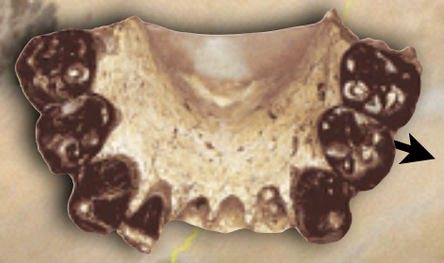
Australopithecus afarensis

Garusi (Laetoli) maxilla fragment found 1939

Australopithecus afarensis distribution

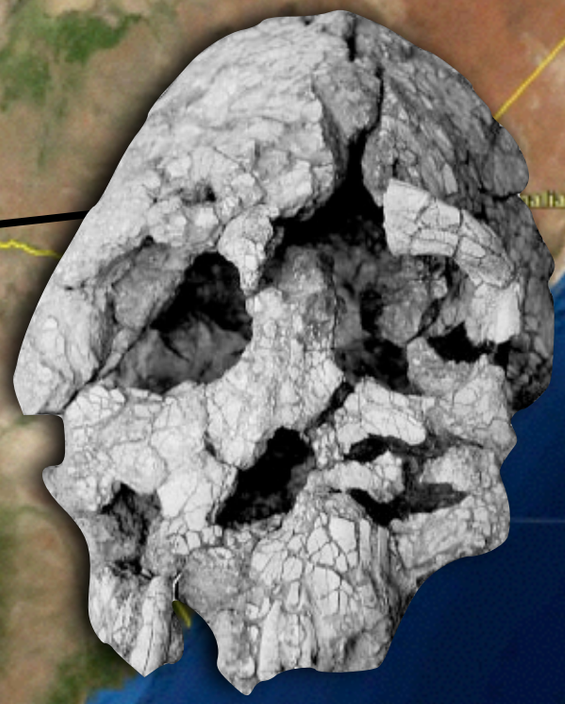


Hadar, Dikika

Middle Awash: Maka

Laetoli

Laetoli footprints, Tanzania



Chad

Central African Republic

Eritrea

Yemen

Djibouti

Ethiopia

Somalia

Uganda

Kenya

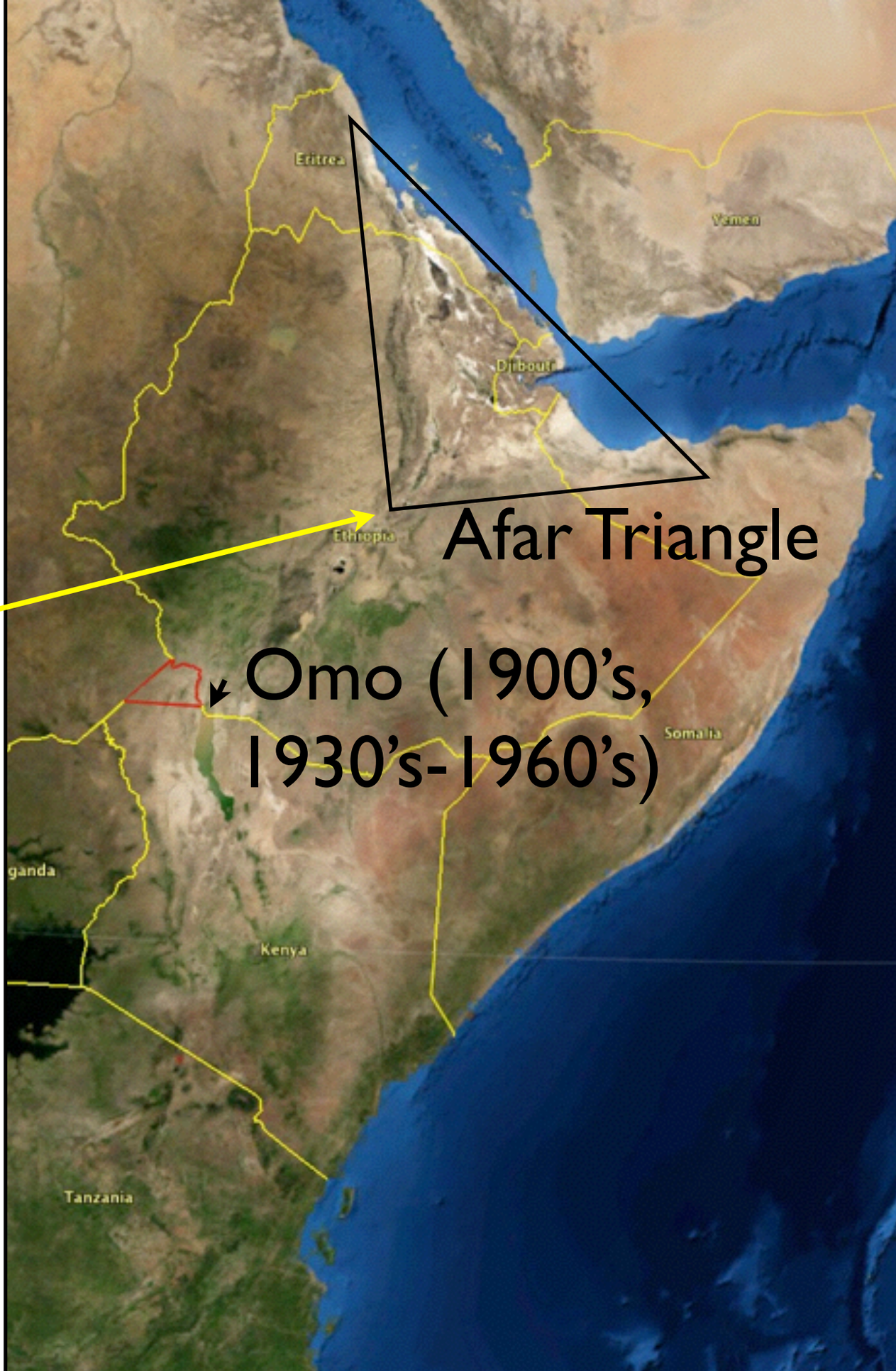
Rwanda

Burundi

Tanzania

The Afar Triangle 1970's-present

Although fossils from the southern portion of the Ethiopian Rift have been known since the 1902 (de Bozas French Expedition to the Omo), the paleoanthropological potential of the Awash River basin, which traces the Afar Rift, was not realized until the 1965 discovery of Melke Kunture by United Nations Development Programme water project personnel and its excavation by Chavaillon (Chavaillon et al., 1979). Chavaillon influenced geology student Maurice Taieb, who explored further north in the Afar basin in the late 1960's. Taieb discovered many fossiliferous areas, including what would later become the Middle Awash and Hadar paleoanthropological study areas. After reconnaissance work in 1970, Taieb was joined in 1972 by John Kalb, Yves Coppens, and Donald Johanson. They formed the International Afar Research Expedition (IARE) and began work at Hadar 1973.



Lower strata at Omo were about 3 Ma.

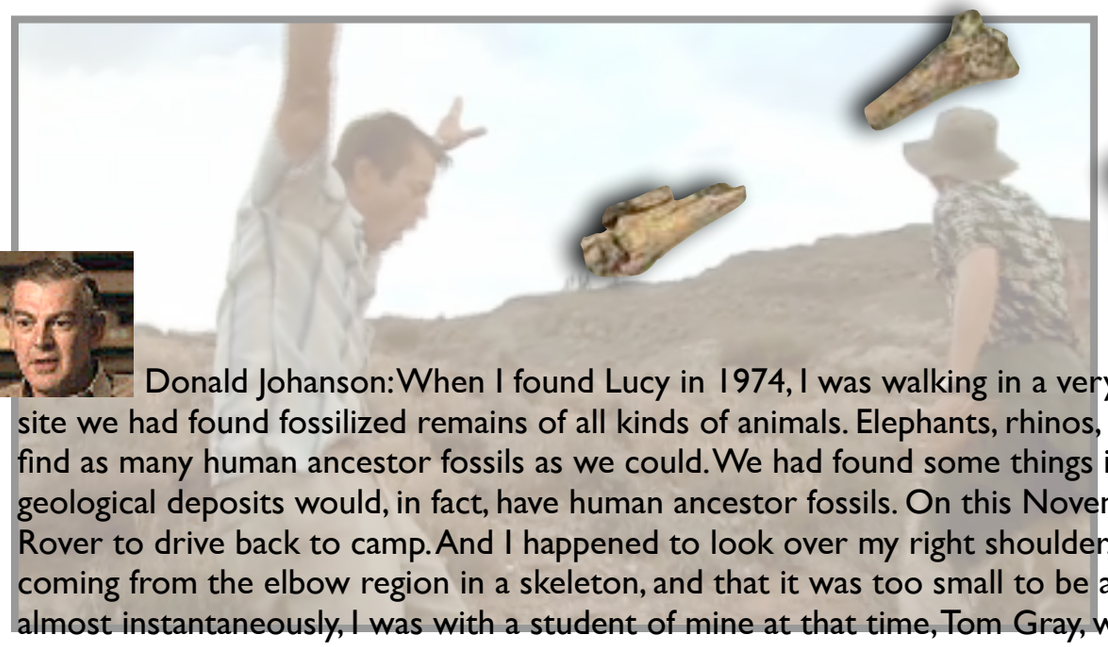
They had teeth (no skulls)

Everyone was saying they were *Au. africanus*

AL (Afar locality) 129 knee joint.
Johansen took it to Nairobi without telling Taib or Kalb.

1974: Lucy

A.L. 288-1



Donald Johanson: When I found Lucy in 1974, I was walking in a very desolate, remote part of Ethiopia known as Hadar. At the Hadar site we had found fossilized remains of all kinds of animals. Elephants, rhinos, gazelles, monkeys, and so on. But our main goal, of course, was to find as many human ancestor fossils as we could. We had found some things in 1973 that titillated us and alerted us to the fact that these geological deposits would, in fact, have human ancestor fossils. On this November morning, it was about noon, I was heading back to my Land Rover to drive back to camp. And I happened to look over my right shoulder. And as I did so, I saw a fragment of a bone which I recognized as coming from the elbow region in a skeleton, and that it was too small to be anything but one of these Hominids. And the anatomy was right. And almost instantaneously, I was with a student of mine at that time, Tom Gray, we realized that there were fragments of her, of this skeleton, that were distributed along a slope. There was a piece of a leg, there was a piece of a pelvis, there was a piece of a jaw, there was a piece of a skull. And I realized almost instantaneously that we had part of a skeleton. Normally, we are happy to find a fragment of jaw, a few isolated teeth, a bit of an arm, a bit of a skull. But to find associated body parts is extremely rare. I realized that no matter what it was, even if it was from a creature that we already knew about, another kind of human ancestor that had already been studied and named and so on, it was going to be important because so few discoveries had arms associated with legs, bits of skull associated with a pelvis. I realized immediately that this was a terribly important find, a terribly important discovery, but I didn't realize at the moment how important it would be until we had spent a lot of time in the laboratory studying her. http://www.achievement.org/autodoc/page/joh1int-1

Hadar

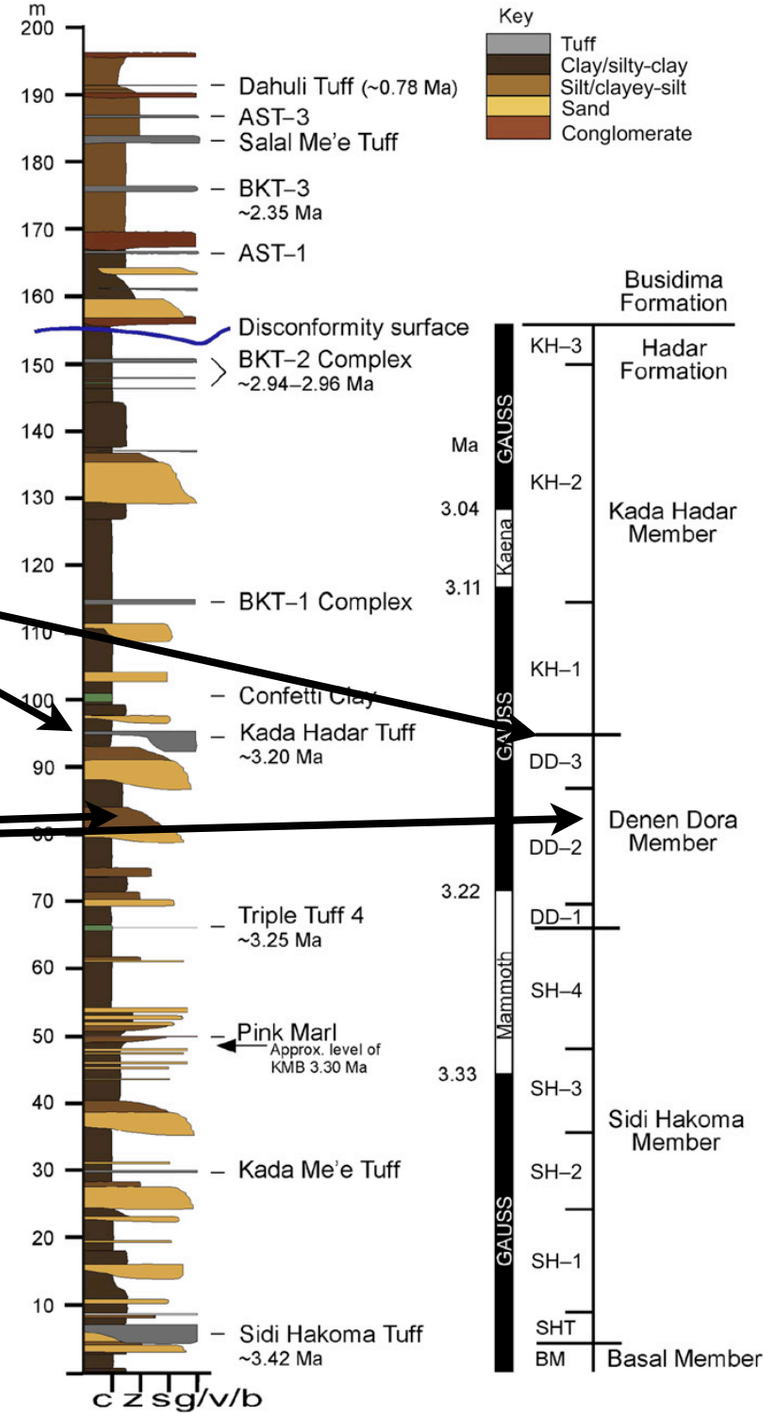
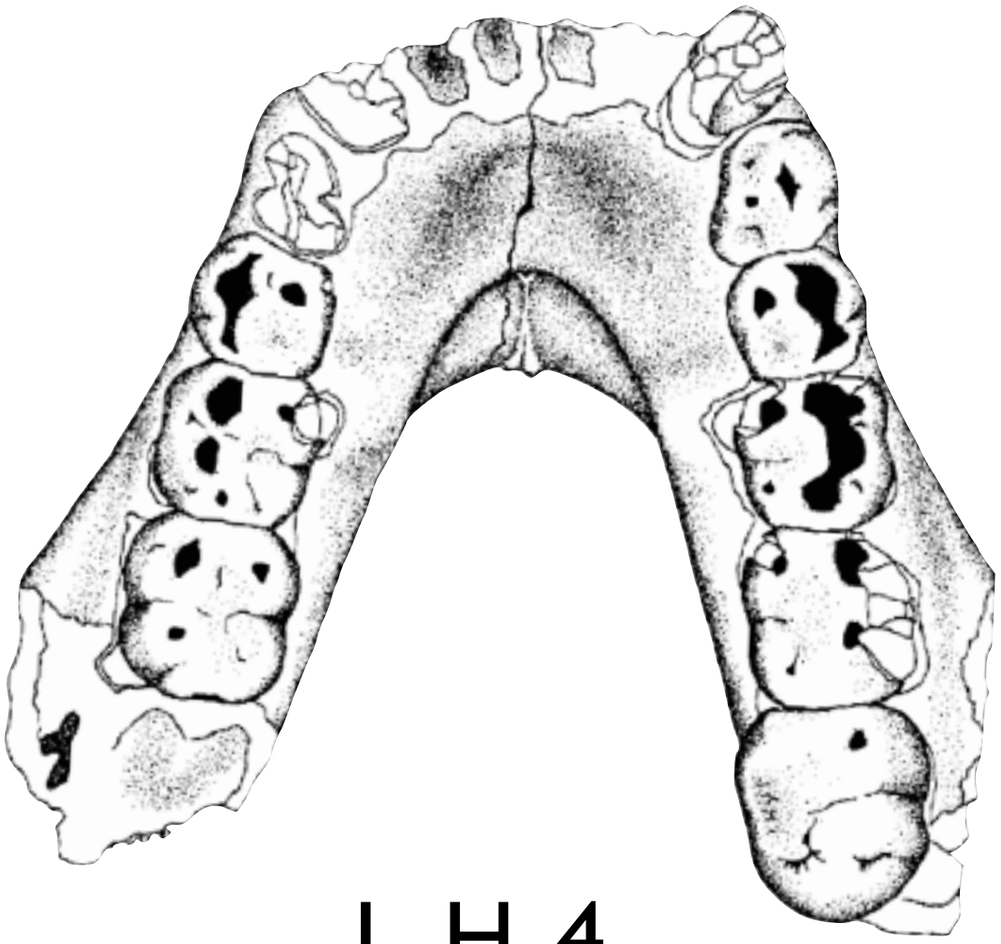


Fig. 1. Composite stratigraphic section of the Hadar and Busidima Formations at Hadar (courtesy of C. Campisano). Tuffs, major marker beds, and submember divisions are labeled alongside the section. $^{40}Ar/^{39}Ar$ dates and paleomagnetic transitions from Schmitt and Nairn, 1984; Renne et al., 1993; Walter and Aronson, 1993; Walter, 1994; Kimbel et al., 1996, 2004; Semaw et al., 1997; and Campisano, 2007. Previously published $^{40}Ar/^{39}Ar$ dates have been recalculated to reflect the updated age of the Fish Canyon sanidine standard (increased by approximately 0.65%; Renne et al., 1998). The left column depicts the changes in depositional environment from clays to gravels. The right hand column equates the submembers discussed in the text with the depositional environments and the dates. Key: c = clays; z = silts; s = sands; g/v/b = gravel, conglomerate, volcanoclastics, bioclastics.

Johanson, D. C., T. D. White, et al. 1978. A New Species of the Genus Australopithecus (primates: Hominidae) from the Pliocene of Eastern Africa, Cleveland Museum of Natural History; distributed by Kent State University Press.

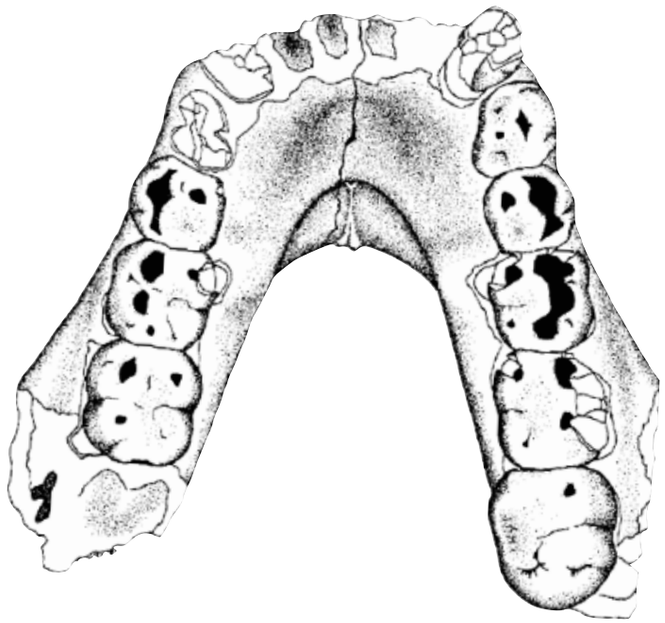


L. H. 4

found in 1974

Laetoli: ~13 total hominids
Laetoli footprints
Type speçimen of *Au. afarensis*: L.H. 4

Australopithecus afarensis



Date of Publication: 1978

Currently used nomen: *Australopithecus afarensis*

Species as named: *Australopithecus afarensis*

Authors: Donald Johansen, Tim White, Yves Coppens

Holotype: *Australopithecus afarensis*

Citation: Johanson, D. C., T. D. White, et al. 1978. A New Species of the Genus *Australopithecus* (primates: Hominidae) from the Pliocene of Eastern Africa, Cleveland Museum of Natural History; distributed by Kent State University Press.
Synonomy: Australopithecus afarensis

Note that the Leakey's are not in on the action!
Mary Leakey was running things at Laetoli!
Leakey's called LH 4 and ALL NON-ROBUSTS *Homo*

Garusi (Laetoli) maxilla fragment found 1939

Date of Publication: 1950
Currently used nomen: *Australopithecus afarensis*
Species as named: *Meganthropus africanus*
Authors: Hans Weinert
Holotype: Garusi 1
Citation: Weinert, H. 1950. Uber die neuen Vor-und Fruhmenschenfunde aus Afrika, Java, China und Frankreich. Zeitschrift für morphologische Anthropologie 42: 113-148.
Synonomy: *Australopithecus afarensis*

Praeanthropus africanus
??

As used by Johanson *et al*. (4), the name *A. afarensis* clearly does not identify a new species. Rather, it only enlarges the hypodigm of Weinert's species *M. africanus* and provides a necessary replacement name to apply to this species when it is included within the genus *Australopithecus*.

If ever this species is considered to be generically distinct from the taxon represented by Dart's holotype of *A. africanus*, then the valid specific name must revert to *africanus* Weinert if it is the senior available name within the recognized species-group (Article 59c).

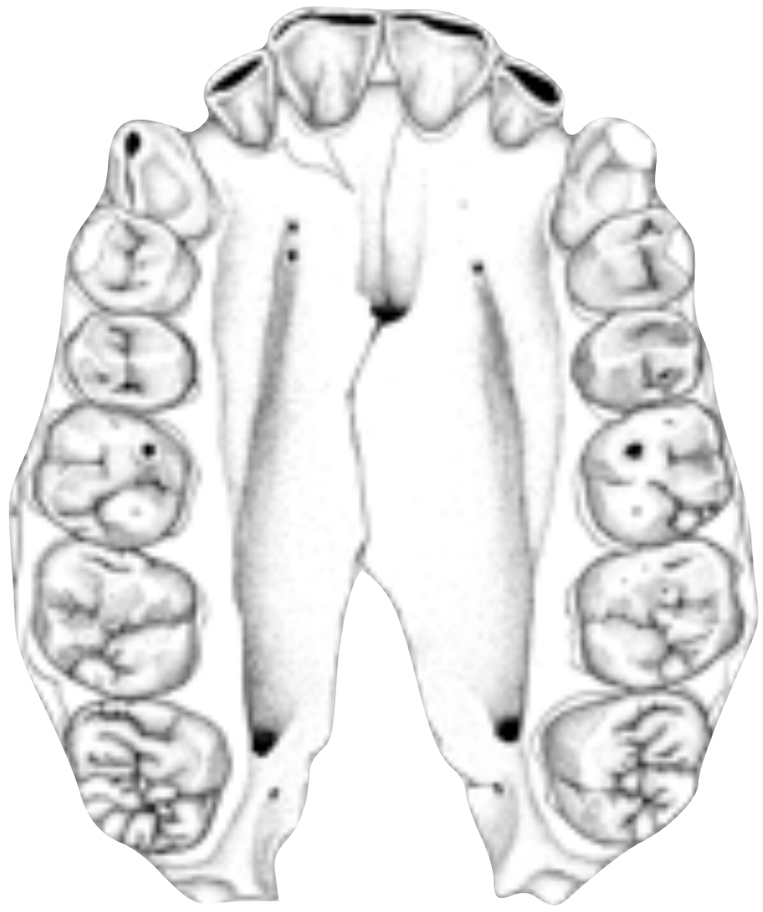
In view of the problems created in the usage of *A. afarensis*, it seems particularly confusing that the lectotype designated for this geographically descriptive name should have been selected from the Tanzanian Laetoli specimens. The wisdom of this decision is made even more questionable since the Afar material, which constitutes the majority of the specimens in the type-series, includes some Pliocene specimens of unequaled morphological completeness such as A.L. 288-1.

In the 1970's Lucy was about 1 million years OLDER than the earliest well-known hominid species.

It was, in many ways, seen as the "missing link-a bipedal ape."

Cranial capacity was approximately 375cc-550cc... chimp-like

Chimp



AL 200-1

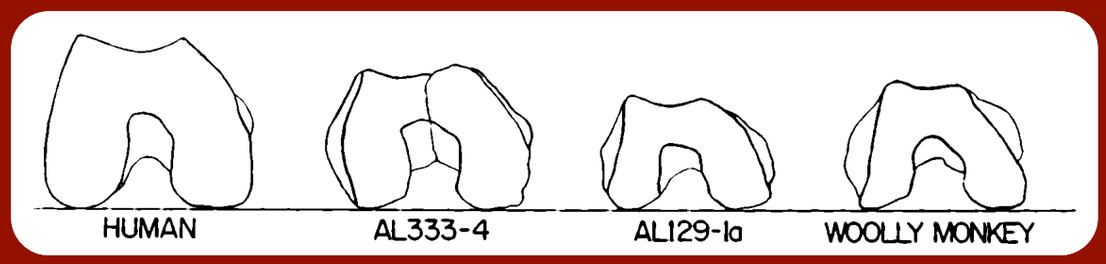
Au. afarensis

Human

Arboreal behavior?

Was *Au. afarensis* bipedality different?

Yes, significantly
Stern and Sussman, 1983



Not significantly
Lovejoy, 1981-present

Science 11 February 2011:
Vol. 331 no. 6018 pp. 750–753
DOI: 10.1126/science.1201463

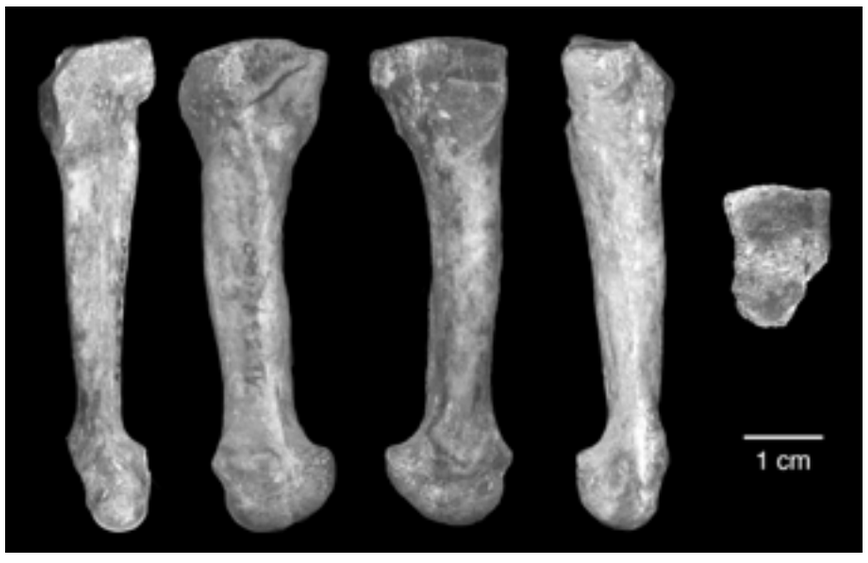
REPORT

Complete Fourth Metatarsal and Arches in the Foot of *Australopithecus afarensis*

Carol V. Ward[1,*], William H. Kimbel[2], and Donald C. Johanson[2]

± Author Affiliations

*To whom correspondence should be addressed. E-mail: wardcv@missouri.edu



ABSTRACT

The transition to full-time terrestrial bipedality is a hallmark of human evolution. A key correlate of human bipedalism is the development of longitudinal and transverse arches of the foot that provide a rigid propulsive lever and critical shock absorption during striding bipedal gait. Evidence for arches in the earliest well-known *Australopithecus* species, *A. afarensis*, has long been debated. A complete fourth metatarsal of *A. afarensis* was recently discovered at Hadar, Ethiopia. It exhibits torsion of the head relative to the base, a direct correlate of a transverse arch in humans. The orientation of the proximal and distal ends of the bone reflects a longitudinal arch. Further, the deep, flat base and tarsal facets imply that its midfoot had no ape-like midtarsal break. These features show that the *A. afarensis* foot was functionally like that of modern humans and support the hypothesis that this species was a committed terrestrial biped.

Sexual dimorphism in *Au. afarensis*

Pronounced dimorphism

Strong postcranial size dimorphism in *Australopithecus afarensis*: Results from two new resampling …

AD Gordon, DJ Green, BG Richmond - Am J Phys Anthropol, 2007 - ncbi.nlm.nih.gov

Like modern humans

The case is unchanged and remains robust: Australopithecus afarensis exhibits only moderate skeletal dimorphism. A reply to Plavcan et al. (2005)

Philip L. Reno, Richard S. Meindl, Melanie A. McCollum, and C. Owen Lovejoy,

Woranso-Mille
3.6 million

Haile-Selassie, Y. (2010). Phylogeny of early Australopithecus: new fossil evidence from the Woranso-Mille (central Afar, Ethiopia). Phil. Trans. R. Soc. B 365(1556), 3323-3331
Abstract The earliest evidence of Australopithecus goes back to ca 4.2 Ma with the first recorded appearance of Australopithecus anamensis at Kanapoi, Kenya. Australopithecus afarensis is well documented between 3.6 and 3.0 Ma mainly from deposits at Laetoli (Tanzania) and Hadar (Ethiopia). The phylogenetic relationship of these two species is hypothesized as ancestordescendant. However, the lack of fossil evidence from the time between 3.6 and 3.9 Ma has been one of its weakest points. Recent fieldwork in the Woranso-Mille study area in the Afar region of Ethiopia has yielded fossil hominids dated between 3.6 and 3.8 Ma. These new fossils play a significant role in testing the proposed relationship between *Au. anamensis* and *Au. afarensis*. The Woranso-Mille hominids (3.63-3.8 Ma) show a mosaic of primitive, predominantly *Au. anamensis*-like, and some derived (*Au. afarensis*-like) dentognathic features. Furthermore, they show that, as currently known, there are no discrete and functionally significant anatomical differences between *Au. anamensis* and *Au. afarensis*. Based on the currently available evidence, it appears that there is no compelling evidence to falsify the hypothesis of chronospecies pair or ancestor-descendant relationship between *Au. anamensis* and *Au. afarensis*. Most importantly, however, the temporally and morphologically intermediate Woranso-Mille hominids indicate that the species names *Au. afarensis* and *Au. anamensis* do not refer to two real species, but rather to earlier and later representatives of a single phyletically evolving lineage. However, if retaining these two names is necessary for communication purposes, the Woranso-Mille hominids are best referred to as *Au. anamensis* based on new dentognathic evidence.

Tulu Bor Member

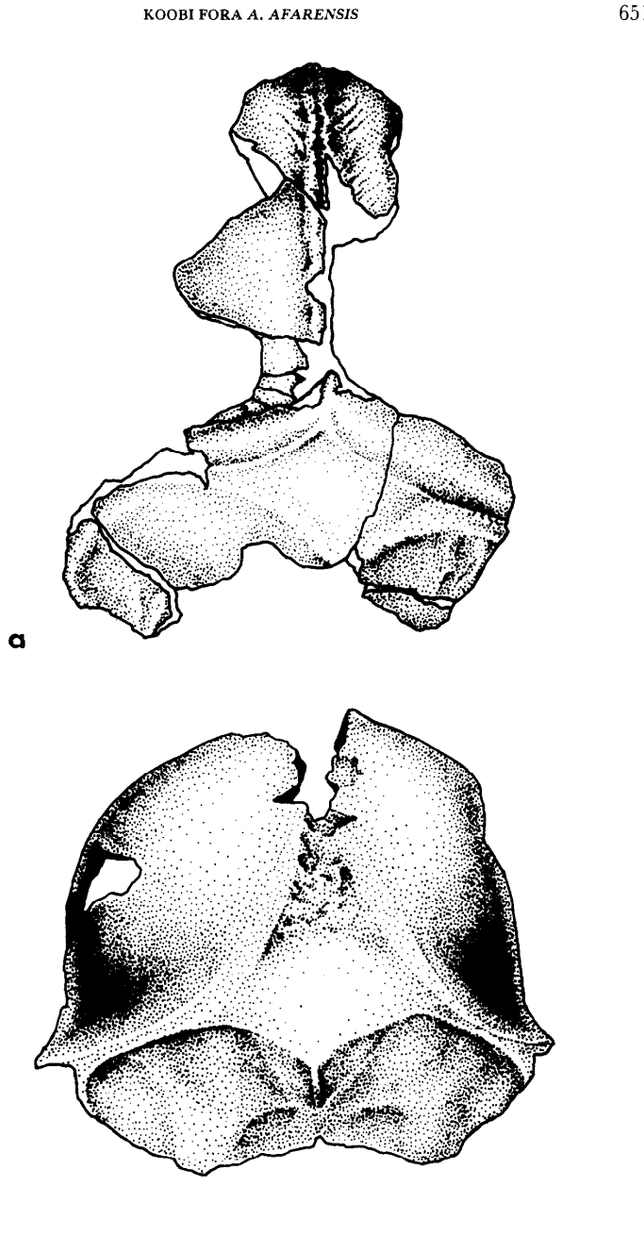


Figure 2. Artists's renderings of KNM-ER 2602 (a) and A.L. 162-28 (b), posterior view (natural size).

Koobi Fora Formation, East Lake Turkana

Occipital and parietals identified as *A. afarensis*

Kimbel, W. H. Journal of Human Evolution (1988) 17, 647-656

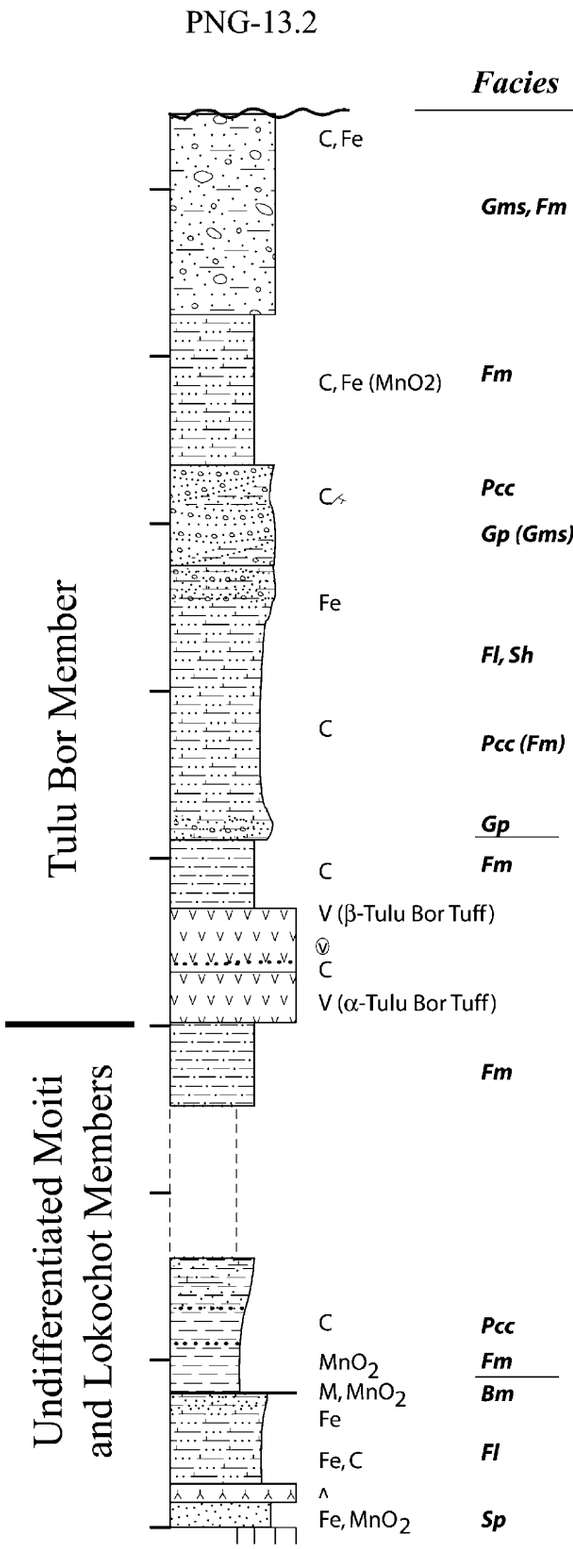
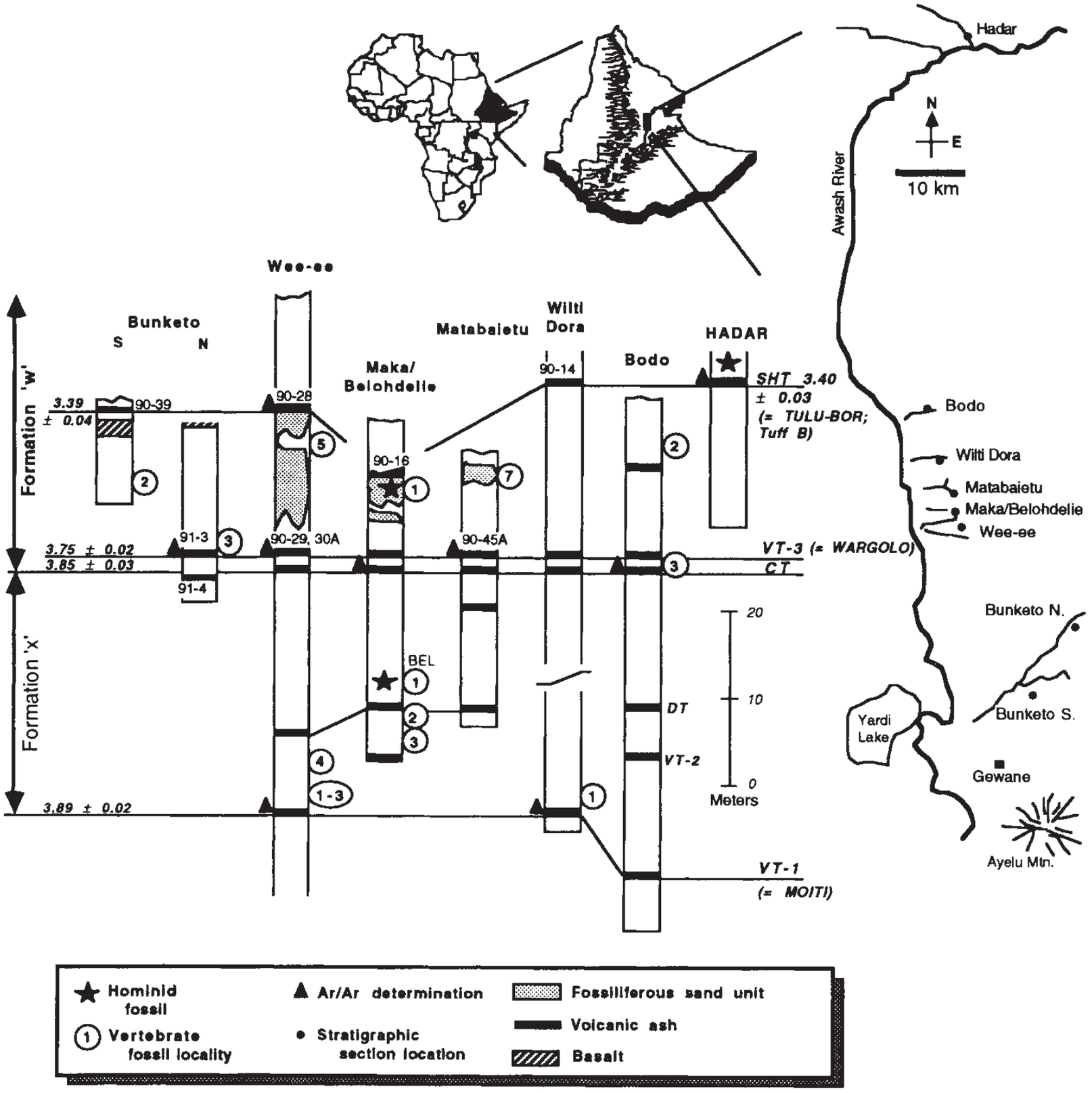


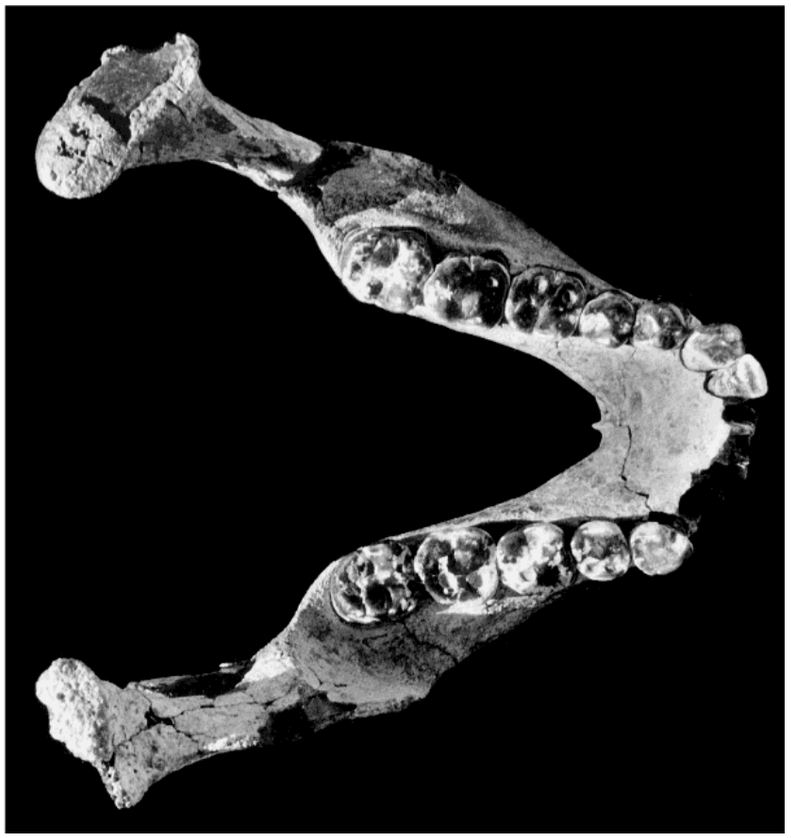
Fig. 6. Stratigraphi

Bonus

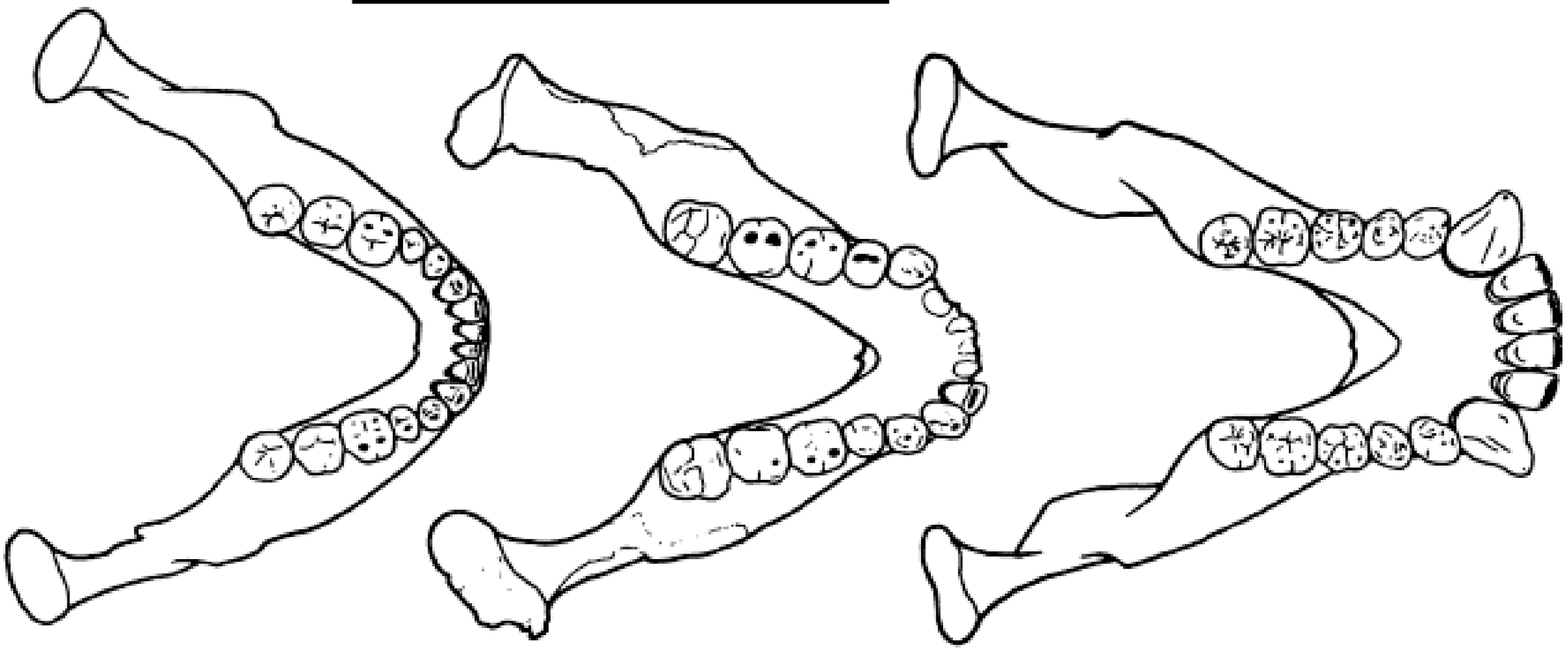

Hadar
N
E
10 km
Awash River
Bodo
Wilti Dora
Matabaietu
Maka/Belohdelie
Wee-ee
Bunketo N.
Bunketo S.
Yardi Lake
Gewane
Ayelu Mtn.
Wee-ee
Bunketo
S
N
Matabaietu
Wilti Dora
HADAR
Maka/ Belohdelie
Bodo
Formation 'w'
Formation 'x'
3.39 ± 0.04
90-39
90-28
SHT 3.40 ± 0.03 (= TULU-BOR; Tuff B)
90-16
90-14
91-3
90-29, 30A
90-45A
3.75 ± 0.02
3.85 ± 0.03
VT-3 (= WARGOLO)
CT
91-4
BEL
DT
VT-2
20
10
0
Meters
3.89 ± 0.02
VT-1 (= MOITI)
Hominid fossil
Vertebrate fossil locality
Ar/Ar determination
Stratigraphic section location
Fossiliferous sand unit
Volcanic ash
Basalt

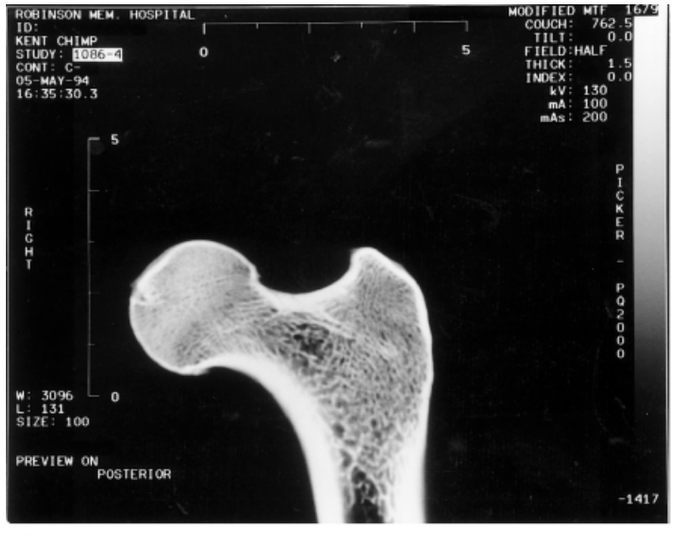
Maka

3.4 Ma



Maka, Ethiopia

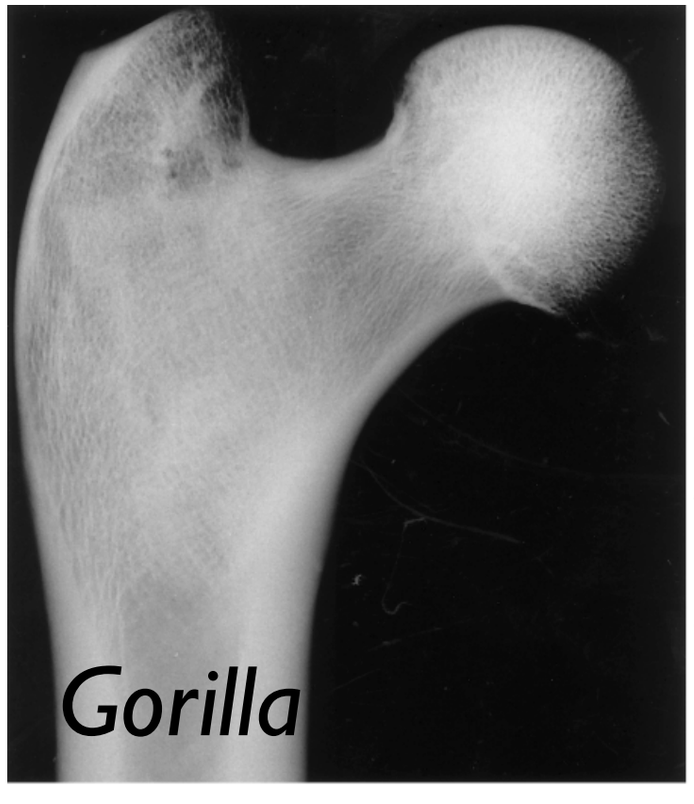




A

Pan

B



A

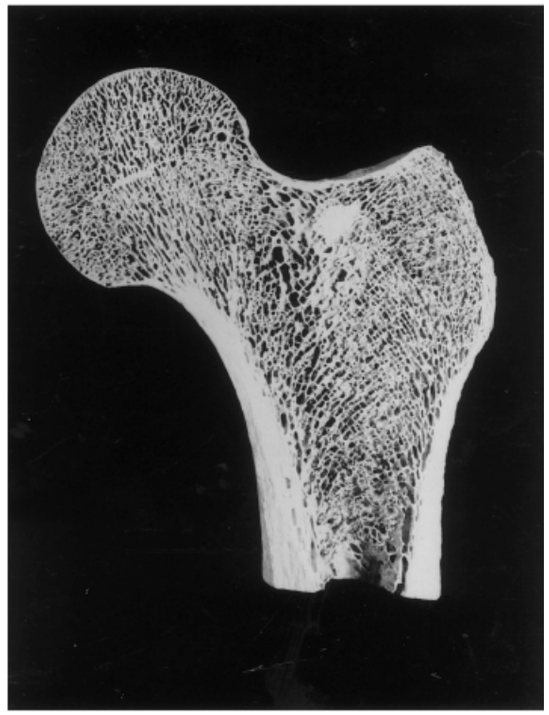
Gorilla

Homo

B

C

Homo

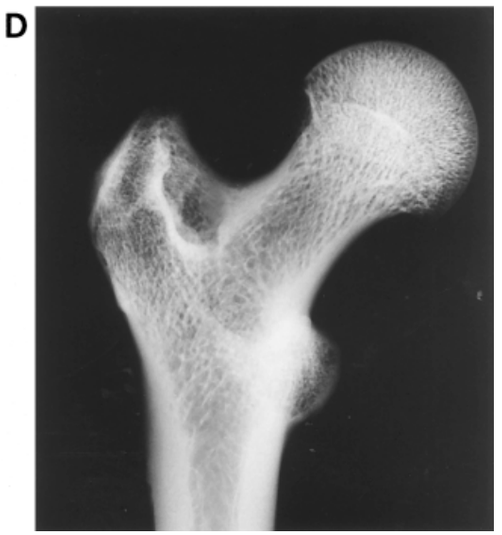


D

C

Pan

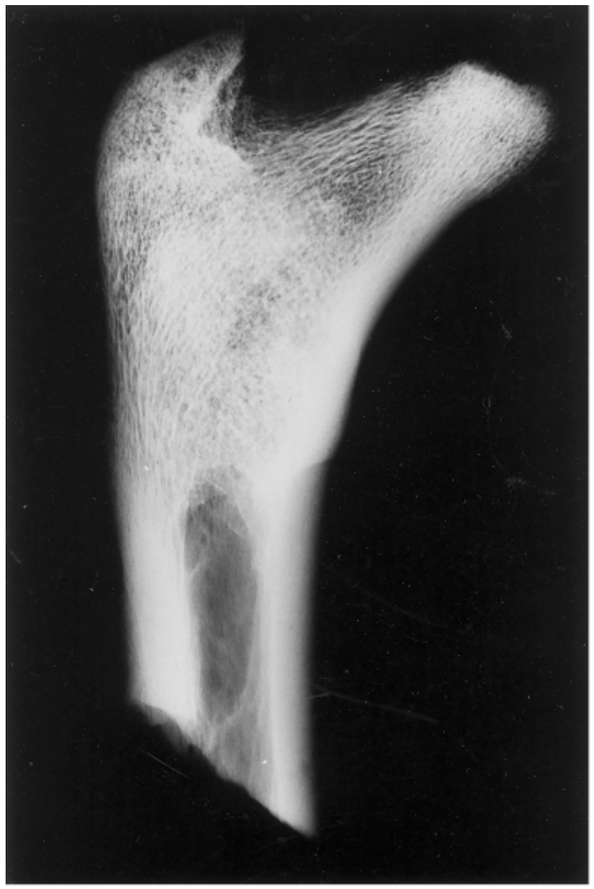
D



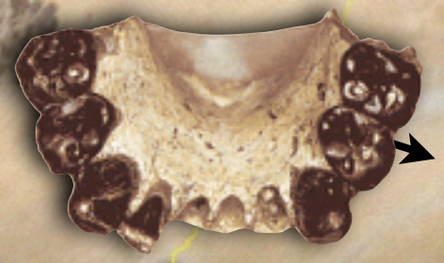
Pongo

Maka

Maka femur




Australopithecus afarensis distribution

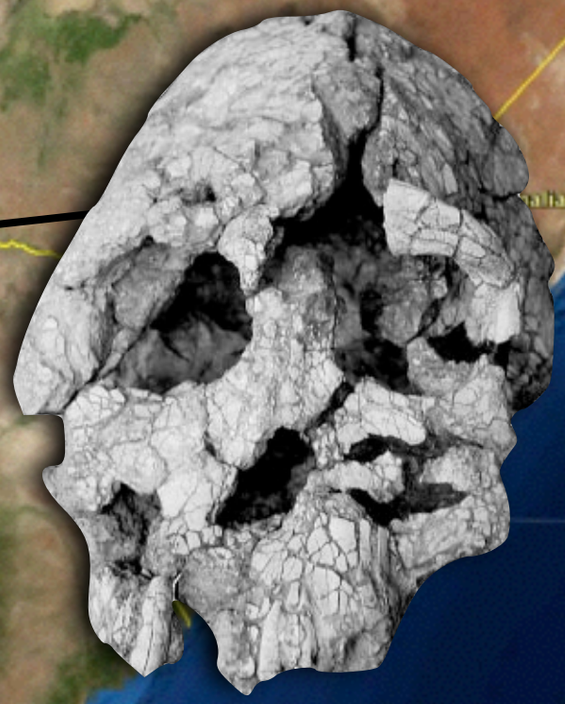


Hadar, Dikika

Middle Awash: Maka

Laetoli

Laetoli footprints, Tanzania



Chad

Central African Republic

Eritrea

Yemen

Djibouti

Ethiopia

Somalia

Uganda

Kenya

Rwanda

Burundi

Tanzania

Au. afarensis geographic variation

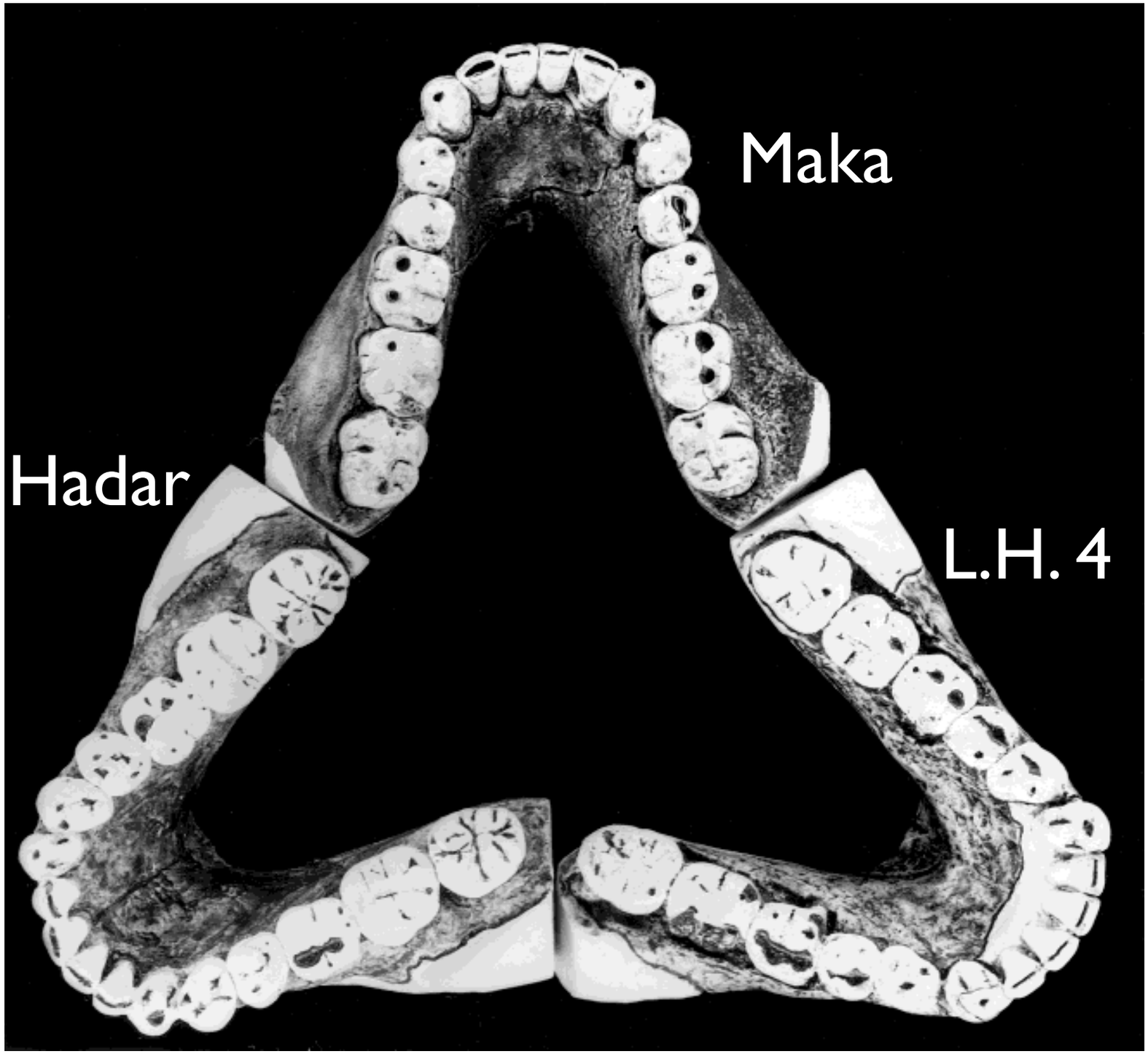
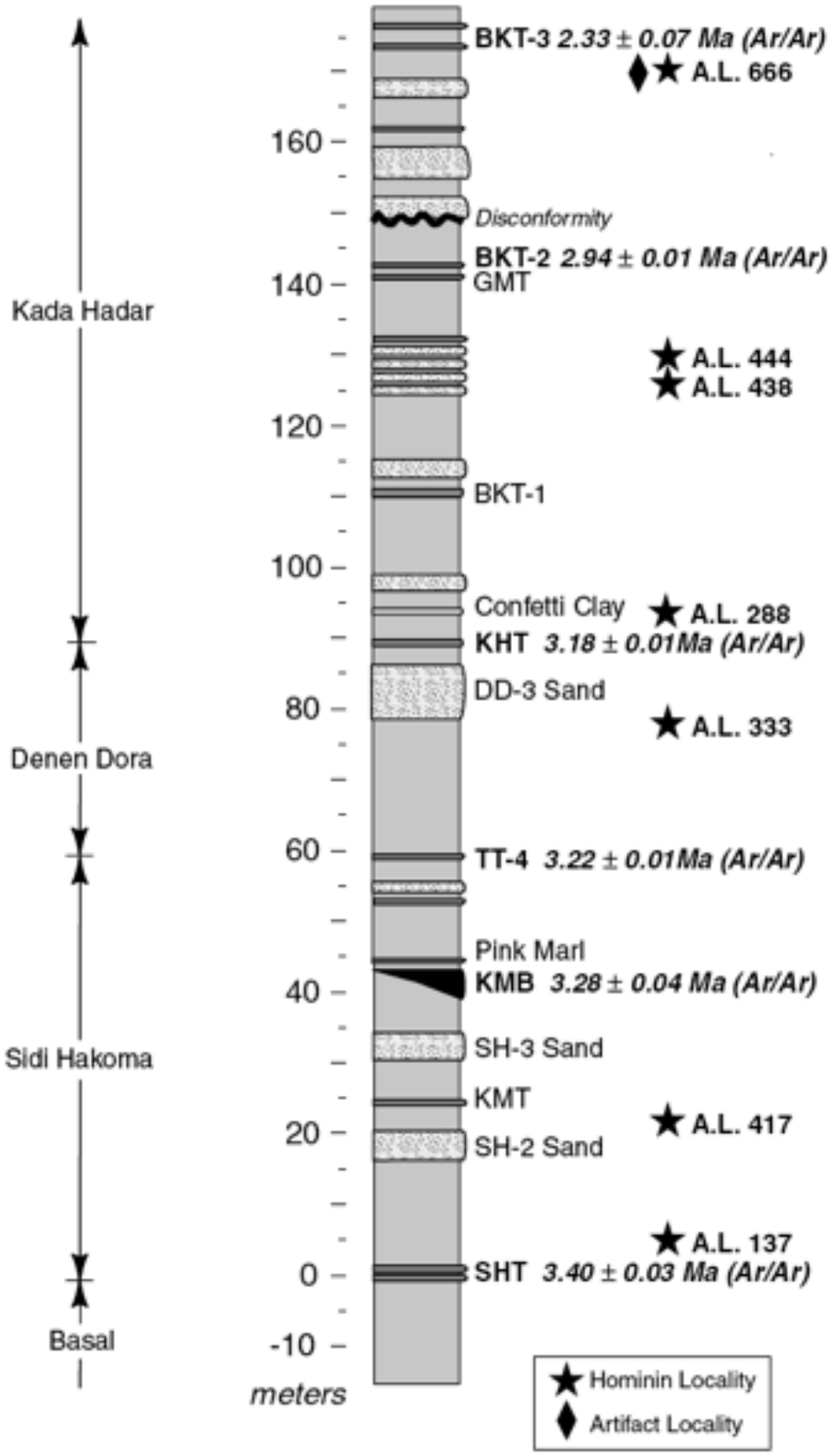


Fig. 13. Reconstructed mandibular bodies of the most complete mandibles from the three major *A. afarensis* sites. **Top**: Maka MAK-VP-1/12. **Right**: Laetoli L.H.-4. **Left**: Hadar A.L. 400-1a. Alignment of the specimens in this nonstandard orientation facilitates comparisons of dental size and arcade shapes. It is difficult to find individuals whose dental arcades match so closely in contemporary populations of African apes, lending strong support to the interpretation of *A. afarensis* as a single, ecologically and geographically widespread early hominid species.

Hadar

Approximately 90% of the hypodigm of *Au. afarensis* comes from Hadar Formation sediments exposed at the Hadar site in Ethiopia



A.L. 444

Au. afarensis temporal variation

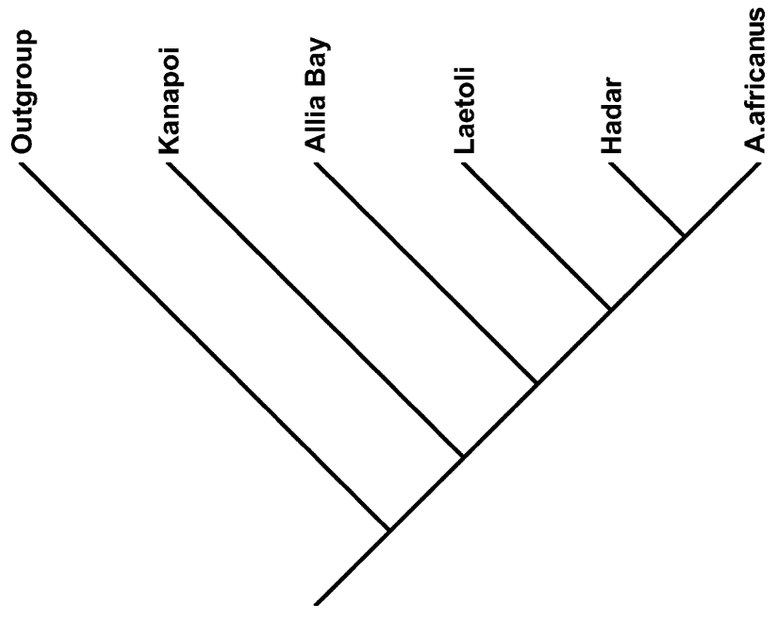
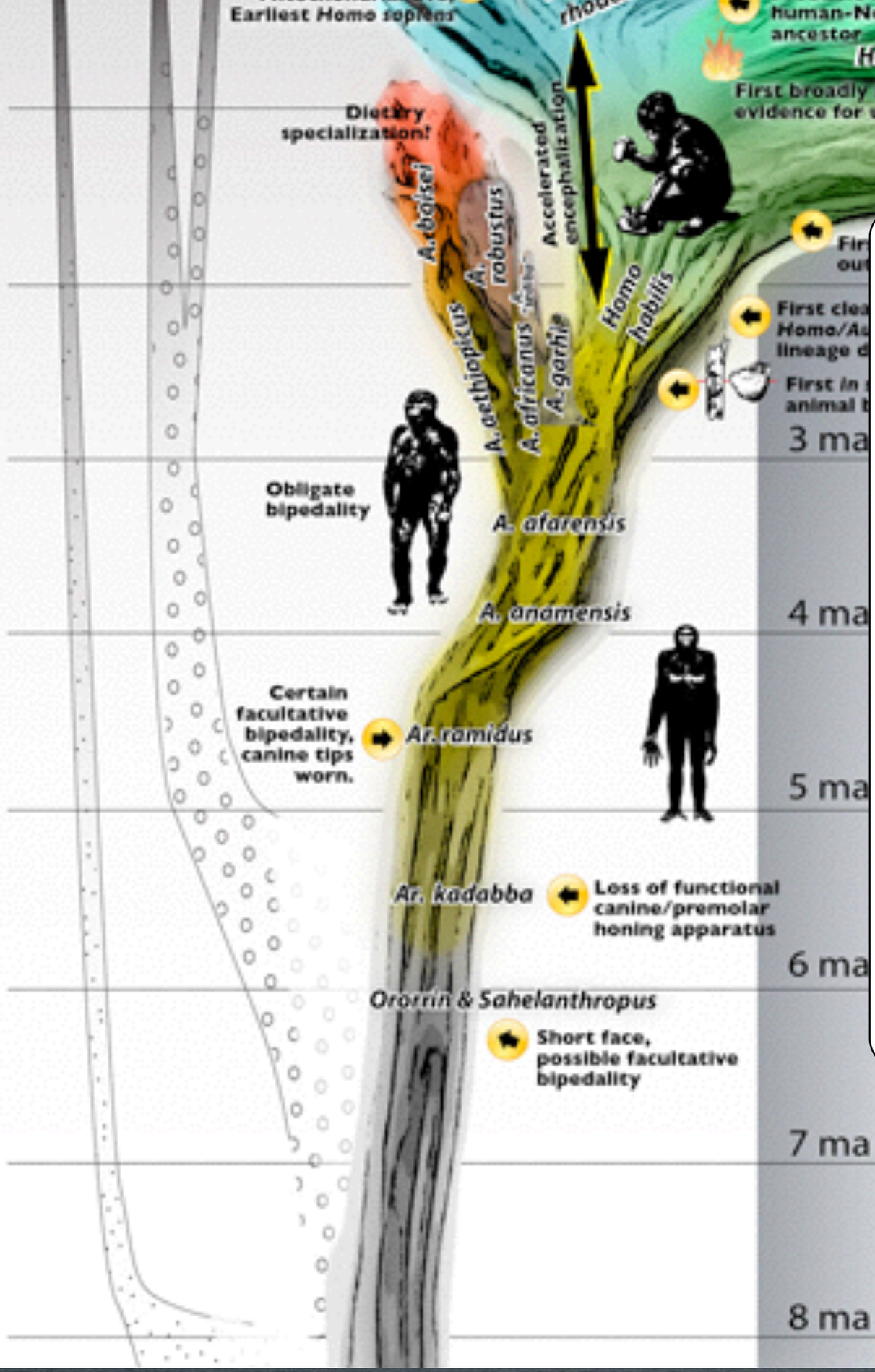


Fig. 2. The most parsimonious cladogram of relationships among the four OTUs and *Australopithecus africanus* (tree length = 31; CI = 0.903), corresponding to the null hypothesis.



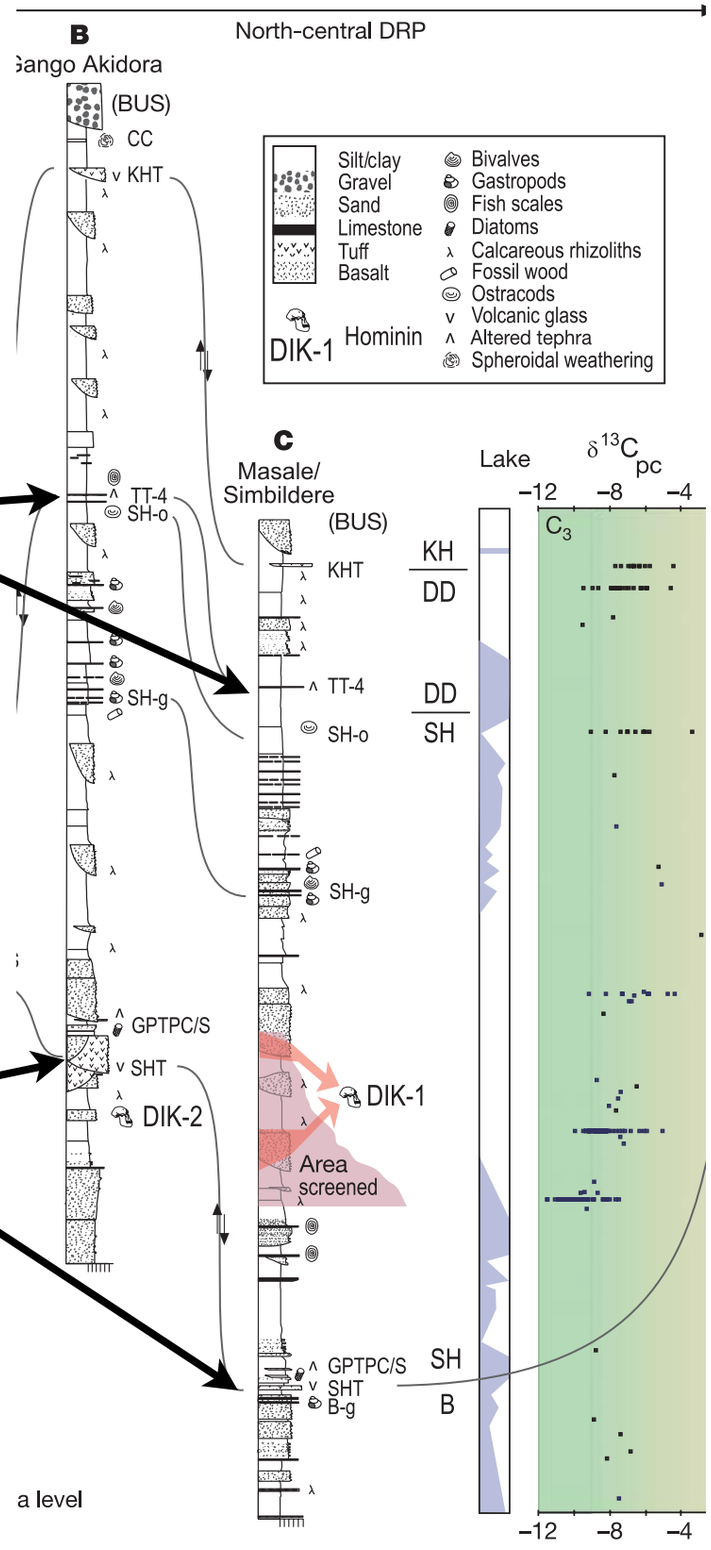
Toros Menella	Laetoli	Turkana Basin	Omo	Hadar	Woranso/ Mile	Middle Awash
				Homo habilis		
Australopithecus afarensis Abel (KT 12/H1)	*Australopithecus afarensis*	*Australopithecus afarensis* (WT 40000)		*Australopithecus afarensis*	*Australopithecus afarensis/ anamensis*	*Australopithecus afarensis*
		Australopithecus anamensis				*Australopithecus anamensis*
						Ardipithecus ramidus
						Ardipithecus kadabba
						Ardipithecus kadabba

Sahelanthropus tschadensis

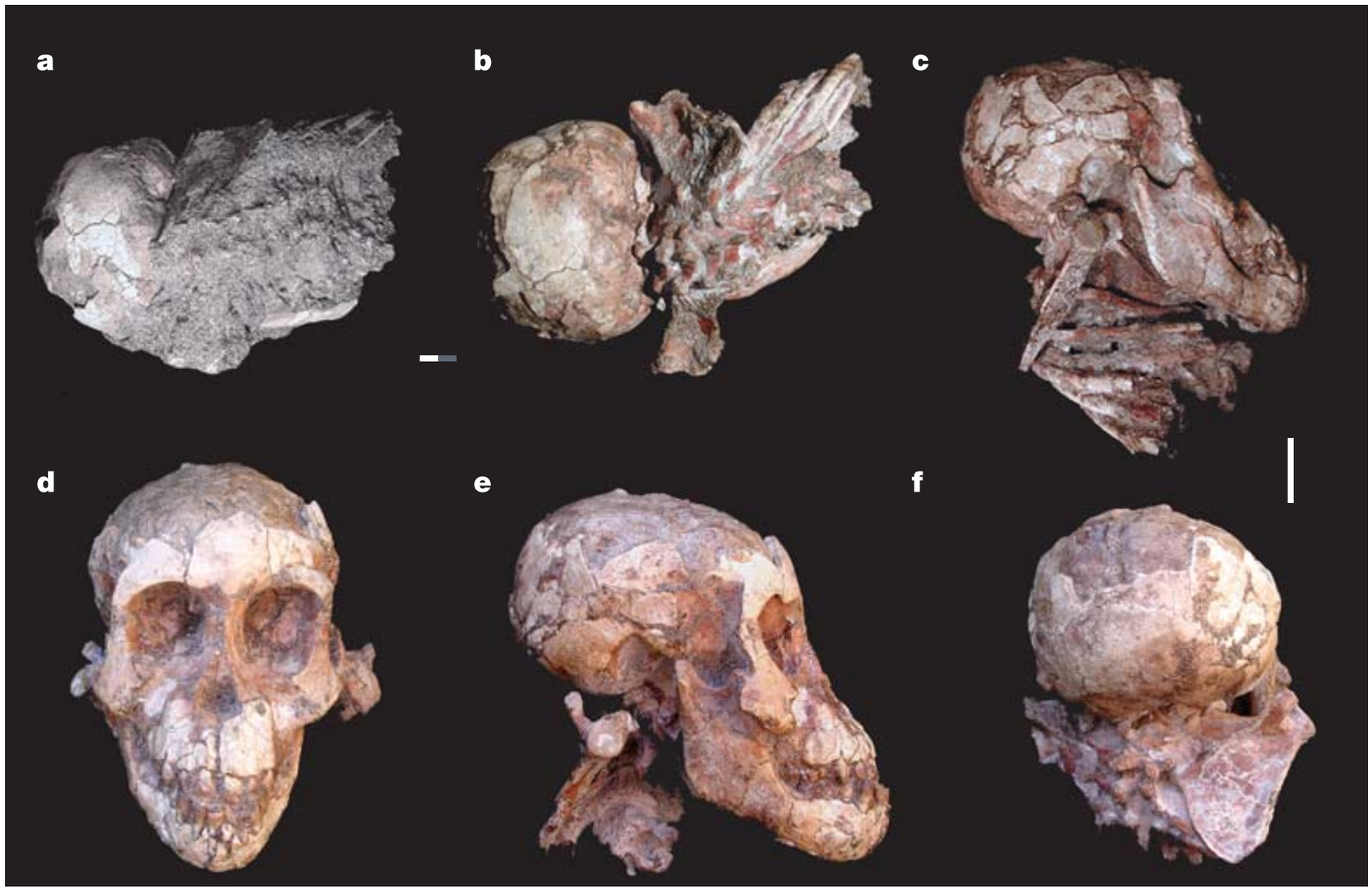
Dikika

3.25 Ma

3.4 Ma



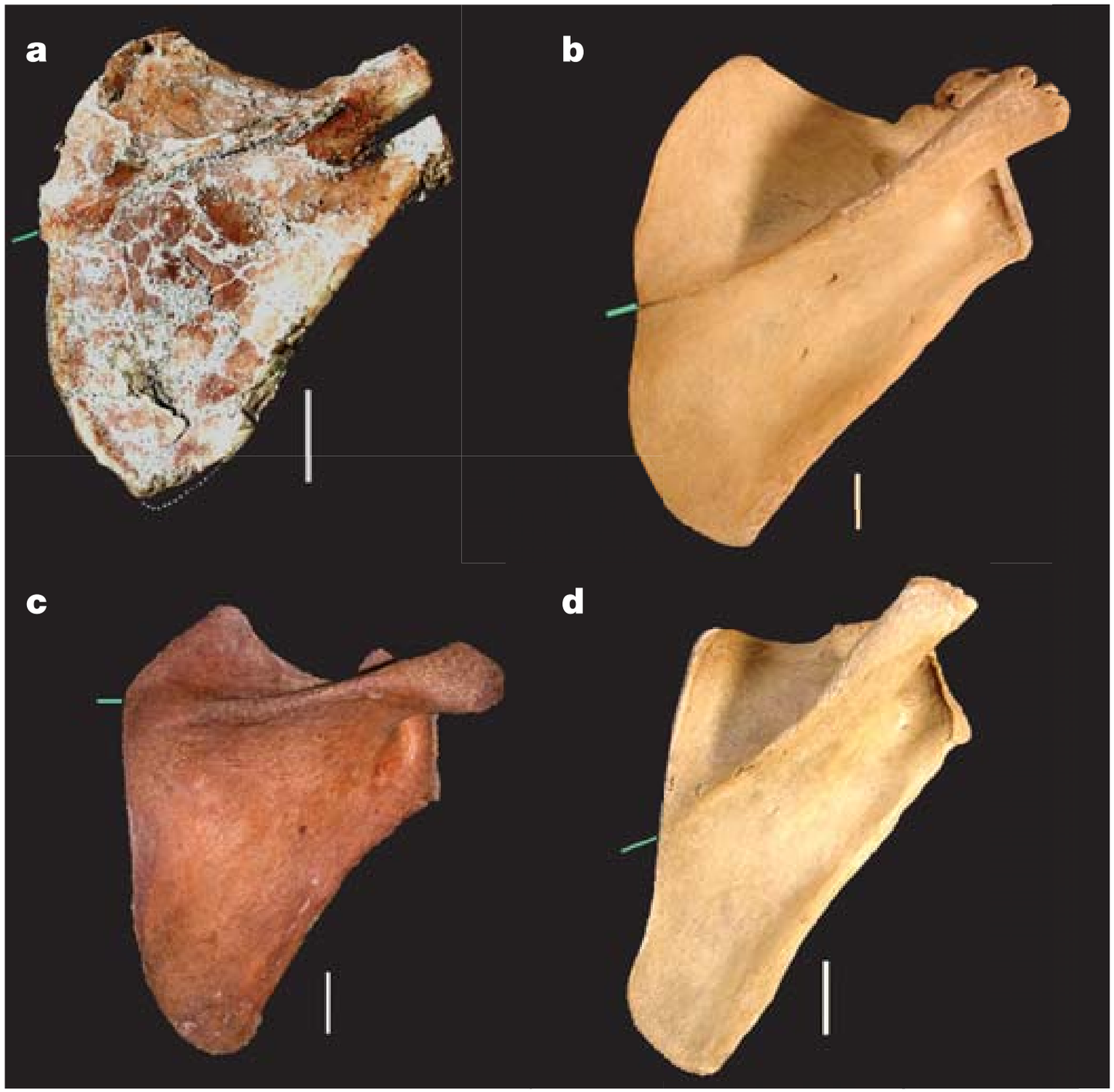
Dikika



Dikika

Gorilla-like scapula?

Dikika



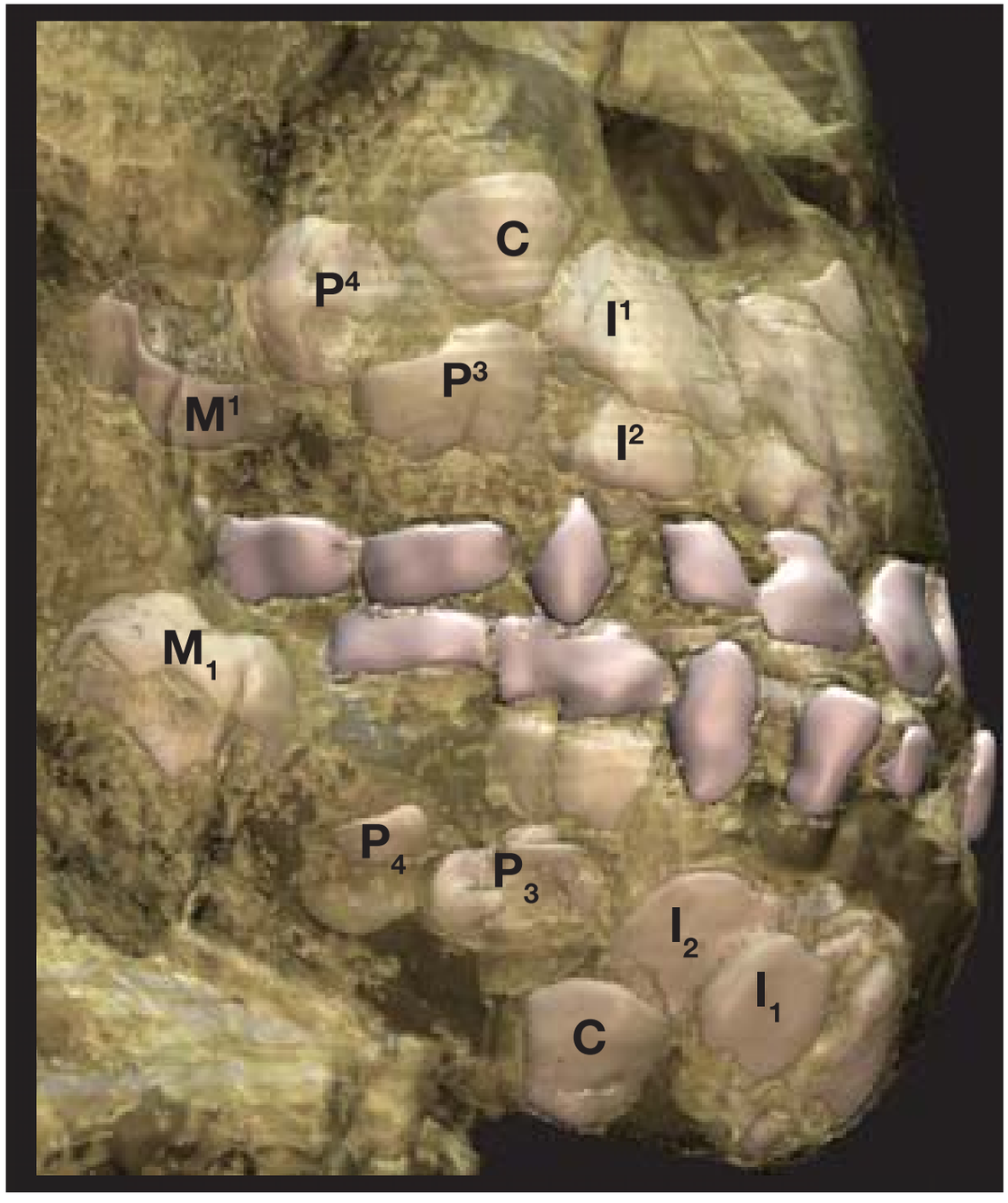
Gorilla

Human

Chimp

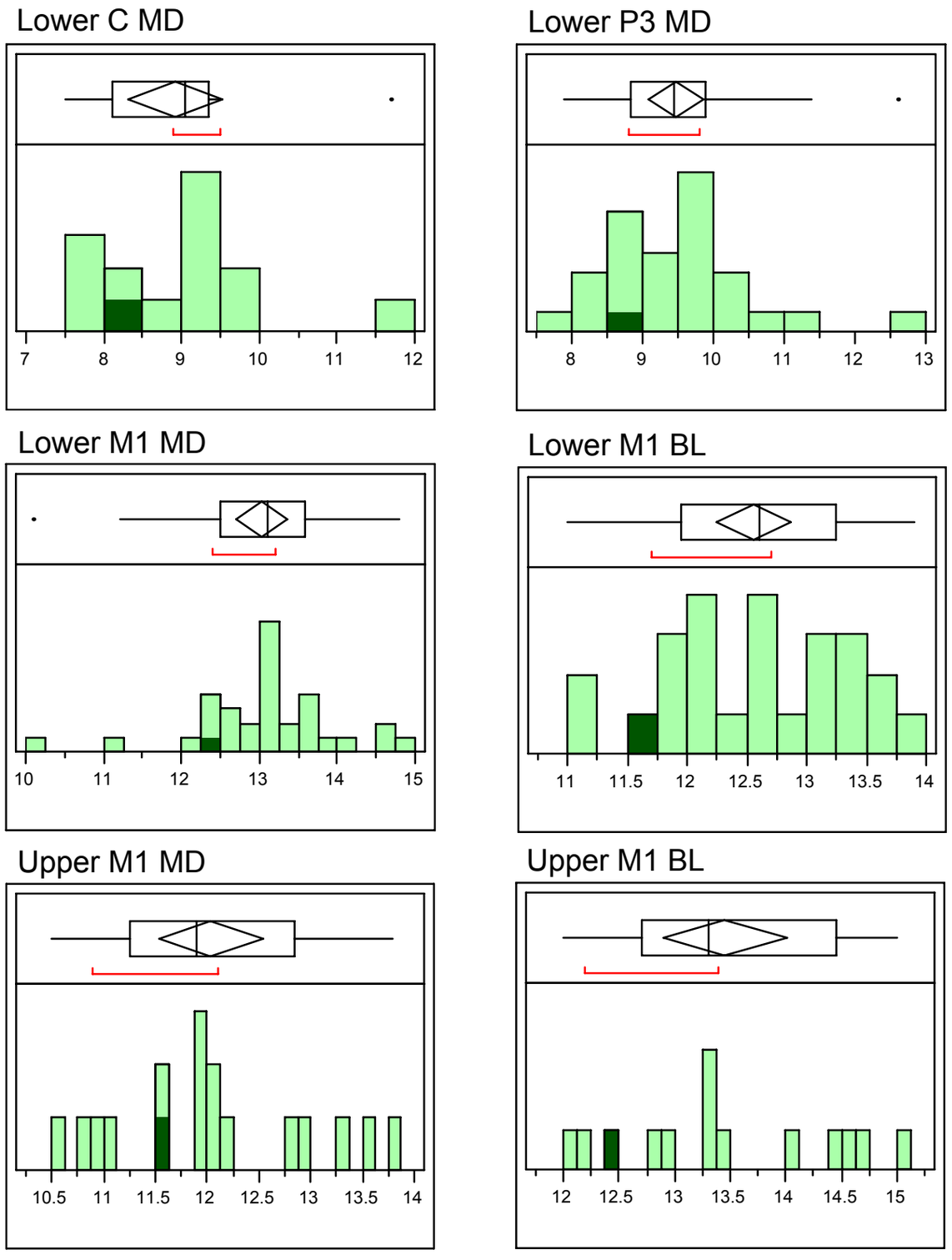
Dikika Female?

...measurements of the fully formed permanent tooth crowns suggest that the specimen is female...



S1. DENTAL DIMENSIONS AND SEX OF DIK-1-1

Dimensions of fully formed permanent teeth of DIK-1-1 (dark green) compared with *Australopithecus afarensis* from Hadar, Laetoli and Maka[1]. The box-and-whisker plot shows the median, the upper and lower quartiles (box), the range, the mean and two standard deviations (diamond), and the location of the most dense half of the distribution (red bracket). DIK-1-1 is most likely female given that its dental size is consistently in the lower half of the distribution, and close to confirmed female individuals such as A.L. 417-1[1]



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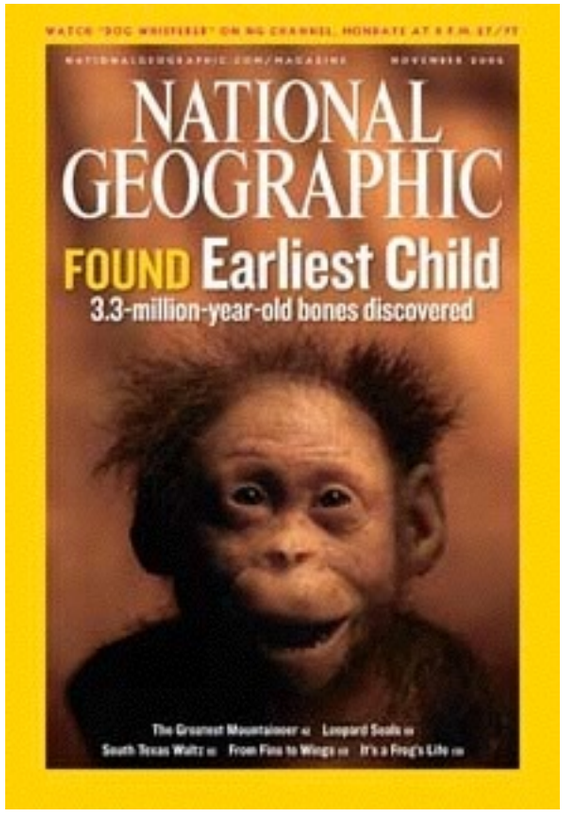
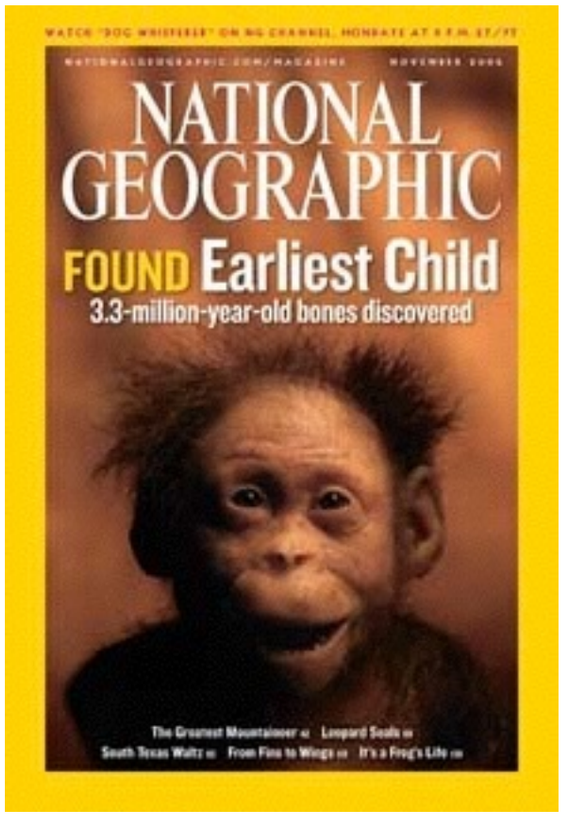


Max Planck Institute for Evolutionary Anthropology

The earliest *afarensis* child?



AL 333: discovered in 1970's

Cut mark controversy commences over 3.4 million-year-old bones

09:00 AM

By Dan Vergano, USA TODAY

Cut marks on 3.4 million-year-old bones resulted from trampling, not stone tools wielded by pre-human butchers, suggests a Monday study.

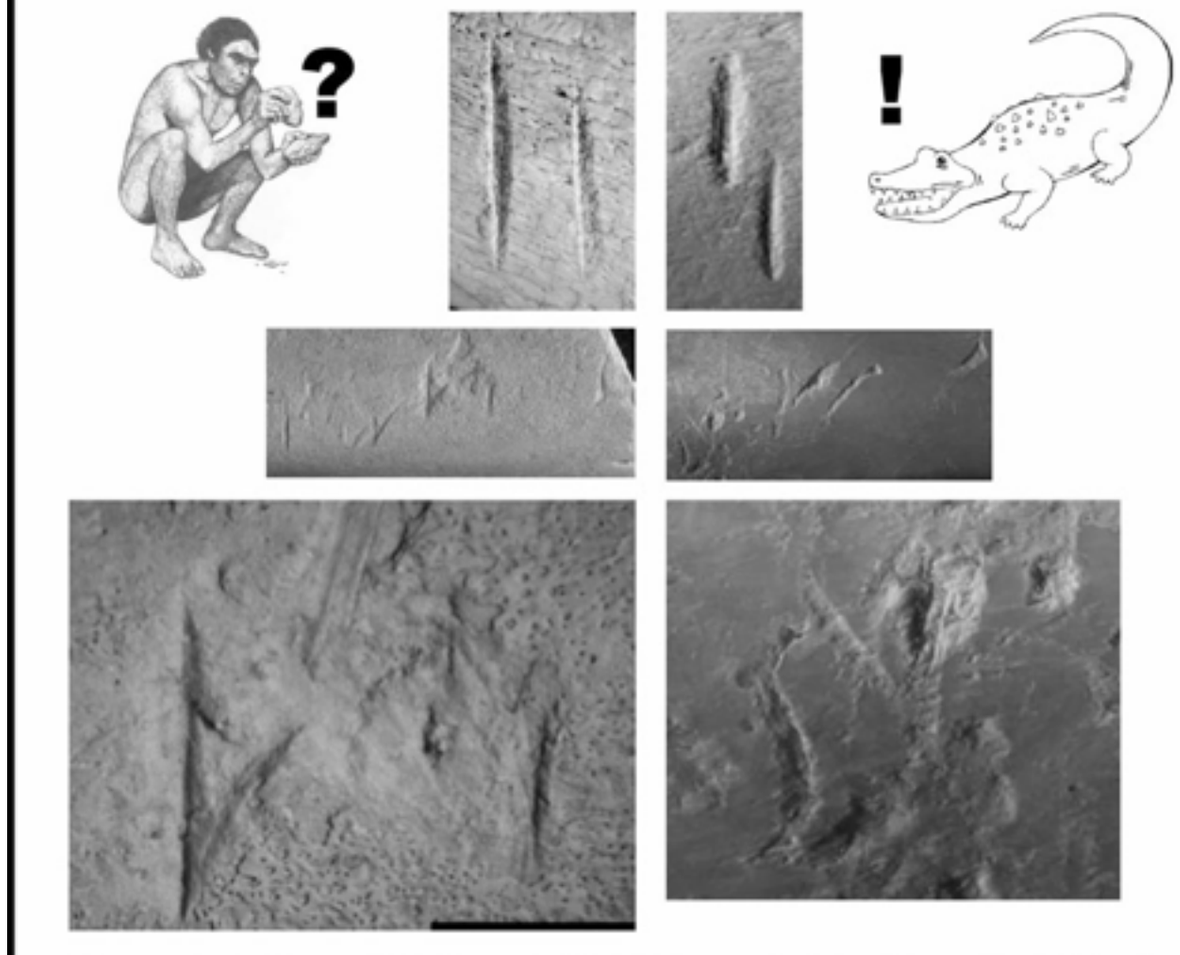
CAPTION © Dikika Research Project

In the current *Proceedings of the National Academies of Science*, a team led by Manuel Domínguez-Rodrigo of Ciudad Universitaria in Madrid, examines the August report of evidence for the pre-human species *Australopithecus afarensis* butchering antelope nearly a million years earlier than the previously-established age for such tool use.

Reported in the Aug. 12 *Nature* by a "Dikika" site team headed by Zeray Alemseged of the California Academy of Sciences in San Francisco, the evidence consists of cut marks on two fossilized bones from the Hadar Formation in Ethiopia. In the critique, Domínguez-Rodrig and colleagues complain the cut fossils were surface fossils, adding to uncertainty over their origin. The critics performed a trampling experiment, stomping on rocks with grass-soled shoes and looking at the results, claiming to see cut marks that resemble the *Nature* report ones:

Butchered by Early Humans or Eaten by Crocodiles?

The images on the left show marks from the two animal bone fragments claimed to have been butchered by early humans. The images on the right show marks from bones chewed by crocodiles in a modern experiment.



Left images are from McPherron et al. (2010), Nature, 466:857-860. Right images are from Njau and Blumenschine (2006), Journal of Human Evolution, 50:142-162. Images are copyright of the authors/journals as appropriate. Dr. Jackson Njau is particularly thanked for his images and experimental work.