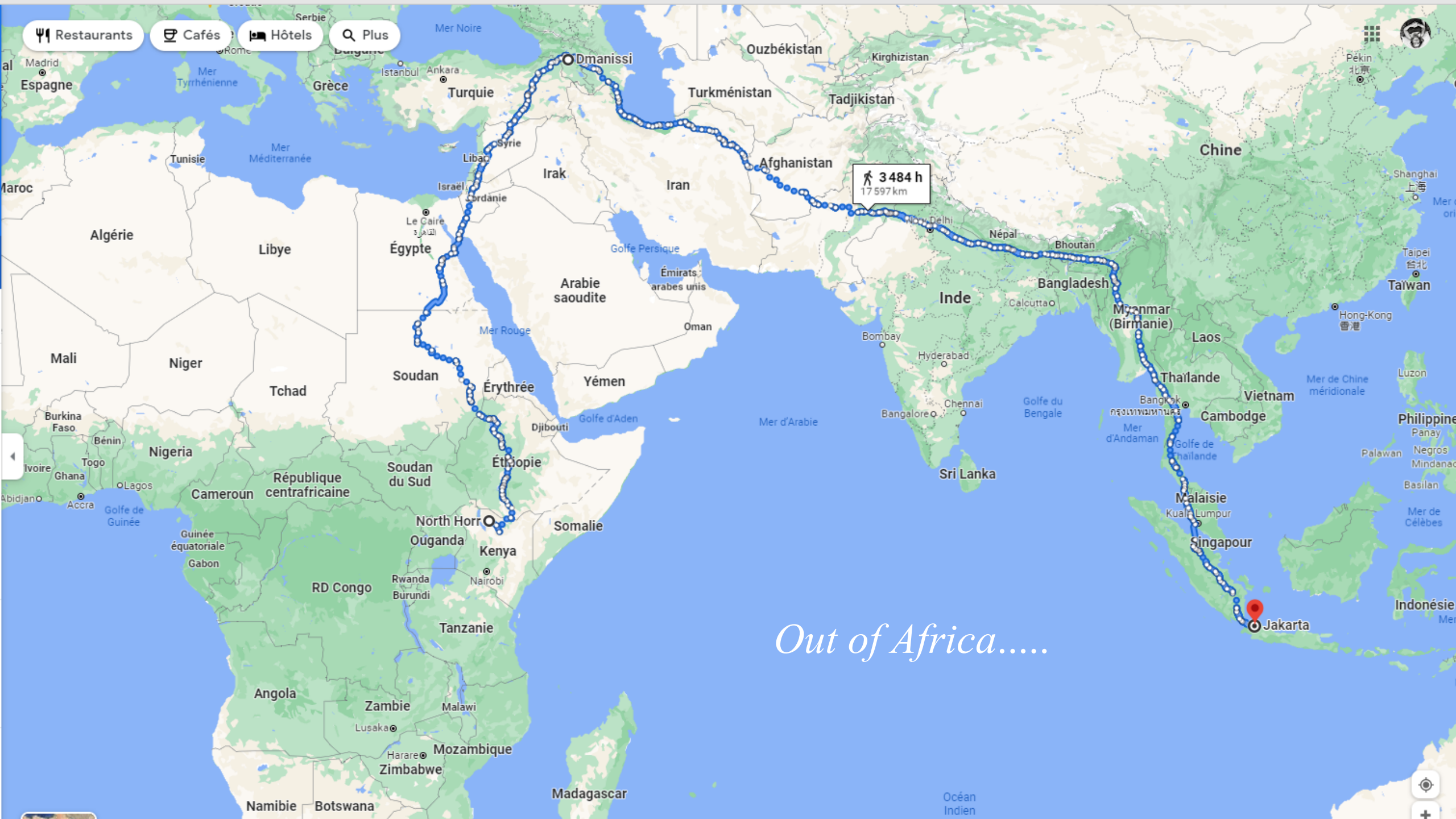
Out-of-Africa toward Asia

Julie Arnaud

julie.arnaud@unife.it


Restaurants
Cafés
Hôtels
Plus
Dmanissi
3 484 h
17 597 km
Jakarta
Out of Africa.....
Mer Noire
Ouzbékistan
Kirghizistan
Turkménistan
Tadjikistan
Afghanistan
Chine
Pékin
Shanghai
Taipei
Taiwan
Hong-Kong
Mer Méditerranée
Grèce
Turquie
Istanbul
Ankara
Syrie
Liban
Israël
Jordanie
Irak
Iran
Tunisie
Algérie
Libye
Égypte
Le Caire
Golfe Persique
Émirats arabes unis
Arabie saoudite
Oman
Mer Rouge
Yémen
Érythrée
Soudan
Mali
Niger
Tchad
Djibouti
Golfe d'Aden
Éthiopie
Somalie
Nigeria
Cameroun
République centrafricaine
Soudan du Sud
North Horr
Ouganda
Kenya
Nairobi
Rwanda
Burundi
RD Congo
Tanzanie
Angola
Zambie
Malawi
Lusaka
Mozambique
Harare
Zimbabwe
Namibie
Botswana
Madagascar
Océan Indien
Mer d'Arabie
Golfe du Bengale
Sri Lanka
Inde
Bombay
Hyderabad
Chennai
Bangalore
Calcutta
Népal
Bhoutan
Bangladesh
Myanmar (Birmanie)
Laos
Thaïlande
Bangkok
Vietnam
Cambodge
Mer d'Andaman
Golfe de Thaïlande
Malaisie
Kuala Lumpur
Singapour
Mer de Chine méridionale
Luzon
Philippine
Panay
Palawan
Negros
Mindanao
Basilan
Mer de Célèbes
Indonésie
Burkina Faso
Bénin
Togo
Ghana
Ivoire
Lagos
Accra
Abidjan
Golfe de Guinée
Guinée équatoriale
Gabon
Madrid
Espagne
Mer Tyrrhénienne

Quaternary Science Reviews 219 (2019) 1–19

Contents lists available at ScienceDirect

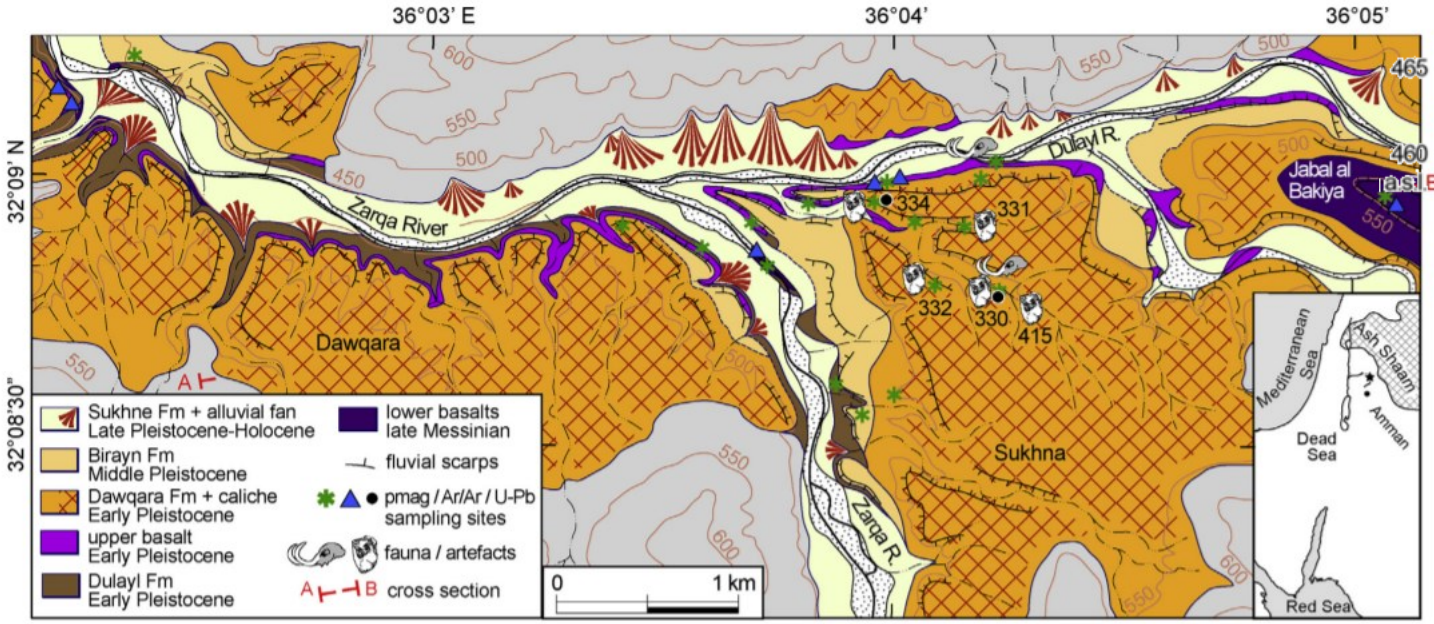
Quaternary Science Reviews

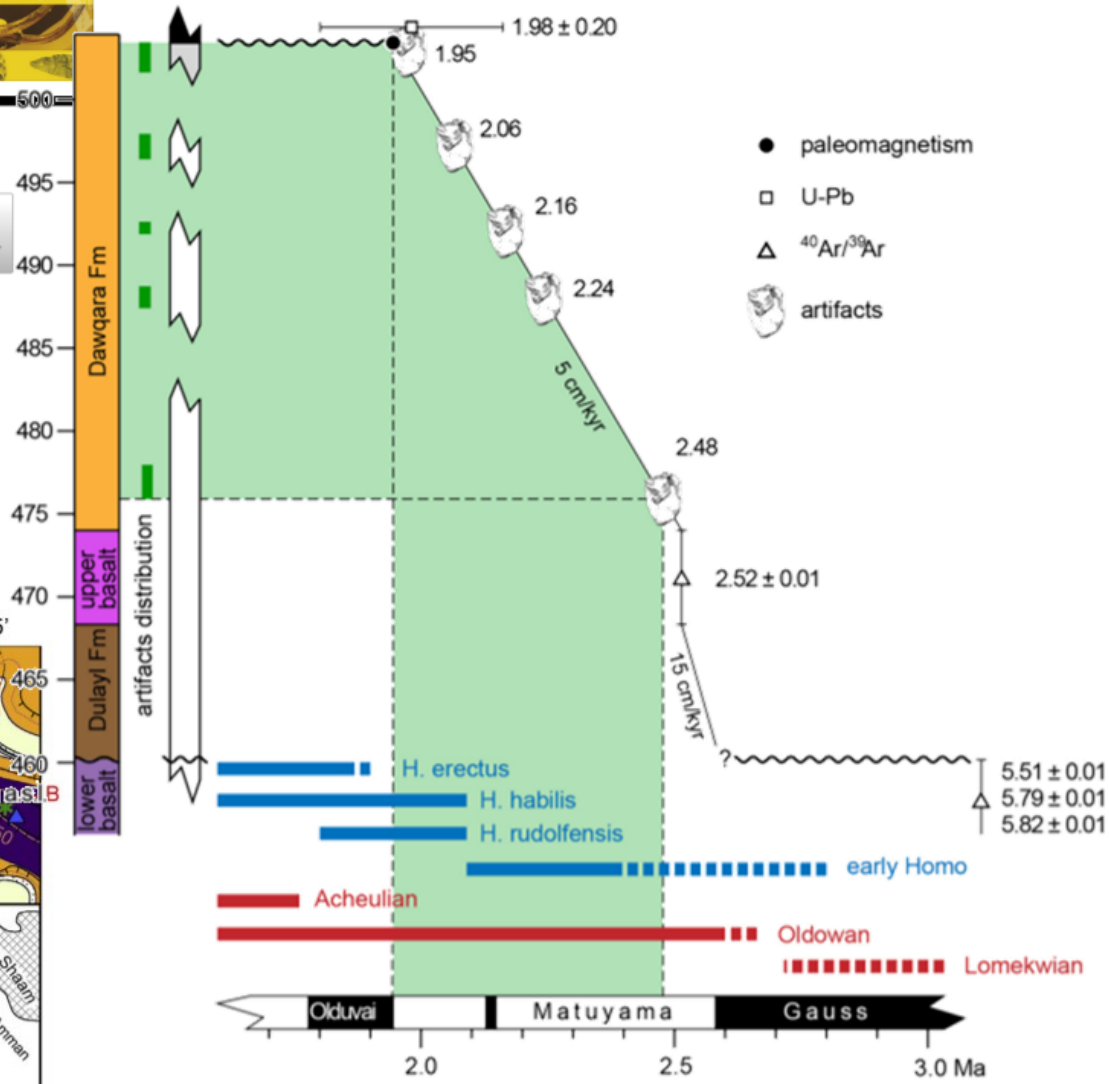
journal homepage: www.elsevier.com/locate/quascirev

Invited paper

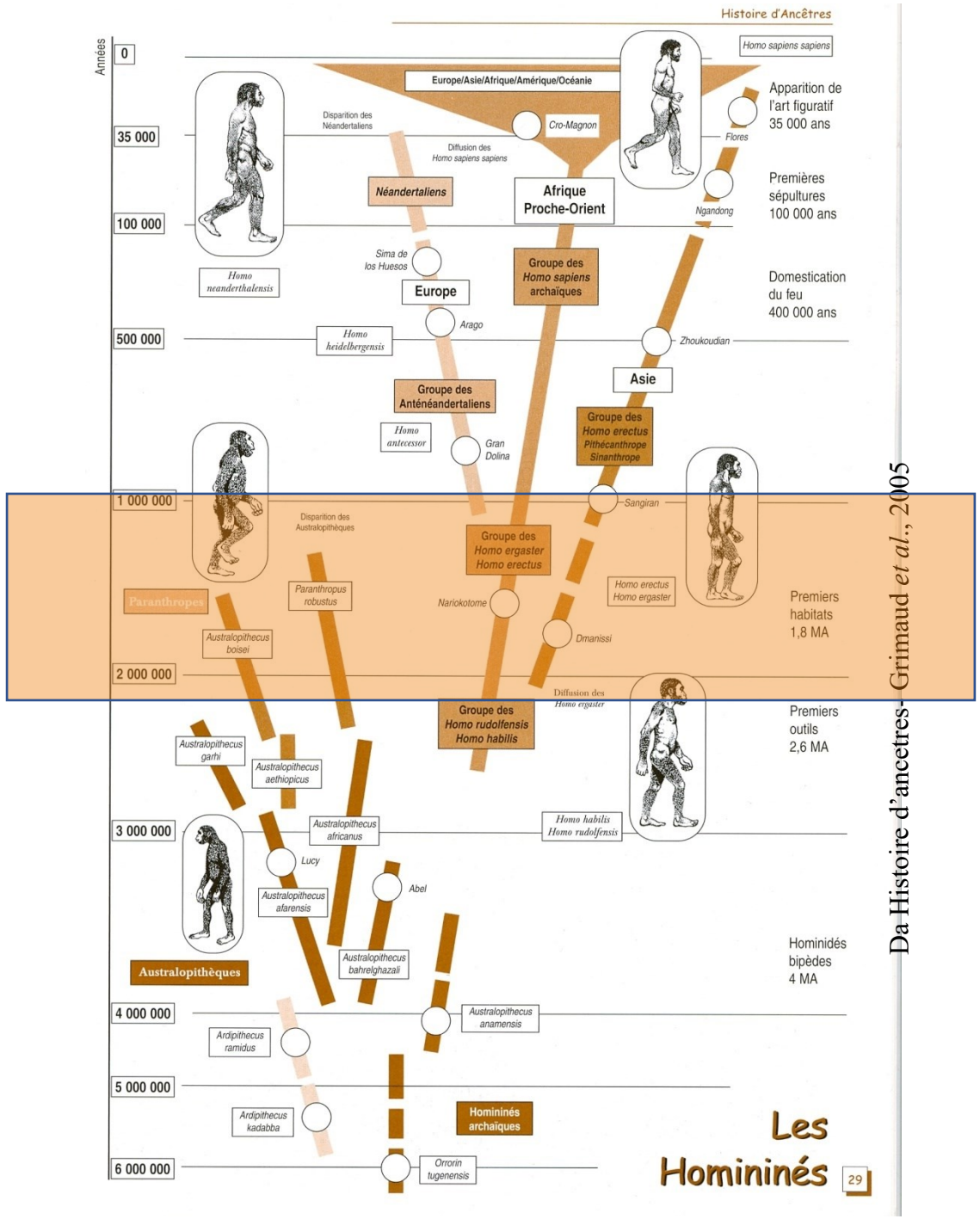
Chronologic constraints on hominin dispersal outside Africa since 2.48 Ma from the Zarqa Valley, Jordan

Giancarlo Scardia [a, *], Fabio Parenti [b, c], Daniel P. Miggins [d], Axel Gerdes [e], Astolfo G.M. Araujo [f], Walter A. Neves [g]

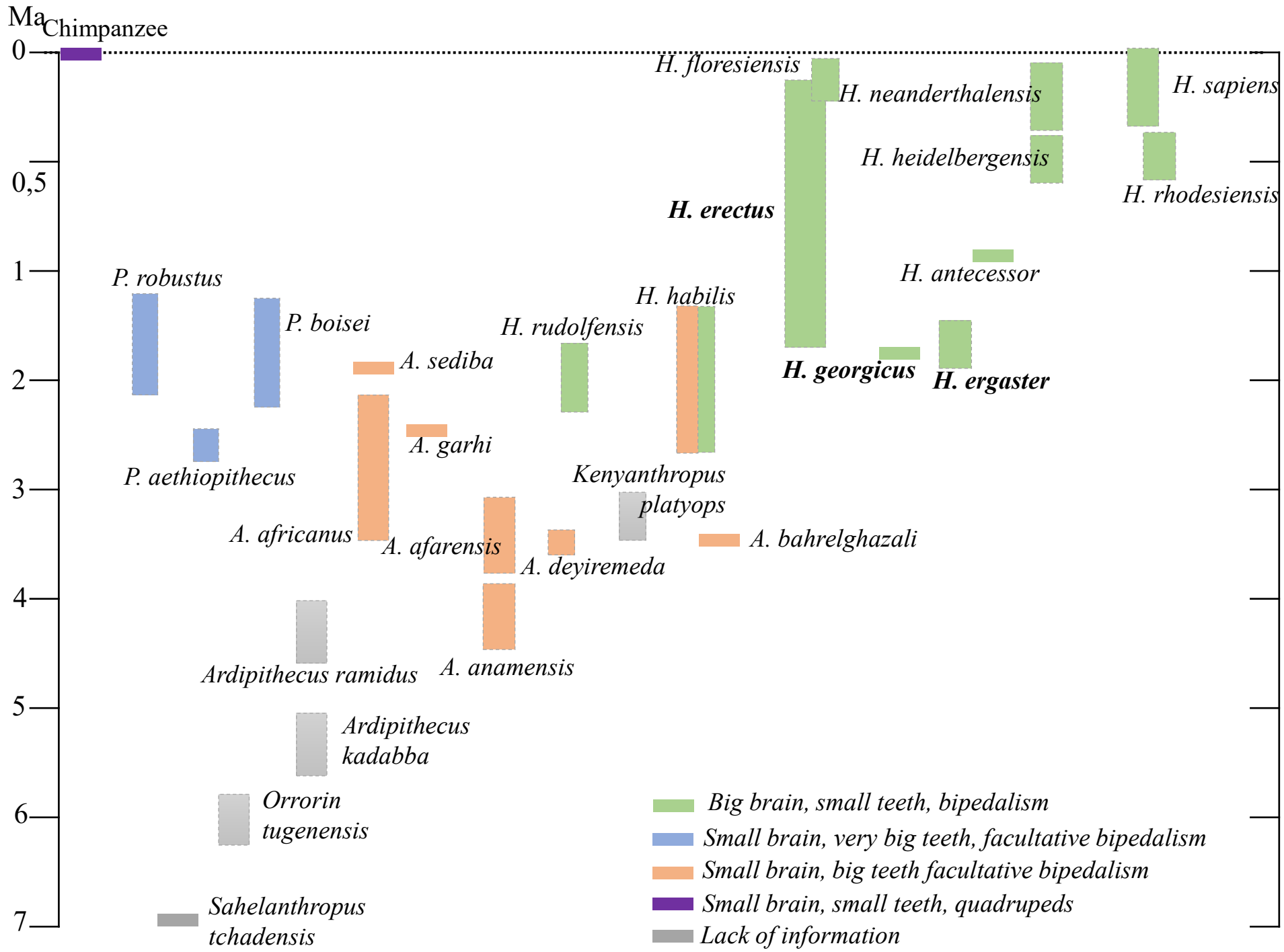




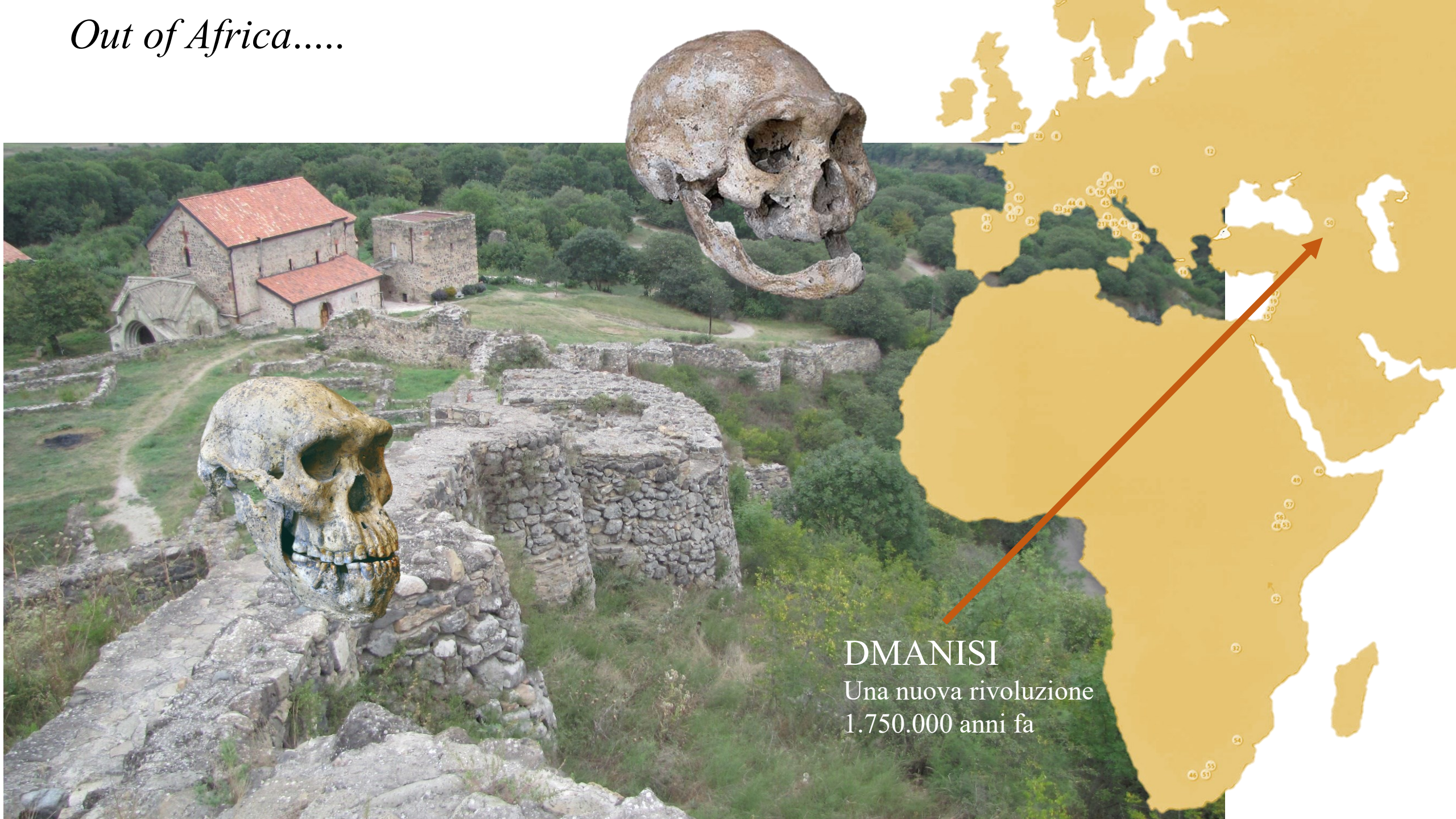
Out of Africa.....



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


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

Out of Africa.....



1.8-million-year-old hominin skull

These features had not been observed together in an early Homo *fossil until now.*

A small brain similar to the older *Homo habilis*

Long face similar to the more recent *Homo erectus*

Large teeth similar to older *Homo rudolfensis*

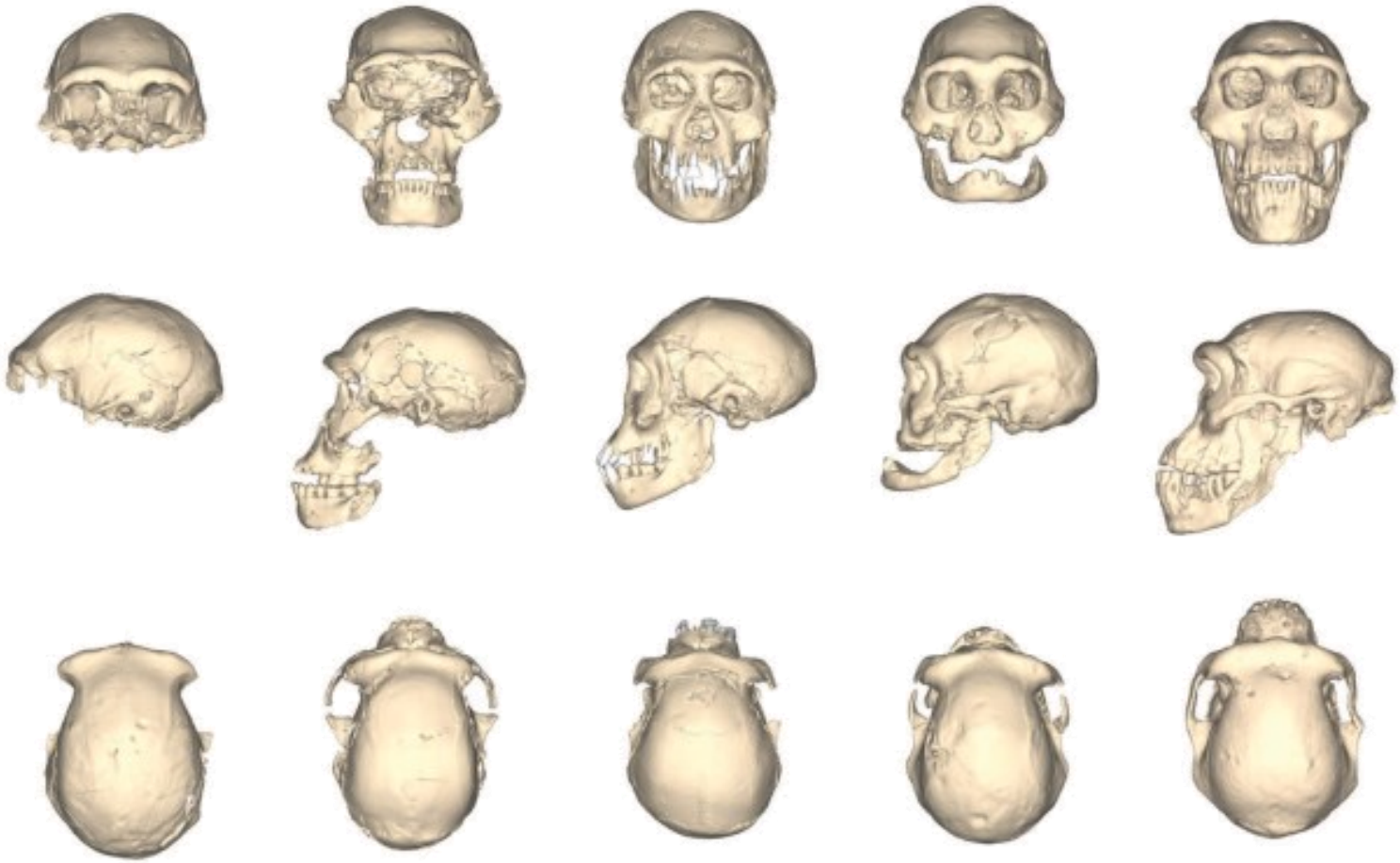
The blend of features suggests early humans were one species that had diverse facial and cranial characteristics.

SKULL IMAGE COURTESY OF M. PONCE DE LEÓN AND CH. ZOLLIKOFER, UNIVERSITY OF ZURICH, SWITZERLAND

NG STAFF; SOURCE: SCIENCE

A Complete Skull from Dmanisi, Georgia, and the Evolutionary Biology of Early *Homo*

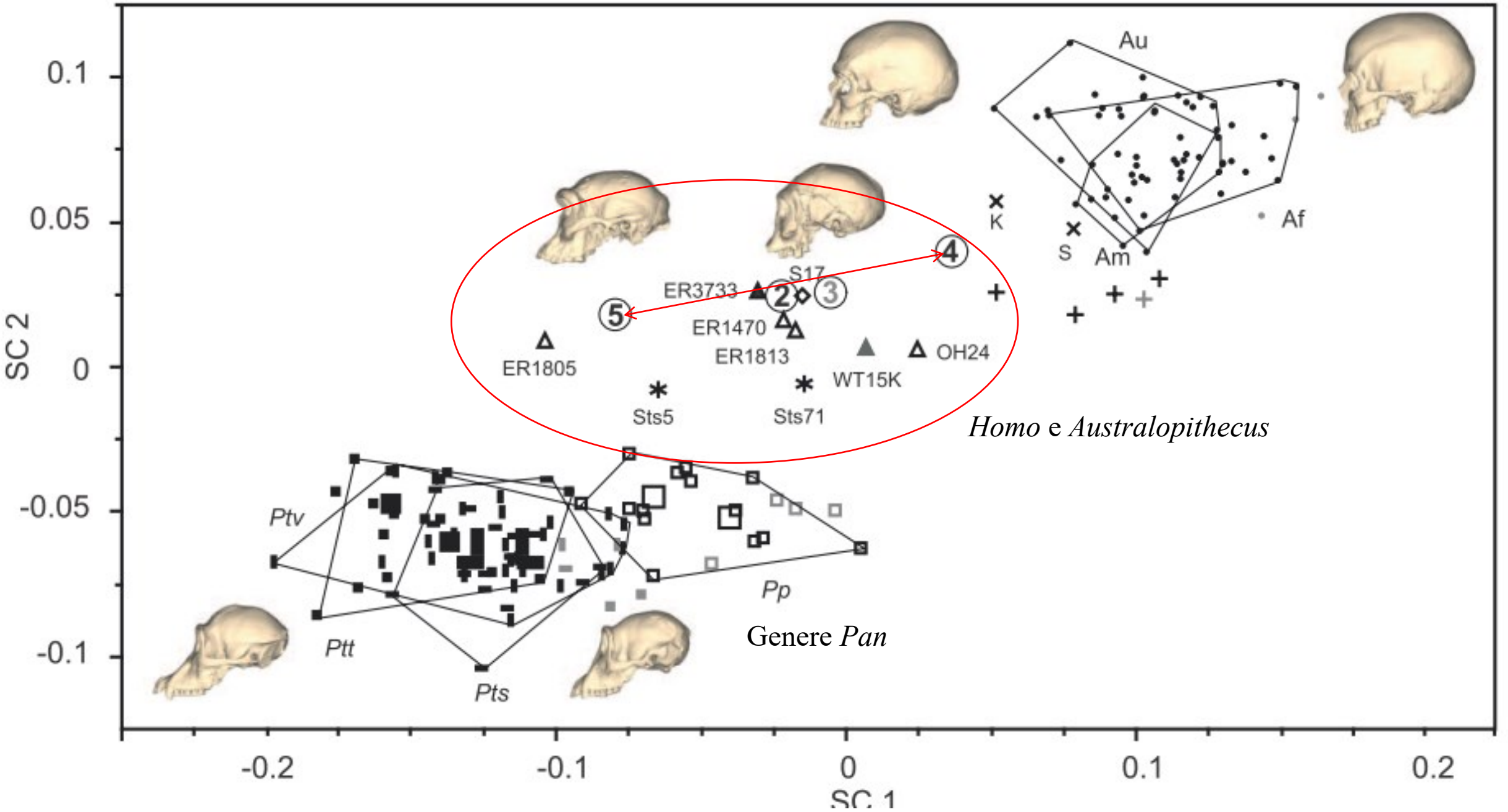
David Lordkipanidze,[1*] Marcia S. Ponce de León,[2] Ann Margvelashvili,[1,2] Yoel Rak,[3] G. Philip Rightmire,[4] Abesalom Vekua,[1] Christoph P. E. Zollikofer[2*]



Il campione di Dmanisi, che comprende ad oggi 5 crani, fornisce delle evidenze dirette di una variazione morfologica ampia all'interno e tra I primi *Homo.*

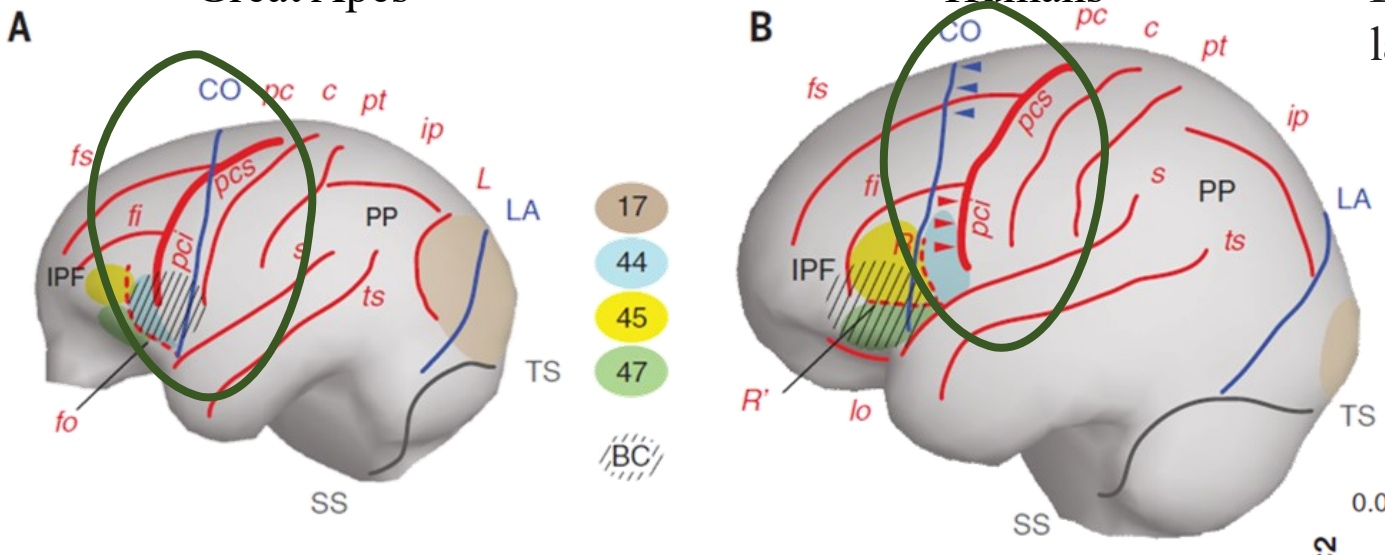
Questo suggerisce l'esistenza di una linea evolutiva unica dei primi *Homo,* con una continuità filogeographica attraverso I continenti.

The Dmanisi sample, which now comprises five crania, provides direct evidence for wide morphological variation within and among early Homo *paleodemes. This implies the existence of a single evolving lineage of early* Homo*, with phylogeographic continuity across continents.*


0.1
0.05
0
-0.05
-0.1
SC 2
-0.2
-0.1
0
0.1
0.2
SC 1
Au
Af
K
S
Am
S17
ER3733
ER1470
ER1813
ER1805
OH24
WT15K
Sts5
Sts71
1
2
3
4
5
Ptv
Ptt
Pts
Pp
Homo e Australopithecus
Genere Pan

Great Apes

Humans

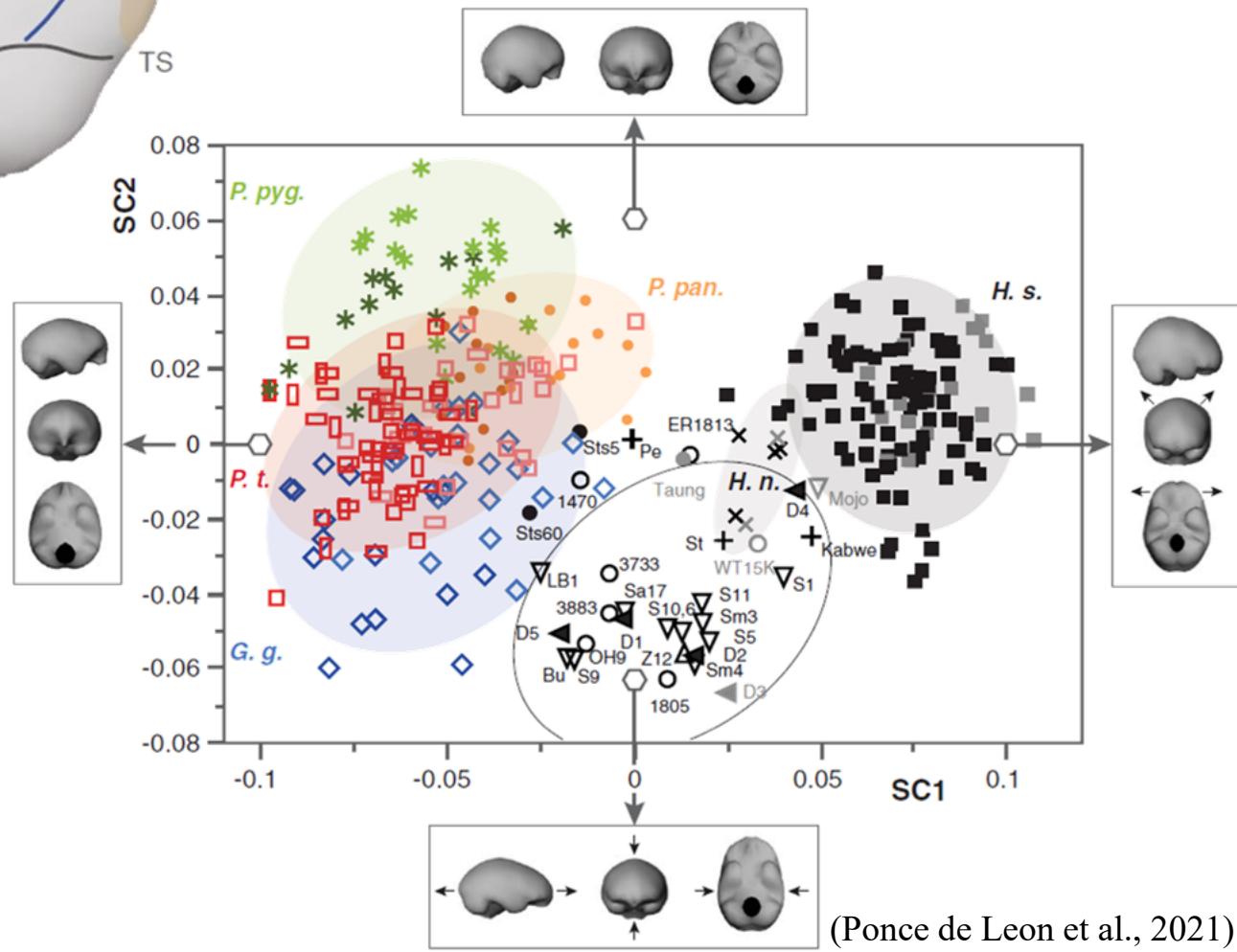


BC, Broca's cap; CO, coronal suture; LA, lambdoid suture.

Blue: Cranial sutures
Red: cerebral sulci

A) In great apes, the precentral sulcus (pc) crosses the coronal suture (CO), such that its inferior portion (pci) is located anterior to CO. The lunate sulcus (L) marks the anterior border of the primary visual cortex (Brodmann area 17).

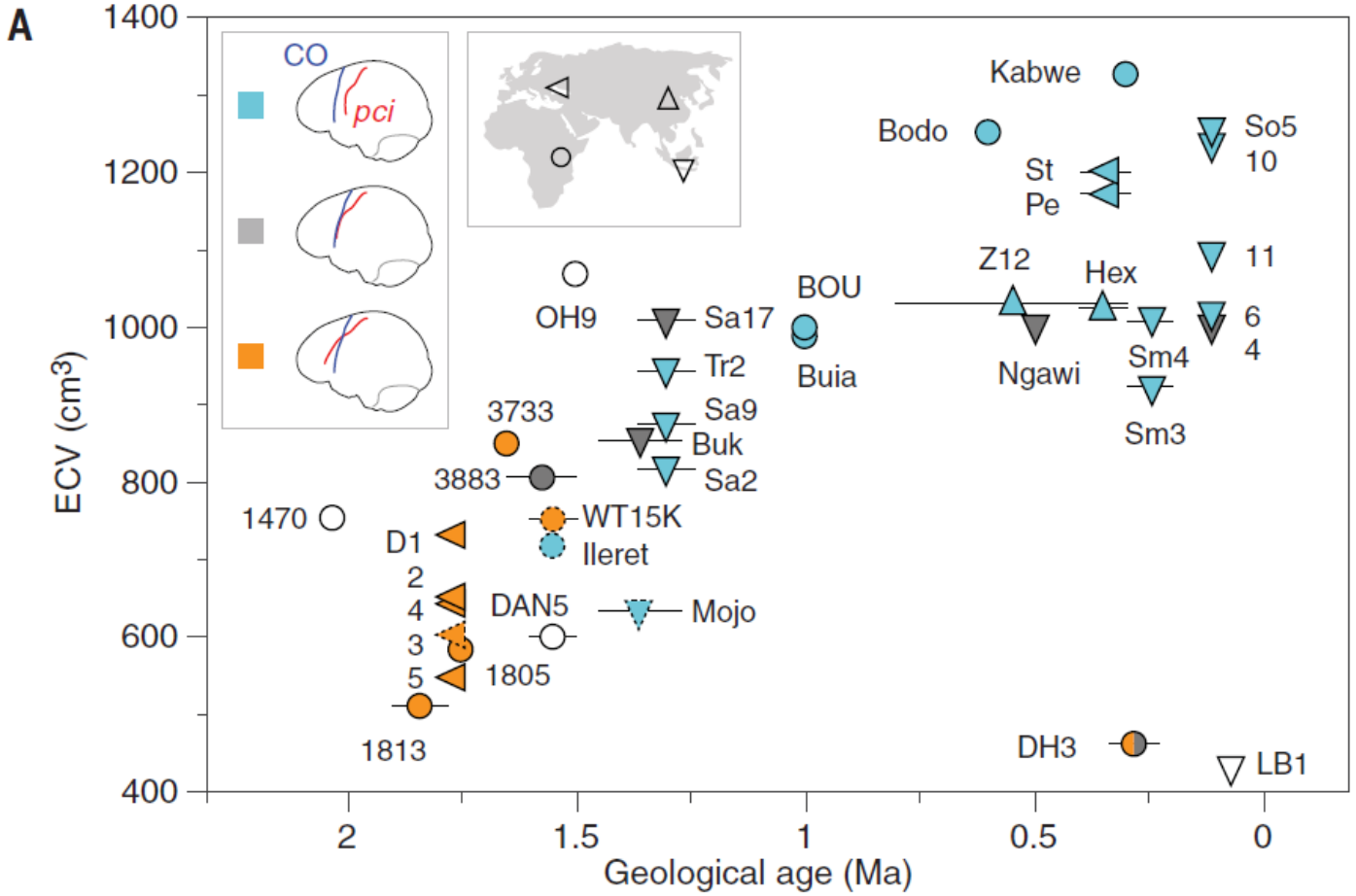
B) In humans, evolutionary expansion of the inferior prefrontal cortex (IPF) resulted in a shift of the pci toward the posterior side of CO (red arrowheads). Concomitant expansion of the parietal bone resulted in anterior shift (blue arrowheads) of the apical portion of CO. Expansion of the posterior parietal cortex (PP) resulted in fragmentation and eventual disappearance of L. Numbers indicate Brodmann areas. Neurocranial structures:



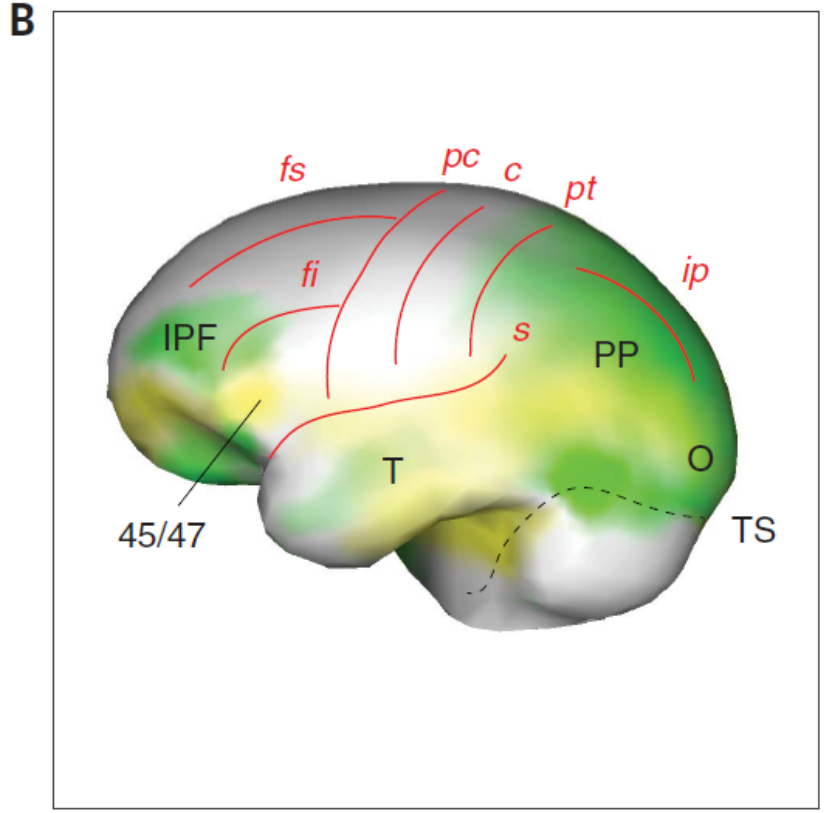
(Ponce de Leon et al., 2021)

The brains of early *Homo* from Africa and Western Asia (Dmanisi) retained a primitive, great ape–like organization of the frontal lobe. By contrast, African *Homo* younger than 1.5 million years ago, as well as all Southeast Asian *Homo* erectus, exhibited a more derived, humanlike brain organization.

Changes in ECV (mean endocranial volume) and craniocerebral topography over the past 2 Ma.

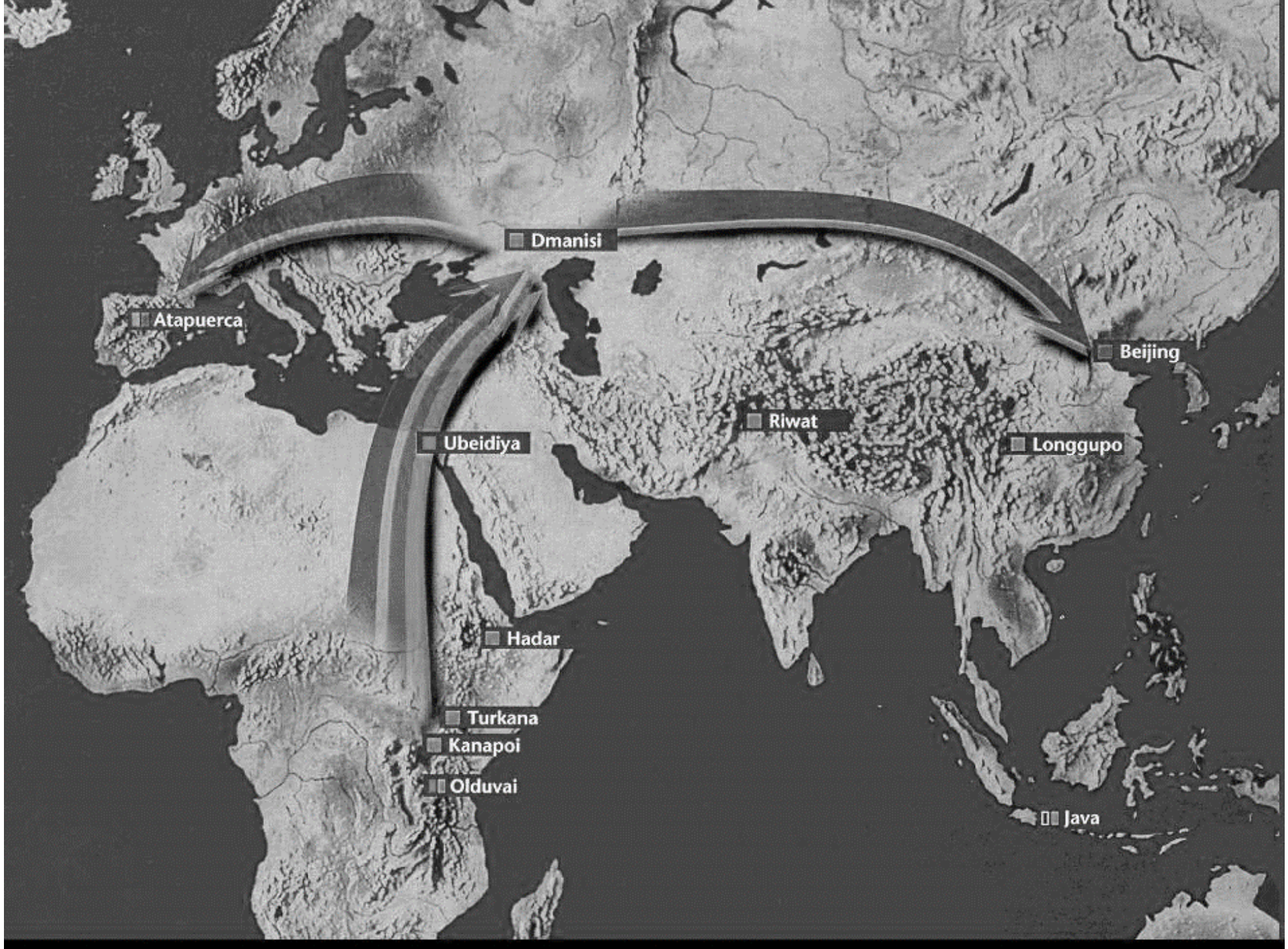


Endocranial shape change associated with frontal lobe reorganization (left lateral view). Colors denote above average expansion (green) and bulging (yellow) of the endocranial surface, indicating differential enlargement of labeled brain regions

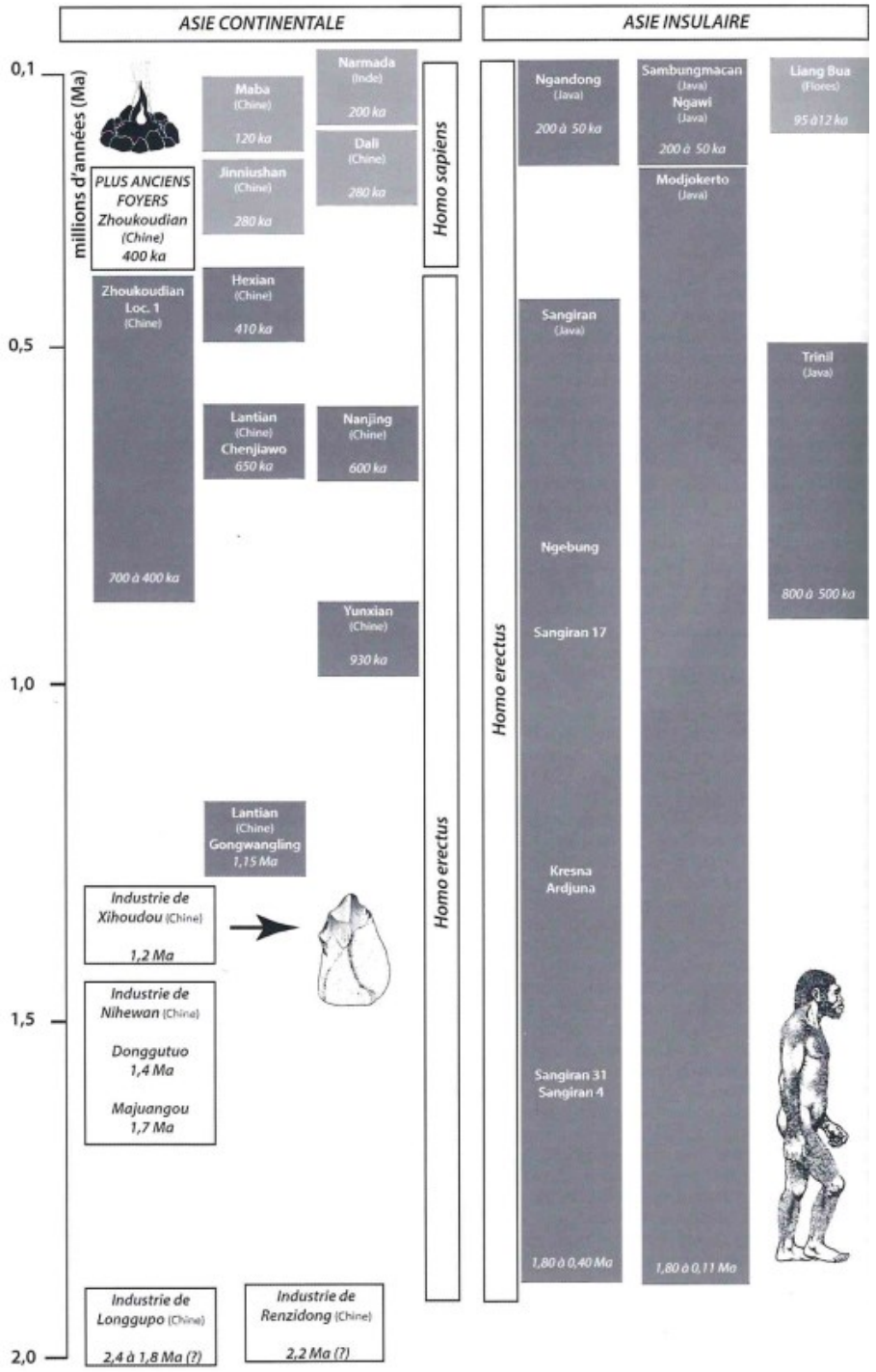


(Ponce de Leon et al., 2021)

Out of Africa.....

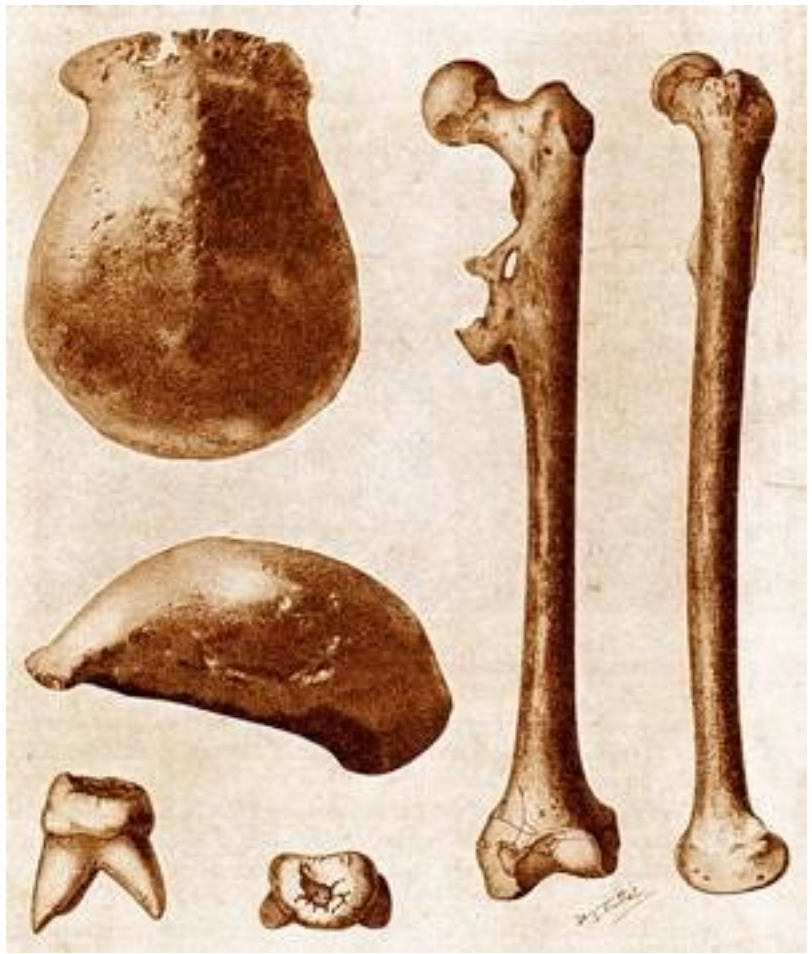

Dmanisi
Atapuerca
Beijing
Riwat
Ubeidiya
Longgupo
Hadar
Turkana
Kanapoi
Olduvai
Java

Out of Africa.....toward Asia



Out of Africa.....who?

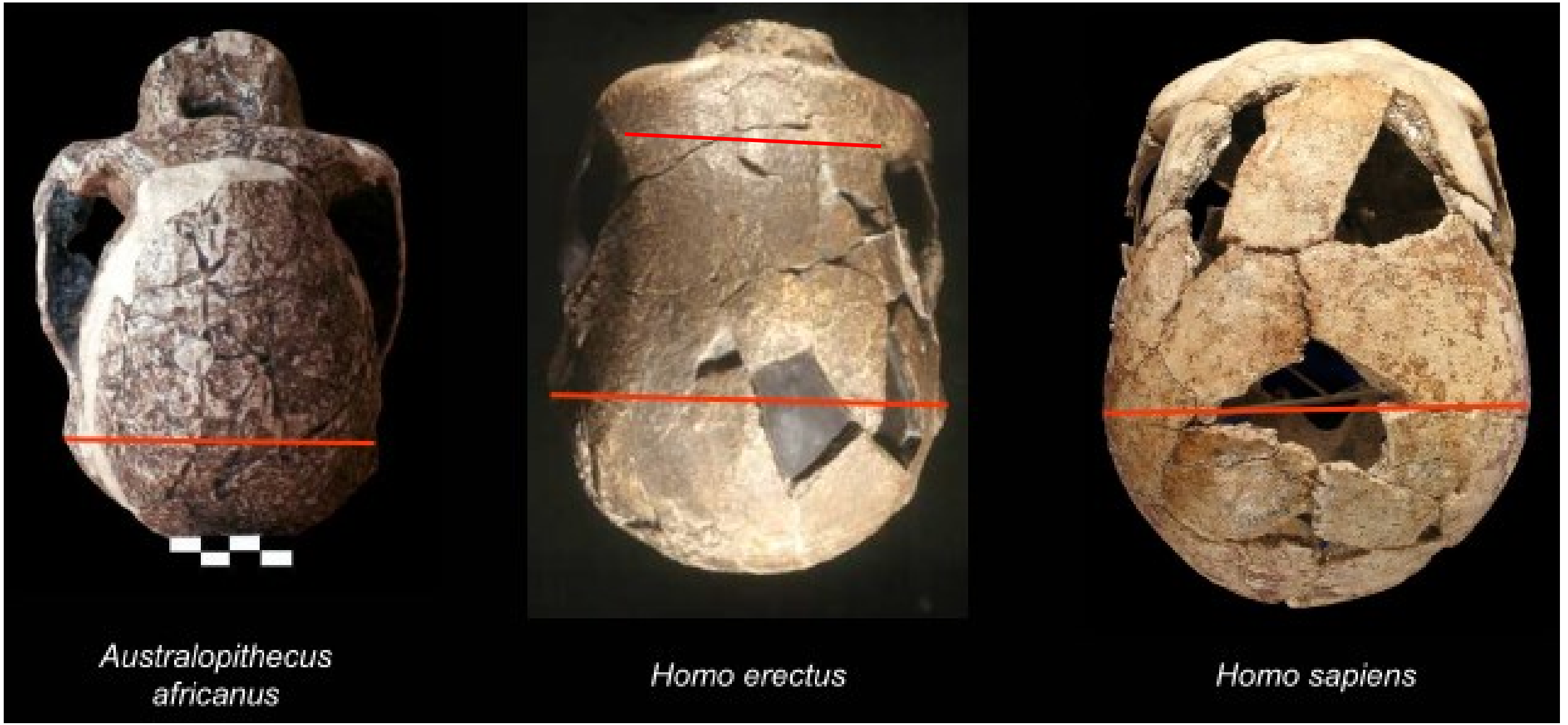
- The holotype of *Homo erectus* is the Trinil skull (Java)
- The skull from Zhoukoudian (China), Sangiran and Ngandong belongs to the same species
- … and the African one?



Most ancient african fossil: *Homo ergaster*
Most recent: *Homo erectus*

Larghezza cranica massima

Maximum cranial breadth



Forma sfenoide: larghezza massima in posizione arretrata / *Sphenoid shape: Maximum breadth backward*

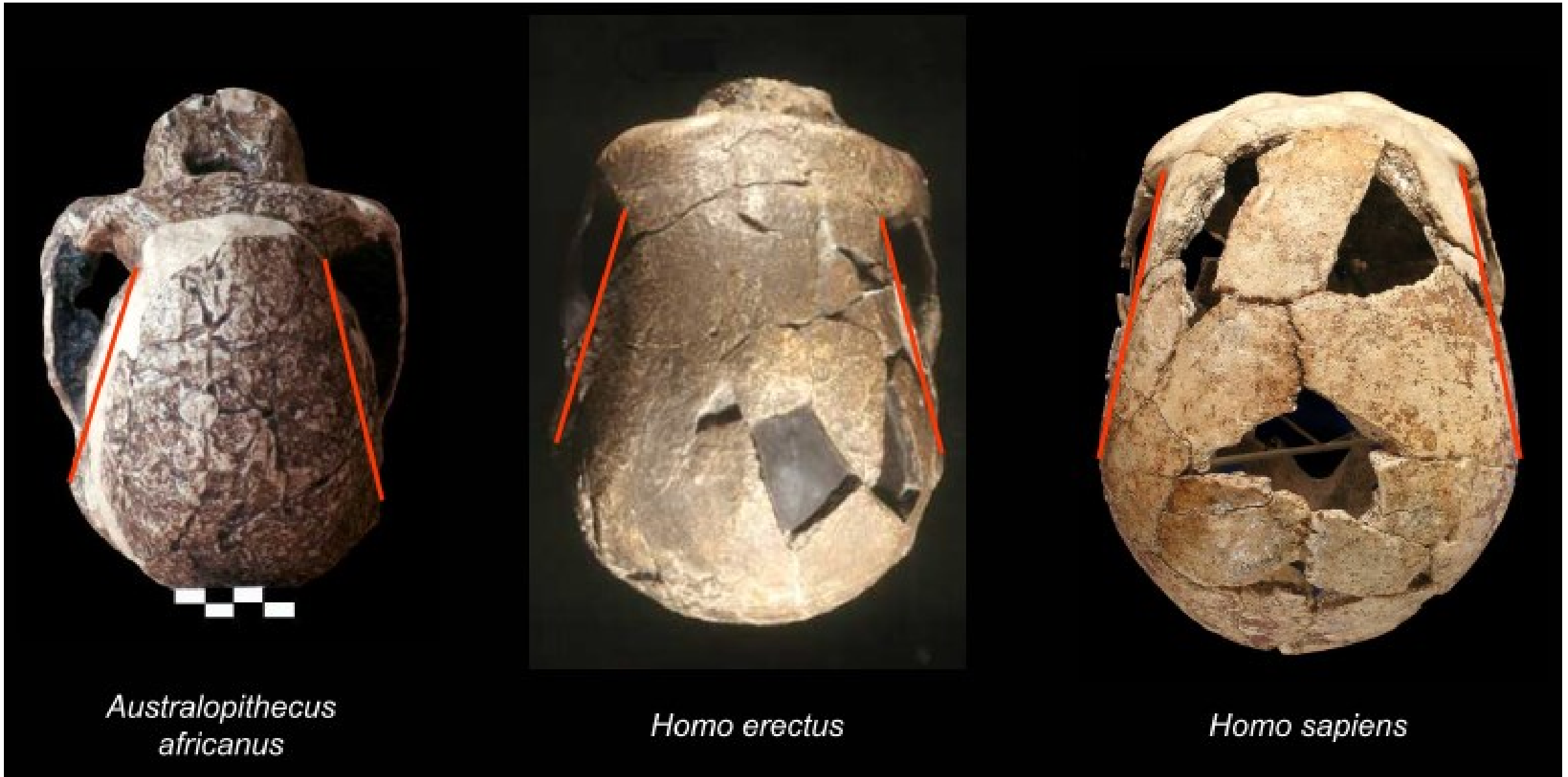
Restringimento dietro il toro sopra-orbitale / *Shrinkage retro orbital*

Parete convergente verso l'avanti: forma sfenoide

Wall convergente forward: sphenoidal shape

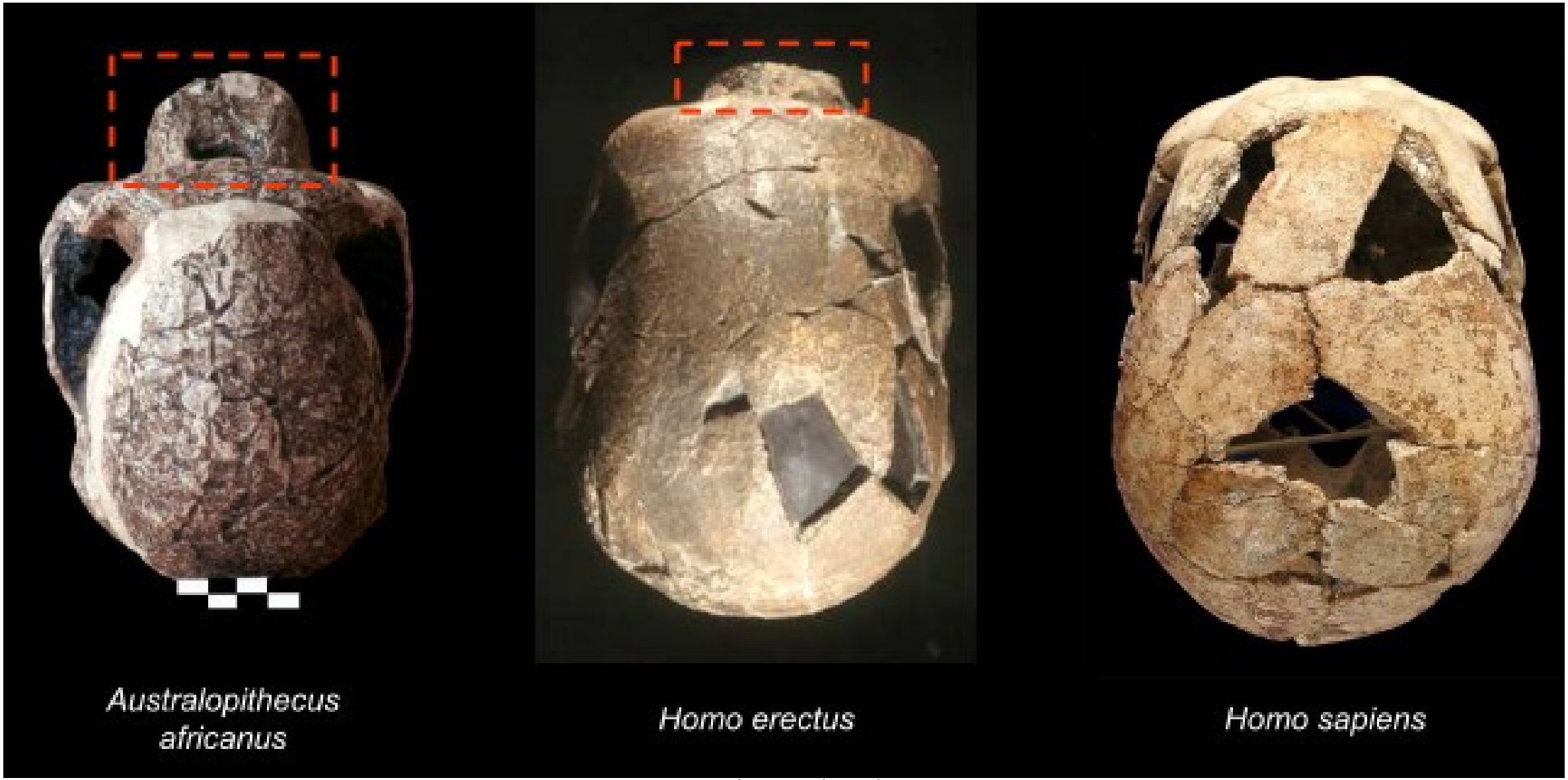
Parete convergente quasi-parallele: forma ovoidea

Wall almost parallele: ovoidal shape



Prognatismo faciale

Facial prognatism

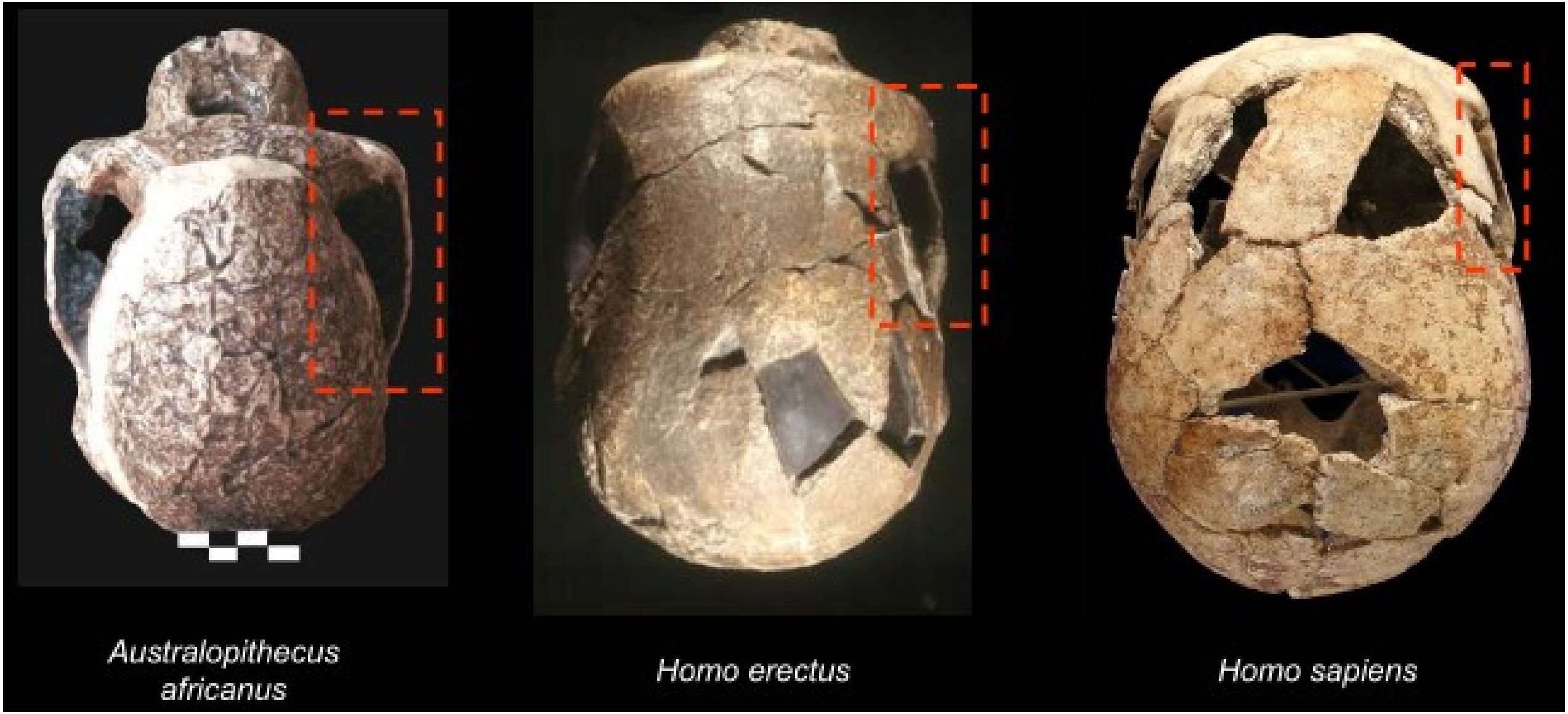


Prognatismo alveolare

Alveolare prognathism

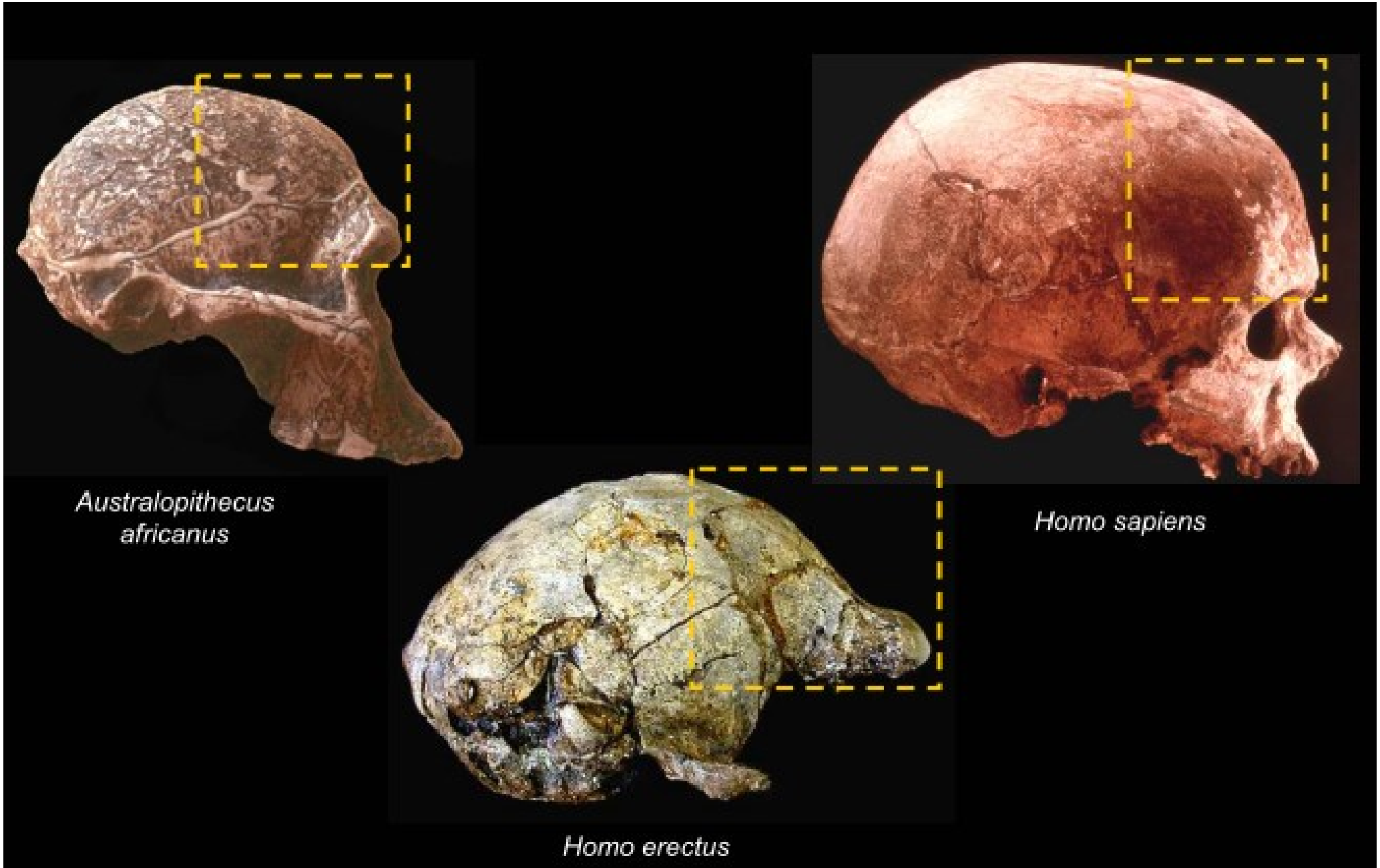
Proiezione laterale dei zigomatici

Lateral projection of the zygomatics



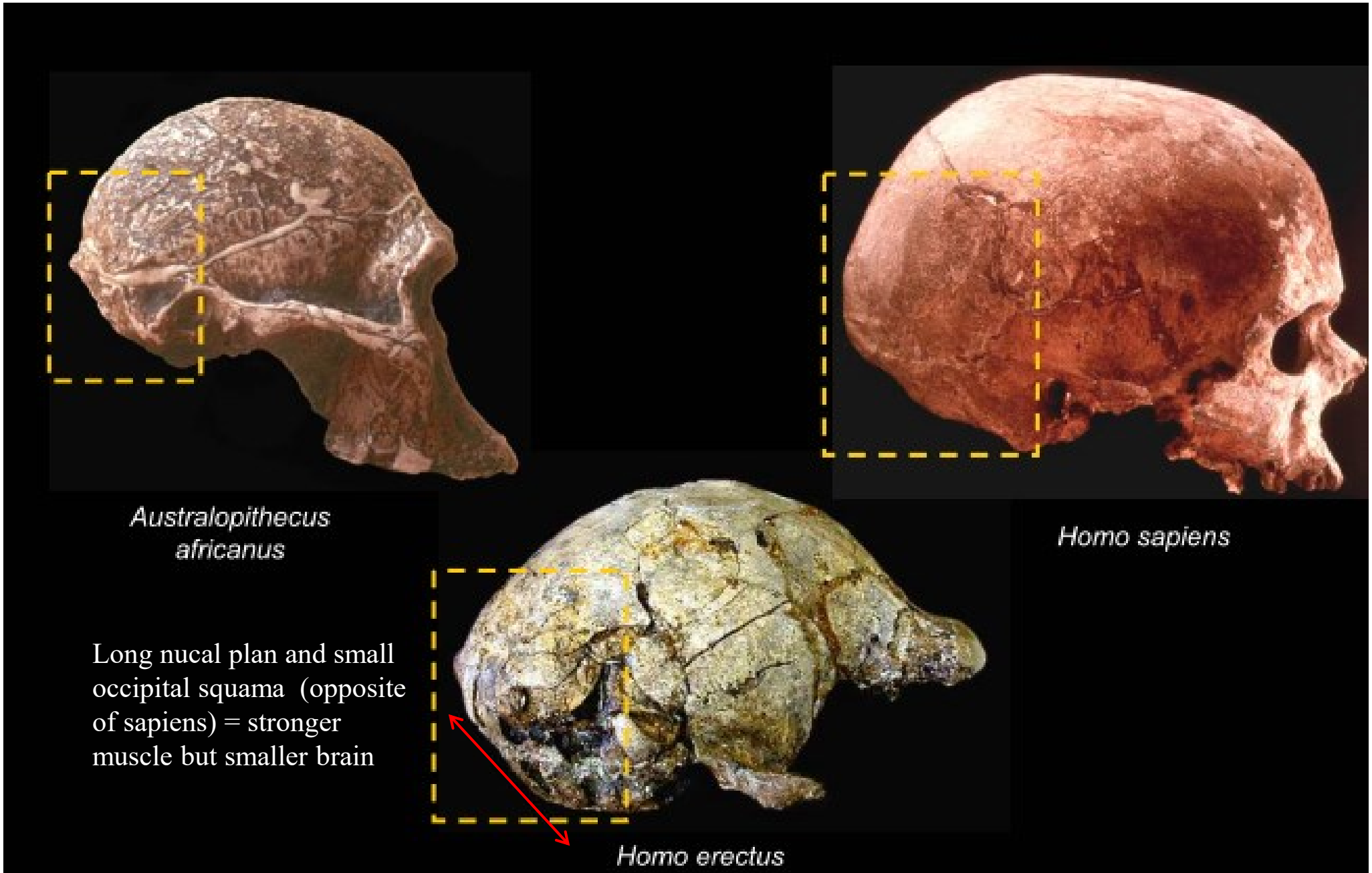
Osso frontale sfuggente

Receding frontal bone



Forma dell'osso occipitale

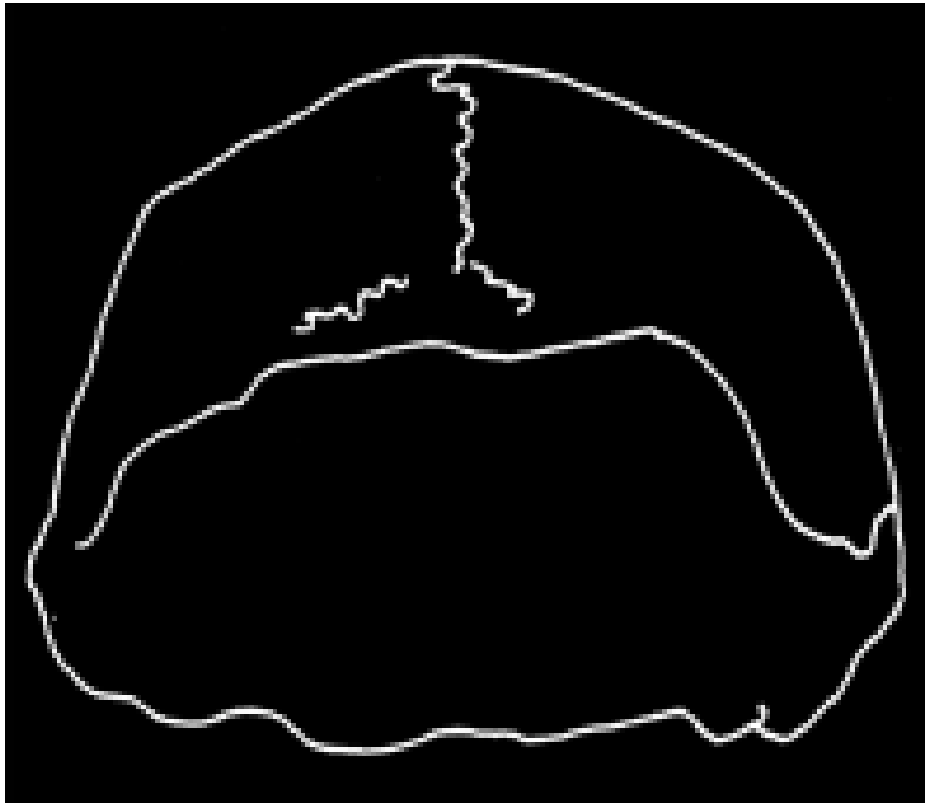
Occipital shape



Long nucal plan and small occipital squama (opposite of sapiens) = stronger muscle but smaller brain

Forma del cranio in vista posteriore

Cranial shape in posterior view

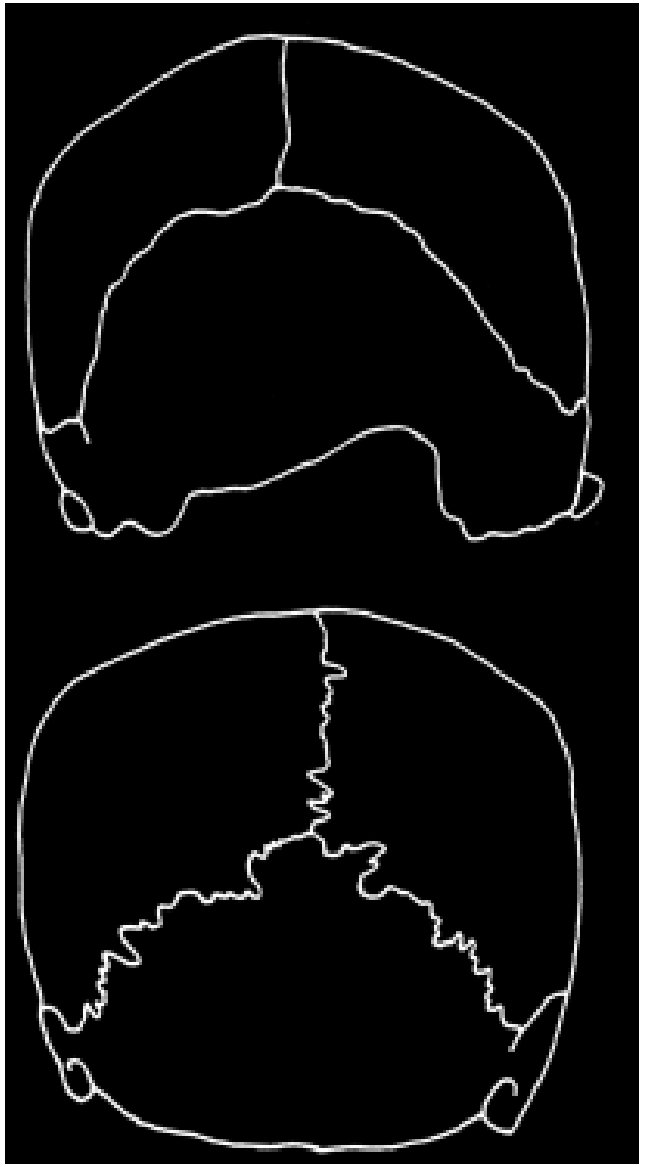


Pentagonale a parete convergente verso l'alto

Pentagonal with the wall convergent upward

Bozze parietale non sviluppate

Undeveloped parietal bump

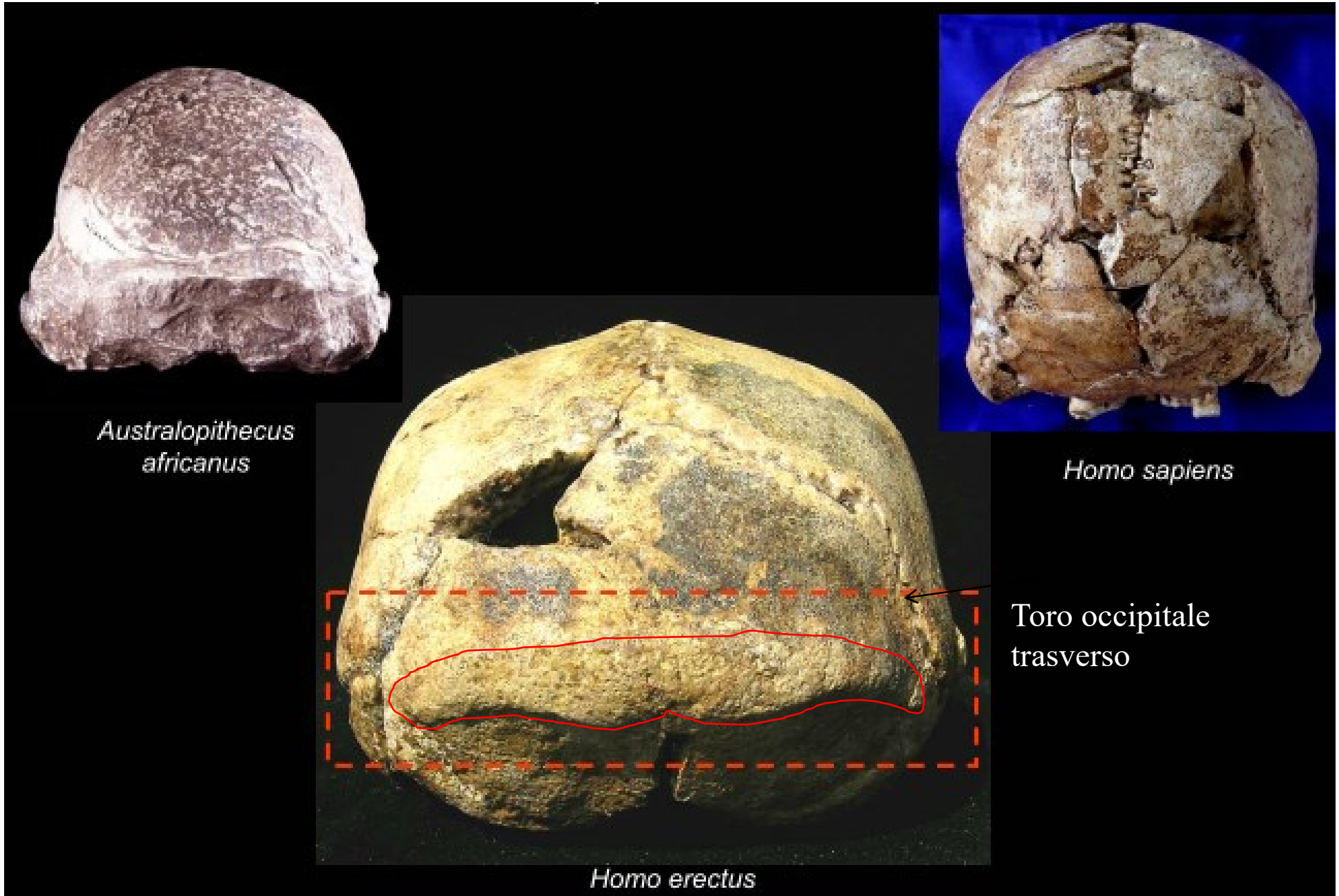


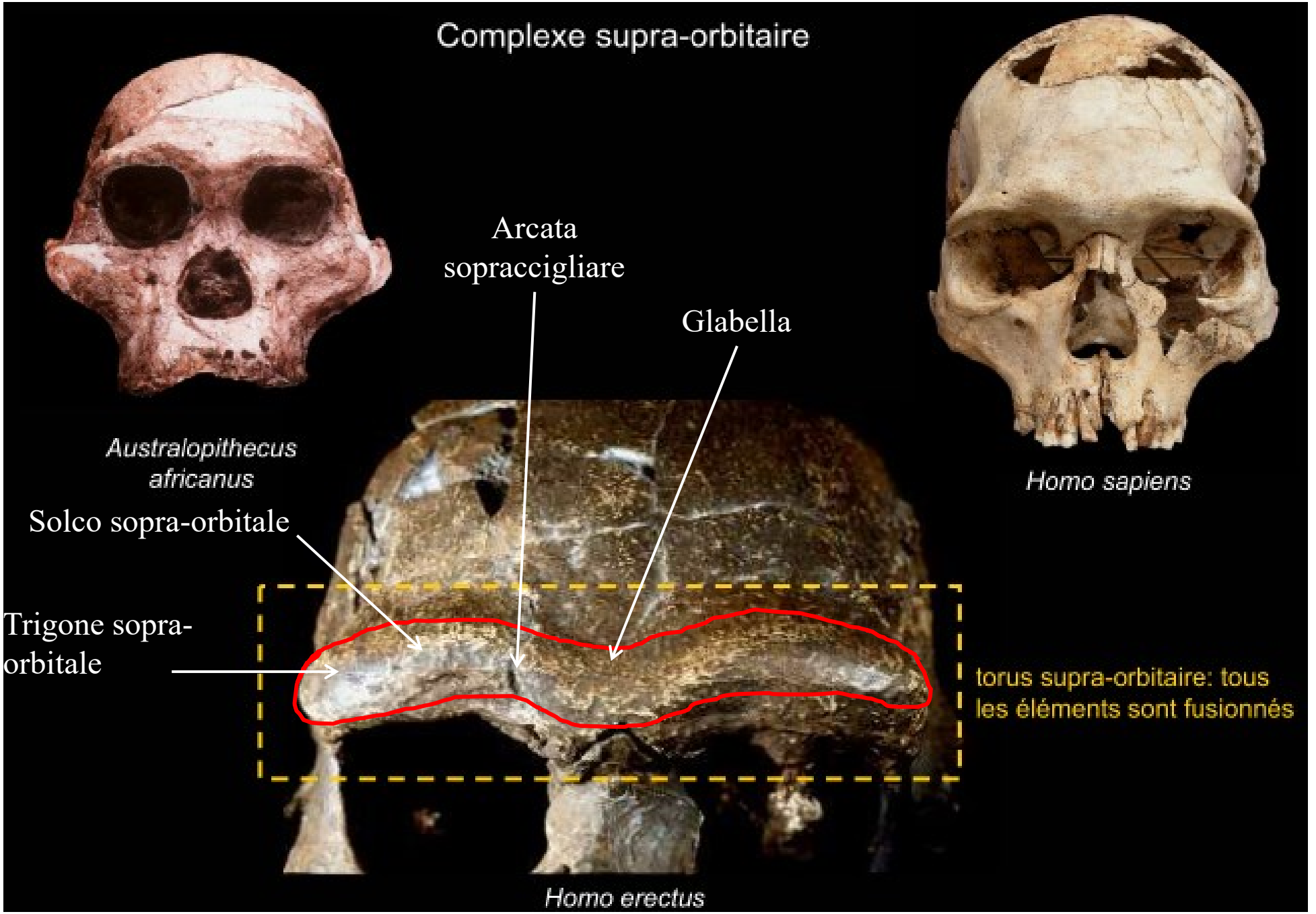
A « tetto di casa »
(*Homo sapiens)*

In « House roof »
(Homo sapiens*)*

Toro occipital transverso

Occipital transverse torus





Spazio interorbitale largo = becco encefalico / *large interorbital space = encephalic beak*

LONGGUPO (2 Ma BP)

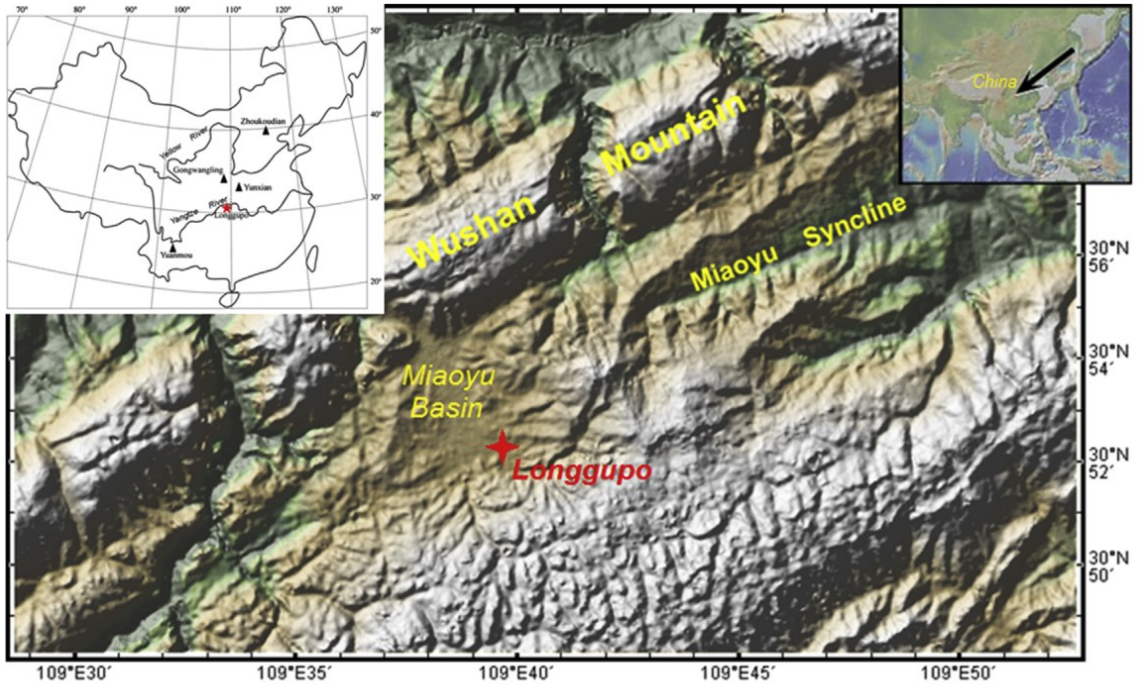
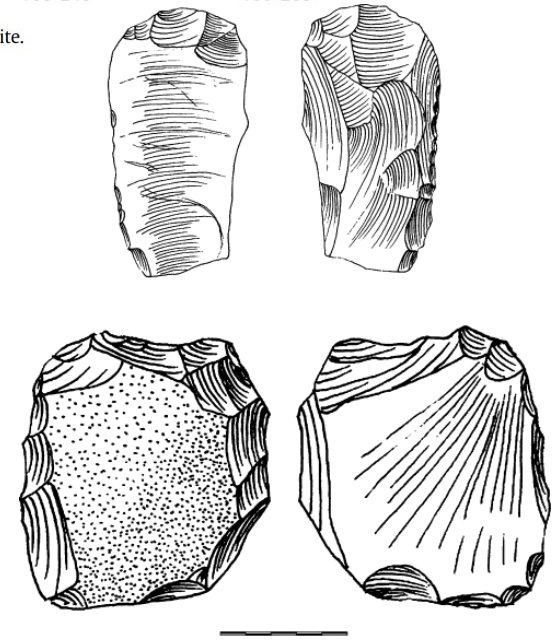


Fig. 1. Location of Longgupo site.



Quaternary International xxx (2015) 1–9

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Quaternary International

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

The earliest evidence of hominid settlement in China: Combined electron spin resonance and uranium series (ESR/U-series) dating of mammalian fossil teeth from Longgupo cave

Fei Han [a, *], Jean-Jacques Bahain [b], Chenglong Deng [c], Éric Boëda [d, e, f], Yamei Hou [e], Guangbiao Wei [f], Wanbo Huang [f, g], Tristan Garcia [h], Qingfeng Shao [i], Cunding He [f], Christophe Falguères [b], Pierre Voinchet [b], Gongming Yin [a]

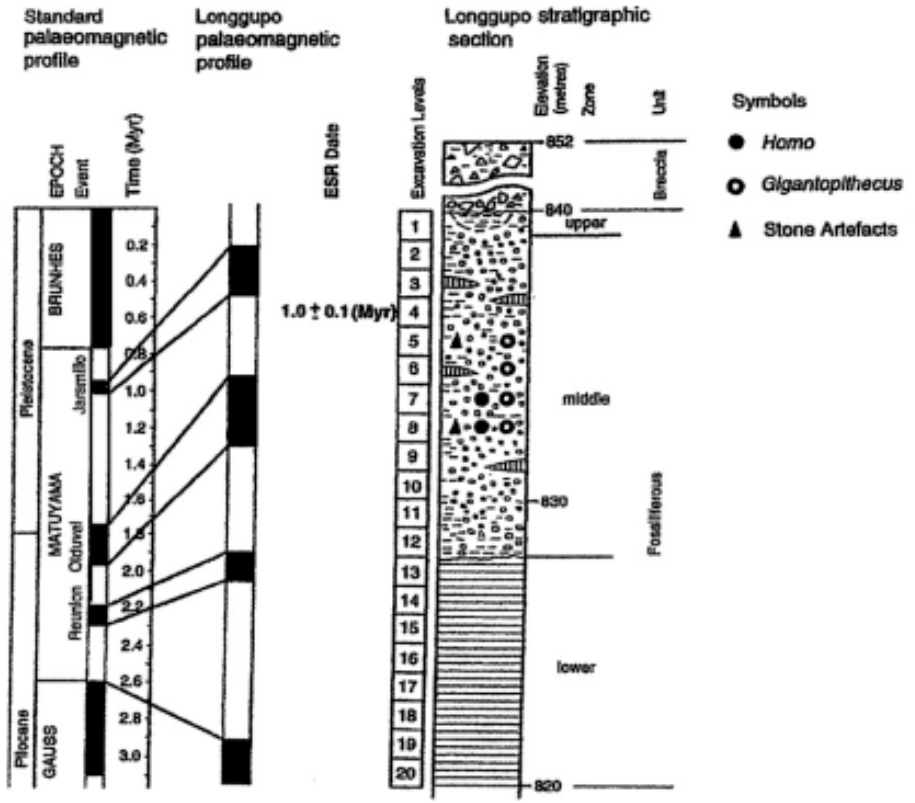
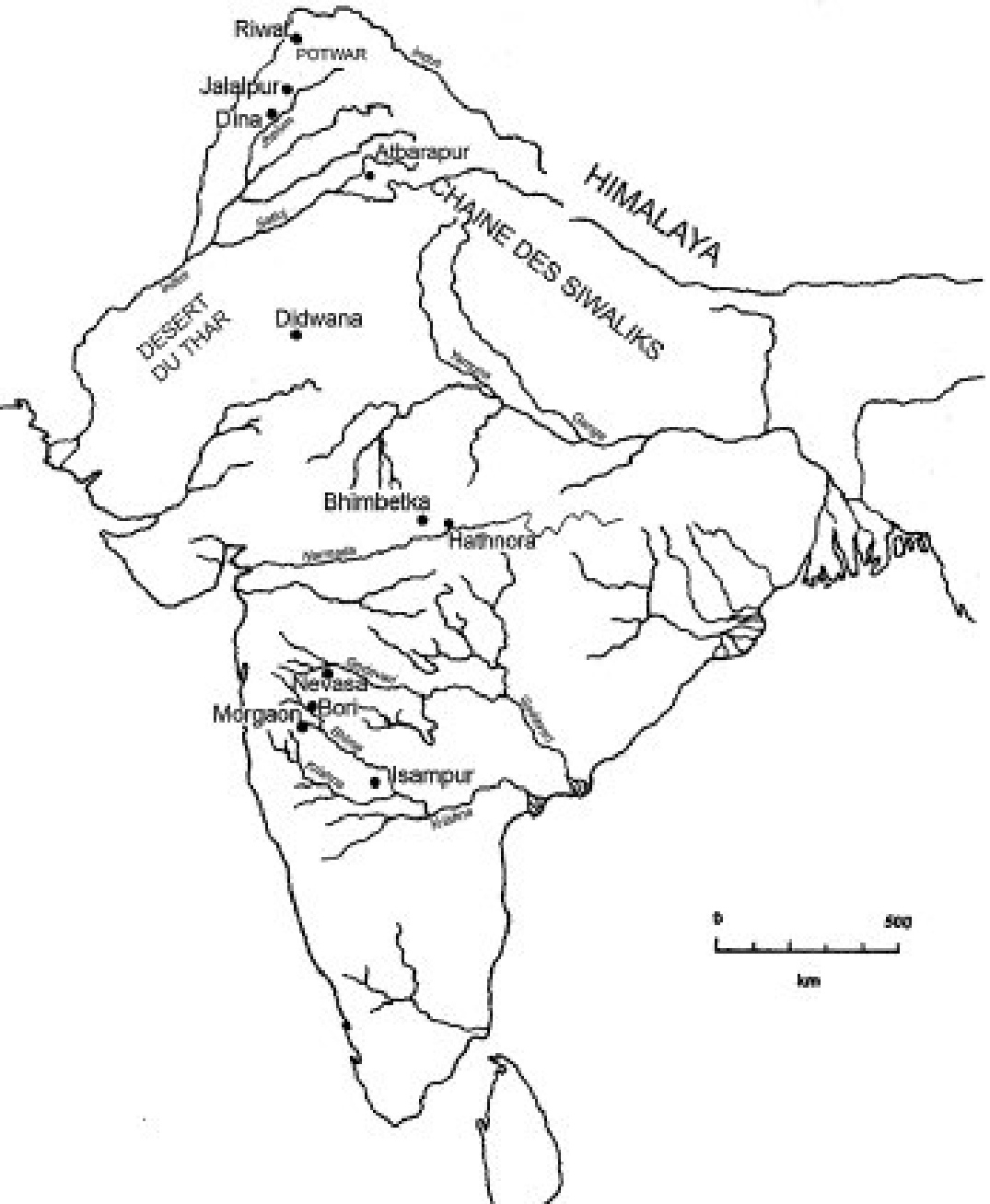


Fig. 6. Stratigraphie de la grotte Longgupo et hypothèses de datation (d'après Huang et al., 1995).
Fig. 6. Stratigraphy of the Longgupo cave and hypotheses for datation (after Huang et al., 1995).

RIWAT 1,9 Ma BP



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C. R. Palevol 5 (2006) 359–369

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http://france.elsevier.com/direct/PALEVO/

Paléontologie humaine et Préhistoire

Les premiers peuplements d'Asie du Sud : vestiges culturels

Claire Gaillard

UMR 5198 du CNRS, département de préhistoire du Muséum national d'histoire naturelle, Institut de paléontologie humaine, 1, rue René-Panhard, 75013 Paris, France

Reçu le 22 novembre 2004 ; accepté après révision le 19 septembre 2005
Disponible sur internet le 28 novembre 2005
invitation du Comité éditorial

ISAMPUR 1 Ma BP

Java

Modjokerto 1,8-0,4 Ma

Sangiran 1,8-0,4 Ma

(Sangiran 4, 31, Ardjuna, Kresna, Sangiran17, Ngebung)

Trinil 0,8-0,5 Ma

China

Lantian - Gongwangling 1,15 Ma

Yunxian 0,93 Ma

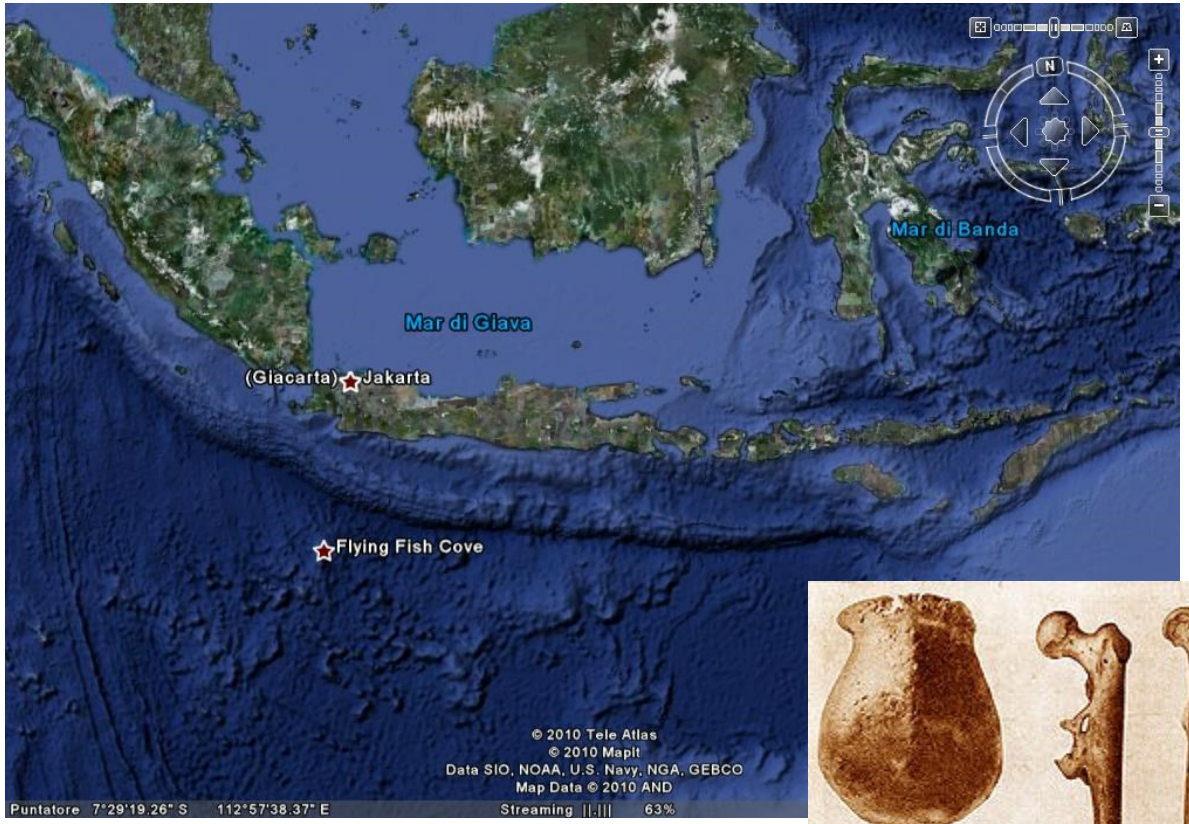
Zhoukoudian loc. 1 0,7-0,4 Ma

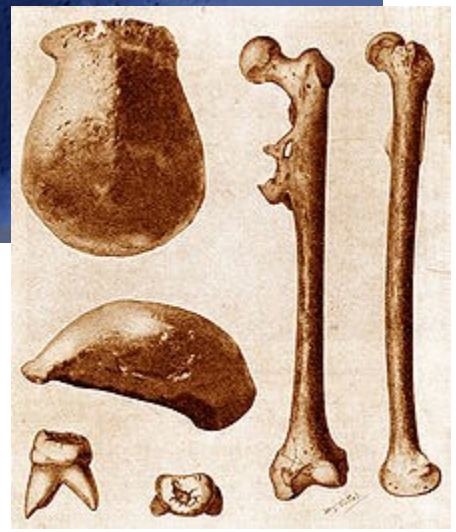
Lantian – Chenjiawo 0,65 Ma

Nanjing 0,6 Ma

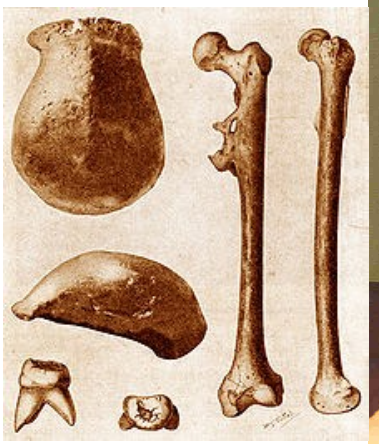
Hexian 0,41 Ma

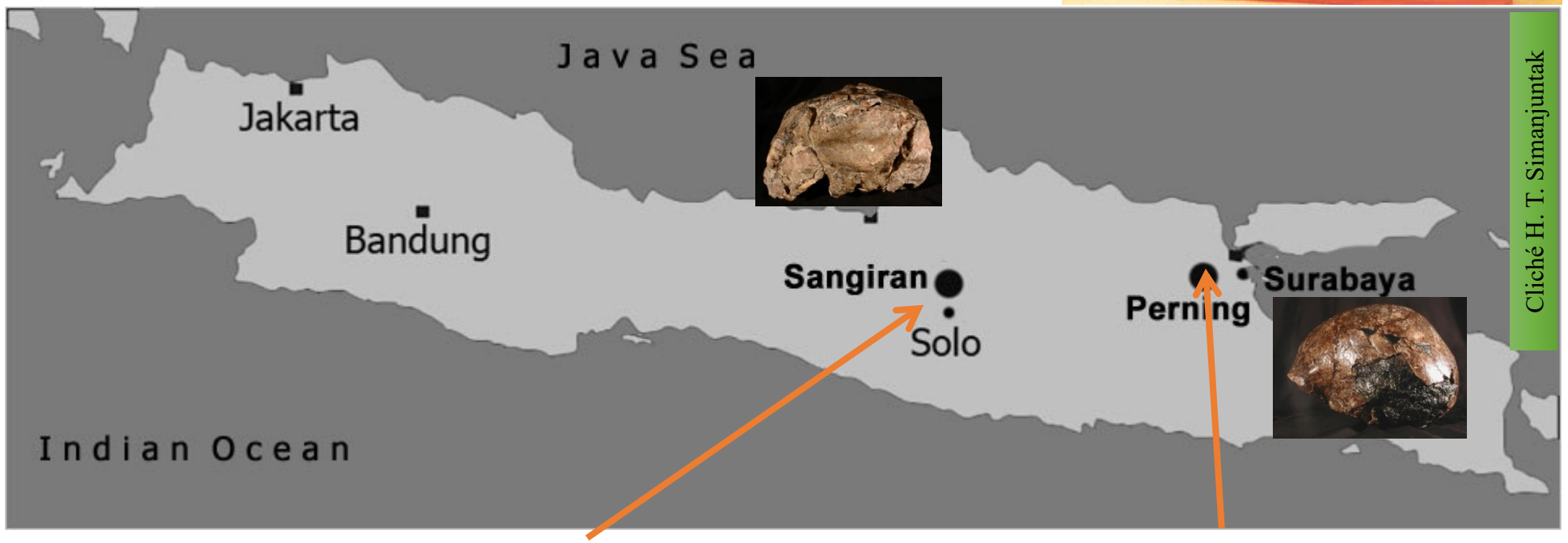
Homo erectus à Java (*Pithecanthropus*)





Homo erectus à Java (*Pithecanthropus*)

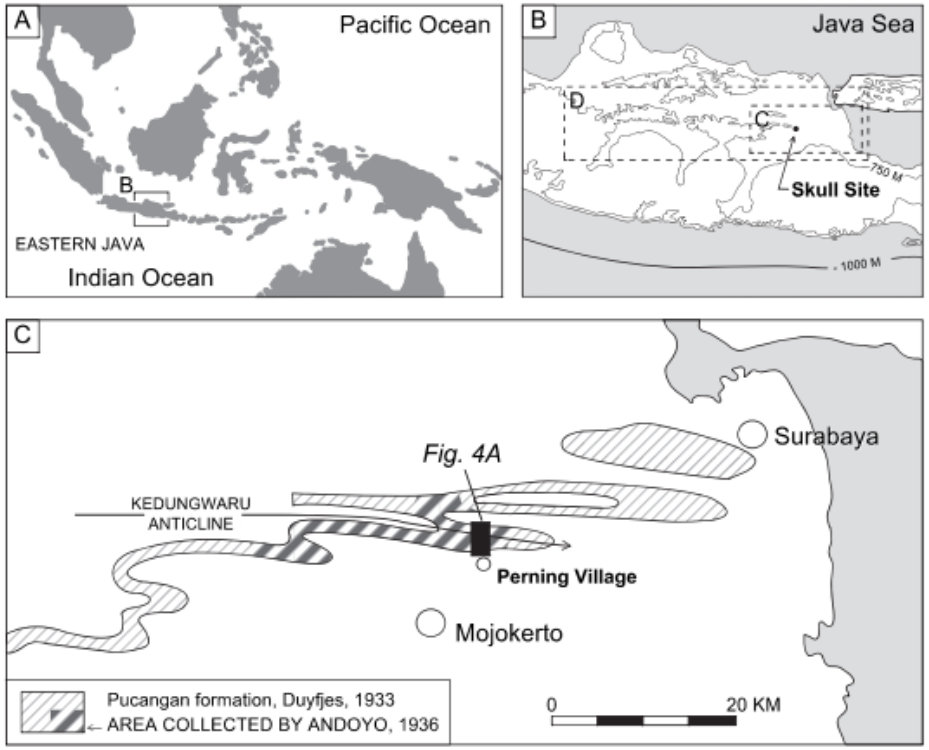


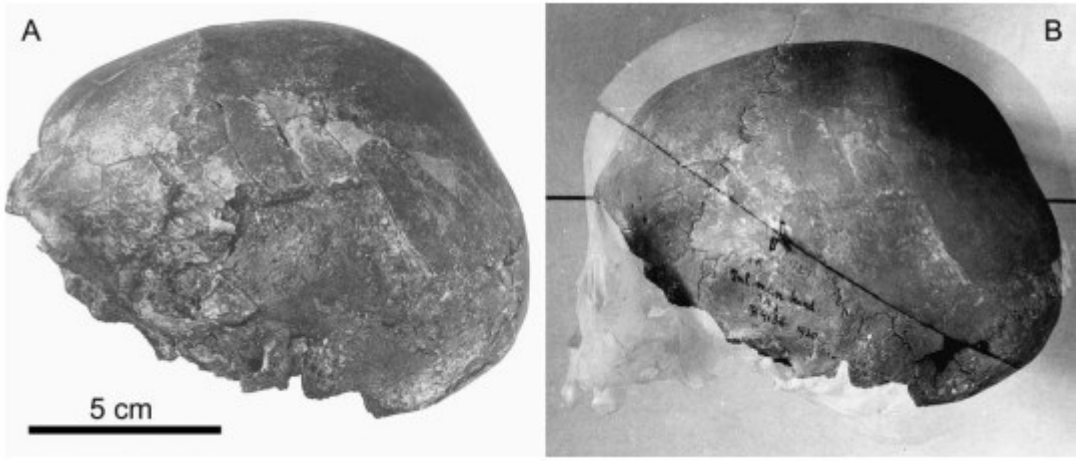


1.6 ± 0.04 mya (Jacob & Curtis 1971)
1.66 ± 0.04 mya (Swisher *et al* 1994)
1.64-1.67 mya: Kalibeng-Pucangan (Sémah 2000)
1.66 ± 0.04 mya: Lowest Pucangan: (Widiasmoro 2001).

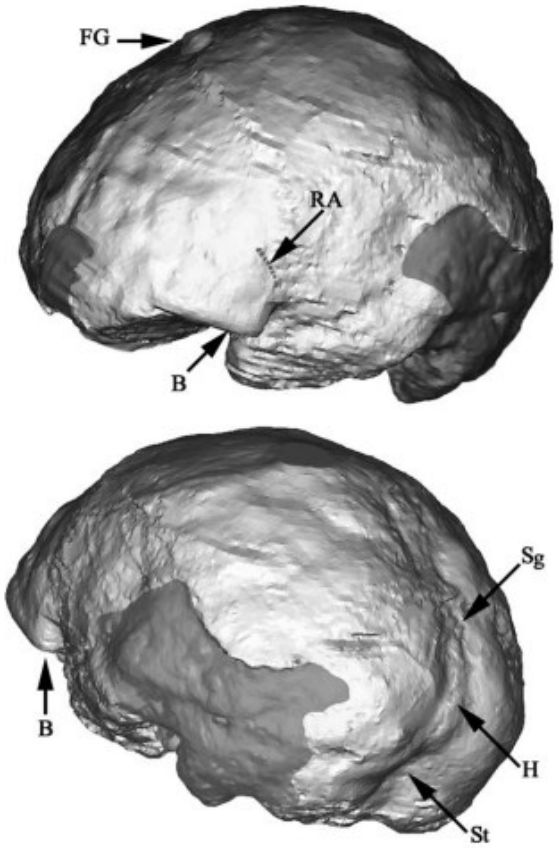
1.9 ± 0.5 mya (Jacob & Curtis 1971)
1.81 ± 0.04 mya (Swisher *et al* 1994).

Mojokerto, 1.9 Myr



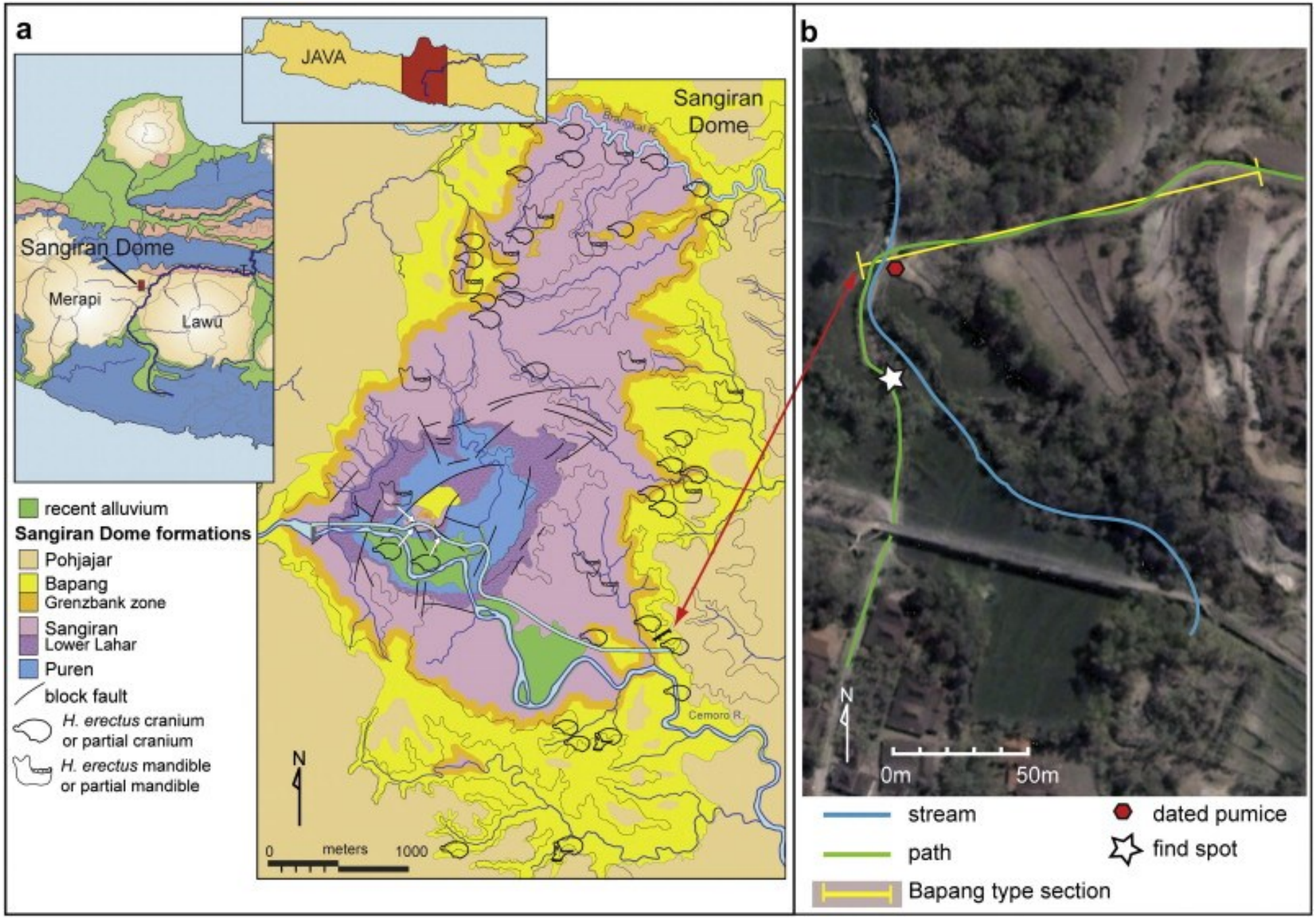


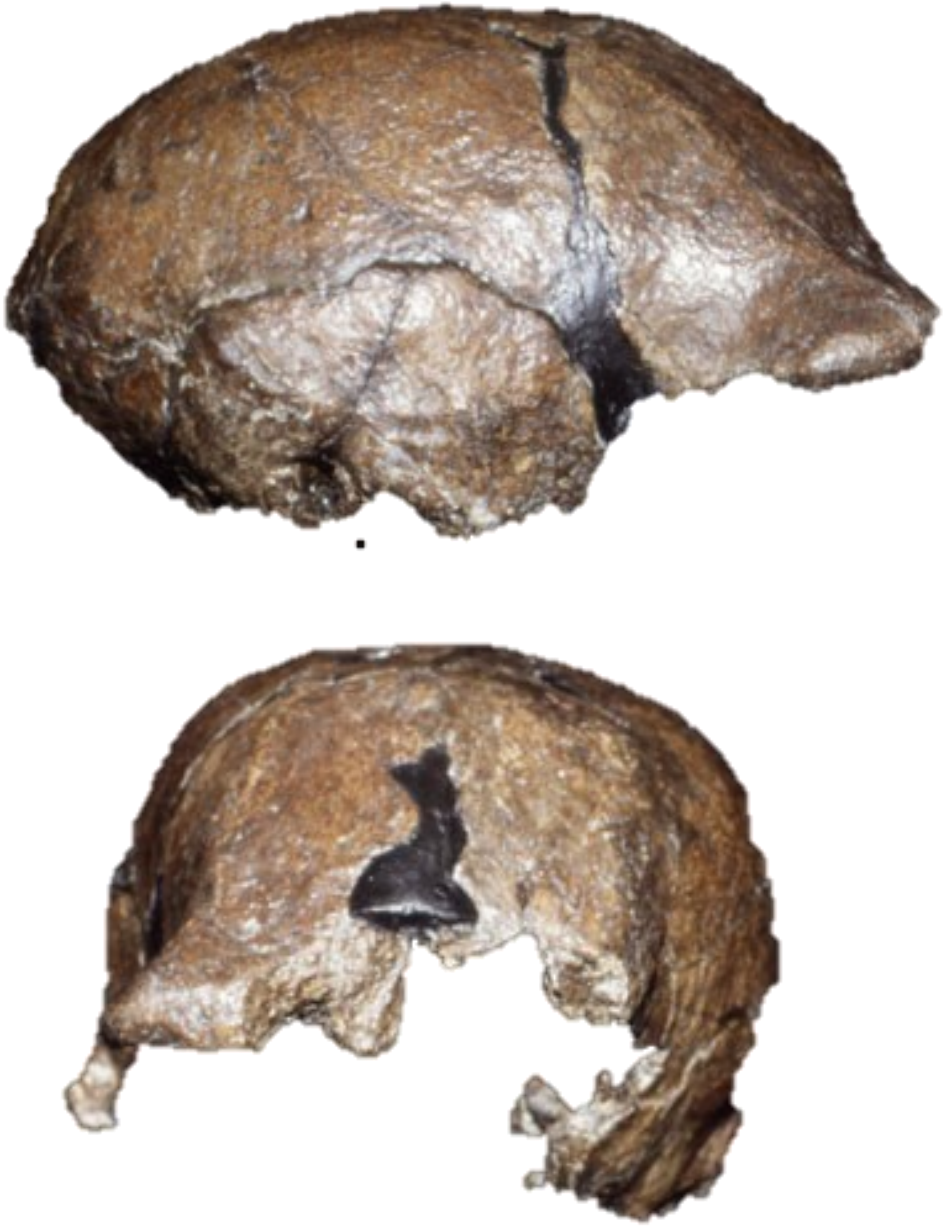
Photographs of Mojokerto child skull. A) left lateral view B) compared with 1,5 years old modern-child skull



Visualization of Mojokerto endocast (Balzeau, 2005)

Sangiran, Java, Indonesia



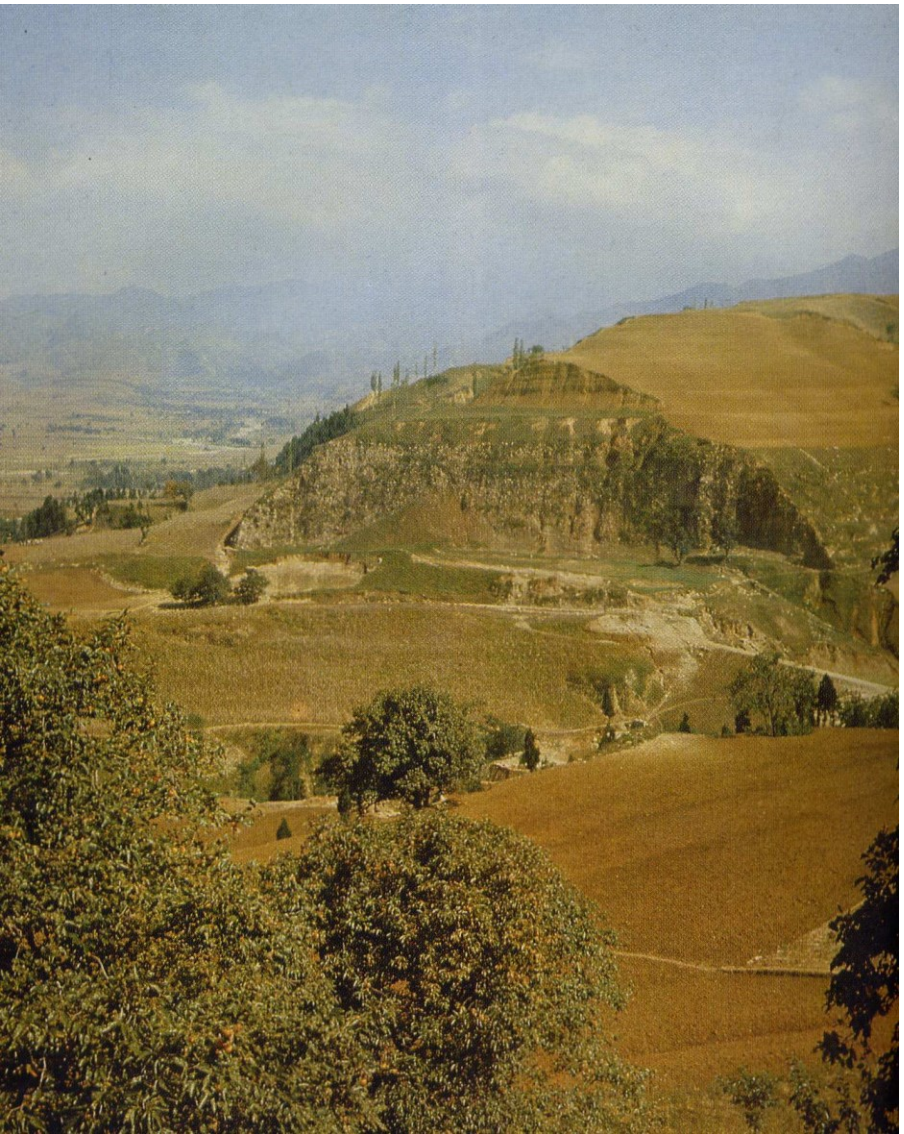


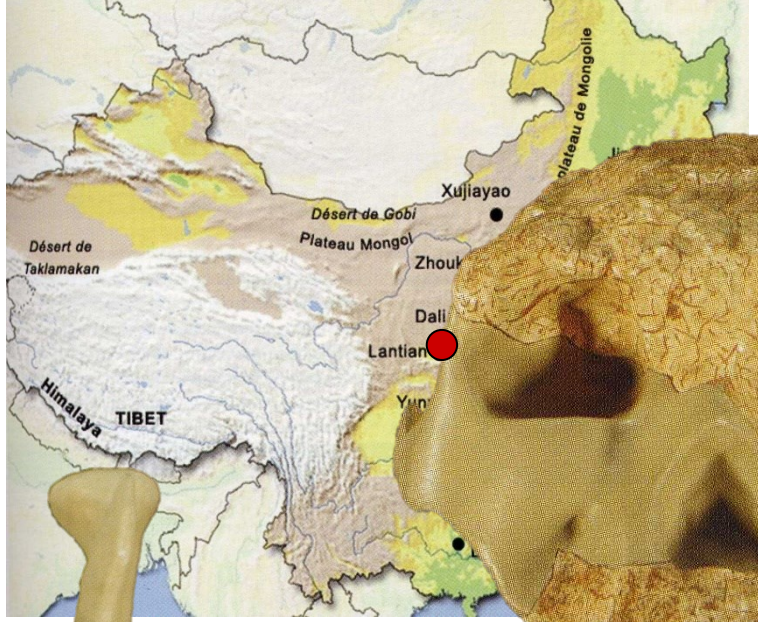
Sangiran 2

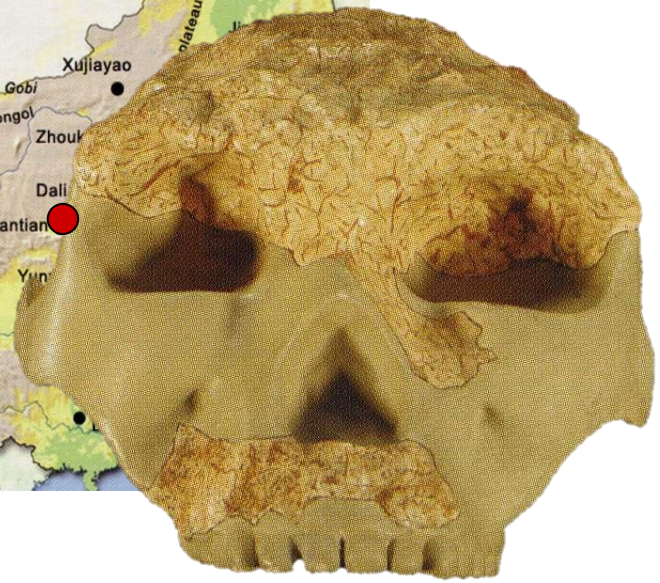
Sangiran 38

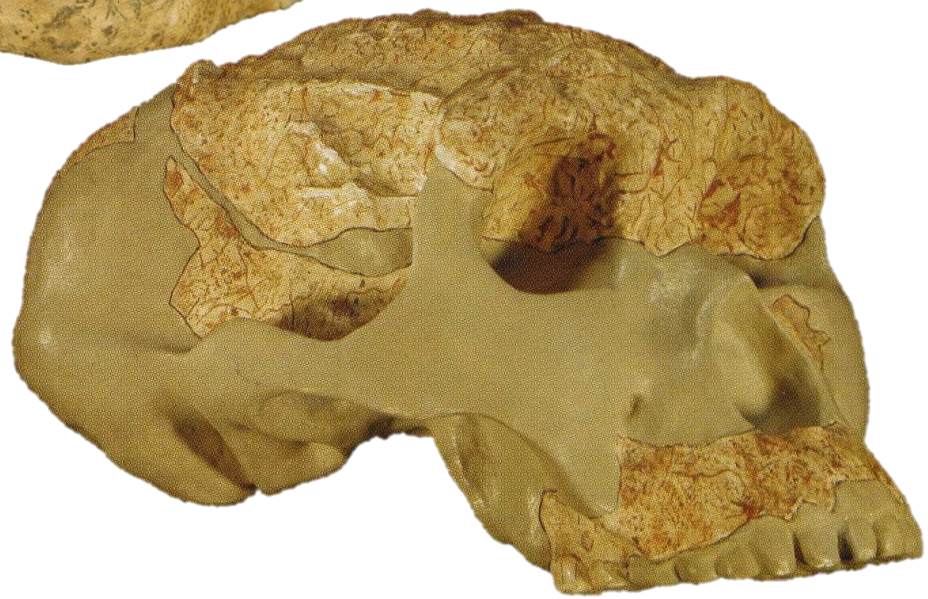
Out of Africa.....toward Asia

LANTIAN

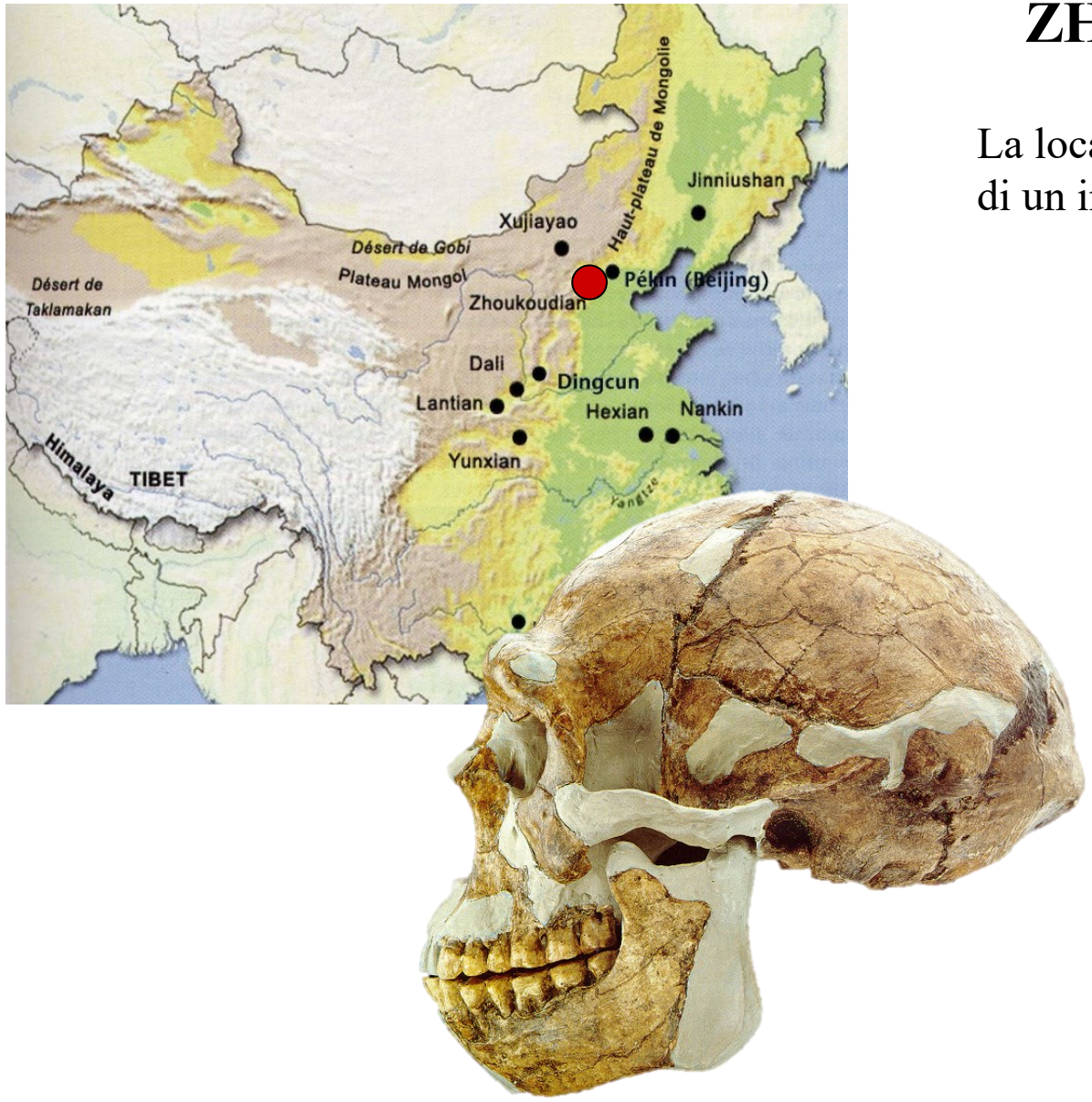






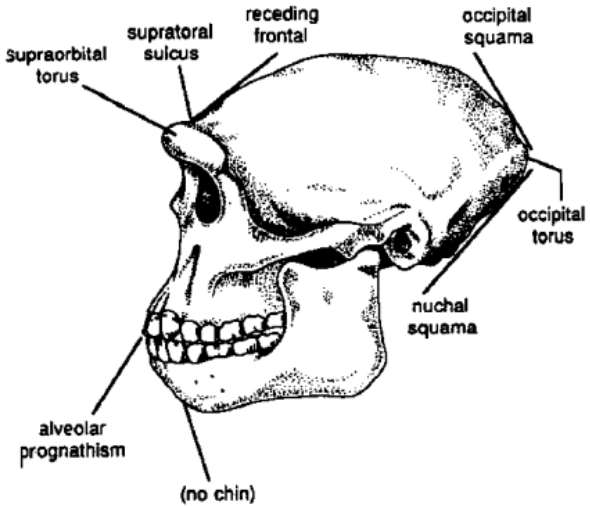


Out of Africa.....toward Asia



ZHOUKOUDIAN

La località 1 è stata datata tra 600.000 e 200.000 anni BP. Si tratta di un insediamento in grotta.



Confronto tra Sangiran 4 (basso) e Zhoukoudian)

Journal of Human Evolution 88 (2015) 54–69

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A geometric morphometric study of a Middle Pleistocene cranium from Hexian, China

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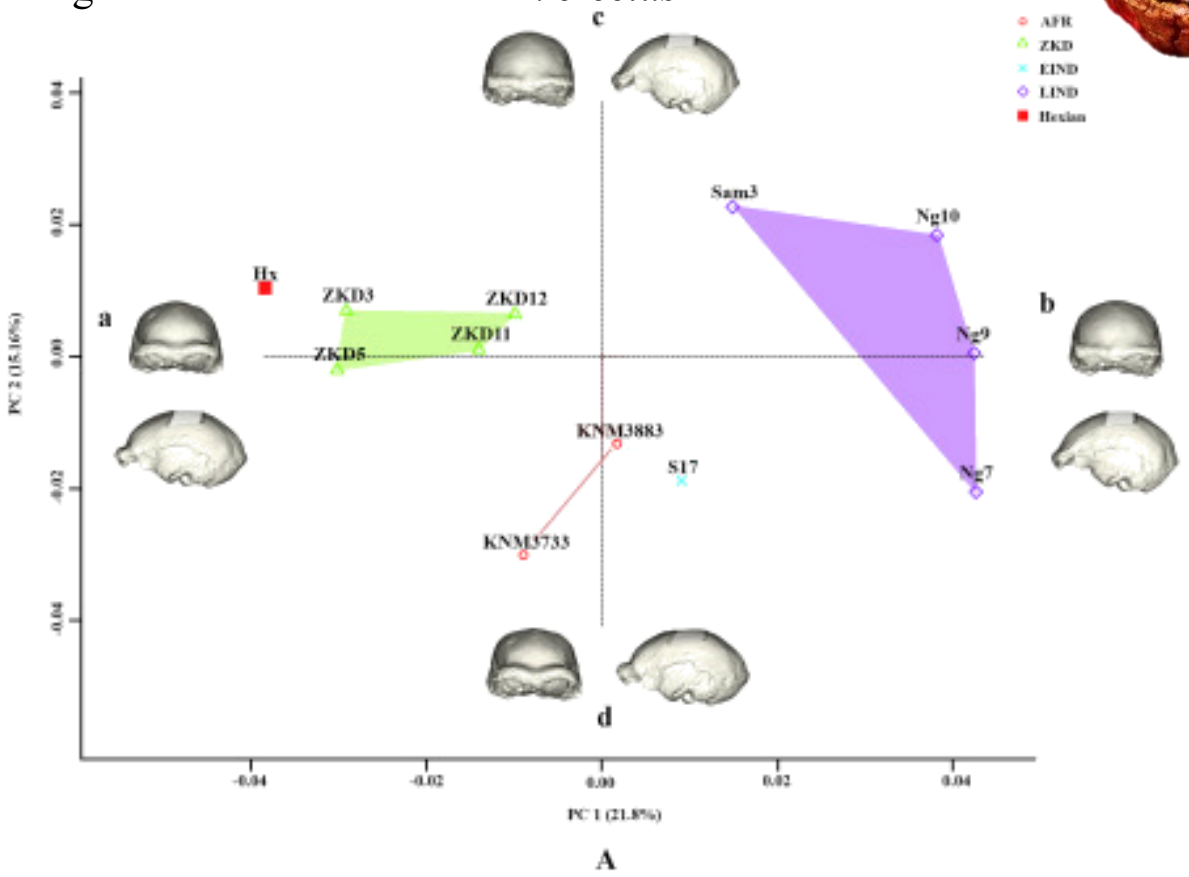
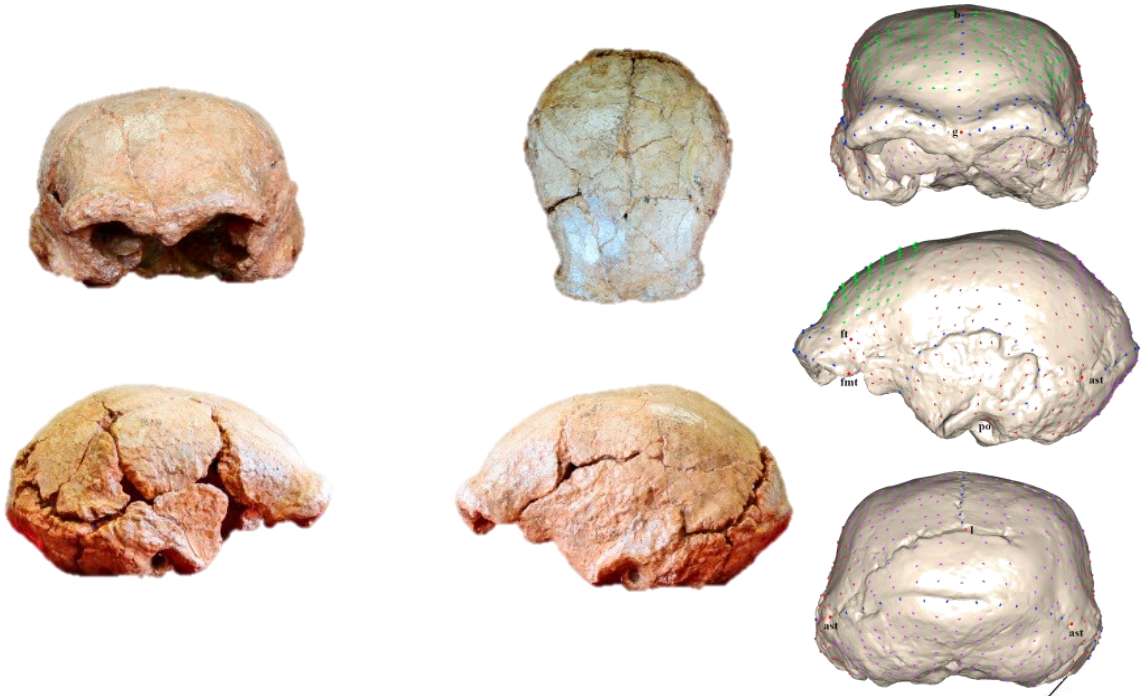
[b] University of the Chinese Academy of Sciences, Beijing 100049, China

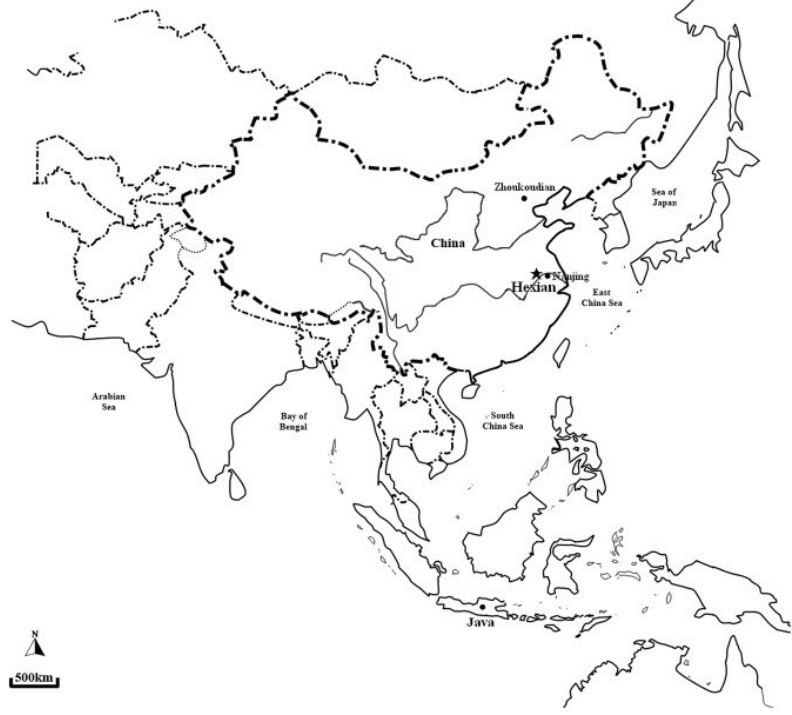
150 and 412 ka

Regional variation in Asian *H. erectus*



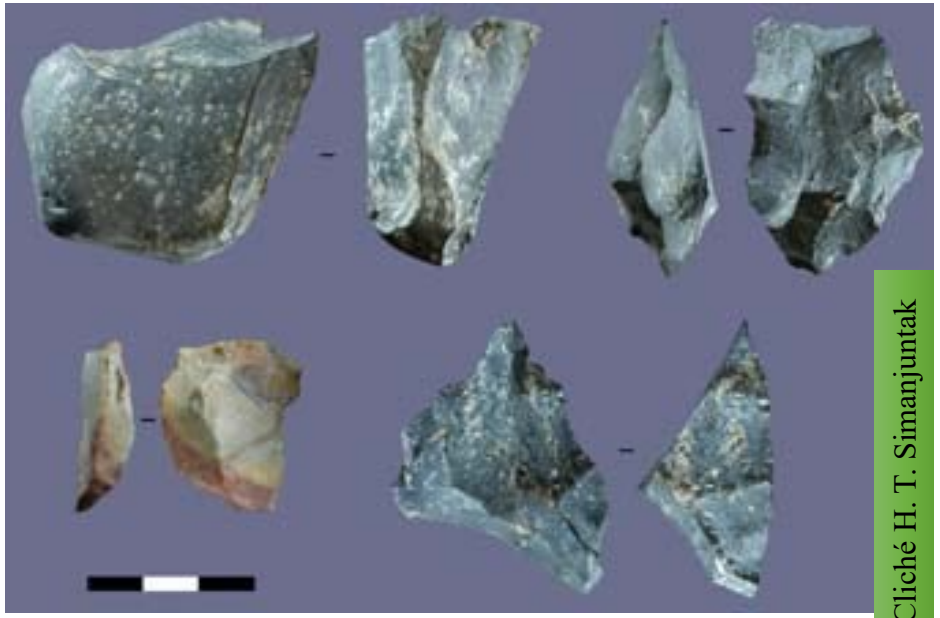
A





Soa Bassin, Flores

Lithic artifacts discovery at the open sites of Mata menge, Tangitallo, etc associated with Stegodon, komodo dragon, rat and various other taxa from layers dated to c.800,000 BP (Morwood *et al.* 1997-1999).



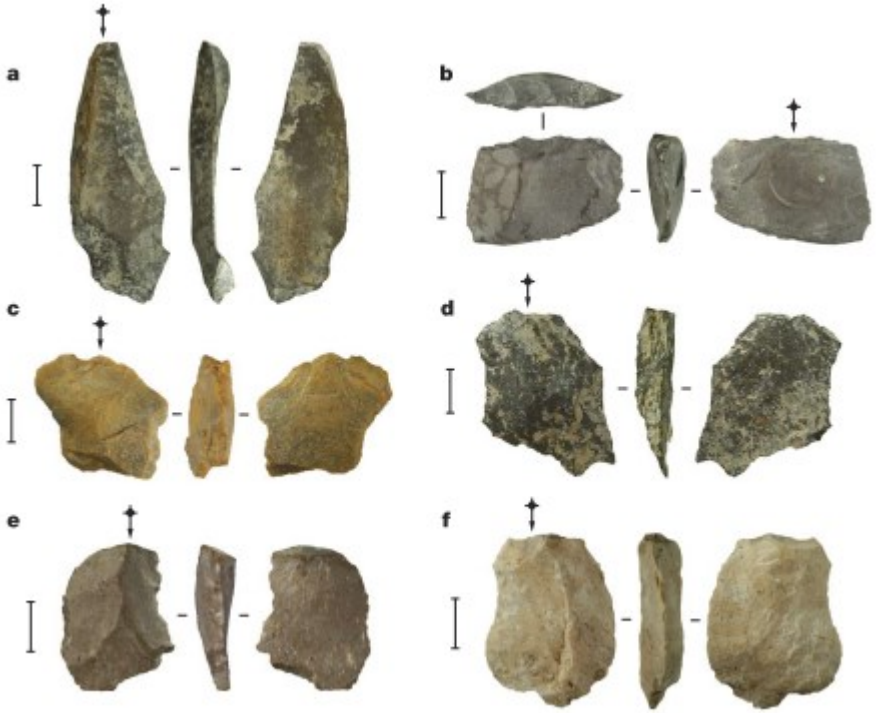
Cliché H. T. Simanjuntak

doi:10.1038/nature08844

LETTERS

Hominins on Flores, Indonesia, by one million years ago

Adam Brumm[1], Gitte M. Jensen[2], Gert D. van den Bergh[1,3], Michael J. Morwood[1], Iwan Kurniawan[4], Fachroel Aziz[4] & Michael Storey[2]



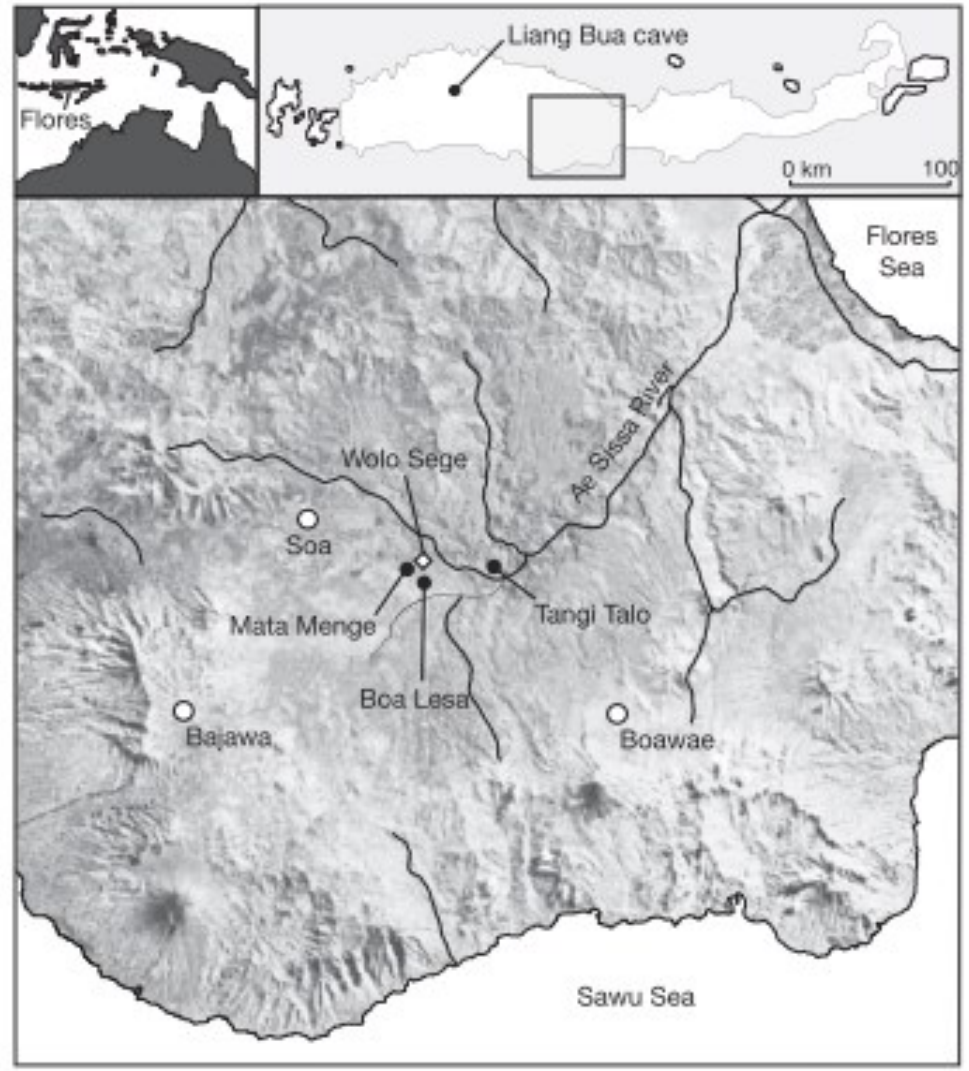
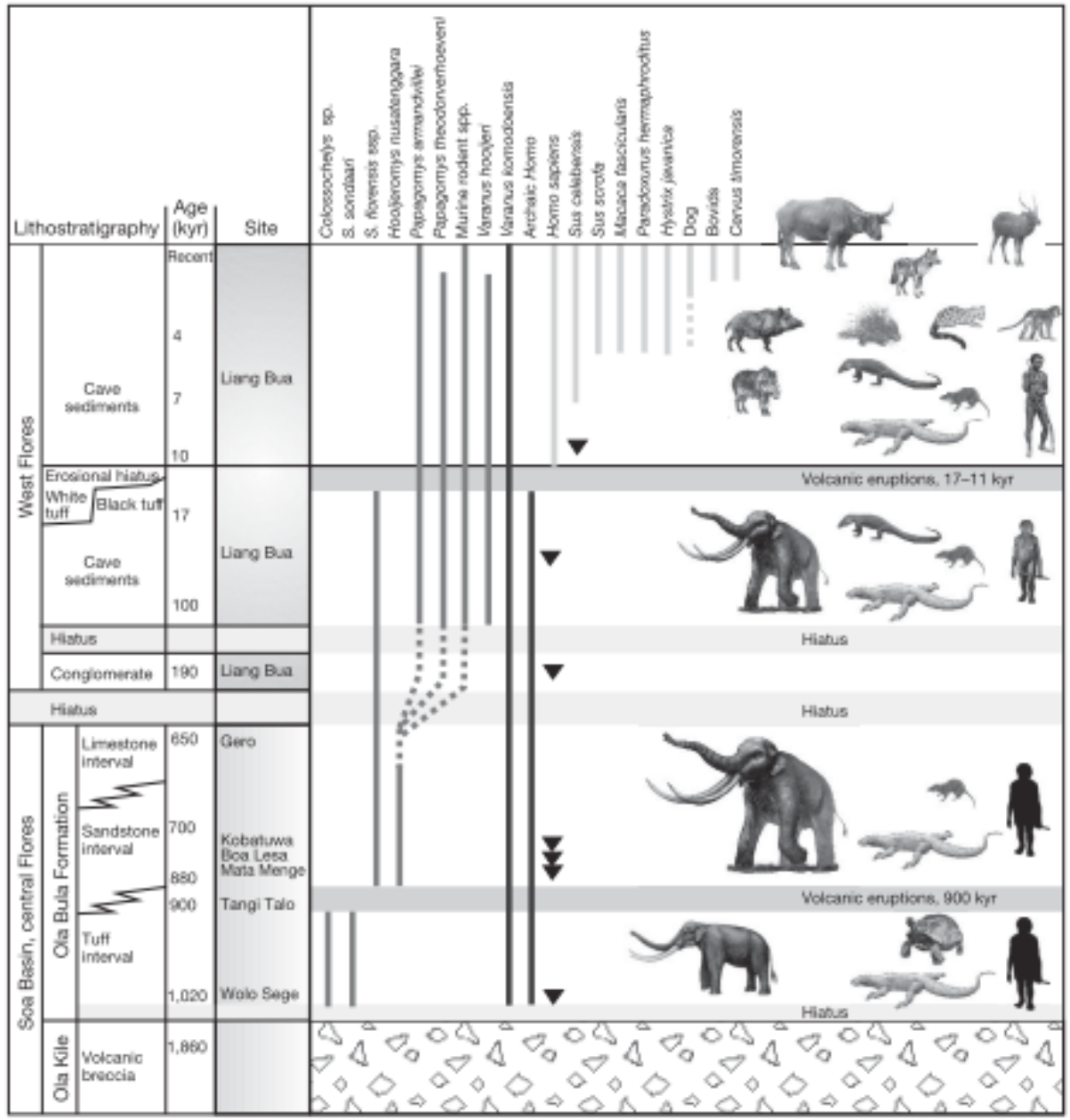


Figure 1 | Map of Flores showing the location of Wolo Sege. Also shown are other key early- or middle-Pleistocene archaeological and palaeontological localities in the Soa Basin mentioned in the text, and the late-Pleistocene Liang Bua cave in western Flores. (Base maps courtesy of D. Hobbs.)


Lithostratigraphy
Age (kyr)
Site
Colossochelys sp.
S. sondaari
S. florensis ssp.
Hooijeromys nusatenggara
Papagomys armandvillei
Papagomys theodorverhoeveni
Murine rodent spp.
Varanus hooijeri
Varanus komodoensis
Archaic Homo
Homo sapiens
Sus celebensis
Sus scrofa
Macaca fascicularis
Paradoxurus hermaphroditus
Hystrix javanica
Dog
Bovids
Cervus timorensis
West Flores
Cave sediments
Recent
4
7
10
Liang Bua
Erosional hiatus
White tuff
Black tuff
17
Cave sediments
100
Liang Bua
Volcanic eruptions, 17–11 kyr
Hiatus
Hiatus
Conglomerate
190
Liang Bua
Hiatus
Hiatus
Soa Basin, central Flores
Ola Bula Formation
Limestone interval
650
Gero
Sandstone interval
700
Kobatuwa
Boa Lesa
Mata Menge
880
900
Tangi Talo
Volcanic eruptions, 900 kyr
Tuff interval
1,020
Wolo Sege
Hiatus
Ola Kile
Volcanic breccia
1,860

A new small-bodied hominin from the Late Pleistocene of Flores, Indonesia

P. Brown[1], T. Sutikna[2], M. J. Morwood[1], R. P. Soejono[2], Jatmiko[2], E. Wayhu Saptomo[2] & Rokus Awe Due[2]

[1]*Archaeology & Palaeoanthropology, School of Human & Environmental Studies, University of New England, Armidale, New South Wales 2351, Australia*
[2]*Indonesian Centre for Archaeology, Jl. Raya Condet Pejaten No. 4, Jakarta 12001, Indonesia*

Currently, it is widely accepted that only one hominin genus, *Homo*, was present in Pleistocene Asia, represented by two species, *Homo erectus* and *Homo sapiens*. Both species are characterized by greater brain size, increased body height and smaller teeth relative to Pliocene *Australopithecus* in Africa. Here we report the discovery, from the Late Pleistocene of Flores, Indonesia, of an adult hominin with stature and endocranial volume approximating 1 m and 380 cm^3, respectively—equal to the smallest-known australopithecines. The combination of primitive and derived features assigns this hominin to a new species, *Homo floresiensis*. The most likely explanation for its existence on Flores is long-term isolation, with subsequent endemic dwarfing, of an ancestral *H. erectus* population. Importantly, *H. floresiensis* shows that the genus *Homo* is morphologically more varied and flexible in its adaptive responses than previously thought.

Description of *Homo floresiensis*

Order Primates Linnaeus, 1758
Suborder Anthropoidea Mivart, 1864
Superfamily Hominoidea Gray, 1825
Family Hominidae Gray, 1825
Tribe Hominini Gray, 1825
Genus *Homo* Linnaeus, 1758
Homo floresiensis sp. nov.

Horizon. The type specimen LB1 was found at a depth of 5.9 m in Sector VII of the excavation at Liang Bua. It is associated with calibrated accelerator mass spectrometry (AMS) dates of approximately 18 kyr and bracketed by luminescence dates of 35 ± 4 kyr and 14 ± 2 kyr. The referred isolated left P_3 (LB2) was recovered just below a discomformity at 4.7 m in Sector IV, and bracketed by a U-series date of 37.7 ± 0.2 kyr on flowstone, and 20 cm above an electron-spin resonance (ESR)/U-series date of 74^{+14}_{-12} kyr on a *Stegodon* molar.

Kaifu, 2011

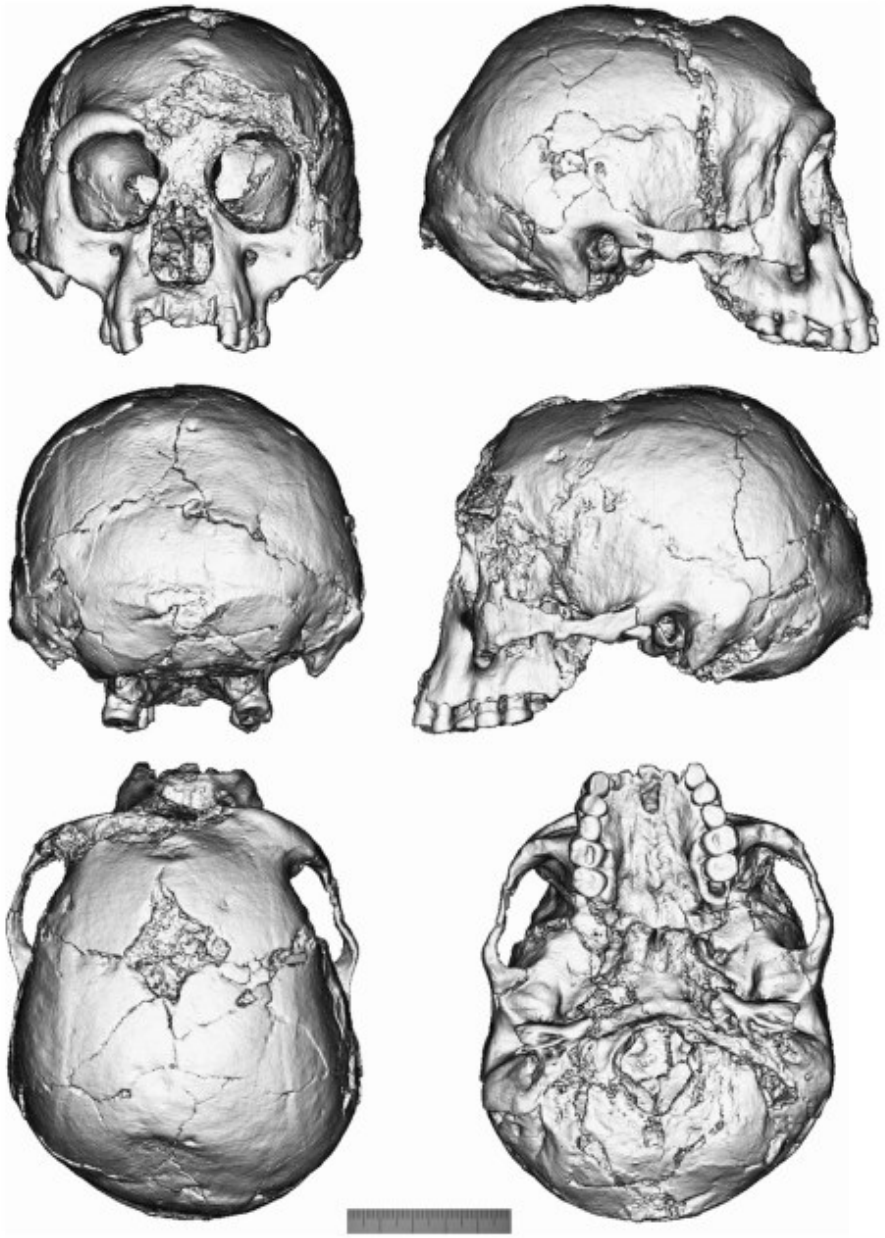


Figure 2. Surface rendered CT images of LB1/1. The orientations and scale same as in Fig. 1.

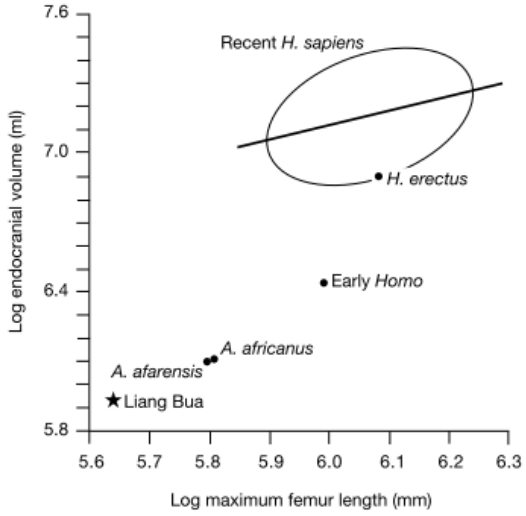


Figure 3 Relationship between endocranial volume and femur length in LB1, *A. afarensis*, *A. africanus*, early *Homo* sp., *H. erectus* and modern *H. sapiens*. Modern human data, with least squares regression line and 95% confidence ellipse, from a global sample of 155 individuals collected by P.B. Details of the hominin samples are in the Supplementary Information.

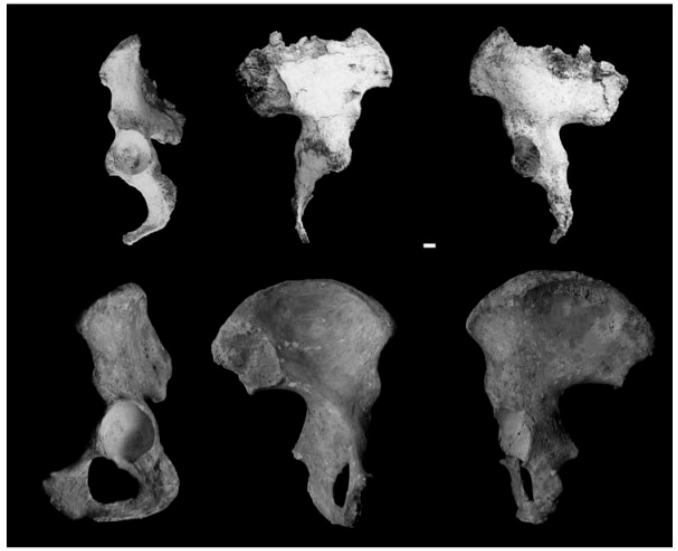


Figure 6 Comparison of the left innominate from LB1 with a modern adult female *H. sapiens*. Lateral (external), and medial and lateral views of maximum iliac breadth. The pubic region of LB1 is not preserved and the iliac crest is incomplete. Scale bar, 1 cm.

Figure 7 Anterior and posterior views of the LB1 right femur and tibia, with cross-sections of the femur neck and midshaft, and tibia midshaft. The anterior surfaces of the medial and lateral condyles of the femur are not preserved. With the exception of the medial malleolus, the tibia is complete and undistorted. Scale bar, 1 cm.

LB1: Mosaica di caratteri primitivi, unici e derivati mai visti in altri ominidi: volume endocranico piccolo e stature = australopitecini
Ma non condivide con questo genere altri caratteri come le dimensione dentale, il prognatismo facciale accentuato che sono piu simili ad altre specie del genere *Homo*

LB1 has the small endocranial volume and stature evident in early australopithecines, it does not have the great postcanine tooth size, deep prognathic facial skeleton and masticatory adaptations common to members of this genus. Instead, the facial and dental proportions, postcranial anatomy consistent with human-like obligate bipedalism.

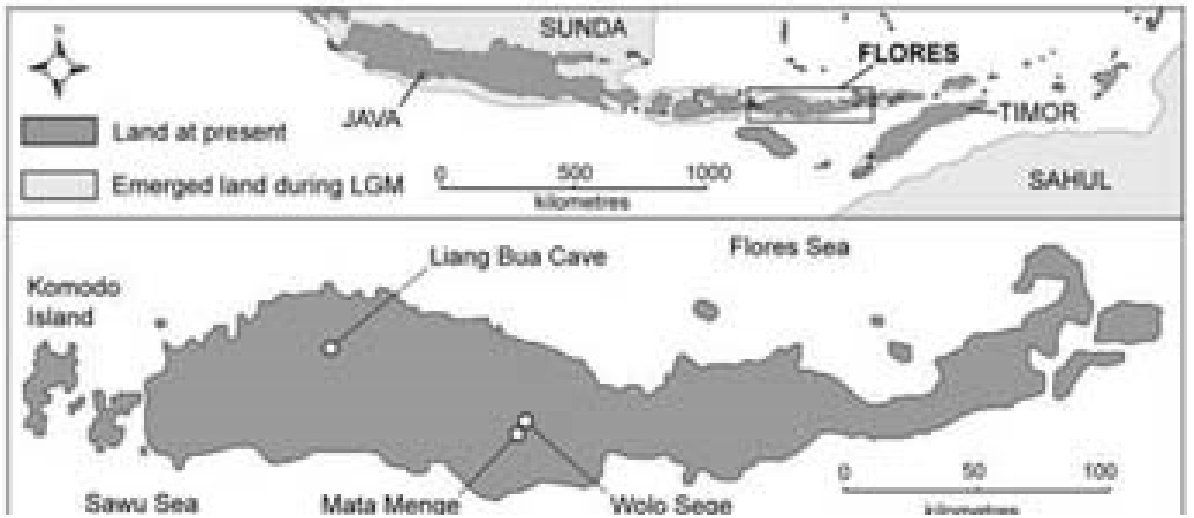
LETTER

doi:10.1038/nature17999

Homo floresiensis–like fossils from the early Middle Pleistocene of Flores

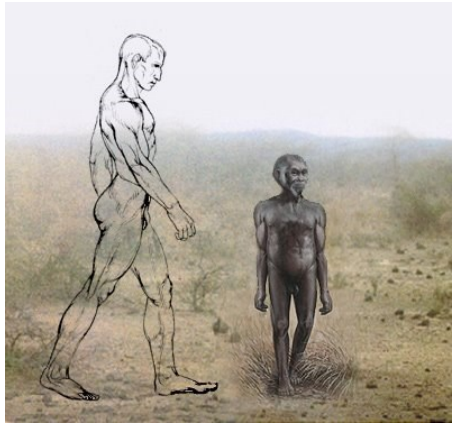
Gerrit D. van den Bergh[1]*, Yousuke Kaifu[2]*, Iwan Kurniawan[3], Reiko T. Kono[2], Adam Brumm[4,5], Erick Setiyabudi[3], Fachroel Aziz[3] & Michael J. Morwood[1]‡

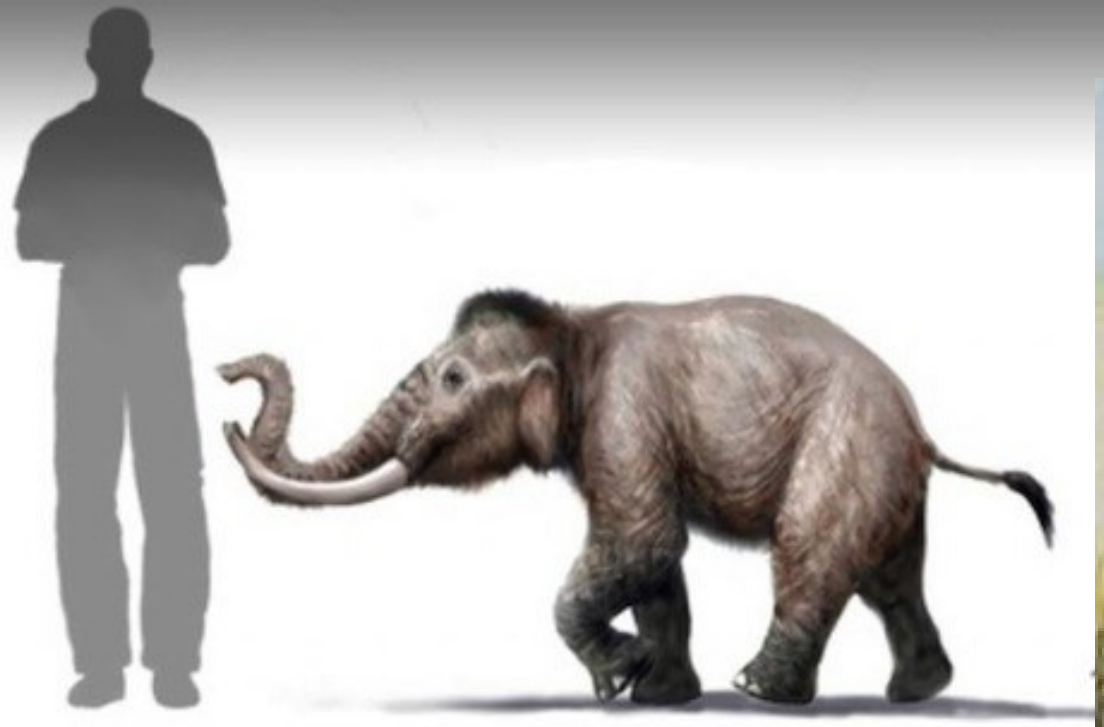
0,7 Ma

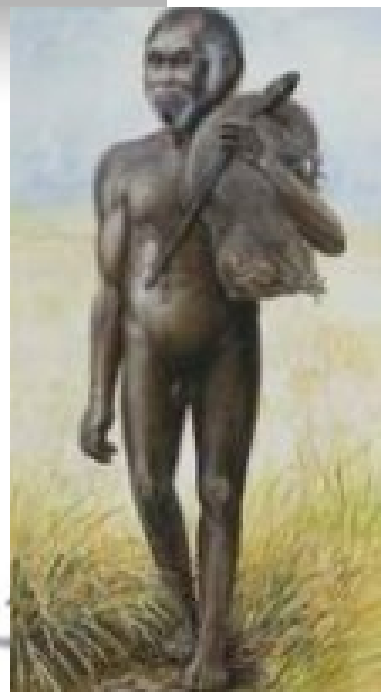


The Mata Menge are derived compared with *Australopitecus* and *H. habilis*, and so tend to support the view that *H. florensiensis* is a dwarfed descendent of early Asian *H. erectus*.

Hominins on Flores has acquired extremely small body size and other morphological traits specific to *H. florensiensis* at an unexpectedly early time

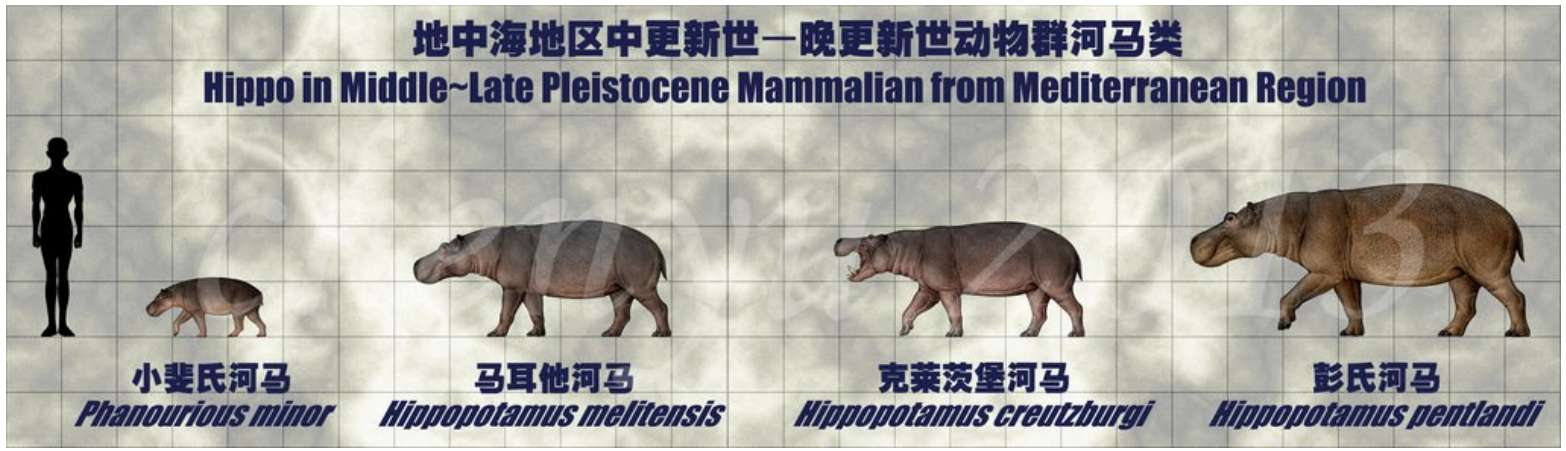






Insular endemism:
Limited ressources
Absence of large predators
Genetic drift

« the smallest become large and the largest become small »



ARTICLE

https://doi.org/10.1038/s41586-019-1067-9

A new species of *Homo* from the Late Pleistocene of the Philippines

Florent Détroit[1]*, Armand Salvador Mijares[2,3]*, Julien Corny[1], Guillaume Daver[4], Clément Zanolli[5,6], Eusebio Dizon[3], Emil Robles[2], Rainer Grün[7,8] & Philip J. Piper[3,9]

A hominin third metatarsal discovered in 2007 in Callao Cave (Northern Luzon, the Philippines) and dated to 67 thousand years ago provided the earliest direct evidence of a human presence in the Philippines. Analysis of this foot bone suggested that it belonged to the genus *Homo*, but to which species was unclear. Here we report the discovery of twelve additional hominin elements that represent at least three individuals that were found in the same stratigraphic layer of Callao Cave as the previously discovered metatarsal. These specimens display a combination of primitive and derived morphological features that is different from the combination of features found in other species in the genus *Homo* (including *Homo floresiensis* and *Homo sapiens*) and warrants their attribution to a new species, which we name *Homo luzonensis*. The presence of another and previously unknown hominin species east of the Wallace Line during the Late Pleistocene epoch underscores the importance of island Southeast Asia in the evolution of the genus *Homo*.

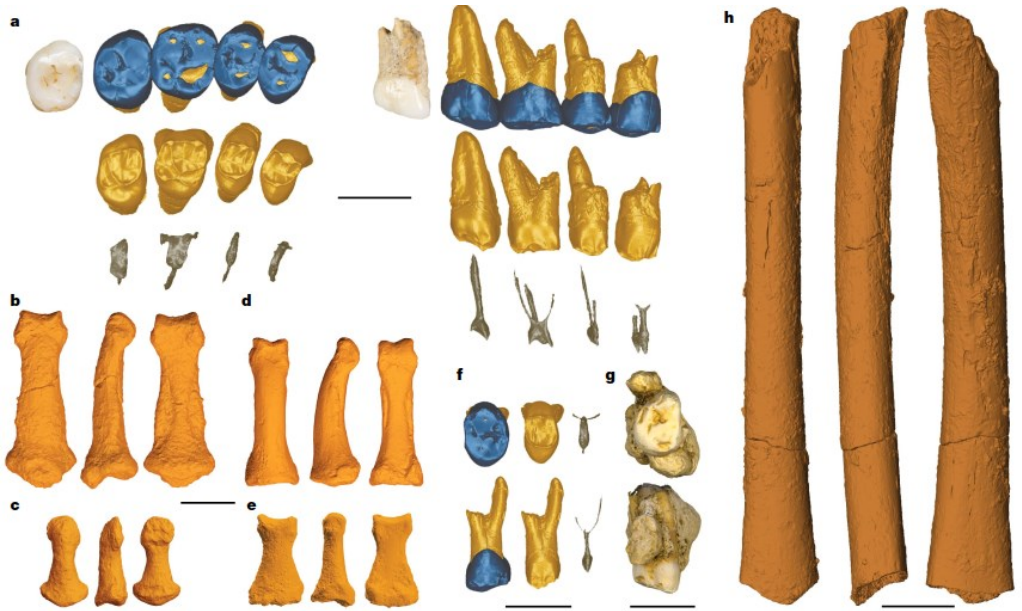
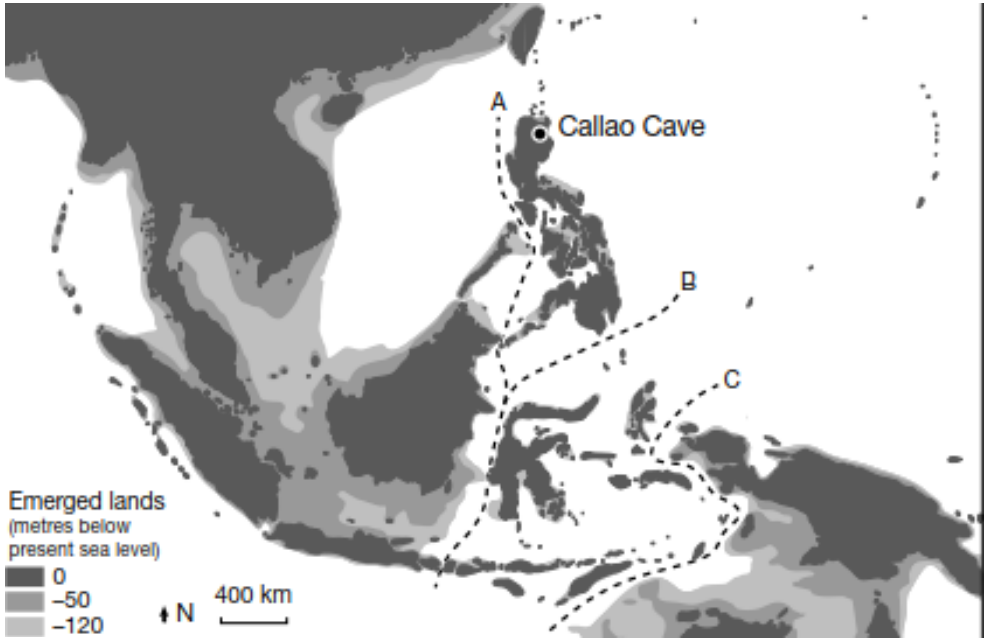
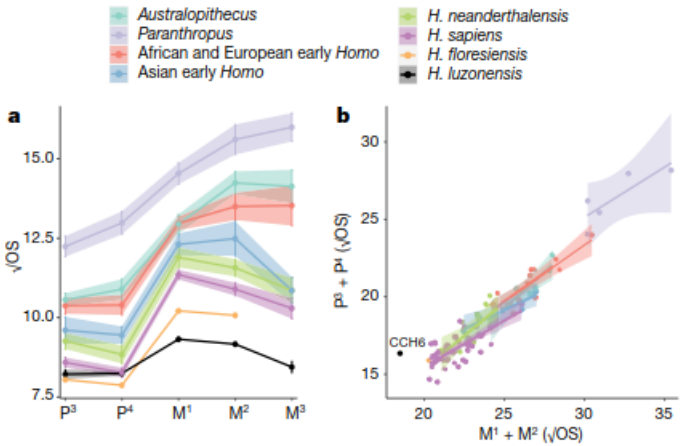
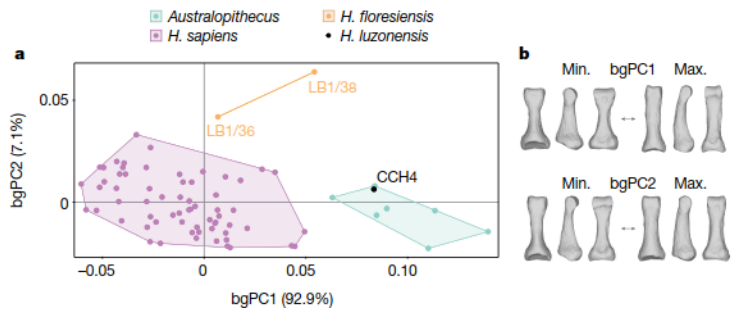


Fig. 2 | Fossil remains of *H. luzonensis* from Late Pleistocene sediments at Callao Cave. a, Holotype CCH6: postcanine maxillary teeth in occlusal (left) and buccal (right) aspects, with three-dimensional rendering of enamel (dark blue), dentine and cement (light brown), and pulp cavity (dark grey) for CCH6-b–CCH6-e. **b**, Intermediate manual phalanx CCH2 (dorsal, lateral and palmar aspects). **c**, Distal manual phalanx CCH5 (dorsal, lateral/medial and palmar aspects). **d**, Proximal pedal phalanx CCH4 (dorsal, lateral and plantar aspects). **e**, Intermediate pedal phalanx CCH3 (dorsal, medial and plantar aspects). **f**, Left P^3 or P^4 CCH8: occlusal (top) and buccal (bottom) aspects, with three-dimensional rendering of enamel, dentine and cement, and pulp cavity. **g**, Right M^3 CCH9: occlusal (top) and buccal (bottom) aspects. **h**, Juvenile femoral shaft CCH7 (anterior, lateral and posterior aspects). Scale bars, 10 mm (**a**–**g**) and 20 mm (**h**); additional views are shown in Extended Data Figs. 1, 5, 7–10.





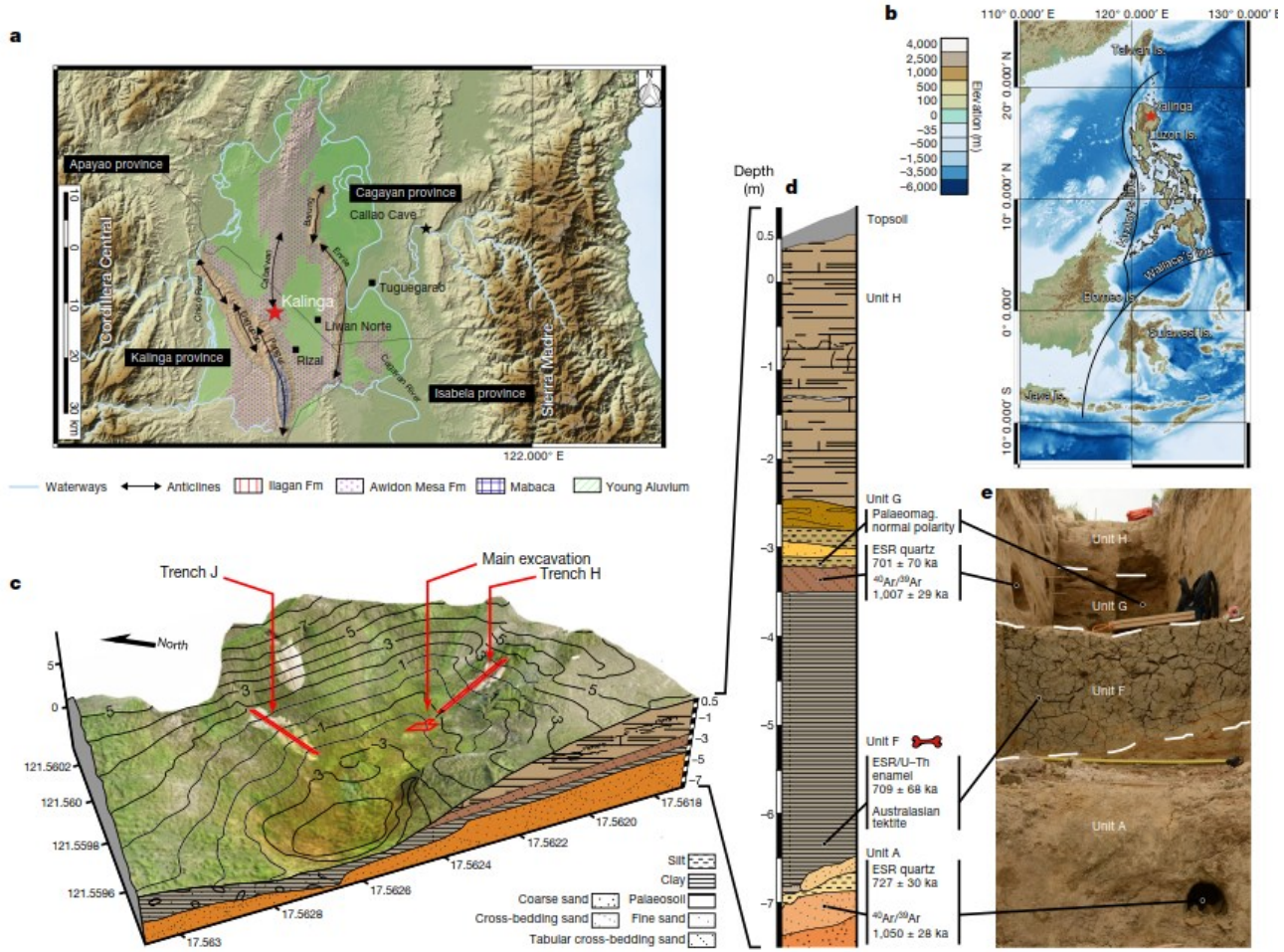


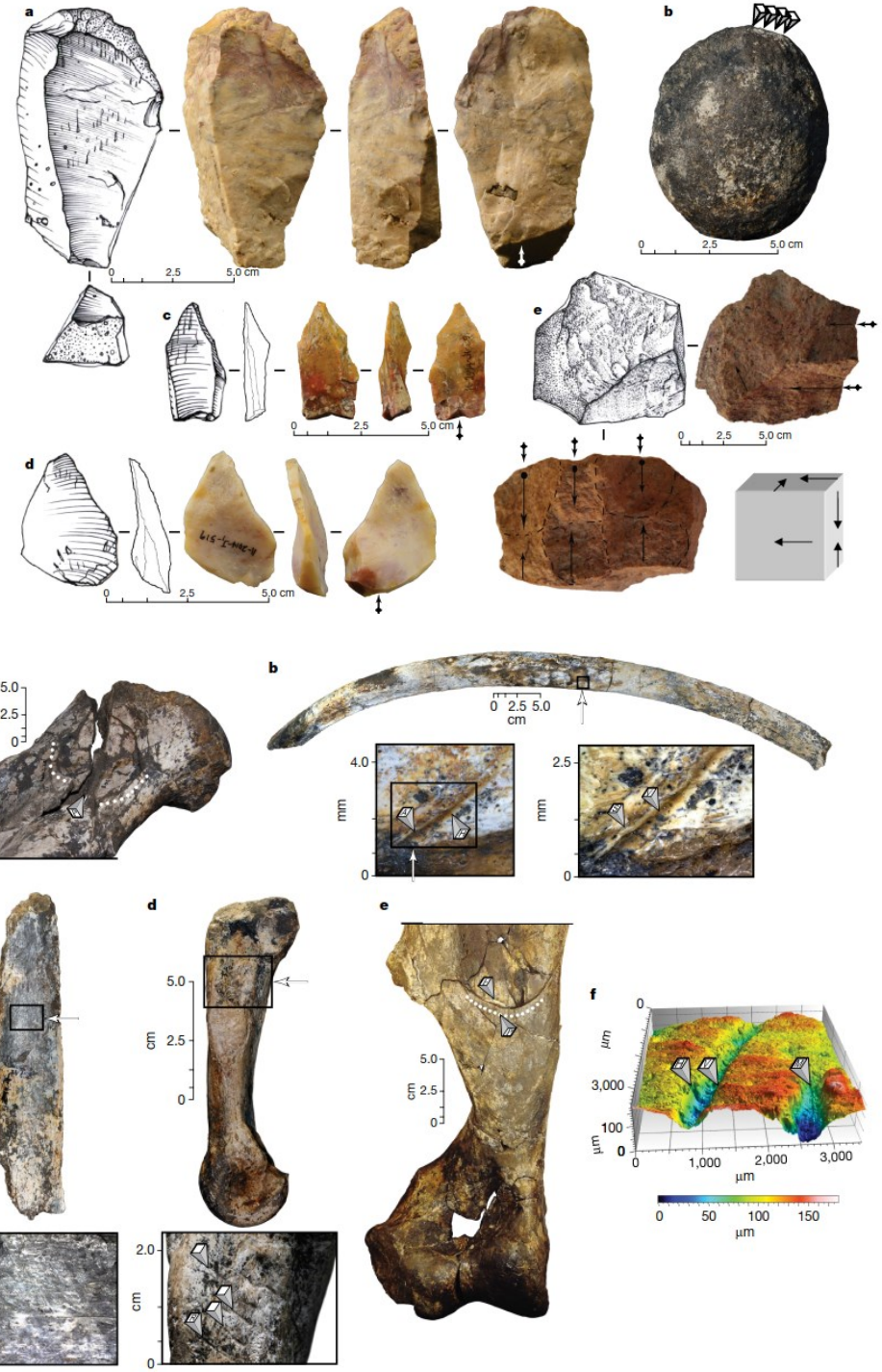
LETTER

https://doi.org/10.1038/s41586-018-0072-8

Earliest known hominin activity in the Philippines by 709 thousand years ago

T. Ingicco[1,2,3,4]*, G. D. van den Bergh[5], C. Jago-on[6], J.-J. Bahain[1,2,3,4], M. G. Chacón[1,2,3,4,7,8], N. Amano[9], H. Forestier[1,2,3,4], C. King[6], K. Manalo[10], S. Nomade[11,12,13], A. Pereira[1,2,3,4,11,12,13,14,15], M. C. Reyes[6,10]*, A.-M. Sémah[1,2,3,4,16], Q. Shao[17], P. Voinchet[1,2,3,4], C. Falguères[1,2,3,4], P. C. H. Albers[18], M. Lising[6,19], G. Lyras[20], D. Yurnaldi[21], P. Rochette[22,23,24,25,26], A. Bautista[6] & J. de Vos[18]





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DOI: 10.1002/evan.21863

ISSUES

Evolutionary Anthropology ISSUES, NEWS, AND REVIEWS WILEY

What kind of hominin first left Africa?

Giancarlo Scardia[1] | Walter A. Neves[2] | Ian Tattersall[3] | Lukas Blumrich[2]

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[2]Universidade de São Paulo (USP), Instituto de Estudos Avançados, São Paulo, Brazil

[3]Division of Anthropology, American Museum of Natural History, New York, New York

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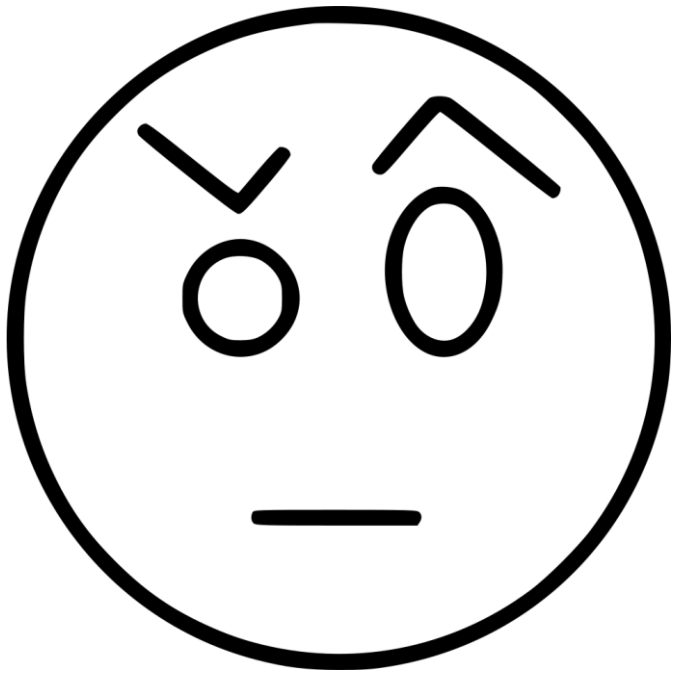
Abstract

Recent discoveries of stone tools from Jordan (2.5 Ma) and China (2.1 Ma) document hominin presence in Asia at the beginning of the Pleistocene, well before the conventional Dmanisi datum at 1.8 Ma. Although no fossil hominins documenting this earliest Out of Africa phase have been found, on chronological grounds a pre-*Homo erectus* hominin must be considered the most likely maker of those artifacts. If so, this sheds new light on at least two disputed subjects in paleoanthropology, namely the remarkable variation among the five Dmanisi skulls, and the ancestry of *Homo floresiensis*.



Quaternary Science Reviews 219 (2019) 1–19

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Invited paper

Chronologic constraints on hominin dispersal outside Africa since 2.48 Ma from the Zarqa Valley, Jordan

Giancarlo Scardia [a, *], Fabio Parenti [b, c], Daniel P. Miggins [d], Axel Gerdes [e], Astolfo G.M. Araujo [f], Walter A. Neves [g]