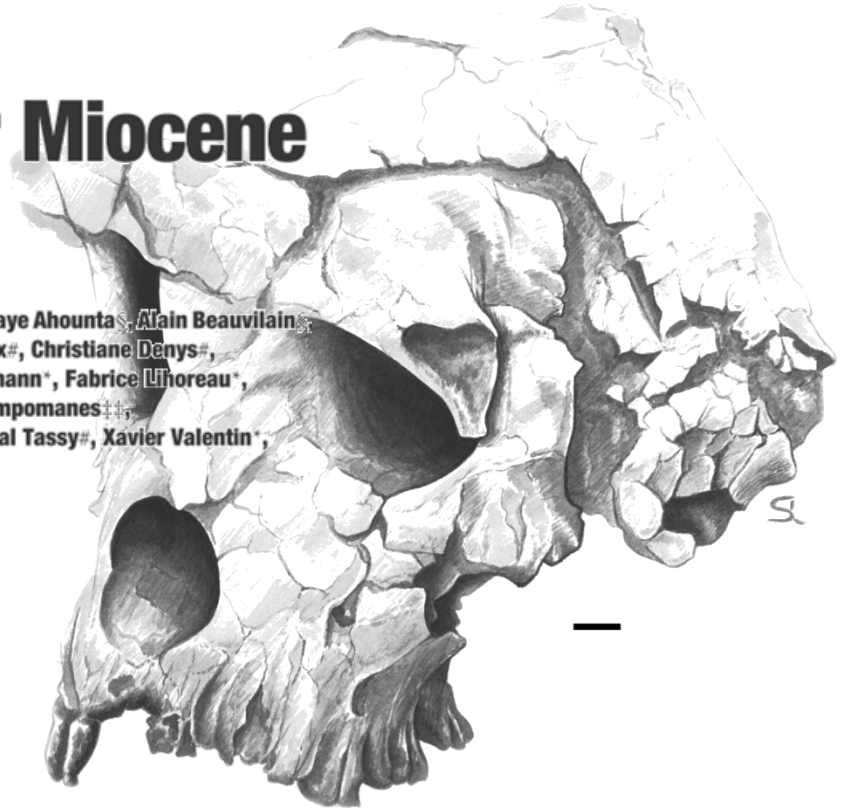
Scoperta: Djurab desert (Chad)

Fossils:
- Skull TM266-01-060-1
- Right jaw fragment

Age: 7 Ma

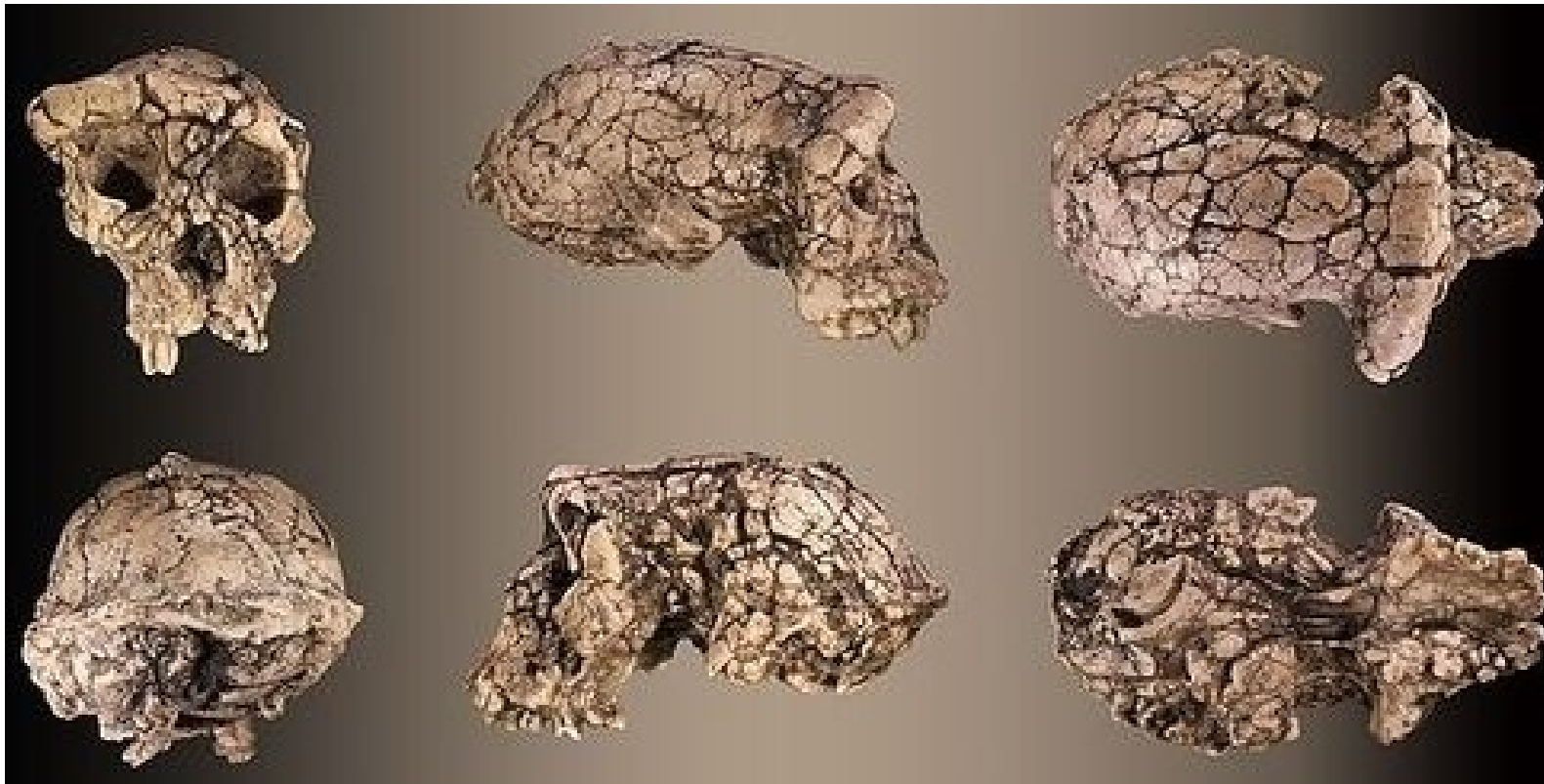
A new hominid from the Upper Miocene of Chad, Central Africa

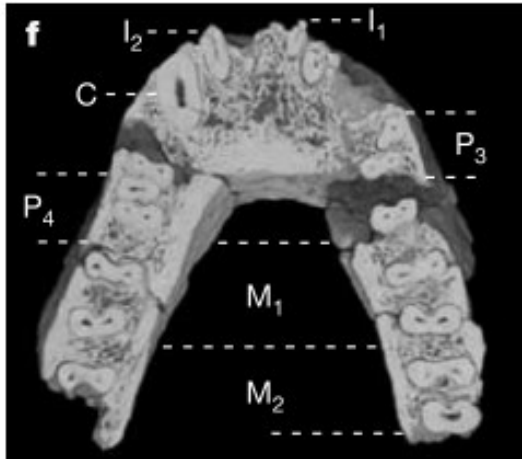
Michel Brunet*, Franck Guy*†, David Pilbeam†, Hassane Taisso Mackaye‡, Andossa Likius*‡, Djimdoumalbaye Ahounta§, Alain Beauvilain§, Cécile Blondel*, Hervé Bocherens‖, Jean-Renaud Boisserie*, Louis De Bonis*, Yves Coppens¶, Jean Dejax#, Christiane Denys#, Philippe Duringer☆, Véra Eisenmann#, Gongdibé Fanone§, Pierre Fronty*, Denis Geraads**, Thomas Lehmann*, Fabrice Lihoreau*, Antoine Louchart††, Adoum Mahamat§, Gildas Merceron*, Guy Mouchelin*, Olga Otero*, Pablo Pelaez Campomanes‡‡, Marcia Ponce De Leon§§, Jean-Claude Rage#, Michel Sapanet‖‖, Mathieu Schuster☆, Jean Sudre‖, Pascal Tassy#, Xavier Valentin*, Patrick Vignaud*, Laurent Viriot*, Antoine Zazzo¶¶ & Christoph Zollikofer§§



Robust supra-orbital morphology
(Male?)
Morfologia sovra-orbitaria
Robusta (Maschio?)

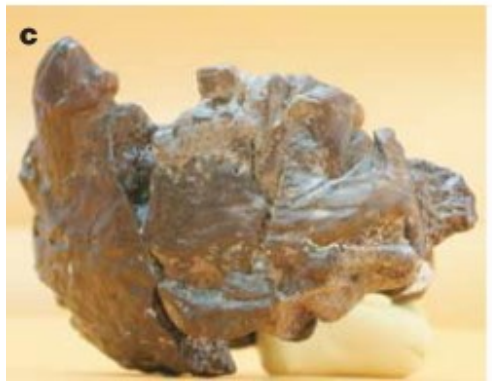
Low molar and premolar crown
Enamel thickness between chimp and Ardipithecus Corona dei molari e dei premolari bassa
Spessore dello smalto tra scimpanzé e *Ardipithecus*

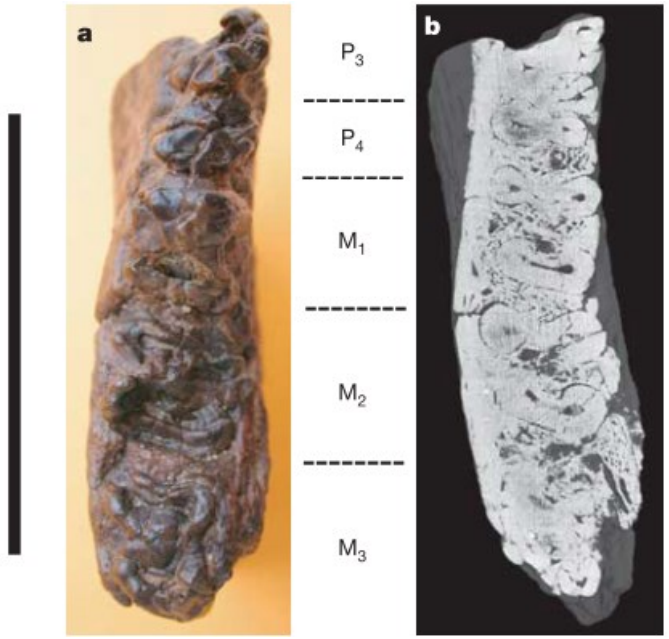


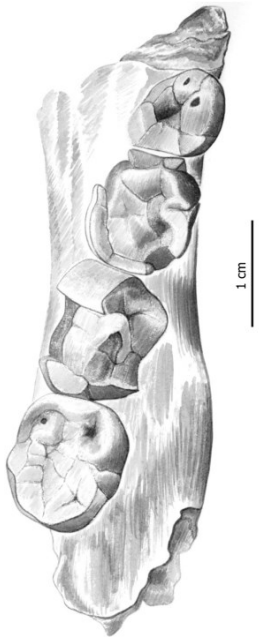


- C/P3 non affilati / *not sharp*
- Assenza di diastema tra C/P3

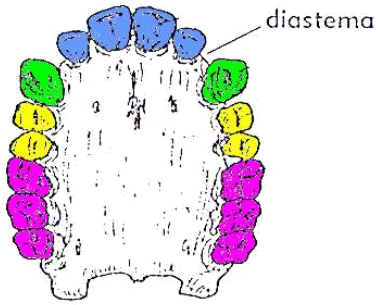
No diastema between C/P3

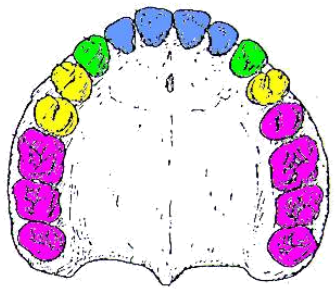


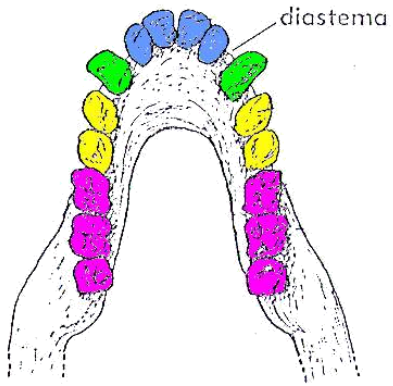


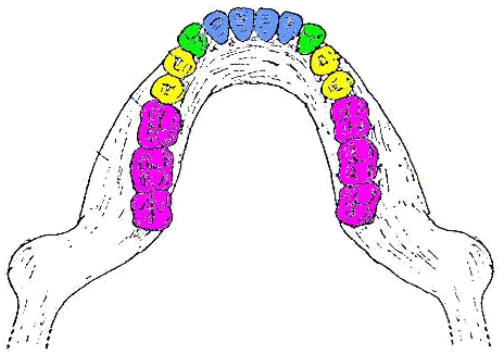


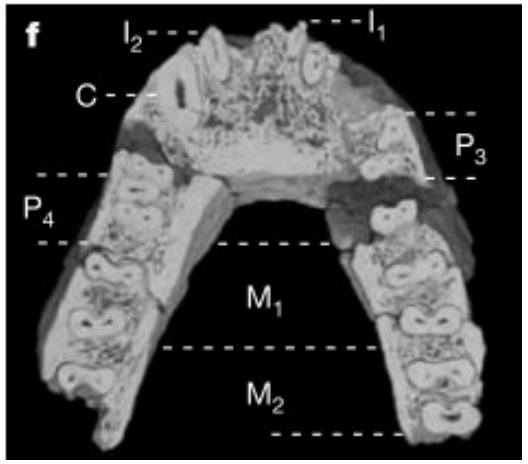
Brunet, 2005 (Nature vol 434)


diastema



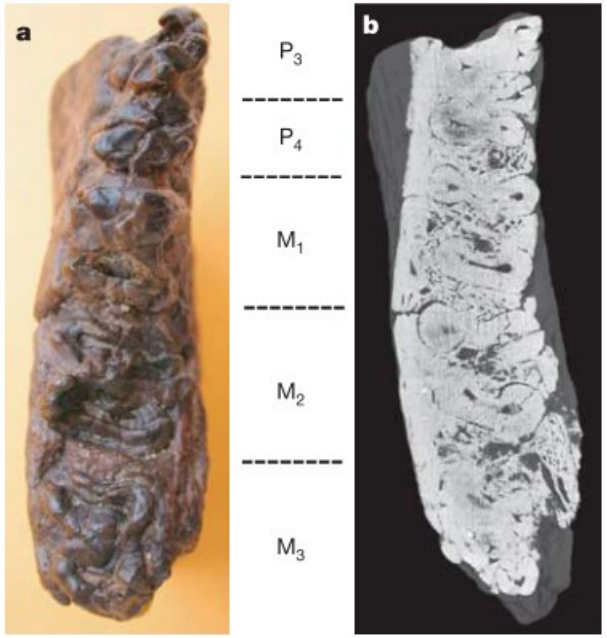

diastema

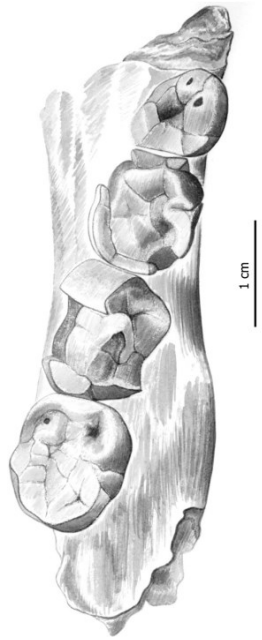




- C/P3 non affilati
- Assenza di diastema tra C/P3
- Sinfisi piuttosto verticale
- i denti post-C presentano un spessore dello smalto tra i scimpanzé e i australopitecine

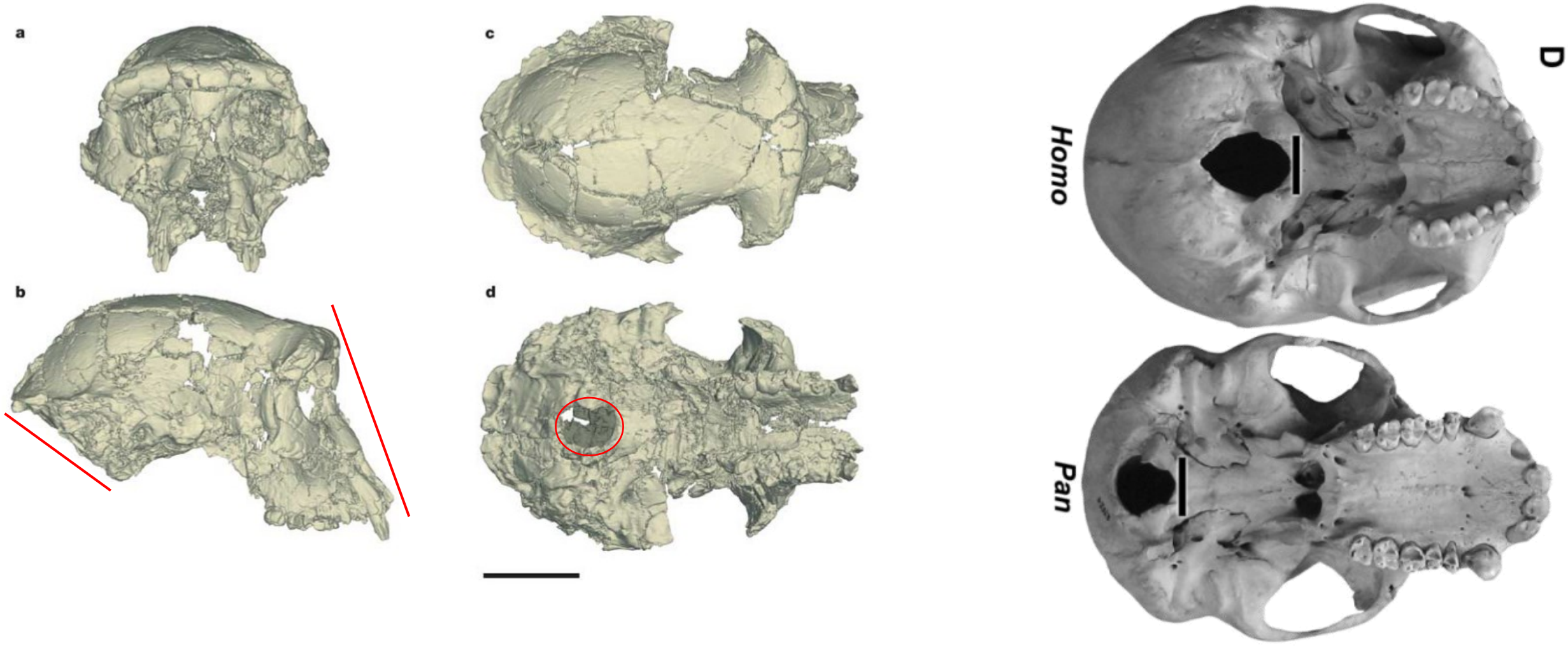
Post-C teeth present an enamel thickness between chimp and Australo





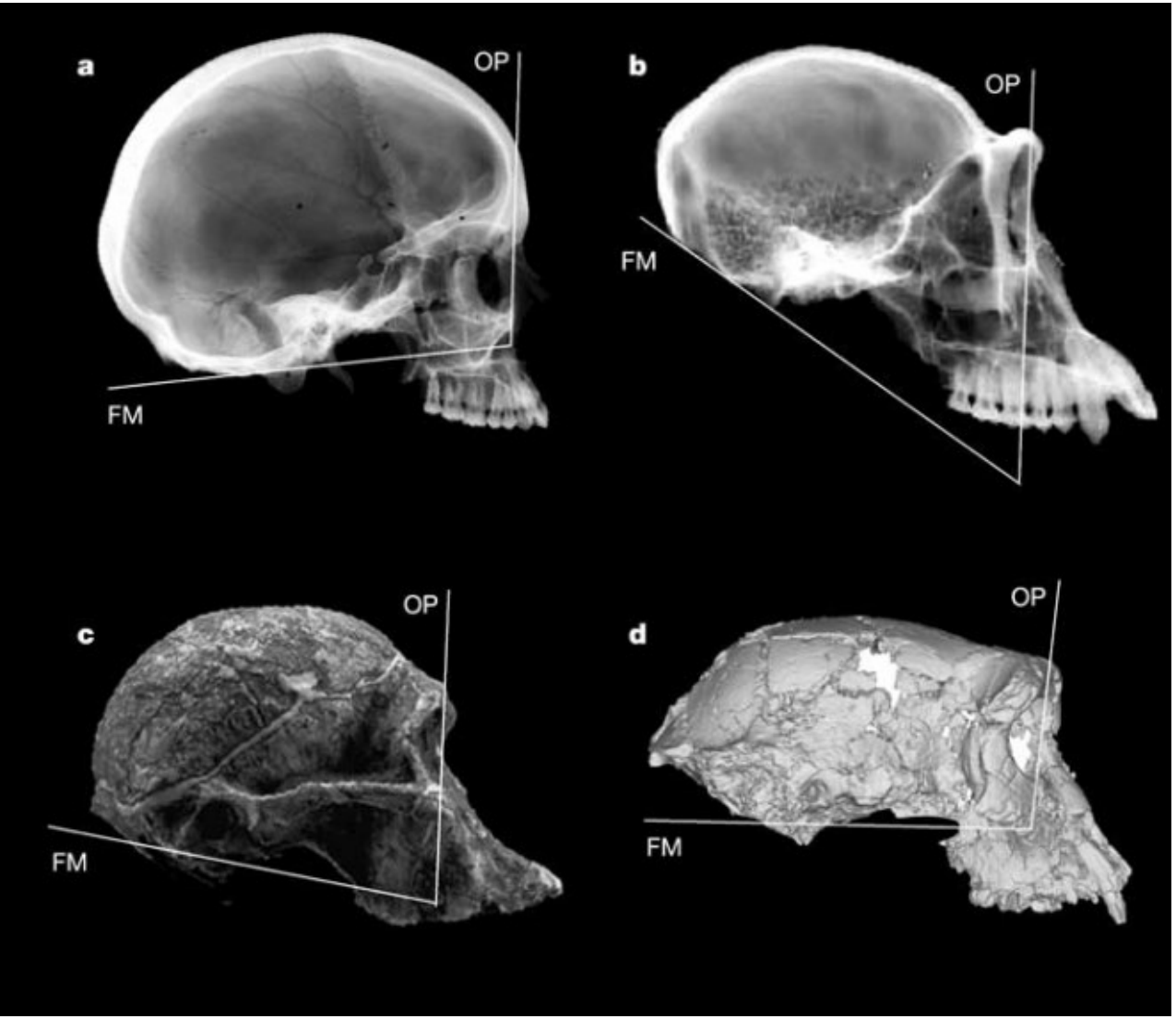
Brunet, 2005 (Nature vol 434)

(Zollikofer, 2005)



- Faccia relativamente verticale con un premascellare corto anteroposteriormente / *Face relatively vertical with a anteroposteriorly short premaxilla*
- Piano nucale piatto e largo / *Nuchal plan flat and wide*
- Foramen magnum posizionato anteriormente /*Anterior position of the foramen magnum*

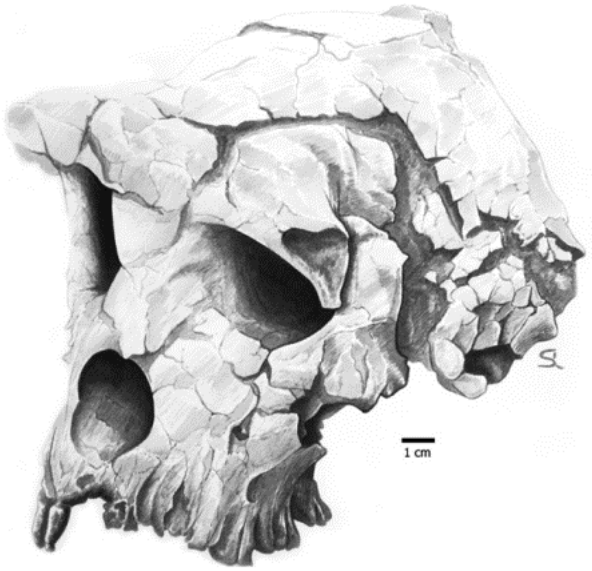
Bipedia?

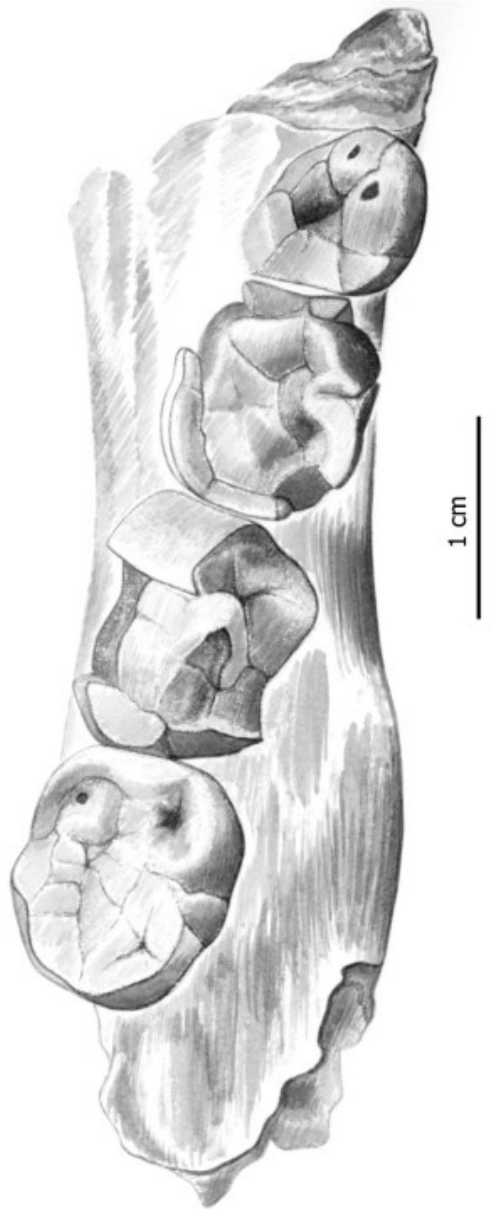


(Zollikofer, 2005)
FM: Foramen magnum
OP: orbital planes

- Angolo tra il piano orbitale (OP) e il piano del foramen magnum (FM)
Angle between the orbital plan and the foramen magnum

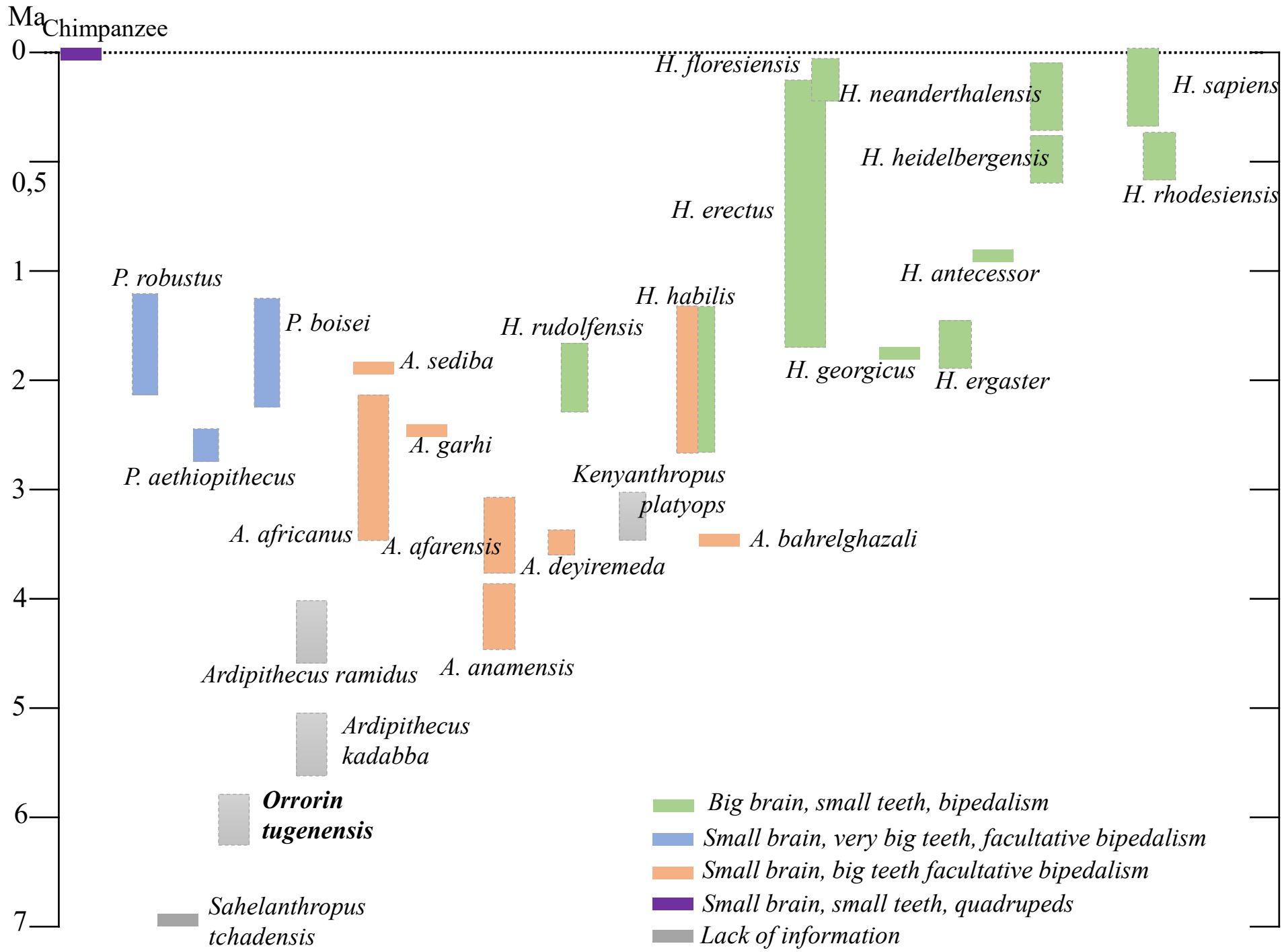
- Orientazione del piano nucale relativamente al piano di Francoforte nella variabilità dei Australopitecine e *Homo*
Orientation of the nuchal plane relative to the Frankfurt plan inside Australopitecine and Homo *variability*



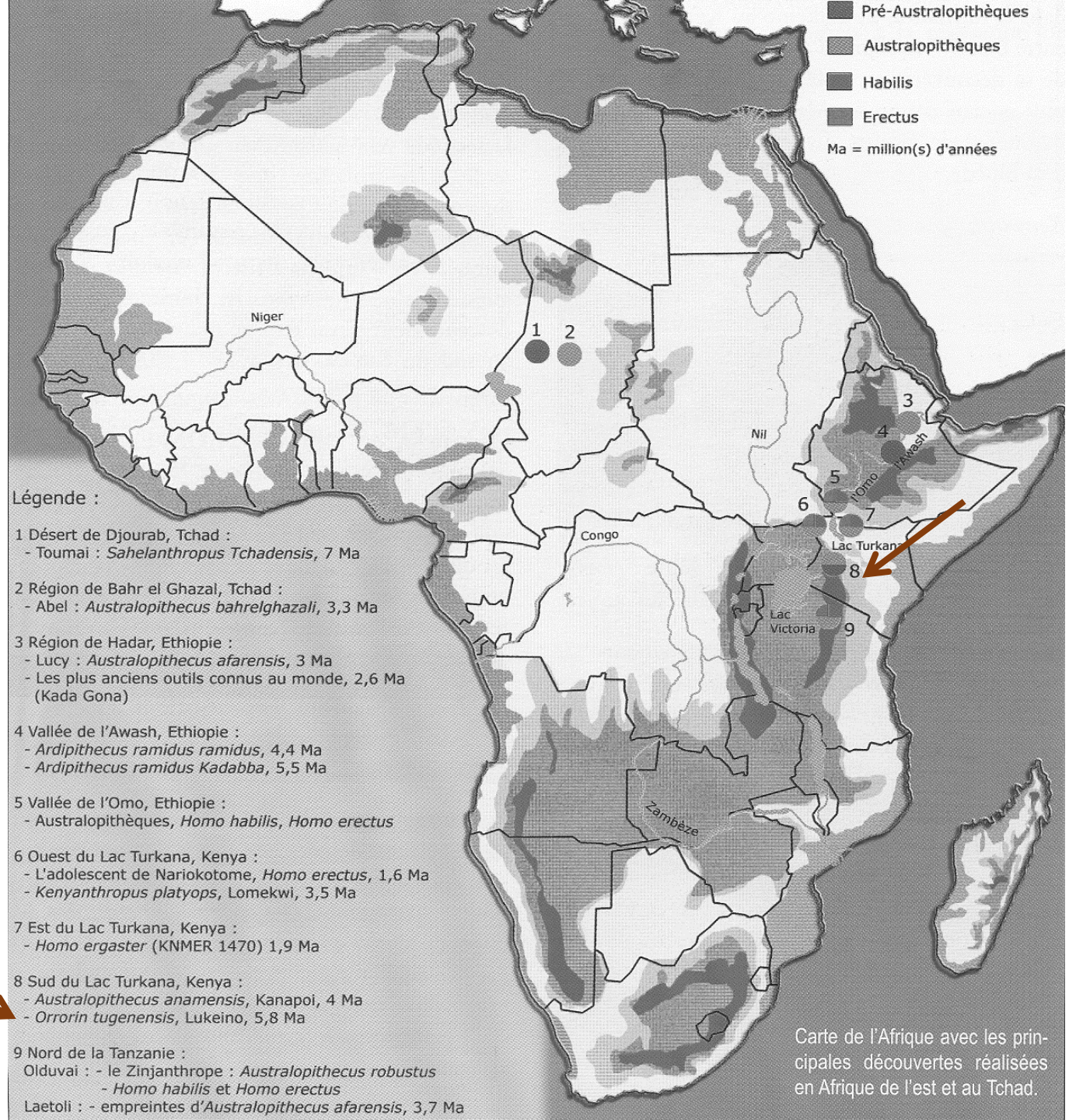


Probabilmente bipede
Probably bipedal

Frequentava spazi forestali
Associated with forest


Ma
Chimpanzee
0
0,5
1
2
3
4
5
6
7
H. floresiensis
H. neanderthalensis
H. sapiens
H. heidelbergensis
H. rhodesiensis
H. erectus
H. antecessor
P. robustus
P. boisei
H. habilis
H. rudolfensis
A. sediba
H. georgicus
H. ergaster
A. garhi
P. aethiopithecus
Kenyanthropus platyops
A. africanus
A. afarensis
A. bahrelghazali
A. deyiremeda
A. anamensis
Ardipithecus ramidus
Ardipithecus kadabba
Orrorin tugenensis
Sahelanthropus tchadensis
Big brain, small teeth, bipedalism
Small brain, very big teeth, facultative bipedalism
Small brain, big teeth facultative bipedalism
Small brain, small teeth, quadrupeds
Lack of information

Orrorin tugenensis



Légende :

1 Désert de Djourab, Tchad :
- Toumai : *Sahelanthropus Tchadensis*, 7 Ma

2 Région de Bahr el Ghazal, Tchad :
- Abel : *Australopithecus bahrelghazali*, 3,3 Ma

3 Région de Hadar, Ethiopie :
- Lucy : *Australopithecus afarensis*, 3 Ma
- Les plus anciens outils connus au monde, 2,6 Ma (Kada Gona)

4 Vallée de l'Awash, Ethiopie :
- *Ardipithecus ramidus ramidus*, 4,4 Ma
- *Ardipithecus ramidus Kadabba*, 5,5 Ma

5 Vallée de l'Omo, Ethiopie :
- Australopithèques, *Homo habilis*, *Homo erectus*

6 Ouest du Lac Turkana, Kenya :
- L'adolescent de Nariokotome, *Homo erectus*, 1,6 Ma
- *Kenyanthropus platyops*, Lomekwi, 3,5 Ma

7 Est du Lac Turkana, Kenya :
- *Homo ergaster* (KNMER 1470) 1,9 Ma

8 Sud du Lac Turkana, Kenya :
- *Australopithecus anamensis*, Kanapoi, 4 Ma
- *Orrorin tugenensis*, Lukeino, 5,8 Ma

9 Nord de la Tanzanie :
Olduvai : - le Zinjanthrope : *Australopithecus robustus*
- *Homo habilis* et *Homo erectus*
Laetoli : - empreintes d'*Australopithecus afarensis*, 3,7 Ma

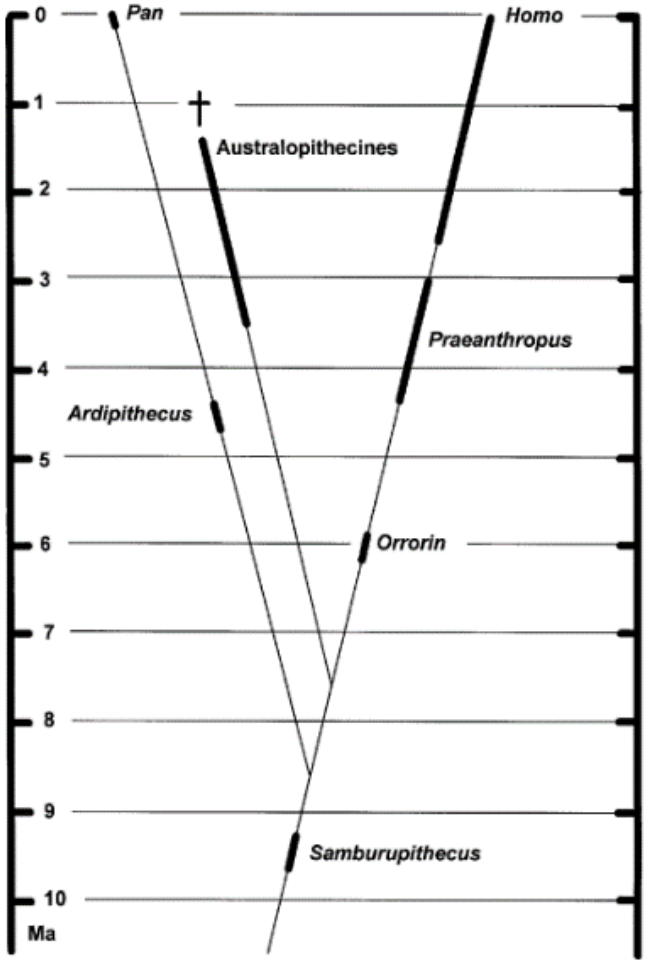
Carte de l'Afrique avec les principales découvertes réalisées en Afrique de l'est et au Tchad.

(Senut *et al.*, 2001)

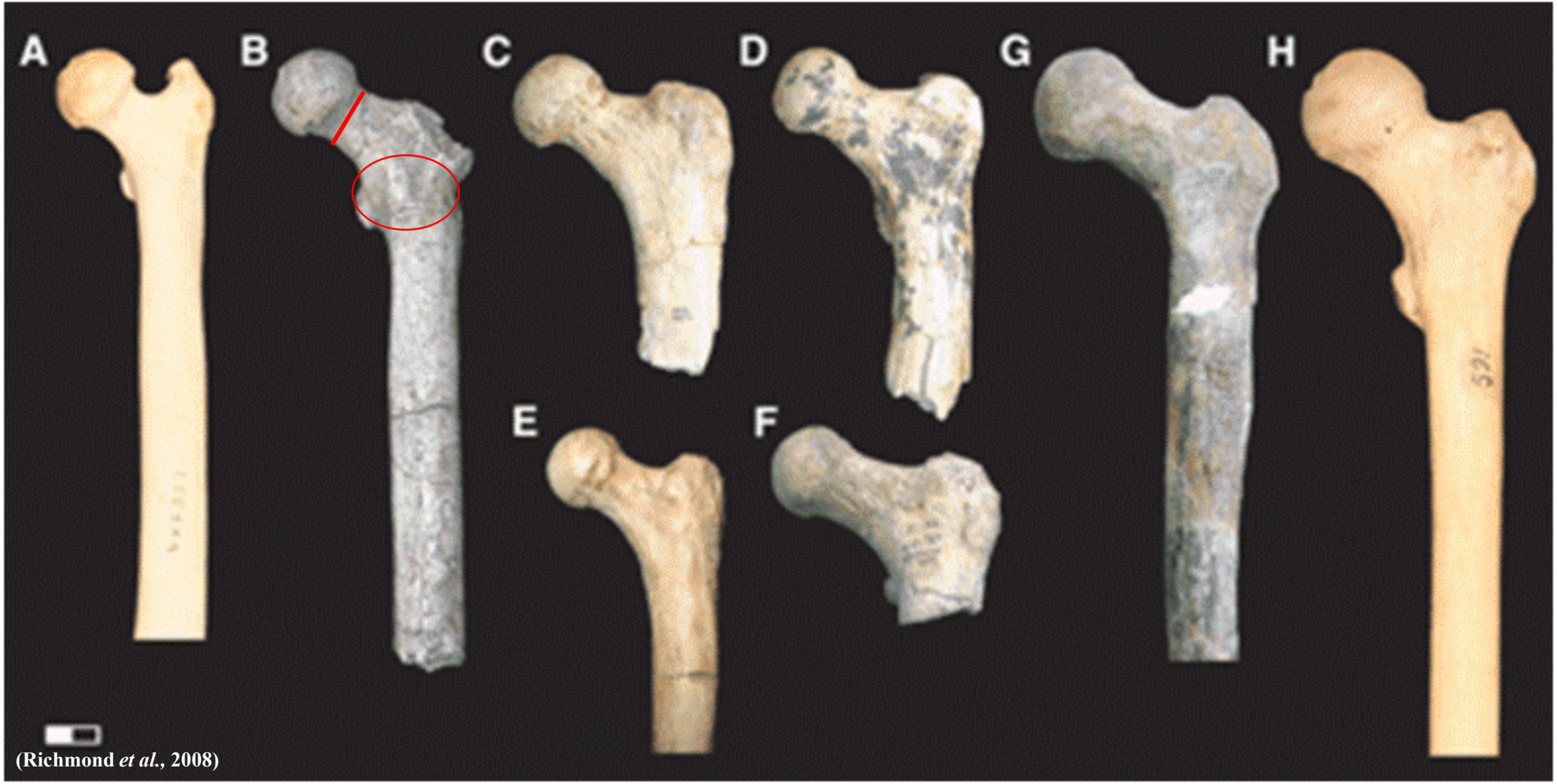
Discovery: Tugen hills, Baringo Lake, Kenys

Reperti:
- Left femur (A, B)
- Right jaw fragment with M_3(C)
- Left jaw fragment with M_{2-3}(D,E)
- Right M^3 (F)
- Right P_4 (G)
- I^1 (H)
- Right C (I)
- Right humerus (J)
- Left proximal part of a femur (K)
- Proximal hand phalanx (L)
- Left M^3 (M)
- Proximal fragment of a right femur (N)

Età: 6 Ma



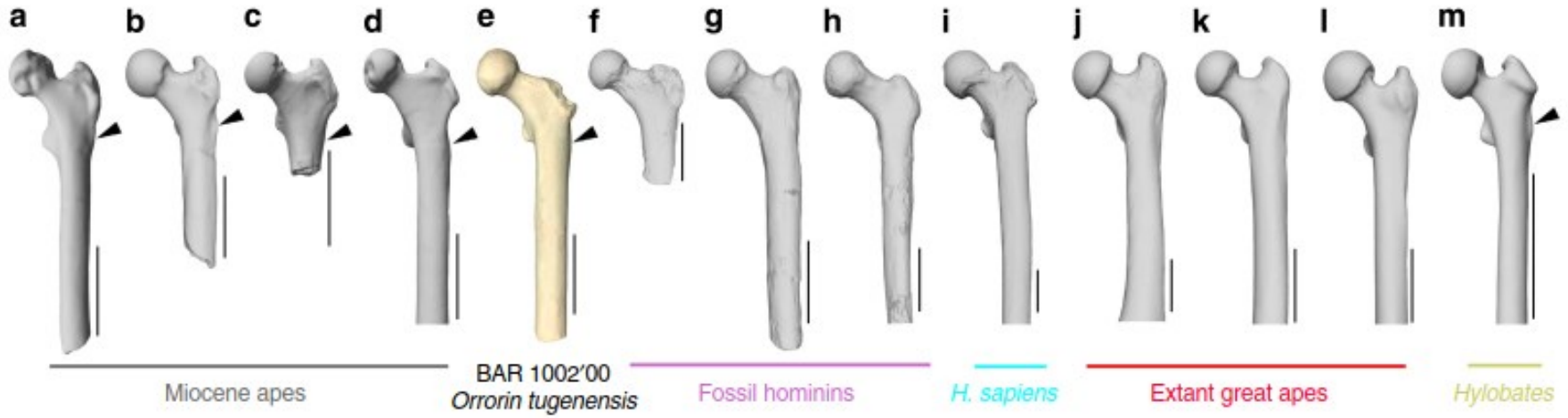
La taglia dei denti iugali mostra che la faccia era corta
Lo spessore dello smalto dei denti iugali attesta un regime alimentare probabilmente onnivoro
Molar and premolar highlight a short face
Enamel thickness attest an omnivore alimentation



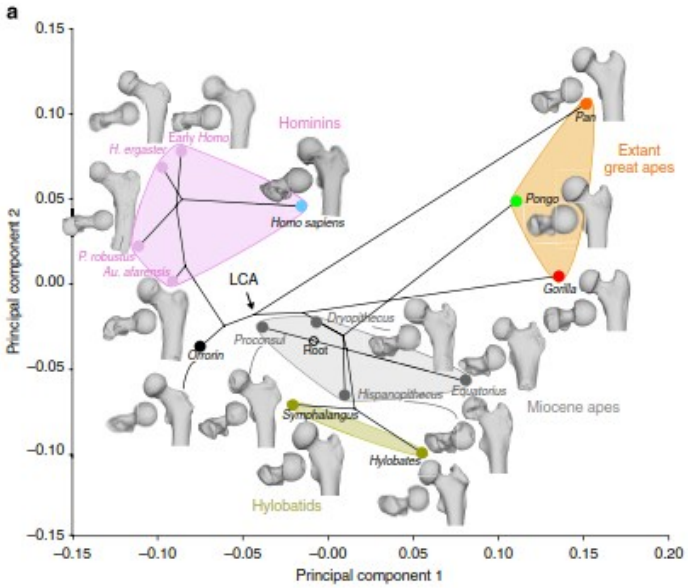
(A) *P. troglodytes*, (**B**) *O. tugenensis* (BAR 1002'00), (**C** and **D**) *Paranthropus robustus* (SK 97 and SK 82, reversed), (**E**) *A. afarensis* (A.L. 288-1ap), (**F**) *Paranthropus boisei* (KNM-ER 1503, reversed), (**G**) early *Homo* (KNM-ER 1481), and (**H**) modern *H. sapiens*. Scale bar, 2 cm.

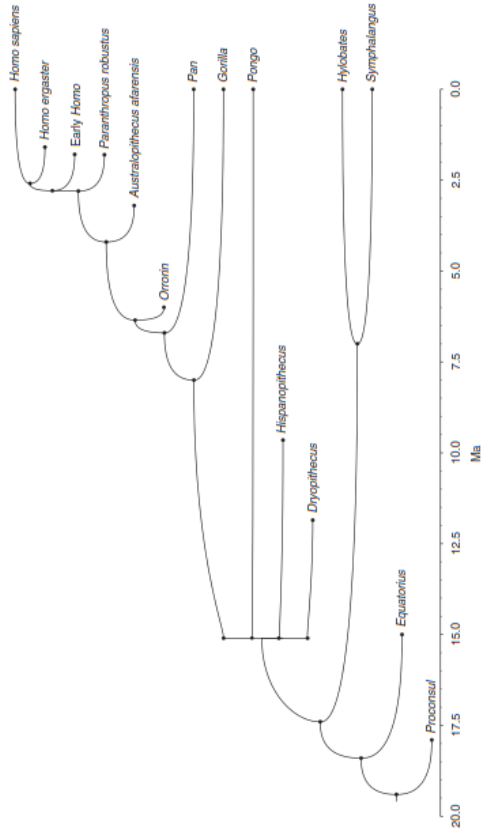
Like the other early hominins' femurs (C to F), Orrorin is different from modern human and great apes with a long and narrow femoral neck and a wide proximal diaphysis.

Come gli altri femore dei primi ominini (C a F), *Orrorin* si distingue dei umani moderni e delle grande scimmie con un collo femorale lungo e stretto e una diafisi prossimale larga.



The arrows indicate a laterally protruding gluteal tuberosity, observed in Hylobates, Miocene hominoids, as well as in *Orrorin* and *Ardipithecus ramidus*

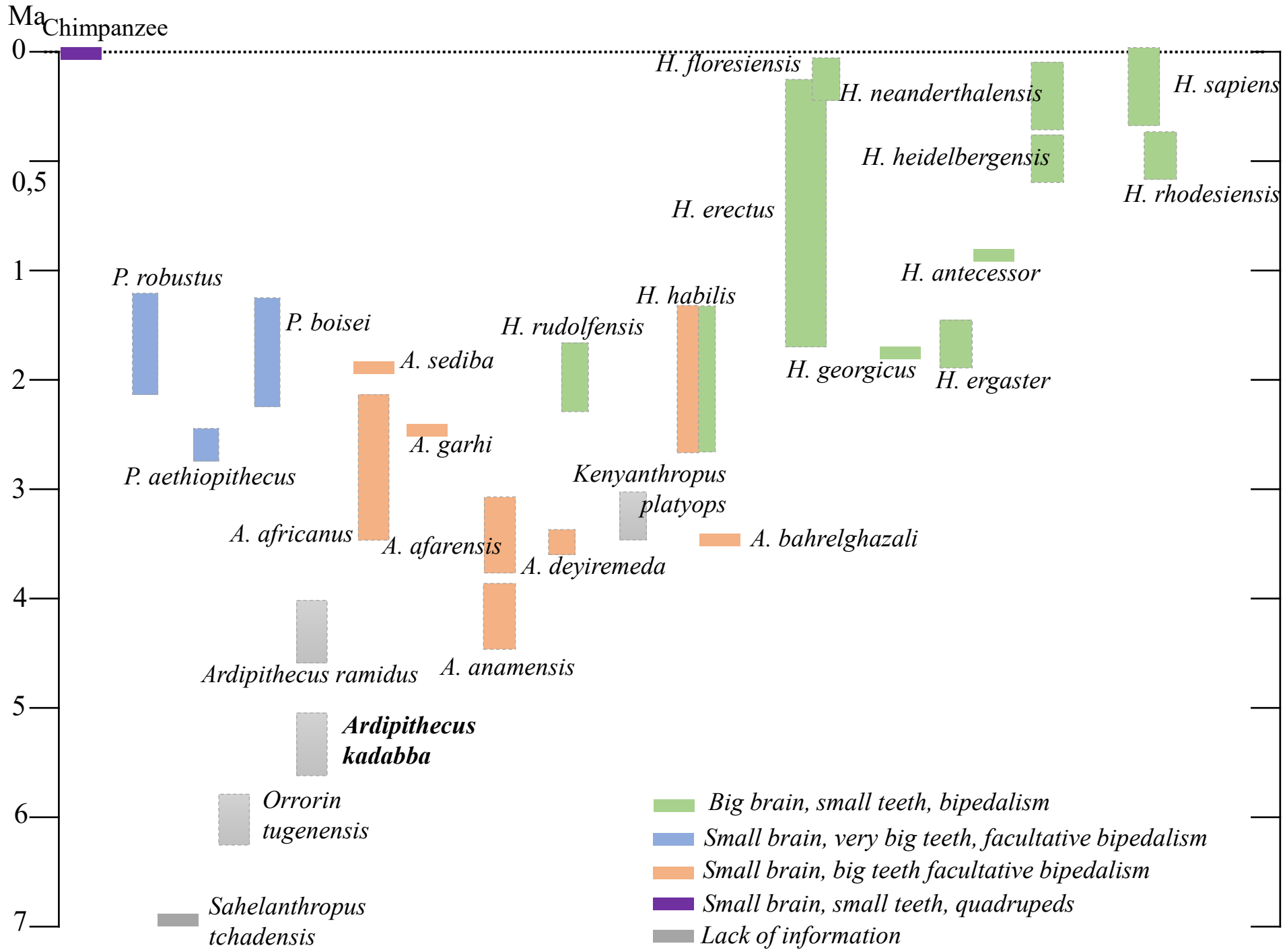




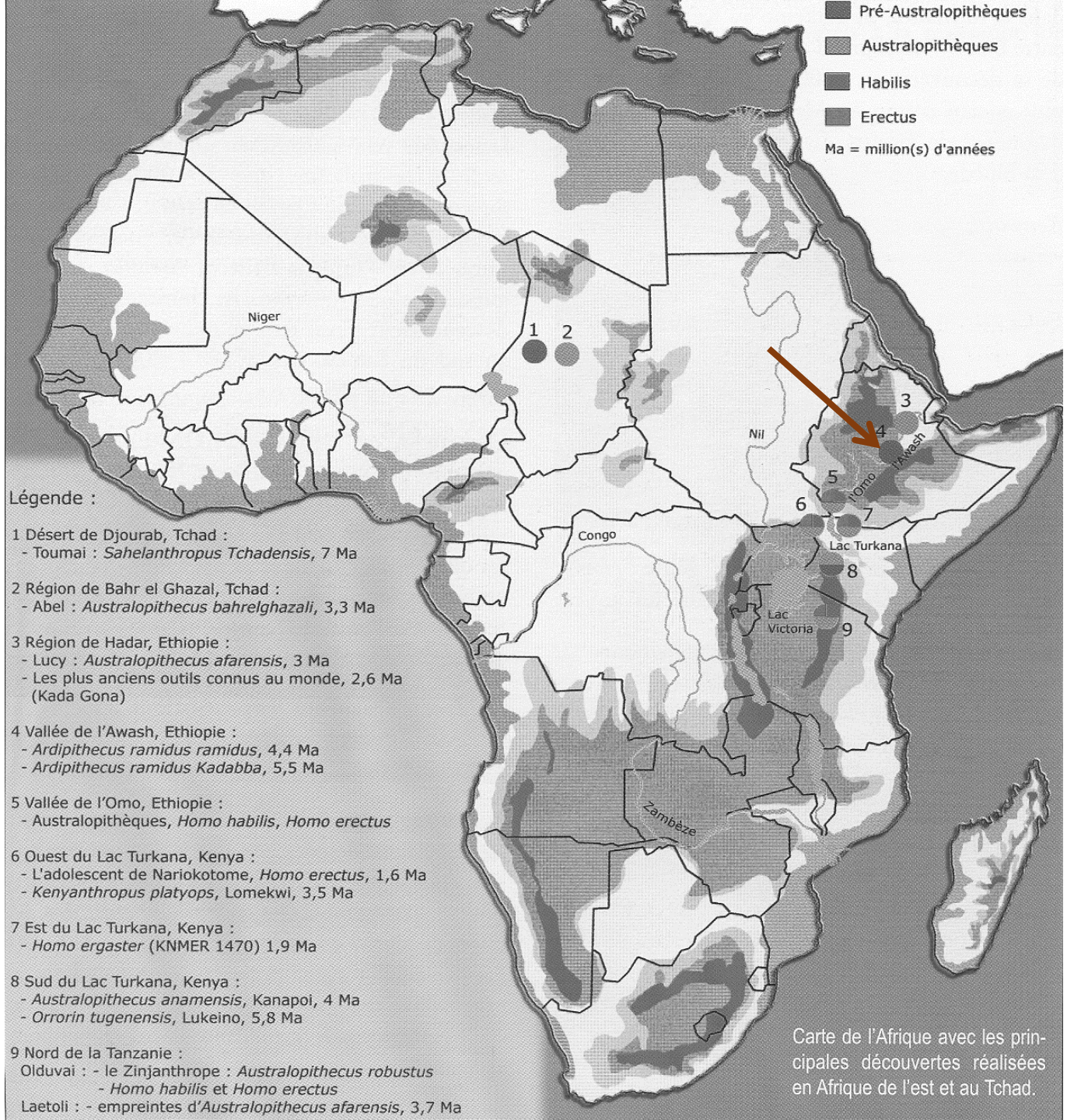
ARTICLE
Received 7 Oct 2013 | Accepted 7 Nov 2013 | Published 3 Dec 2013
DOI: 10.1038/ncomms3888

The femur of *Orrorin tugenensis* exhibits morphometric affinities with both Miocene apes and later hominins

Sergio Almécija[1,2,3], Melissa Tallman[4], David M. Alba[3,5], Marta Pina[3], Salvador Moyà-Solà[6] & William L. Jungers[1]


Ma
Chimpanzee
0
0,5
1
2
3
4
5
6
7
H. floresiensis
H. neanderthalensis
H. sapiens
H. heidelbergensis
H. rhodesiensis
H. erectus
H. antecessor
P. robustus
H. habilis
P. boisei
H. rudolfensis
H. georgicus
H. ergaster
A. sediba
A. garhi
P. aethiopithecus
Kenyanthropus platyops
A. africanus
A. afarensis
A. bahrelghazali
A. deyiremeda
A. anamensis
Ardipithecus ramidus
Ardipithecus kadabba
Orrorin tugenensis
Sahelanthropus tchadensis
Big brain, small teeth, bipedalism
Small brain, very big teeth, facultative bipedalism
Small brain, big teeth facultative bipedalism
Small brain, small teeth, quadrupeds
Lack of information

Ardipithecus kadabba



Légende :

1 Désert de Djourab, Tchad :
- Toumai : *Sahelanthropus Tchadensis*, 7 Ma

2 Région de Bahr el Ghazal, Tchad :
- Abel : *Australopithecus bahrelghazali*, 3,3 Ma

3 Région de Hadar, Ethiopie :
- Lucy : *Australopithecus afarensis*, 3 Ma
- Les plus anciens outils connus au monde, 2,6 Ma (Kada Gona)

4 Vallée de l'Awash, Ethiopie :
- *Ardipithecus ramidus ramidus*, 4,4 Ma
- *Ardipithecus ramidus Kadabba*, 5,5 Ma

5 Vallée de l'Omo, Ethiopie :
- Australopithèques, *Homo habilis*, *Homo erectus*

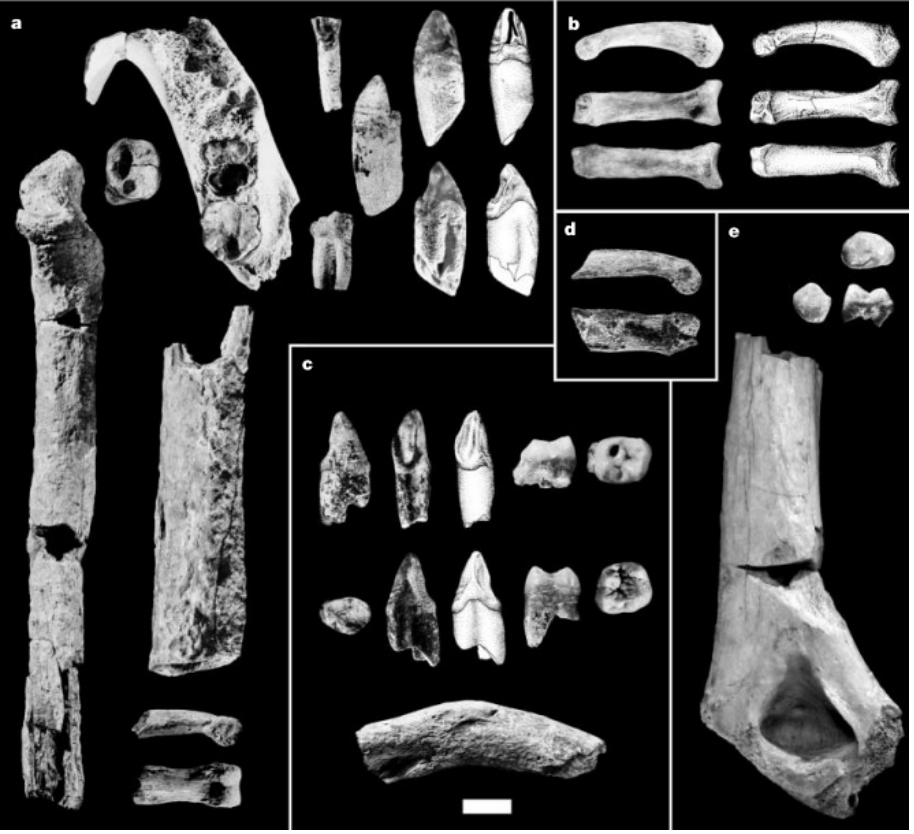
6 Ouest du Lac Turkana, Kenya :
- L'adolescent de Nariokotome, *Homo erectus*, 1,6 Ma
- *Kenyanthropus platyops*, Lomekwi, 3,5 Ma

7 Est du Lac Turkana, Kenya :
- *Homo ergaster* (KNMER 1470) 1,9 Ma

8 Sud du Lac Turkana, Kenya :
- *Australopithecus anamensis*, Kanapoi, 4 Ma
- *Orrorin tugenensis*, Lukeino, 5,8 Ma

9 Nord de la Tanzanie :
Olduvai : - le Zinjanthrope : *Australopithecus robustus*
- *Homo habilis* et *Homo erectus*
Laetoli : - empreintes d'*Australopithecus afarensis*, 3,7 Ma

Carte de l'Afrique avec les principales découvertes réalisées en Afrique de l'est et au Tchad.



Discovery: Aramis area, Awash valley, Ethiopia
Fossils:

- Jaw fragment (a)
- Fragment of ulna and humerus (a)
- Clavicle fragment (c)
- Foot and hand phalanx (b,d)
- 11 isolated teeth (a,c,e)
- 4 post-cranial fragments

Age: 5,8 – 5,2 Ma

Late Miocene hominids from the Middle Awash, Ethiopia

Yohannes Haile-Selassie

Department of Integrative Biology and Laboratory for Human Evolutionary Studies, Museum of Vertebrate Zoology, 3060 VLSB, University of California, Berkeley, California 94720, USA

Molecular studies suggest that the lineages leading to humans and chimpanzees diverged approximately 6.5–5.5 million years (Myr) ago, in the Late Miocene[1–3]. Hominid fossils from this interval, however, are fragmentary and of uncertain phylogenetic status, age, or both[4–6]. Here I report new hominid specimens from the Middle Awash area of Ethiopia that date to 5.2–5.8 Myr and are associated with a wooded palaeoenvironment[7]. These Late Miocene fossils are assigned to the hominid genus *Ardipithecus* and represent the earliest definitive evidence of the hominid clade. Derived dental characters are shared exclusively with all younger hominids. This indicates that the fossils probably represent a hominid taxon that postdated the divergence of lineages leading to modern chimpanzees and humans. However, the persistence of primitive dental and postcranial characters in these new fossils indicates that *Ardipithecus* was phylogenetically close to the common ancestor of chimpanzees and humans. These new findings raise additional questions about the claimed hominid status of *Orrorin tugenensis*[8], recently described from Kenya and dated to ~6 Myr[9].

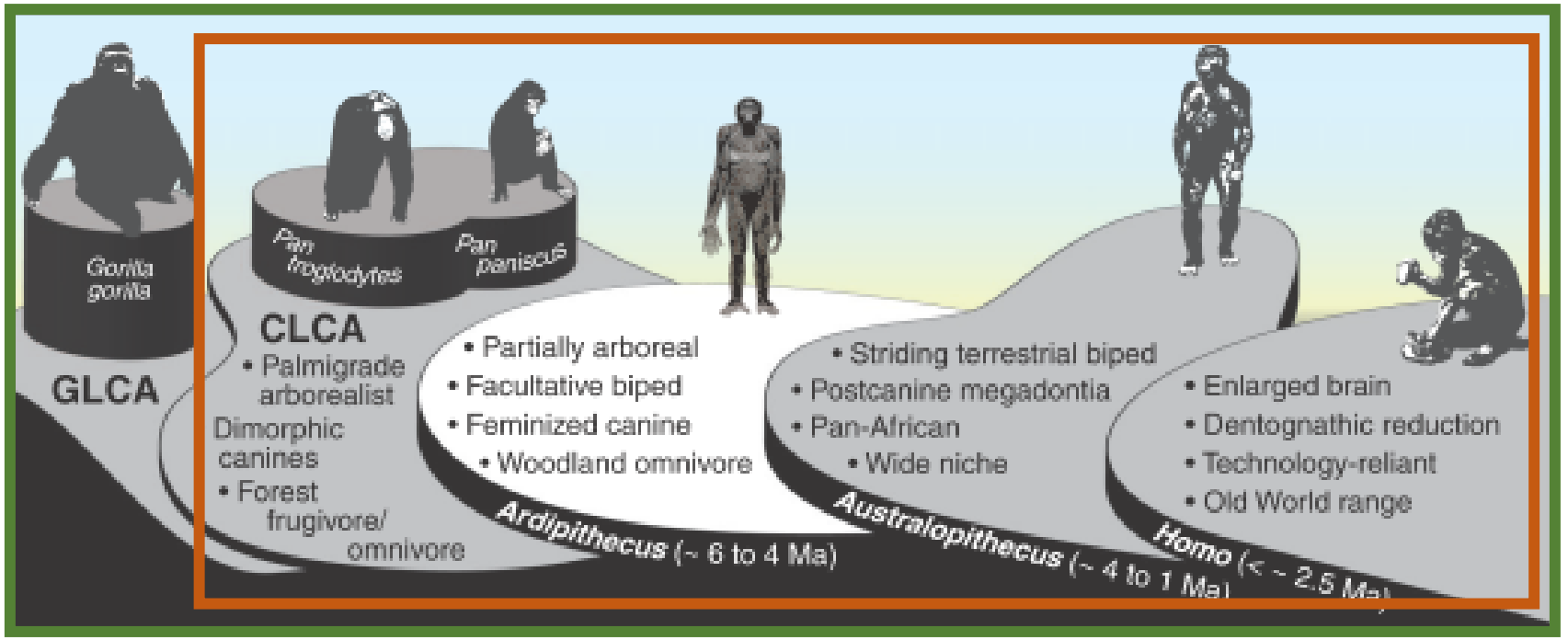
(Nature 412, 2001)

Ardipithecus ramidus kadabba

Ardipithecus kadabba

Canines are tendenzialy incisoforme
Post-cranial elements similar to great apes: adaptation to arboreal locomotion
Differences between *Ar. kadabba* e *Ar. ramidus* in teeth roots

Homininae Hominini



Evolution of hominids and African apes since the gorilla/chimp+human (GLCA) and chimp/human (CLCA) last common ancestors. Pedestals on the left show separate lineages leading to the extant apes (gorilla, and chimp and bonobo); text indicates key differences among adaptive plateaus occupied by the three hominid genera.

SCIENCE - VOL 326 - 2 October 2009

Ardipithecus ramidus and the Paleobiology of Early Hominids

Tim D. White,[1]* Berhane Asfaw,[2] Yonas Beyene,[3] Yohannes Haile-Selassie,[4] C. Owen Lovejoy,[5] Gen Suwa,[6] Giday WoldeGabriel[7]

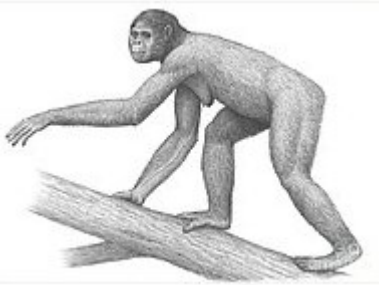
Fig. 1. Geography and stratigraphy of the Aramis region. Two dated volcanic horizons constrain the main *Ardipithecus*-bearing stratigraphic interval in the Aramis region. The top frame shows these tephra in situ near the eastern end of the 9-km outcrop. The dark stripe in the background is the riverine forest of the modern Awash River running from right to left, south to north, through the Middle Awash study area of the Afar Rift. The lower frames are contemporaneous helicopter views over ARA-VP-1 (Yonas Molar Site) to show the geographic position of the top photo and to depict the extensive outcrop of the upper tuff horizon (dotted lines show the DABT) across the local landscape. Vehicles are in the same position to provide orientation. Sediments outcropping immediately below this 4.4-million-year-old horizon yielded the floral, faunal, and isotopic contexts for *Ar. ramidus*. The frame to the left shows the slight eastward dip of the Sagantole Formation toward the modern Awash River. The contiguous frame to the right is a view up the modern upper Aramis catchment. The ARA-VP-6 locality where the partial *Ardipithecus* skeleton was excavated is near its top right corner (Fig. 2).

SCIENCE - VOL 326 - 2 October 2009

Ardipithecus ramidus and the Paleobiology of Early Hominids

Tim D. White,[1]* Berhane Asfaw,[2] Yonas Beyene,[3] Yohannes Haile-Selassie,[4] C. Owen Lovejoy,[5] Gen Suwa,[6] Giday WoldeGabriel[7]

Età: 4.4 Ma

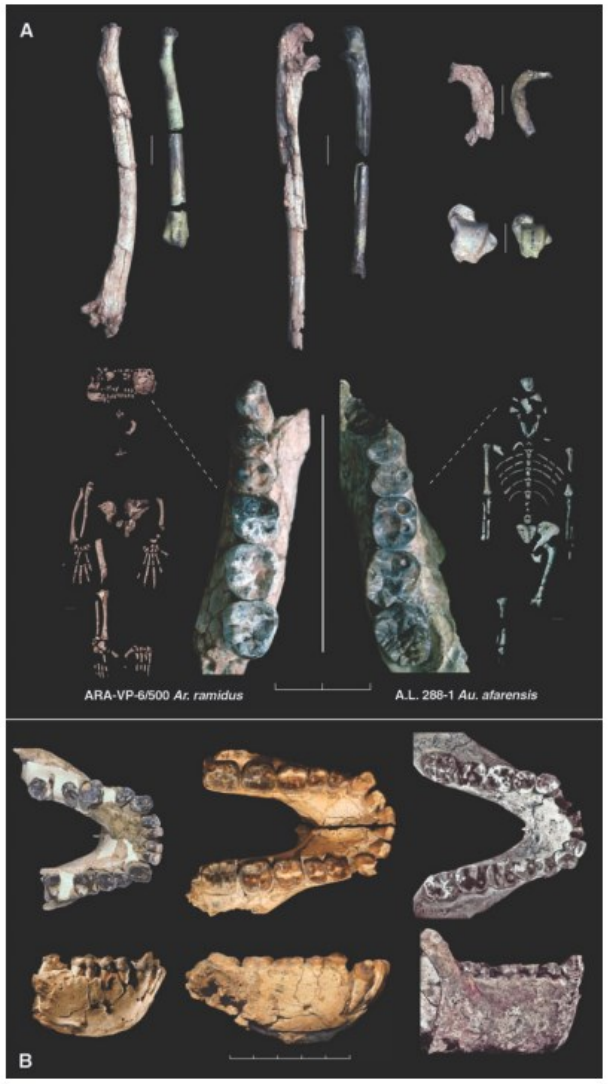


-110 resti ritrovati
- 50 kg , 120 cm di altezza
- Piccole differenze nella taglia corporea tra maschio e femmina
Little body size difference between males and females
- Capacità cranica / *Brain size* = chimpanzees
- Faccia piccola e canini/premolari ridotti (riduzione delle competizione sociali)
Small face and reduced canine/premolar complex (minimal social agression)
- Nessuna sospensione, o knuckle-walking ma una bipedia più primitiva che i Australopitecini
No suspension, vertical climbing of knuckle-walking but more primitive bipedy than Australopithecus
- Riduzione dello spessore delle smalto in confronto a *Australopithecus*
Reduced thickness of the enamel compared to Australopithecus

Ar. Ramidus indica che gli ultimi antenati comuni tra i umani e le scimmie africane non erano «chimpanzee-like» e che gli ominidi e le scimmie africani estinti sono fortemente specializzati, ma attraverso un cammino evolutive molto diverso.

Ar. ramidus *thus indicates that the last common ancestors of human and African apes were not chimpanzee-like and that both hominids and extant African apes are each highly specialized, but through very different evolutionary pathways.*

SCIENCE - VOL 326 - 2 October 2009



AR A-VP-6/500

KNM-KP 29281 *Au. Anamensis* 4,12 Ma

MAK-VP-1/12 *Au. Afarensis* 3,4 Ma

I scheletri dimostrano delle dimensioni postcraniali importanti relativamente alle dimensione dentarie

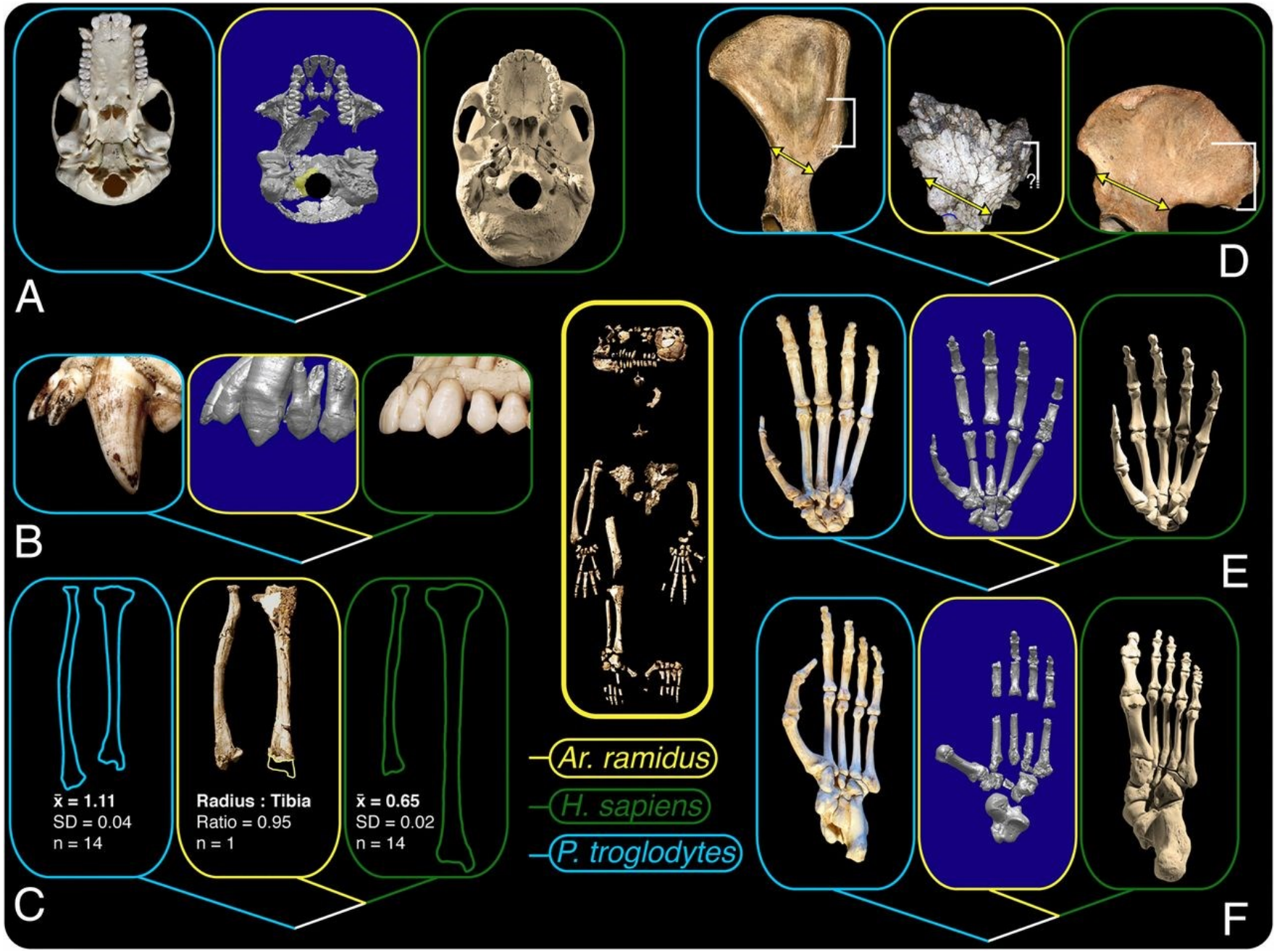
Skeletal individuals illustrate larger postcranial dimensions for the Ardipithecus *individual relative to dental size.*

Confronti tra dimensioni dentarie post canini rivelano la megadontia dei *Autralopitecini.*

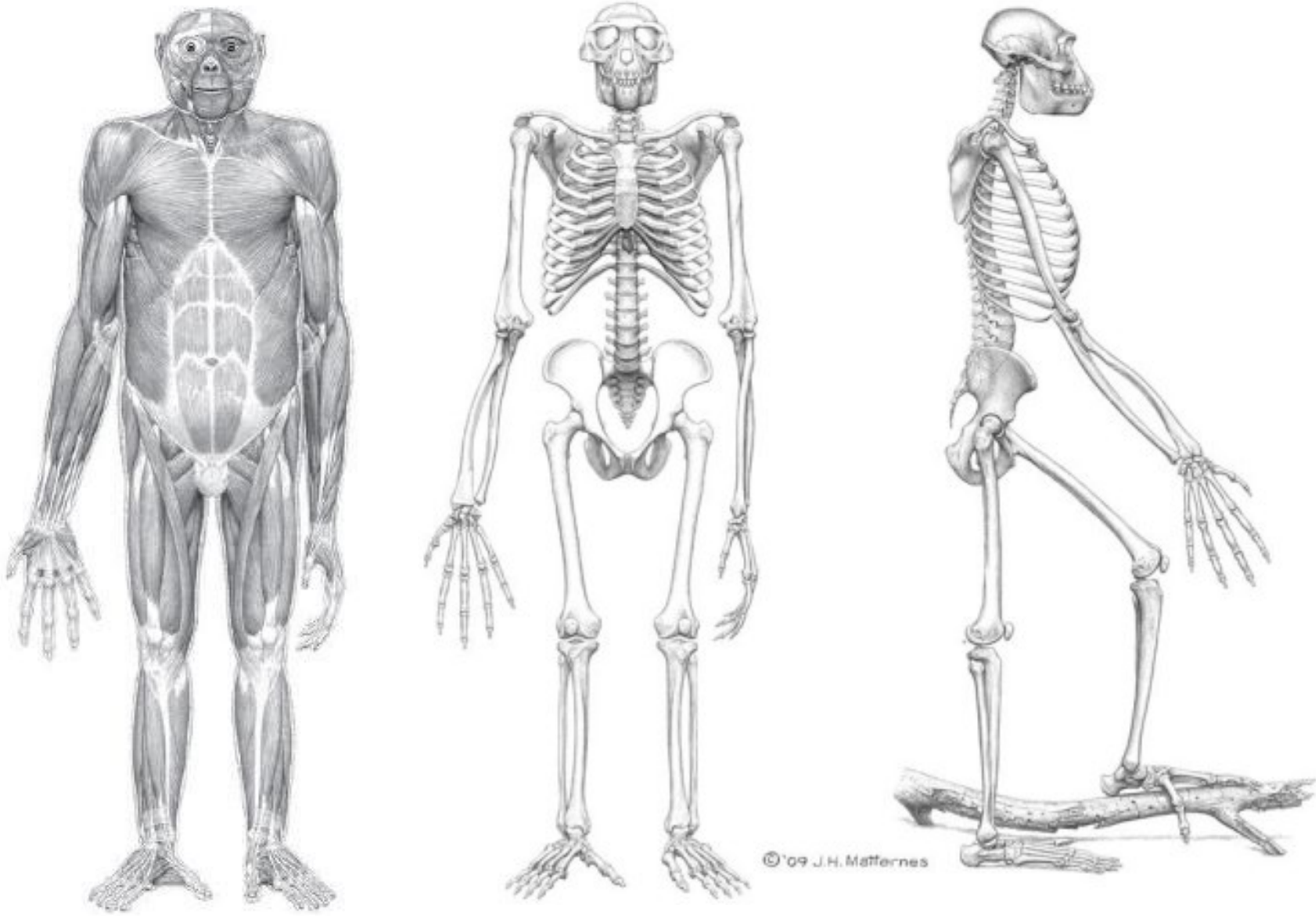
Comparison of the postcanine dentitions reveals the megadontia of the Australopithecus *individual*

Fig. 3. The *ARA-VP-6/500* skeleton. This is a composite photograph to show the approximate placement of elements recovered. Some pieces found separately in the excavation are rejoined here. Intermediate and terminal phalanges are only provisionally allocated to position and side.

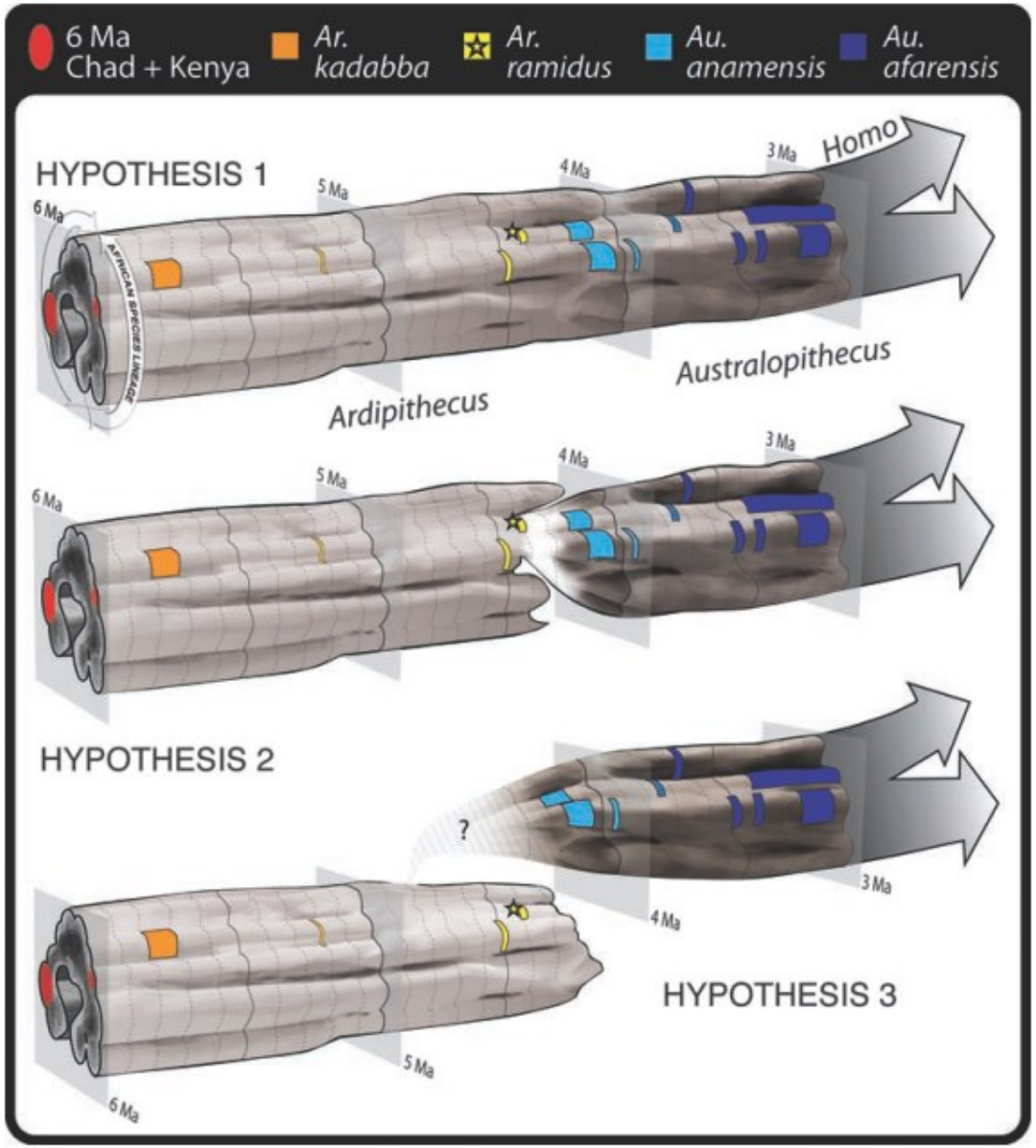
Evolution in different directions.



Tim D. White et al. PNAS 2015;112:4877-4884


©'09 J.H. Matternes

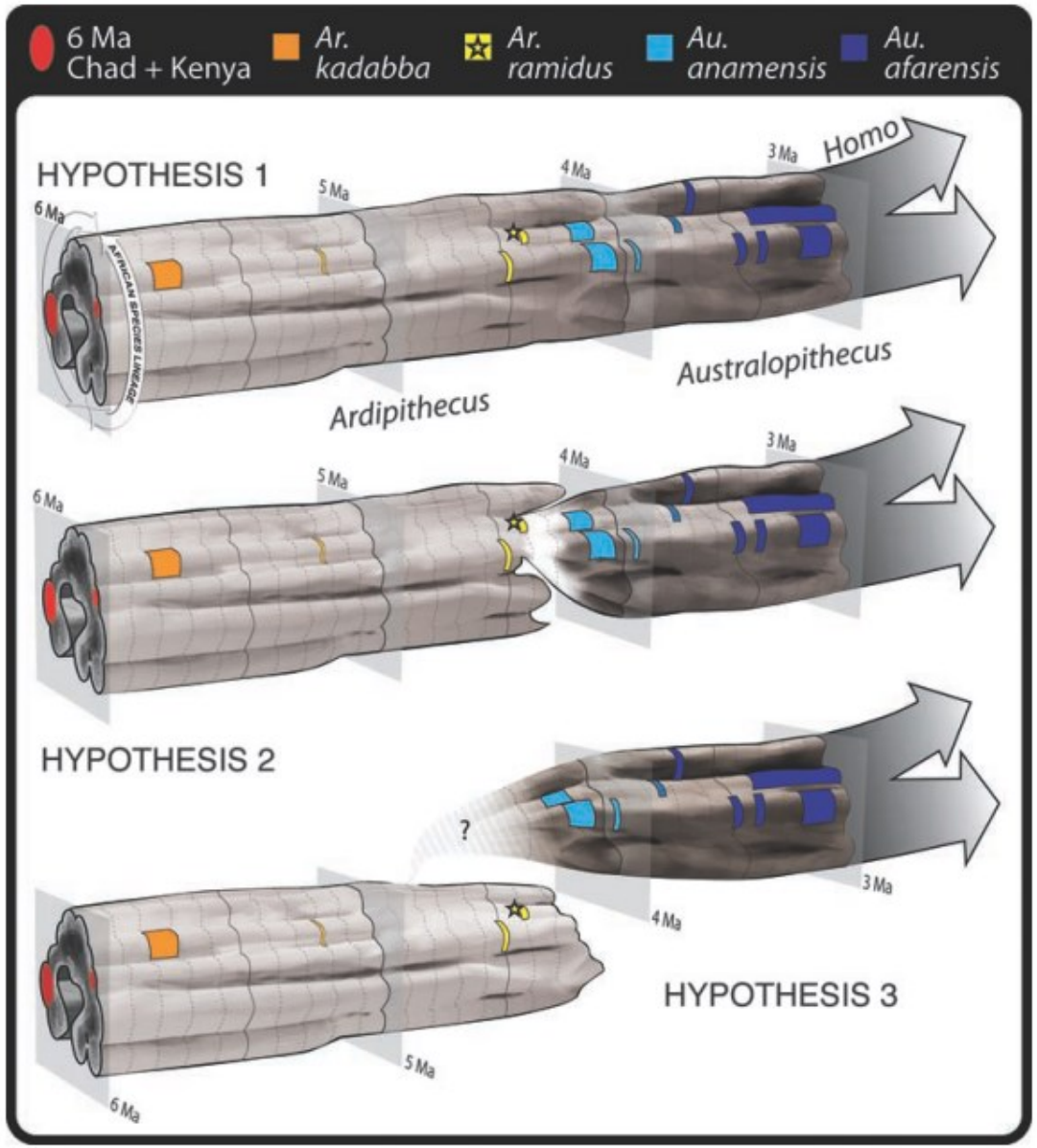
SCIENCE - VOL 326 - 2 October 2009



1 ipotesi: tutte le evidenze conosciute rappresentano un unica linea evolutiva

2 ipotesi; raffigura la stessa evidenza di una transizione diretta tra *Ardipithecus* e *Australopithecus* (speciazione) accaduta tra 4,5 e 4,2 Ma in un gruppo di popolazione regionale (o locale) che potrebbe avere incluso I rift dell'Afar e Turkana.

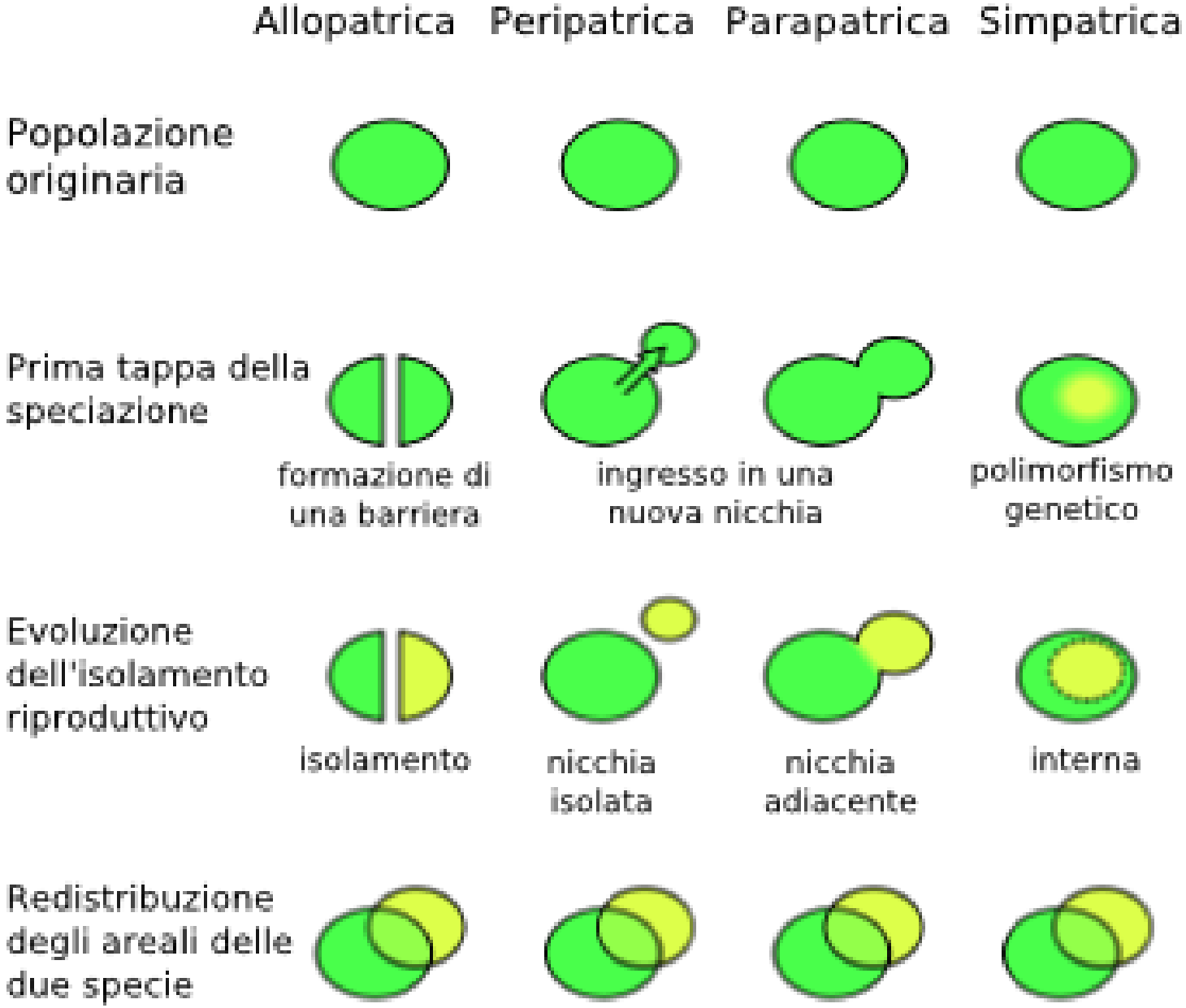
3 ipotesi: consente una speciazione allopatrica (cladogenesi attraverso una microevoluzione accumulata in una popolazione periferica isolata che è diventata separata al livello riproduttivo.



Hypothesis 1: interprets all known evidence to represent a species lineage evolving phyletically across its entire range.

Hypothesis 2: depicts the same evidence in an Ardipithecus-to- Australopithecus transition (speciation) occurring between ~4.5 and ~4.2 Ma in a regional (or local) group of populations that might have included either or both the Afar and Turkana rifts.

Hypothesis 3: accommodates the same evidence to an alternative, much earlier peripheral allopatric "rectangular" speciation model (cladogenesis through microevolution accumulated in a peripheral isolate population, becoming reproductively separated).

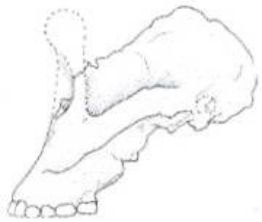

Allopatrica
Peripatrica
Parapatrica
Simpatrica
Popolazione originaria
Prima tappa della speciazione
formazione di una barriera
ingresso in una nuova nicchia
polimorfismo genetico
Evoluzione dell'isolamento riproduttivo
isolamento
nicchia isolata
nicchia adiacente
interna
Redistribuzione degli areali delle due specie

Autralopithecus

Australopithecus africanus Dart 1925

Holotype : Crâne de Taung (Afrique du Sud)

Synonymies :
- *Australopithecus transvaalensis* Broom, 1936 Sterkfontein, fgt de maxillaire TM 1511 (S1)
- *Plesianthropus transvaalensis* (Broom et Schepers, 1946) Sterkfontein, fgt mandibule TM 1516 et crâne Sts 5
- *Australopithecus prometheus* Dart, 1948 Makapansgat, calotte crânienne MDL-1



Paranthropus robustus Broom 1938

Holotype : Crâne et postcrânien TM 1517 (Kromdraai, Afrique du Sud)

Synonymies :
- *Paranthropus crassidens* Broom, 1949 Swartkrans, mandibule SK 6

Paranthropus boisei (Tobias 1967)

Holotype : Crâne OH 5 (Olduvai, Tanzanie)

Synonymies :
Zinjanthropus boisei Leakey, 1959
Paranthropus boisei (Robinson, 1960)
Australopithecus (Paranthropus) boisei (Leakey, Tobias et Napier, 1964)

Paranthropus aethiopicus (Arambourg et Coppens 1967)

Holotype : Mandibule Omo 18-1967-18 (Shungura, Omo, Éthiopie)

Australopithecus afarensis Johanson, White et Coppens 1978

Holotype : Mandibule LH 4 (Laetoli, Tanzanie)

Synonymies :
- *Meganthropus africanus* (Wernert, 1950) Maxillaire Garusi I
- *Praeanthropus africanus* (Senyürek, 1955) Maxillaire Garusi I

Australopithecus bahrelghazali Brunet *et al.* 1996

Holotype : Mandibule KT 12/H1 (Koro Toro, Tchad)

Australopithecus anamensis Leakey *et al.* 1995

Holotype : Mandibule KNM-KP 29 281 (Kanapoi, Kenya)

Australopithecus garhi Asfaw *et al.* 1999

Holotype : Bou-VP-12/130 (Bouri, Middle Awash, Ethiopie)

Kenyanthropus platyops Leakey *et al.* 2001

Holotype : Crâne KNM-WT 40000 (Lomekwi, Ouest-Turkana, Kenya)

Histoire d'ancetres- Grimaud *et al.*, 2005

Autralopithecus

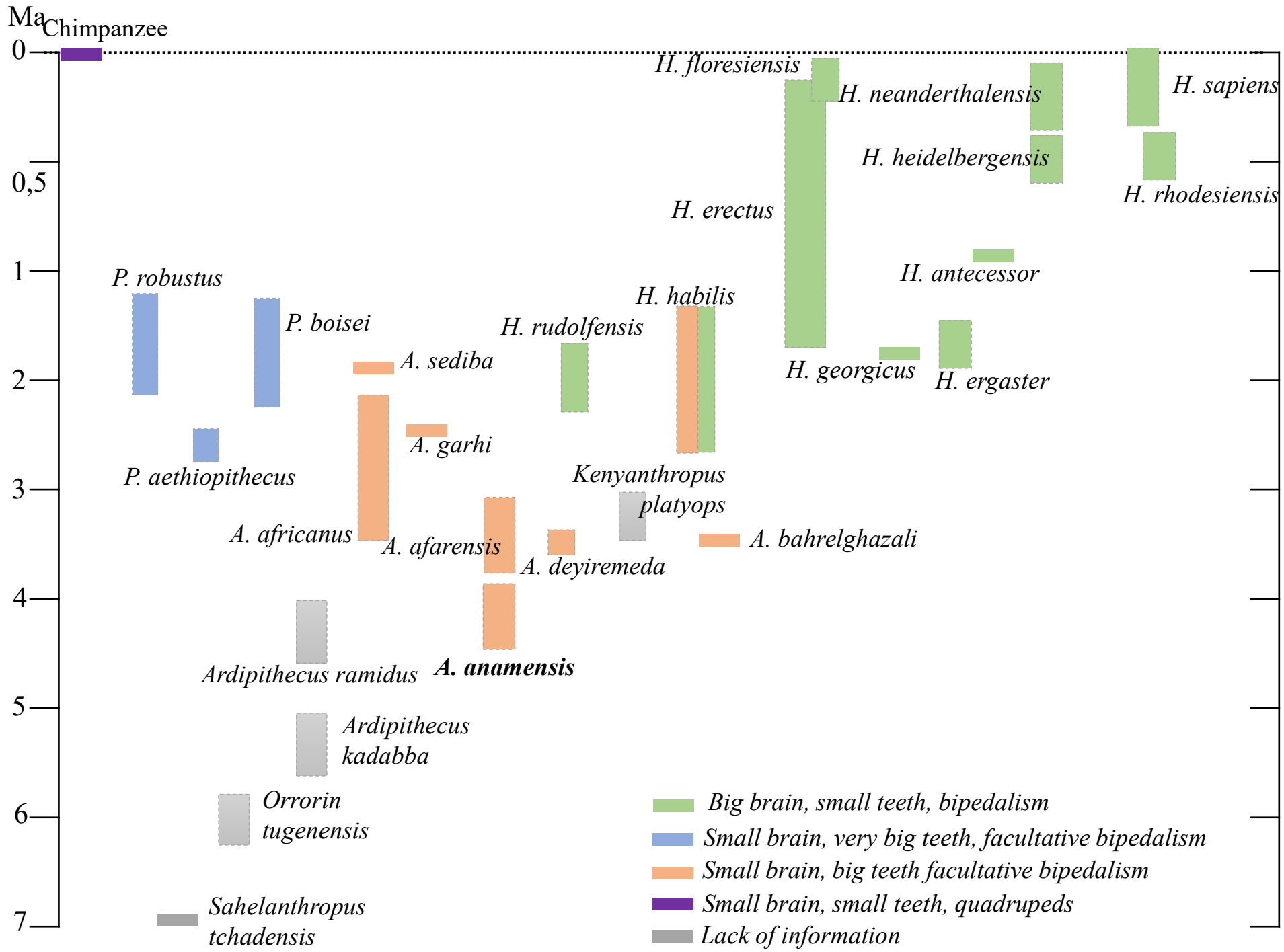
Caratteristiche condivise dalle Australopitecine

1. Dimensione del cervello ± scimpanzé (ca. 375-550 cm^3)
2. Parte mesio-facciale verticale e corta inferio-superiormente con una regione zigomaticomascellare massiccia e un forte prognatismo subnasale
3. Basicranio corto con un foramen magnum posizionato anteriormente
4. Canini ridotti e non affilati
5. Premolari e molari grandi (in rapporto alla taglia del corpo) con smalto spesso
6. Corpo mandibolare spesso trasversalmente e rami alti

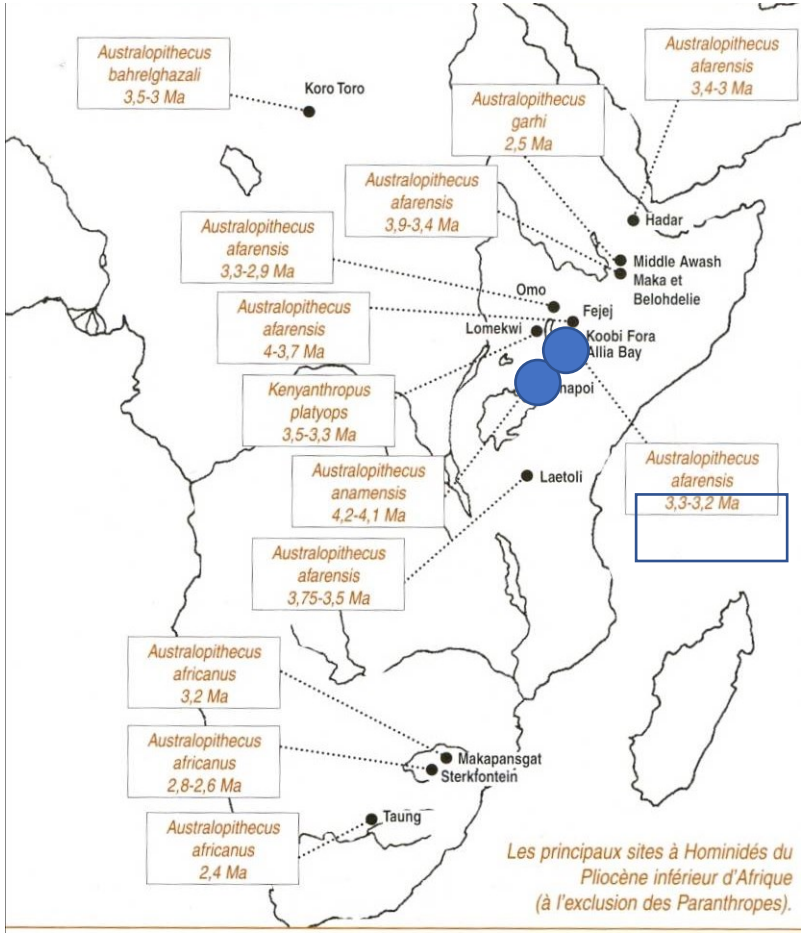
Autralopithecus

Features shared by the Australopiths

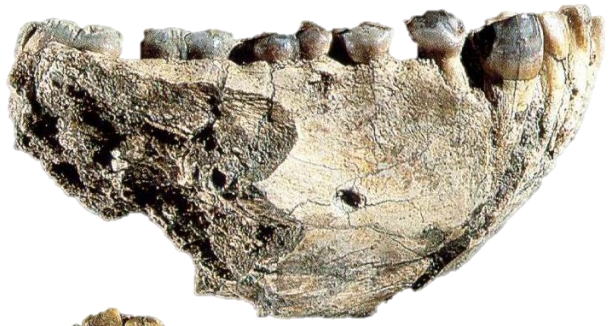
1. Brain dimension ± chimpanzee (ca. 375-550 cm^3)
2. Vertical and short mesofacial area with a thick zigomaticomaxillary complex and an important subnasal prognatism
3. Short basicranium with a foramen magnum situated anteriorly
4. Reduced unsharped canines
5. Large premolars and molars (in relation to body size) with thick enamel
6. Thick mandibular corpus with high ramus


Ma
Chimpanzee
0
0,5
1
2
3
4
5
6
7
H. floresiensis
H. neanderthalensis
H. sapiens
H. heidelbergensis
H. rhodesiensis
H. erectus
H. antecessor
P. robustus
H. habilis
P. boisei
H. rudolfensis
A. sediba
H. georgicus
H. ergaster
A. garhi
P. aethiopithecus
Kenyanthropus platyops
A. africanus
A. afarensis
A. bahrelghazali
A. deyiremeda
A. anamensis
Ardipithecus ramidus
Ardipithecus kadabba
Orrorin tugenensis
Sahelanthropus tchadensis
Big brain, small teeth, bipedalism
Small brain, very big teeth, facultative bipedalism
Small brain, big teeth facultative bipedalism
Small brain, small teeth, quadrupeds
Lack of information

Autralopithecus anamensis



Da Histoire d'ancetres- Grimaud *et al.*, 2005



KNM-KP 29 281 4,1 Ma

Discovery: Kanapoi and Allia bay, Kenya (Turkana Lake), Woranso-Mille (Ethiopia)

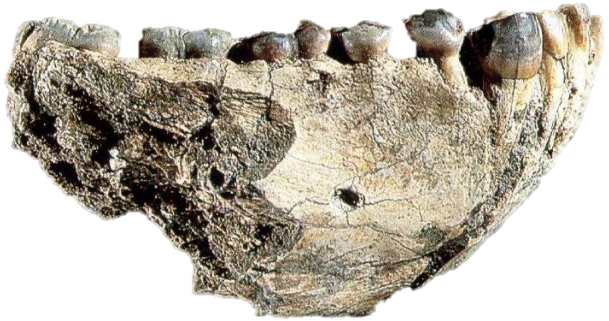
Age: 4,2-4,1 Ma for Kanapoi and 3,9 Ma for Allia Bay, 3,8 Ma Woranso-Mille

- Mandibola stretta con corpo mandibolare quasi parallele

Narrow mandible with almost parallel corpus

- Spessore dello smalto > *Ar. ramidus*

Enamel thickness > Ar. ramidus



KNM-KP 29 281 4,1 Ma

≠ scimmie esistente e gli omini del Mio-Pliocene
(*Ardipithecus* e *Sahelanthropus)*
- Premolari più complessi
- Smalto dei denti iugali più spesso
- Canini meno *ape-like*

≠ australopitecine successive
Morfologia della dentizione, particolarmente nella arcata anteriore

≠ extant African apes and Mio-Pliocene hominins
*(*Ardipithecus *and* Sahelanthropus)
- *More complex premolars*
- *Ticker cheek-tooth enamel*
- *Canines less apelike*

≠ later australopiths
Morphology of the dentition, mostly in the anterior arcade.

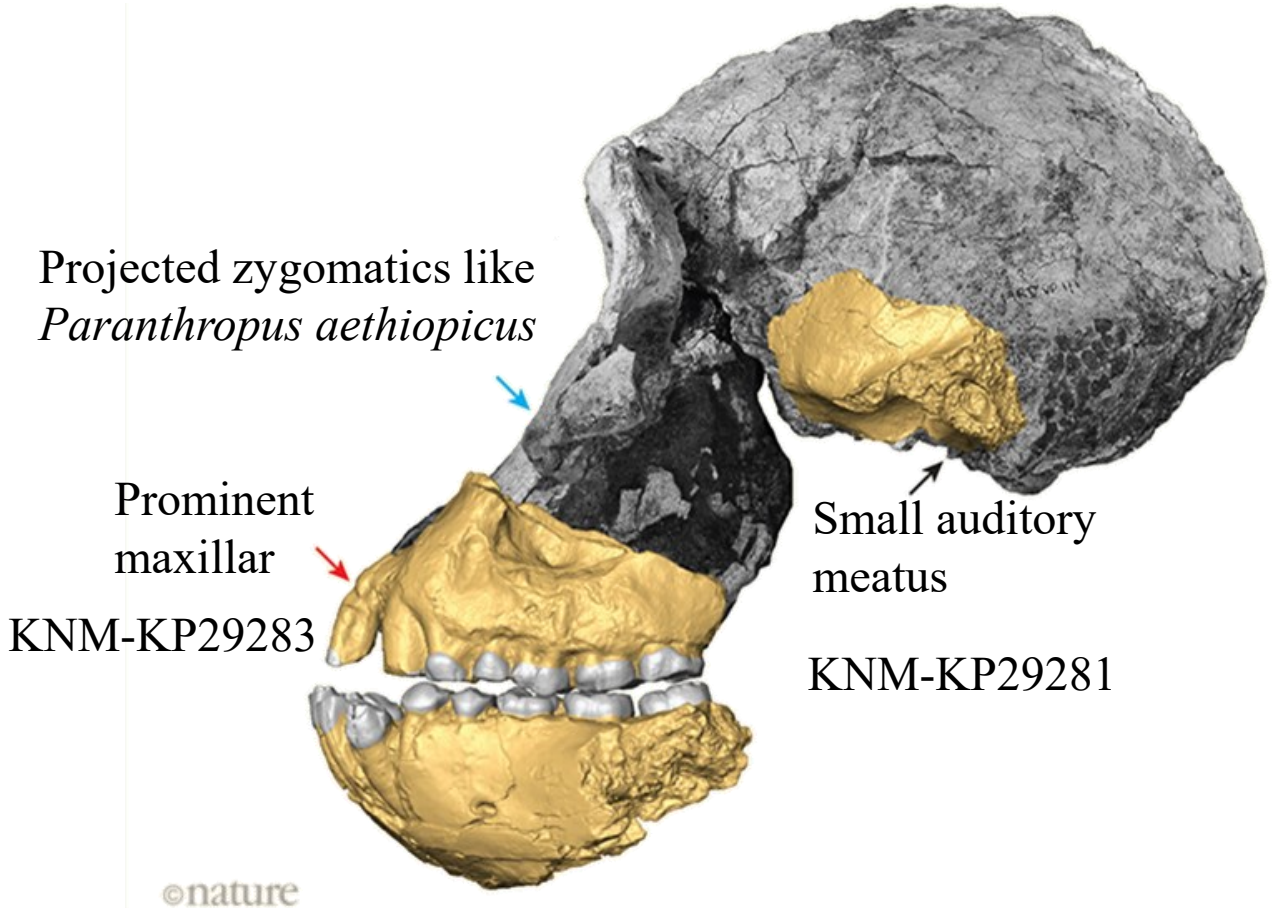
ARTICLE

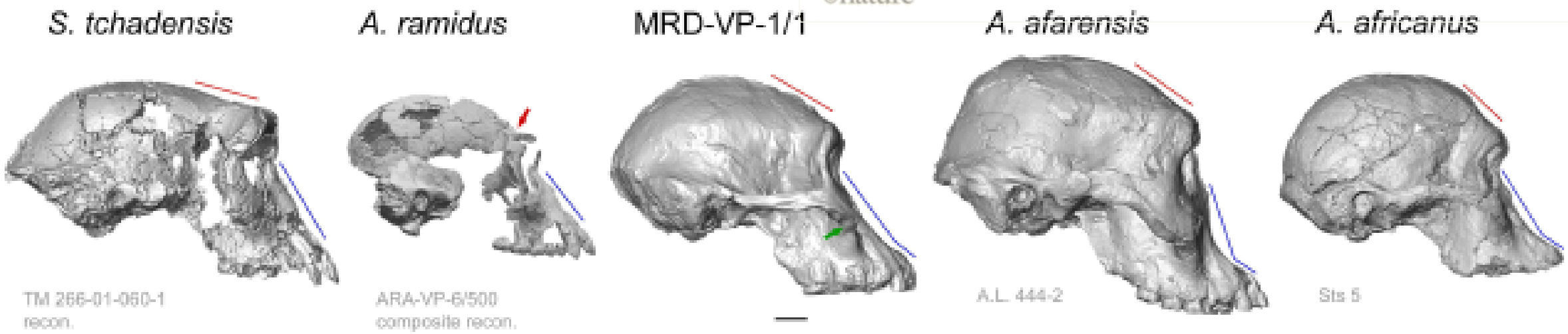
https://doi.org/10.1038/s41586-019-1513-8

A 3.8-million-year-old hominin cranium from Woranso-Mille, Ethiopia

Yohannes Haile-Selassie[1,5*], Stephanie M. Melillo[2,5*], Antonino Vazzana[3], Stefano Benazzi[3] & Timothy M. Ryan[4]

The cranial morphology of the earliest known hominins in the genus *Australopithecus* remains unclear. The oldest species in this genus (*Australopithecus anamensis*, specimens of which have been dated to 4.2–3.9 million years ago) is known primarily from jaws and teeth, whereas younger species (dated to 3.5–2.0 million years ago) are typically represented by multiple skulls. Here we describe a nearly complete hominin cranium from Woranso-Mille (Ethiopia) that we date to 3.8 million years ago. We assign this cranium to *A. anamensis* on the basis of the taxonomically and phylogenetically informative morphology of the canine, maxilla and temporal bone. This specimen thus provides the first glimpse of the entire craniofacial morphology of the earliest known members of the genus *Australopithecus*. We further demonstrate that *A. anamensis* and *Australopithecus afarensis* differ more than previously recognized and that these two species overlapped for at least 100,000 years—contradicting the widely accepted hypothesis of anagenesis.





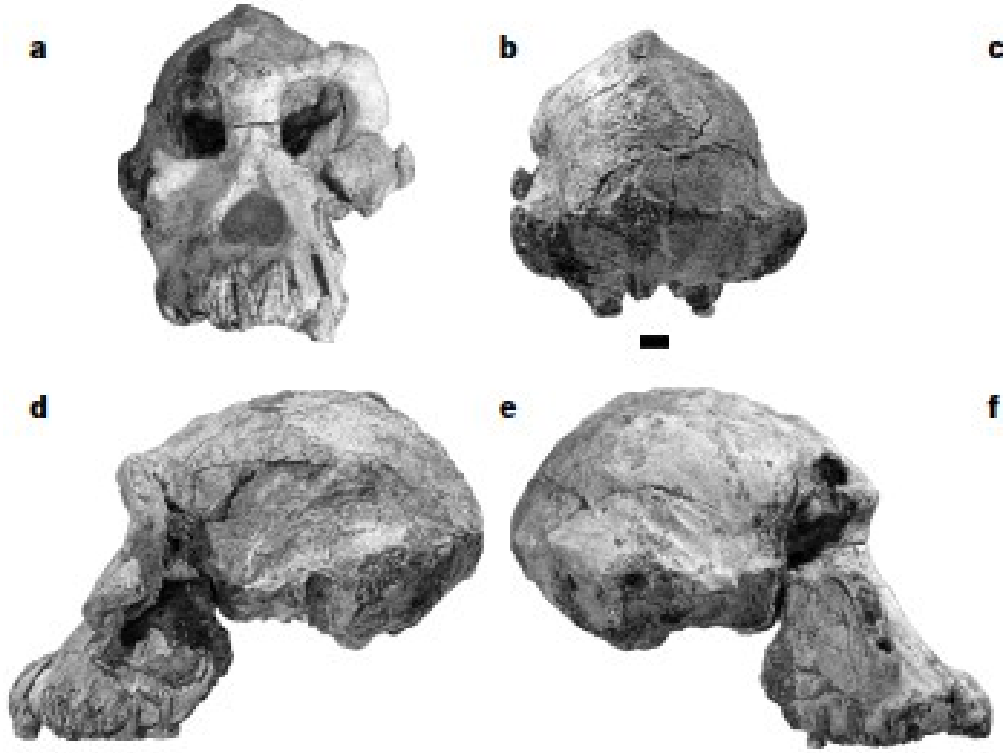
ARTICLE

https://doi.org/10.1038/s41586-019-1513-8

A 3.8-million-year-old hominin cranium from Woranso-Mille, Ethiopia

Yohannes Haile-Selassie[1,5]*, Stephanie M. Melillo[2,5]*, Antonino Vazzana[3], Stefano Benazzi[3] & Timothy M. Ryan[4]

The cranial morphology of the earliest known hominins in the genus *Australopithecus* remains unclear. The oldest species in this genus (*Australopithecus anamensis*, specimens of which have been dated to 4.2–3.9 million years ago) is known primarily from jaws and teeth, whereas younger species (dated to 3.5–2.0 million years ago) are typically represented by multiple skulls. Here we describe a nearly complete hominin cranium from Woranso-Mille (Ethiopia) that we date to 3.8 million years ago. We assign this cranium to *A. anamensis* on the basis of the taxonomically and phylogenetically informative morphology of the canine, maxilla and temporal bone. This specimen thus provides the first glimpse of the entire craniofacial morphology of the earliest known members of the genus *Australopithecus*. We further demonstrate that *A. anamensis* and *Australopithecus afarensis* differ more than previously recognized and that these two species overlapped for at least 100,000 years—contradicting the widely accepted hypothesis of anagenesis.



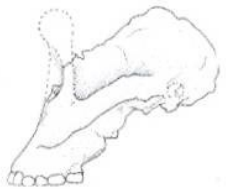
« In summary, although MRD and other discoveries from Woranso-Mille **do not falsify the proposed ancestor–descendant relationship between *A. anamensis* and *A. afarensis*, they indicate that *A. afarensis* may not have evolved from a single ancestral population.** Most importantly, MRD shows that despite the widely accepted hypothesis of anagenesis, ***A. afarensis* did not appear as a result of phyletic transformation**. It also shows that at least **two related hominin species co-existed in eastern Africa around 3.8 Myr ago**, further lending support to mid-Pliocene hominin diversity. »

Autralopithecus afarensis

Australopithecus africanus Dart 1925

Holotype : Crâne de Taung (Afrique du Sud)

Synonymies :
- *Australopithecus transvaalensis* Broom, 1936 Sterkfontein, fgt de maxillaire TM 1511 (S1)
- *Plesianthropus transvaalensis* (Broom et Schepers, 1946) Sterkfontein, fgt mandibule TM 1516 et crâne Sts 5
- *Australopithecus prometheus* Dart, 1948 Makapansgat, calotte crânienne MDL-1



Paranthropus robustus Broom 1938

Holotype : Crâne et postcrânien TM 1517 (Kromdraai, Afrique du Sud)

Synonymies :
- *Paranthropus crassidens* Broom, 1949 Swartkrans, mandibule SK 6

Paranthropus boisei (Tobias 1967)

Holotype : Crâne OH 5 (Olduvai, Tanzanie)

Synonymies :
Zinjanthropus boisei Leakey, 1959
Paranthropus boisei (Robinson, 1960)
Australopithecus (Paranthropus) boisei (Leakey, Tobias et Napier, 1964)

Paranthropus aethiopicus (Arambourg et Coppens 1967)

Holotype : Mandibule Omo 18-1967-18 (Shungura, Omo, Éthiopie)

Australopithecus afarensis Johanson, White et Coppens 1978

Holotype : Mandibule LH 4 (Laetoli, Tanzanie)

Synonymies :
- *Meganthropus africanus* (Wernert, 1950) Maxillaire Garusi I
- *Praeanthropus africanus* (Senyürek, 1955) Maxillaire Garusi I

Australopithecus bahrelghazali Brunet *et al.* 1996

Holotype : Mandibule KT 12/H1 (Koro Toro, Tchad)

Australopithecus anamensis Leakey *et al.* 1995

Holotype : Mandibule KNM-KP 29 281 (Kanapoi, Kenya)

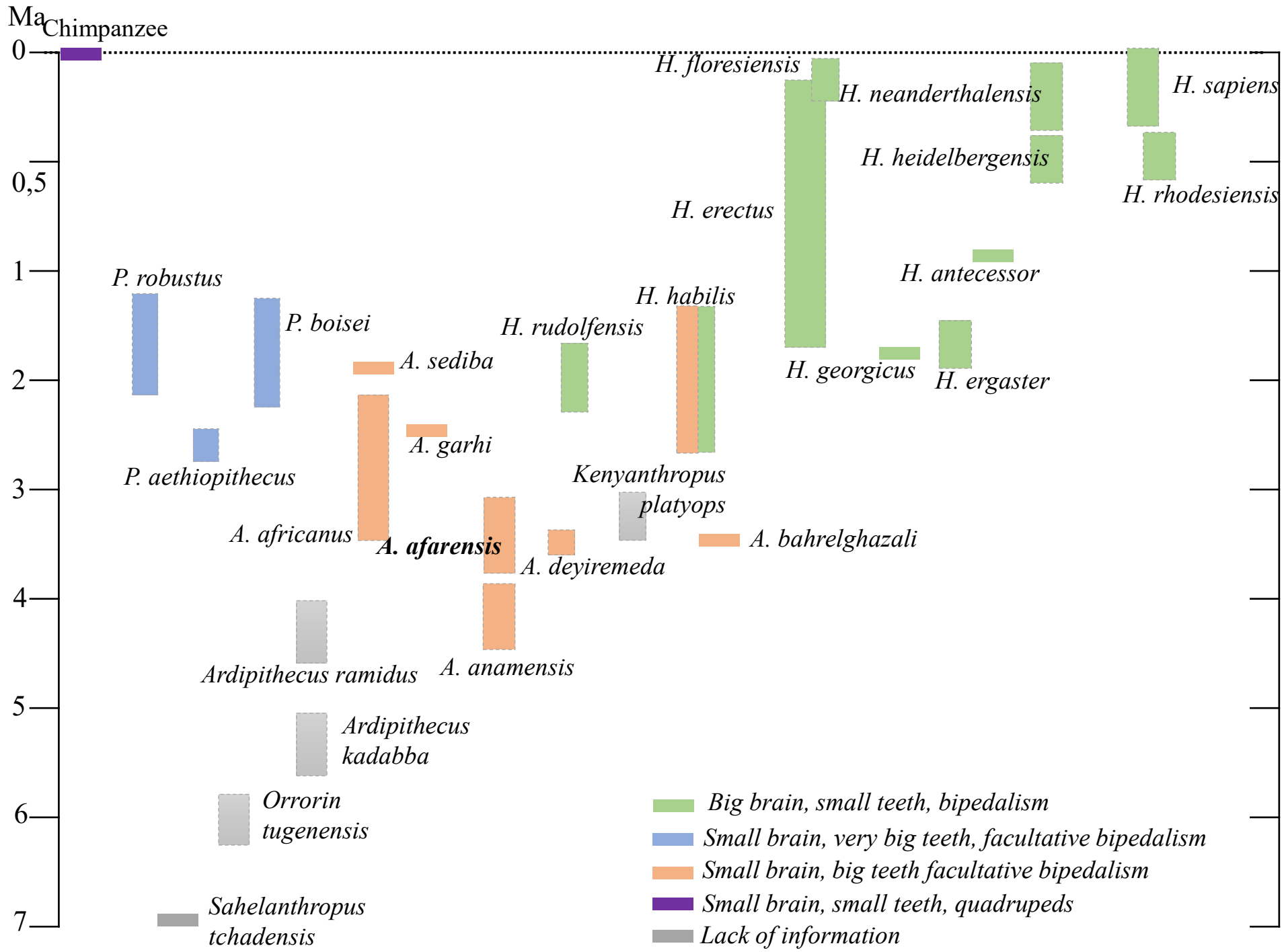
Australopithecus garhi Asfaw *et al.* 1999

Holotype : Bou-VP-12/130 (Bouri, Middle Awash, Ethiopie)

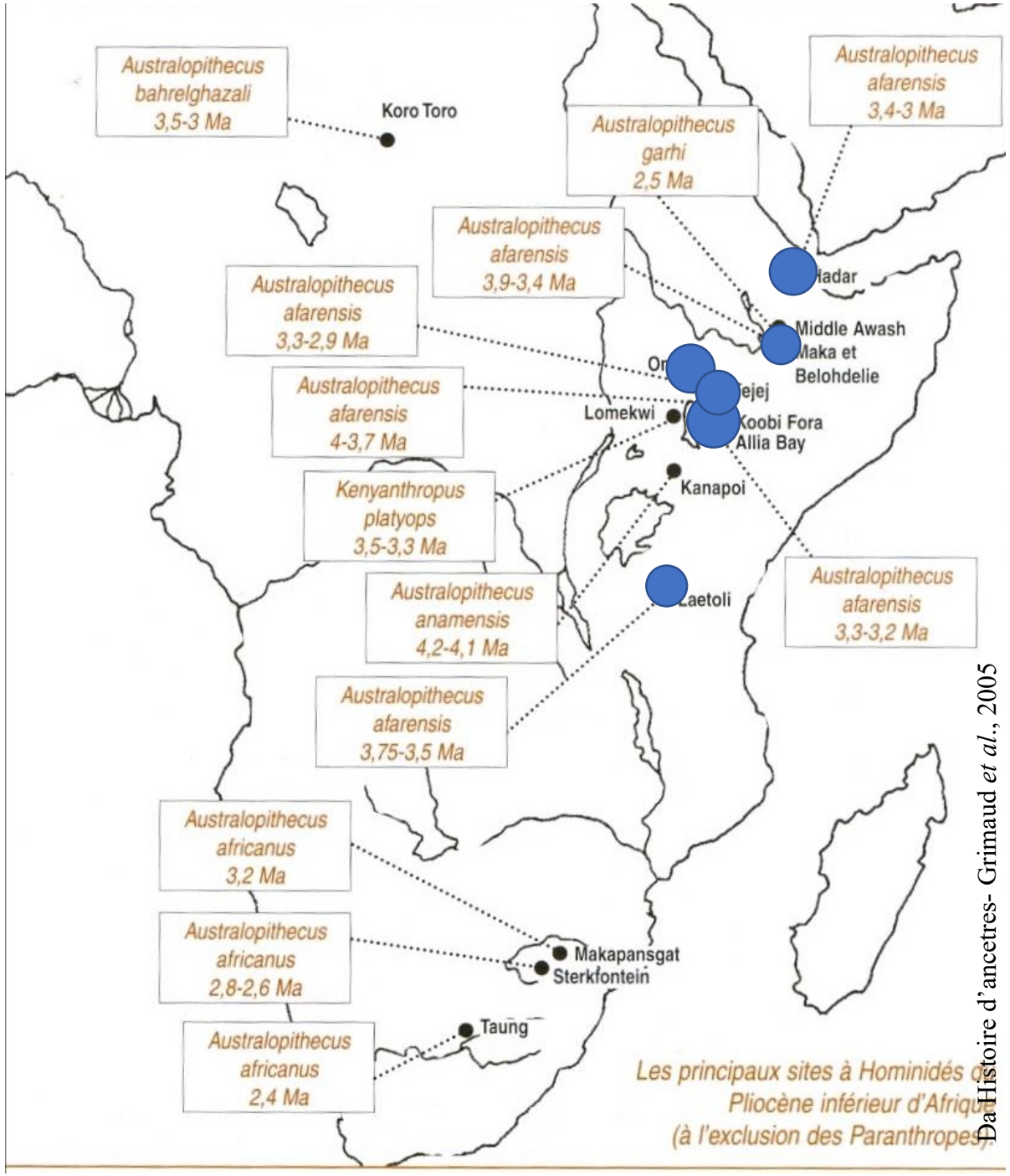
Kenyanthropus platyops Leakey *et al.* 2001

Holotype : Crâne KNM-WT 40000 (Lomekwi, Ouest-Turkana, Kenya)

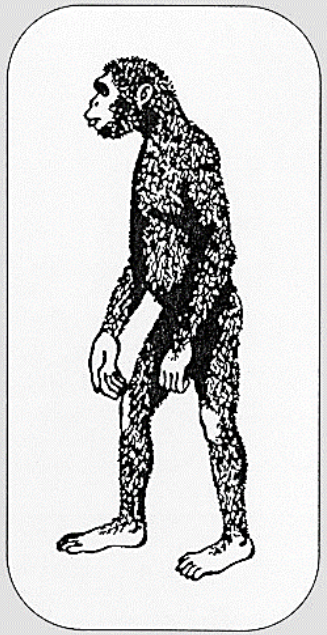
Da Histoire d'ancetres- Grimaud *et al*., 2005


Ma
Chimpanzee
0
0,5
1
2
3
4
5
6
7
H. floresiensis
H. neanderthalensis
H. sapiens
H. heidelbergensis
H. rhodesiensis
H. erectus
H. antecessor
P. robustus
H. habilis
P. boisei
H. rudolfensis
H. georgicus
H. ergaster
A. sediba
A. garhi
P. aethiopithecus
Kenyanthropus platyops
A. africanus
A. afarensis
A. bahrelghazali
A. deyiremeda
A. anamensis
Ardipithecus ramidus
Ardipithecus kadabba
Orrorin tugenensis
Sahelanthropus tchadensis
Big brain, small teeth, bipedalism
Small brain, very big teeth, facultative bipedalism
Small brain, big teeth facultative bipedalism
Small brain, small teeth, quadrupeds
Lack of information

Autralopithecus afarensis



Da Histoire d'ancetres- Grimaud *et al.*, 2005



Nom : *Australopithecus afarensis*

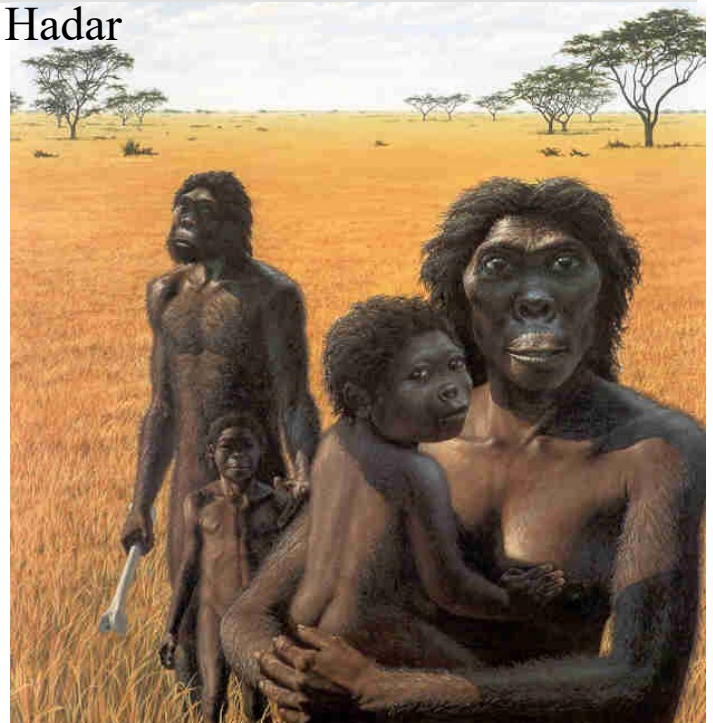
Origine : Afrique de l'Est (Hadar, Laetoli, Maka, Belohdelie, Chemeron, Omo, Koobi Fora)

Dat 3,9? à 3 MA

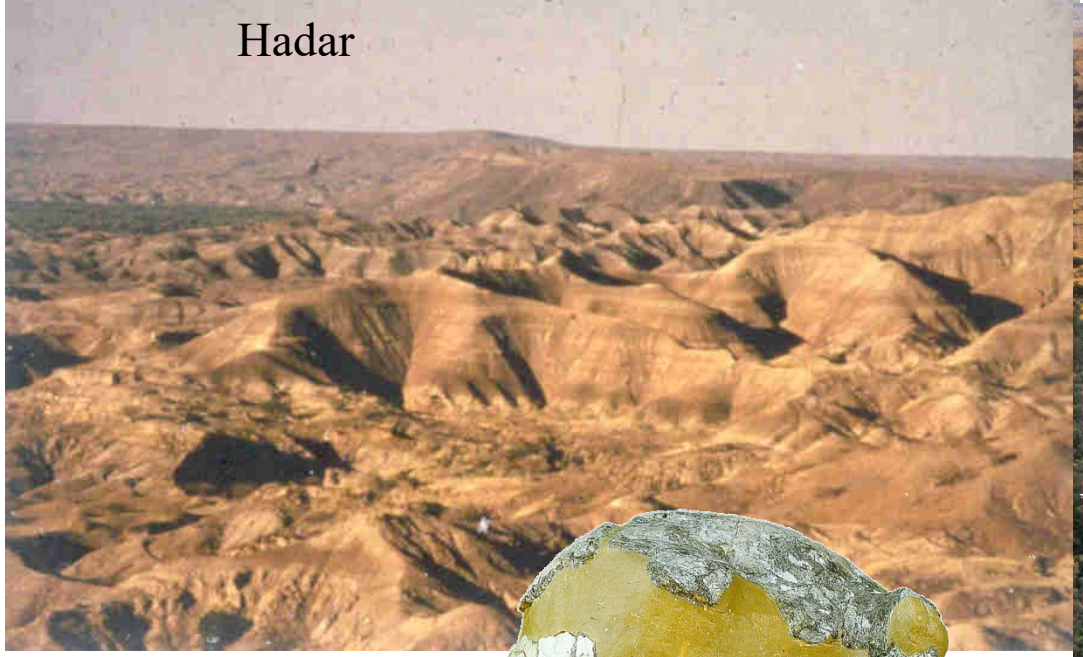
Cerveau : 300 à 400 cm^3

Taille : 1,10 m

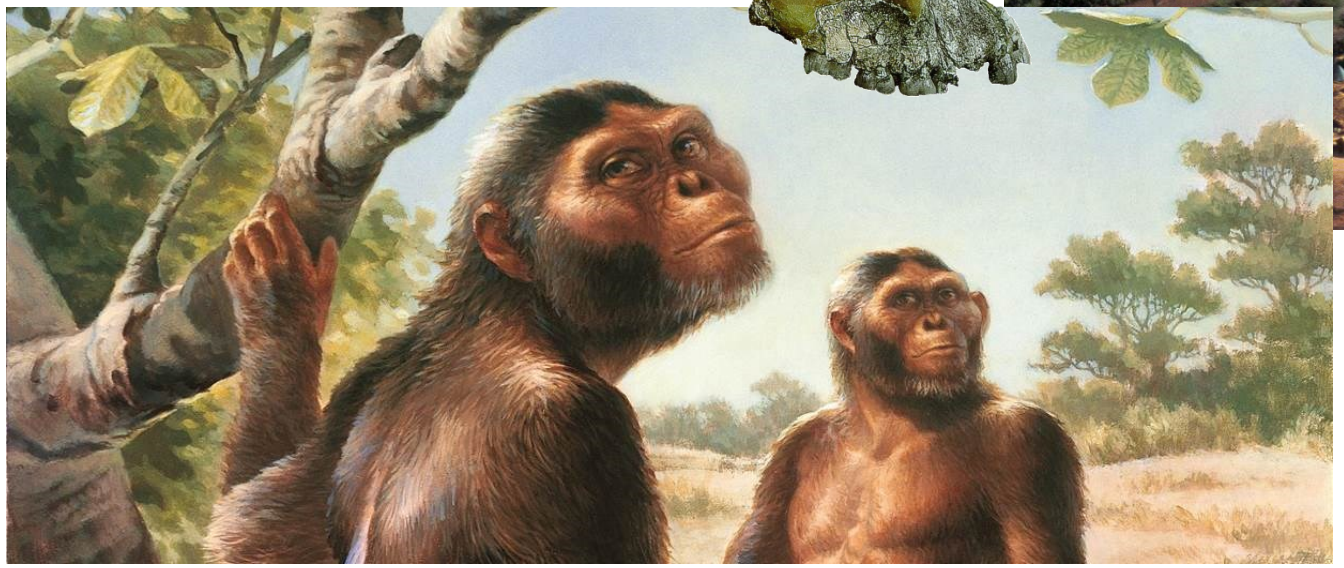
Hadar

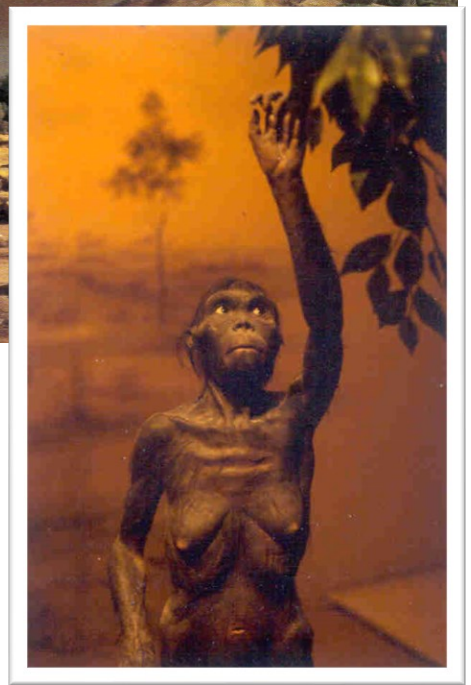


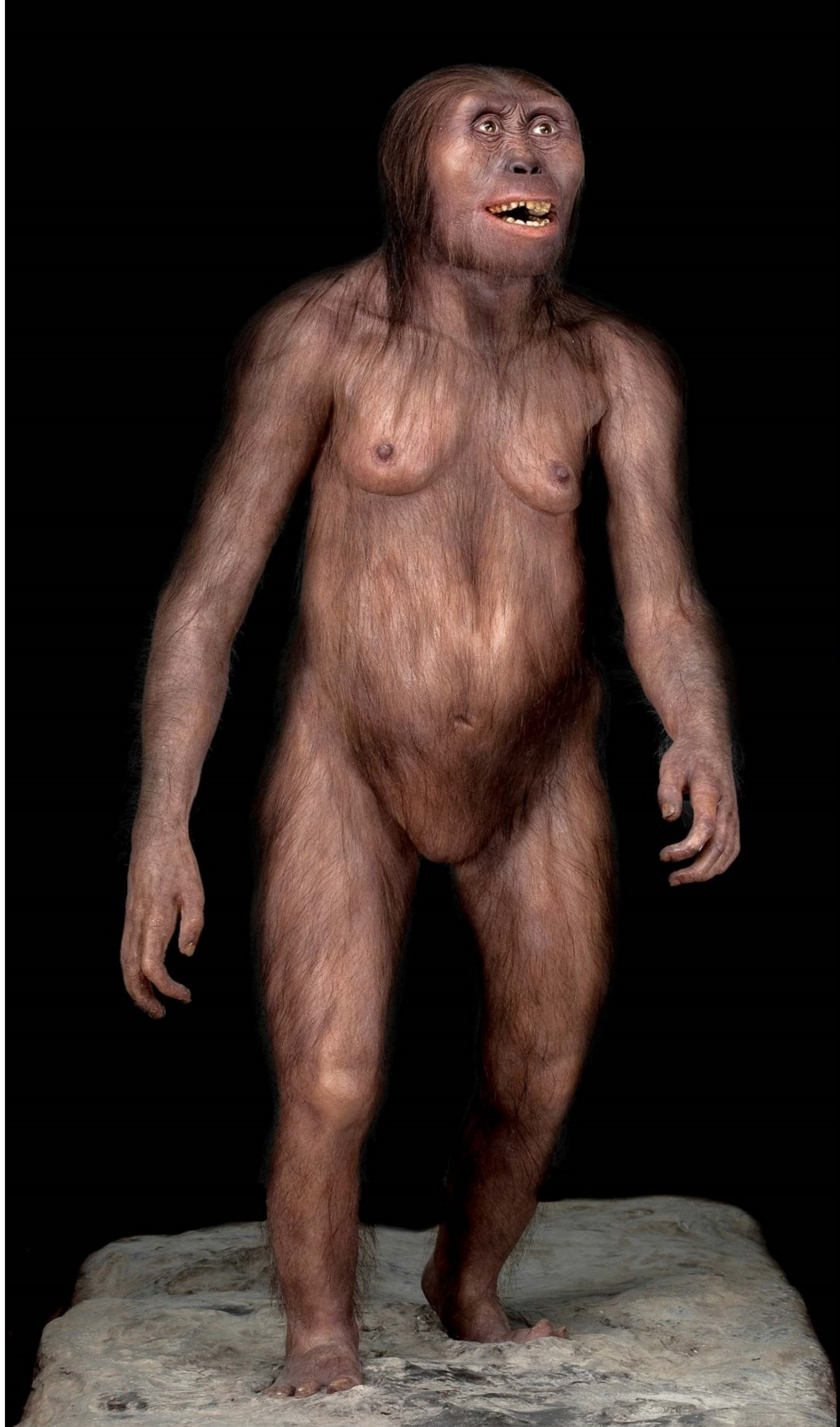
Hadar

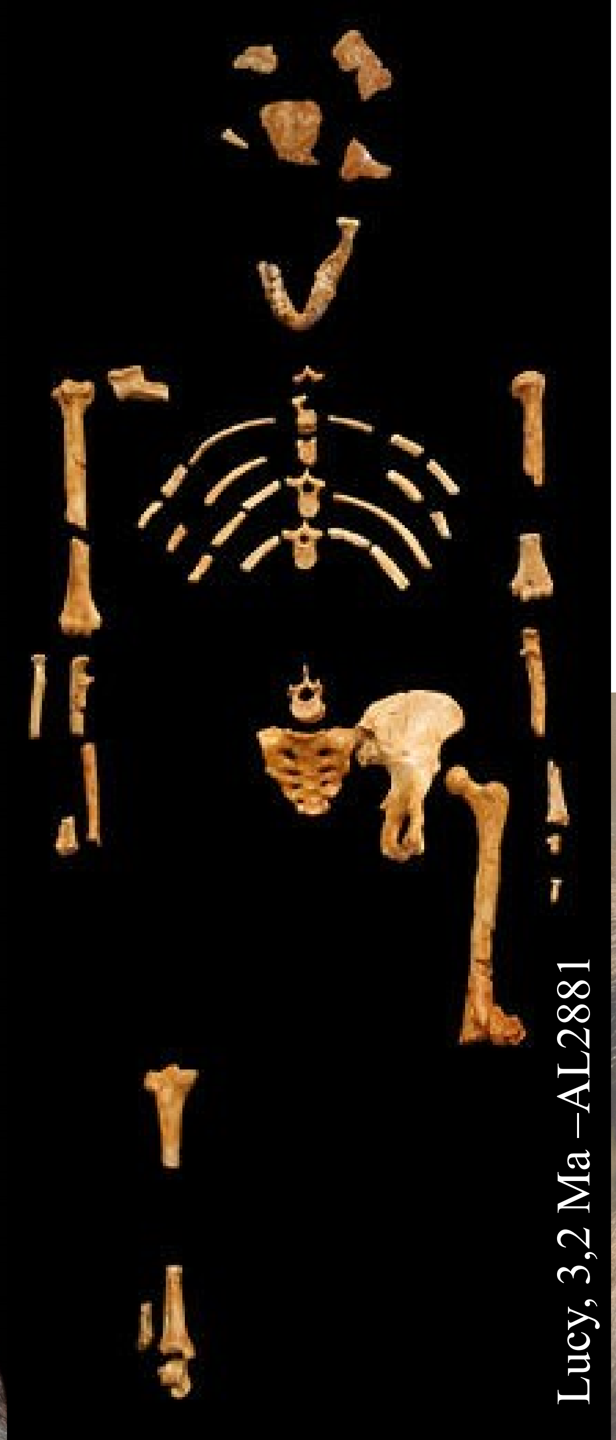


AL 444-2 (Hadar, Etiopia 3Ma)





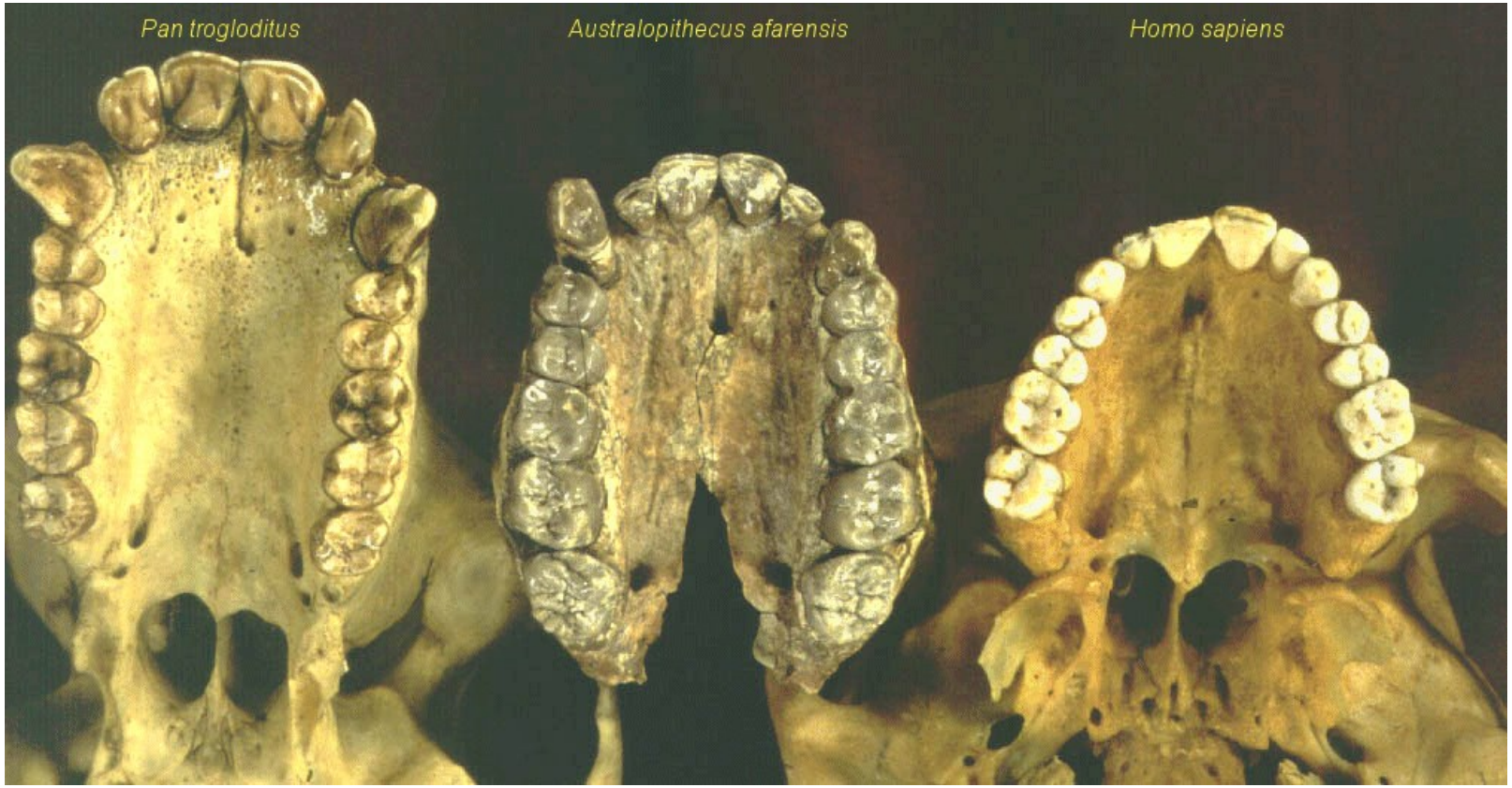



Lucy, 3,2 Ma –AL2881

- Important sexual dimorphism
- Small skull
- Large and prognathic face
- Canine and incisor reduced
- Frequent presence of diastema

Elevata competizione tra i maschi

- Facultative bipedalism (bambina di DIKIKA Afar) : Glenoid fossa of the scapula is shallow implying an important movement of the humerus : advantage for arboreal locomotion

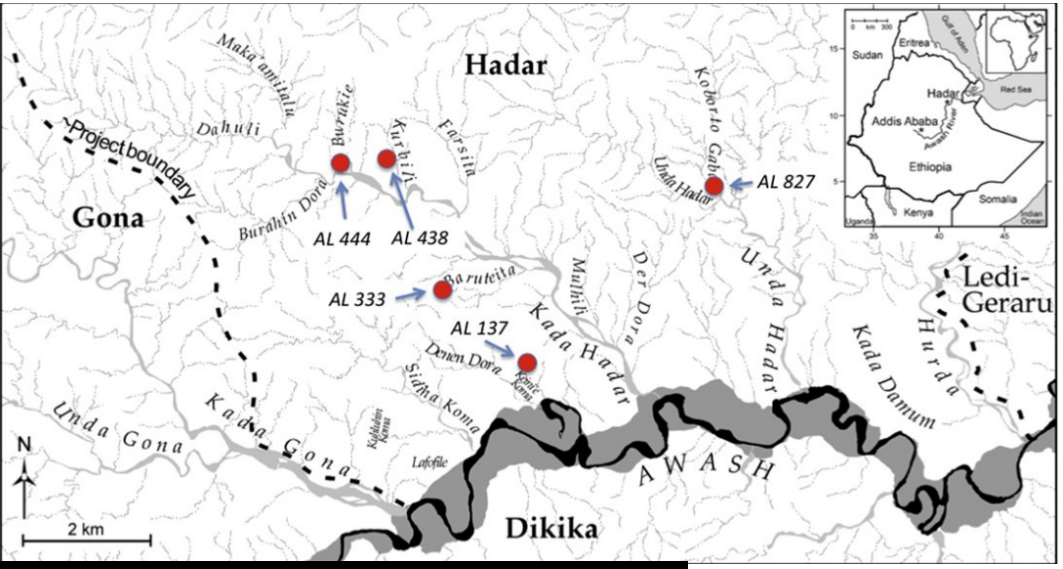


≠ con *Au. anamensis* (condizione derivata)
- P3 e dm1 più molarizzati
- Palato più largo relativamente alla sua lunghezza
- Apertura nasale definita da margini laterali affilati
- Meato auditivo più largo

≠ con gli altri australopitecine
Anatomia del cranio e dei denti prevalentemente plesiomorfa
Larghezza delle aperture nasale e orbitale strette che contrasta una regione zigomatica massiccia
Per gli individui più grandi: mandibola a U
Canine e premolari in una «transizione evolutiva».
P3 meno molarizzati

AL 444-2 (Hadar, Etiopia 3Ma)

Note: Grande variazioni nella forma del cranio
- Dimorfismo sessuale (taglia e forma)
- Tendenze anagenetiche nella morfologia craniodentale durante la prima meta (3,5 – 3,0 Ma) della speciazione *anamensis-afarensis*



I arti inferiori confermano che *Au. afarensis* iniziava abitualmente ad essere occasionalmente bipede durante la loro ontogenesi.

The lower limb remains confirm that Au. afarensis *individuals habitually engaged in upright terrestrial bipedality throughout their ontogeny*

Journal of Human Evolution 63 (2012) 1–51

Contents lists available at SciVerse ScienceDirect

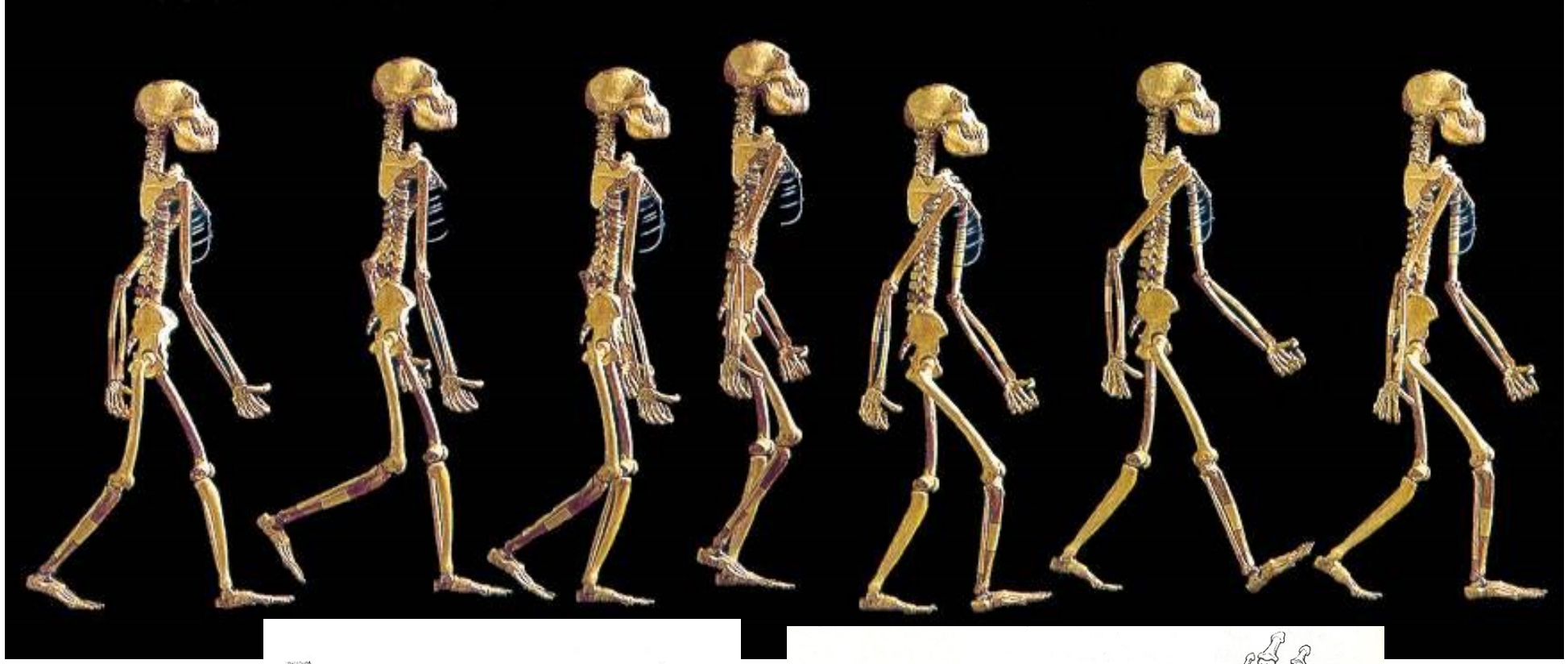
Journal of Human Evolution

journal homepage: www.elsevier.com/locate/jhevol

New postcranial fossils of *Australopithecus afarensis* from Hadar, Ethiopia (1990–2007)

Carol V. Ward [a,*], William H. Kimbel [b], Elizabeth H. Harmon [c,1], Donald C. Johanson [b]

[a] Department of Pathology and Anatomical Sciences, M263 Medical Sciences Building, One Hospital Drive, University of Missouri, Columbia, MO 65212, USA
[b] Institute of Human Origins, School of Human Evolution and Social Change, PO Box 874101, Arizona State University, Tempe, AZ 85287-4101, USA
[c] Department of Anthropology, Hunter College, CUNY, 695 Park Avenue, NY 10065, USA



femore umano

femore dell'australopiteco

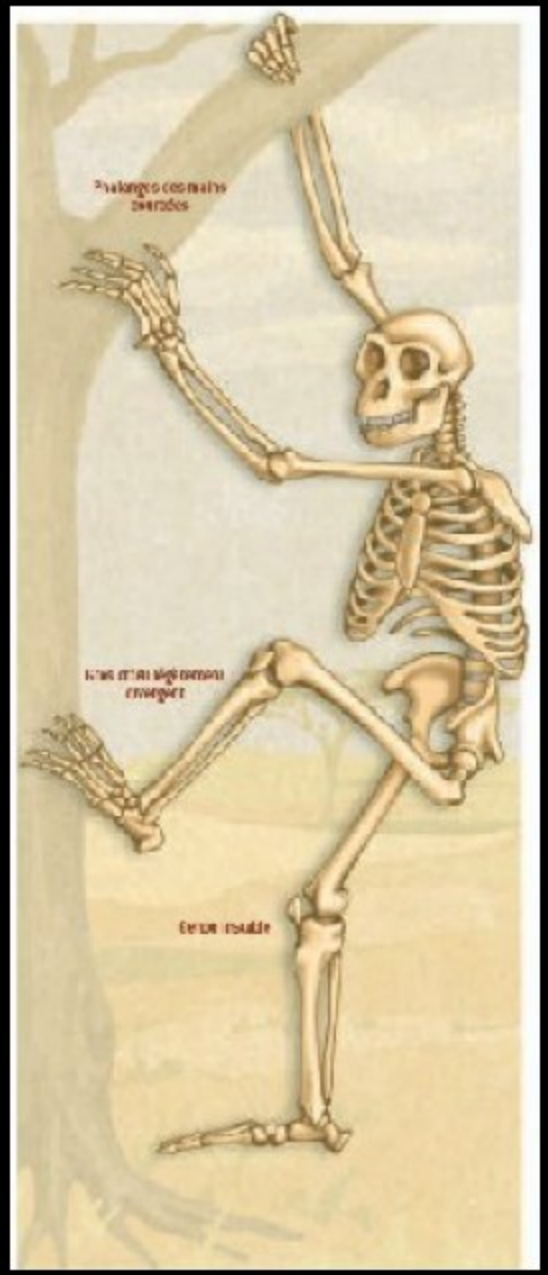
ossa delle dita

uomo

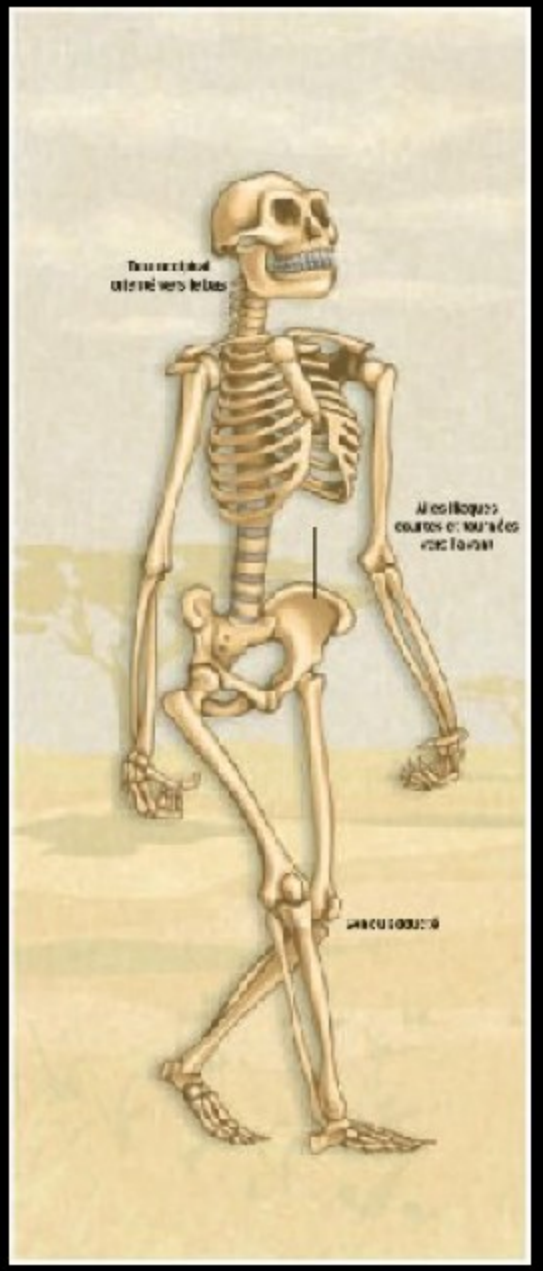
Piede di australopiteco basato sulle ossa del piede e dell'alluce provenienti da Gola di Olduvai, Tanzania

gorilla

Les bipédies des *Australopithecus*



The bipedalisms of the *Australopithecus*



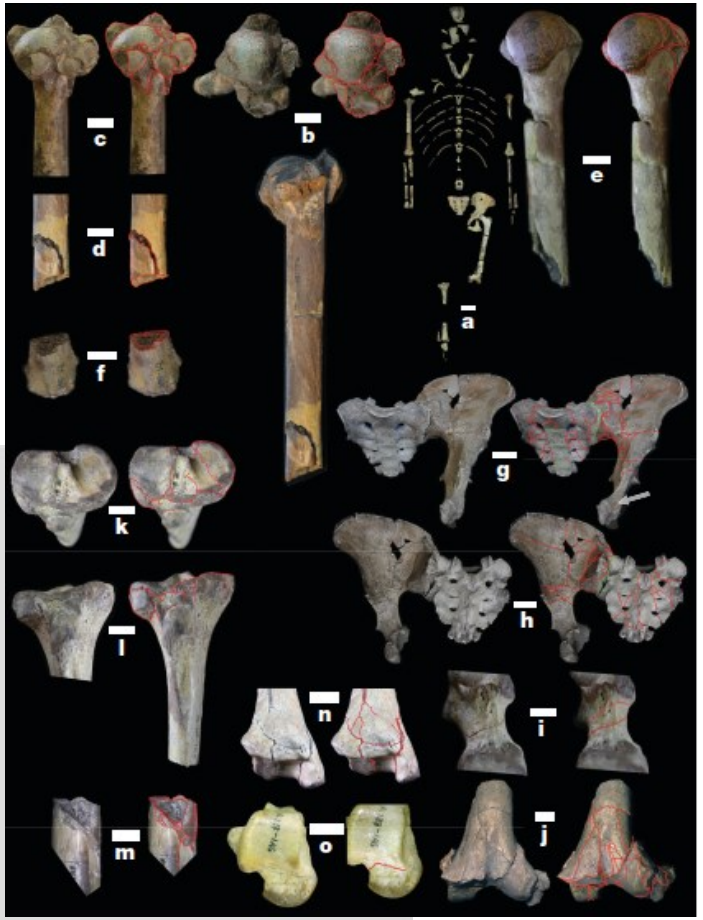
(Berillon & Marchal, 2005)

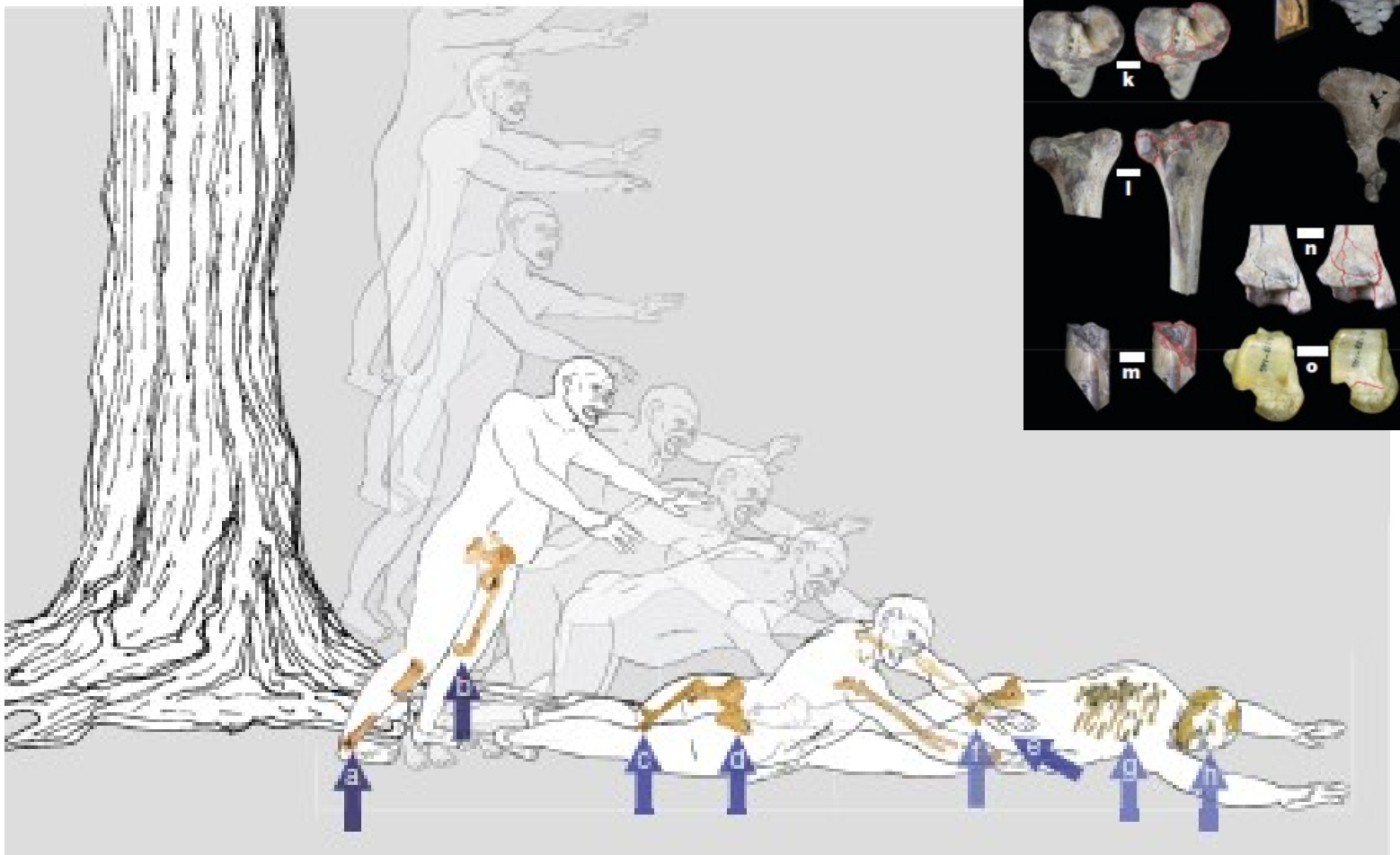
ARTICLE

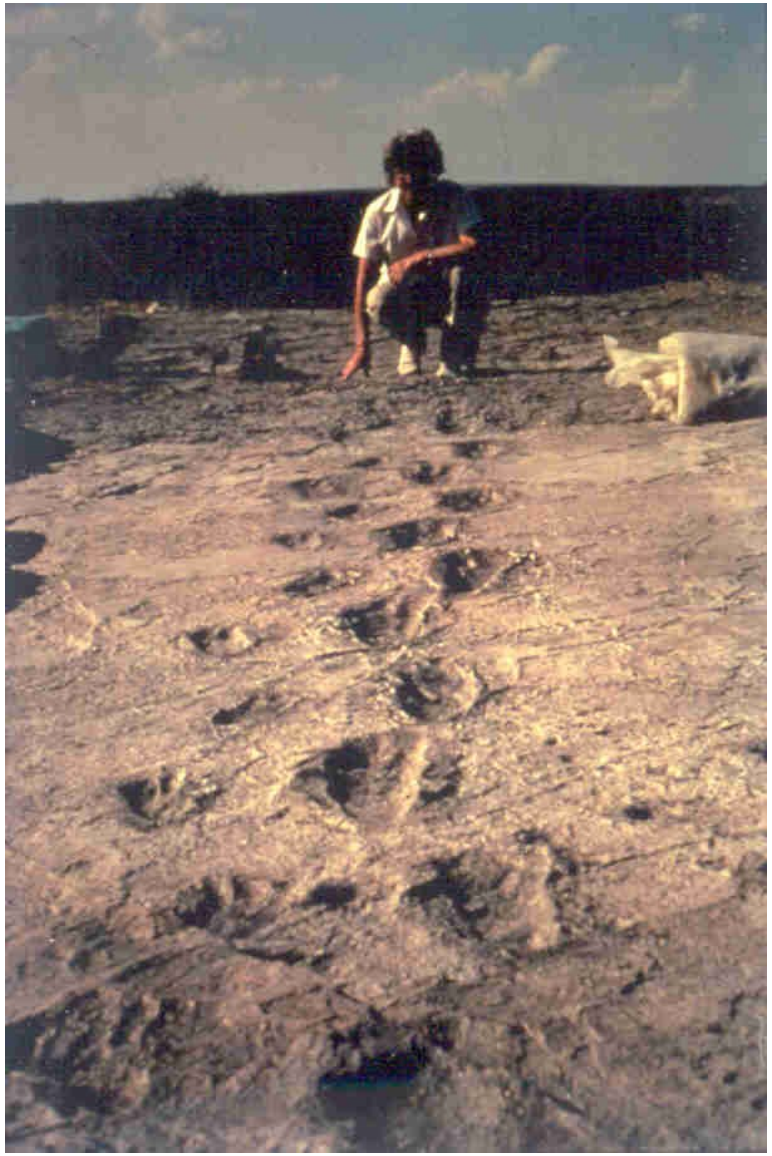
doi:10.1038/nature19332

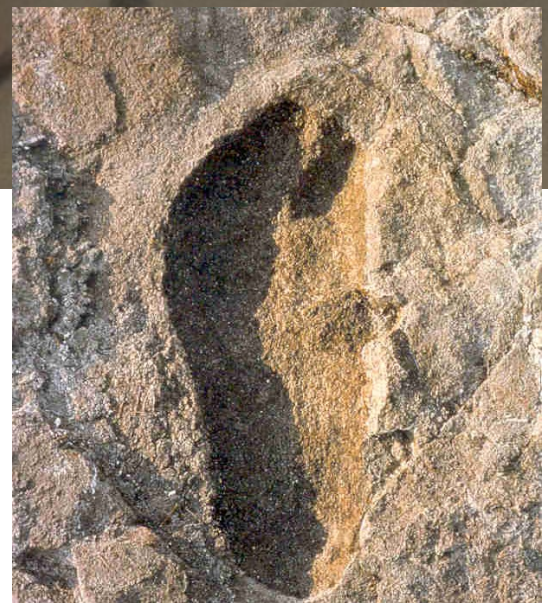
Perimortem fractures in Lucy suggest mortality from fall out of tall tree

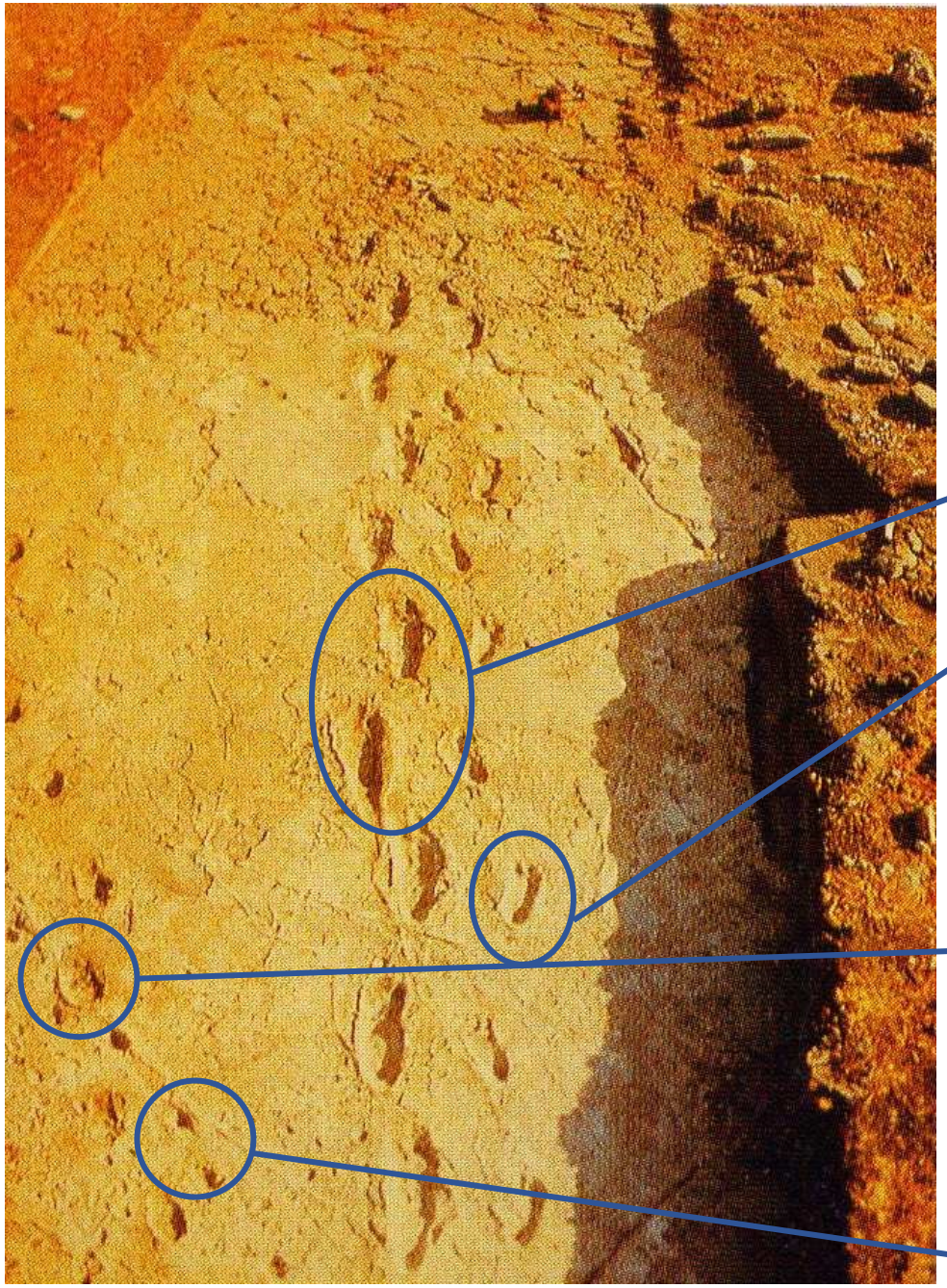
John Kappelman[1,2], Richard A. Ketcham[2], Stephen Pearce[3], Lawrence Todd[1], Wiley Akins[4], Matthew W. Colbert[2], Mulugeta Feseha[5], Jessica A. Maisano[2] & Adrienne Witzel[1]











Laetoli footprints

3,75 Ma

Superimposition of two adults footprints

Young hominid footprints

Hipparion footprints

Young Hipparion footprints

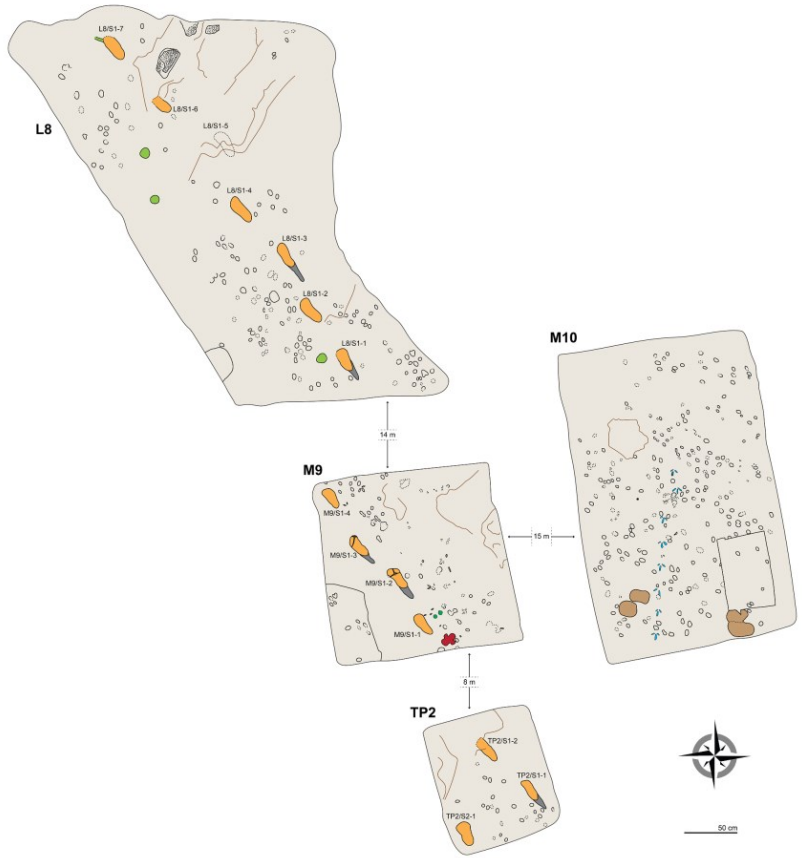
eLIFE elifesciences.org

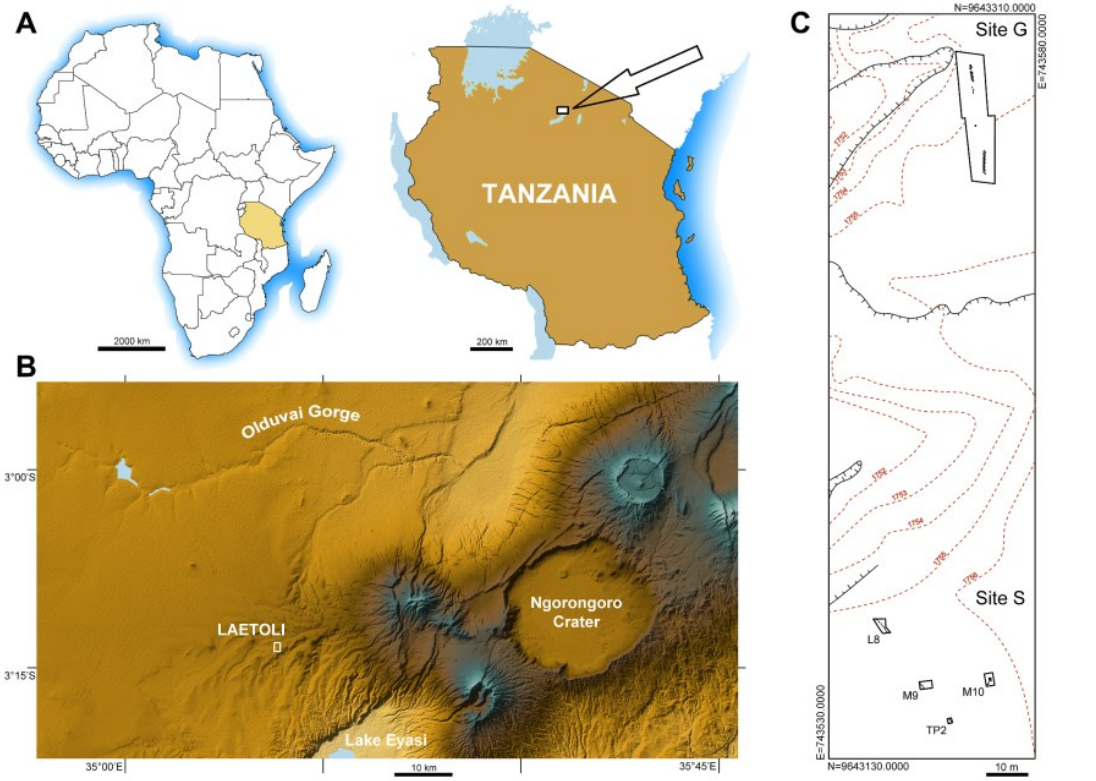
RESEARCH ARTICLE

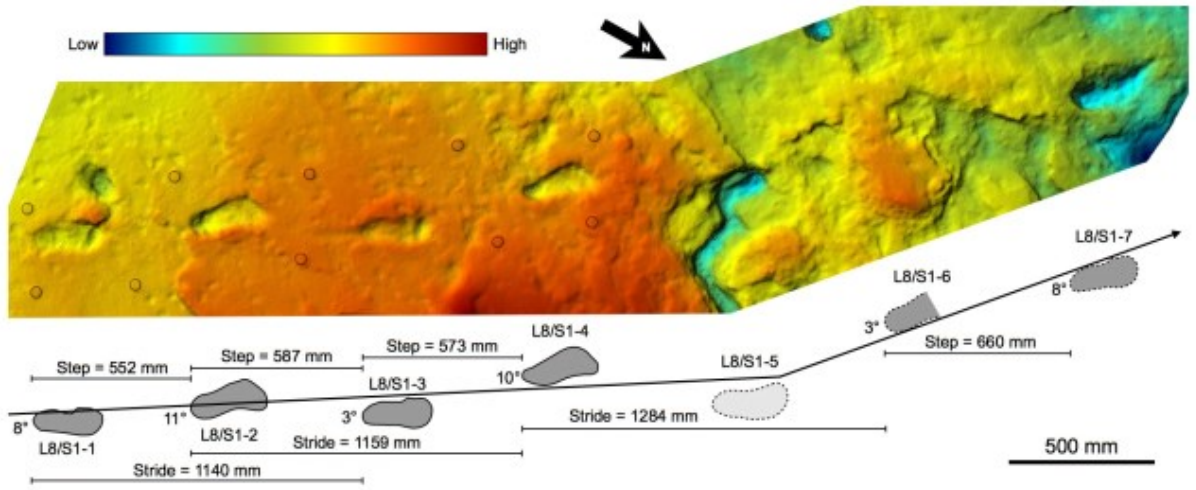
New footprints from Laetoli (Tanzania) provide evidence for marked body size variation in early hominins

Fidelis T Masao[1], Elgidius B Ichumbaki[1], Marco Cherin[2,3]*, Angelo Barili[4], Giovanni Boschian[5], Dawid A Iurino[3,6], Sofia Menconero[7], Jacopo Moggi-Cecchi[8], Giorgio Manzi[9]

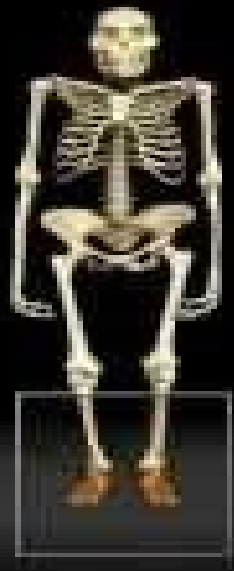
[1]Department of Archaeology and Heritage Studies, University of Dar es Salaam, Dar es Salaam, Tanzania; [2]Dipartimento di Fisica e Geologia, Università di Perugia, Perugia, Italy; [3]PaleoFactory, Sapienza Università di Roma, Roma, Italy; [4]Galleria di Storia Naturale, Centro d'Ateneo per i Musei Scientifici, Università di Perugia, Perugia, Italy; [5]Dipartimento di Biologia, Università di Pisa, Pisa, Italy; [6]Dipartimento di Scienze della Terra, Sapienza Università di Roma, Roma, Italy; [7]Studio Associato Grassi, Perugia, Italy; [8]Dipartimento di Biologia, Università di Firenze, Firenze, Italy; [9]Dipartimento di Biologia Ambientale, Sapienza Università di Roma, Roma, Italy





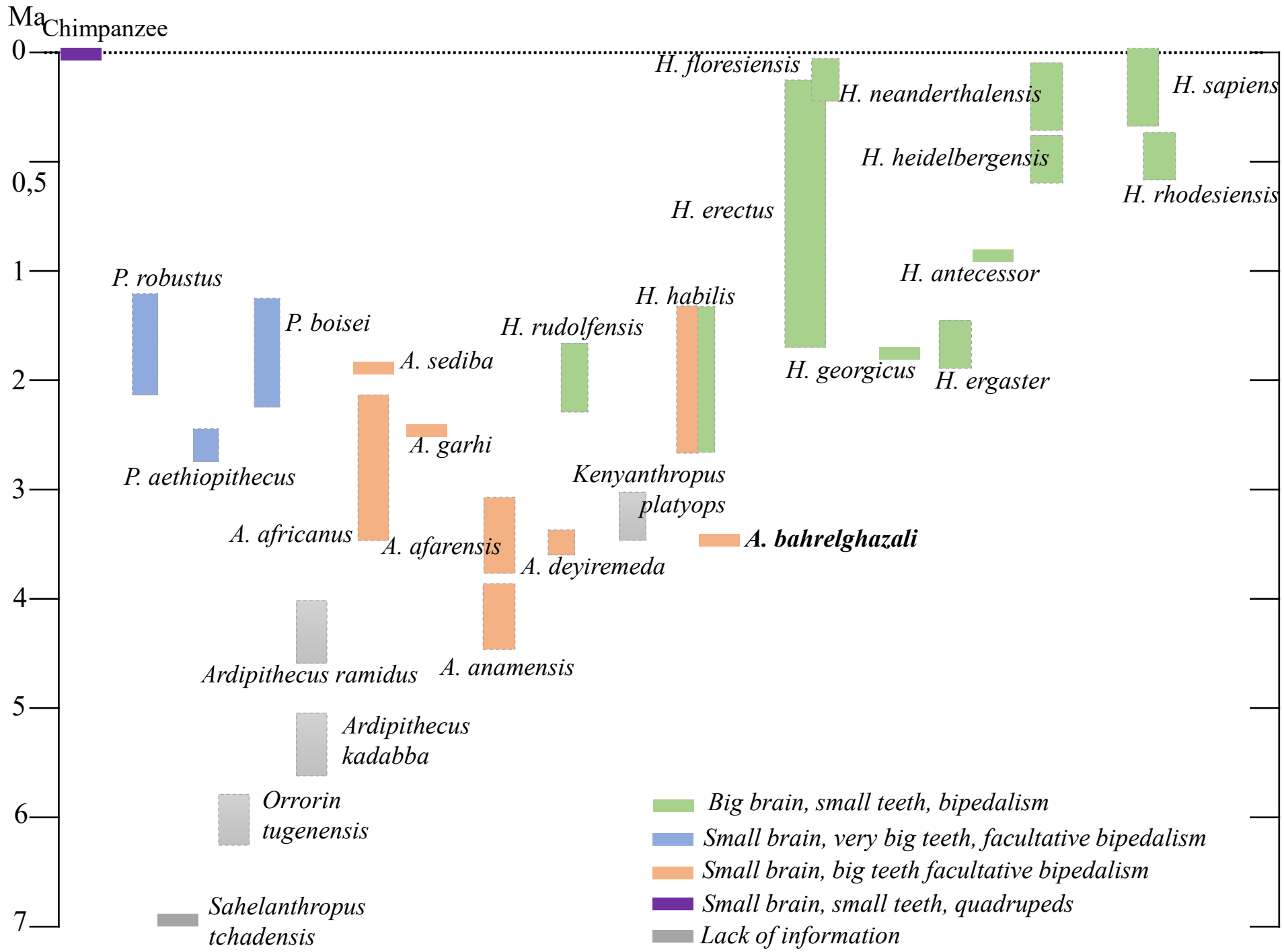


Chimpanzee



Lucy
Australopithecus afarensis

Modern human

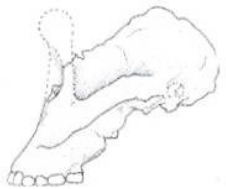

Ma
Chimpanzee
0
0,5
1
2
3
4
5
6
7
H. floresiensis
H. neanderthalensis
H. sapiens
H. heidelbergensis
H. rhodesiensis
H. erectus
H. antecessor
P. robustus
H. habilis
P. boisei
H. rudolfensis
A. sediba
H. georgicus
H. ergaster
A. garhi
P. aethiopithecus
Kenyanthropus platyops
A. africanus
A. afarensis
A. bahrelghazali
A. deyiremeda
A. anamensis
Ardipithecus ramidus
Ardipithecus kadabba
Orrorin tugenensis
Sahelanthropus tchadensis
Big brain, small teeth, bipedalism
Small brain, very big teeth, facultative bipedalism
Small brain, big teeth facultative bipedalism
Small brain, small teeth, quadrupeds
Lack of information

Autralopithecus bahrelghazali

Australopithecus africanus Dart 1925

Holotype : Crâne de Taung (Afrique du Sud)

Synonymies :
- *Australopithecus transvaalensis* Broom, 1936 Sterkfontein, fgt de maxillaire TM 1511 (S1)
- *Plesianthropus transvaalensis* (Broom et Schepers, 1946) Sterkfontein, fgt mandibule TM 1516 et crâne Sts 5
- *Australopithecus prometheus* Dart, 1948 Makapansgat, calotte crânienne MDL-1



Paranthropus robustus Broom 1938

Holotype : Crâne et postcrânien TM 1517 (Kromdraai, Afrique du Sud)

Synonymies :
- *Paranthropus crassidens* Broom, 1949 Swartkrans, mandibule SK 6

Paranthropus boisei (Tobias 1967)

Holotype : Crâne OH 5 (Olduvai, Tanzanie)

Synonymies :
Zinjanthropus boisei Leakey, 1959
Paranthropus boisei (Robinson, 1960)
Australopithecus (Paranthropus) boisei (Leakey, Tobias et Napier, 1964)

Paranthropus aethiopicus (Arambourg et Coppens 1967)

Holotype : Mandibule Omo 18-1967-18 (Shungura, Omo, Éthiopie)

Australopithecus afarensis Johanson, White et Coppens 1978

Holotype : Mandibule LH 4 (Laetoli, Tanzanie)

Synonymies :
- *Meganthropus africanus* (Wernert, 1950) Maxillaire Garusi I
- *Praeanthropus africanus* (Senyürek, 1955) Maxillaire Garusi I

Australopithecus bahrelghazali Brunet *et al.* 1996

Holotype : Mandibule KT 12/H1 (Koro Toro, Tchad)

Australopithecus anamensis Leakey *et al.* 1995

Holotype : Mandibule KNM-KP 29 281 (Kanapoi, Kenya)

Australopithecus garhi Asfaw *et al.* 1999

Holotype : Bou-VP-12/130 (Bouri, Middle Awash, Ethiopie)

Kenyanthropus platyops Leakey *et al.* 2001

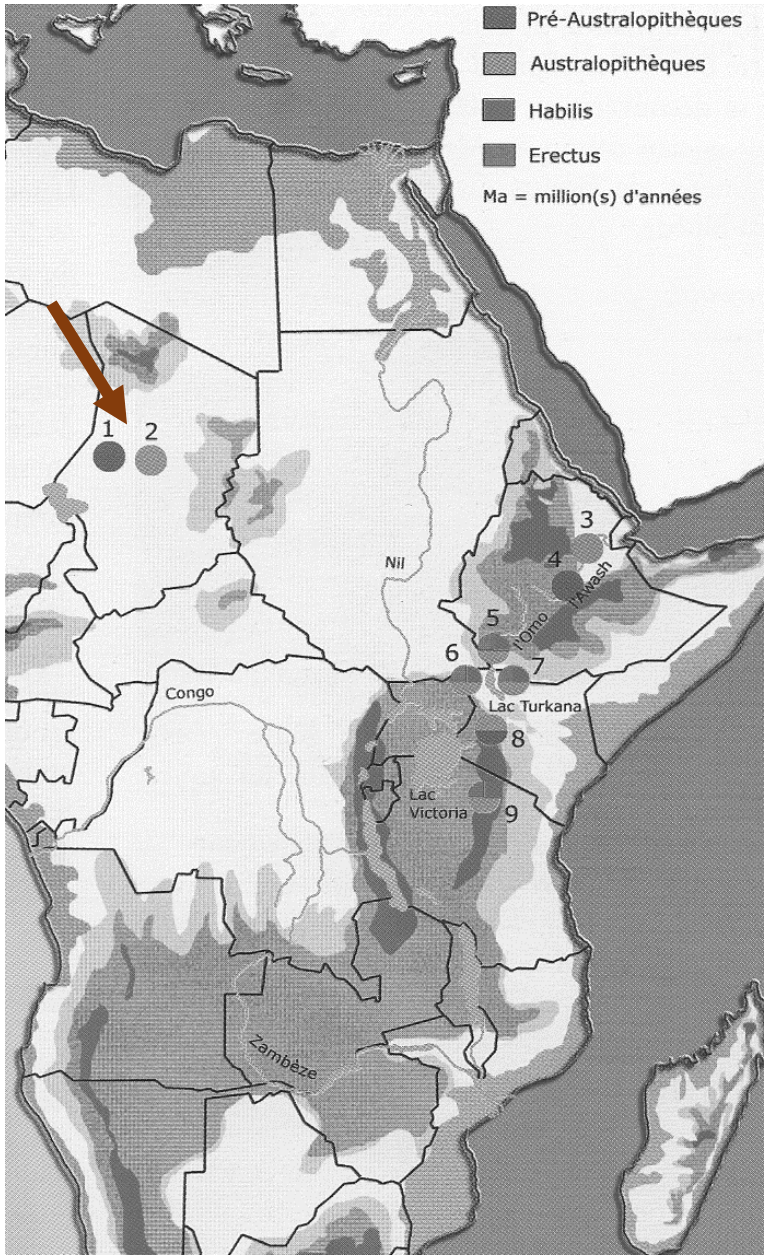
Holotype : Crâne KNM-WT 40000 (Lomekwi, Ouest-Turkana, Kenya)

Da Histoire d'ancetres- Grimaud *et al.*, 2005

Au. bahrelghazali, Ciad 3-3.5 MA
(Abel)

Mandibola particolarmente verticale anteriormente = prognatismo ridotto
Forma parabolica

Anterior part of the mandible almost vertical = reduction of the prognathism
Parabolic shape



Available online at www.sciencedirect.com
ScienceDirect
Journal of Human Evolution 55 (2008) 37–47

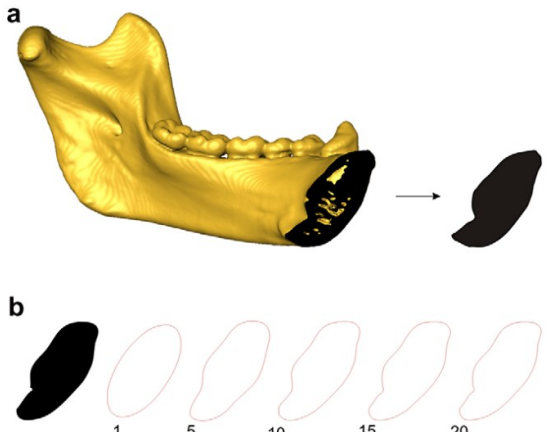
Symphyseal shape variation in extant and fossil hominoids, and the symphysis of *Australopithecus bahrelghazali*

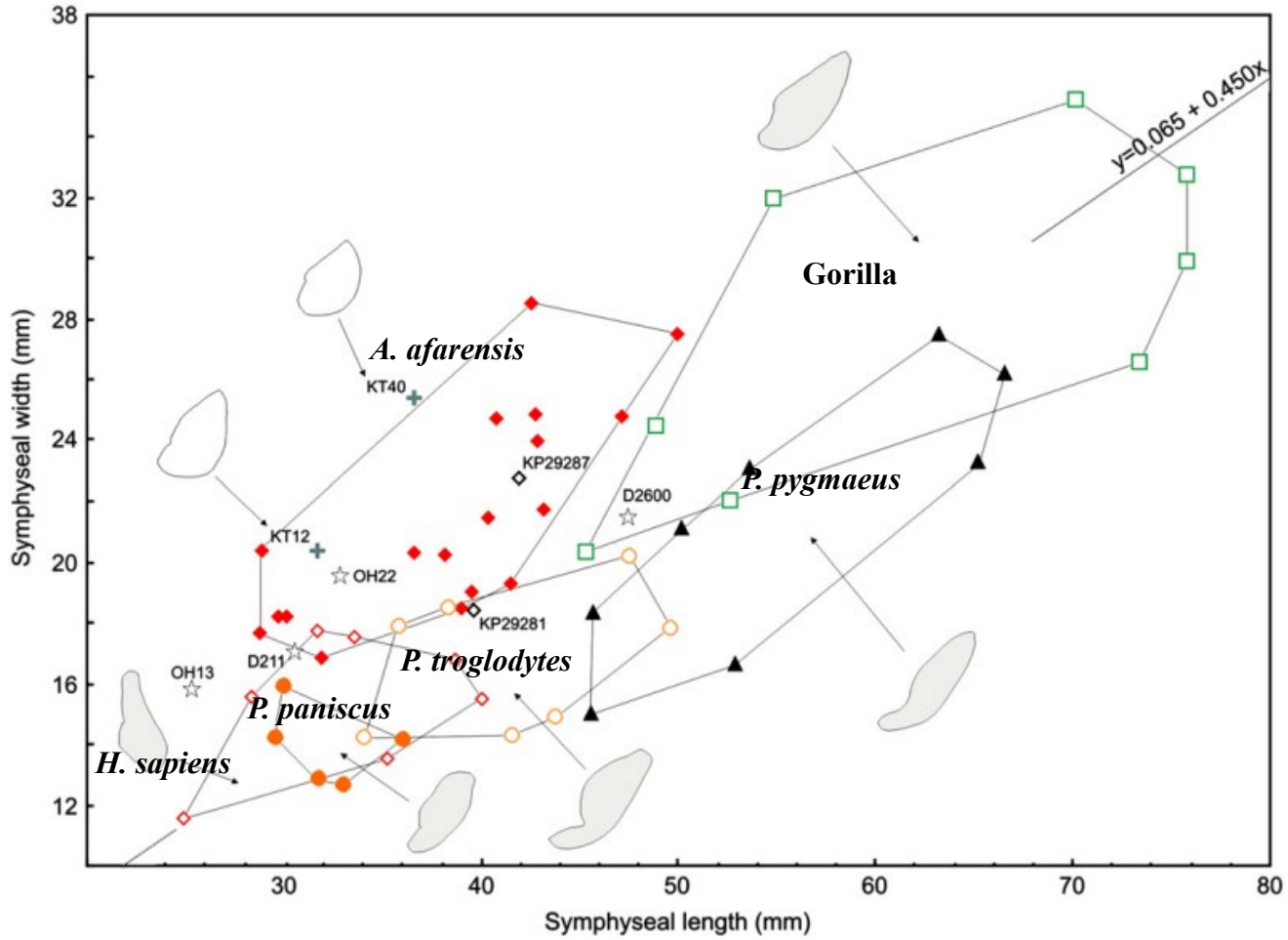
Franck Guy [a,*], Hassane-Taïsso Mackaye [b], Andossa Likius [b], Patrick Vignaud [a], Matthieu Schmittbuhl [c], Michel Brunet [a]

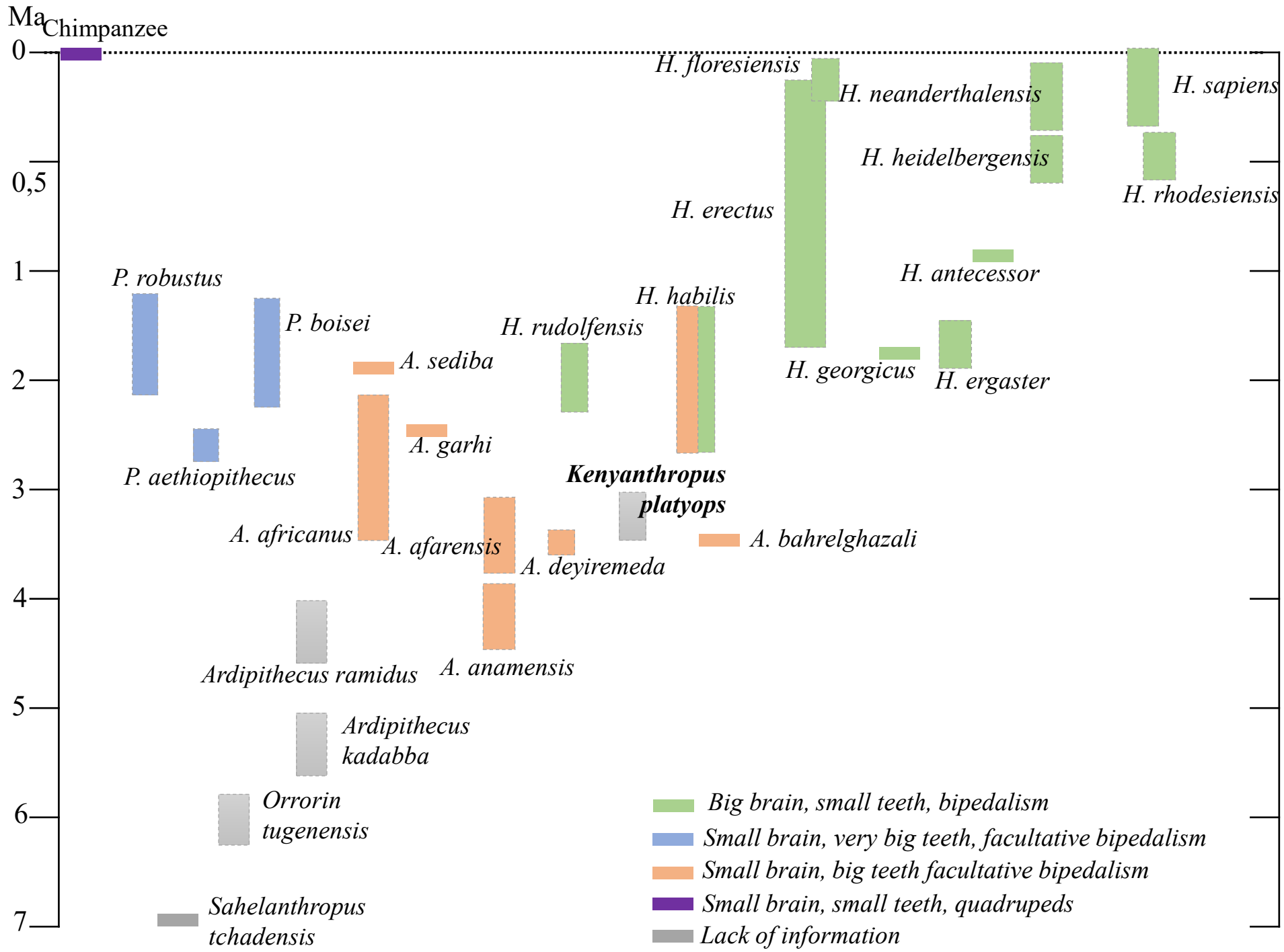
[a] CNRS UMR 6046, IPHEP Institut International de Paléoprimatologie, Paléontologie Humaine: Evolution et Paléoenvironnements, Faculté des Sciences, Université de Poitiers, 40 Avenue du Recteur Pineau, F-86022 Poitiers Cedex, France
[b] Université de N'Djamena, BP 1117, N'Djamena, Tchad
[c] EA 3428: ''Espèce humaine et primates: variabilité et évolution,'' Faculté de Médecine, F-67085 Strasbourg, France

Received 9 October 2006; accepted 3 December 2007

Au. anamensis: KNM-KP 29287, KNM-KP 29281
Early *Homo*: D211, D2600, OH 13, OH 22





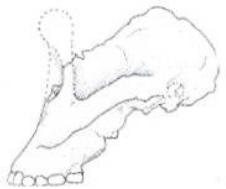

Ma
Chimpanzee
0
0,5
1
2
3
4
5
6
7
H. floresiensis
H. neanderthalensis
H. sapiens
H. heidelbergensis
H. rhodesiensis
H. erectus
H. antecessor
P. robustus
H. habilis
P. boisei
H. rudolfensis
A. sediba
H. georgicus
H. ergaster
A. garhi
P. aethiopithecus
Kenyanthropus platyops
A. africanus
A. afarensis
A. bahrelghazali
A. deyiremeda
A. anamensis
Ardipithecus ramidus
Ardipithecus kadabba
Orrorin tugenensis
Sahelanthropus tchadensis
Big brain, small teeth, bipedalism
Small brain, very big teeth, facultative bipedalism
Small brain, big teeth facultative bipedalism
Small brain, small teeth, quadrupeds
Lack of information

Kenyanthropus platyops

Australopithecus africanus Dart 1925

Holotype : Crâne de Taung (Afrique du Sud)

Synonymies :
- *Australopithecus transvaalensis* Broom, 1936 Sterkfontein, fgt de maxillaire TM 1511 (S1)
- *Plesianthropus transvaalensis* (Broom et Schepers, 1946) Sterkfontein, fgt mandibule TM 1516 et crâne Sts 5
- *Australopithecus prometheus* Dart, 1948 Makapansgat, calotte crânienne MDL-1



Paranthropus robustus Broom 1938

Holotype : Crâne et postcrânien TM 1517 (Kromdraai, Afrique du Sud)

Synonymies :
- *Paranthropus crassidens* Broom, 1949 Swartkrans, mandibule SK 6

Paranthropus boisei (Tobias 1967)

Holotype : Crâne OH 5 (Olduvai, Tanzanie)

Synonymies :
Zinjanthropus boisei Leakey, 1959
Paranthropus boisei (Robinson, 1960)
Australopithecus (Paranthropus) boisei (Leakey, Tobias et Napier, 1964)

Paranthropus aethiopicus (Arambourg et Coppens 1967)

Holotype : Mandibule Omo 18-1967-18 (Shungura, Omo, Éthiopie)

Australopithecus afarensis Johanson, White et Coppens 1978

Holotype : Mandibule LH 4 (Laetoli, Tanzanie)

Synonymies :
- *Meganthropus africanus* (Wernert, 1950) Maxillaire Garusi I
- *Praeanthropus africanus* (Senyürek, 1955) Maxillaire Garusi I

Australopithecus bahrelghazali Brunet *et al.* 1996

Holotype : Mandibule KT 12/H1 (Koro Toro, Tchad)

Australopithecus anamensis Leakey *et al.* 1995

Holotype : Mandibule KNM-KP 29 281 (Kanapoi, Kenya)

Australopithecus garhi Asfaw *et al.* 1999

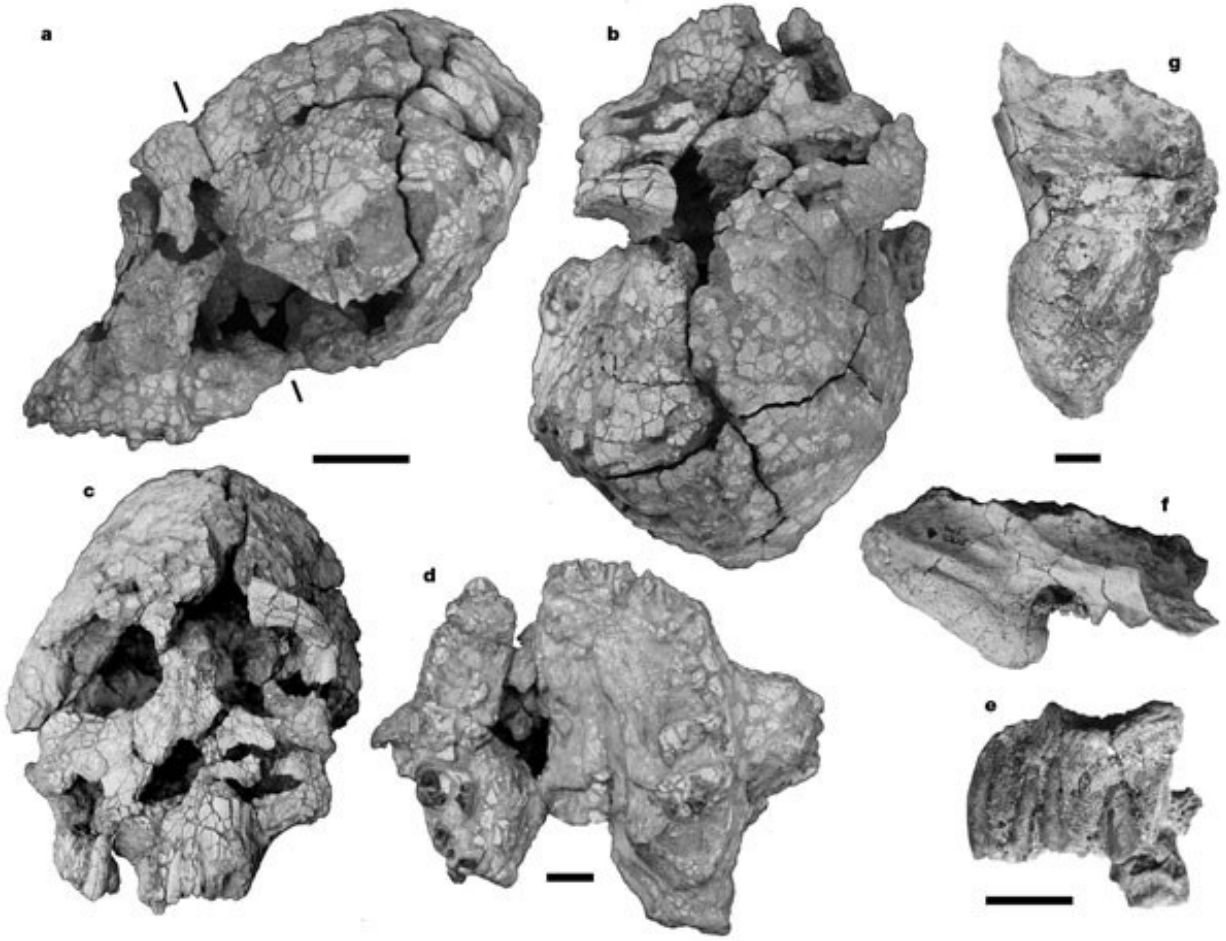
Holotype : Bou-VP-12/130 (Bouri, Middle Awash, Ethiopie)

Kenyanthropus platyops Leakey *et al.* 2001

Holotype : Crâne KNM-WT 40000 (Lomekwi, Ouest-Turkana, Kenya)

Da Histoire d'ancetres- Grimaud *et al.*, 2005

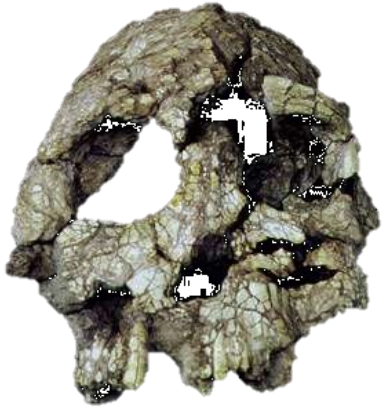
KNM - WT 40000 – West Turkana 3,5 – 3 Ma



(Leakey et al., 2001) - b, Superior view. c, Anterior view. d, Occlusal view of palate. Paratype KNM-WT 38350. e, Lateral view. KNM-WT 40001. f, Lateral view. g, Inferior view.

Tim White: *A. afarensis*
M. Leakey: linea evolutiva distinta forse alla base della speciazione del genere *Homo*
Evolutionary lineage distinct at the basis of the Homo *speciation*

Faccia piatta *Flat face*
Denti piccoli Small teeth
Capacità cranica = australopitecine


KNM WT 40000

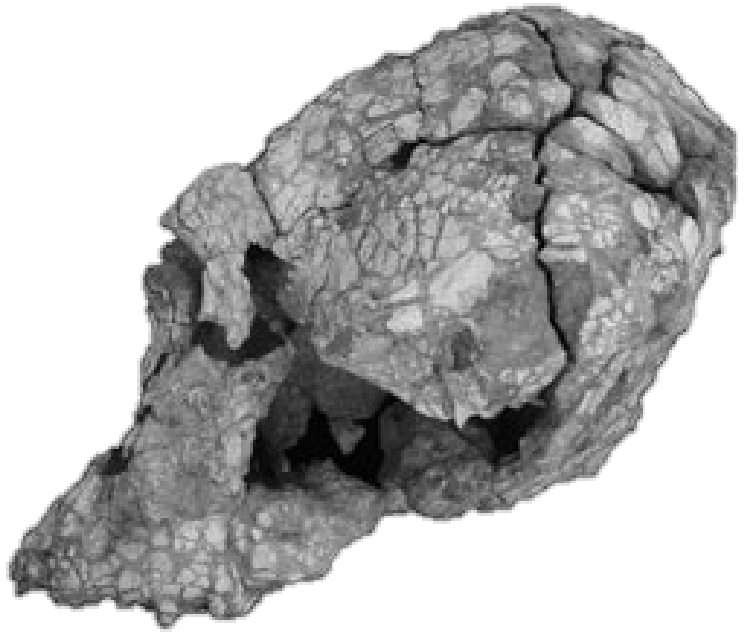

ER 1470 (*H. rudolfensis*)

Condivide caratteristiche primitive con *A. afarensis*

≠ *A. afarensis* (specie contemporanea)
- Sulla parte inferiore della faccia

Radice del processo maxillo-zigomatico posizionato anteriormente
Piano subnasale trasversalmente e sagittalmente piatto con una proiezione minima oltre i canini

Non ci sono caratteri derivati che potrebbe unirlo alla linea evolutiva *anamensis-afarensis*

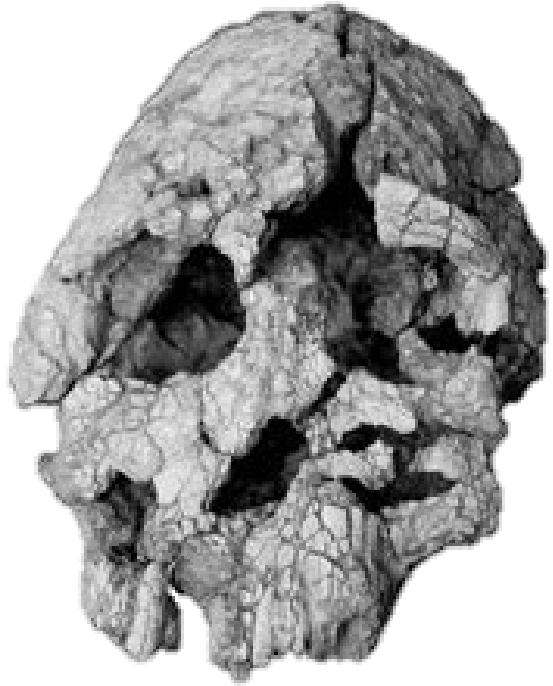


Shared primitive features with *Au. afarensis*

≠ *A. afarensis* (contemporaneous specie)
- On the lower part of the face:

anteriorly positioned root of the maxillary zygomatic process transversely and sagittaly flat submasal plane with minimal projection beyond the canines

There are no shared derived characters linking it to the *anamensis-afarensis* species-lineage



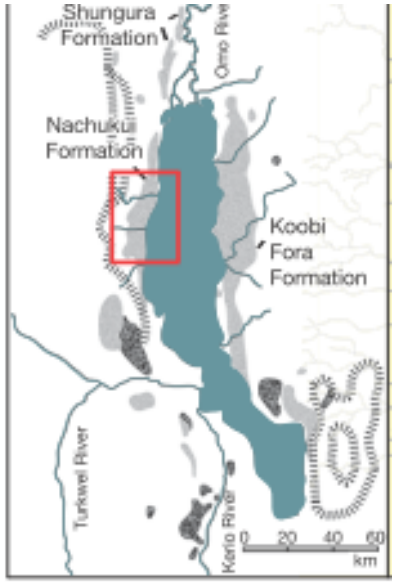
ARTICLE

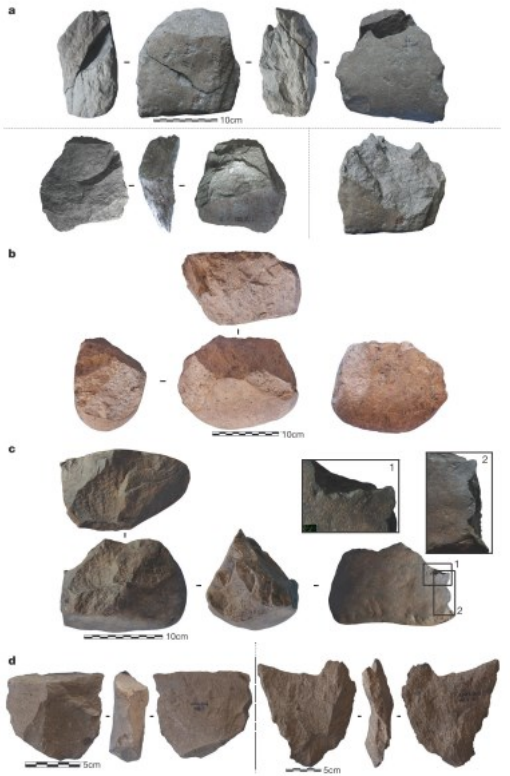
doi:10.1038/nature14464

3.3-million-year-old stone tools from Lomekwi 3, West Turkana, Kenya

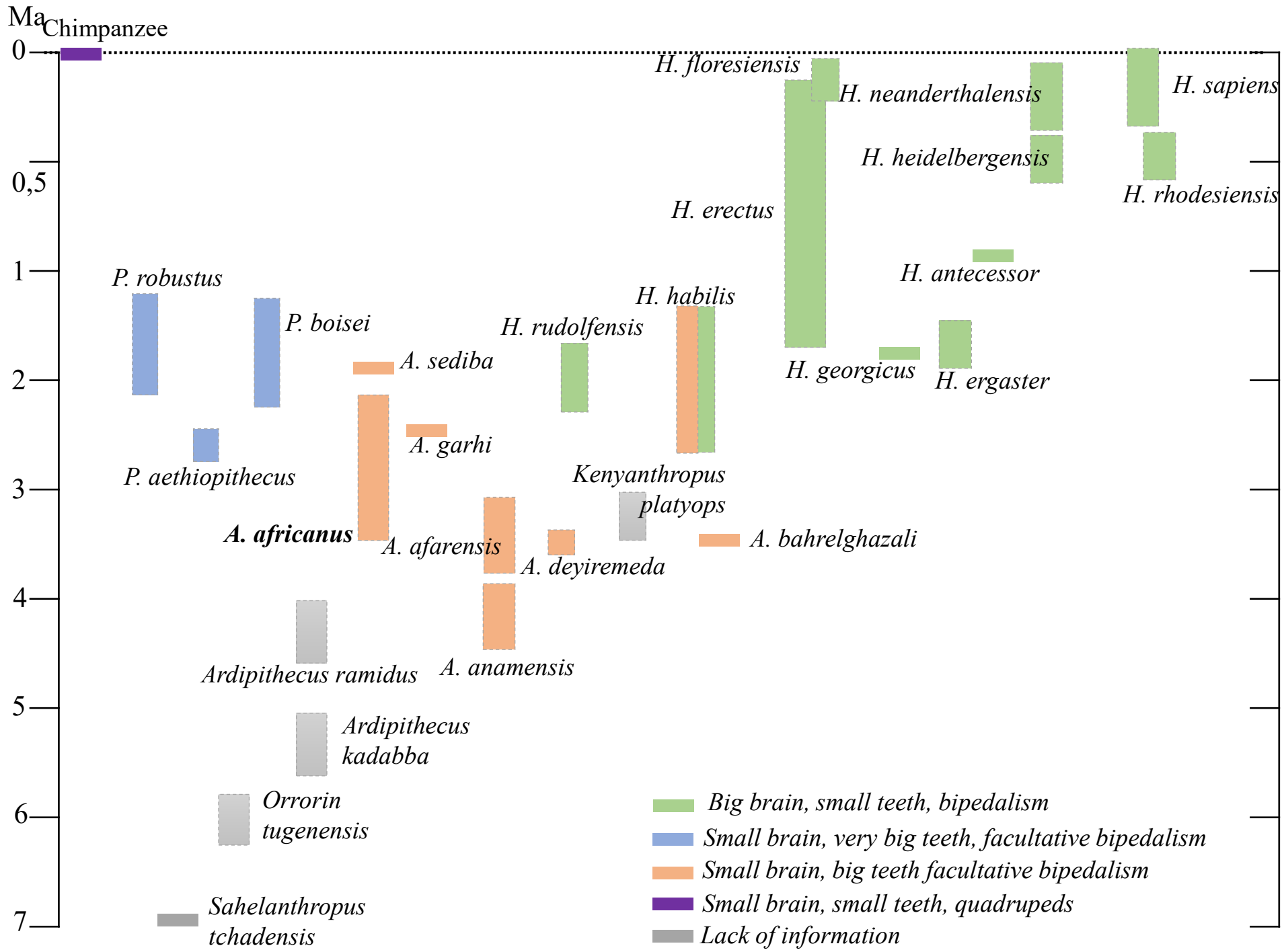
Sonia Harmand[1,2,3], Jason E. Lewis[1,3,4], Craig S. Feibel[3,4,5], Christopher J. Lepre[3,5,6], Sandrine Prat[3,7], Arnaud Lenoble[3,8], Xavier Boës[3,7], Rhonda L. Quinn[3,5,9], Michel Brenet[8,10], Adrian Arroyo[2], Nicholas Taylor[2,3], Sophie Clément[3,11], Guillaume Daver[12], Jean-Philip Brugal[3,13], Louise Leakey[1], Richard A. Mortlock[5], James D. Wright[5], Sammy Lokorodi[3], Christopher Kirwa[3,14], Dennis V. Kent[5,6] & Hélène Roche[2,3]

Human evolutionary scholars have long supposed that the earliest stone tools were made by the genus *Homo* and that this technological development was directly linked to climate change and the spread of savannah grasslands. New fieldwork in West Turkana, Kenya, has identified evidence of much earlier hominin technological behaviour. We report the discovery of Lomekwi 3, a 3.3-million-year-old archaeological site where *in situ* stone artefacts occur in spatio-temporal association with Pliocene hominin fossils in a wooded palaeoenvironment. The Lomekwi 3 knappers, with a developing understanding of stone's fracture properties, combined core reduction with battering activities. Given the implications of the Lomekwi 3 assemblage for models aiming to converge environmental change, hominin evolution and technological origins, we propose for it the name 'Lomekwian', which predates the Oldowan by 700,000 years and marks a new beginning to the known archaeological record.





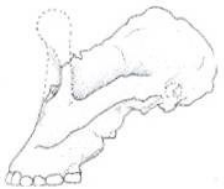
These finds occur in the same geographic and chronological range as the paratype of *Kenyanthropus platyops* (KNM-WT 38350), other hominin fossils generally referred to cf. *K. platyops*, and one unpublished hominin tooth (KNM-WT 64060) found by WTAP in 2012.


Ma
Chimpanzee
0
0,5
1
2
3
4
5
6
7
H. floresiensis
H. neanderthalensis
H. sapiens
H. heidelbergensis
H. rhodesiensis
H. erectus
H. antecessor
P. robustus
P. boisei
H. habilis
H. rudolfensis
A. sediba
H. georgicus
H. ergaster
A. garhi
P. aethiopithecus
Kenyanthropus platyops
A. africanus
A. afarensis
A. deyiremeda
A. bahrelghazali
A. anamensis
Ardipithecus ramidus
Ardipithecus kadabba
Orrorin tugenensis
Sahelanthropus tchadensis
Big brain, small teeth, bipedalism
Small brain, very big teeth, facultative bipedalism
Small brain, big teeth facultative bipedalism
Small brain, small teeth, quadrupeds
Lack of information

Australopithecus africanus Dart 1925

Holotype : Crâne de Taung (Afrique du Sud)

Synonymies :
- *Australopithecus transvaalensis* Broom, 1936 Sterkfontein, fgt de maxillaire TM 1511 (S1)
- *Plesianthropus transvaalensis* (Broom et Schepers, 1946) Sterkfontein, fgt mandibule TM 1516 et crâne Sts 5
- *Australopithecus prometheus* Dart, 1948 Makapansgat, calotte crânienne MDL-1



Paranthropus robustus Broom 1938

Holotype : Crâne et postcrânien TM 1517 (Kromdraai, Afrique du Sud)

Synonymies :
- *Paranthropus crassidens* Broom, 1949 Swartkrans, mandibule SK 6

Paranthropus boisei (Tobias 1967)

Holotype : Crâne OH 5 (Olduvai, Tanzanie)

Synonymies :
Zinjanthropus boisei Leakey, 1959
Paranthropus boisei (Robinson, 1960)
Australopithecus (Paranthropus) boisei (Leakey, Tobias et Napier, 1964)

Paranthropus aethiopicus (Arambourg et Coppens 1967)

Holotype : Mandibule Omo 18-1967-18 (Shungura, Omo, Éthiopie)

Australopithecus afarensis Johanson, White et Coppens 1978

Holotype : Mandibule LH 4 (Laetoli, Tanzanie)

Synonymies :
- *Meganthropus africanus* (Wernert, 1950) Maxillaire Garusi I
- *Praeanthropus africanus* (Senyürek, 1955) Maxillaire Garusi I

Australopithecus bahrelghazali Brunet *et al.* 1996

Holotype : Mandibule KT 12/H1 (Koro Toro, Tchad)

Australopithecus anamensis Leakey *et al.* 1995

Holotype : Mandibule KNM-KP 29 281 (Kanapoi, Kenya)

Australopithecus garhi Asfaw *et al.* 1999

Holotype : Bou-VP-12/130 (Bouri, Middle Awash, Ethiopie)

Kenyanthropus platyops Leakey *et al.* 2001

Holotype : Crâne KNM-WT 40000 (Lomekwi, Ouest-Turkana, Kenya)

Da Histoire d'ancetres- Grimaud *et al.*, 2005

Nom : *Australopithecus africanus*

Origine : Afrique du Sud (Makapansgat, Sterkfontein, Taung)

Dates : 3,5 à 1,2 MA

Cerveau : 400 à 500 cm^3

Taille : 1,20 m

Intermediate form between *Paranthropus* and *Autralopithecus*

Taung baby 2,6 Ma

STS 5 Miss Ples 2,8 – 2, 6 Ma

STS 14

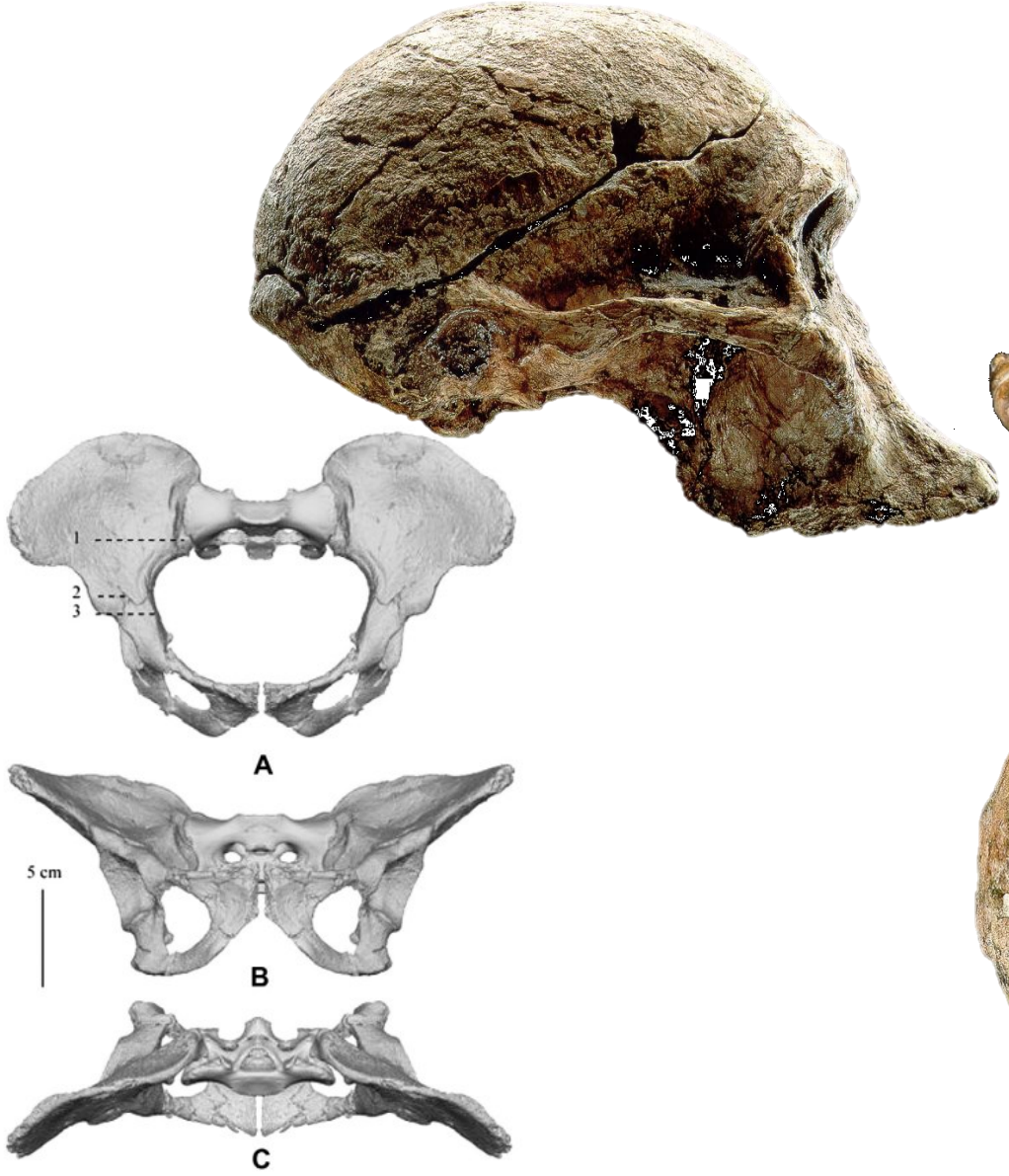
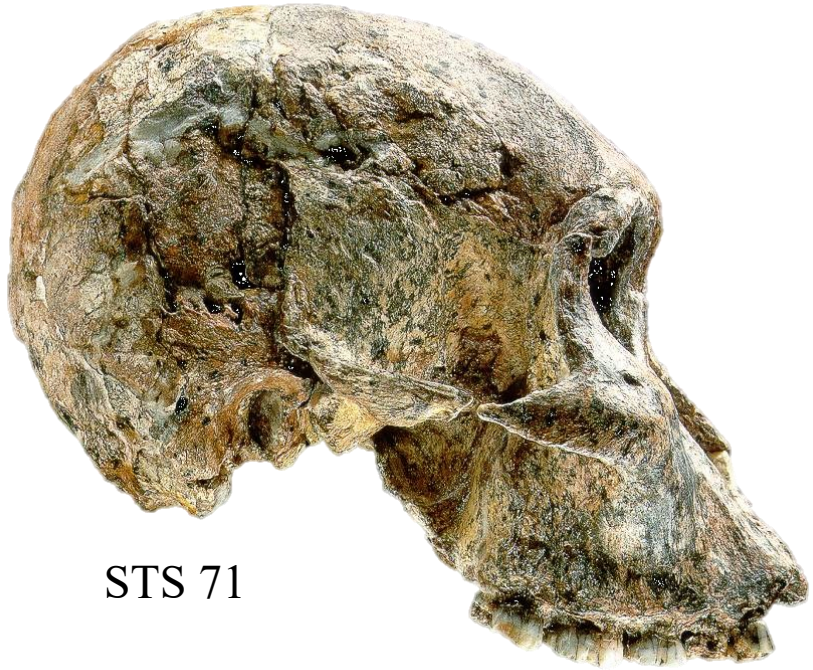
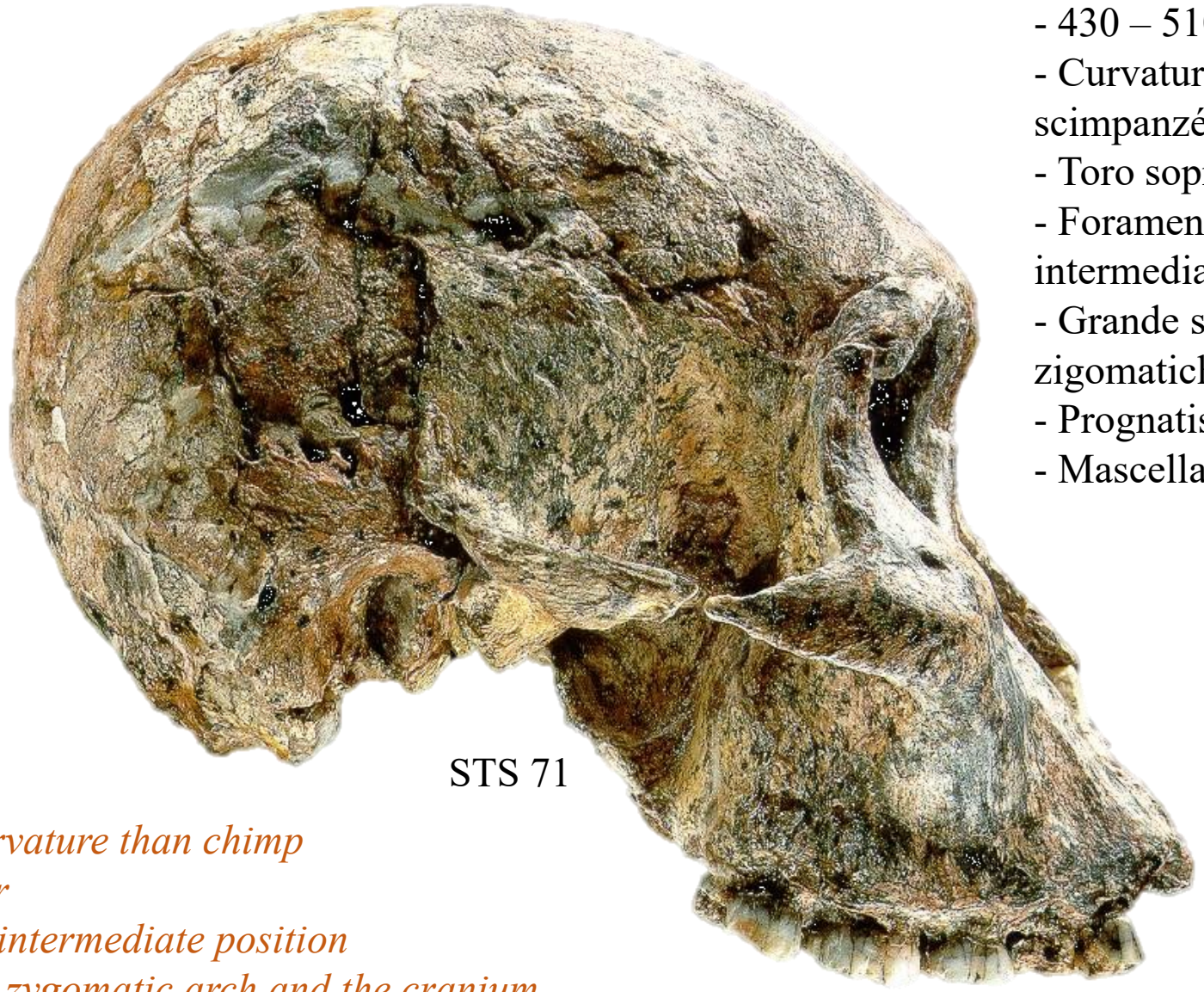


Fig. 5. The reconstructed Sts 14 pelvis. A: anterior superior view; B: anterior view. C: superior view. 1: space corresponding to the epiphysial lamina; 2: crack-line; 3: iliopubic eminence.

Berge 2010, JHE 58



STS 71



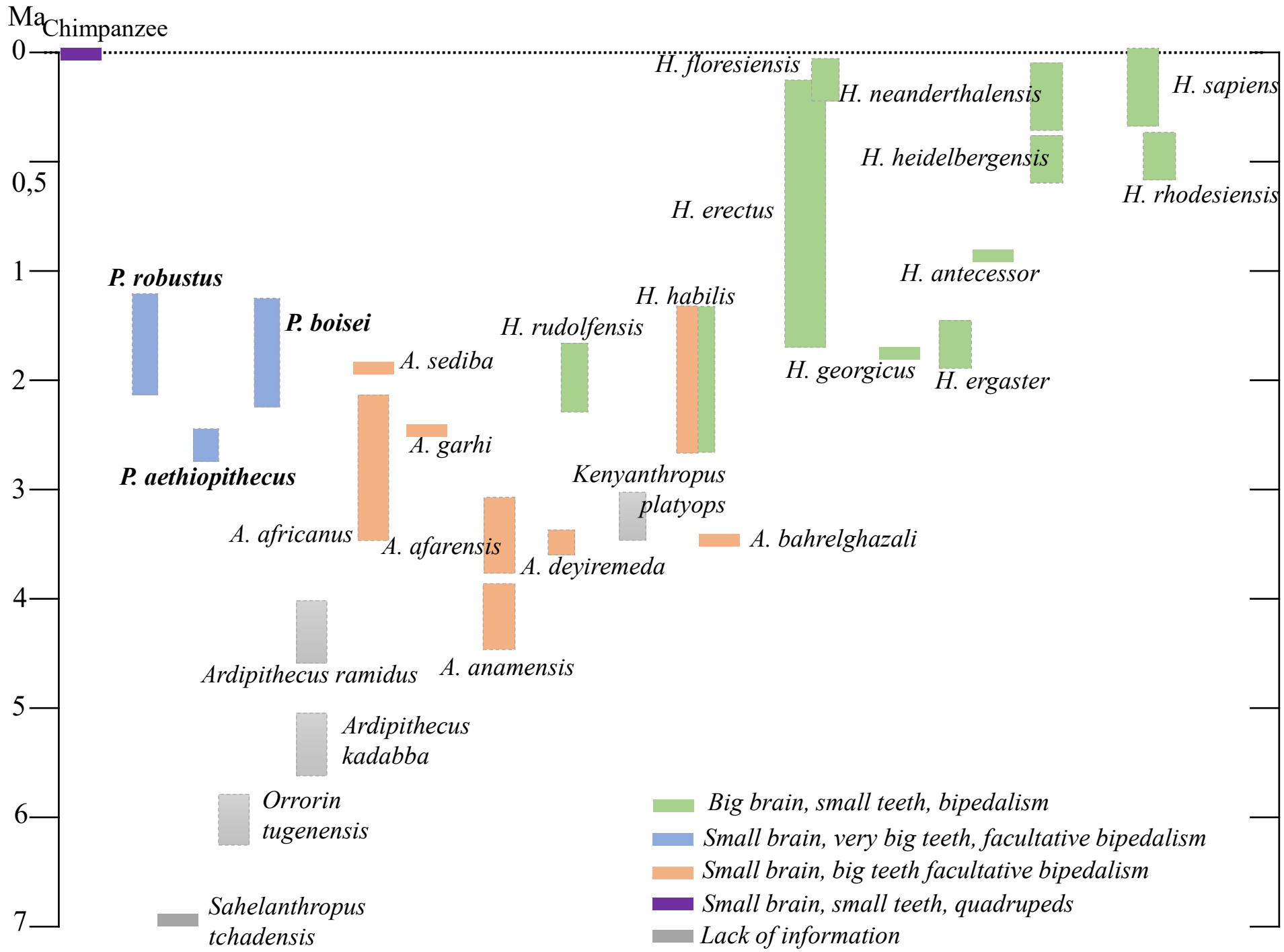
STS 71

1,20 m
- 430 – 510 cc
- Curvature cranica più marcata che i scimpanzé
- Toro sopra-orbitale più spesso
- Foramen magnum in posizione intermedia
- Grande spazio tra le arcate zigomatiche e il cranio
- Prognatismo alveolare pronunciato
- Mascella parabolica

- 1,20 m
- 430 – 510 cc
- More marked cranial curvature than chimp
- Supra orbital torus ticker
- Foramen magnum in an intermediate position
- Large space between the zygomatic arch and the cranium
- Marked alveolar prognatism
- Parabolic jaw

≠ *A. afarensis*
Scattola cranica più alta e corta senza cresta sagittale
Base del cranio stretta relativamente alla sua lunghezza
Foramen magnum situato posteriormente
Pilastro anteriore prominente che limita l'apertura nasale
Zona subnasale piatta e meno proiettata relativamente all'asse bicanino
Radice del processo zigomatico prende origine anteriormente
Corpo mandibolare più robusto
Denti postcanini più larghi

≠ *A. afarensis*
Higher and shorter braincase with rare sagittal cresting
Cranial base narrow relative to its lenght
Foramen magnum located more posteriorly
Prominent anterior pillars bord the nasal aperture
Subnasal plate is flat and much less projecting relative to the bicanine axis
Zygomatic process roots originated more anteriorly
Mandible corpus more robust
Larger postcanine teeth

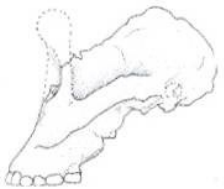

Ma
Chimpanzee
0
0,5
1
2
3
4
5
6
7
H. floresiensis
H. neanderthalensis
H. sapiens
H. heidelbergensis
H. rhodesiensis
H. erectus
H. antecessor
P. robustus
P. boisei
H. habilis
H. rudolfensis
H. georgicus
H. ergaster
A. sediba
A. garhi
P. aethiopithecus
Kenyanthropus platyops
A. africanus
A. afarensis
A. deyiremeda
A. bahrelghazali
A. anamensis
Ardipithecus ramidus
Ardipithecus kadabba
Orrorin tugenensis
Sahelanthropus tchadensis
Big brain, small teeth, bipedalism
Small brain, very big teeth, facultative bipedalism
Small brain, big teeth facultative bipedalism
Small brain, small teeth, quadrupeds
Lack of information

Parantropus robustus, boisei, aethiopicus

Australopithecus africanus Dart 1925

Holotype : Crâne de Taung (Afrique du Sud)

Synonymies :
- *Australopithecus transvaalensis* Broom, 1936 Sterkfontein, fgt de maxillaire TM 1511 (S1)
- *Plesianthropus transvaalensis* (Broom et Schepers, 1946) Sterkfontein, fgt mandibule TM 1516 et crâne Sts 5
- *Australopithecus prometheus* Dart, 1948 Makapansgat, calotte crânienne MDL-1



Paranthropus robustus Broom 1938

Holotype : Crâne et postcrânien TM 1517 (Kromdraai, Afrique du Sud)

Synonymies :
- *Paranthropus crassidens* Broom, 1949 Swartkrans, mandibule SK 6

Paranthropus boisei (Tobias 1967)

Holotype : Crâne OH 5 (Olduvai, Tanzanie)

Synonymies :
Zinjanthropus boisei Leakey, 1959
Paranthropus boisei (Robinson, 1960)
Australopithecus (Paranthropus) boisei (Leakey, Tobias et Napier, 1964)

Paranthropus aethiopicus (Arambourg et Coppens 1967)

Holotype : Mandibule Omo 18-1967-18 (Shungura, Omo, Éthiopie)

Australopithecus afarensis Johanson, White et Coppens 1978

Holotype : Mandibule LH 4 (Laetoli, Tanzanie)

Synonymies :
- *Meganthropus africanus* (Wernert, 1950) Maxillaire Garusi I
- *Praeanthropus africanus* (Senyürek, 1955) Maxillaire Garusi I

Australopithecus bahrelghazali Brunet *et al.* 1996

Holotype : Mandibule KT 12/H1 (Koro Toro, Tchad)

Australopithecus anamensis Leakey *et al.* 1995

Holotype : Mandibule KNM-KP 29 281 (Kanapoi, Kenya)

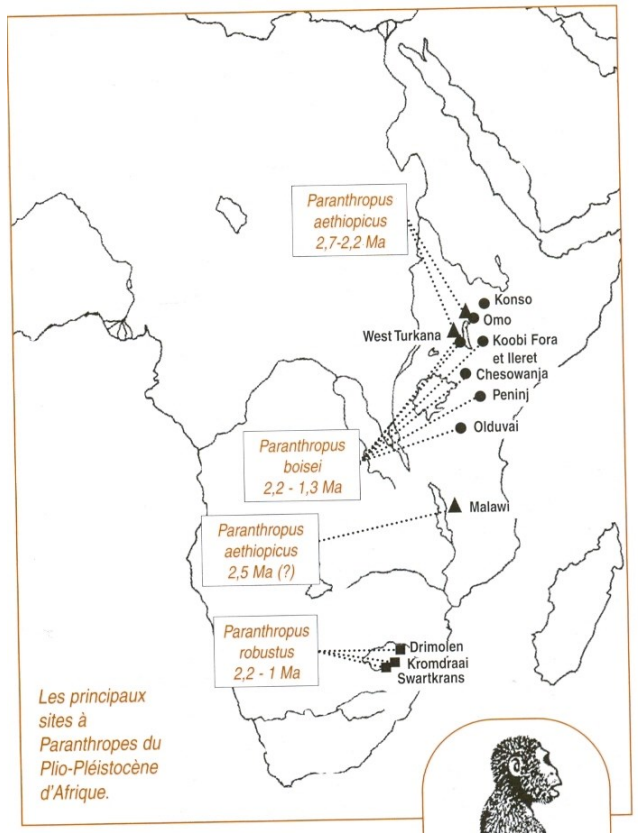
Australopithecus garhi Asfaw *et al.* 1999

Holotype : Bou-VP-12/130 (Bouri, Middle Awash, Ethiopie)

Kenyanthropus platyops Leakey *et al.* 2001

Holotype : Crâne KNM-WT 40000 (Lomekwi, Ouest-Turkana, Kenya)

Da Histoire d'ancetres- Grimaud *et al.*, 2005



Les principaux sites à Paranthropes du Plio-Pléistocène d'Afrique.

Nom : Paranthropus aethiopicus
Origine : Afrique de l'Est (Omo, West-Turkana, Malawi)
Dates : 2,7 à 2,2 Ma
Cerveau : 500 à 550 cm^3
Taille : 1,50 m - 1,60 m

P. aethiopicus KNM-WT 17000 2.5 MA

≠ *A. afarensis*
Extreme midfacial prognathism, flat subnasal plane, vertically thick palate, anteriorly positioned zygomatic process rooths, massive postcanine dentition

Nom : *Paranthropus robustus*

Origine : Afrique du Sud (Swartkrans, Kromdraai)

Dates : 2,2 à 1,5 MA

Cerveau : 500 à 550 cm^3

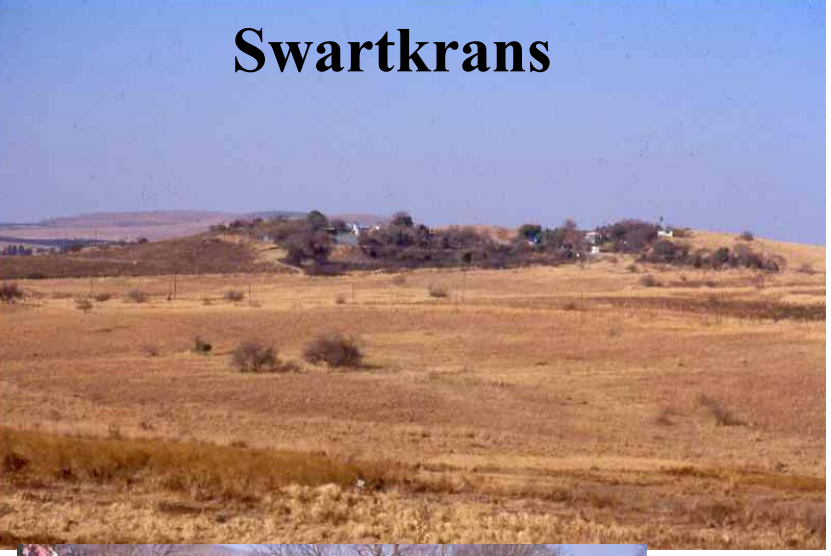
Taille : 1,50 - 1,60 m

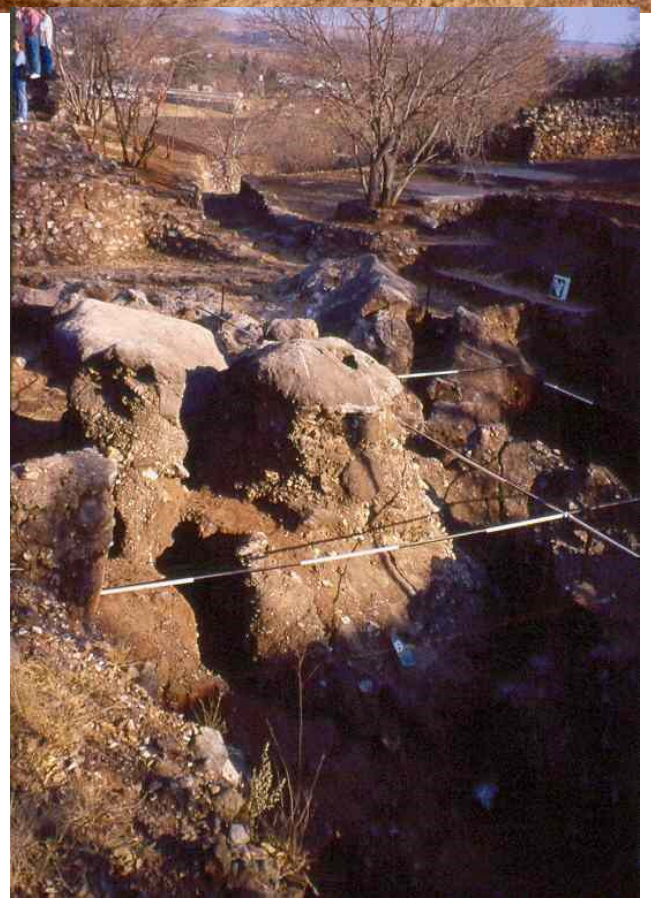
P. robustus SK 48 Swartkrans, 2-1.5 MA

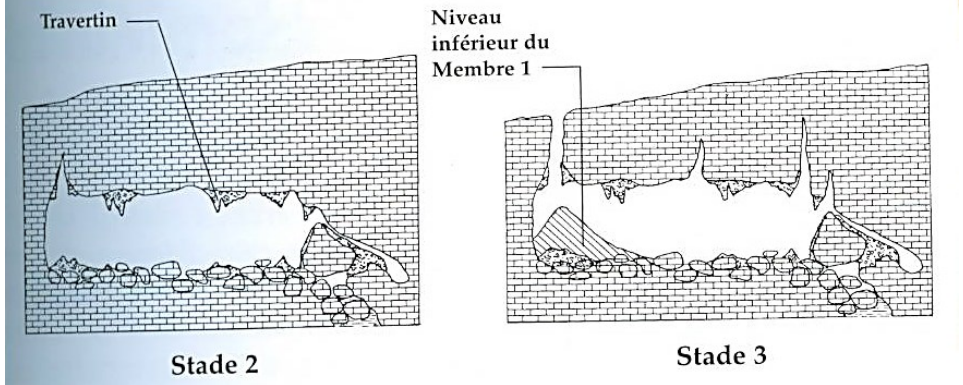
≠ *A. afarensis*

Large postcanine dentition and unusual facial morphology with depressed infraorbital surfaces

Swartkrans

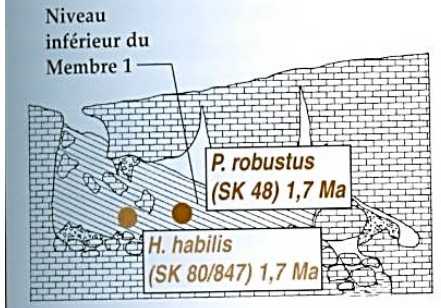




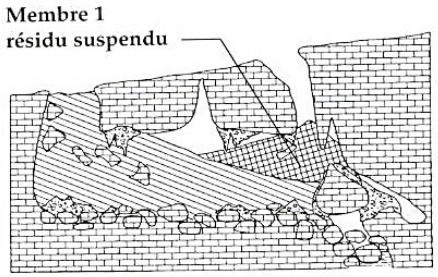


Stade 2

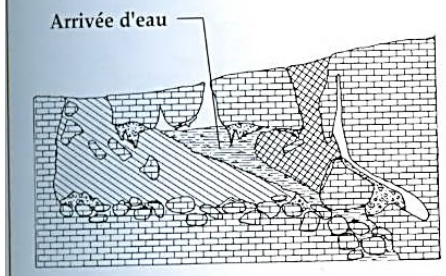
Stade 3



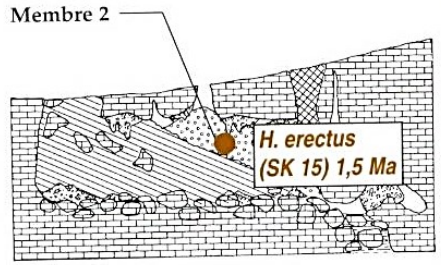
Stade 4



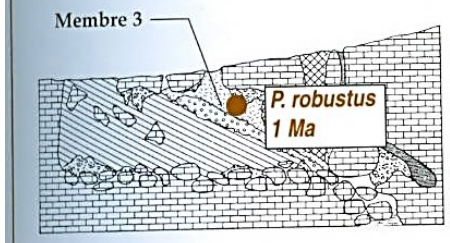
Stade 5



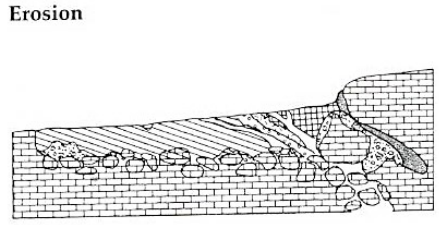
Stade 6



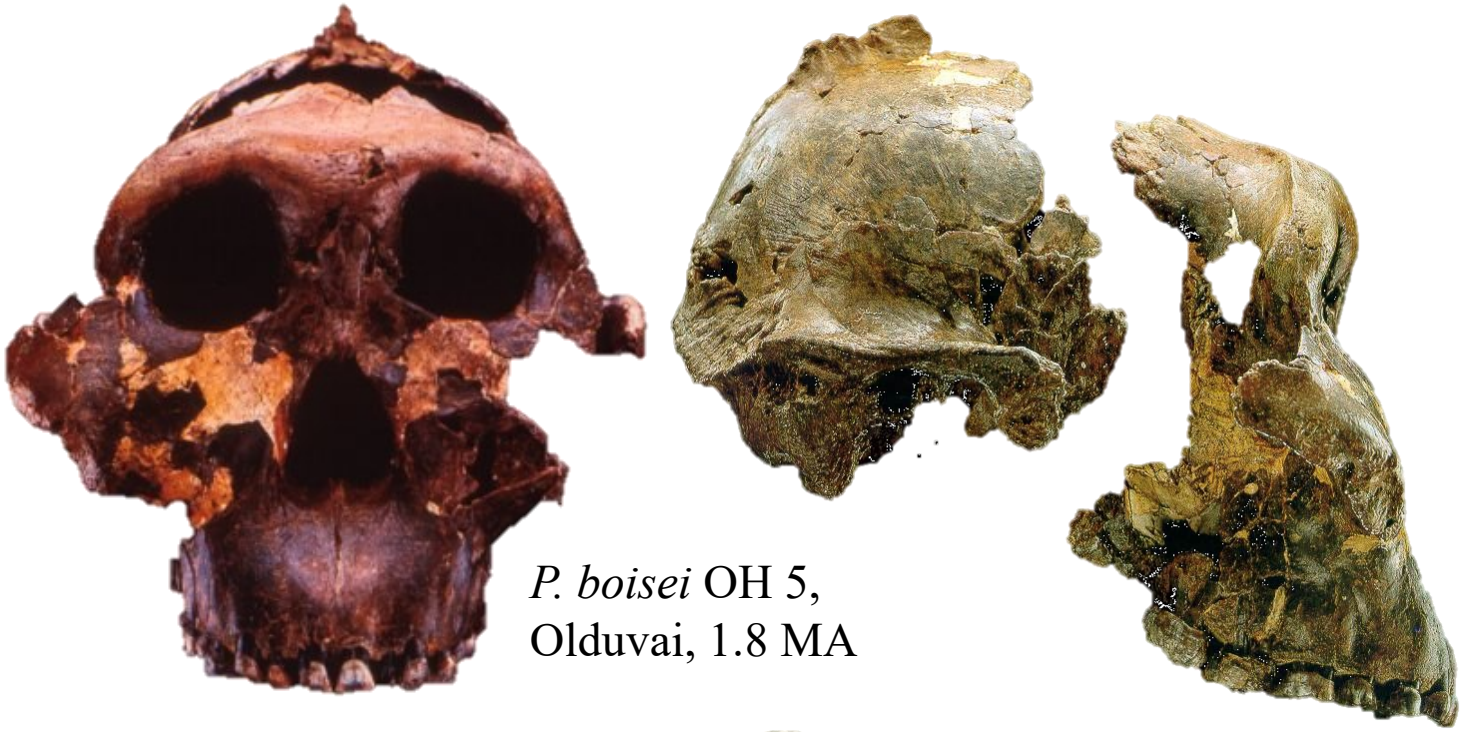
Stade 7



Stade 8



Stade 9



P. boisei OH 5,
Olduvai, 1.8 MA

P. boisei KNM-ER
732, Koobi Fora
1.7 MA

P. boisei KNM-ER
406, Koobi Fora
1.7 MA

P. boisei OH 5,
Olduvai, 1.8 MA

≠ *P. robustus* principalmente nel complesso dentognatico
Denti postcanini più larghi
Disproporzione tra la dentizione postcanini e anteriore più importante
Toro sopraorbitale più robusto
Foramen magnum piu corto

≠ *P. robustus* principaly in the dentognathic complex
Absolutely larger postcanine teeth
Greater disproportion between the postcanine and anterior dentitions
Stronger supraorbital torus
Shorter foramen magnum

Sagital keeling

VS

Sagital crest

Carena sagittale

Bone robustness

Cresta sagittale : Insertion of temporal muscle

Muscular robustness

PARANTROPI o AUSTRALOPITECI ROBUSTI:

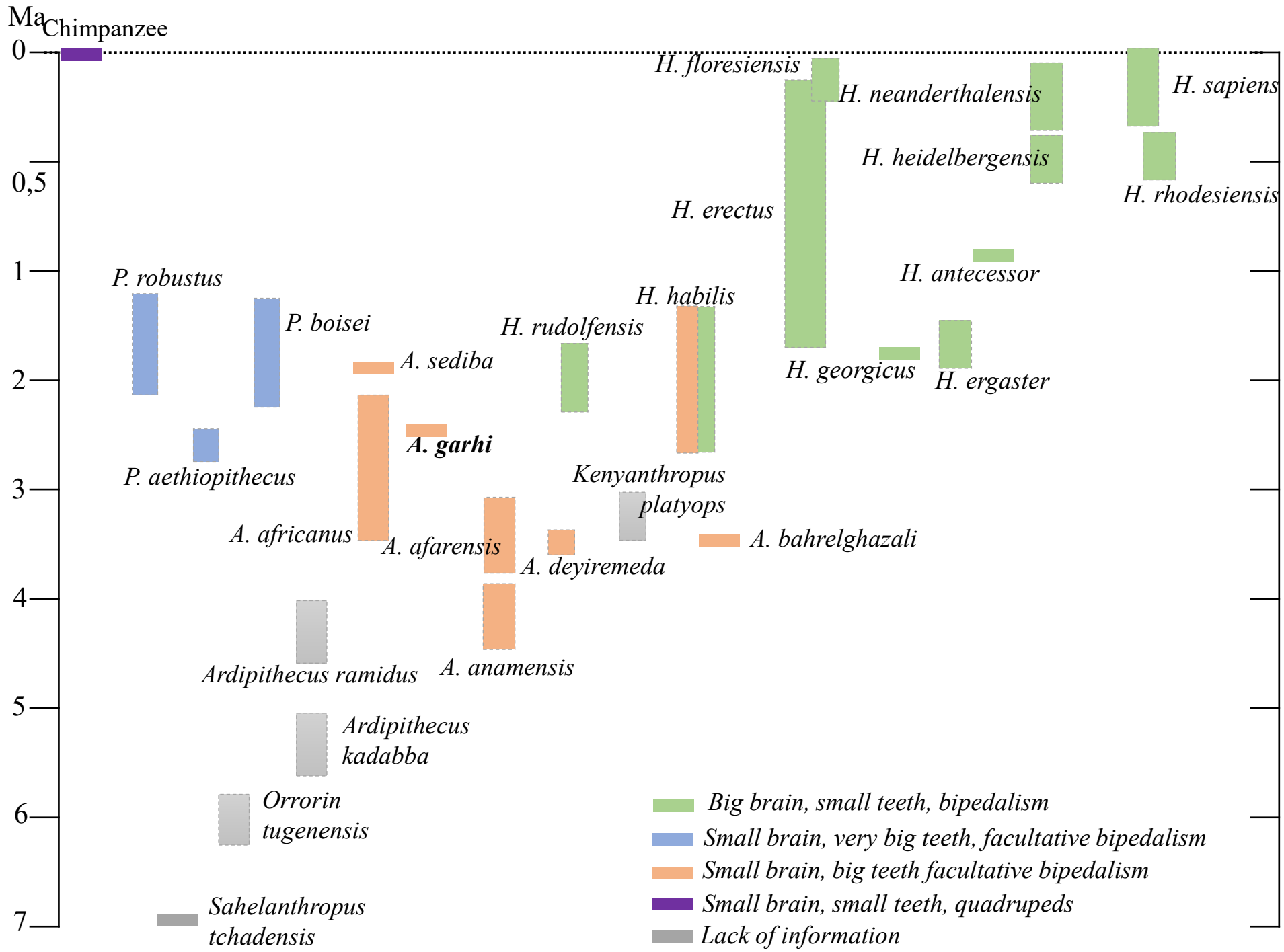
-Così definiti per la robustezza dell'apparato masticatorio (denti, mandibole, mascelle, creste di inserzione muscolare)
Defined for the robustness of the masticatory apparatus (teeth, mandible, maxilla, sagittal crest)

-Sviluppata cresta sagittale che da inserzione ai muscoli temporali che avvolgono praticamente tutto il cranio
Developed sagittal crest for the insertion of the temporal muscle which envelop almost all the skull

-Fosse temporali molto ampie
Wide temporal fossa

-Arcate zigomatiche vistose
Considerable zygomatics

-Scheletro facciale accorciato
Short face

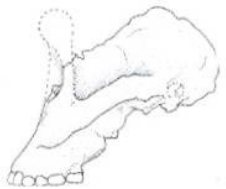

Ma
Chimpanzee
0
0,5
1
2
3
4
5
6
7
H. floresiensis
H. neanderthalensis
H. sapiens
H. heidelbergensis
H. rhodesiensis
H. erectus
H. antecessor
P. robustus
H. habilis
P. boisei
H. rudolfensis
H. georgicus
H. ergaster
A. sediba
A. garhi
P. aethiopithecus
Kenyanthropus platyops
A. africanus
A. afarensis
A. bahrelghazali
A. deyiremeda
A. anamensis
Ardipithecus ramidus
Ardipithecus kadabba
Orrorin tugenensis
Sahelanthropus tchadensis
Big brain, small teeth, bipedalism
Small brain, very big teeth, facultative bipedalism
Small brain, big teeth facultative bipedalism
Small brain, small teeth, quadrupeds
Lack of information

Australopithecus garhi

Australopithecus africanus Dart 1925

Holotype : Crâne de Taung (Afrique du Sud)

Synonymies :
- *Australopithecus transvaalensis* Broom, 1936 Sterkfontein, fgt de maxillaire TM 1511 (S1)
- *Plesianthropus transvaalensis* (Broom et Schepers, 1946) Sterkfontein, fgt mandibule TM 1516 et crâne Sts 5
- *Australopithecus prometheus* Dart, 1948 Makapansgat, calotte crânienne MDL-1



Paranthropus robustus Broom 1938

Holotype : Crâne et postcrânien TM 1517 (Kromdraai, Afrique du Sud)

Synonymies :
- *Paranthropus crassidens* Broom, 1949 Swartkrans, mandibule SK 6

Paranthropus boisei (Tobias 1967)

Holotype : Crâne OH 5 (Olduvai, Tanzanie)

Synonymies :
Zinjanthropus boisei Leakey, 1959
Paranthropus boisei (Robinson, 1960)
Australopithecus (Paranthropus) boisei (Leakey, Tobias et Napier, 1964)

Paranthropus aethiopicus (Arambourg et Coppens 1967)

Holotype : Mandibule Omo 18-1967-18 (Shungura, Omo, Éthiopie)

Australopithecus afarensis Johanson, White et Coppens 1978

Holotype : Mandibule LH 4 (Laetoli, Tanzanie)

Synonymies :
- *Meganthropus africanus* (Wernert, 1950) Maxillaire Garusi I
- *Praeanthropus africanus* (Senyürek, 1955) Maxillaire Garusi I

Australopithecus bahrelghazali Brunet *et al.* 1996

Holotype : Mandibule KT 12/H1 (Koro Toro, Tchad)

Australopithecus anamensis Leakey *et al.* 1995

Holotype : Mandibule KNM-KP 29 281 (Kanapoi, Kenya)

Australopithecus garhi Asfaw *et al.* 1999

Holotype : Bou-VP-12/130 (Bouri, Middle Awash, Ethiopie)

Kenyanthropus platyops Leakey *et al.* 2001

Holotype : Crâne KNM-WT 40000 (Lomekwi, Ouest-Turkana, Kenya)

Da Histoire d'ancetres- Grimaud *et al.*, 2005

BOU-BP-12-130

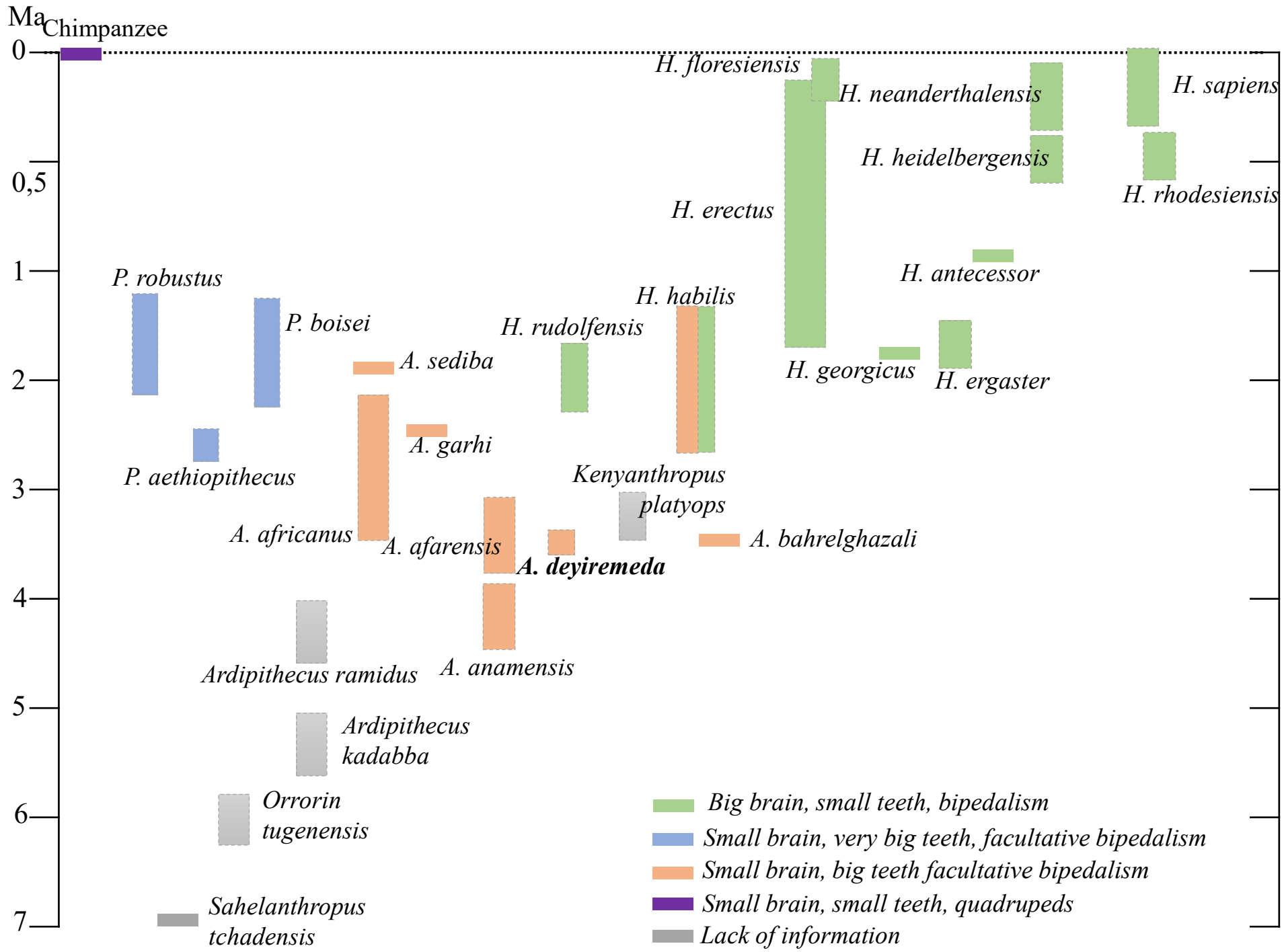
Età : 2, 5 Ma

Intermediario tra *A. afarensis* e i primi appartenenti al genere *Homo*
Combina una faccia e un palato plesiomorfi con una morfologia del calvaria derivata e una configurazione dentaria insolita (denti molto grandi)

Intermediate between A. afarensis *and the first* Homo
Combine a largely plesiomorphic face and palate with derived calvaria morphology and a highly unusual hominin dental configuration (huge teeth)

= Au. afarensis
Prognatismo pronunciato, zona subnasale convessa, margine dell'apertura nasale affilate, assenza di pilastro, palato poco profondo
Maxillary features: strongly prognathic, convex subnasal surface, sharp lateral margins of the nasal aperture, lack of anterior pillar, shallow palate

Asfaw, B., T.D. White, O. Lovejoy, B. Latimer, S. Simpson, and G. Suwa. 1999. "Australopithecus garhi: A new species of early hominid from Ethiopia." In Science, vol. 284, pp. 629-635


Ma
Chimpanzee
0
0,5
1
2
3
4
5
6
7
H. floresiensis
H. neanderthalensis
H. sapiens
H. heidelbergensis
H. rhodesiensis
H. erectus
H. antecessor
P. robustus
H. habilis
P. boisei
H. rudolfensis
A. sediba
H. georgicus
H. ergaster
A. garhi
P. aethiopithecus
Kenyanthropus platyops
A. africanus
A. afarensis
A. bahrelghazali
A. deyiremeda
A. anamensis
Ardipithecus ramidus
Ardipithecus kadabba
Orrorin tugenensis
Sahelanthropus tchadensis
Big brain, small teeth, bipedalism
Small brain, very big teeth, facultative bipedalism
Small brain, big teeth facultative bipedalism
Small brain, small teeth, quadrupeds
Lack of information

Autralopithecus deyiremeda

ARTICLE

doi:10.1038/nature14448

New species from Ethiopia further expands Middle Pliocene hominin diversity

Yohannes Haile-Selassie[1,2], Luis Gibert[3], Stephanie M. Melillo[4], Timothy M. Ryan[5], Mulugeta Alene[6], Alan Deino[7], Naomi E. Levin[8], Gary Scott[7] & Beverly Z. Saylor[2]

Middle Pliocene hominin species diversity has been a subject of debate over the past two decades, particularly after the naming of *Australopithecus bahrelghazali* and *Kenyanthropus platyops* in addition to the well-known species *Australopithecus afarensis*. Further analyses continue to support the proposal that several hominin species co-existed during this time period. Here we recognize a new hominin species (*Australopithecus deyiremeda* sp. nov.) from 3.3–3.5-million-year-old deposits in the Woranso–Mille study area, central Afar, Ethiopia. The new species from Woranso–Mille shows that there were at least two contemporaneous hominin species living in the Afar region of Ethiopia between 3.3 and 3.5 million years ago, and further confirms early hominin taxonomic diversity in eastern Africa during the Middle Pliocene epoch. The morphology of *Au. deyiremeda* also reinforces concerns related to dentognathic (that is, jaws and teeth) homoplasy in Plio–Pleistocene hominins, and shows that some dentognathic features traditionally associated with *Paranthropus* and *Homo* appeared in the fossil record earlier than previously thought.

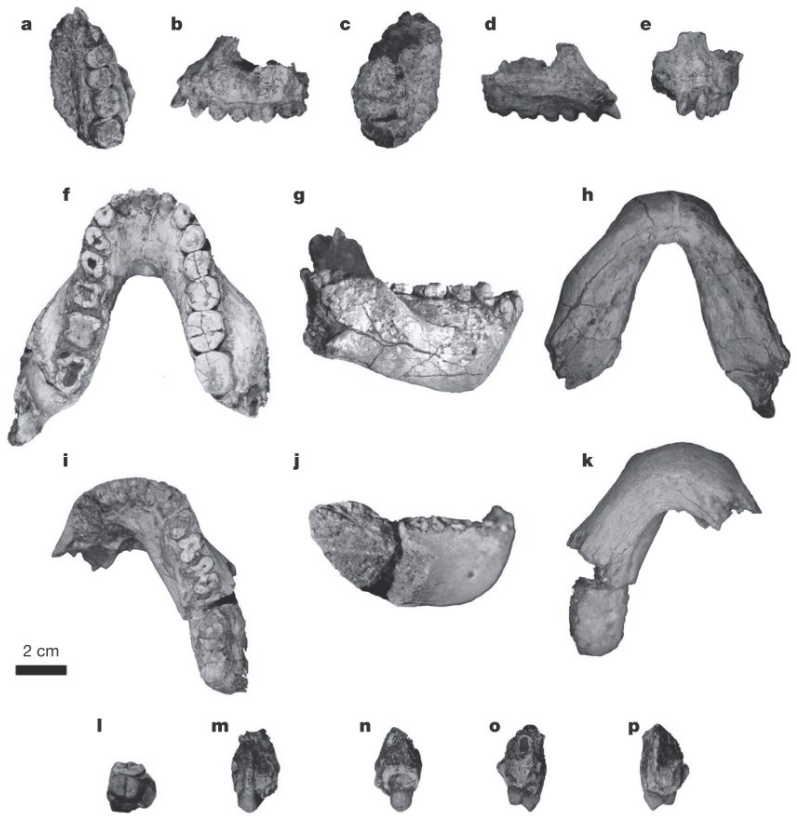
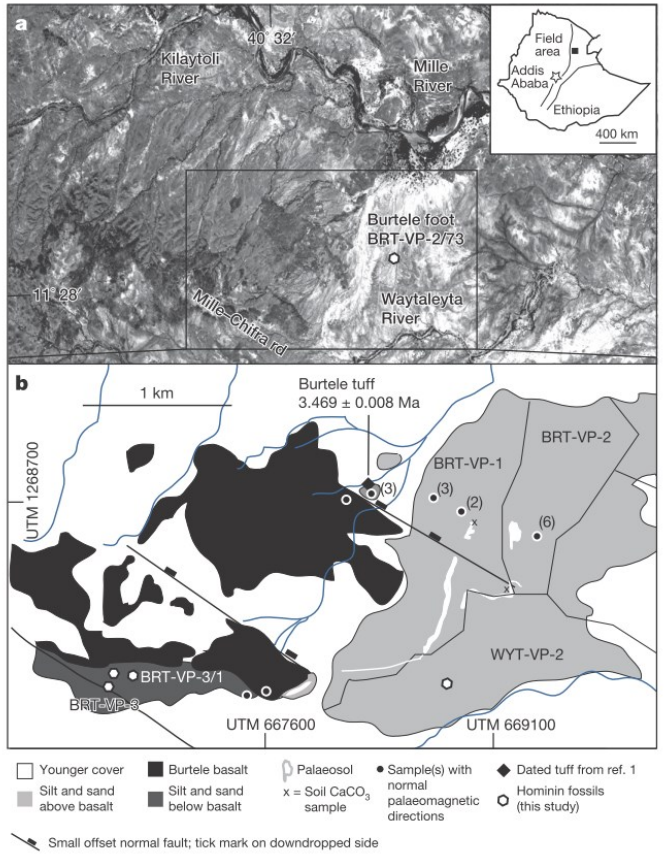


Figure 1 | Holotype BRT-VP-3/1. **a**, Occlusal view. **b**, Lateral view. **c**, Superior view. **d**, Medial view. **e**, Anterior view. Paratype BRT-VP-3/14. **f**, Occlusal view. **g**, Right lateral view. **h**, Basal view. Paratype WYT-VP-2/10. **i**, Occlusal view. **j**, Right lateral view. **k**, Basal view. Referred specimen BRT-VP-3/37. **l**, Occlusal view. **m**, Buccal view. **n**, Lingual view. **o**, Distal view. **p**, Mesial view.



Differential diagnosis: *A. deyiremeda* is
≠ *Ar. ramidus* for: thicker enamel, P4 with 3 roots and a robust jaw
≠ *A. anamensis* for the mandibular symphysis profil slighly receeding, a more robust mandibular corpus, bicuspid P3
≠ *A. afarensis* for the general architecture of the jaw, smaller postcanina teeth
≠ *A garhi* for the reduced subnasal prograthism and the riduced canine and post-canine dimension

Australopithecus sediba

Australopithecus sediba: A New Species of *Homo*-Like Australopith from South Africa

Lee R. Berger,[1,2*] Darryl J. de Ruiter,[3,1] Steven E. Churchill,[4,1] Peter Schmid,[5,1] Kristian J. Carlson,[1,6] Paul H. G. M. Dirks,[2,7] Job M. Kibii[1]

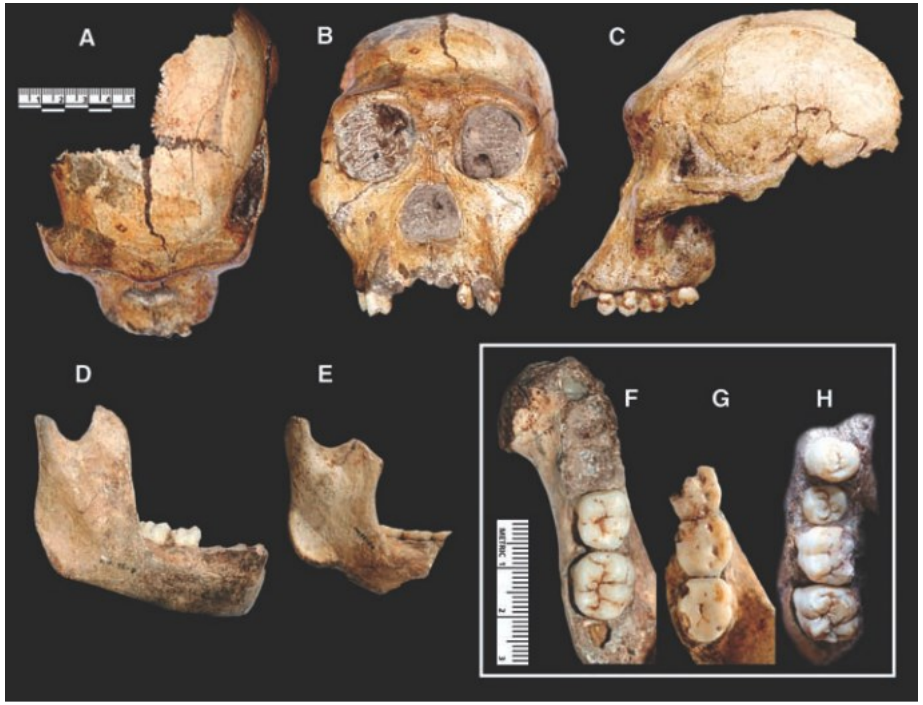
Despite a rich African Plio-Pleistocene hominin fossil record, the ancestry of *Homo* and its relation to earlier australopithecines remain unresolved. Here we report on two partial skeletons with an age of 1.95 to 1.78 million years. The fossils were encased in cave deposits at the Malapa site in South Africa. The skeletons were found close together and are directly associated with craniodental remains. Together they represent a new species of *Australopithecus* that is probably descended from *Australopithecus africanus*. Combined craniodental and postcranial evidence demonstrates that this new species shares more derived features with early *Homo* than any other australopith species and thus might help reveal the ancestor of that genus.

Age: 1,95 e 1,78 Ma

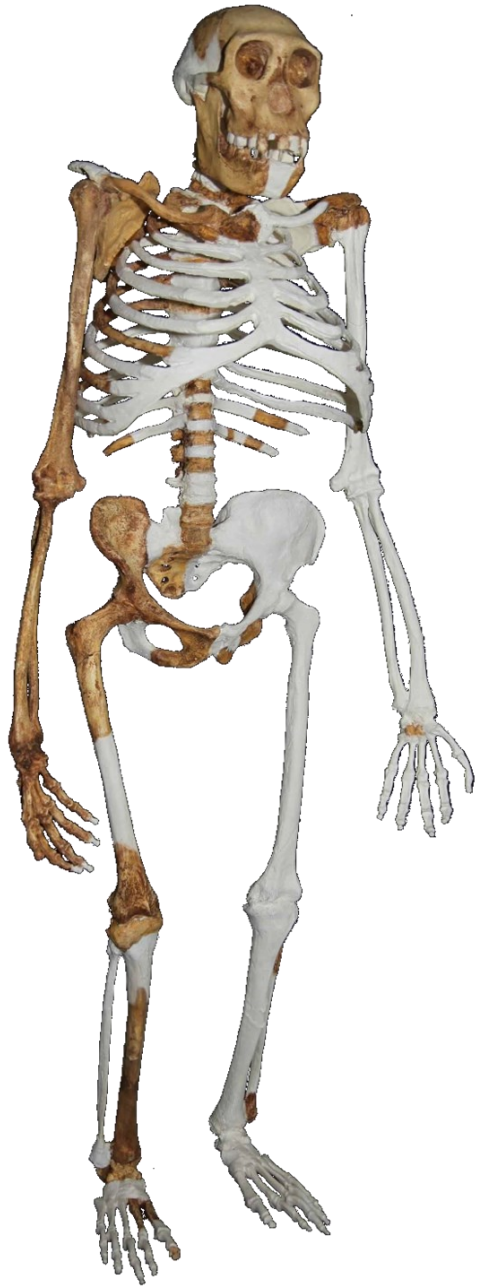
Site: Malapa, Southafrica

Fossils: 2 partial scheletton

Features: share more derivated features with early *Homo* than with Australopiths.



Craniodental elements *of Au. sediba*. UW88-50 (MH1) juvenile cranium in (A) superior, (B) frontal, and (C) left lateral views.
(D) UW88-8 (MH1) juvenile mandible in right lateral view, (E) UW88-54 (MH2) adult mandible in right lateral view, (F) UW88-8 mandible in occlusal view,
(G) UW 88-54 mandible in occlusal view, and
(H) UW 88-50 right maxilla in occlusal view (scale bars are in centimeters).



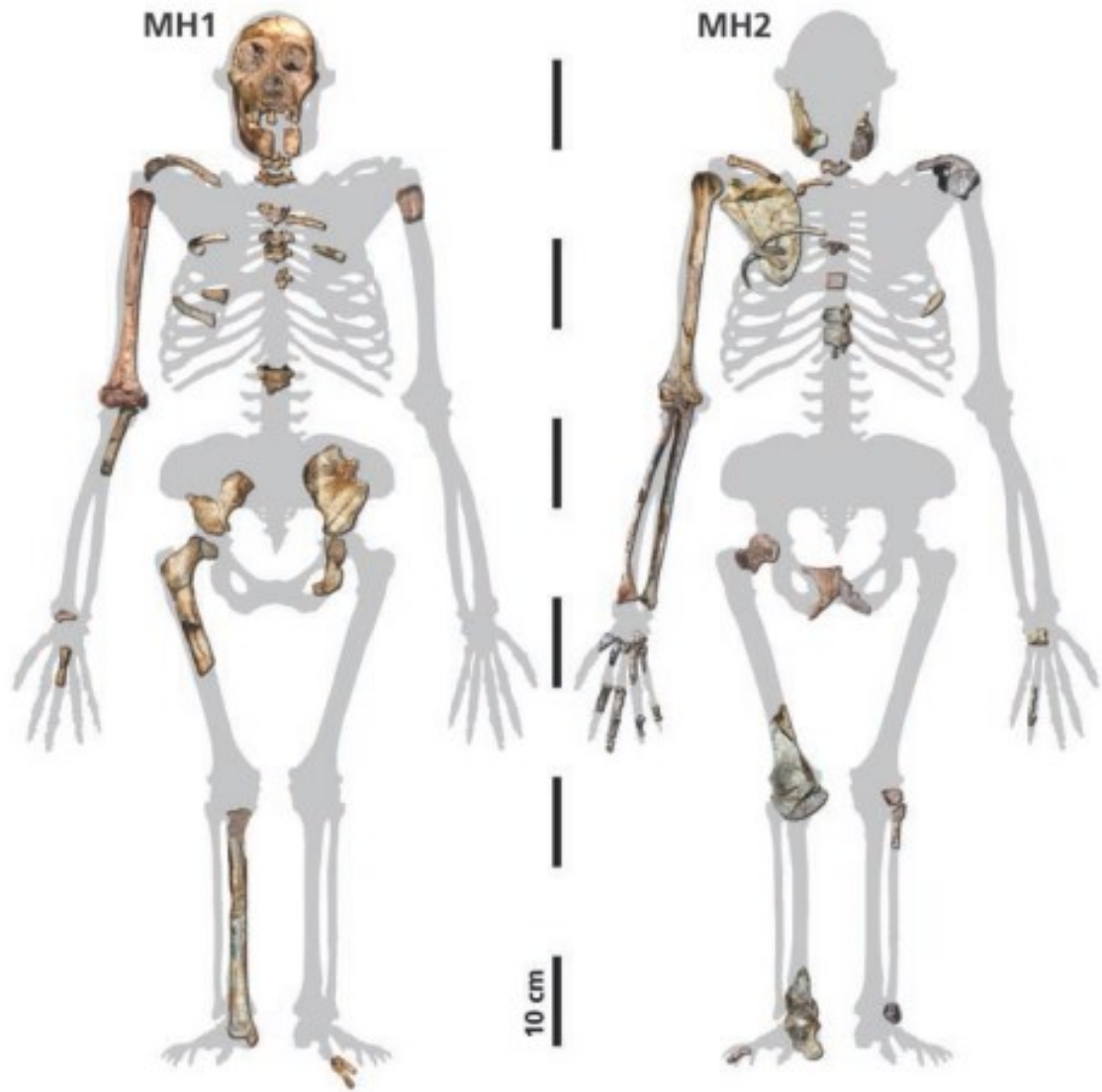


Fig. 2. Associated skeletal elements of MH1 (**left**) and MH2 (**right**), in approximate anatomical position, superimposed over an illustration of an idealized *Au. africanus* skeleton (with some adjustment for differences in body proportions). The proximal right tibia of MH1 has been reconstructed from a natural cast of the proximal metaphysis.

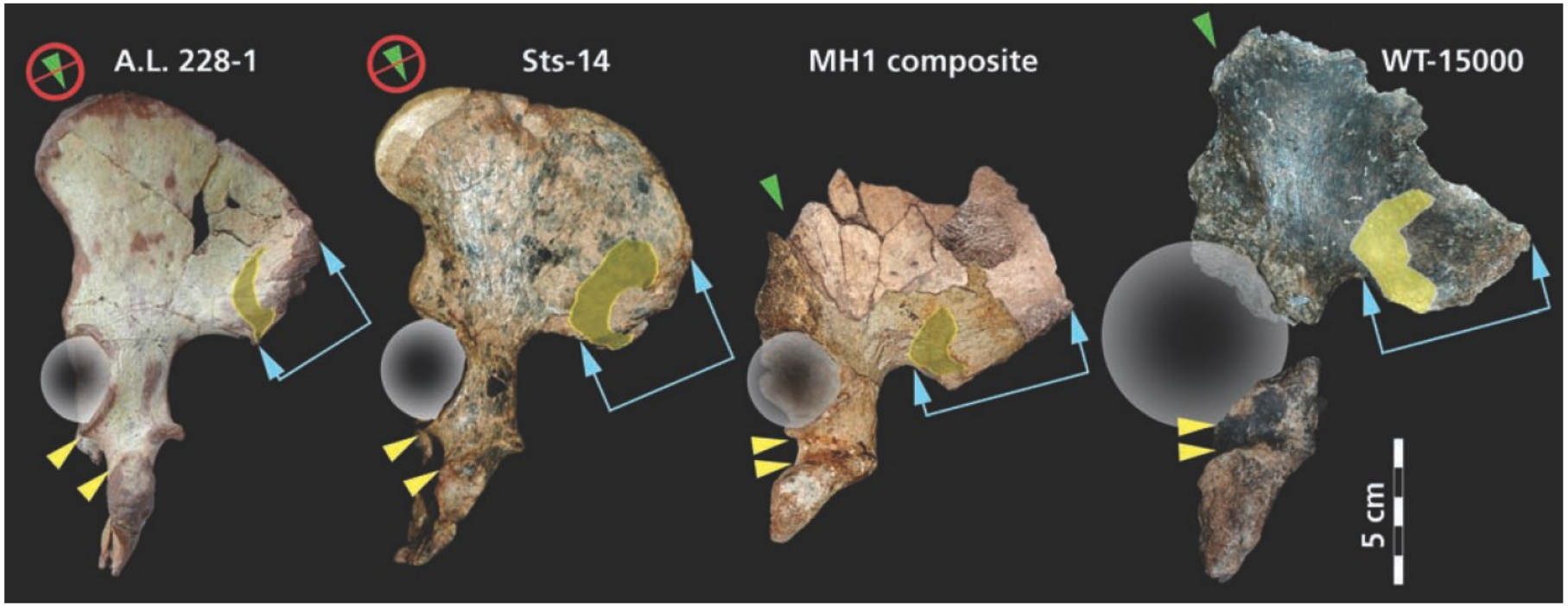


Fig. 4. Representative ossa coxae, in lateral view, from left to right, of *Au. afarensis* (AL 288-1), *Au. africanus* (Sts 14), *Au. sediba* (MH1), and *H. erectus* (KNM-WT 15000). The specimens are oriented so that the iliac blades all lie in the plane of the photograph (which thus leads to differences between specimens in the orientation of the acetabula and ischial tuberosities). MH1 possesses derived, *Homo*-like morphology compared to other australopithecines, including a relative reduction in the weight transfer distance from the sacroiliac (yellow) to hip (circle) joints; expansion of the retroauricular surface of the ilium (blue arrows) (determined by striking a line from the center of the sphere representing the femoral head to the most distant point on the posterior ilium; the superior arrow marks the terminus of this line, and the inferior arrow marks the intersection of this line with the most anterior point on the auricular face); narrowing of the tuberoacetabular sulcus (delimited by yellow arrows); and pronouncement of the acetabulocristal (green arrows) and acetabulosacral buttresses.