

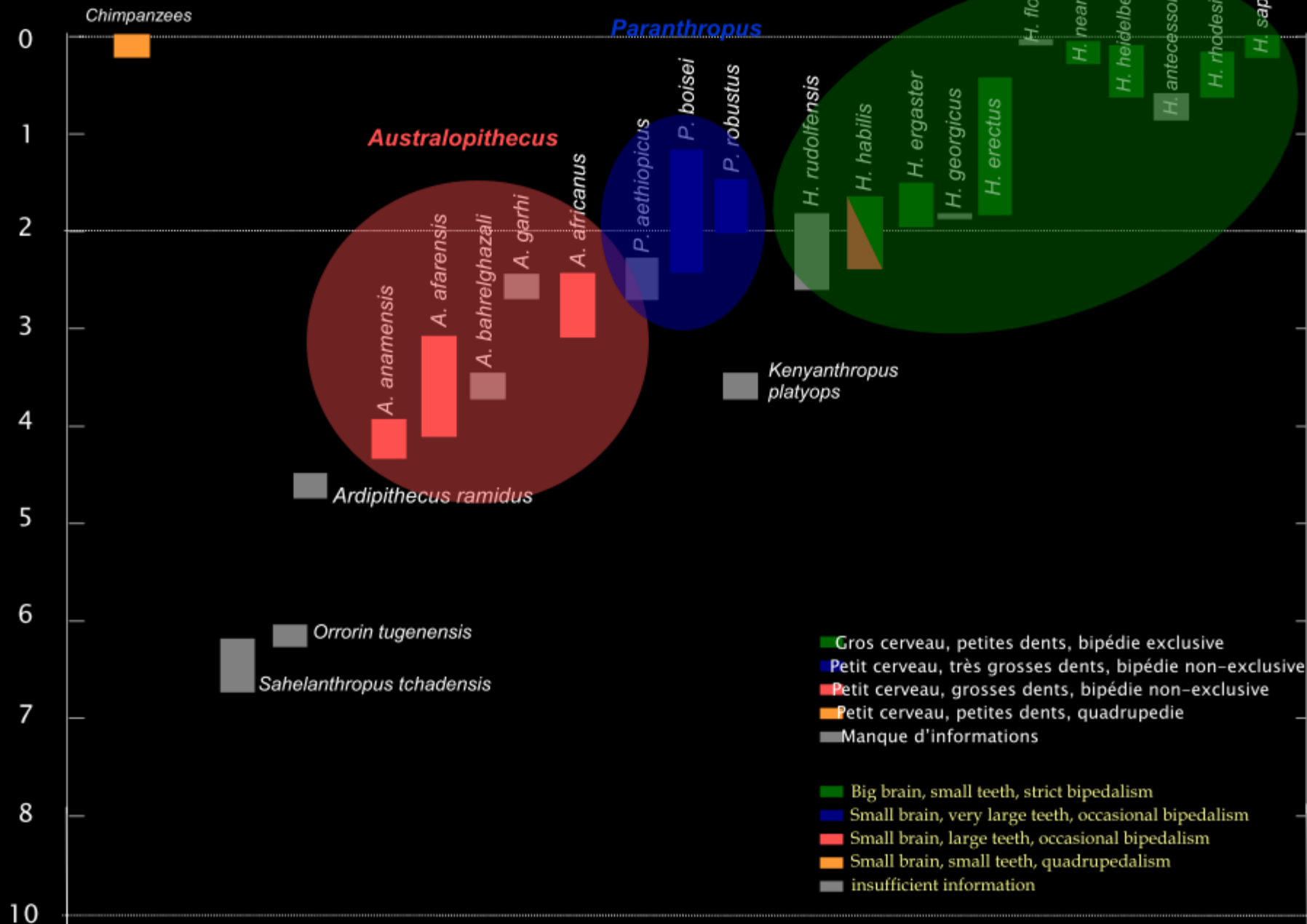


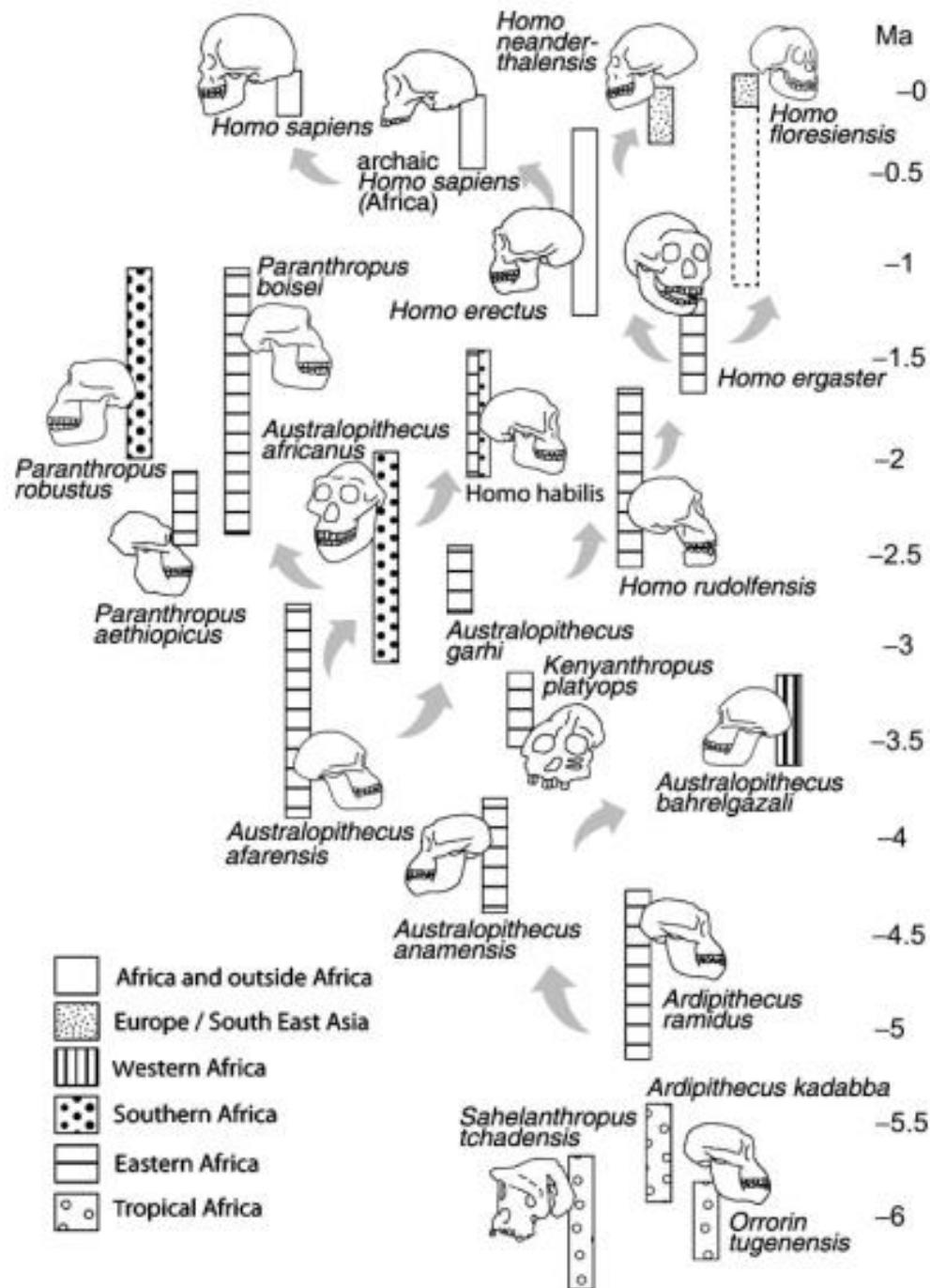
I Primi ominini

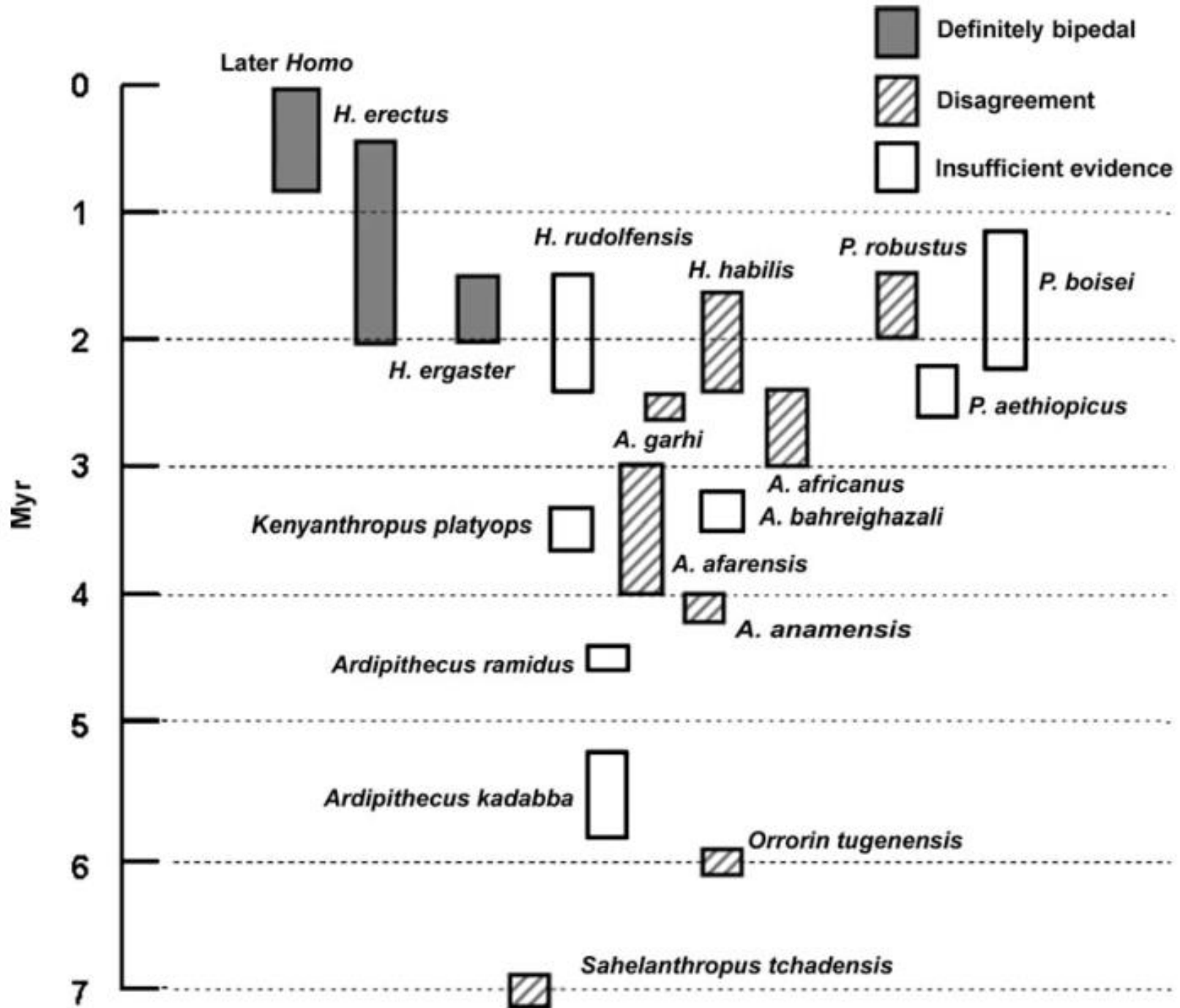
Julie Arnaud

Julie.arnaud@unife.it

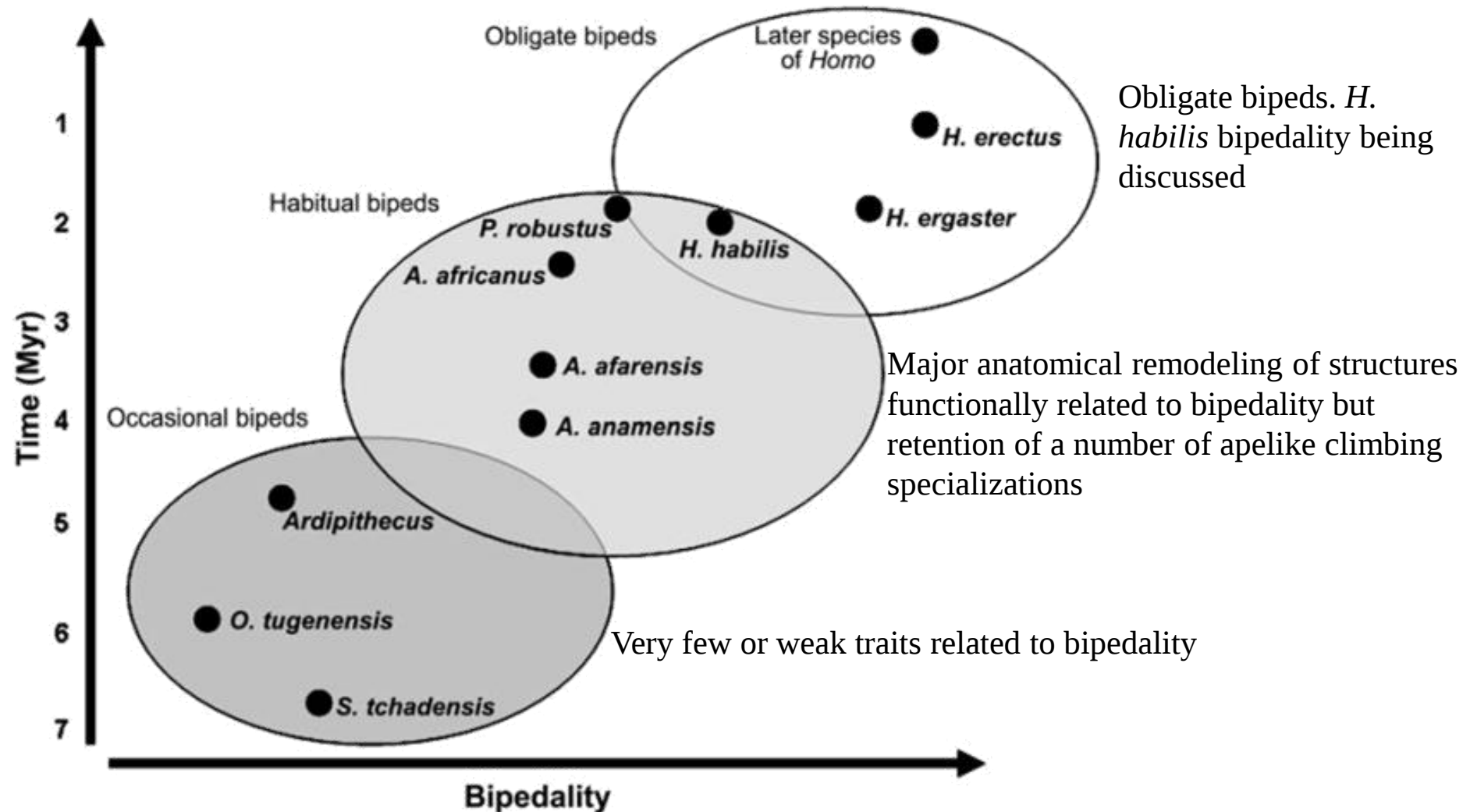
(Ma)

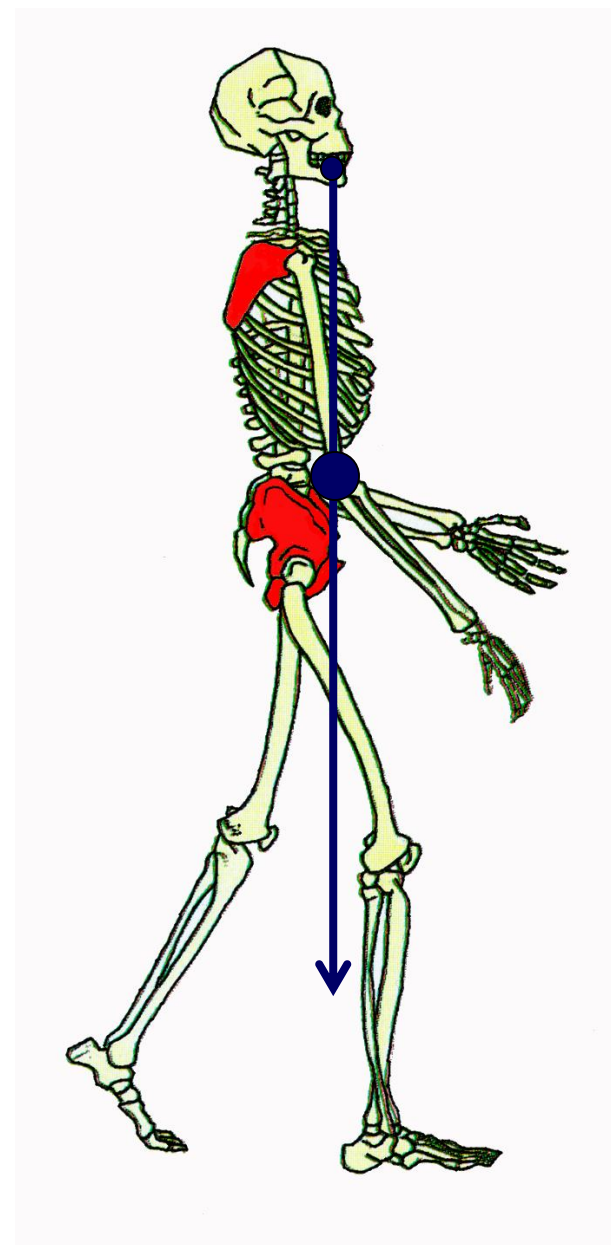
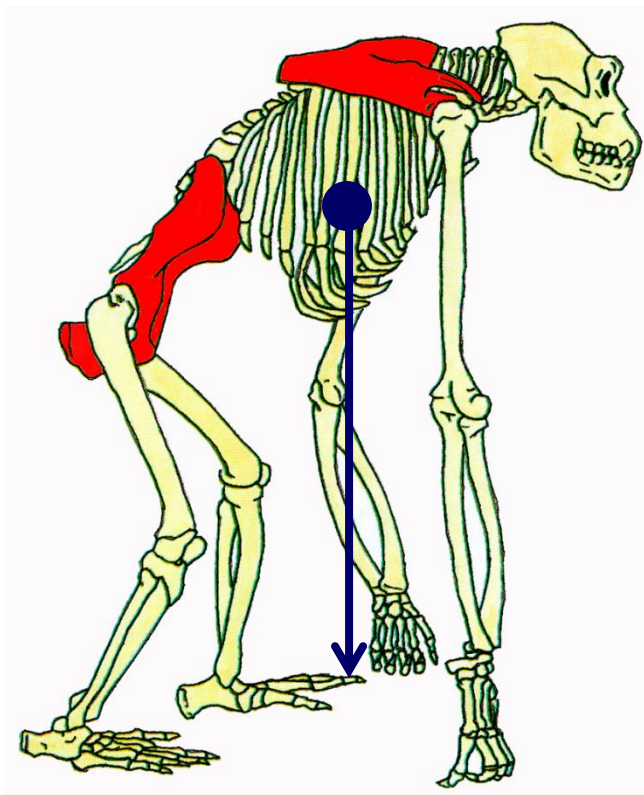






Degree of bipedality in known fossil hominins relative to time. Only taxa with documented traits relating to bipedal locomotion are included.

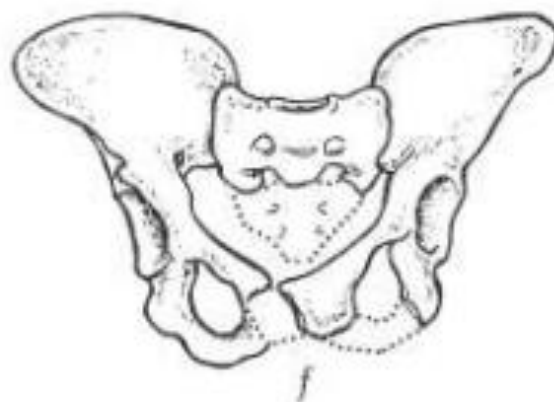
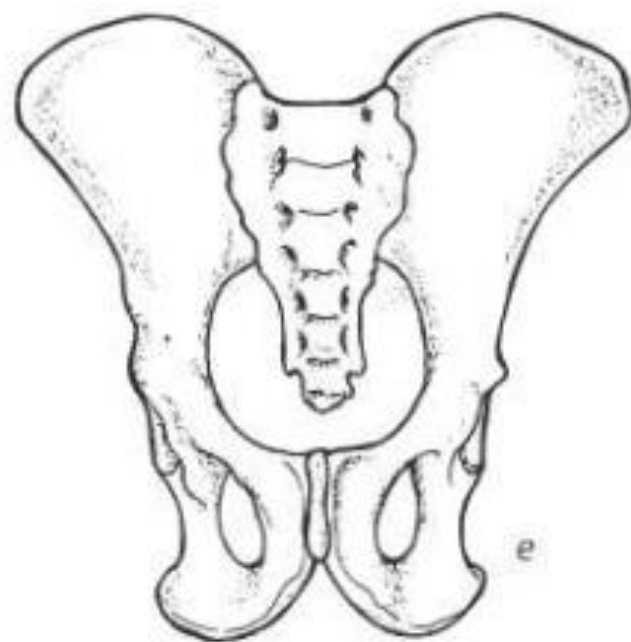
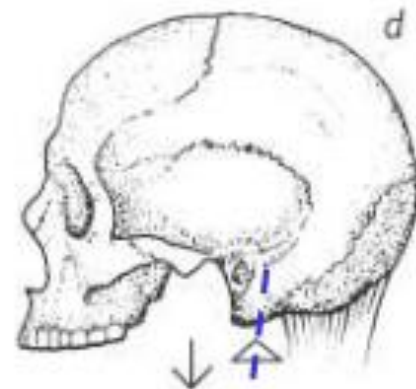
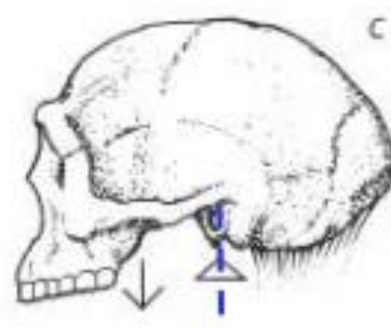
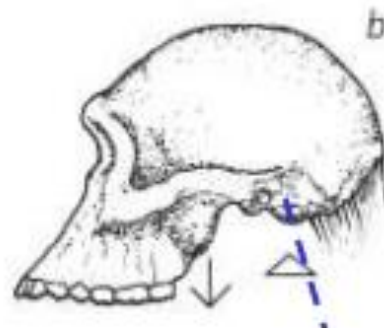
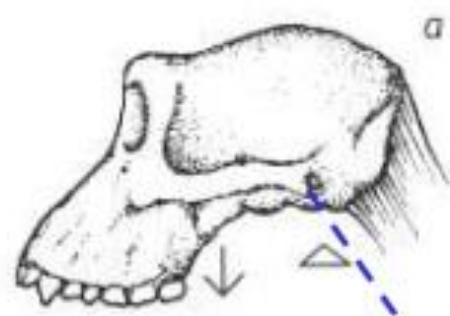




- - - Axe de la colonne vertébrale

△ Point d'appui de la colonne vertébrale

↓ « déséquilibre » face / boîte crânienne



Homme



Les échelles ne sont pas respectées.

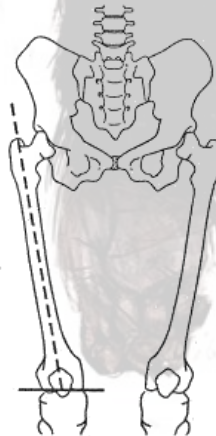
Chimpanzé

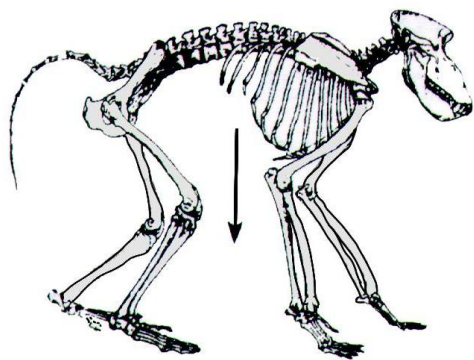


Volume cérébral :
1 300 à 1 500 cm³

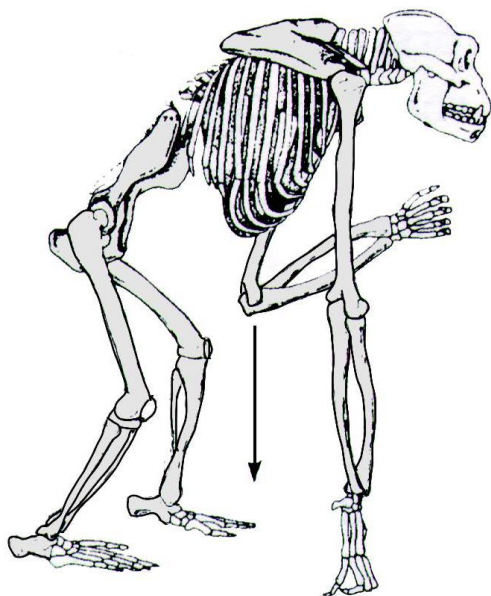


Volume cérébral :
320 à 450 cm³

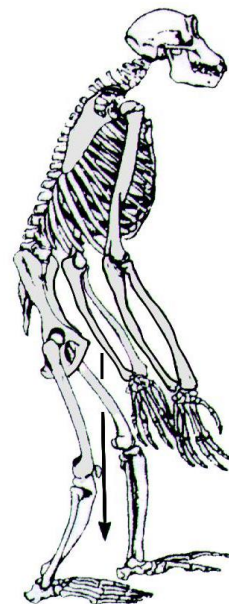




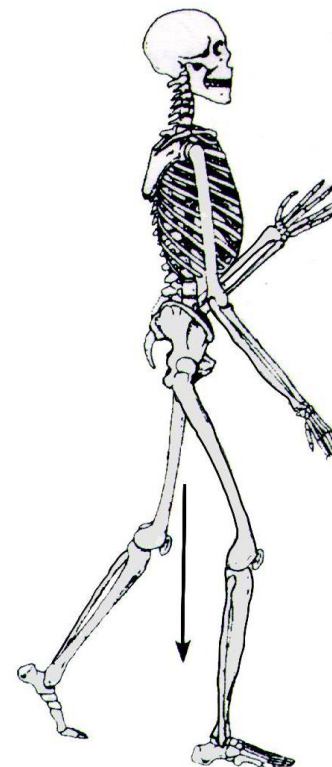
babbuino



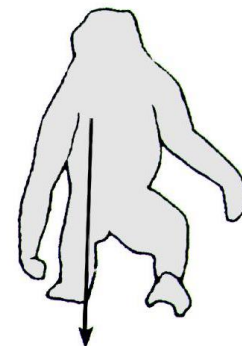
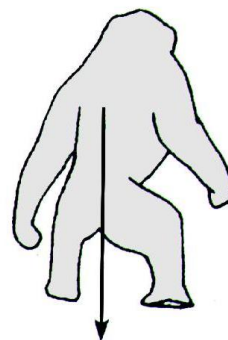
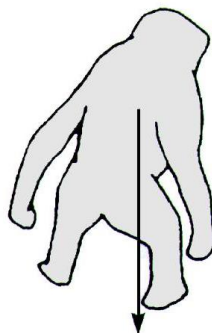
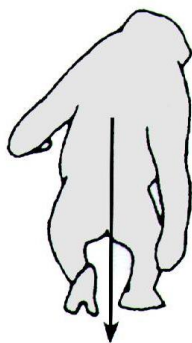
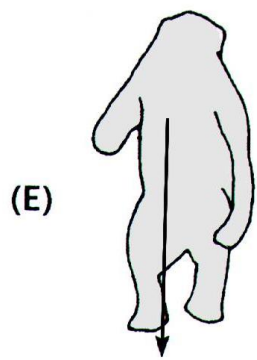
gorilla



scimpanzè



uomo



Bipedismo occasionale



(d)

Chimp



Human



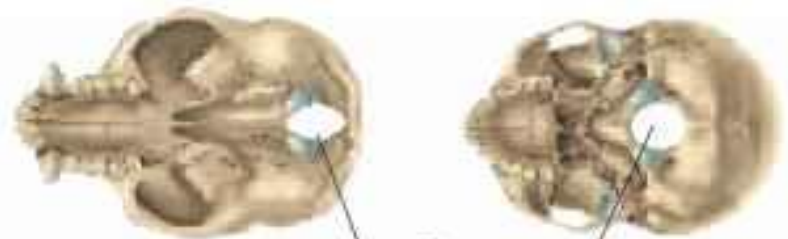
(e)

Chimp

Human



(f)

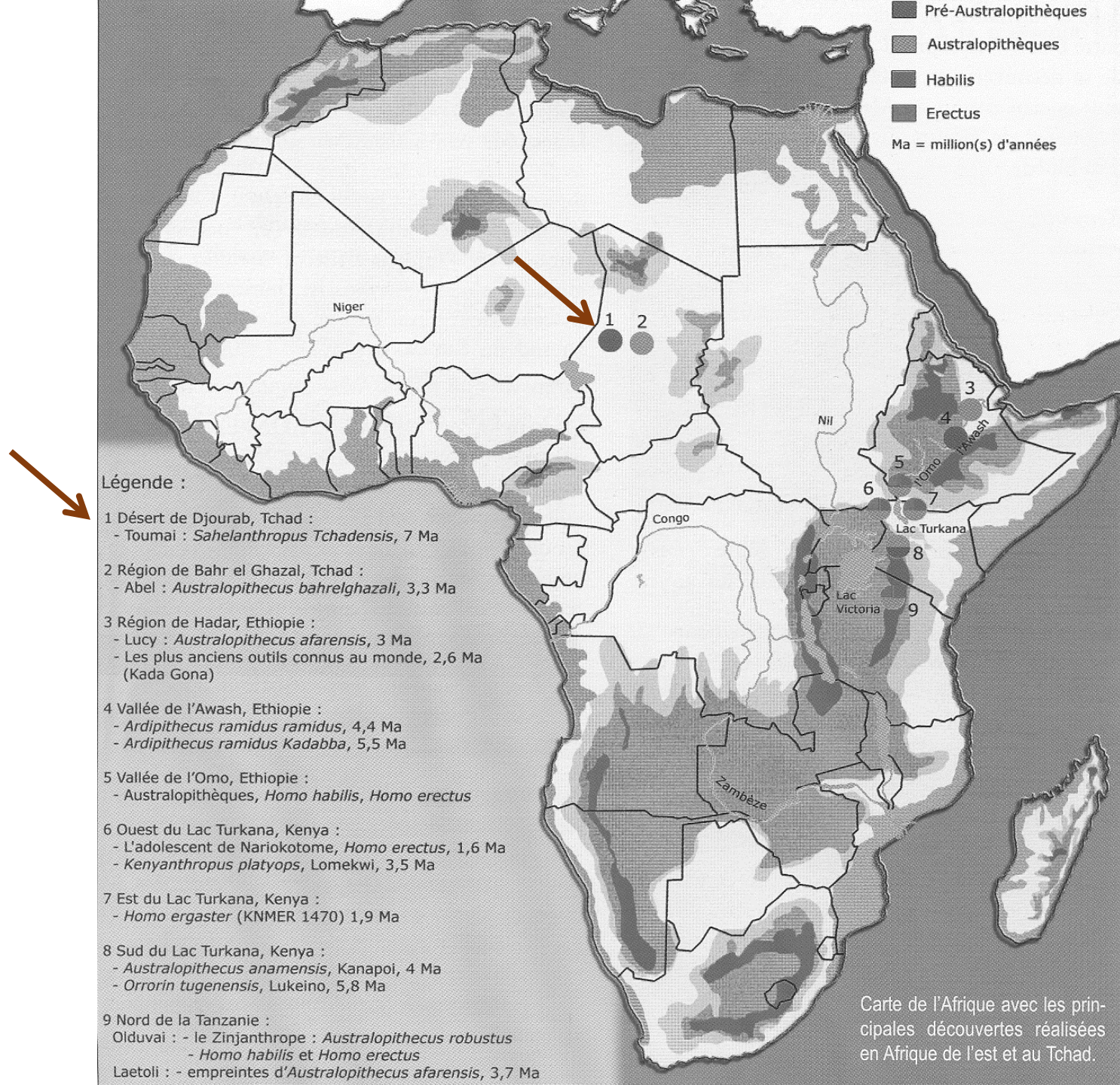


Chimp

Foramen
magnum

Human

Sahelanthropus tchadensis



Sahelanthropus tchadensis (Toumai)

Scoperta: Deserto del Djurab (Ciad)

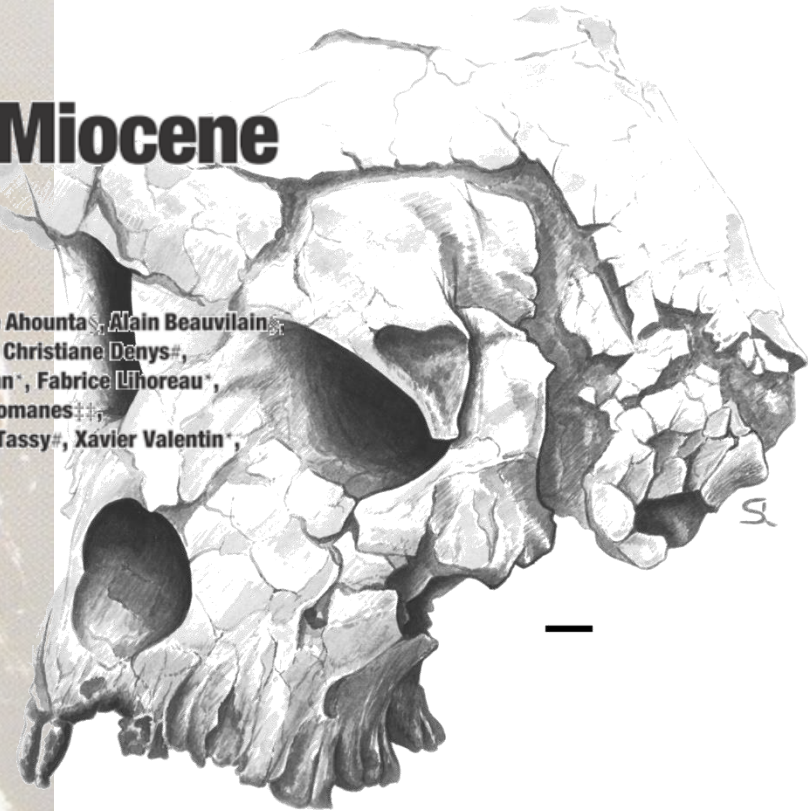
Reperti:

- Cranio TM266-01-060-1
- Frammento di mandibola destra

Età: 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 Dourigner☆, 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\$\$

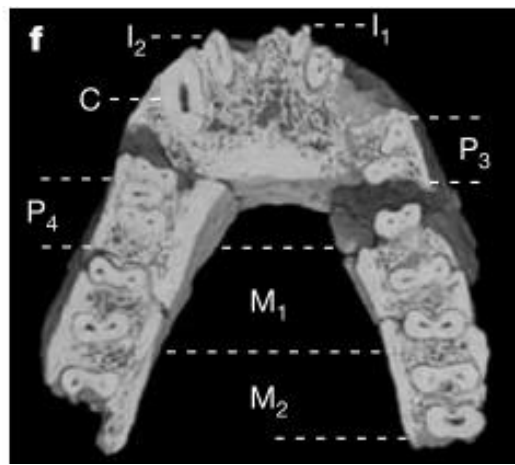




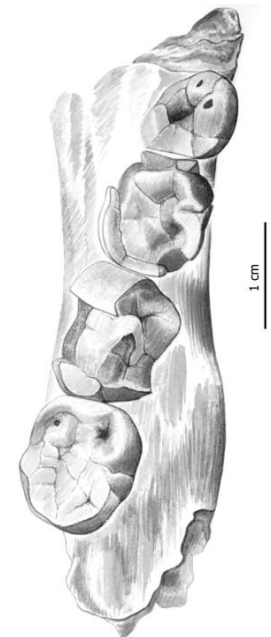
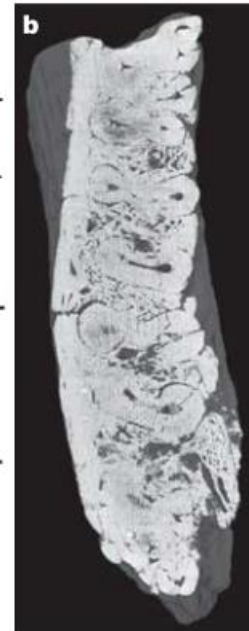
Morfologia sovra-orbitaria
Robusta (Maschio?)
*Robust supra-orbital morphology
(Male?)*

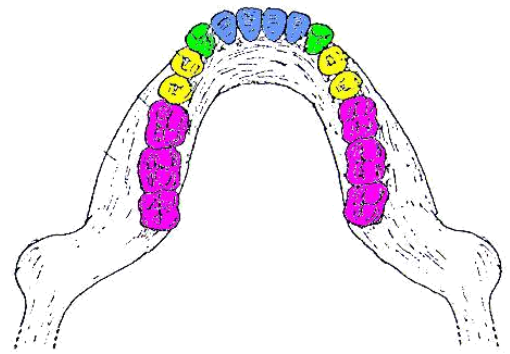
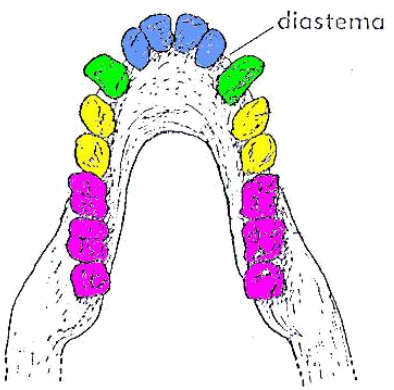
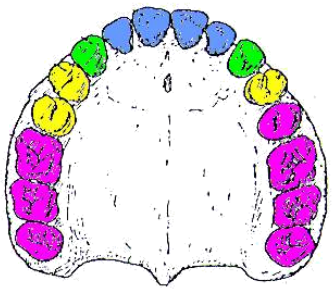
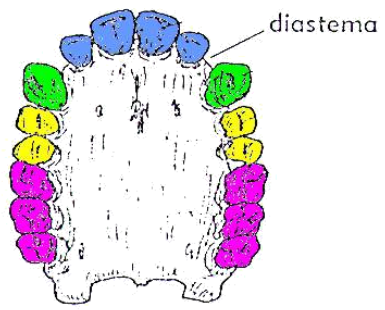
Corona dei molari e dei premolari bassa
Spessore dello smalto tra scimpanzé e
Ardipithecus
Low molar and premolar crown
*Enamel thickness between chimp and
Ardipithecus*

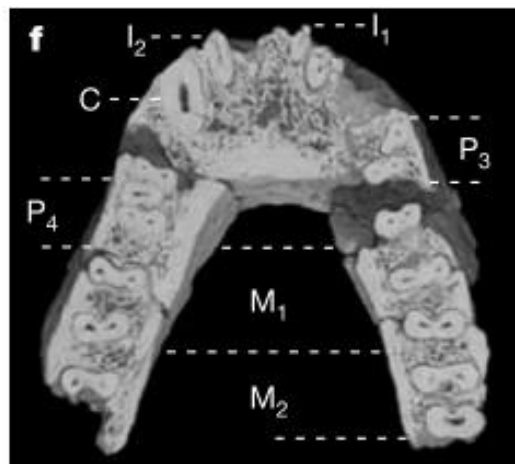




- C/P3 non affilati / *not sharp*
- Assenza di diastema tra C/P3
No diastema between C/P3

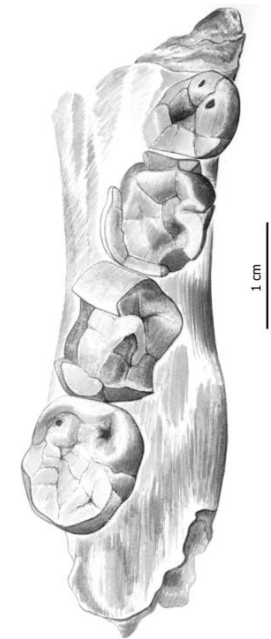
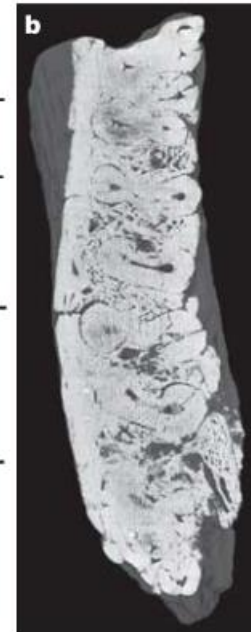


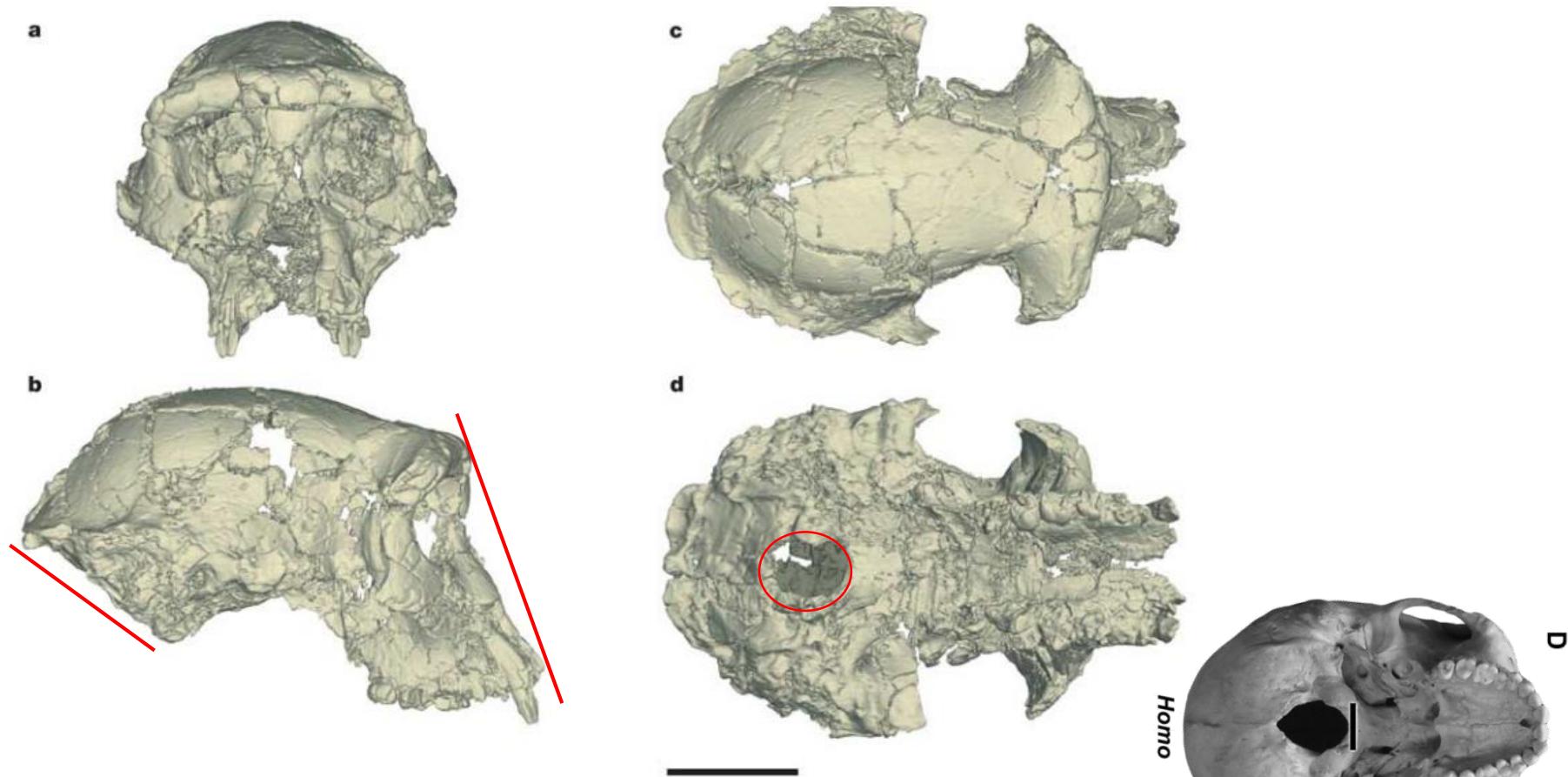




- C/P3 non affilati
- Assenza di diastema tra C/P3
- Sinfisi piuttosto verticale
- i denti post-C presentano un spessore dello smalto tra i scimpanzé e i australopitecine

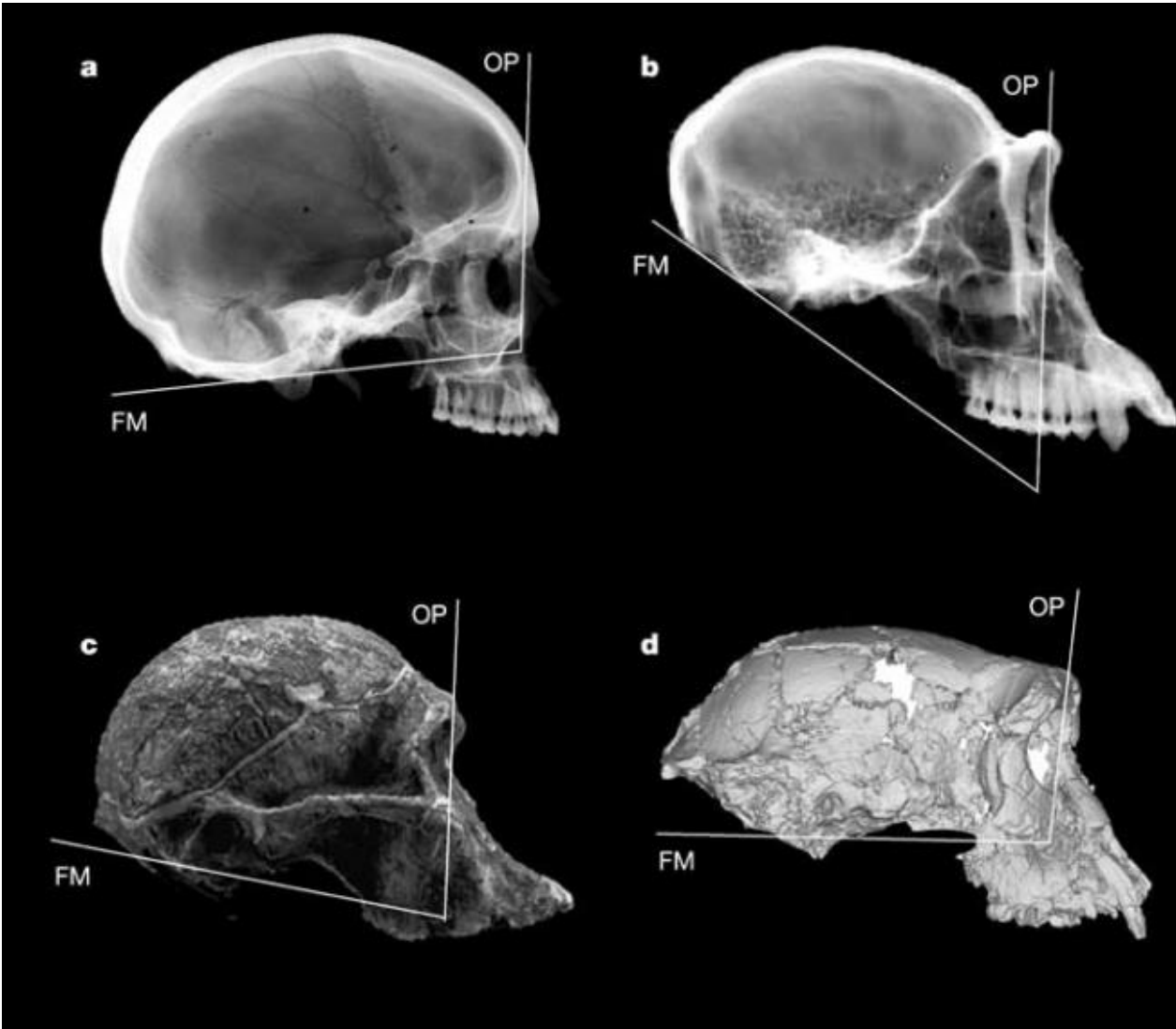
Post-C teeth present an enamel thickness between chimp and Australo





- 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?



- Angolo tra il piano orbitale (OP) e il piano del foramen magnum (FM)

Angle between the orbital plan and the foramen magnum

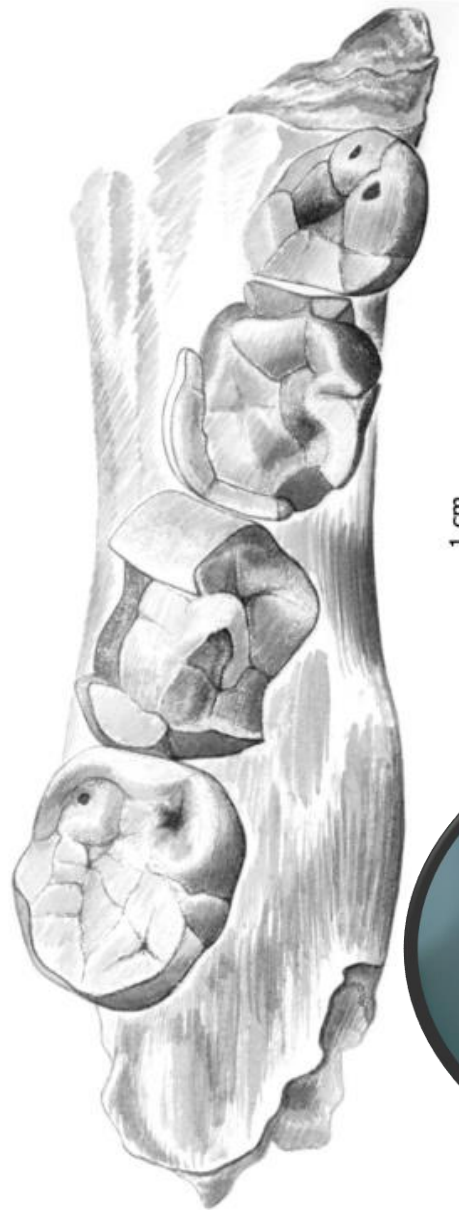
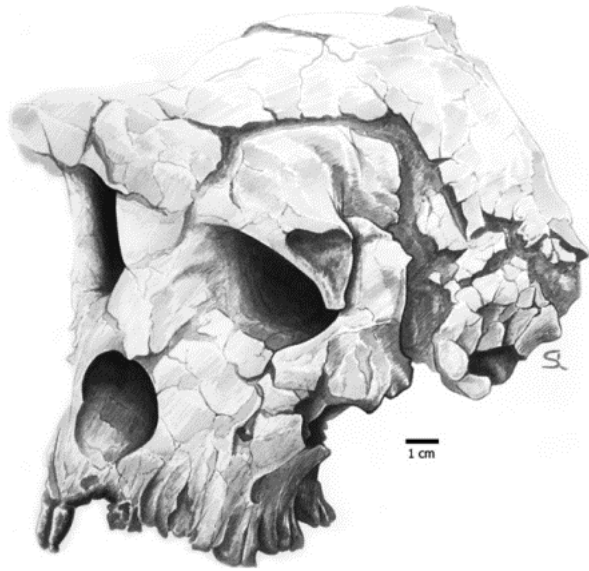
- Orientazione del piano nucale relativamente al piano di Francoforte nella variabilità dei

Australopitecine e *Homo*
Orientation of the nuchal plane relative to the Frankfurt plan inside Australopitecine and Homo variability

(Zollikofer, 2005)

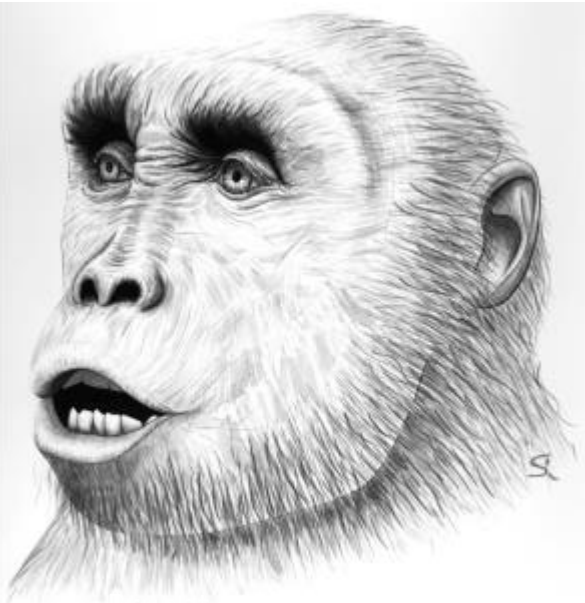
FM: Foramen magnum

OP: orbital planes

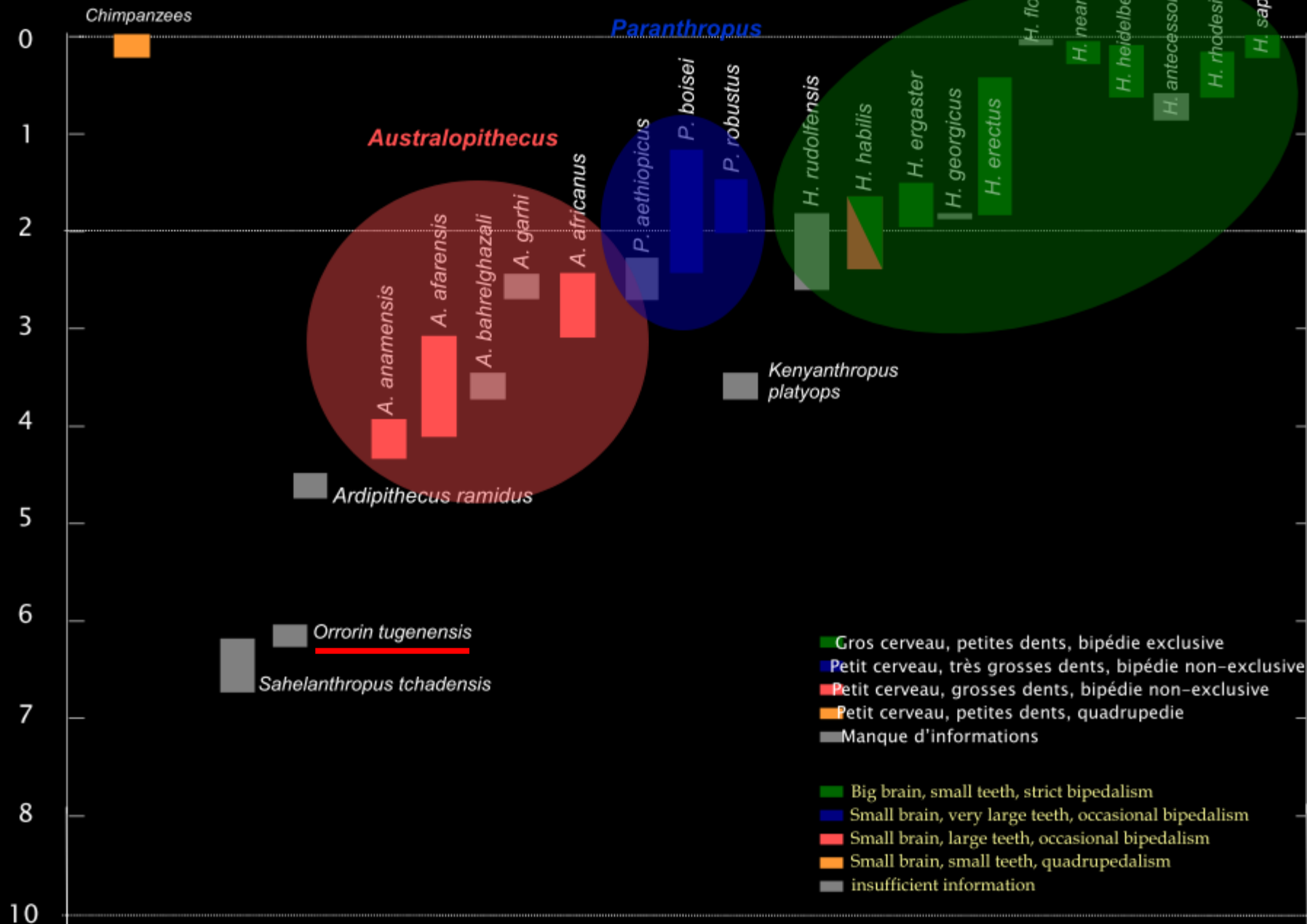


Probabilmente bipede
Probably bipedal

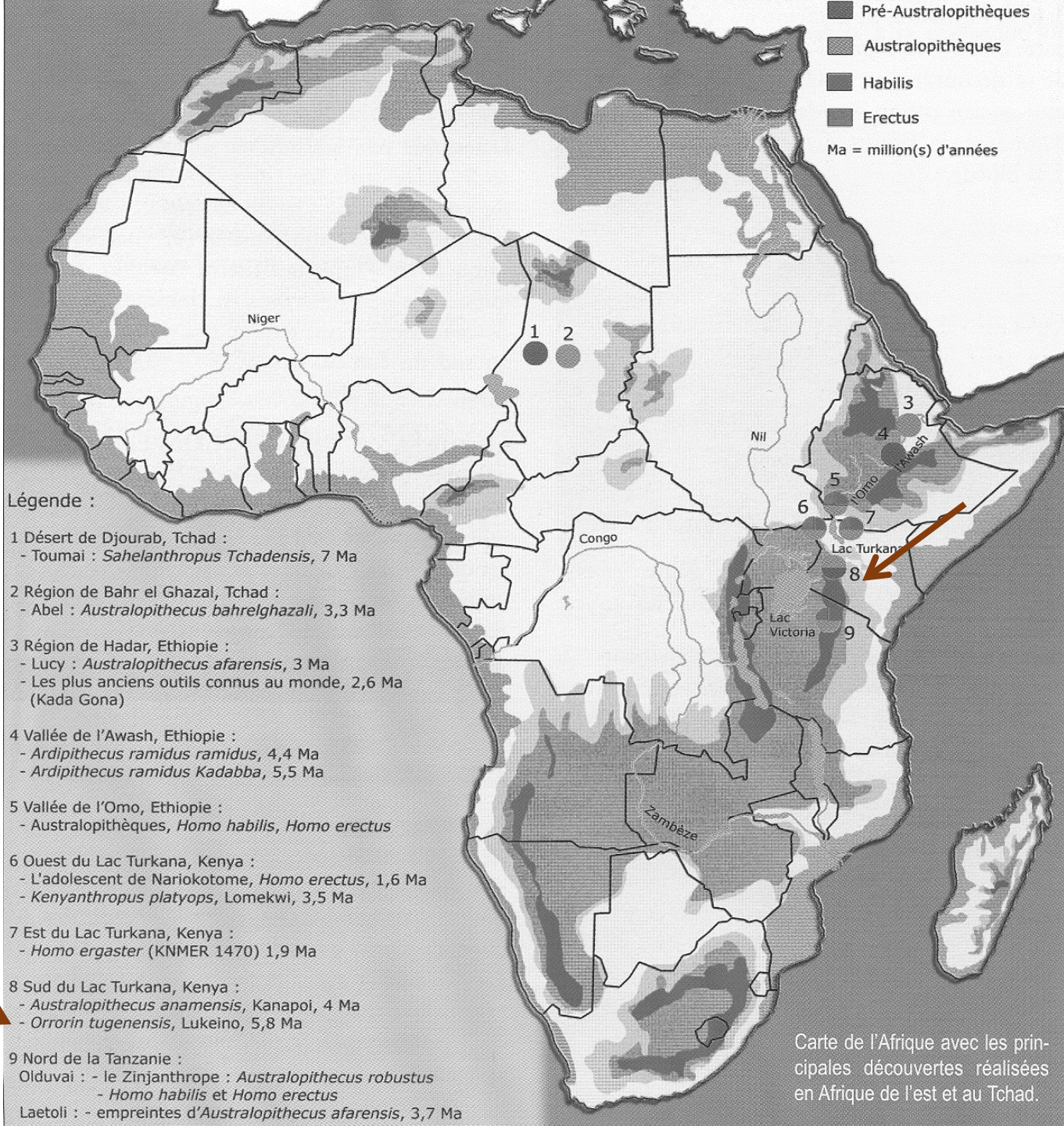
Frequentava spazi
forestali
Associated with forest

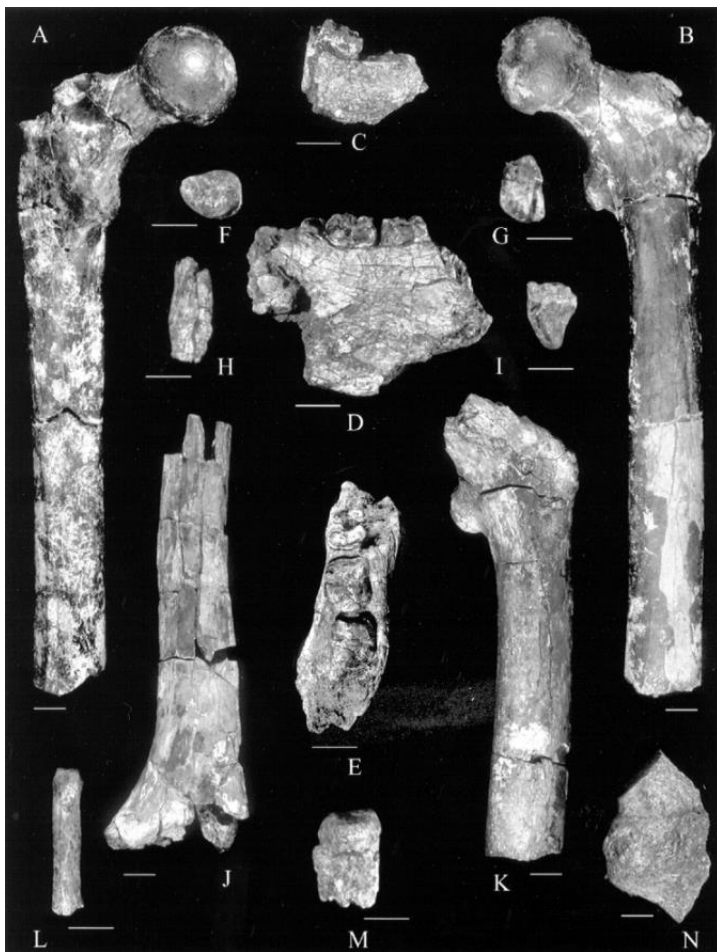


(Ma)



Orrorin tugenensis





Scoperta: Colline di Tugen, Lago Baringo, Kenia

Reperti:

- Femore sinistro (A, B)
- Frammento destro di mandibola con M_3 (C)
- Frammento sinistro di mandibola con M_{2-3} (D, E)
- M^3 destro (F)
- P_4 destro (G)
- I^1 (H)
- C destro (I)
- Omero destro (J)
- Femore sinistro parte prossimale (K)
- Falange prossimale della mano (L)
- M^3 sinistro (M)
- Frammento prossimale di femore destro (N)

Età: 6 Ma

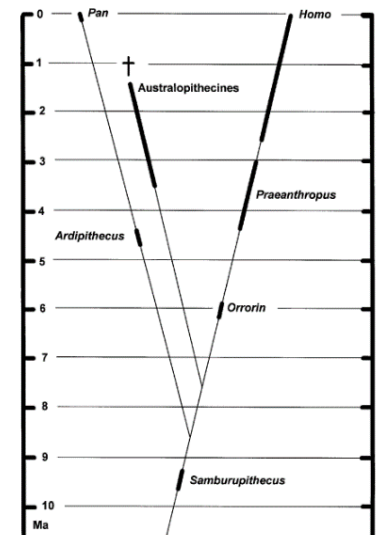
(Senut *et al.*, 2001)

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





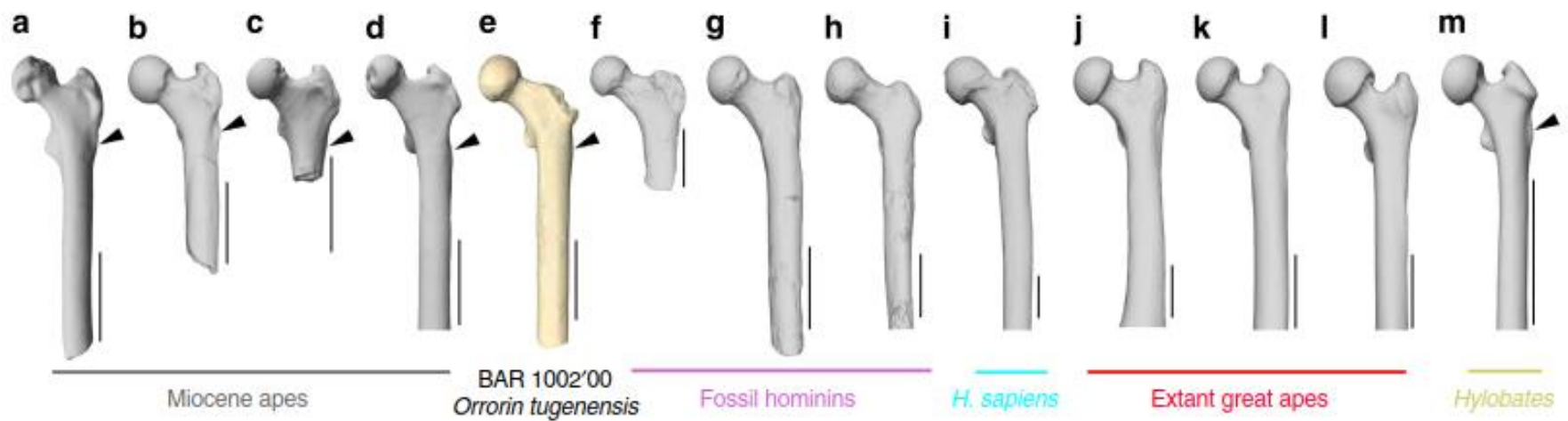
(A) *P. troglodytes*, (B) *O. tugenensis* (BAR 1002'00), (C and D) *Paranthropus robustus* (SK 97 and SK 82, reversed), (E) *A. afarensis* (A.L. 288-1ap), (F) *Paranthropus boisei* (KNM-ER 1503, reversed), (G) early *Homo* (KNM-ER 1481), and (H) modern *H. sapiens*. Scale bar, 2 cm.

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

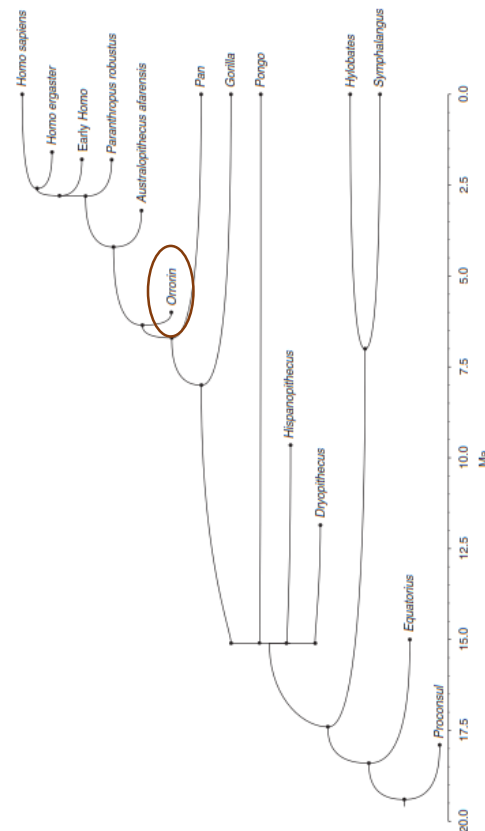
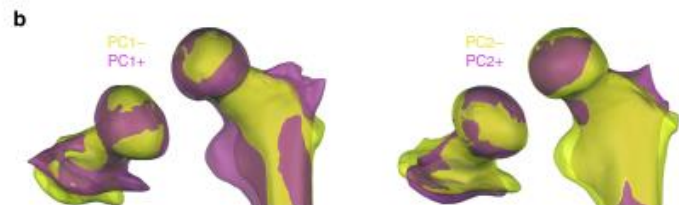
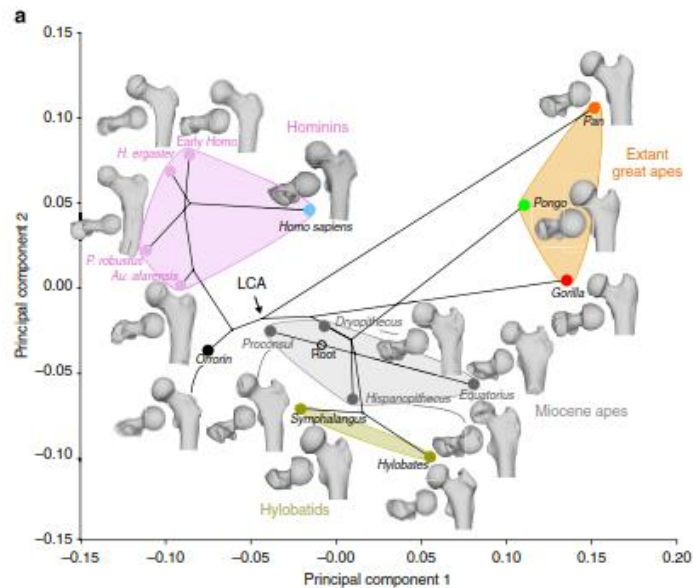


(A) *P. troglodytes*, (B) *O. tugenensis* (BAR 1002'00), (C and D) *Paranthropus robustus* (SK 97 and SK 82, reversed), (E) *A. afarensis* (A.L. 288-1ap), (F) *Paranthropus boisei* (KNM-ER 1503, reversed), (G) early *Homo* (KNM-ER 1481), and (H) modern *H. sapiens*. Scale bar, 2 cm.

Like other early hominin femora (C to F), BAR 1002'00 (B) is distinct from those of modern humans (H) and great apes (A) in having a long, anteroposteriorly narrow neck and wide proximal shaft.

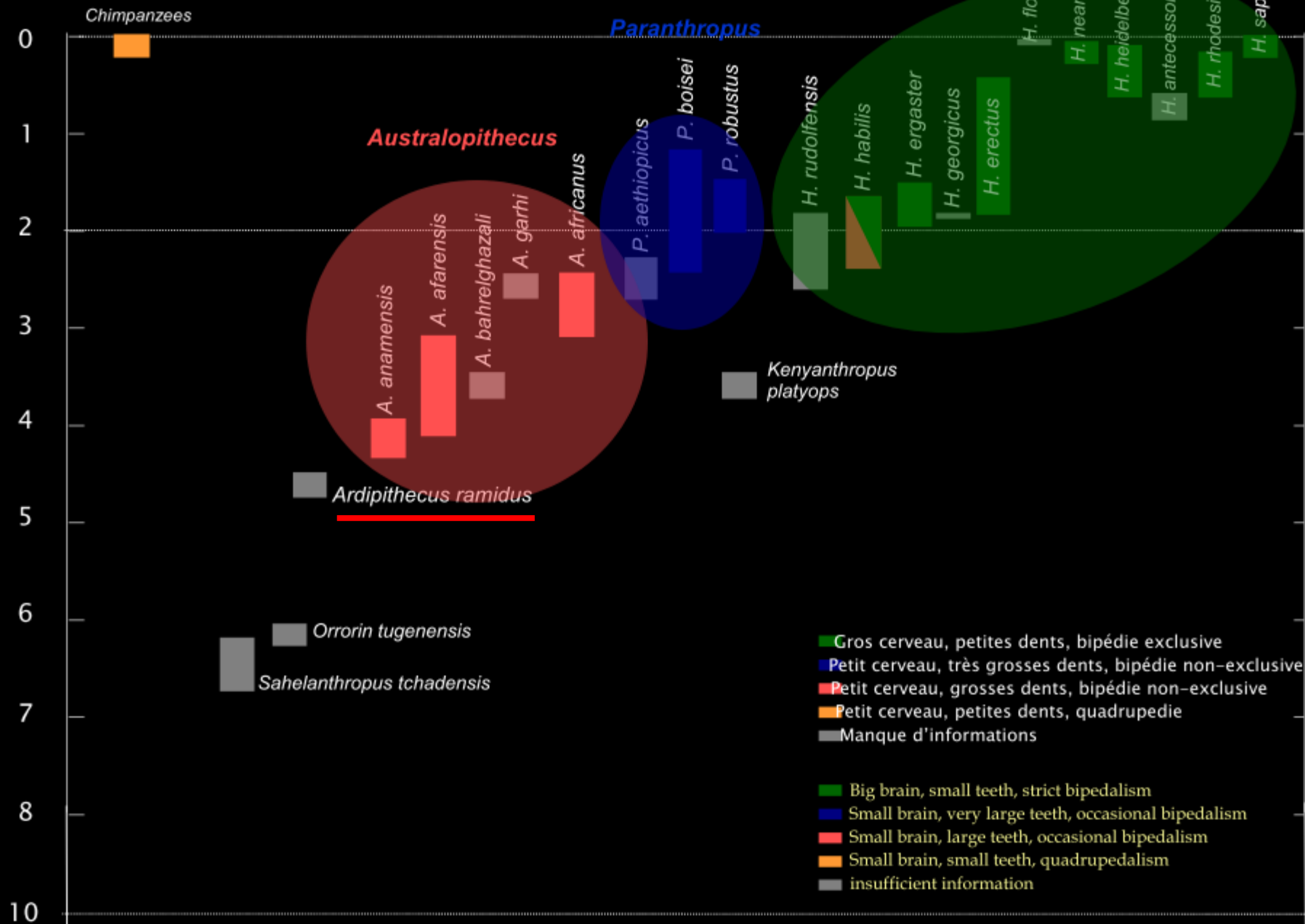


The arrows indicate a laterally protruding gluteal tuberosity, observed in *Hylobates*, Miocene hominoids, as well as in *Orrorin* and *Ardipithecus ramidus*

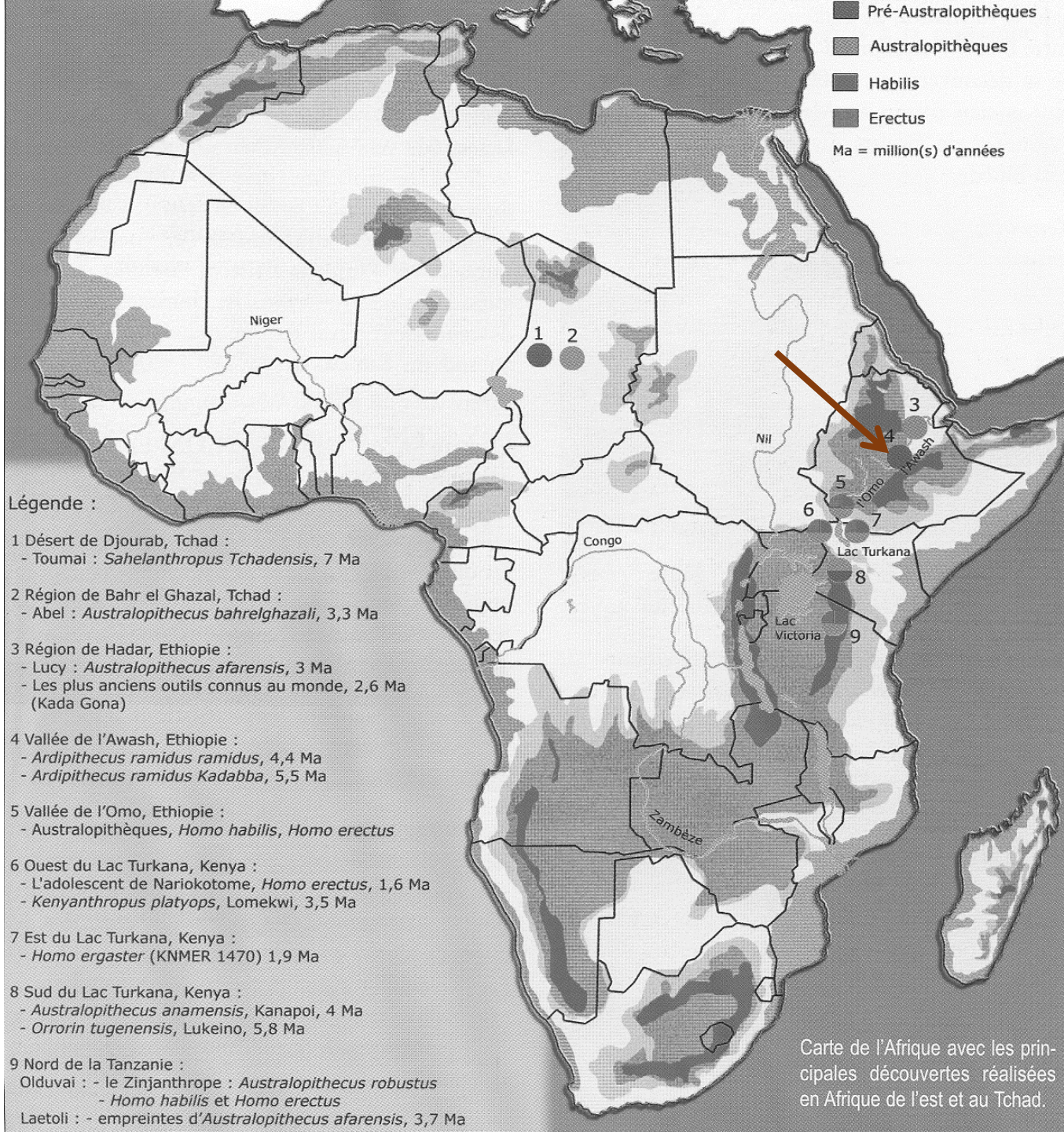


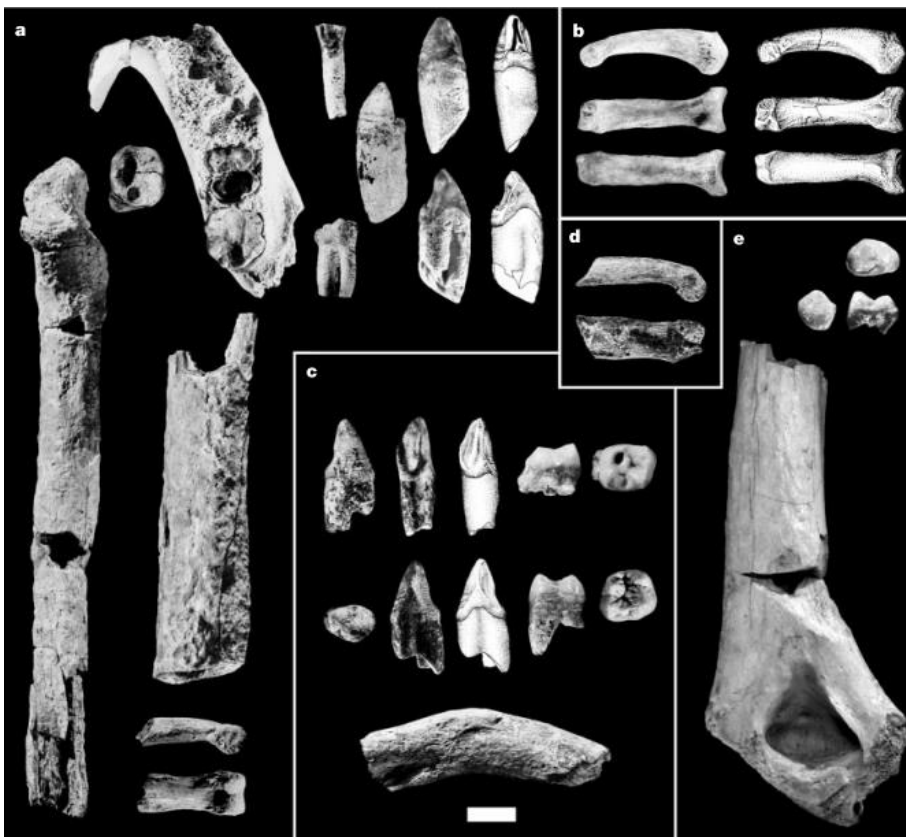
ARTICLE
Received 7 Oct 2013 | Accepted 7 Nov 2013 | Published 3 Dec 2013
DOI: 10.1038/ncomms3888
The femur of *Orrorin tugenensis* exhibits morphometric affinities with both Miocene apes and later hominins
Sergio Almécija^{1,2,3}, Melissa Tallman⁴, David M. Alba^{3,5}, Marta Pina³, Salvador Moyà-Solà⁶ & William L. Jungers¹

(Ma)



Ardipithecus kadabba





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 palaeoenvironment⁷. 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 Myr⁹.

(Nature 412, 2001)

Scoperta: Zona Aramis, Valle dell'Awash, Etiopia

Reperti:

- Frammento di mandibola (a)
- Frammenti di ulna e omero (a)
- Frammento di clavicola (c)
- Falange di piedi e mani (b,d)
- 11 denti isolati (a,c,e)
- 4 frammenti postcraniali

Età: 5,8 – 5,2 Ma

Ardipithecus ramidus kadabba



Ardipithecus kadabba

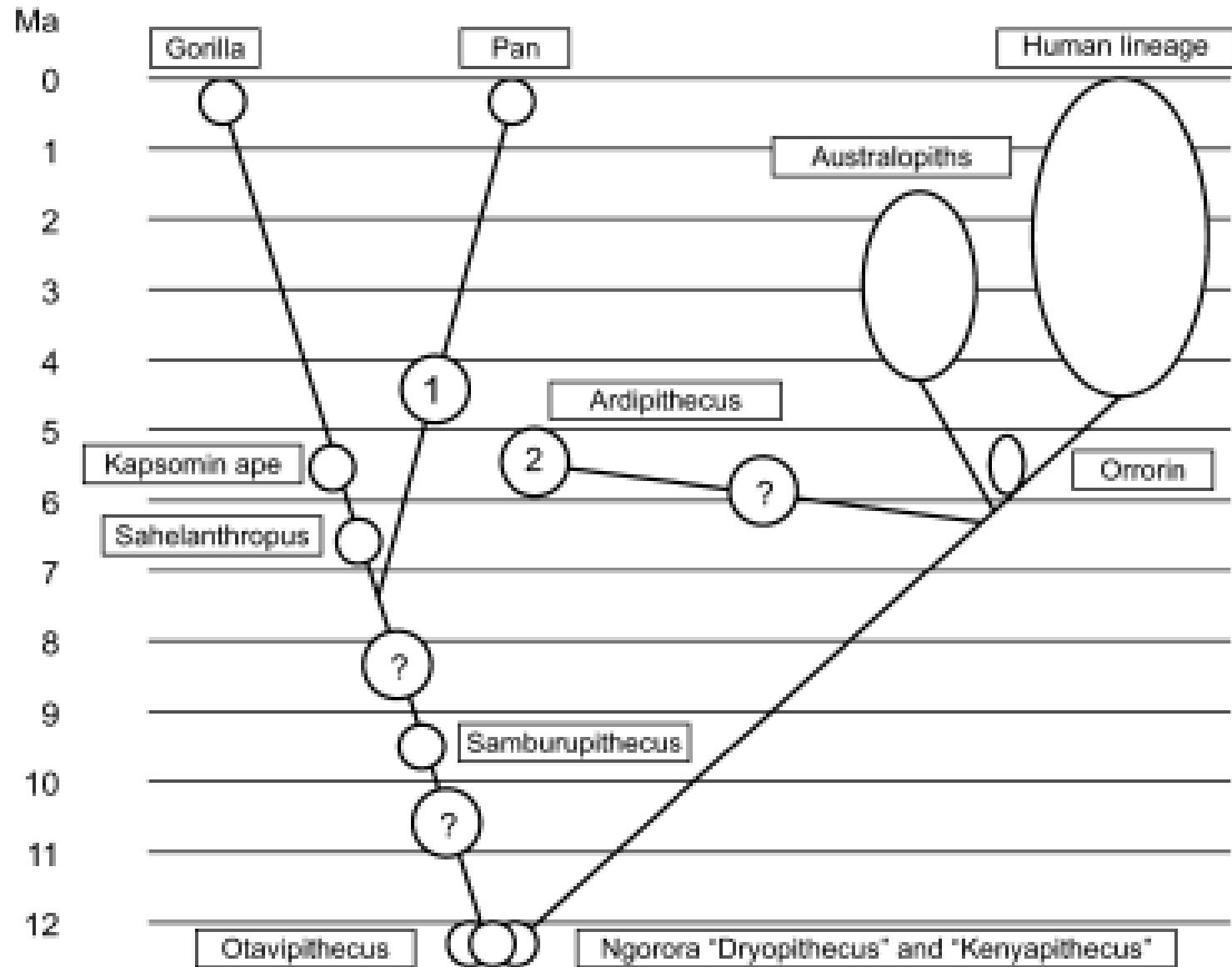
Tendenza dei canini ad essere incisiformi

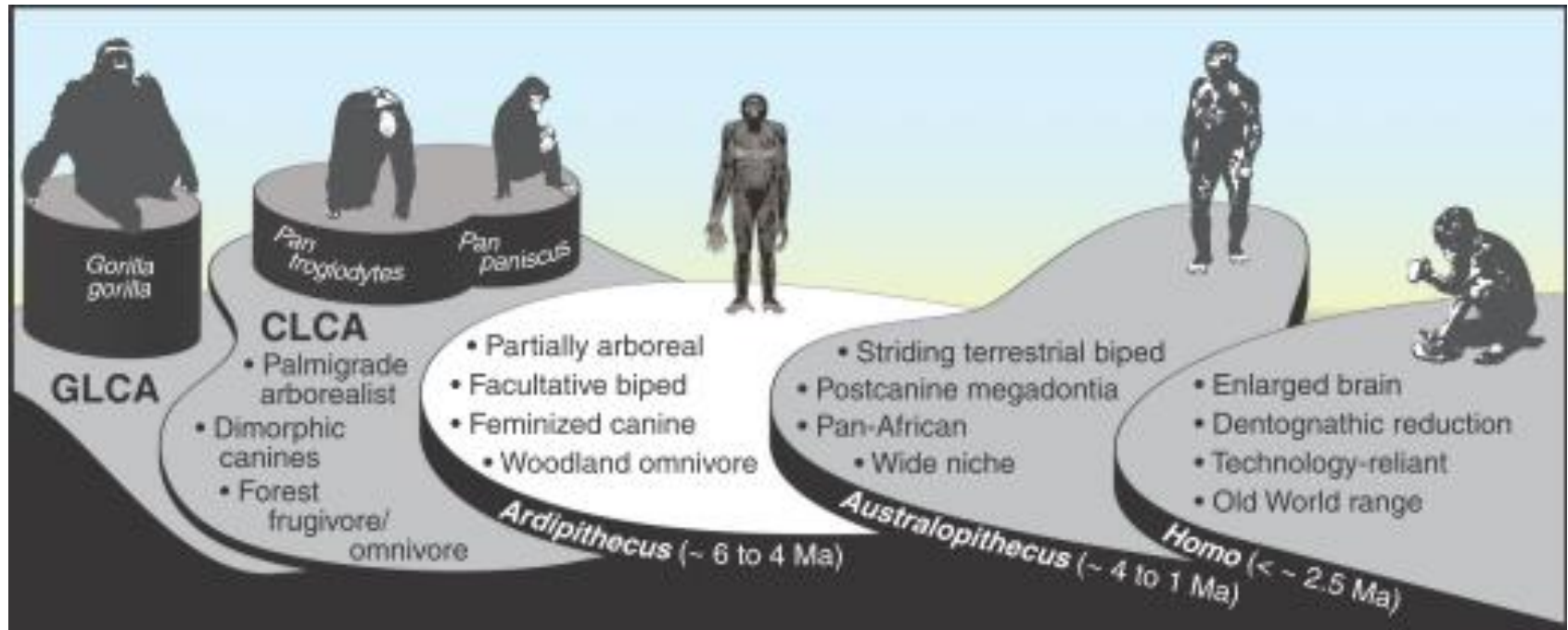
Elementi post-craniali simili a quelli delle grandi scimmie : adattamento alla vita arboricola

Differenza tra *Ar. kadabba* e *Ar. ramidus* nelle radici dei denti



Proposed relationships between early hominids and late apes



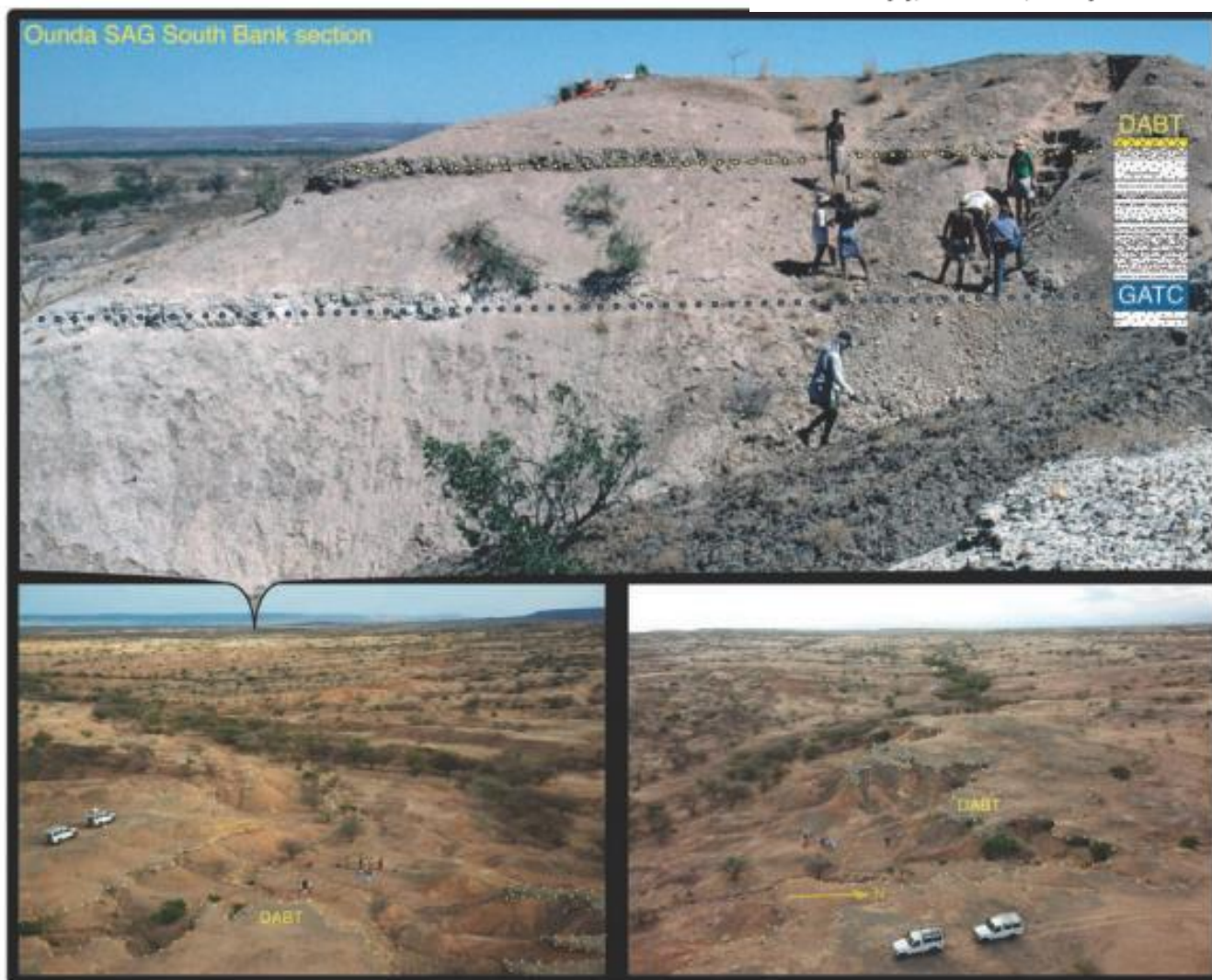


Evolution of hominids and African apes since the gorilla/chimp+human (GLCA) and chimp/human (CLCA) last common ancestors. Pedestals on the left show separate lineages leading to the extant apes (gorilla, and chimp and bonobo); text indicates key differences among adaptive plateaus occupied by the three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

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 WoldeGabriel⁷

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).



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 WoldeGabriel⁷

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 della competizione sociali)

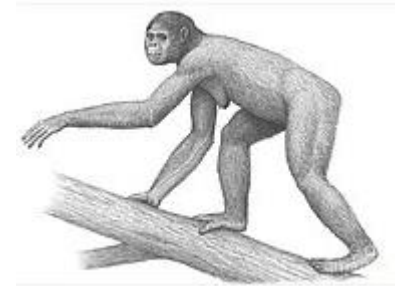
Small face and reduced canine/premolar complex (minimal social aggression)

- Nessuna sospensione, o knuckle-walking ma una bipedia più primitiva che i Australopithecini

No suspension, vertical climbing of knuckle-walking but more primitive bipedy than Australopithecus

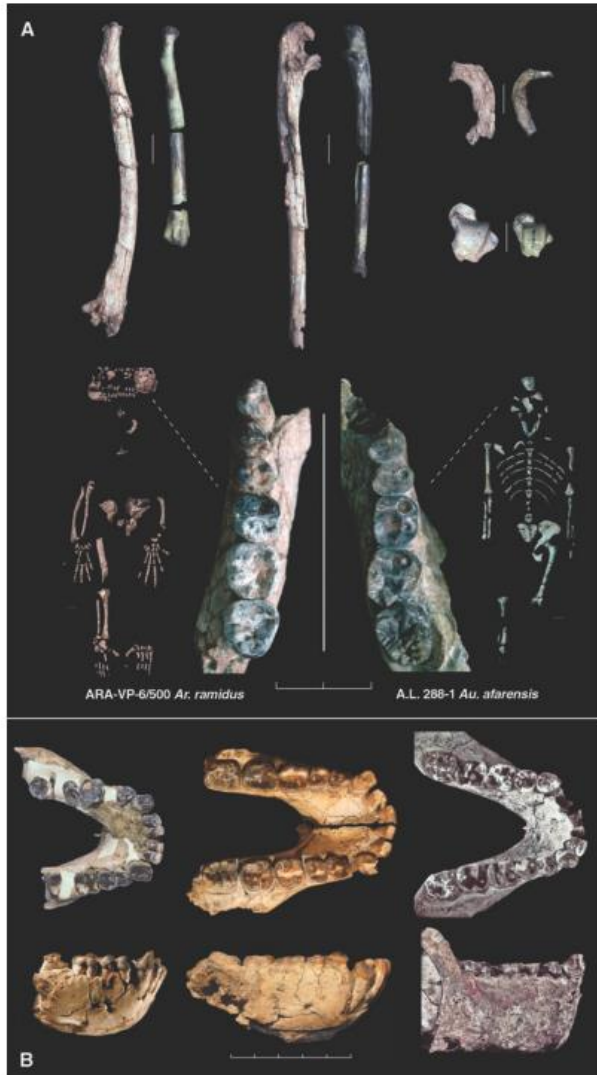
- Riduzione dello spessore dello smalto in confronto a *Australopithecus*

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 africane 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.



I scheletri dimostrano delle dimensioni postcraniali importanti relativamente alle dimensioni 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 *Australopithecini*.

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

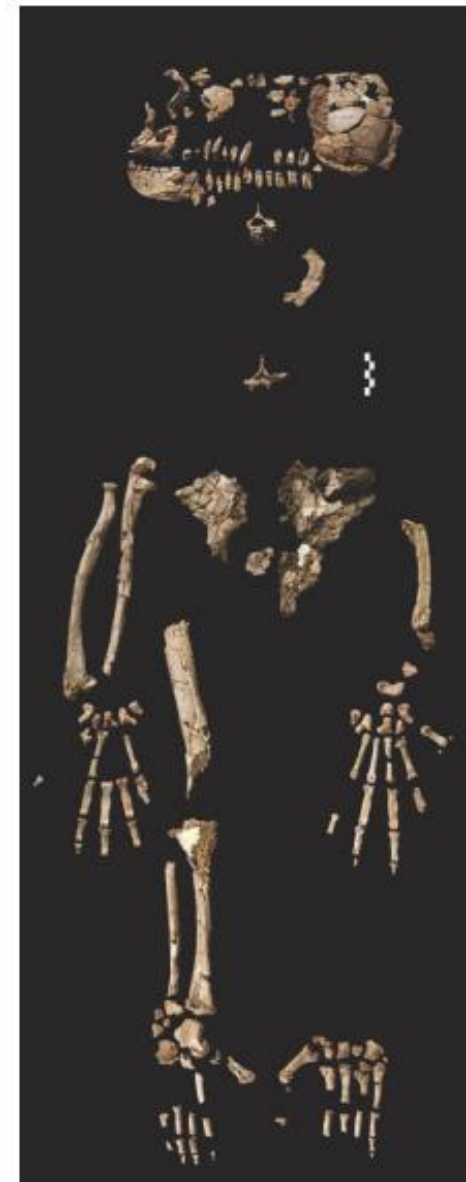


Fig. 3. The ARA-VP-6/500 skeleton. This is a composite photograph to show the approximate placement of elements recovered. Some pieces found separately in the excavation are rejoined here. Intermediate and terminal phalanges are only provisionally allocated to position and side.

AR A-VP-6/500	KNM-KP 29281 <i>Au. Anamensis</i> 4,12 Ma	MAK-VP-1/12 <i>Au. Afarensis</i> 3,4 Ma
---------------	---	---

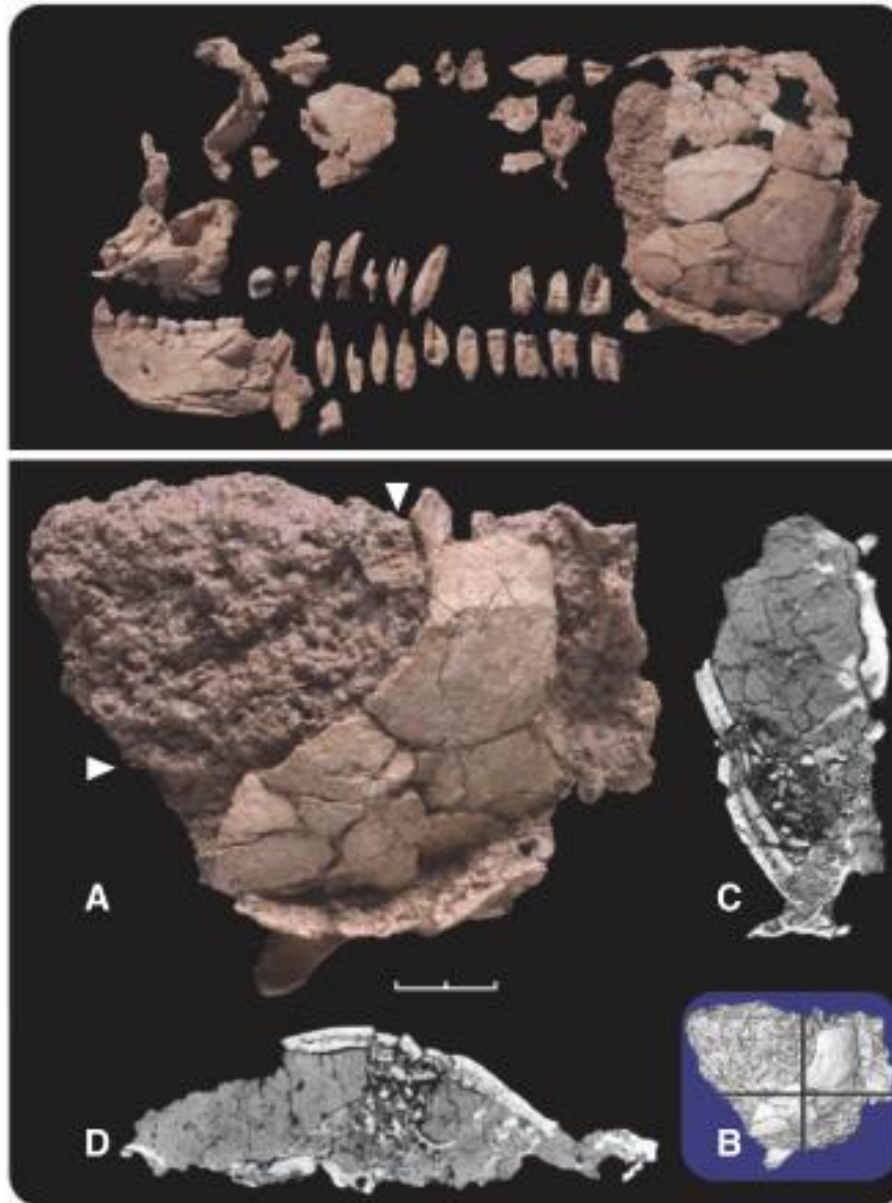
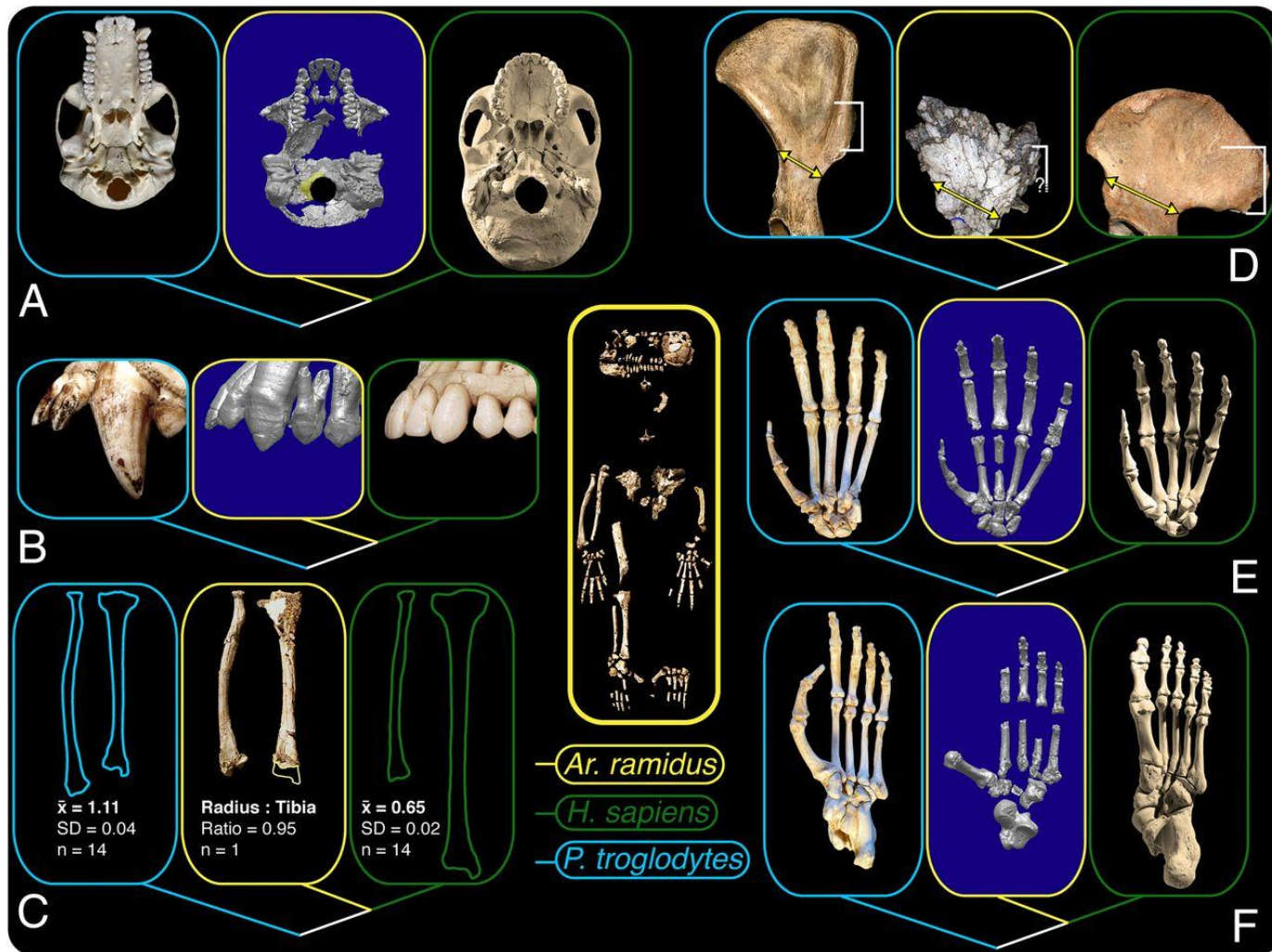
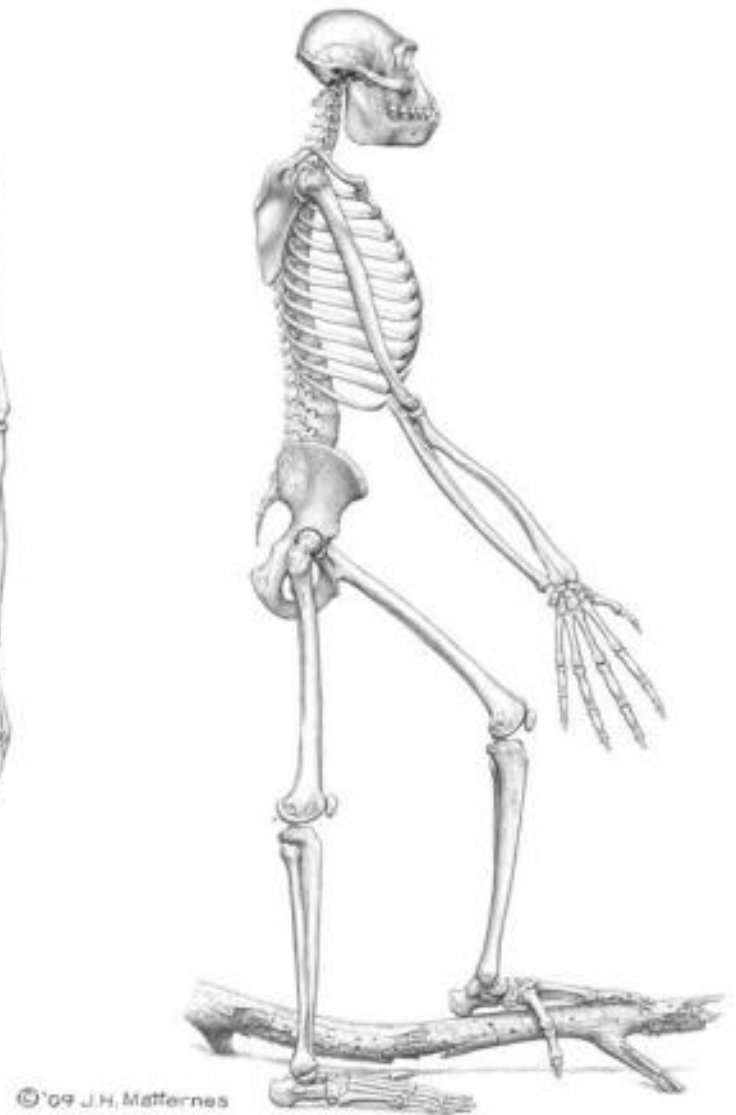


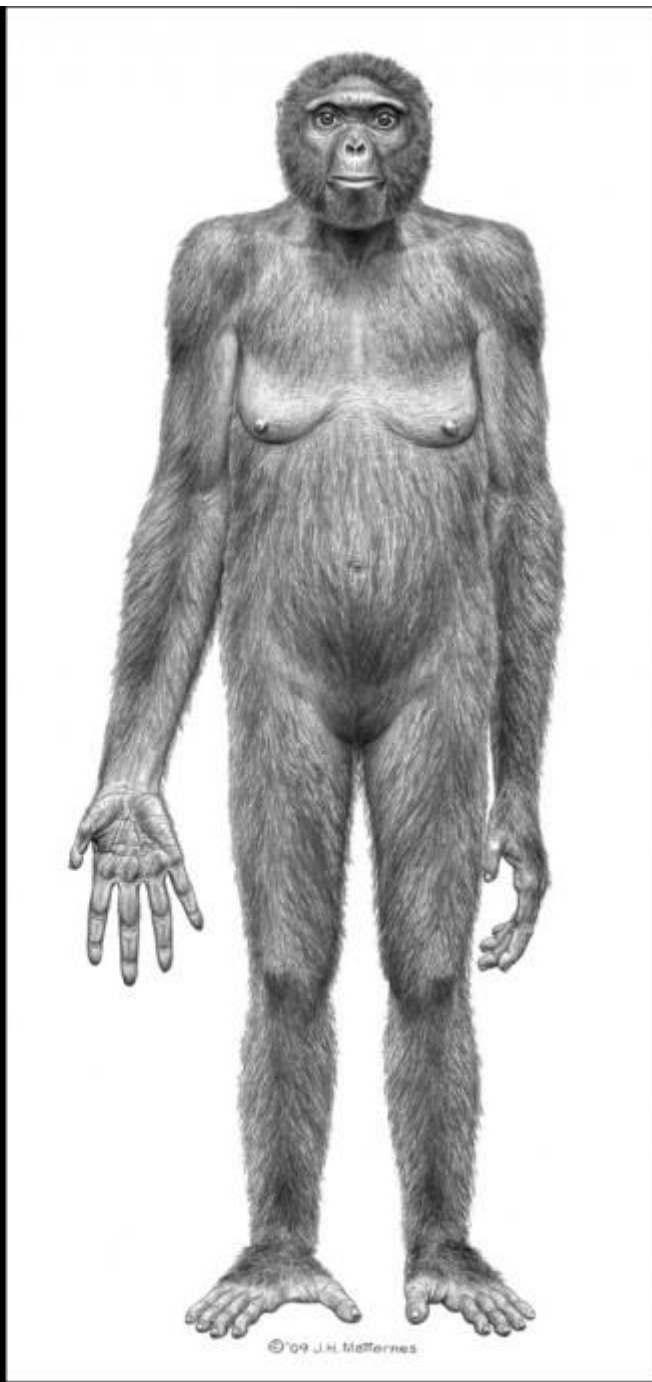
Fig. 1. The fragmented skull of *ARA-VP-6/500*. (Upper panel) Identifiable pieces of the skull after limited refitting for digital and physical molding. (Lower panel) (A) *ARA-VP-6/500-032*, (B) micro-CT rendered image of the same, with cross-sectional locations of (C) and (D) indicated. Arrowheads in (A) denote the positions of (C) and (D).

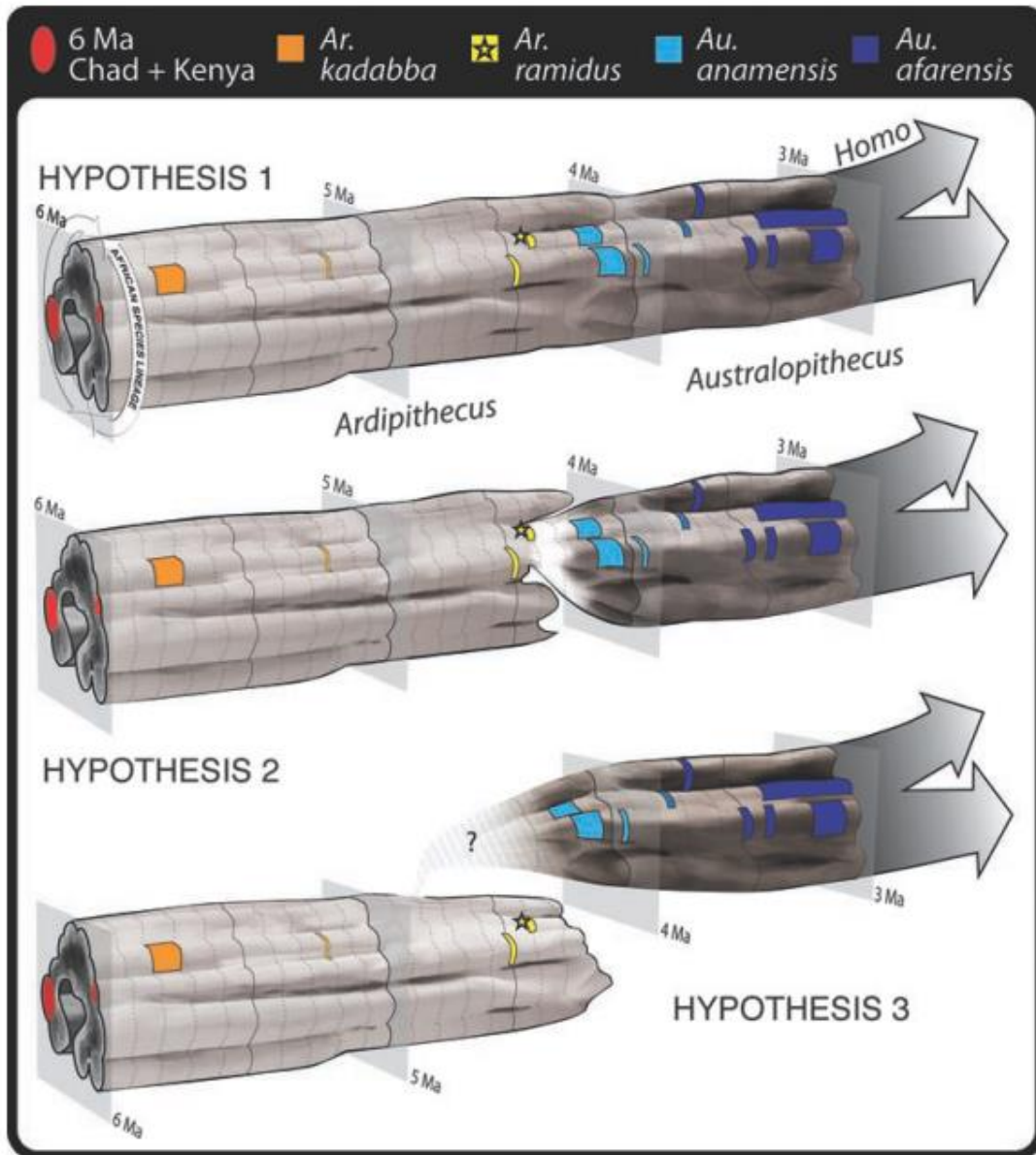
Evolution in different directions.



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



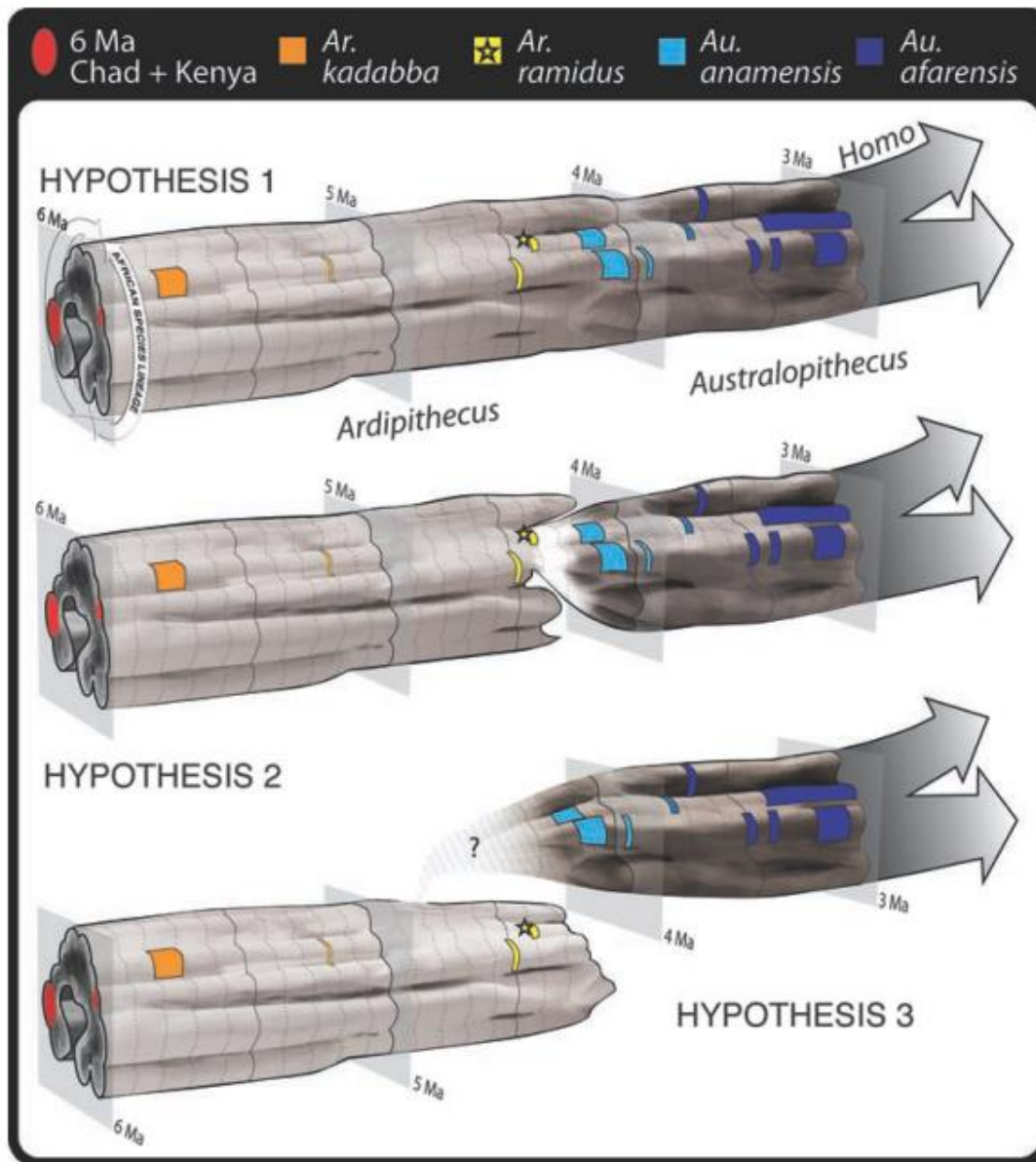




1 ipotesi: tutte le evidenze conosciute rappresentano un'unica linea evolutiva

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 speciation model (cladogenesis through microevolution accumulated in a peripheral isolate population, becoming reproductively separated).

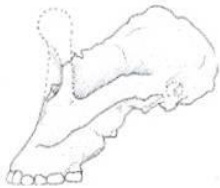


Australopithecus africanus Dart 1925

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, Éthiopie)

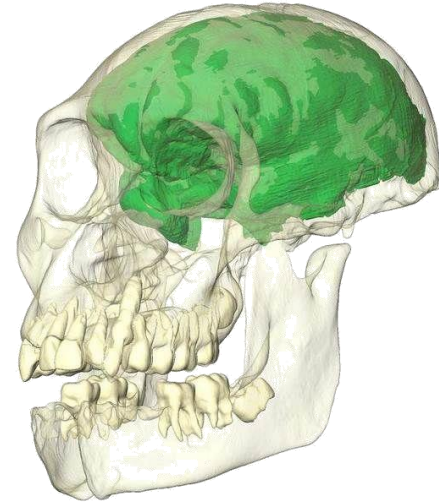


Kenyanthropus platyops Leakey *et al.* 2001

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

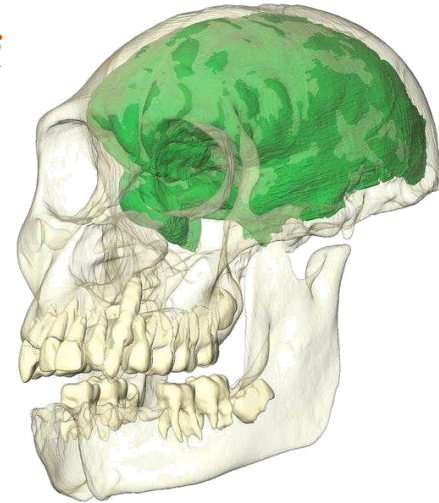
Caratteristiche condivise dalle Australopithecine

1. Dimensione del cervello $\pm$ scimpanze (ca. 375-550 cm³)
2. Parte mesio-facciale vertical 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

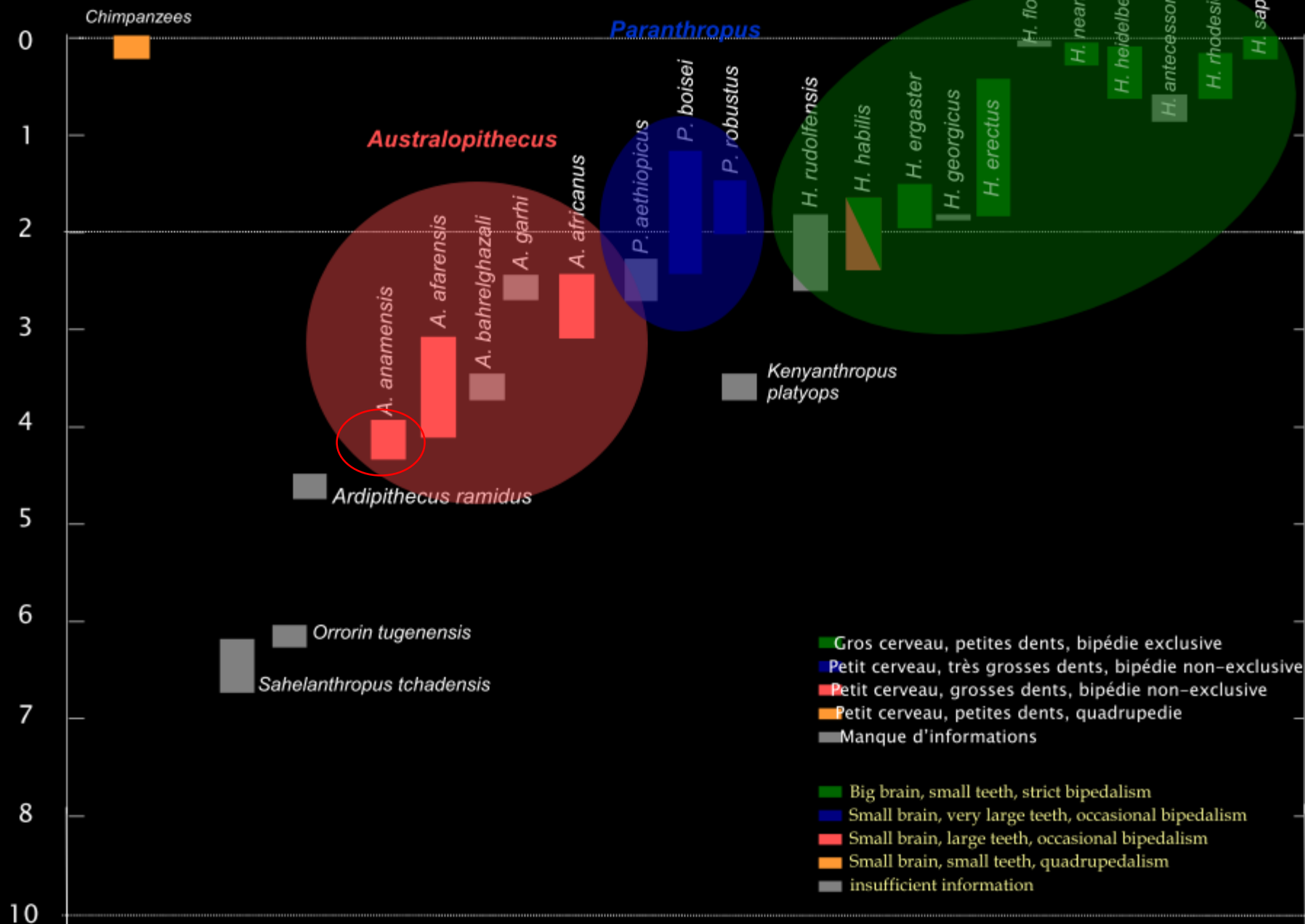


Shared australopith characteristics

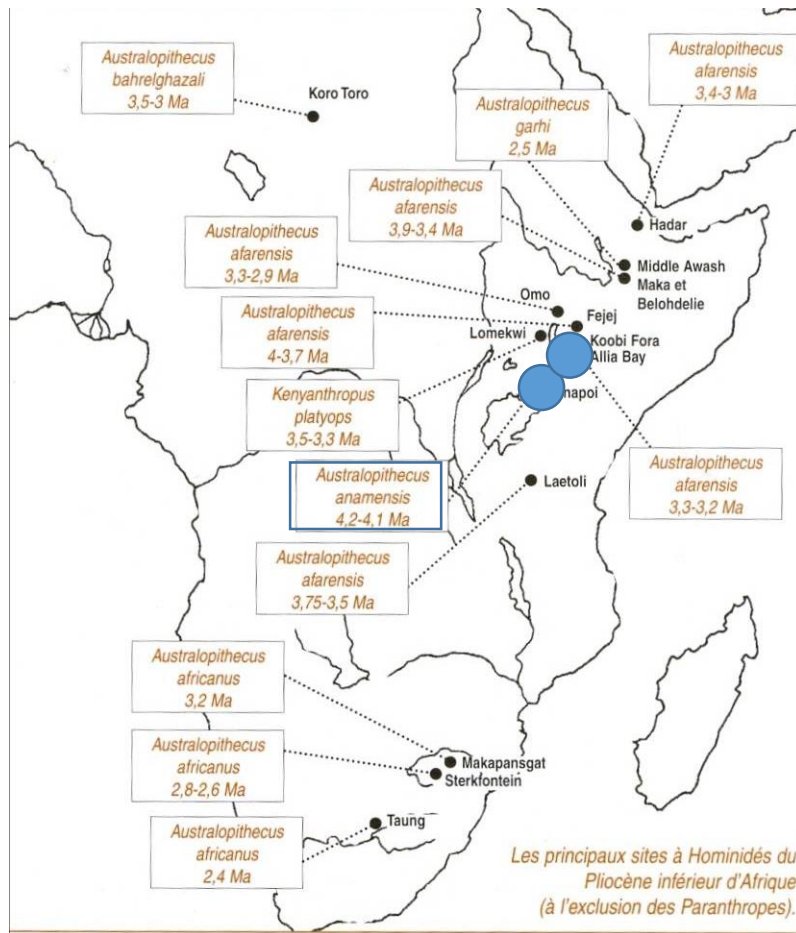
- 1. An approximately ape-size brain (range ca. 375-550 cm³)*
- 2. Inferosuperiorly short, vertical mid-face with massive zygomaticomaxillary region and strong subnasal prognathism*
- 3. Short basicranium with anteriorly positioned foramen magnum*
- 4. Absolutely small, nonhoning canines*
- 5. Large (in relation to body size) premolars and molars capped by variably thick enamel*
- 6. Transversely thick mandibular bodies and tall ascending rami*



(Ma)



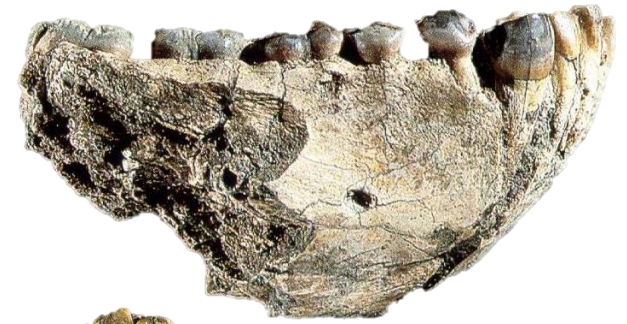
Australopithecus anamensis



Scoperta: Kanapoi e Allia bay, Kenya (lago Turkana)

Età: 4,2-4,1 Ma per Kanapoi e 3,9 Ma per Allia Bay

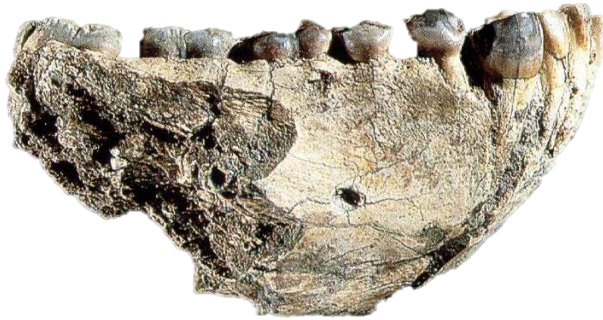
Da Histoire d'ancêtres-Grimaud et al., 2005



KNM-KP 29 281 4,1 Ma



- Mandibola stretta con corpo mandibolare quasi parallele
Narrow mandible with almost parallel corpus
- Assenza di diastema
No diastema
- Spessore dello smalto > *Ar. ramidus*
Enamel thickness > Ar. ramidus



≠ scimmie esistente e gli ominin del Mio-Pliocene hominins (*Ardipithecus* e *Sahelanthropus*)

- Premolari più complessi
- Smalto dei denti giugali più spesso
- Canini meno *ape-like*

≠ australopithecine successive

Morfologia della dentizione, particolarmente nella arcata anteriore



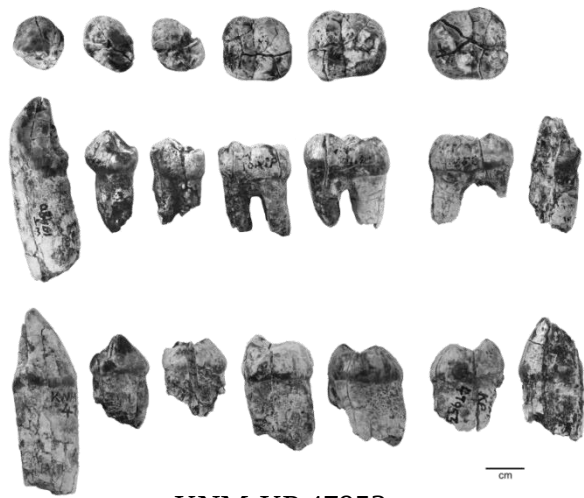
≠ extant African apes and Mio-Pliocene hominins (*Ardipithecus* and *Sahelanthropus*)

- More complex premolars
- Thicker cheek-tooth enamel
- Canines less apelike

KNM-KP 29 281 4,1 Ma

≠ later australopiths

Morphology of the dentition, mostly in the anterior arcade.

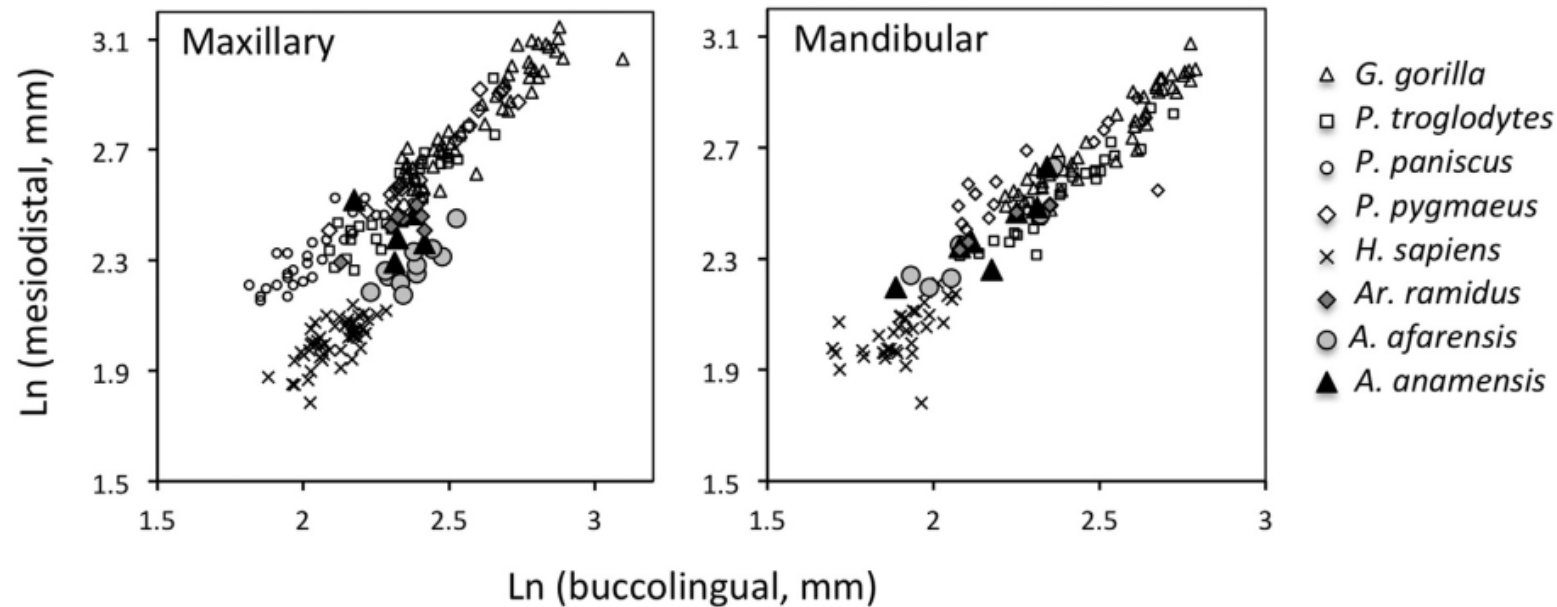


KNM-KP 47953



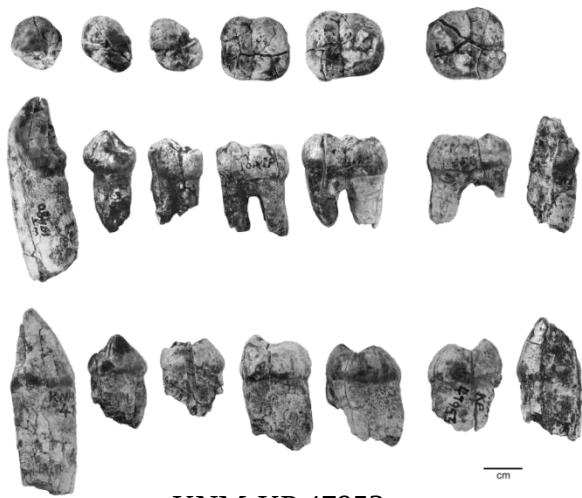
KNM-KP 47956

Canine occlusal shape



Dimensioni della corona dei canini (Ward, JHE 2013)

La forma dei canini di *Au. anamensis* è più simile ai *Ar. ramidus* e alle scimmie attuali. Invece, quelli di *Au. afarensis* sono più avvicinabili a quelli dei uomini moderni.

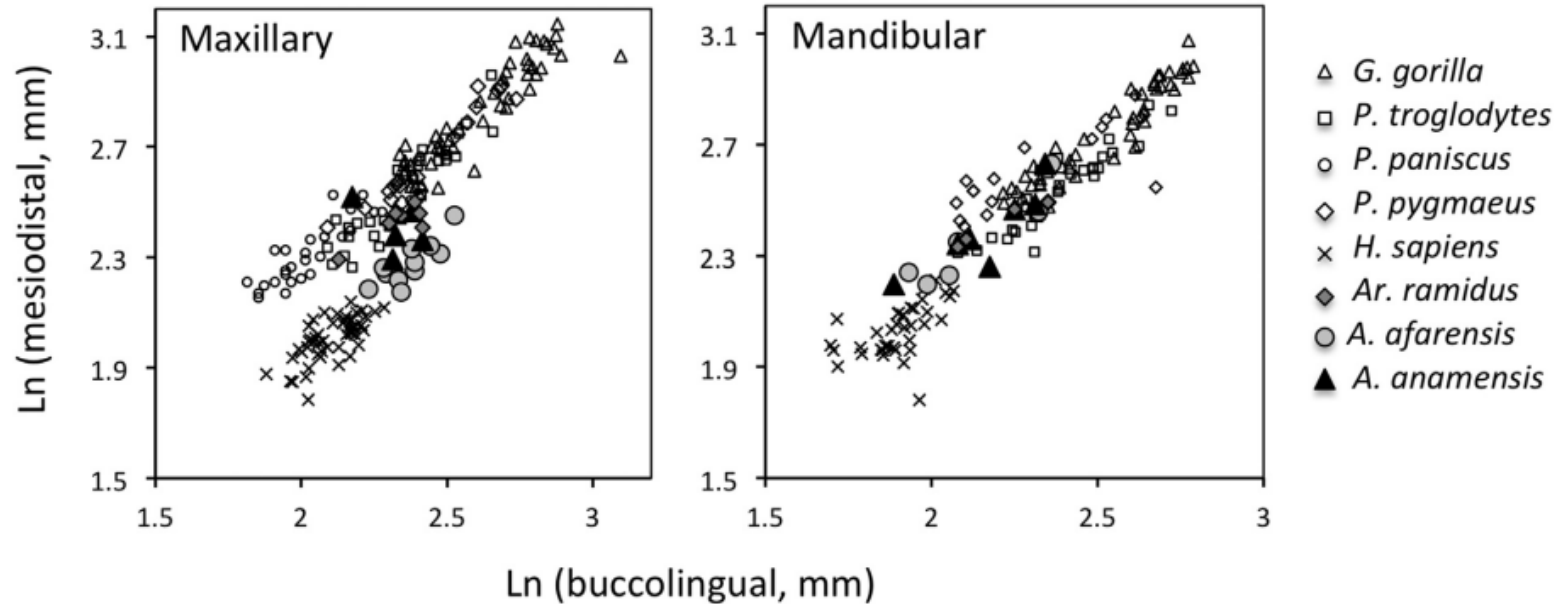


KNM-KP 47953



KNM-KP 47956

Canine occlusal shape



Mandibular canine crown dimensions (Ward, JHE 2013)

Australopithecus anamensis is most like that of Ardipithecus ramidus and extant apes, but those of Australopithecus afarensis are mesiodistally shorter like those of humans.

anamensis VS *afarensis* (Ward, JHE 2013)

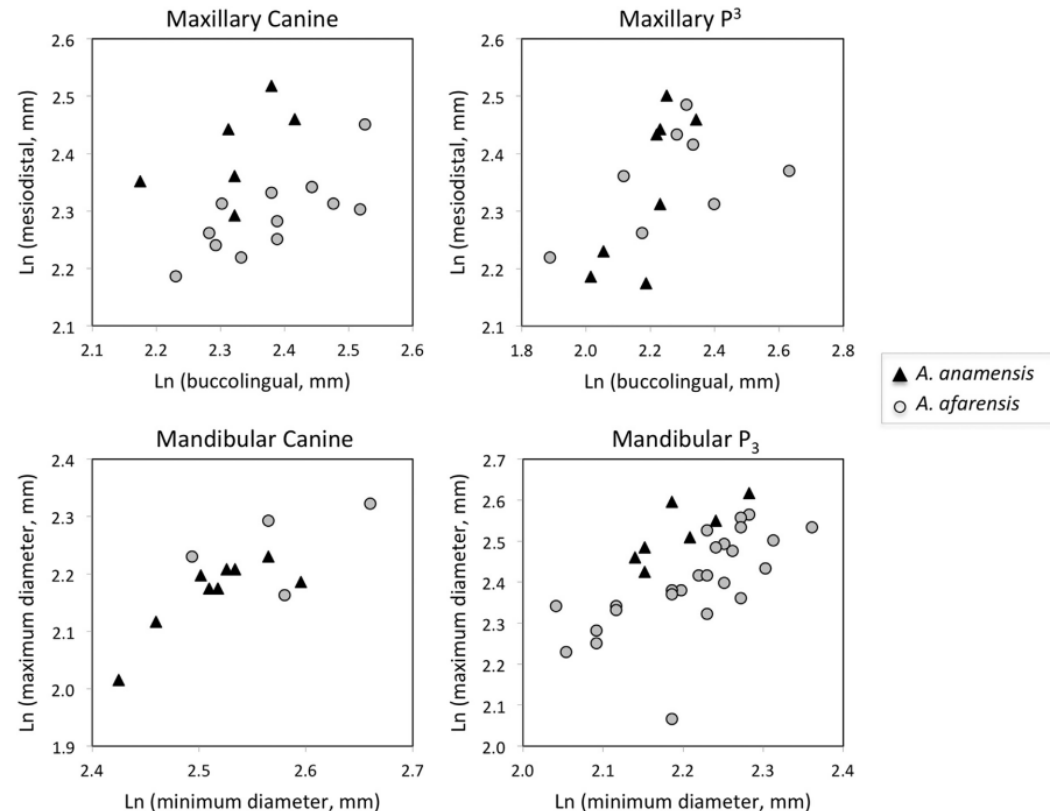
- Morfologia dei canini-premolari distinta, con un affilamento mesiodistale più lungo e delle radici più grande.

Questo dimostra che la perdita della proiezione e del dimorfismo dei canini no è il risultato di un singolo evento ma è stato graduale:

- Diminuzione dell'altezza della corona
- Riduzione della taglia delle radice e della lunghezza mesiodistale dei canini e premolari

Questo suggerisce un cambiamento adattativo della funzione dei canini tra *Au. anamensis* e *Au. afarensis*

Canini e P3 massilari sono relativamente più lunghi in *Au. anamensis* che in *Au. afarensis*, ma nessuna differenza è notata sui canini e P3 mandibolari.



anamensis VS *afarensis* (Ward, JHE 2013)

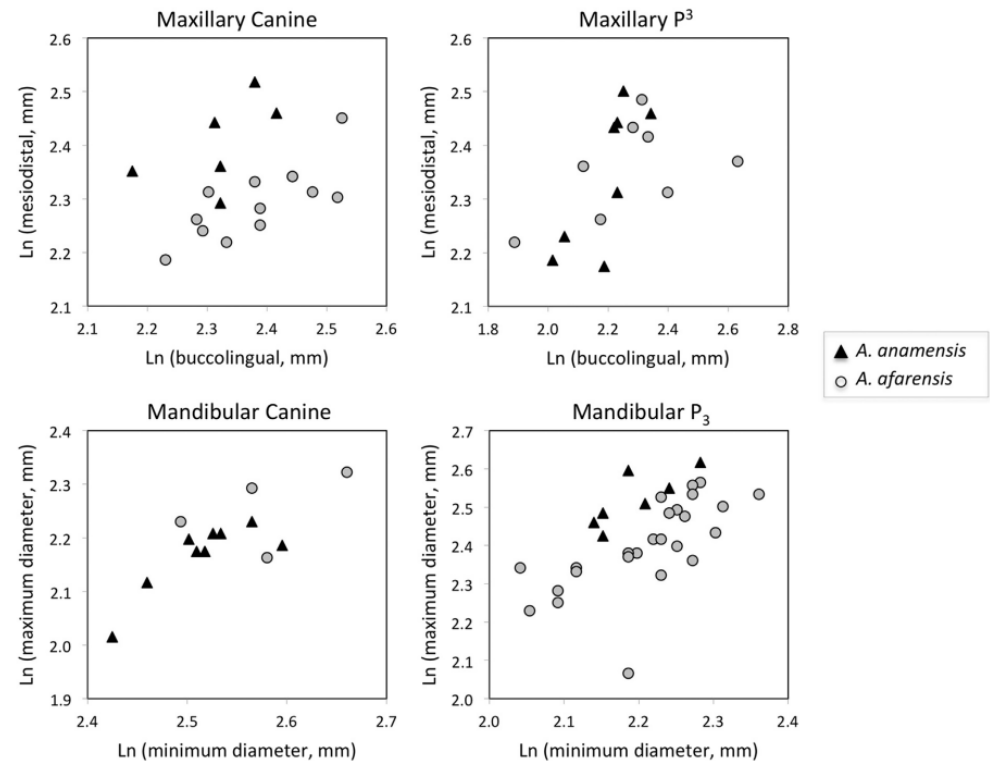
-Distinctive morphology of canine-premolar complex, with mesiodistally longer honing teeth and large canine tooth roots

It is now becoming apparent that the classic hominin characteristic of the loss of projecting canine teeth and canine dimorphism did not result from a single event, but instead occurred in several steps:

- Diminution of the canine crown heights
- Reduction of the canine and premolar roots size and mesiodistal lengths

This suggests a significant adaptive change in canine function from *Au. anamensis* to *Au. afarensis*

Both the maxillary canine and P 3 are relatively longer in *Australopithecus anamensis* than those of *Au. afarensis*, but no apparent differences are seen in the mandibular canine and P3.



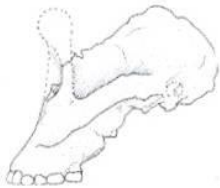


Australopithecus africanus Dart 1925

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)

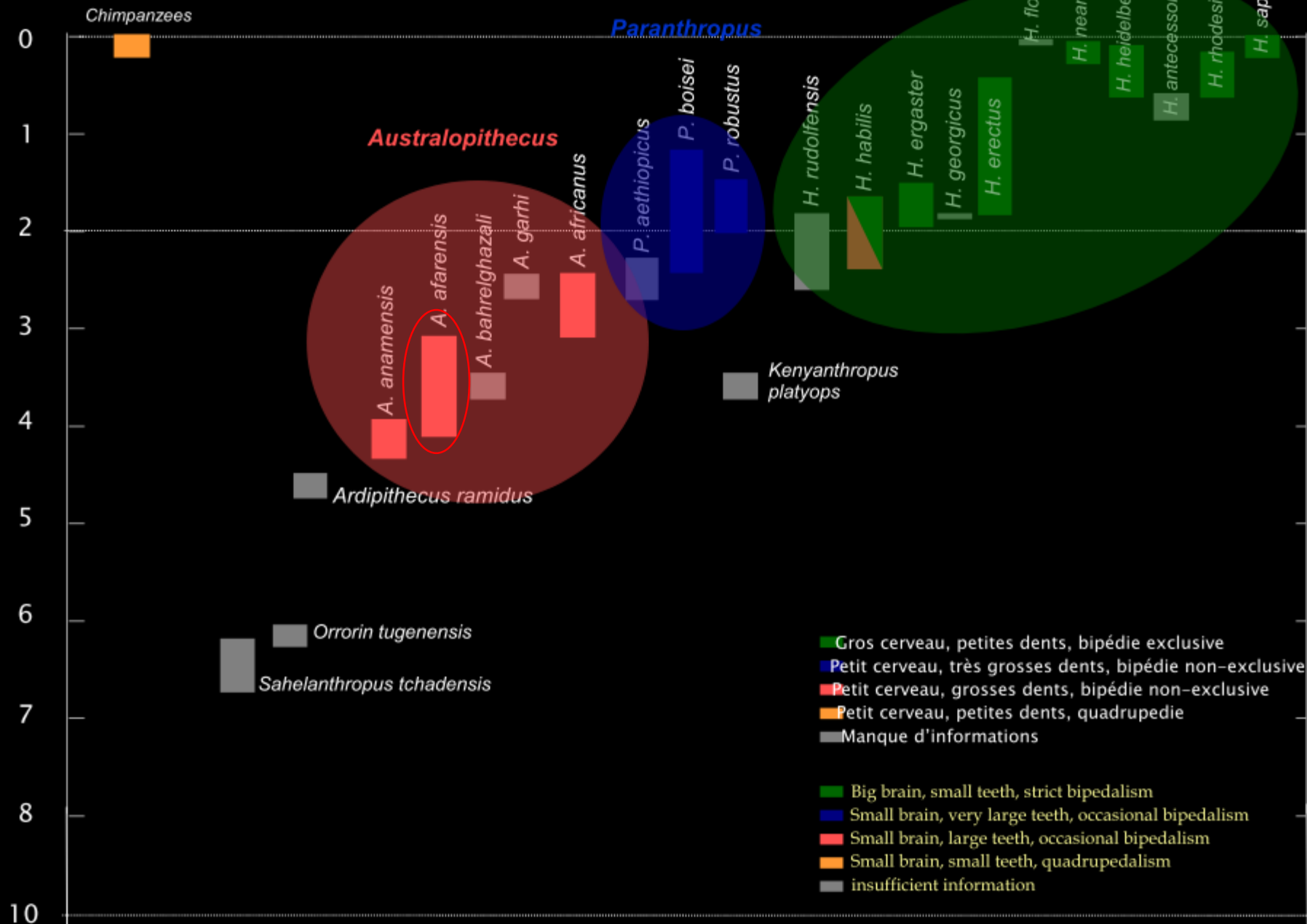
Australopithecus garhi Asfaw *et al.* 1999

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

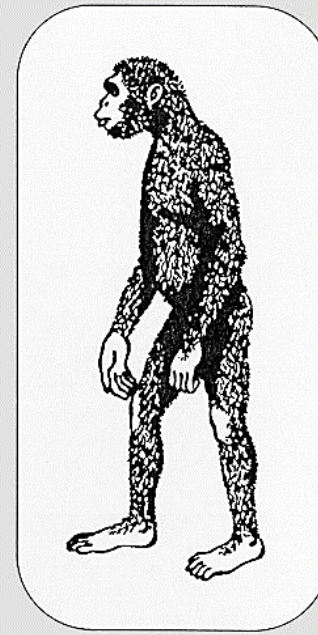
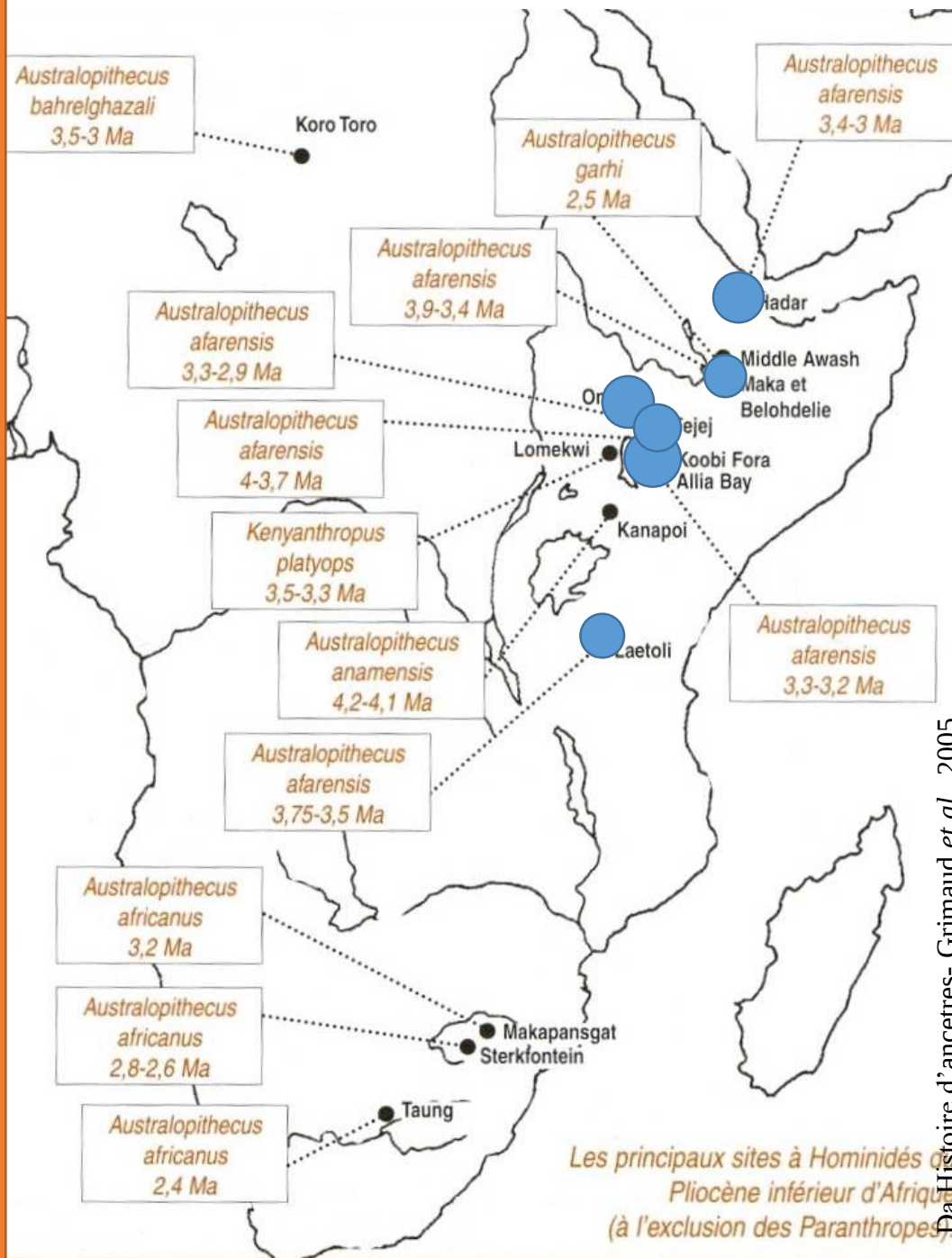
Kenyanthropus platyops Leakey *et al.* 2001

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

(Ma)

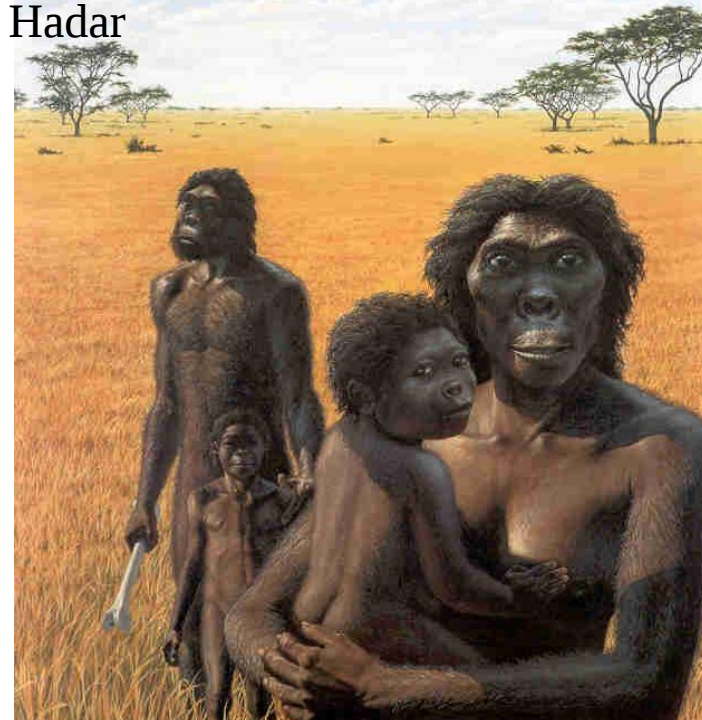


Australopithecus afarensis



Nom : *Australopithecus afarensis*
 Origine : Afrique de l'Est (Hadar, Laetoli, Maka, Belohdelie, Cheron, Omo, Koobi Fora)
 Dates : 5 (?) à 3 MA
 Cerveau : 300 à 400 cm³
 Taille : 1,10 m

Hadar

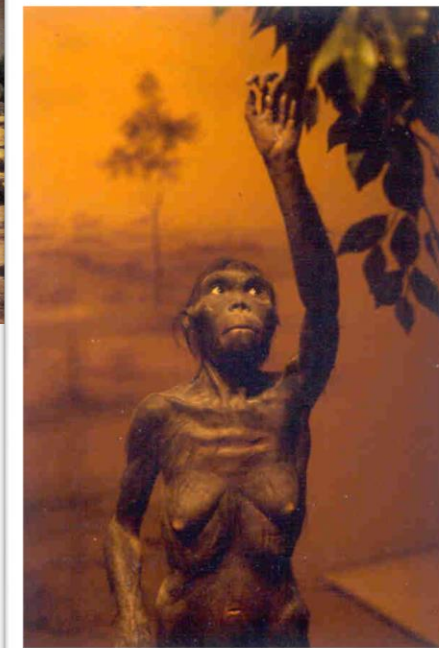


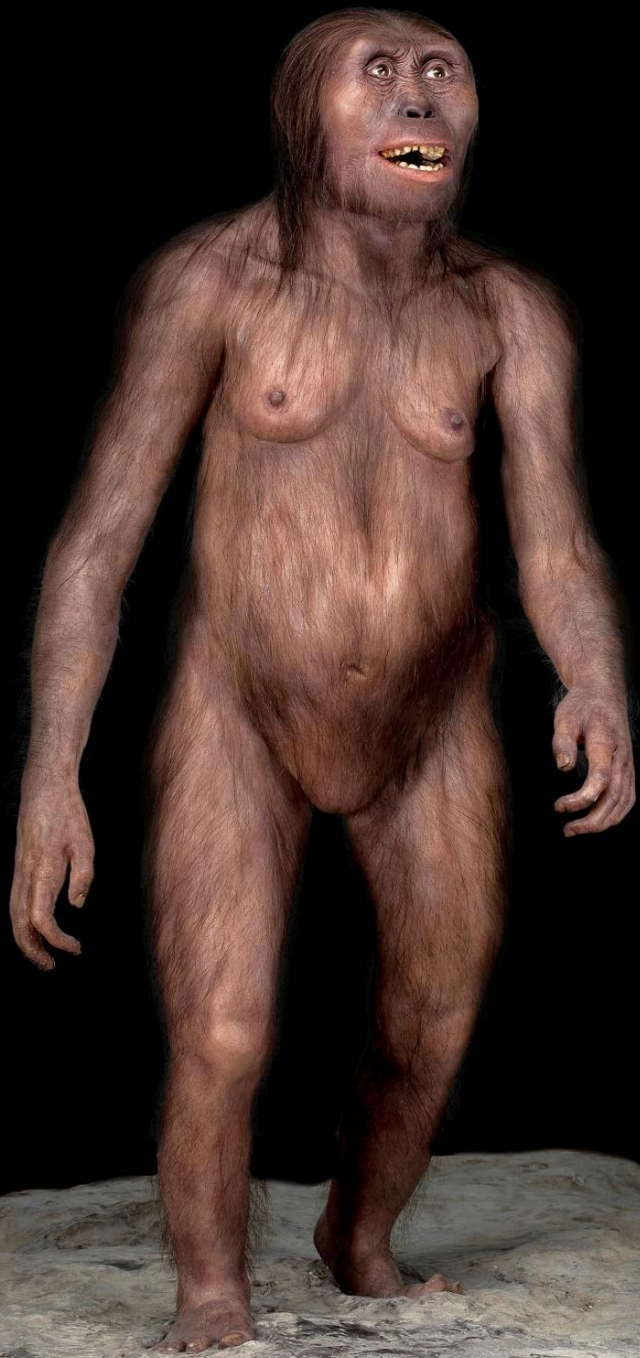
De l'Histoire d'ancêtres- Grimaud et al., 2005

Hadar



AL 444-2 (Hadar, Etiopia 3Ma)



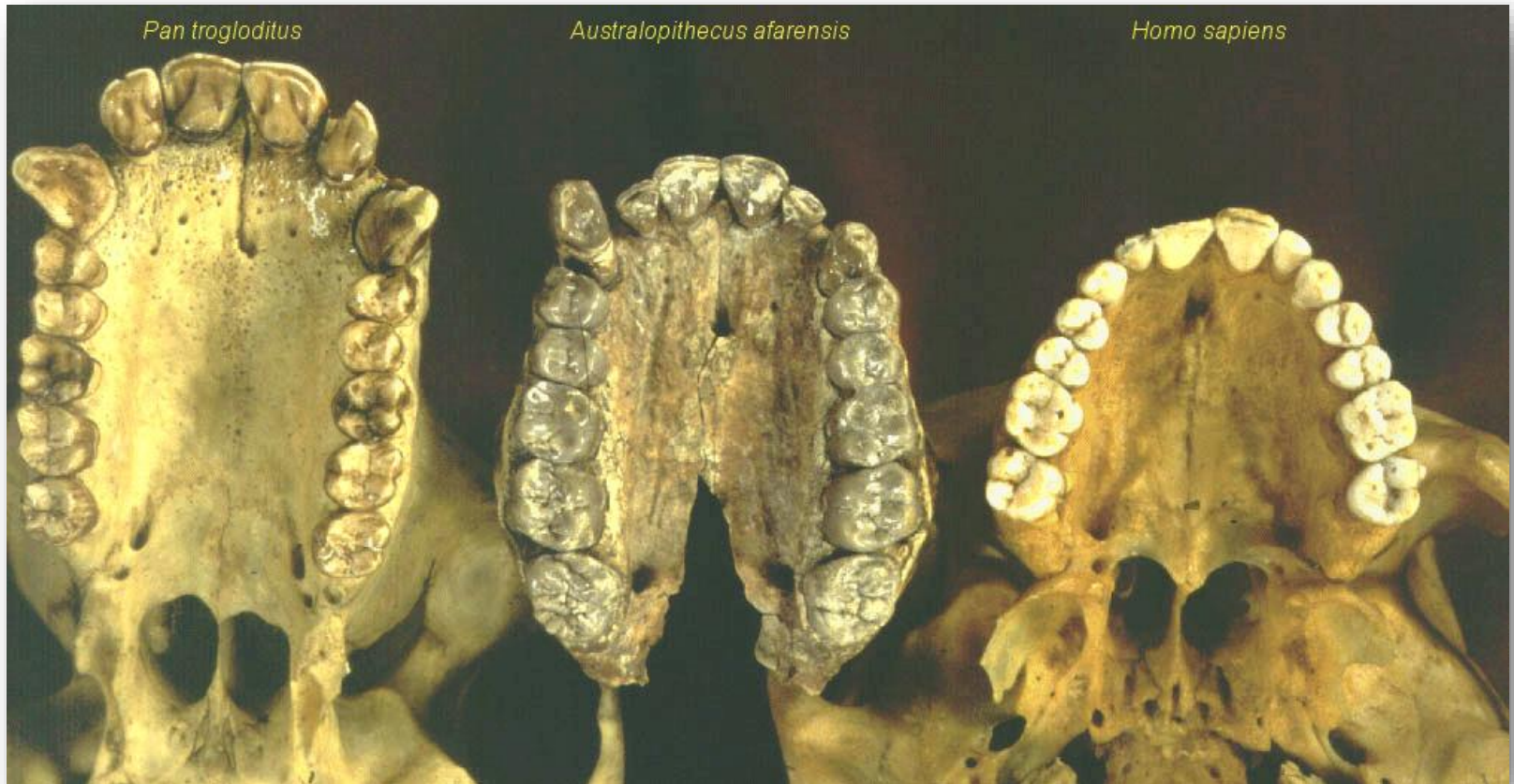


Lucy, 3,2 Ma –AL2881

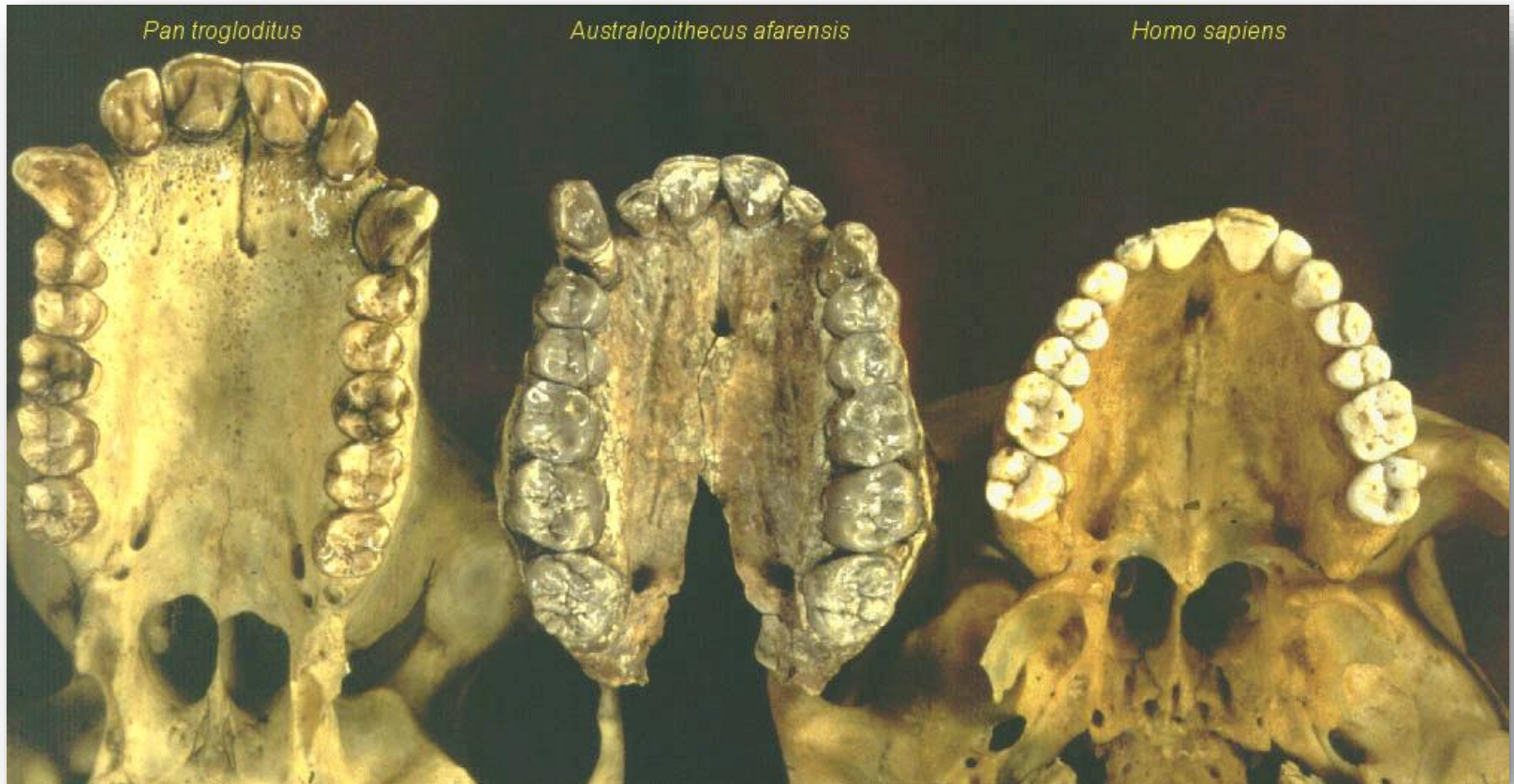


- Elevato dimorfismo sessuale
- Cranio piccolo
- Scheletro facciale grande e prognato
- Riduzione dei canini e degli incisivi
- Frequente presenza di diastemi
- Bipedismo facoltativo (bambina di DIKIKI Afar) : Cavità glenoidea della scapola è poco profonda inducendo un maggiore movimento dell'omero = vantaggio nella locomozione arboricola

Elevata competizione tra i maschi



- High sexual dimorphism
 - Small skull
 - Facial skeleton large and prognathous
 - Canine and incisors reduction
 - Diastema frequently present
 - Occasional bipedalism (Dikika Afar child): Narrow scapular glenoid fossa inducing a more important humerus movement = advantage for arboreal locomotion
- High competition between male



≠ 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 variation 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*

≠ with *Au. anamensis* (derived condition)

- More molarized P3 and dm₁
- Wider palate at equivalent palate lengths
- Nasal aperture defined by sharp lateral margins
- Larger external auditory meatus

≠ with subsequent australopiths

Predominantly plesiomorphic anatomy of the skull and dentition

Interorbital and nasal aperture breadths are narrow, contrasting with the broad, flat and massive zygomatic region

For larger individual: mandible with U-shape

Canine and premolars captured in evolutionary transition

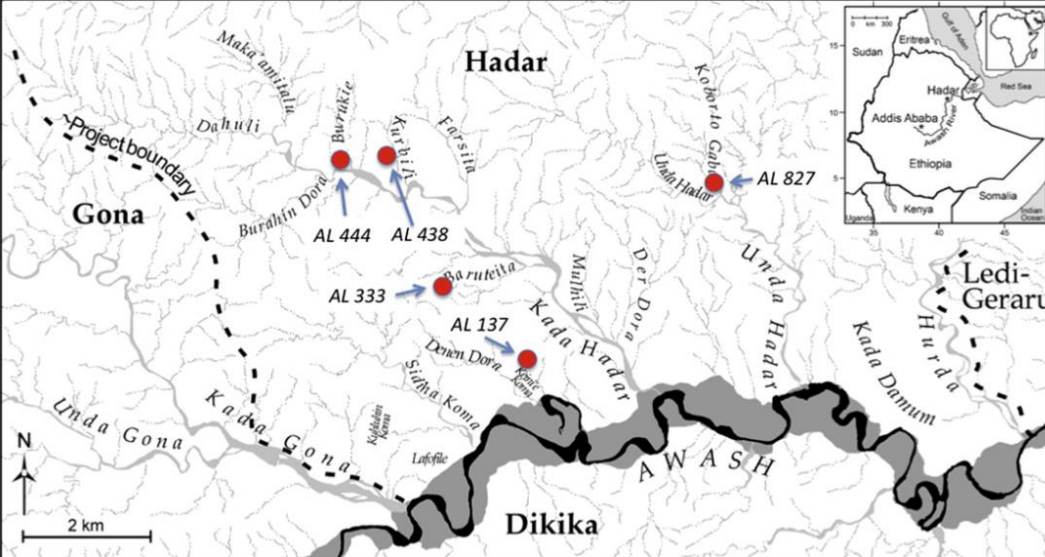
Molarisation of the P3 less advanced



AL 444-2 (Hadar, Ethiopia 3Ma)

Note: High level of cranial polymorphism

- Sexual dimorphism in size and shape
- Anagenetic trends in craniodental morphology during the younger half (3,5-3,0 Ma) of the *anamensis-afarensis* species-lineage.



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



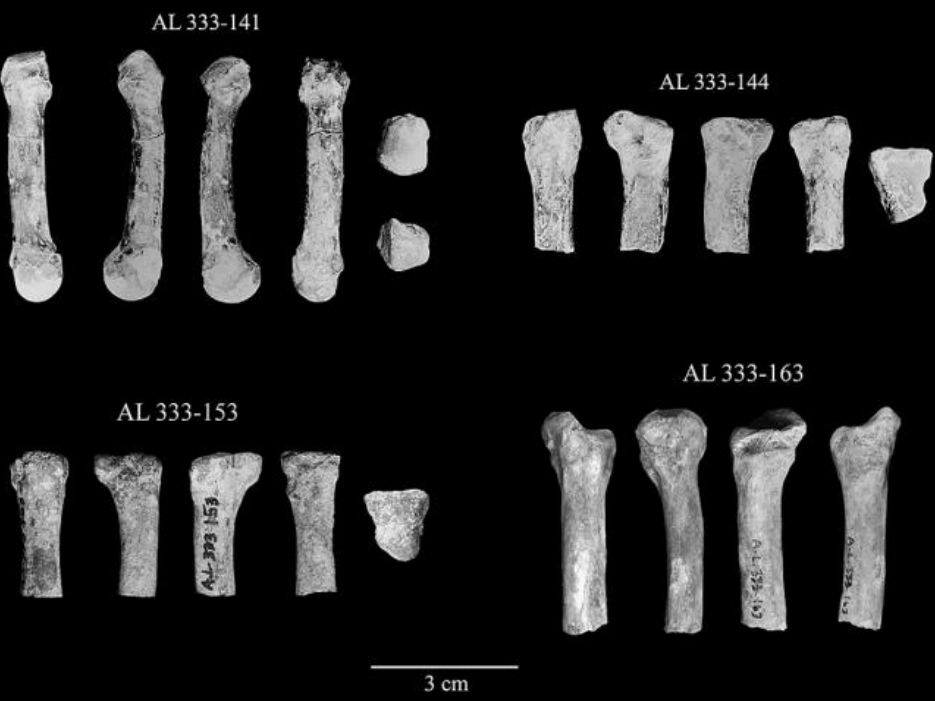
New postcranial fossils of *Australopithecus afarensis* from Hadar, Ethiopia (1990–2007)

Carol V. Ward^{a,*}, William H. Kimbel^b, Elizabeth H. Harmon^{c,1}, Donald C. Johanson^b

^aDepartment of Pathology and Anatomical Sciences, M263 Medical Sciences Building, One Hospital Drive, University of Missouri, Columbia, MO 65212, USA

^bInstitute of Human Origins, School of Human Evolution and Social Change, PO Box 874101, Arizona State University, Tempe, AZ 85287-4101, USA

^cDepartment of Anthropology, Hunter College, CUNY, 695 Park Avenue, NY 10065, USA

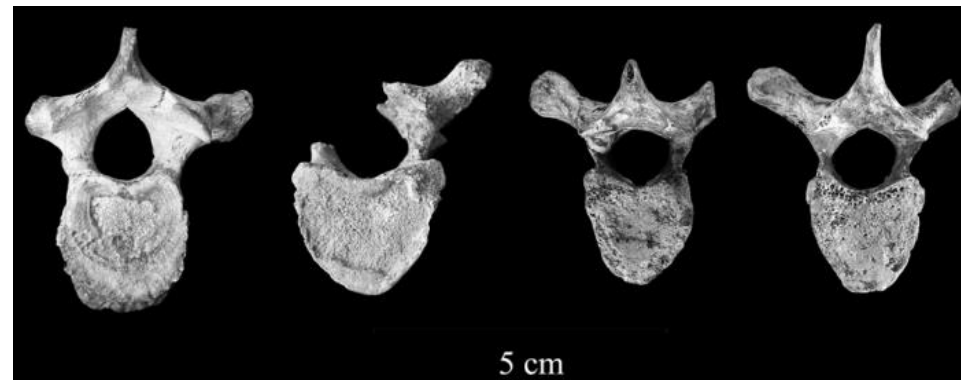


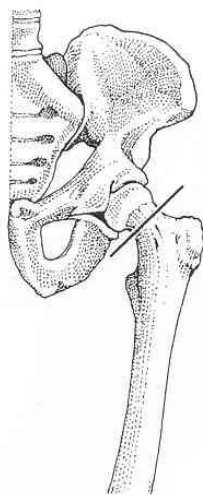
Le falange sono relativamente lunghe e robuste, anche se I metacarpali sono corti come nei umani moderni. Le proporzioni delle mani sono quasi come I umani moderni, con un relativamente lungo pollice e delle dita corte in confronti alle scimmie attuali.

The phalanges are relatively long and robust, although the metacarpals are short, as in humans. Manual proportions are mostly human-like, with a relatively long thumb and short fingers compared with those of extant apes

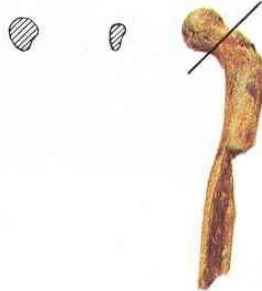
Le vertebre toraciche indicano che la colonna vertebrale toracica e la gabbia toracica sono diventate human-like almeno 3,4 Ma fa con un invaginazione della colonna vertebrale. Questo può avere accompagnato una riorganizzazione del bacino con una tradizione verso il bipedismo.

The thoracic vertebrae indicate that the thoracic vertebral column and rib cage had become more human-like by at least 3.4 Ma with invagination of the vertebral column. This change may have accompanied reorganization of the pelvis with the transition to bipedality.





femore umano



femore
dell'australopiteco

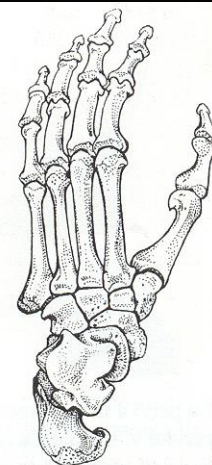


uomo

ossa delle dita



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



gorilla

Les bipédies des *Australopithecus*



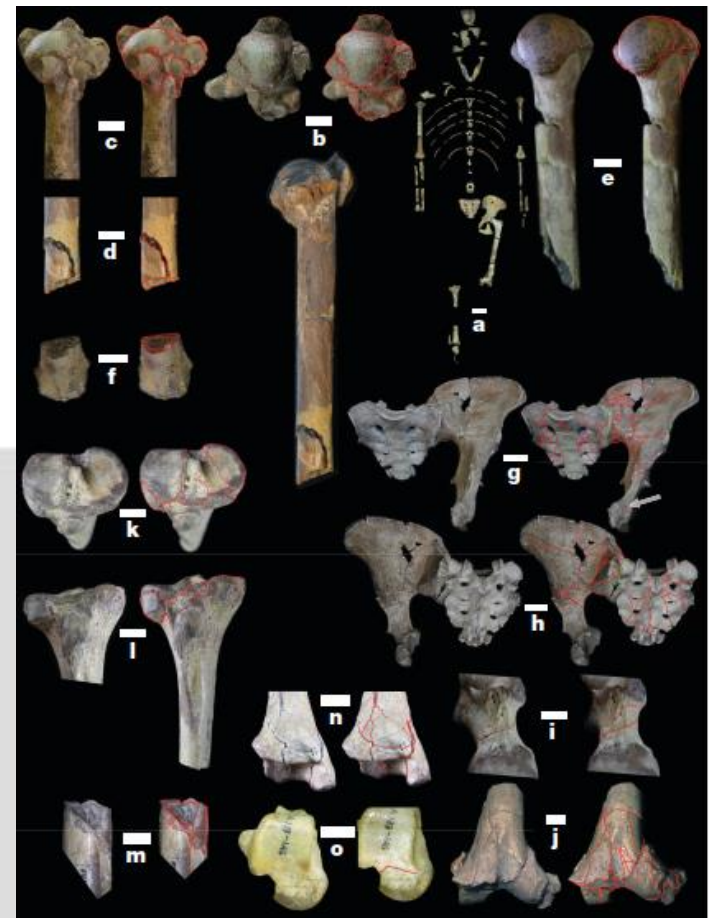
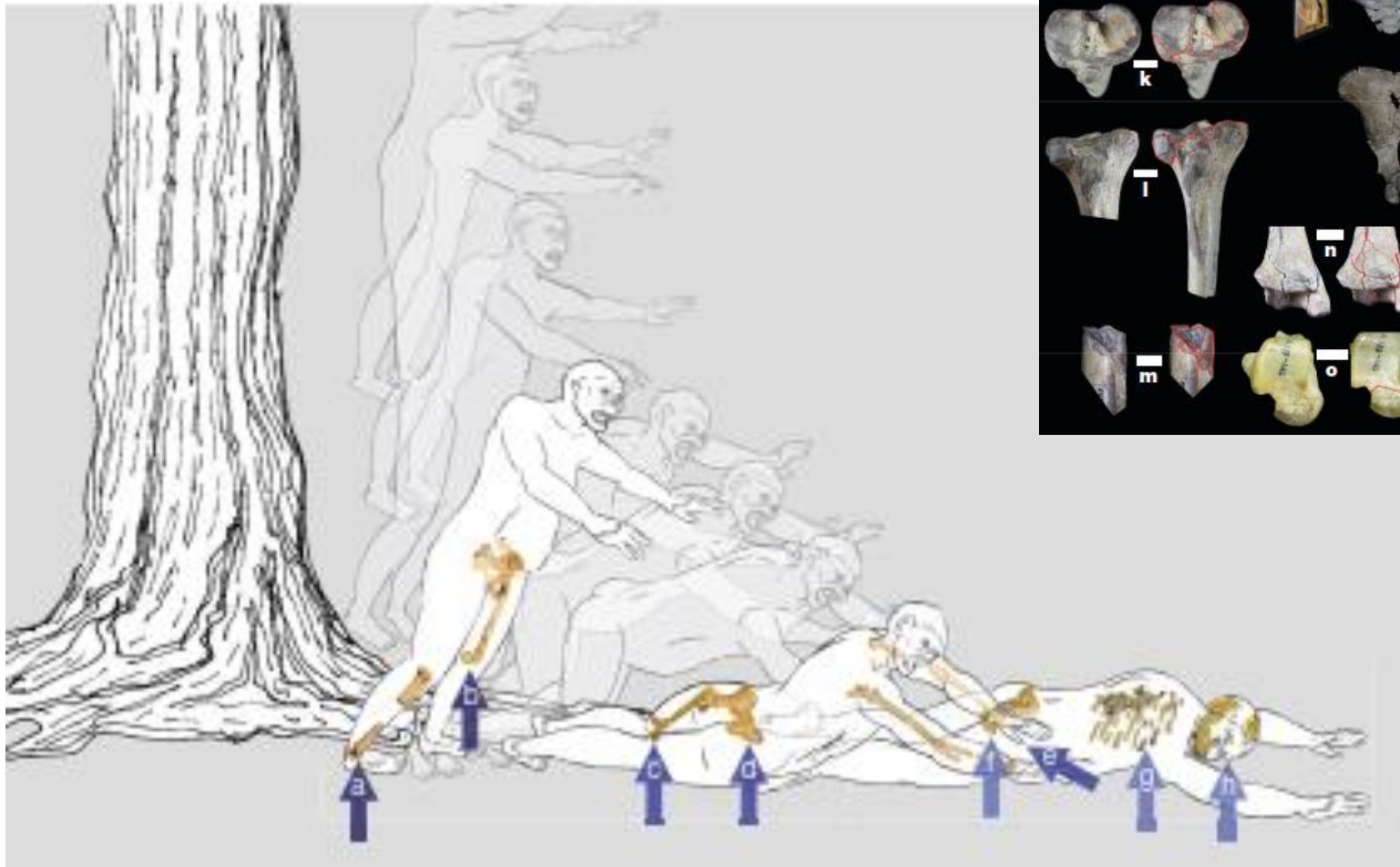
The bipedalisms of the *Australopithecus*

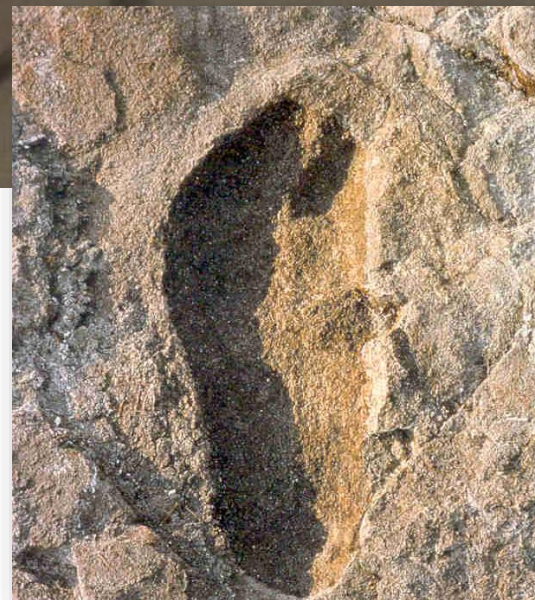


(Berillon & Marchal, 2005)

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

John Kappelman^{1,2}, Richard A. Ketcham², Stephen Pearce³, Lawrence Todd¹, Wiley Akins⁴, Matthew W. Colbert², Mulugeta Feseha⁵, Jessica A. Maisano² & Adrienne Witzel¹

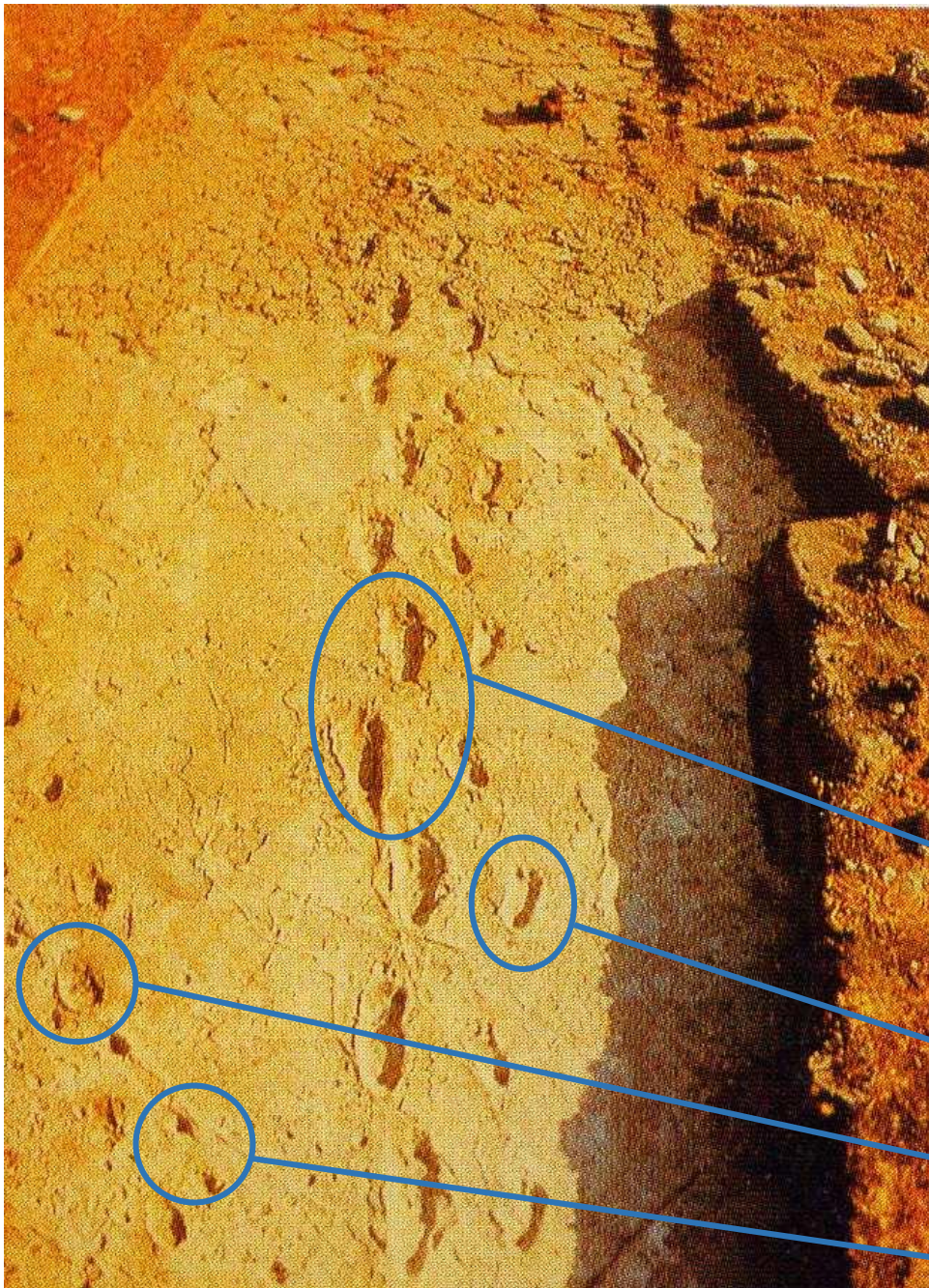




Orme di Lateoli

3,75 milioni di anni BP

Lo studio delle impronte ha permesso di riconoscere un aspetto arcaico della locomozione e del piede, caratterizzato da un grosso alluce staccato dalle altre dita, di questi ominidi.



SOVRAPPOSIZIONE DELLE
IMPRONTE DI DUE OMINIDI
ADULTI

IMPRONTE DI UN GIOVANE
OMINIDE

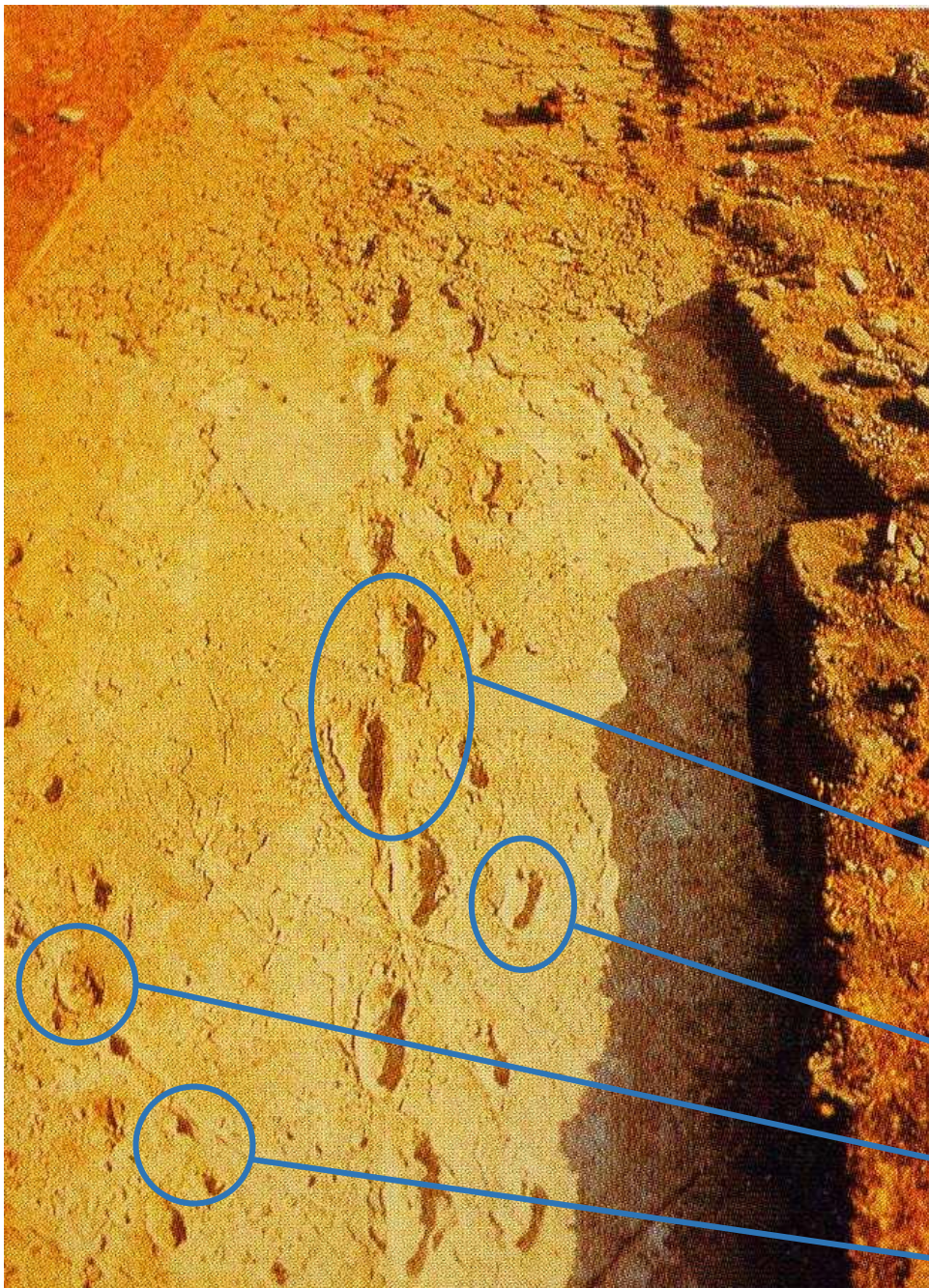
IMPRONTE DI HIPPARION

IMPRONTE DI GIOVANE
HIPPARION

Footsteps in Lateoli

3,75 Ma BP

Archaic aspect of the locomotion and of the foot, with a large big toe separated from the other toes.

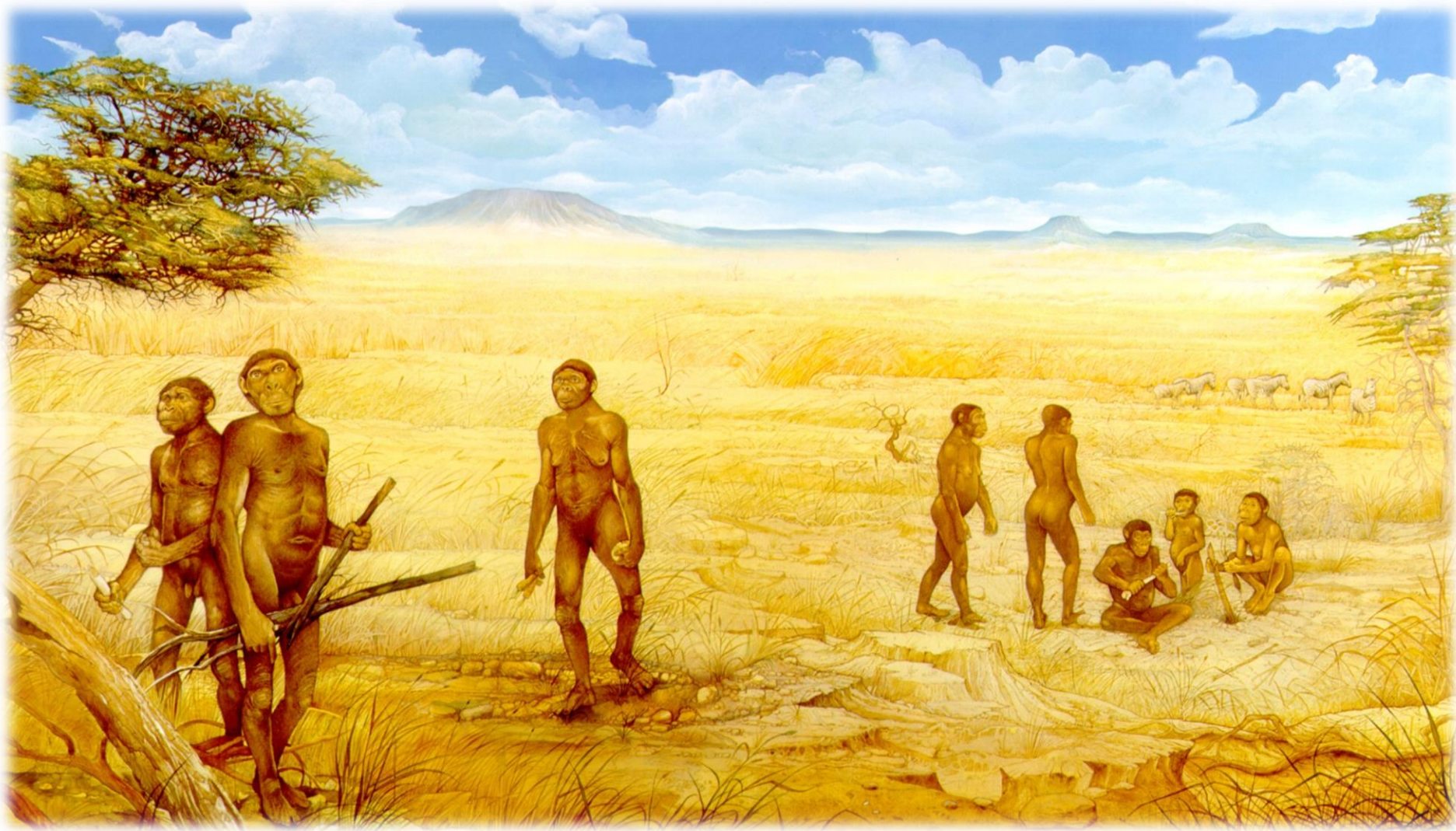


Overlapping of 2 adult hominids footsteps

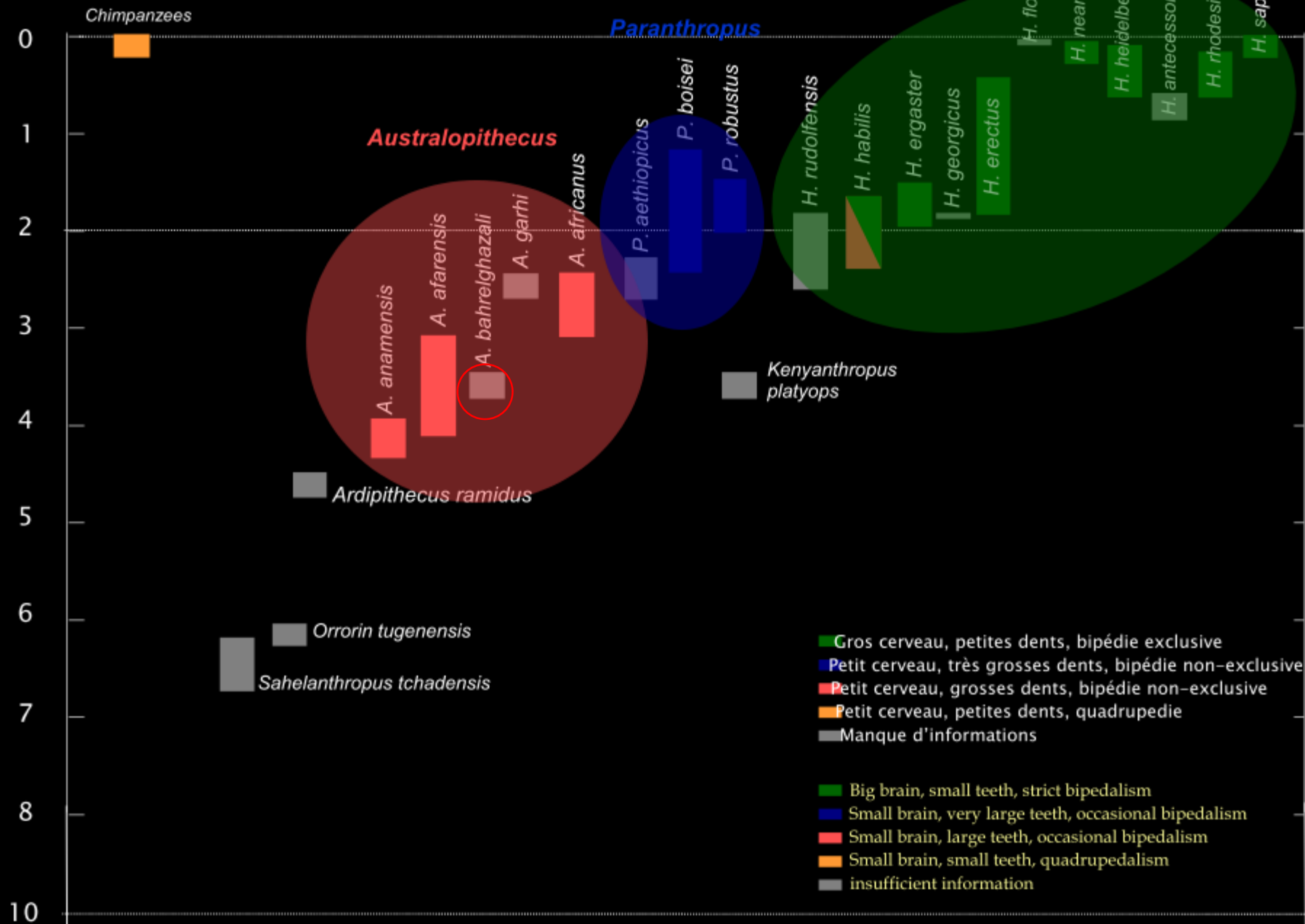
Juvenile hominid footsteps

Hipparion footsteps

Juvenile Hipparion footsteps



(Ma)



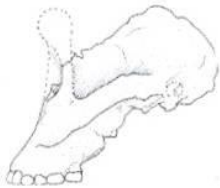


Australopithecus africanus Dart 1925

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, Éthiopie)



Kenyanthropus platyops Leakey *et al.* 2001

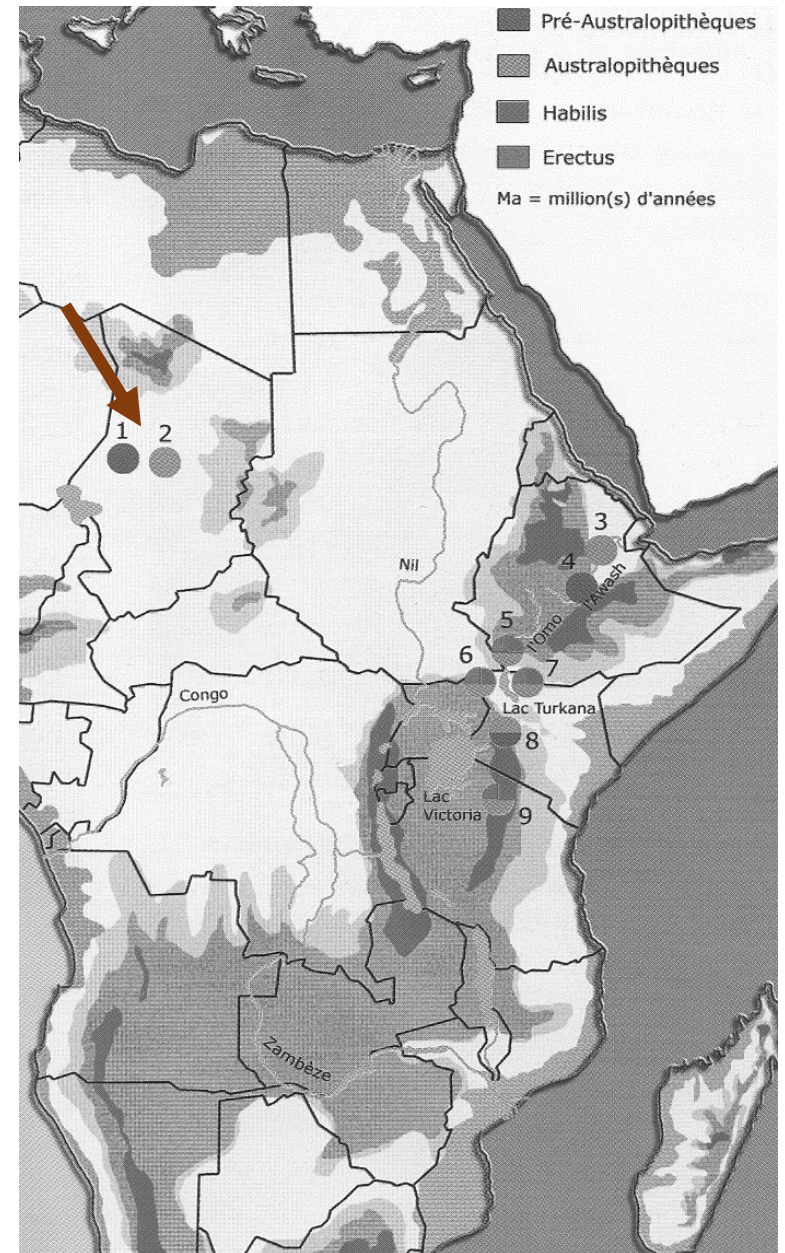
Holotype : Crâne KNM-WT 40000 (Lomekwi, Ouest-Turkana, Kenya)



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*



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

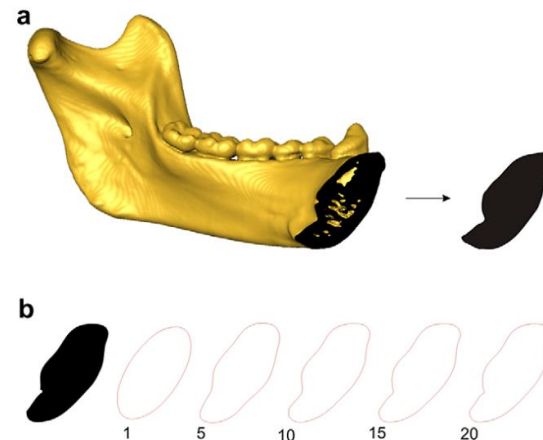
Franck Guy ^{a,*}, Hassane-Taïso Mackaye ^b, Andossa Likius ^b, Patrick Vignaud ^a,
Matthieu Schmittbuhl ^c, Michel Brunet ^a

^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

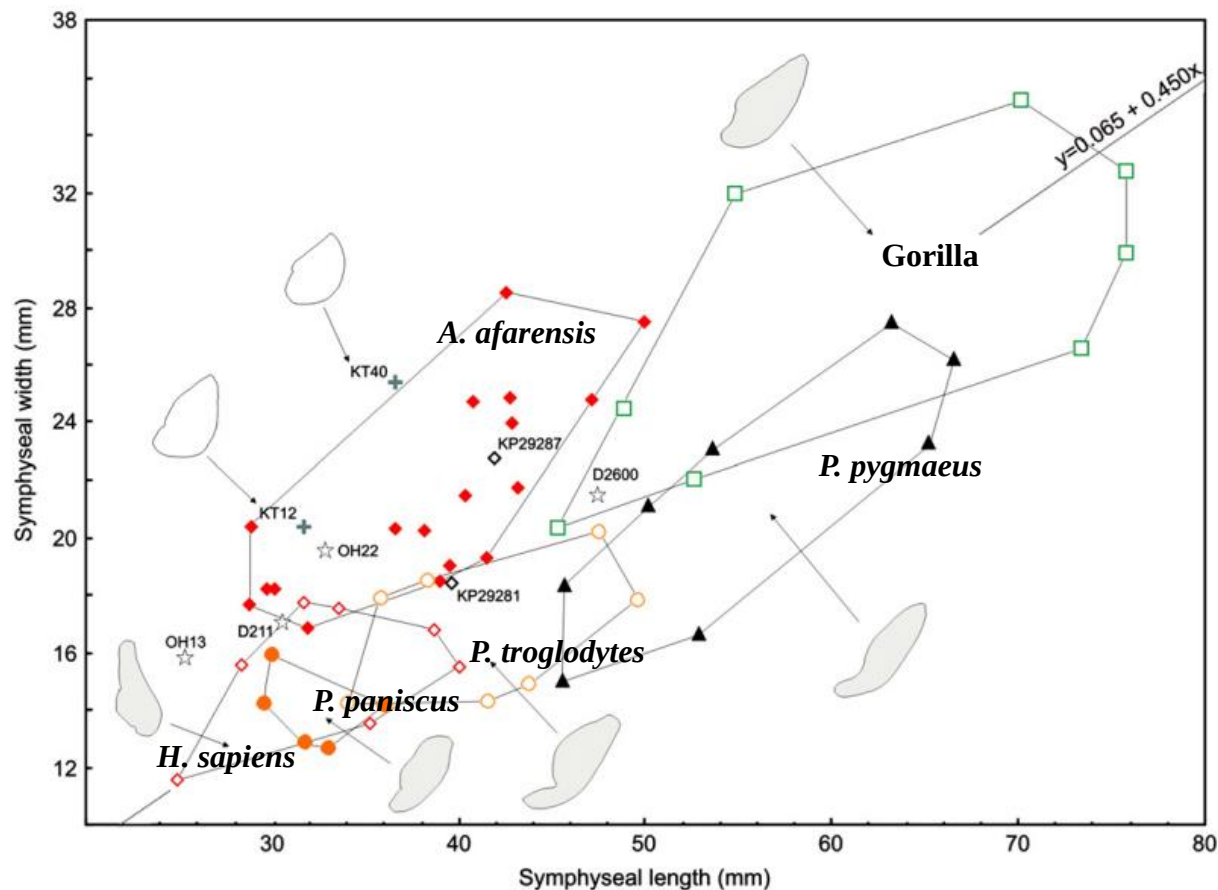
^b Université de N'Djamena, BP 1117, N'Djamena, Tchad

^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



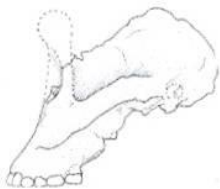


Australopithecus africanus Dart 1925

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

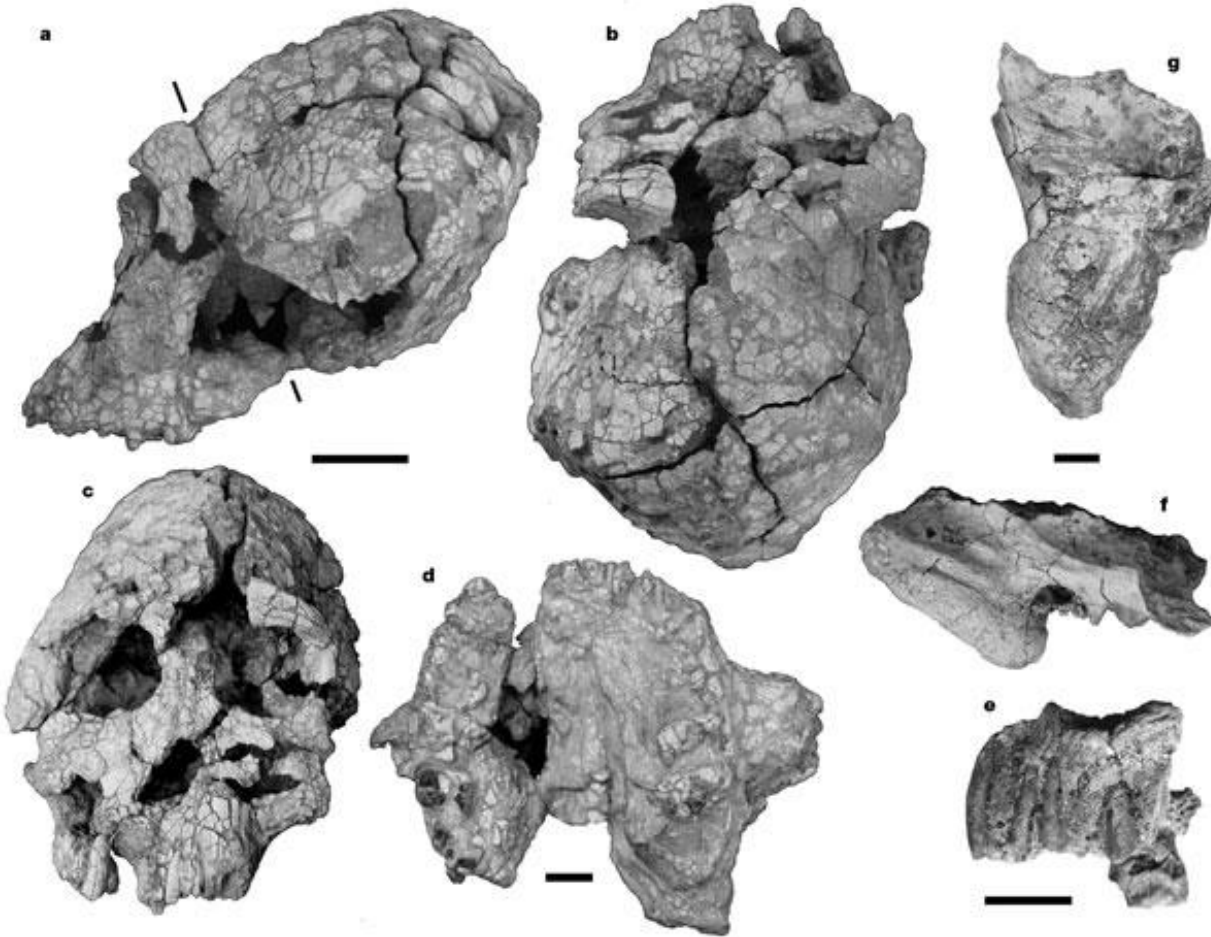
Holotype : Bou-VP-12/130 (Bouri, Middle Awash, Éthiopie)



Kenyanthropus platyops Leakey *et al.* 2001

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

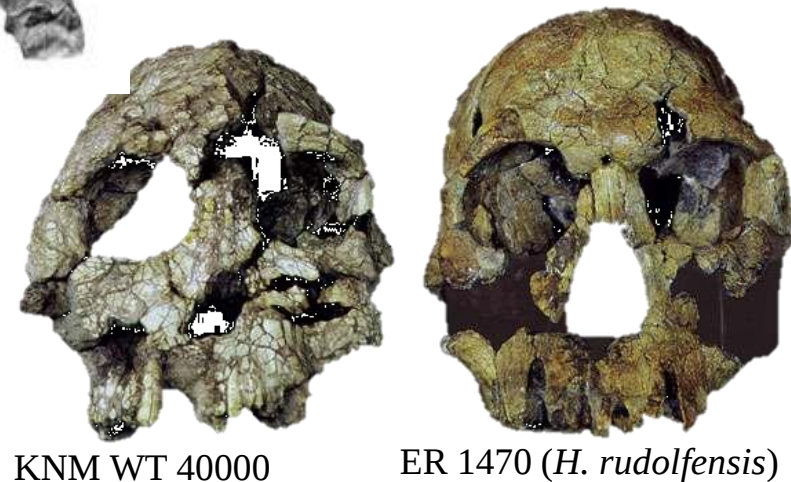
KNM - WT 40000 – West Turkana 3,5 – 3 Ma



(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 *Au. afarensis*

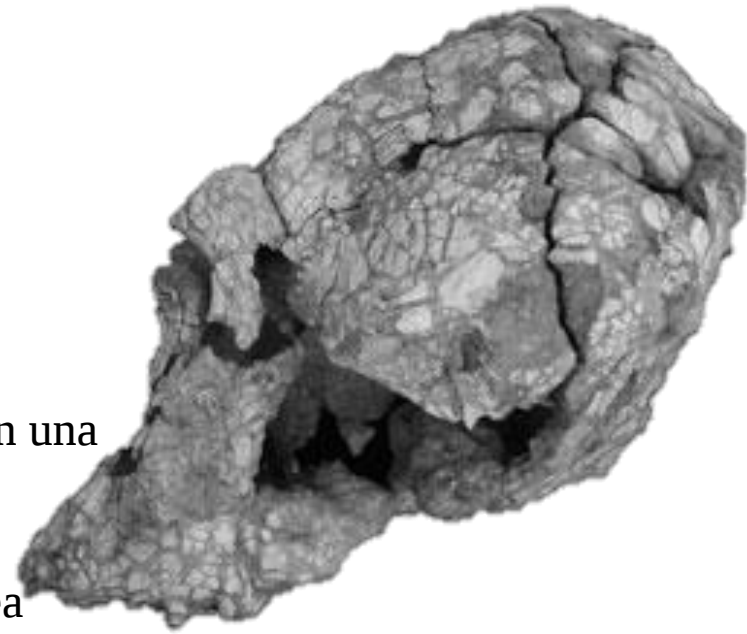
≠ *Au. afarensis* (specie contemporanea)

- 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*

≠ *Au. 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

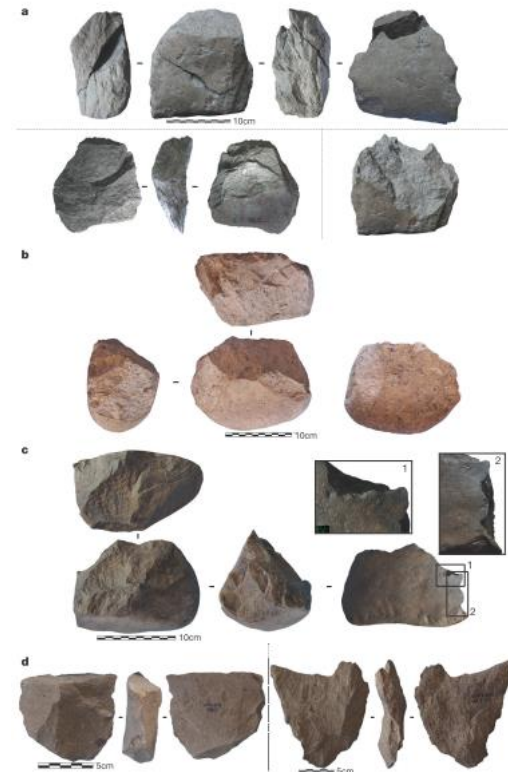
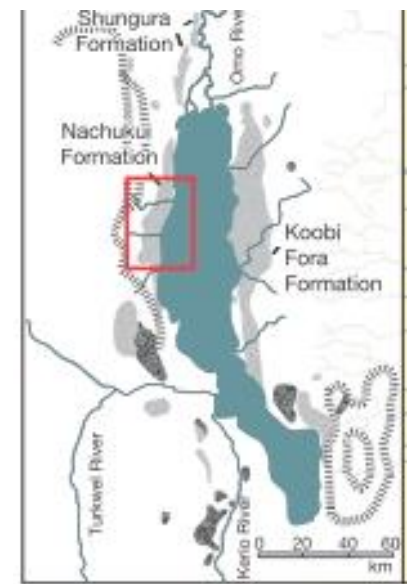


3.3-million-year-old stone tools from Lomekwi 3, West Turkana, Kenya

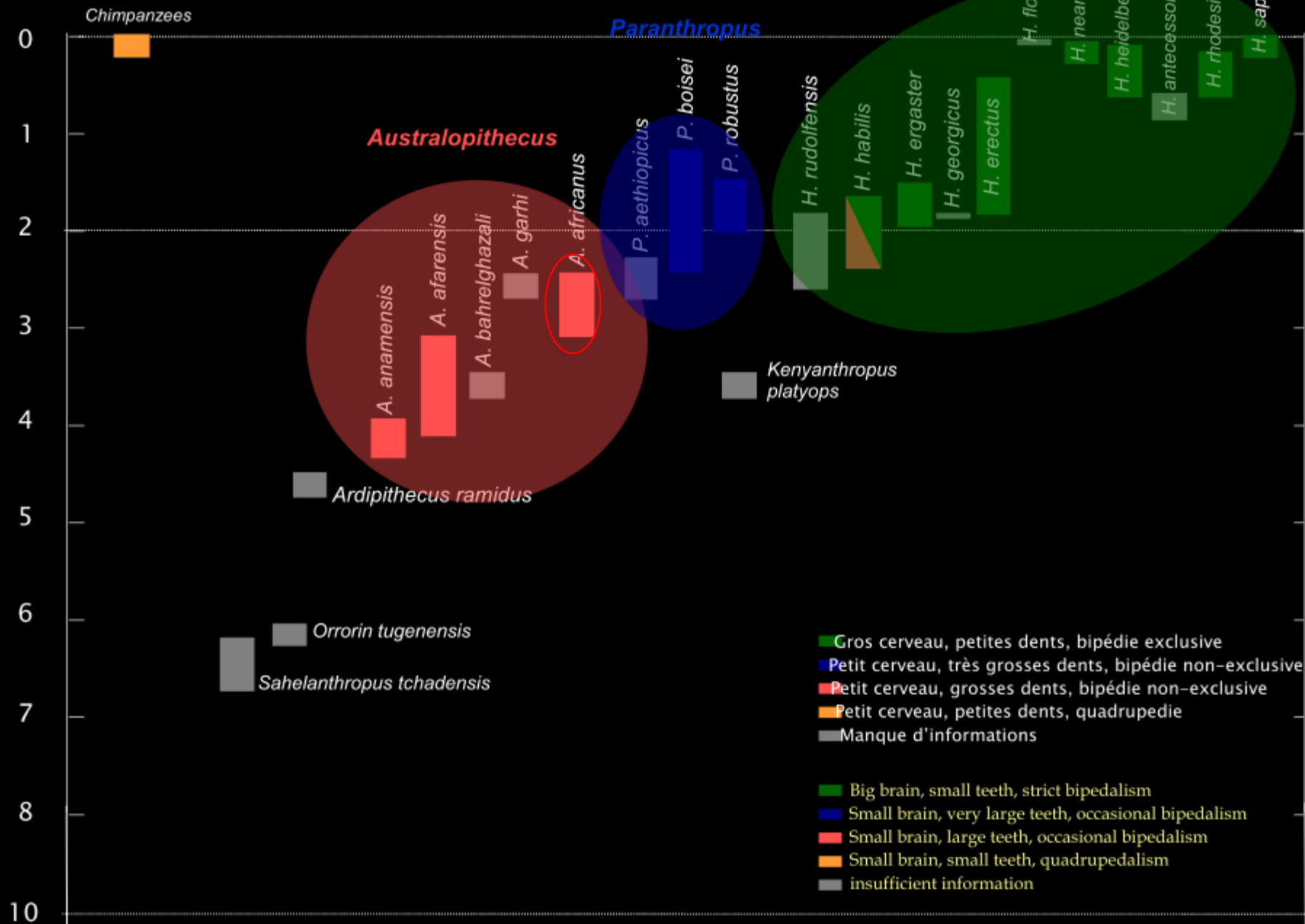
Sonia Harmand^{1,2,3}, Jason E. Lewis^{1,3,4}, Craig S. Feibel^{3,4,5}, Christopher J. Lepre^{3,5,6}, Sandrine Prat^{3,7}, Arnaud Lenoble^{3,8}, Xavier Boës^{3,7}, Rhonda L. Quinn^{3,5,9}, Michel Brenet^{8,10}, Adrian Arroyo², Nicholas Taylor^{2,3}, Sophie Clément^{3,11}, Guillaume Daver¹², Jean-Philip Brugal^{3,13}, Louise Leakey¹, Richard A. Mortlock⁵, James D. Wright⁵, Sammy Lokorodi³, 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)



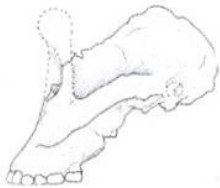


Australopithecus africanus Dart 1925

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, Éthiopie)



Kenyanthropus platyops Leakey *et al.* 2001

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

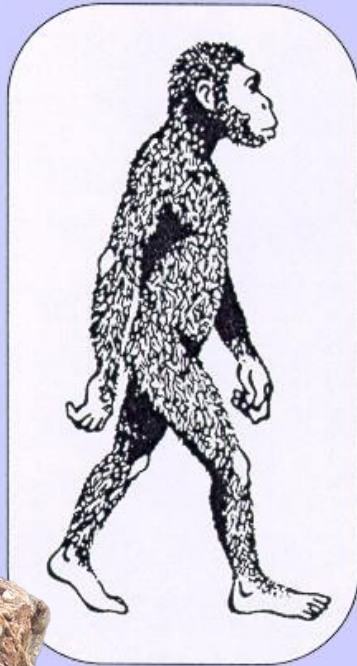
Nom : *Australopithecus africanus*

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

Dates : 3,5 à 1,2 MA

Cerveau : 400 à 500 cm³

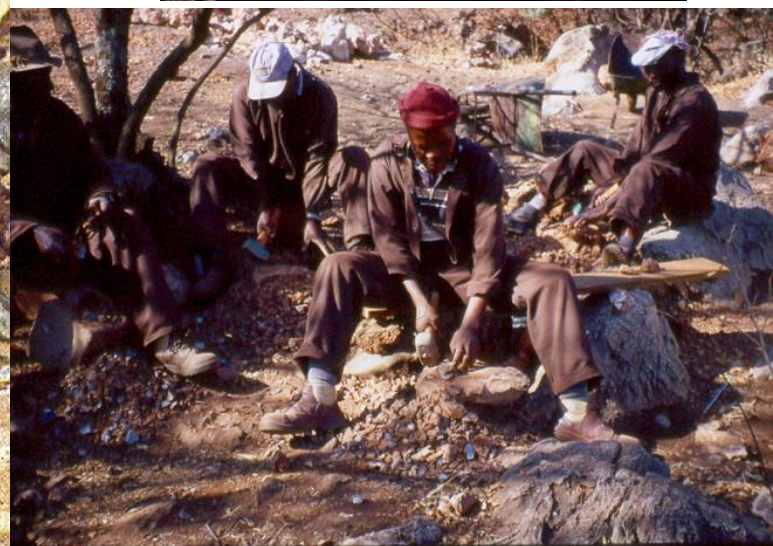
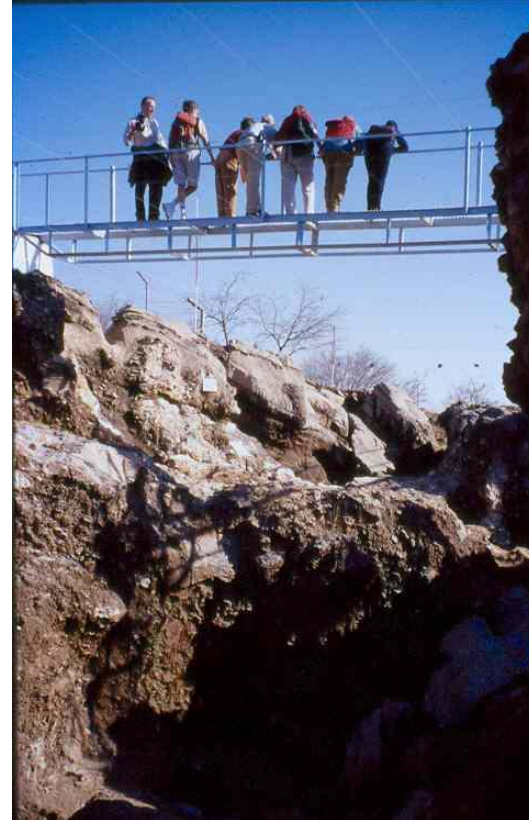
Taille : 1,20 m



Forma intermedia
tra parantropi e
australopiteci

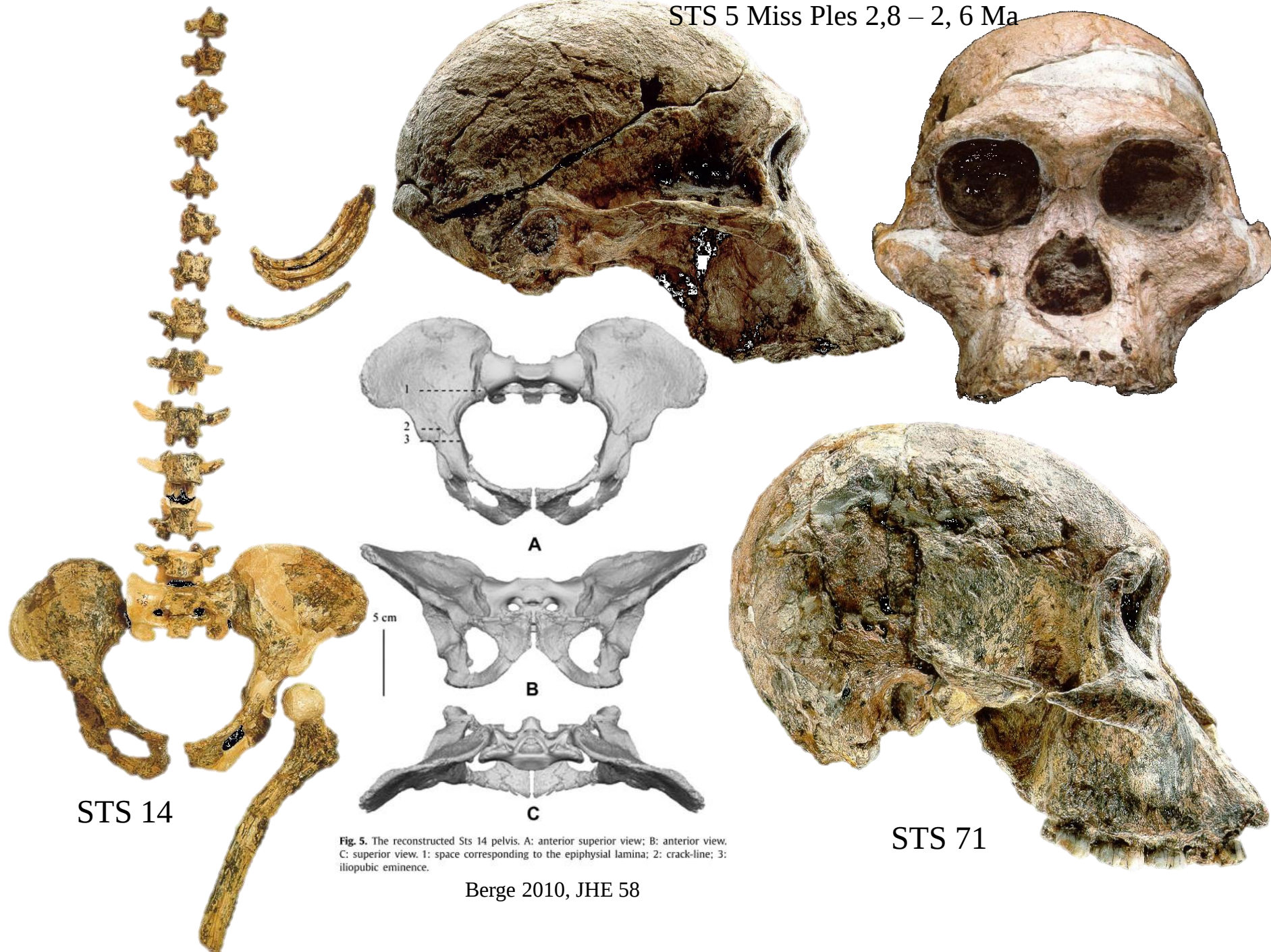


Taung baby 2,6 Ma



Sterkfontein

STS 5 Miss Ples 2,8 – 2, 6 Ma

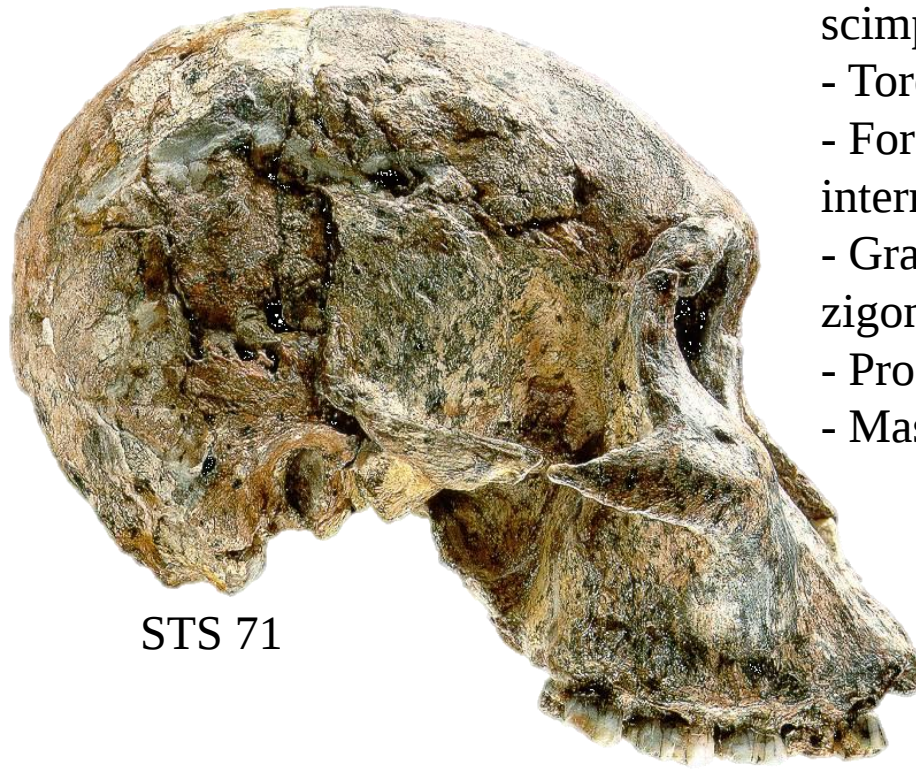


STS 14

STS 71

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

- 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 thicker*
- *Foramen magnum in an intermediate position*
- *Large space between the zygomatic arch and the cranium*
- *Marked alveolar prognathism*
- *Parabolic jaw*

≠ *Au. afarensis*

Scattola cranica più alta e corta senza cresta sagittale

Base del cranio stretta relativamente alla sua lunghezza

Foramen magnum situato posteriormente

Pilastro anteriore proeminente che limita l'apertura nasale

Zona subnasale piatta e meno proiettata relativamente all'asse bicanino

Radice del processo zigomatico prendere origine anteriormente

Corpo mandibolare più robusto

Denti postcanini più larghi



≠ *Au. afarensis*

Higher and shorter braincase with rare sagittal cresting

Cranial base narrow relative to its length

Foramen magnum located more posteriorly

Prominent anterior pillars border the nasal aperture

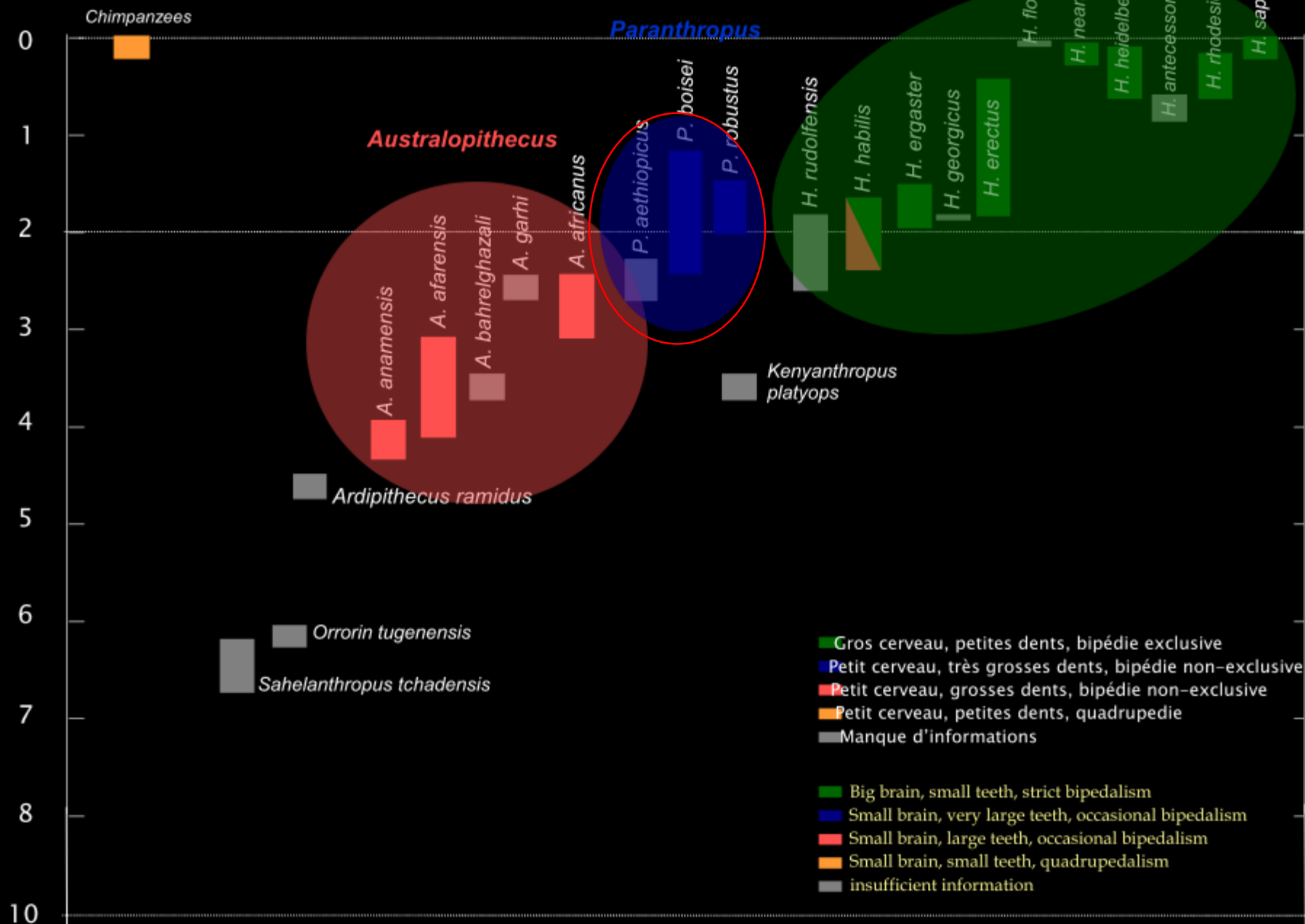
Subnasal plate is flat and much less projecting relative to the bicanine axis

Zygomatic process roots originated more anteriorly

Mandible corpus more robust

Larger postcanine teeth

(Ma)





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

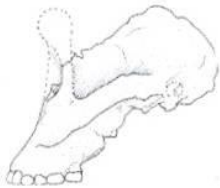


Australopithecus afarensis Johanson, White et Coppens 1978

Holotype : Mandibule LH 4 (Laetoli, Tanzanie)

Synonymies :

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



Paranthropus robustus Broom 1938

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

Synonymies :

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



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)



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)

Australopithecus garhi Asfaw *et al.* 1999

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

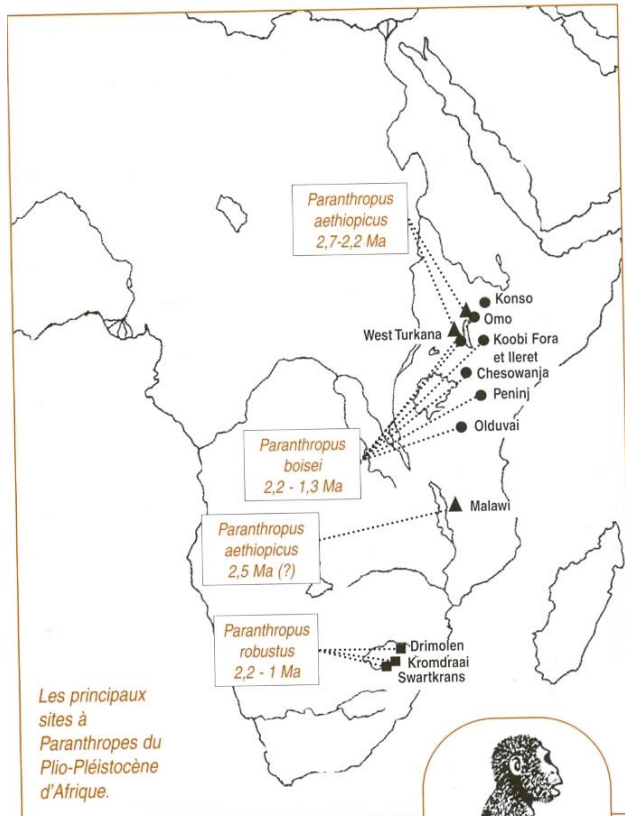


Paranthropus aethiopicus (Arambourg et Coppens 1967)

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

Kenyanthropus platyops Leakey *et al.* 2001

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



Nom : Paranthropus aethiopicus
Origine : Afrique de l'Est (Omo, West-Turkana, Malawi)
Dates : 2,7 à 2,2 Ma
Cerveau : 500 à 550 cm³
Taille : 1,50 m - 1,60 m



P. aethiopicus KNM-WT 17000 2.5 MA

≠ *Au. afarensis*

Extreme midfacial prognathism, flat subnasal plane, vertically thick palate, anteriorly positioned zygomatic process roots, massive postcanine dentition

Nom : *Paranthropus robustus*

Origine : Afrique du Sud
(Swartkrans, Kromdraai)

Dates : 2,2 à 1,5 MA

Cerveau : 500 à 550 cm³

Taille : 1,50 - 1,60 m

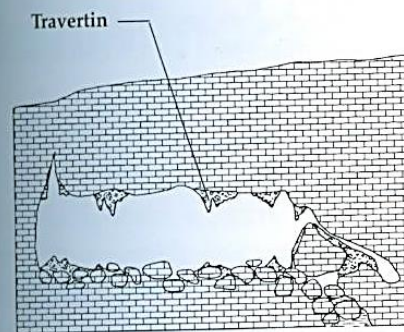
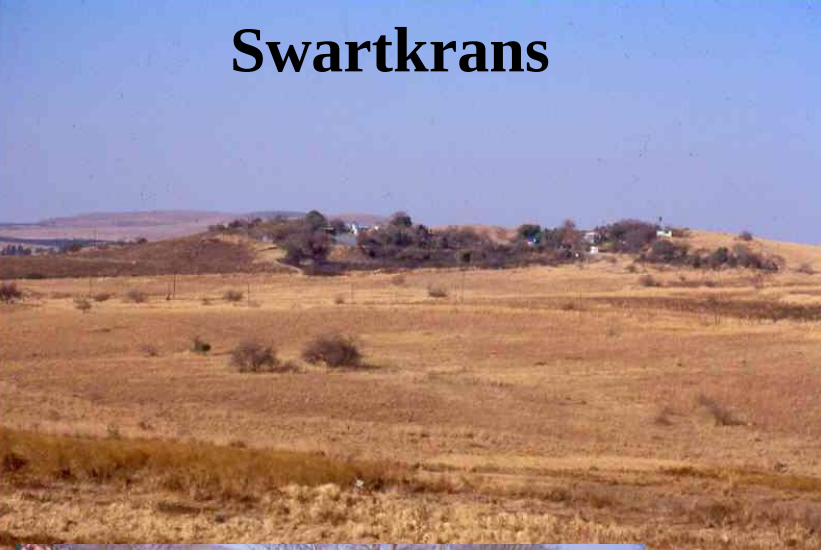


P. robustus SK 48 Swartkrans, 2-1.5 MA

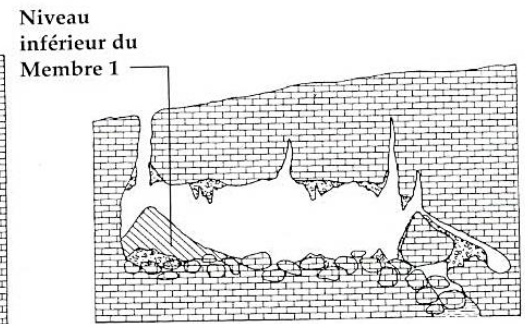
≠ *Au. afarensis*

Large postcanine dentition and unusual
facial morphology with depressed
infraorbital surfaces

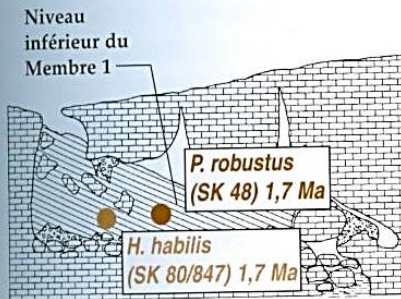
Swartkrans



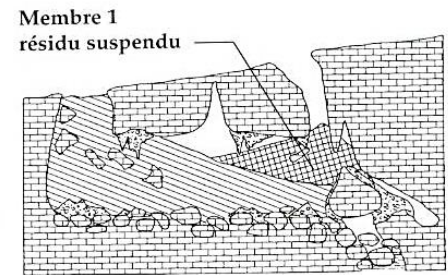
Stade 2



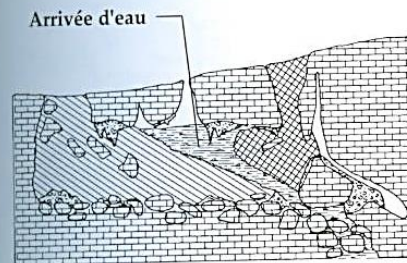
Stade 3



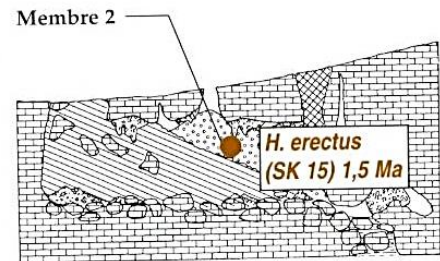
Stade 4



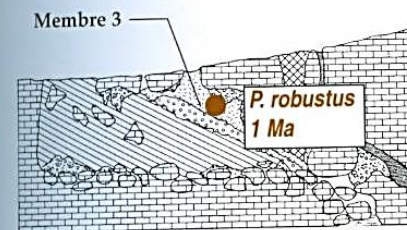
Stade 5



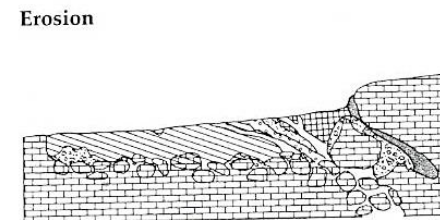
Stade 6



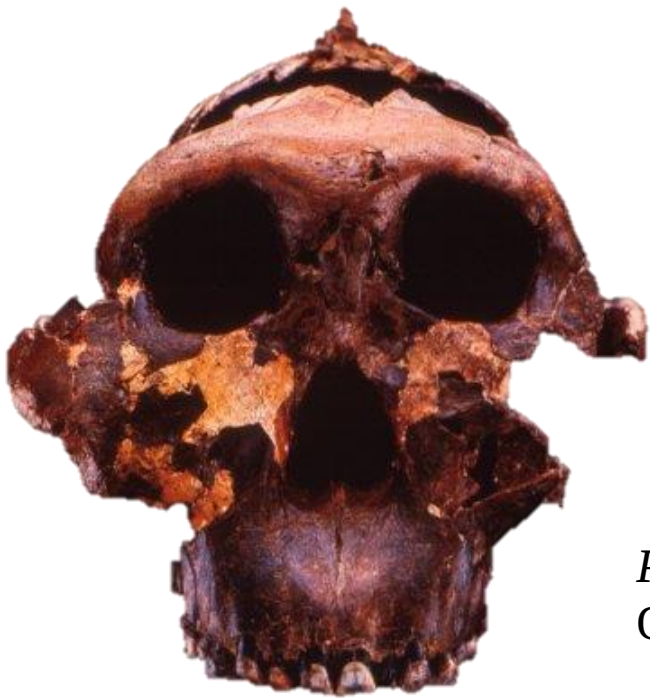
Stade 7



Stade 8



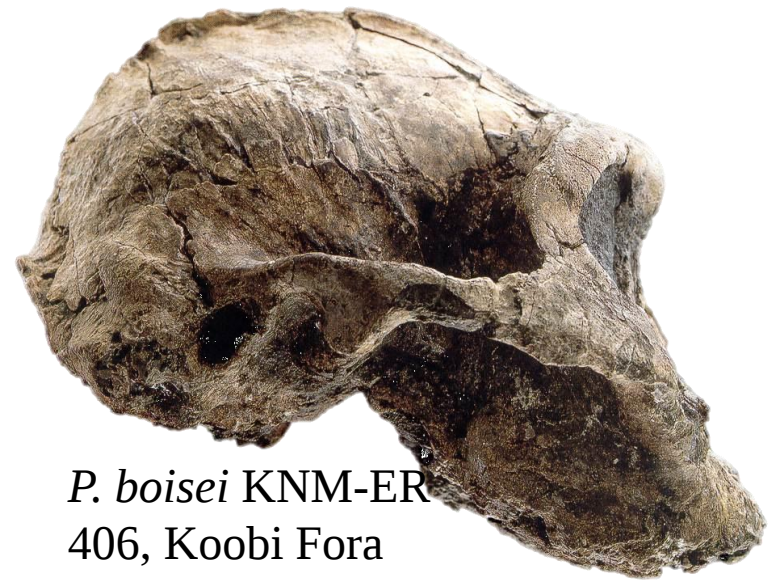
Stade 9



P. boisei OH 5,
Olduvai, 1.8 MA



P. boisei KNM-ER
372, 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 più corto

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

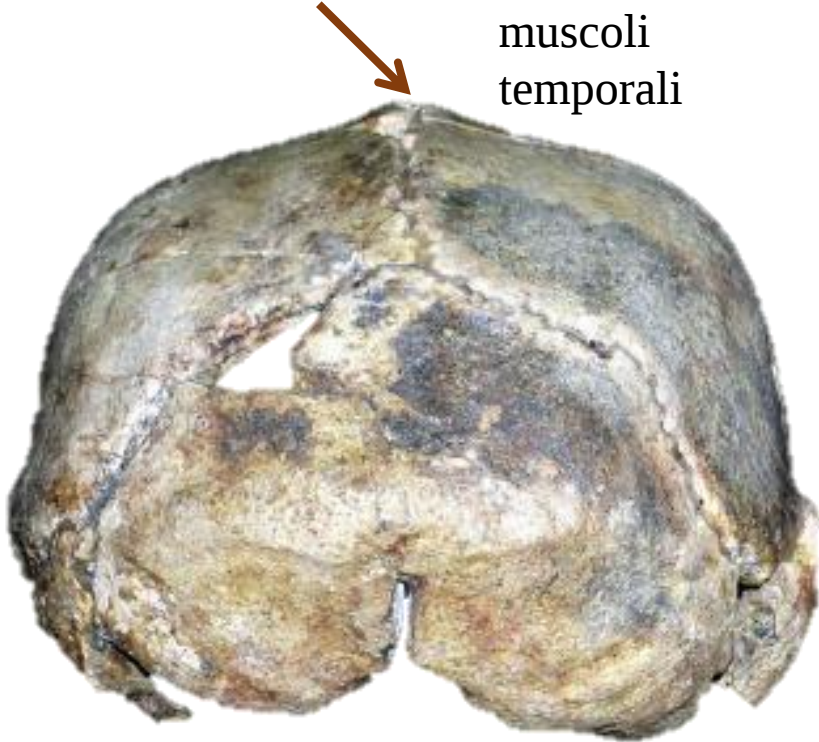
Carena sagittale

VS

Cresta sagittale

Carena sagittale

Inserzione dei
muscoli
temporali



Robustezza ossea

Cresta sagittale : Inserzione dei
muscoli temporali



Robustezza muscolare

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

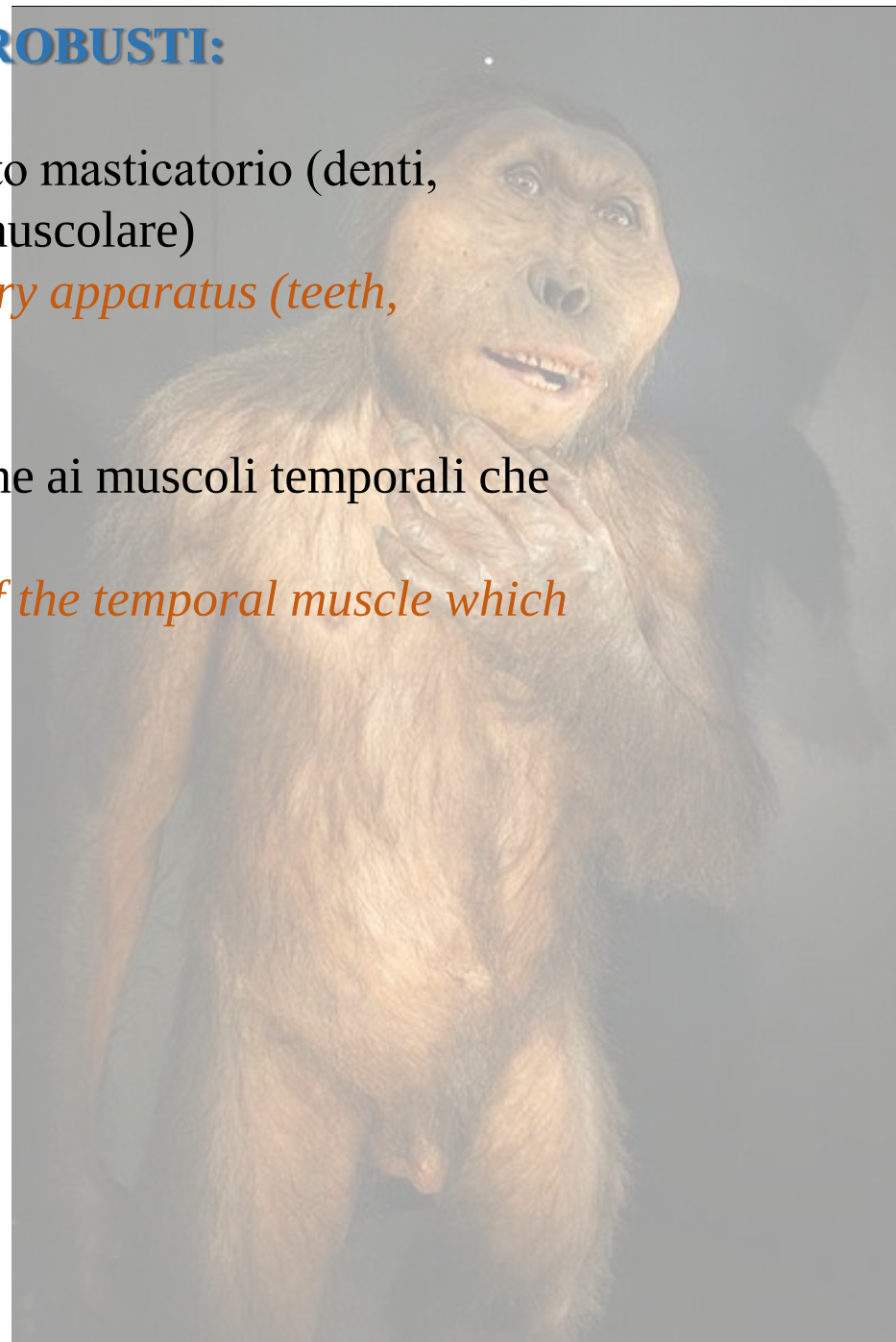
Wide temporal fossa

-Arcate zigomatiche vistose

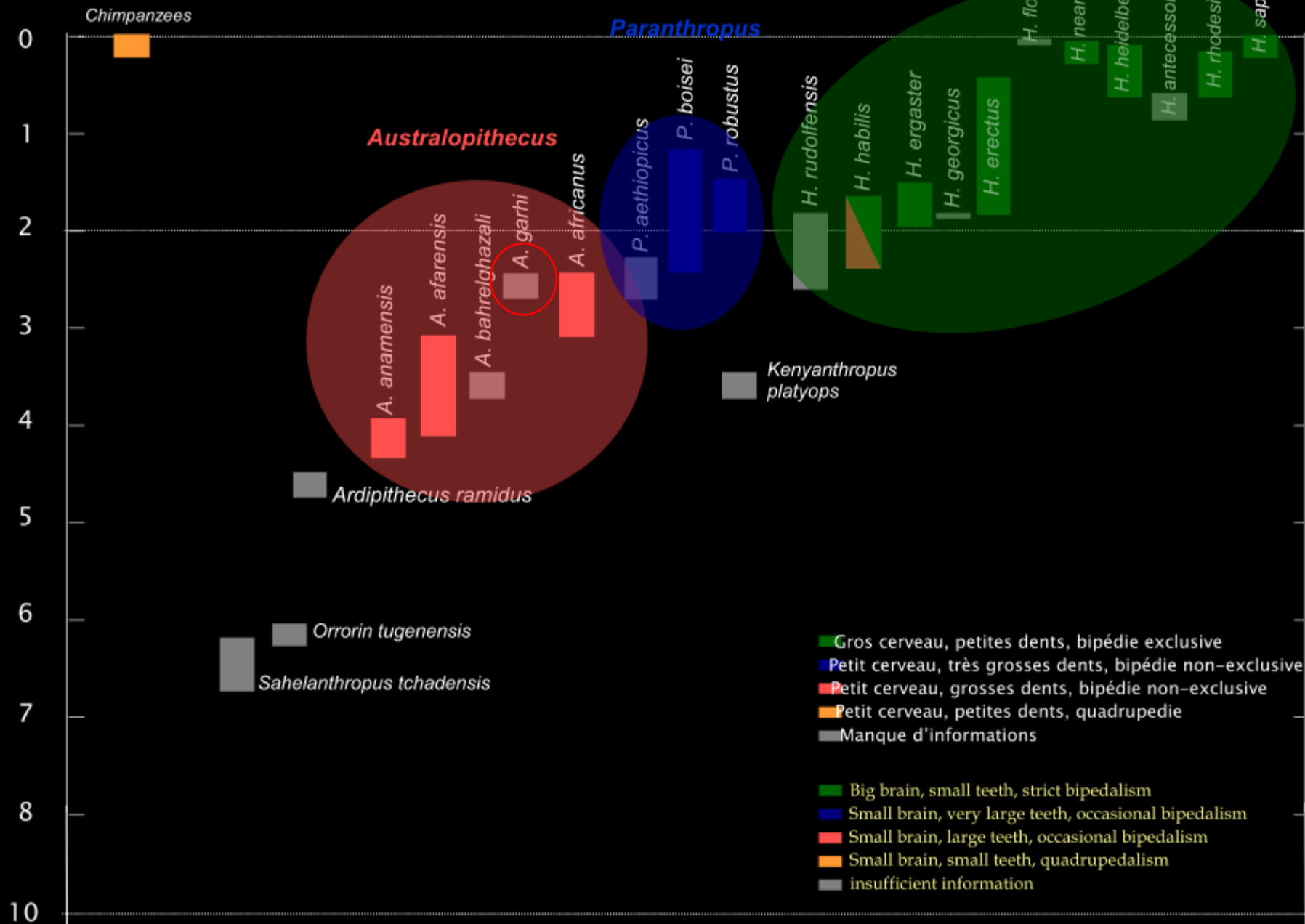
Considerable zygomatics

-Scheletro facciale accorciato

Short face



(Ma)



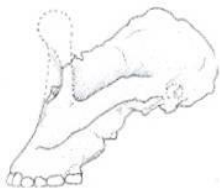


Australopithecus africanus Dart 1925

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, Éthiopie)



Kenyanthropus platyops Leakey *et al.* 2001

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



BOU-BP-12-130

Età : 2, 5 Ma

Intermediario tra *Au. 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 Au. 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



La parte bassa della faccia è prognata con gli incisivi orientate verso il basso.

Le radice dei canini sono posizionati ai lati dei margini dell'apertura nasale.

Il palato è verticalmente sottile

Le radici dei zigomatici si nascono sopra P4/M1

L'arcata dentaria è a U, con una leggera divergenza dei corpi.

La squama frontale postglabellare è depressa con un trigone frontale.

Presenza di una costrizione post-orbitale

I parietali presentano una cresta sagittale bipartita posizionata anteriormente e che si divide sopra lambda..

La capacità cranica è di circa 450 cc





The lower face is **prognathic** with incisors lying down.

Canine roots are placed quite laterally to the nasal aperture margin.

The palate is vertically thin.

The zygomatic roots originate above P4/M1.

The dental arcade is **U-shaped**, with slightly divergent dental rows.

The postglabellar frontal squama is depressed in a frontal trigon.

There is marked **postorbital constriction**.

The parietal bones have a well-formed, bipartite, anteriorly positioned sagittal crest that divides above lambda.

Cranial capacity of approximately 450 cc (reconstructed)





Femore allungato, diverso da *Pan* e *Au. afarensis*, simile a *Homo*
Femur elongated, different from Pan and Au. Afarensis, similar to Homo

Rapporto braccio/avambraccio vede l'avambraccio molto sviluppato, come in *Pan* e *Au. afarensis*

Relation arm/forearm with the forearm more developed, like in Pan and Au. Afarensis.

Dimorfismo sessuale sembra piuttosto marcato

Sexual dimorphism rather marked

Possibile persistenza di adattamenti alla vita arboricola nello scheletro dei piedi

Possible persistence of arboreal locomotion in the foot skeleton



ARTICLE

doi:10.1038/nature14448

New species from Ethiopia further expands Middle Pliocene hominin diversity

Yohannes Haile-Selassie^{1,2}, Luis Gibert³, Stephanie M. Melillo⁴, Timothy M. Ryan⁵, Mulugeta Alene⁶, Alan Deino⁷, Naomi E. Levin⁸, Gary Scott⁷ & Beverly Z. Saylor²

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.

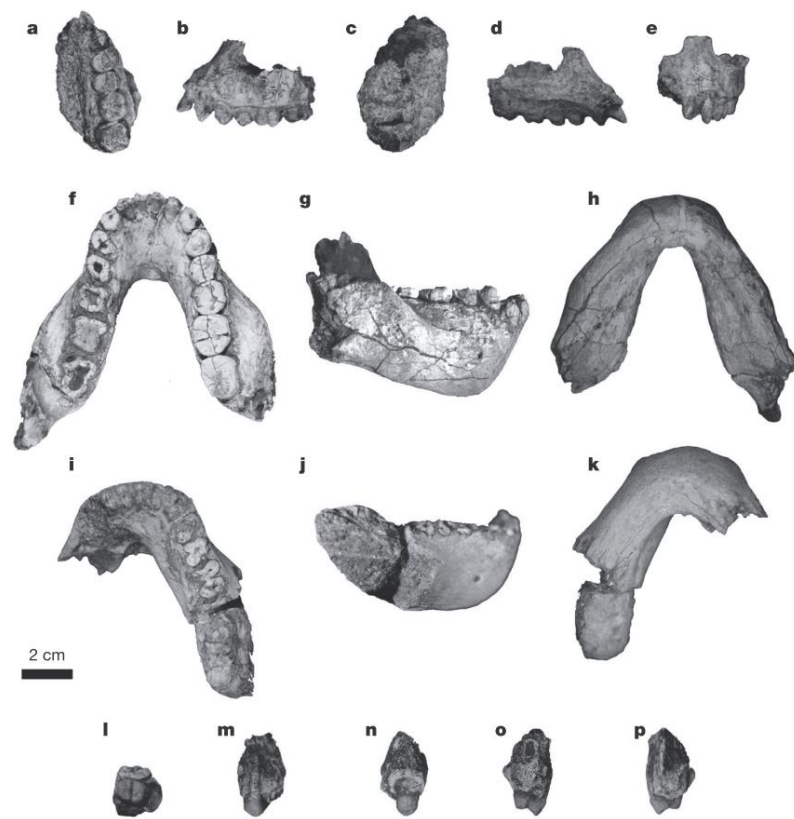
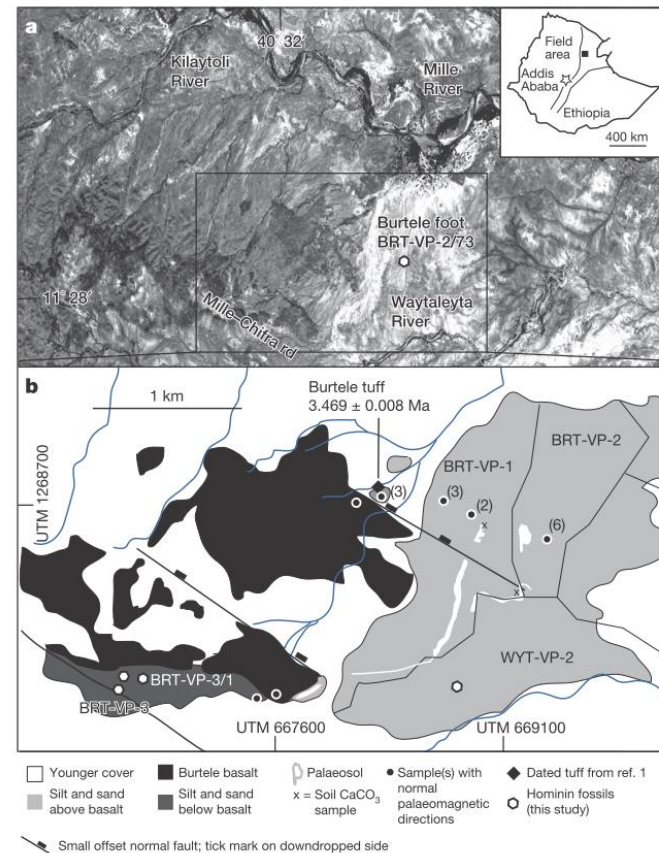


Figure 1 | Holotype BRT-VP-3/1. a, Occlusal view. b, Lateral view. c, Superior view. d, Medial view. e, Anterior view. Paratype BRT-VP-3/14. f, Occlusal view. g, Right lateral view. h, Basal view. Paratype WYT-VP-2/10. i, Occlusal view. j, Right lateral view. k, Basal view. Referred specimen BRT-VP-3/37.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



Diagnosi differenziale: *Au. deyiremeda* è

≠ *Ar. ramidus* per: smalto molto più spesso, P4 con 3 radice e una mandibola robusta

≠ *Au. anamensis* per un profilo della sinfisi mandibolare poco sfuggente, un corpo mandibolare più robusto, una P3 bicuspid

≠ *Au. afarensis* per l'architettura generale della mandibola, mancanza di un corpo laterale incavato, dente superiore postcanine più piccole.

≠ *Au. garhi* per il suo prognatismo subnasale ridotto e le dimensione ridotte dei canini e post-canini.

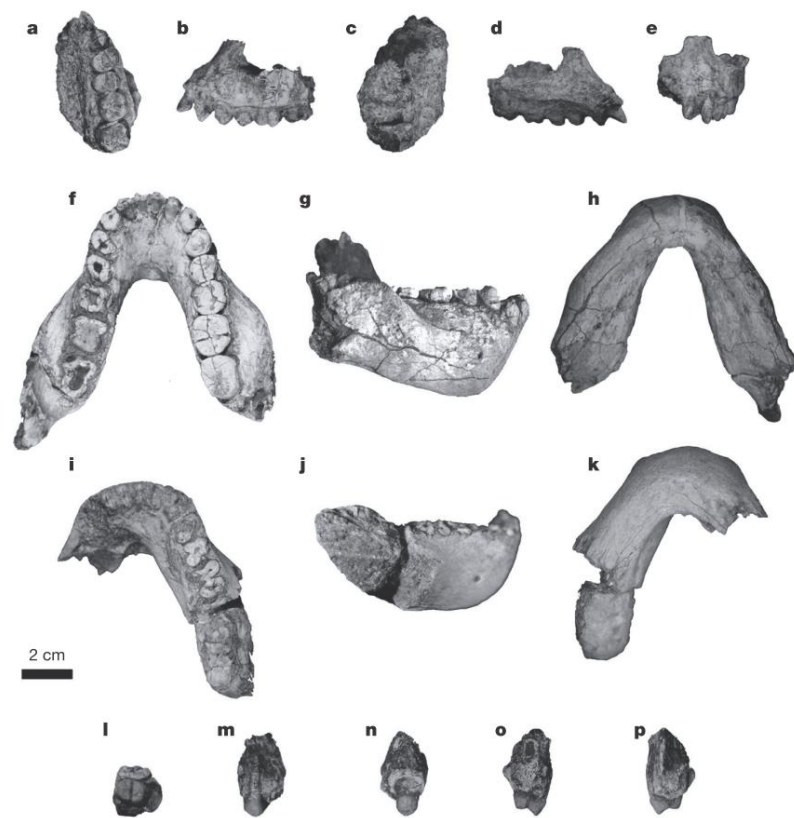
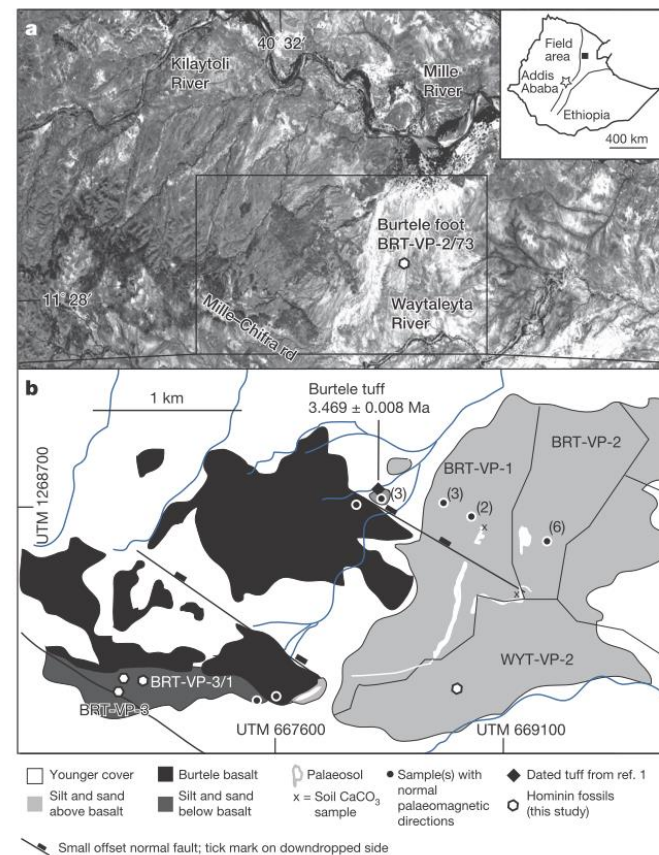


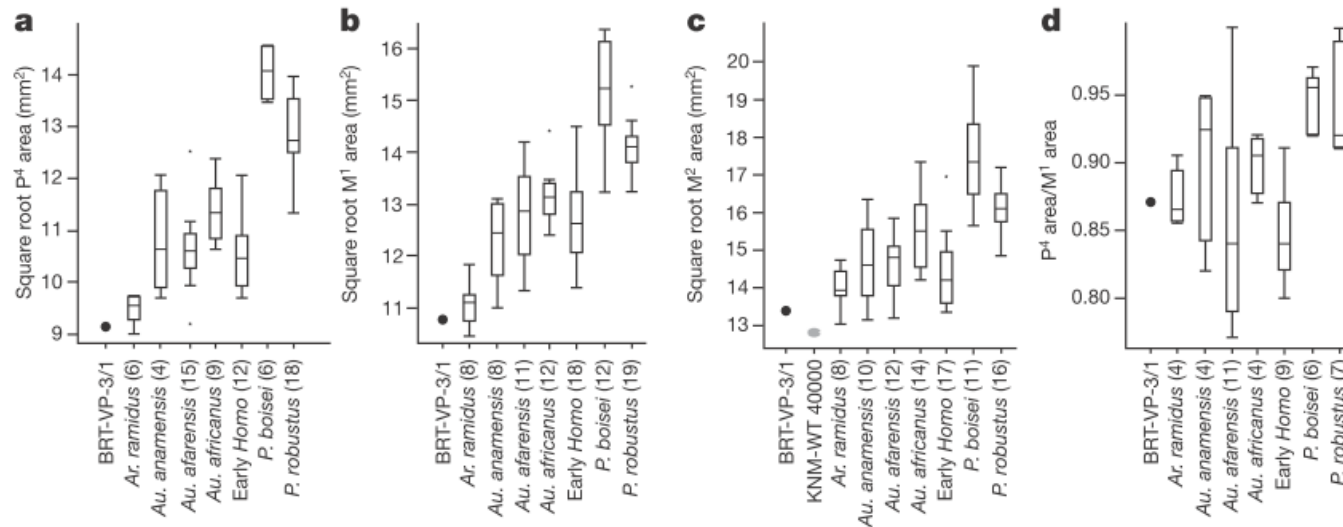
Figure 1 | Holotype BRT-VP-3/1. a, Occlusal view. b, Lateral view. c, Superior view. d, Medial view. e, Anterior view. Paratype BRT-VP-3/14. f, Occlusal view. g, Right lateral view. h, Basal view. Paratype WYT-VP-2/10. i, Occlusal view. j, Right lateral view. k, Basal view. Referred specimen BRT-VP-3/37.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



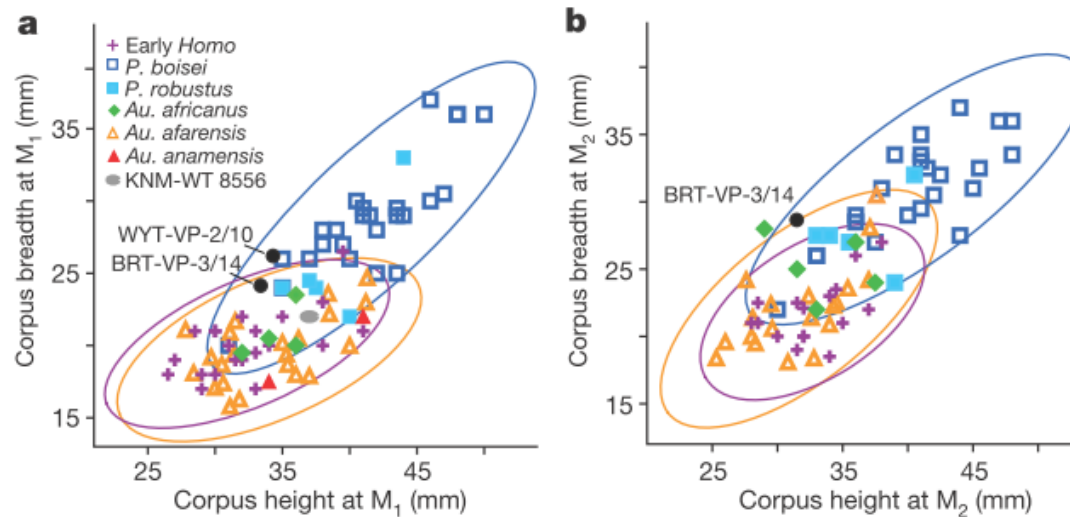
Differential diagnosis : *Au. deyiremeda* is $\neq$ *Ar. ramidus* in having absolutely thicker enamel on its molars, a P 4 with three-roots, a robust mandible. $\neq$ *Au. anamensis* in lacking an extremely receding mandibular symphysis, having a more robust mandibular corpus and a bicuspid P 3.

$\neq$ *Au. afarensis* by its overall mandibular architecture, including the lack of a lateral corpus hollow, the reduced dimension of the postcanine maxillary

$\neq$ *Au garhi* by its reduced subnasal prognathism and absolutely smaller canines and postcanine dentition.



Confronto delle dimensioni dentarie / *dental dimensions comparison*



Confronto delle dimensioni mandibolare / *mandibular dimensions comparison*

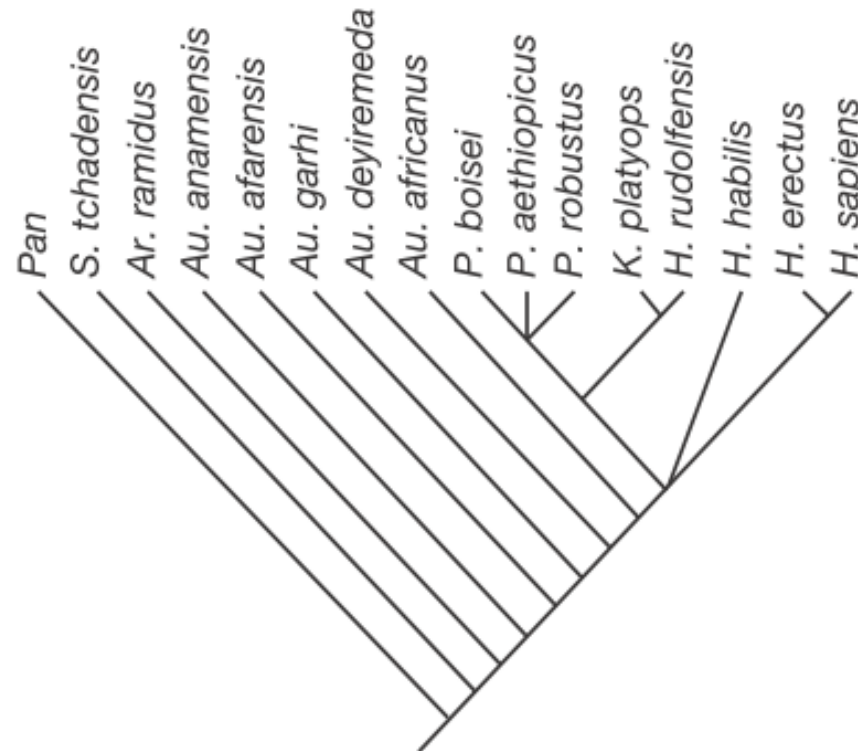


Figure 6 | Cladogram depicting the majority-rule consensus of 17 equally parsimonious trees that result from a phylogenetic analysis of the features preserved in the *Au. deyiremeda* hypodigm. Tree length = 63, consistency index = 0.63. The position of *Au. garhi* and topologies within the *Paranthropus* + *Kenyanthropus* + *Homo* clade are unstable when these features are considered. However, *Au. deyiremeda* is consistently placed as a sister taxon to a clade that includes *Au. africanus*, *Paranthropus*, and *Homo* (see Supplementary Notes 6–8 for further details).

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. Kibii¹

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.

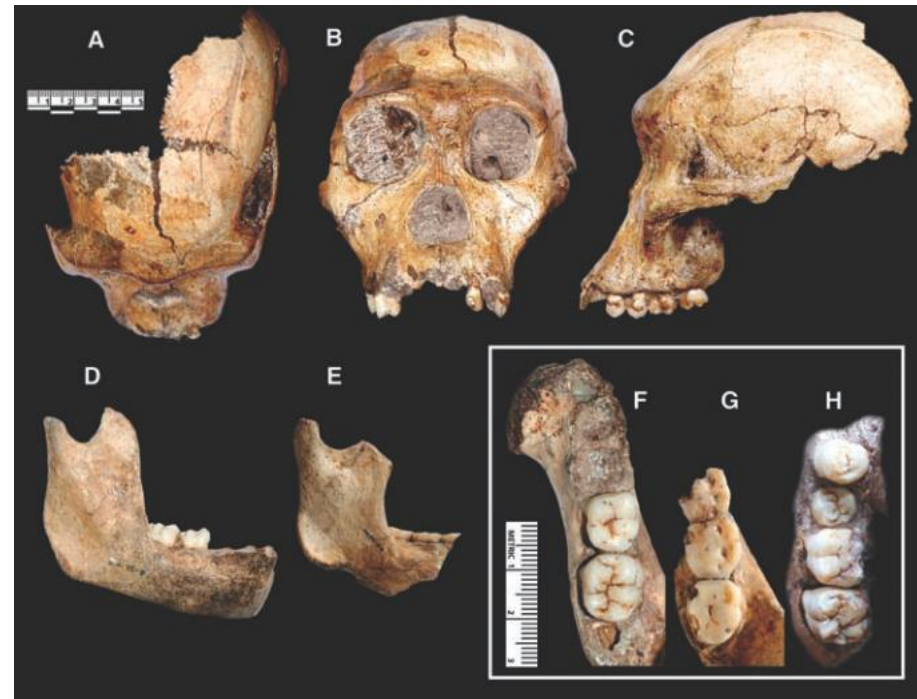
Età: 1,95 e 1,78 Ma

Sito: Malapa, Sudafrica

Resti: 2 scheletri parziali

Caratteristiche:
condividono più caratteri derivati con i primi *Homo* che tutti i altri Australopitecine

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).



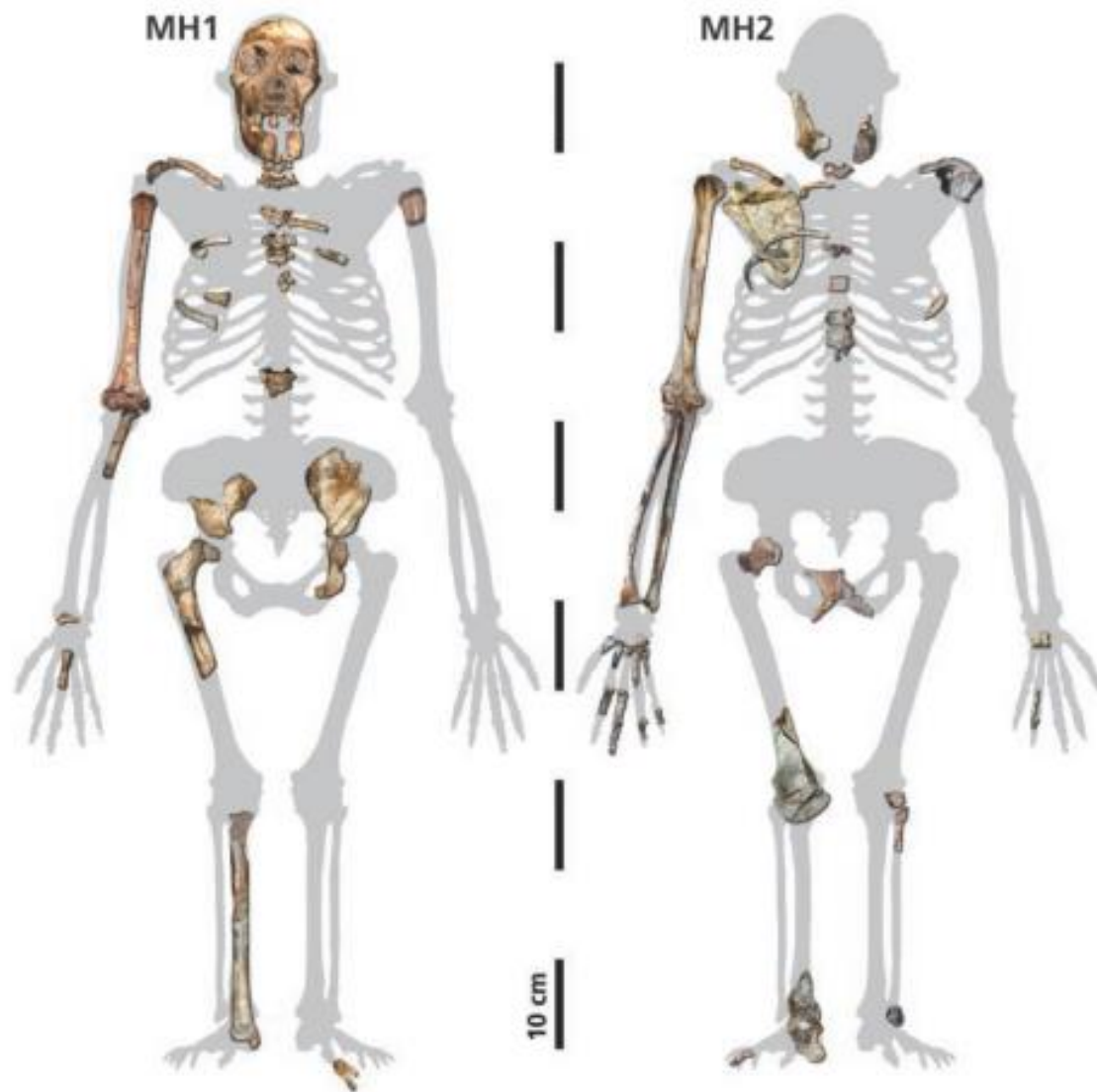
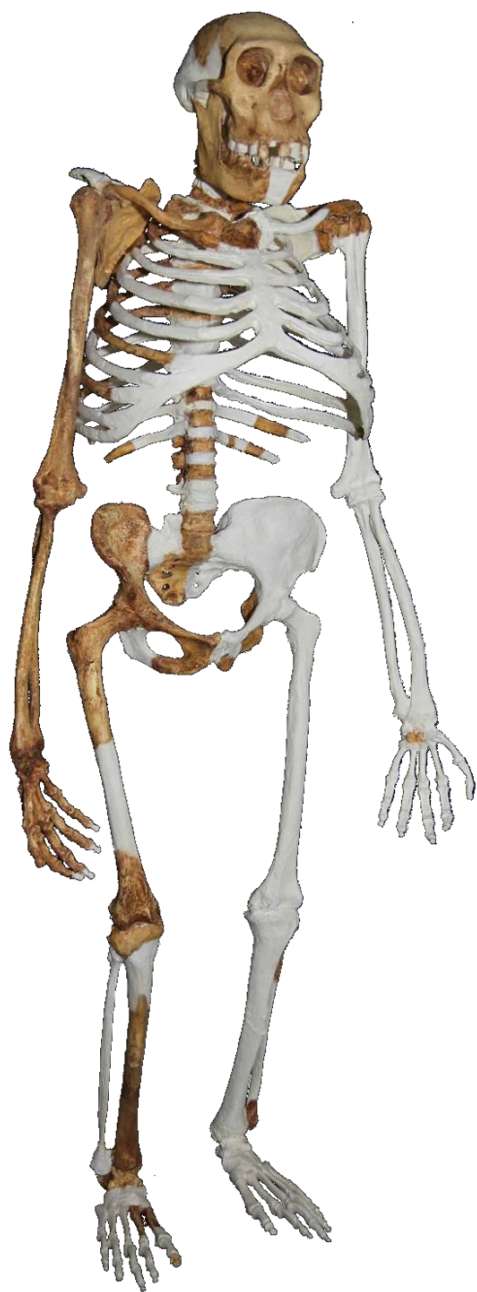
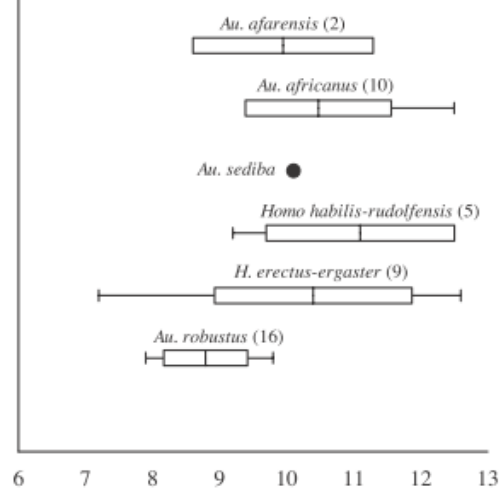
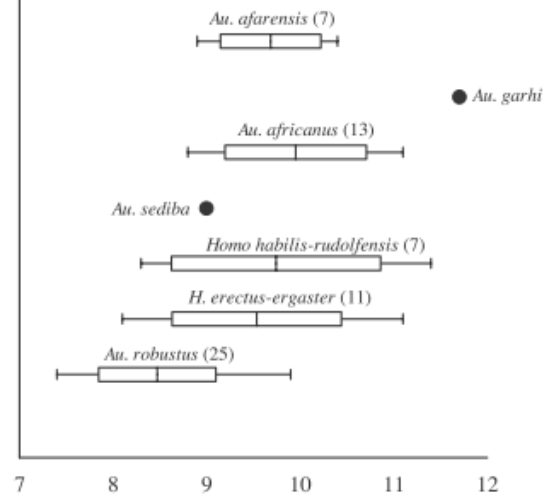


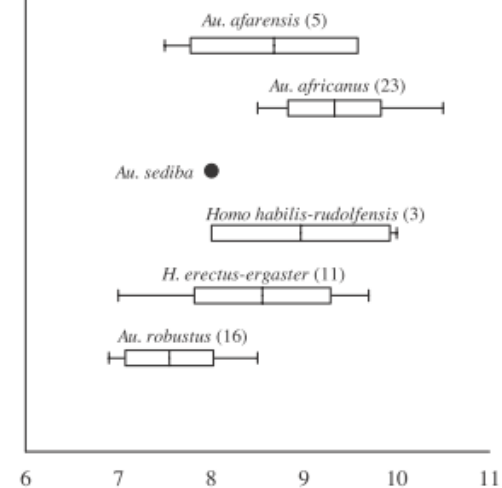
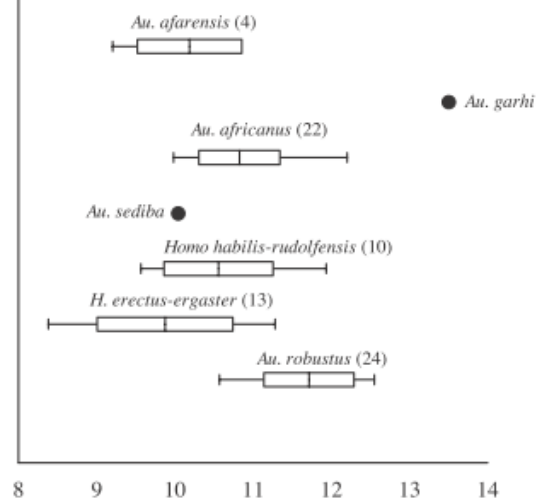
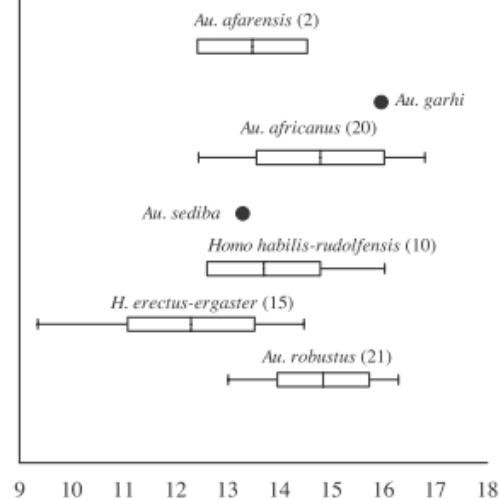
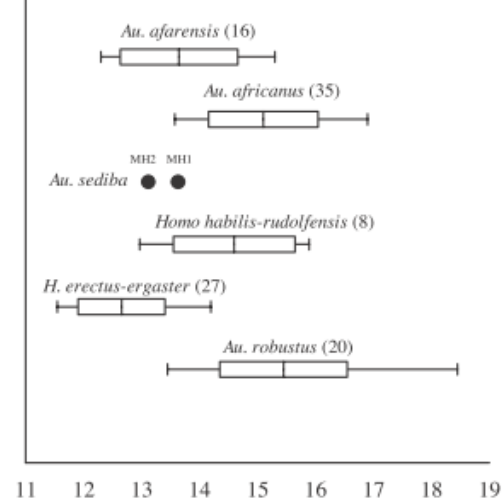
Fig. 2. Associated skeletal elements of MH1 (**left**) and MH2 (**right**), in approximate anatomical position, superimposed over an illustration of an idealized *Au. africanus* skeleton (with some adjustment for differences in body proportions). The proximal right tibia of MH1 has been reconstructed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

AUT¹ length (MD)**B**

UC length (MD)

**C**

LC length (MD)

**D**UP³ area (sqrt)**E**UM² area (sqrt)**F**LM₂ area (sqrt)

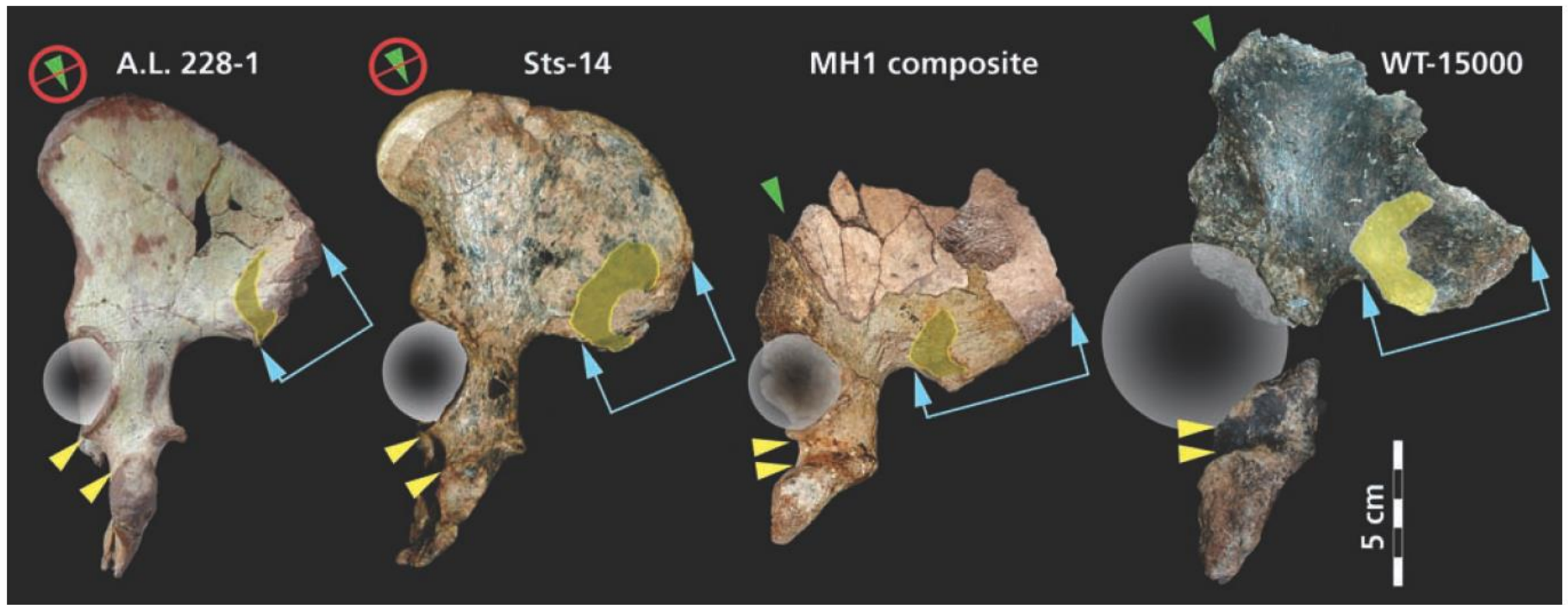
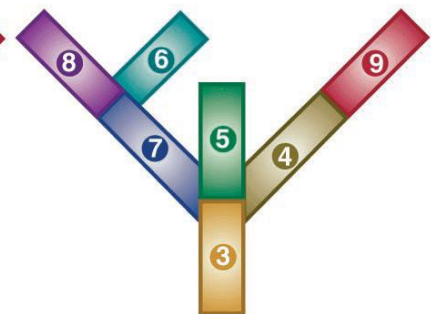
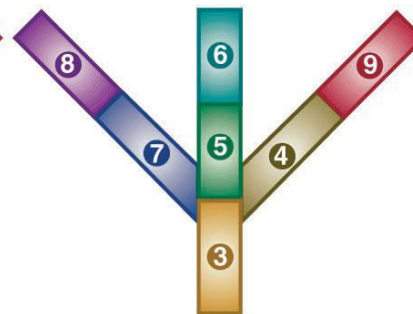
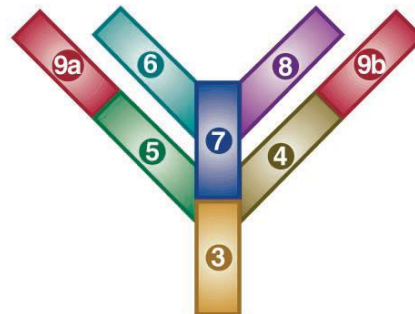
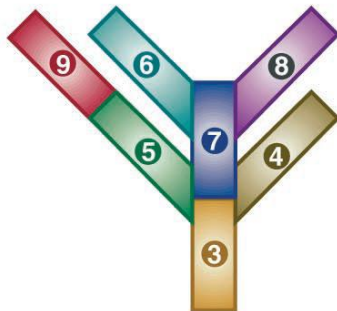
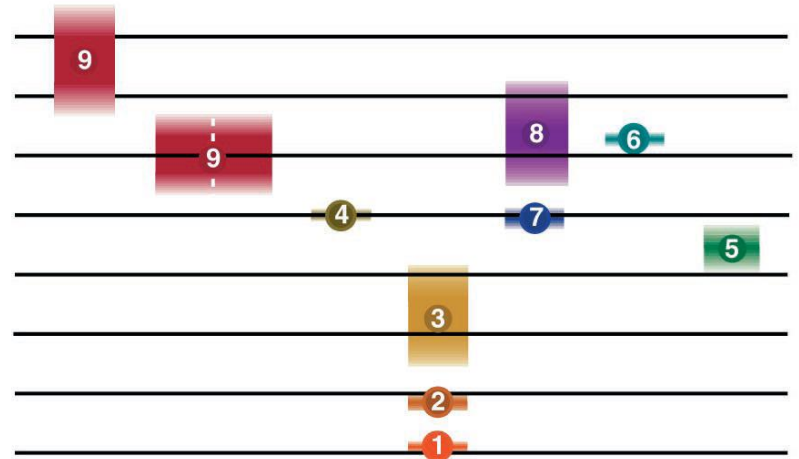
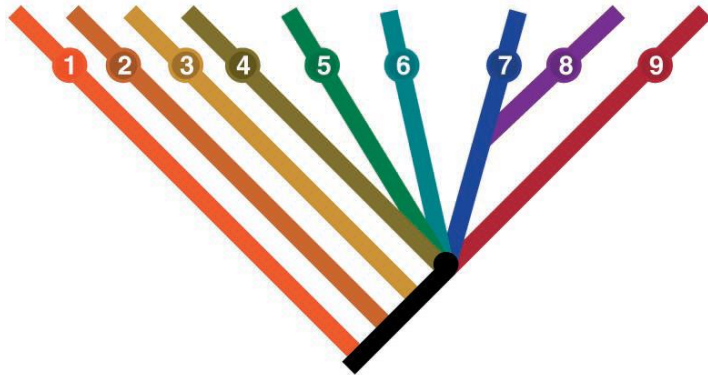


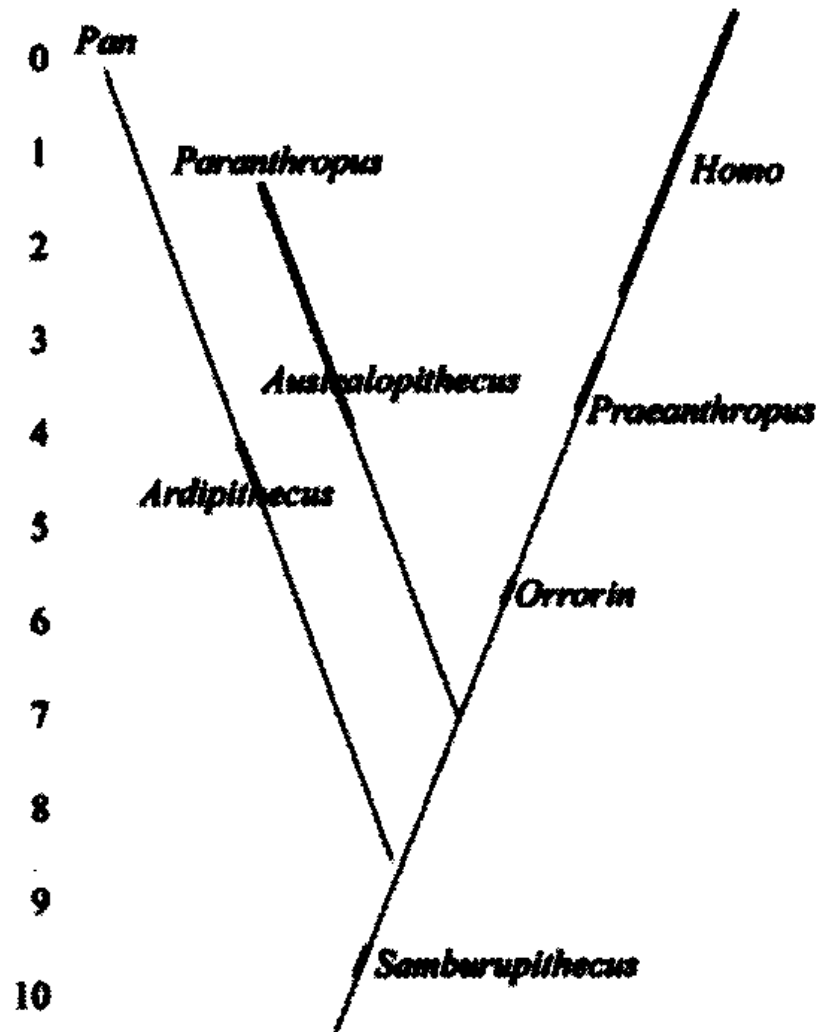
Fig. 4. Representative ossa coxae, in lateral view, from left to right, of *Au. afarensis* (AL 288-1), *Au. africanus* (Sts 14), *Au. sediba* (MH1), and *H. erectus* (KNM-WT 15000). The specimens are oriented so that the iliac blades all lie in the plane of the photograph (which thus leads to differences 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 acetabulocrystal (green arrows) and acetabulosacral buttresses.

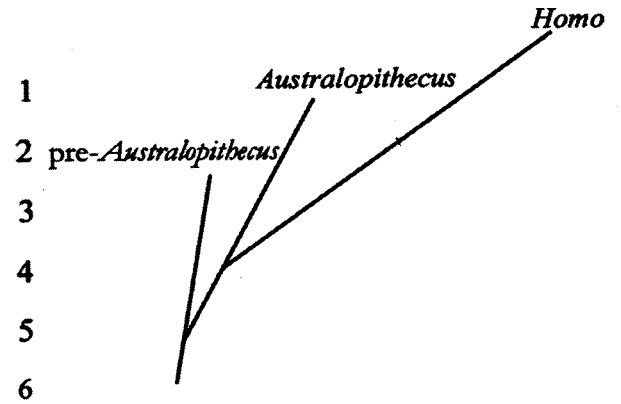
In confronto ai altri Australopitecini, MH1 possiede una morfologia *Homo*-like, coinvolgendo anche una riduzione relativa del trasferimento di peso dal sacroiliaco (giallo) alla giunzione dell'anca (cerchio)

- 1- *Ardipithecus ramidus* 2- *Australopithecus anamensis*
 3- *Australopithecus afarensis* 4- *Australopithecus garhi*
 5 – *Australopithecus africanus* 6- *Australopithecus robustus*
 7 – *Australopithecus aethiopicus* 8- *Australopithecus boisei*
 9- *Homo*

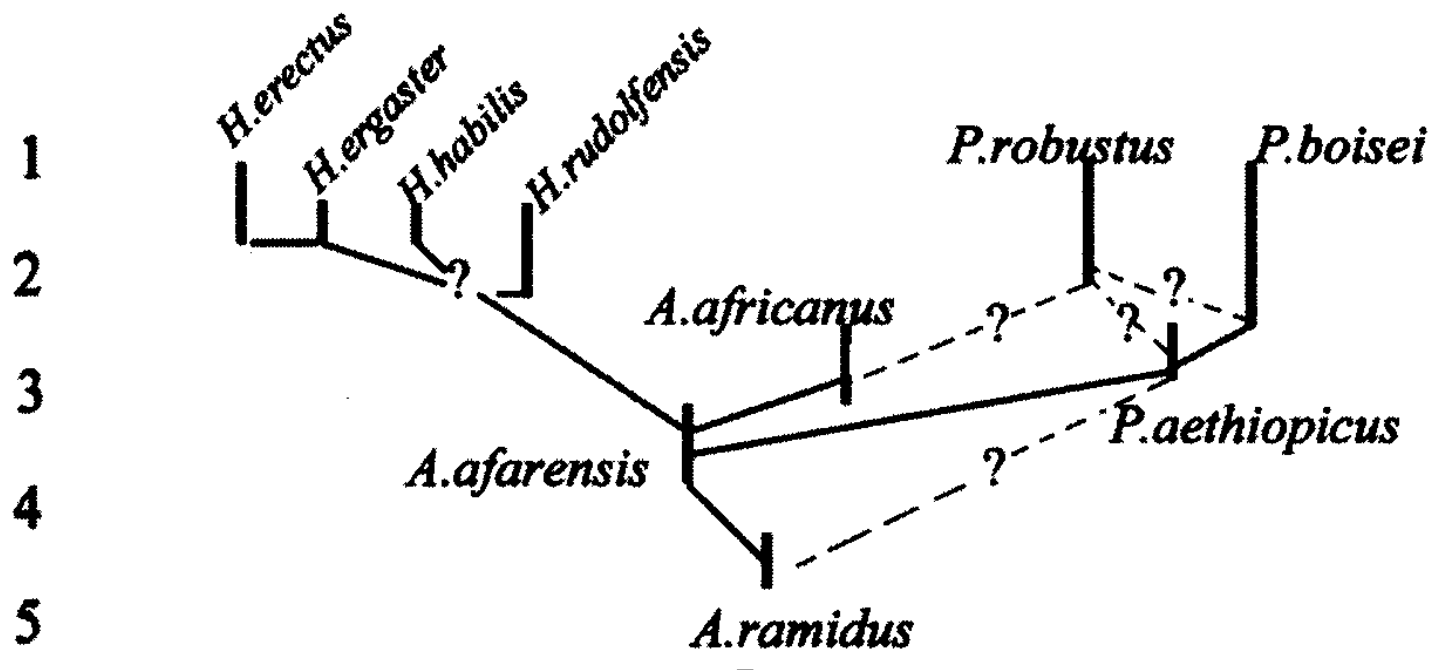




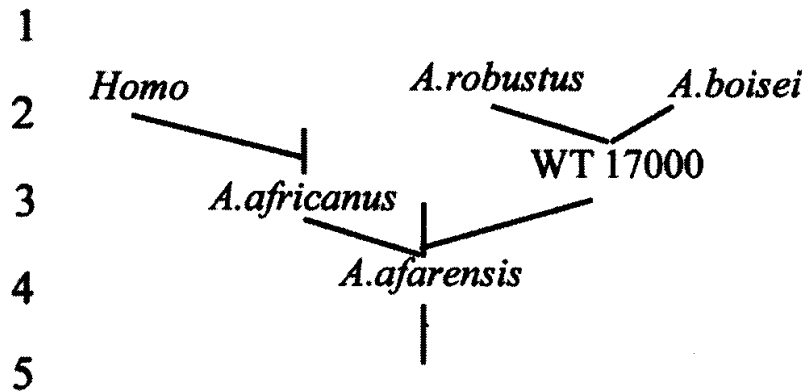
Senut *et alii*, 2001



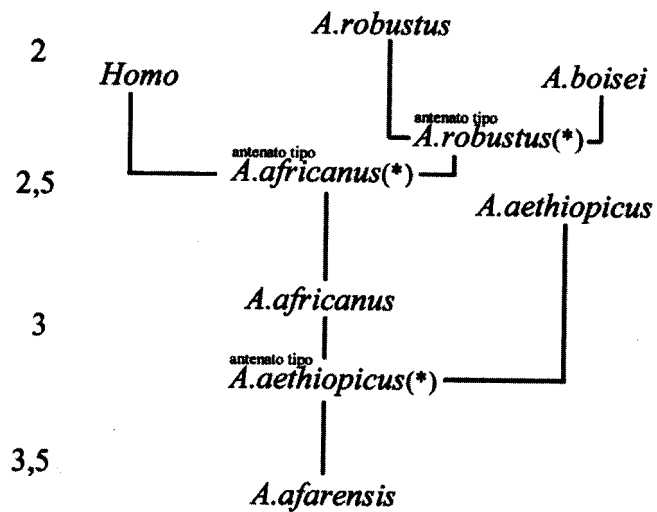
Coppens 1983



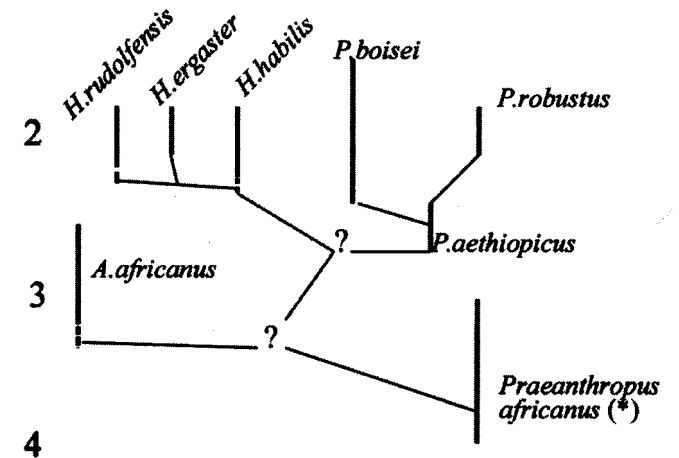
Wood, 1994



Delson 1986



Skelton et alii 1992



(*) *A. afarensis*

Strait et alii 1997