Menelusuri Jejak Perkembangan Manusia Purba di Indonesia

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30 Mei 2020

WEBINAR Prodi Teknik Geologi FITB - ITB

Mengucapkan:
Taqabalallhu minna wa minkum
Mohon maaf lahir-batin
Selamat Iedul Fitri 1441 H

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Homo erectus: Tjg-1993.05/Skull IX (Courtesy Lab.Paleontology ITB; Photo by Y. Zaim).

* Pendahuluan
* Rangkuman Singkat Penemuan Fosil Manusia dan Taksonomi serta Evolusi berdasarkan Fosil Manusia Purba di Indonesia.
* Melacak Perkembangan Manusia Purba di Jawa dan Indonesia:

Plestosen: Sangiran, Sambungmacan, Trinil, Kedungbrubus, Ngandong, Patiayam, Perning/Mojokerto, Lembah Sungai Lusi/Rembang, Flores (?)

Holosen: Wajak/Tulungagung, Pacitan, Lidah Ayer/Sumatra Barat dan Flores (?)

* Kesimpulan

* Pendahuluan

Pendahuluan

* Selama ini banyak kalangan yang memahami bahwa penemu fosil manusia purba di Indonesia adalah Eugene Dubois pada tahun 1891/1892 di Desa Trinil, Jawa Timur.

* Namun sebenarnya yang menemukan fosil manusia purba pertama bukanlah Dubois, melainkan oleh B.D.Van Rietschoten.

* Pada tahun 1888, B.D.Van Rietschoten telah menemukan tengkorak manusia purba dalam endapan teras gua di Gunung Lawa, Desa Wajak (Gambar 1),

* Fosil yang ditemukan berupa dua buah tengkorak yaitu **Wadjak 1** dan dinamakan sebagai "Manusia Wajak" berumur Holosen-10ky (Storm dan Nelson, 1992).

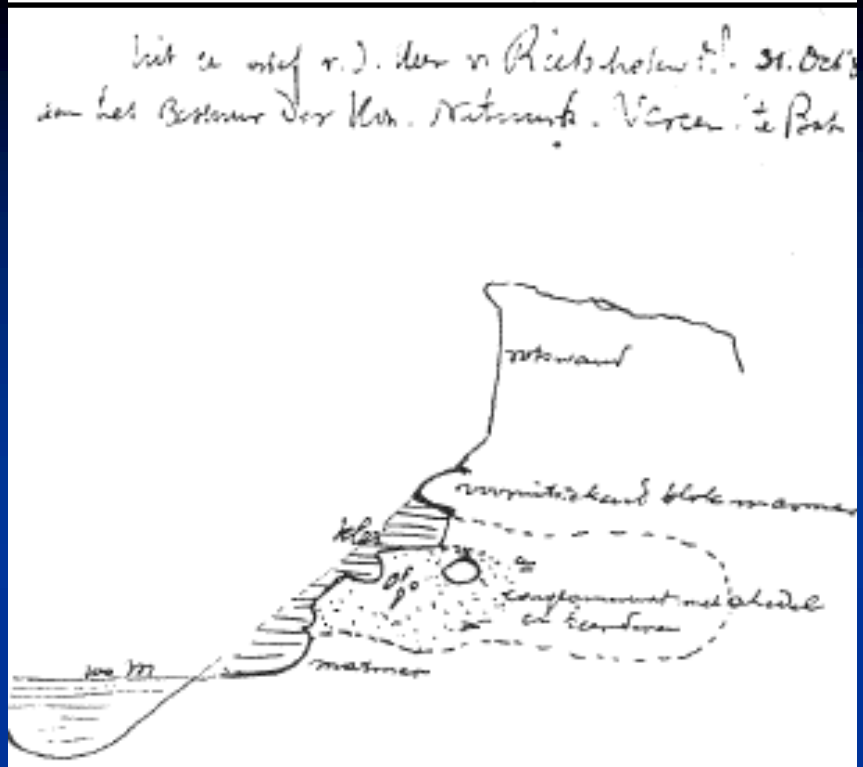


Figure 3. A cross section with accompanying notes of the Wadjak site. Sketch made by C. Sluiter in 1888 after the original discovery of Wadjak I. Property of the Dubois Collection, National Museum of Natural History, Leiden.

The script at the top of the figure reads: 'From a letter of Mr. V. Reitschoten, October 31 1888 to the board of Kon. Natuurk. Veren. in Batavia'. The script in the figure reads, top to bottom: *rotswand* = rocky wall; *vooruitstekend blok marmer* = protruding block of limestone; *klei* = clay; *conglomeraat met schedel en beenderen* = conglomerate with skull and

Gambar 1: Sketsa gua di Gunung Lawa, Desa Wajak oleh C. Sluiter pada tahun 1888 menggambarkan stratigrafi ditemukannya fosil manusia purba Wajak 1 (Storm dan Nelson, 1992).

* Indonesia merupakan salah satu negara yang kaya dengan kandungan fosil manusia purba dan vertebrata demikian juga dengan temuan2 arkeologis berupa alat batu di lokasi fosil manusia purba dan vertebrata ditemukan

* Fosil manusia purba banyak ditemukan di Pulau Jawa, dan hanya sedikit di Sumatera Barat dan Pulau Flores. Sedangkan fosil vdertebrata dijumpai tersebar hampir di seluruh Indonesia

* **Banyaknya fosil manusia purba ditemukan di Indonesia, maka Indonesia merupakan salah satu negara yang sangat penting dalam perkembangan paleontologi manusia maupun paleoantropologi karena banyak ahli berpendapat bahwa fosil manusia purba yang ditemukan di Indonesia memberikan arti penting dalam melacak perkembangan manusia purba di dunia.**

* Rangkuman Singkat Penemuan Fosil Manusia dan Taksonomi serta Evolusi berdasarkan Fosil Manusia Purba di Indonesia.

* Indonesian hominids were found scattered in several areas in Java and recently in Flores Island.

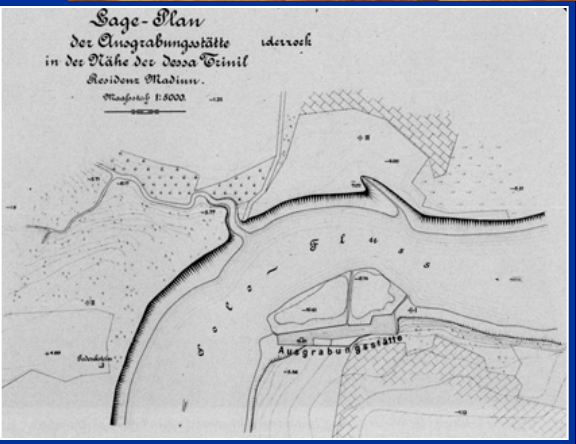
* In Java, first human fossil - a human skull, was found by van Rietschoten, from Gunung Lawa, near Wadjak Village - East Java in 1888, the fossil then called as Wadjak I. Several years later Dubois obtained fragment of human skull in another area neighboring of the Wadjak I site, and the fossil was named as Wadjak II (Storm, 1992)

*All skulls found in Wajak then given the name by Dubois as Wadjak Man. Dubois then did some details determination on all the Wadjak skulls, and based on the study on the Wadjak I, Dubois believed that the Wajak skulls are a modern human, and in human taxonomy he attributed to ***Homo wadjakensis*** and put them into ***Homo sapiens***, as he revealed in his report in 1922 (Kempers, 1982; Storm, 1992).

* The main problem posed for the Wadjak Man is determining the age the specimens.
*Nevertheless, age of the Wadjak Man was believed as Late Pleistocene/Early Holocene (Koenigswald, 1956), and Jacob (1967, 1968) put it in age of **10,000 years old** or **Holocene**

* After the first discovery of the Wadjak Man of ***Homo (sapiens) wadjakensis***, the finds of hominin in Java then followed by other spectacular discovery of a molar, femur and skull of human fossils by Eugene Dubois in 1891/1892 at a river bank of Bengawan Solo, at Trinil Village, East Java, and the fossil was famously known as ***Pithecanthropus erectus***.
* The fossils were found by Dubois from the sandstone layer belongs to Kabuh Formation of Pleistocene in age.

1887 - Eugène Dubois took part in the quest for the missing link in the Southeast Asian archipelago based on the fossils discovered by Raden Saleh. On Java, in 1891/1892 at Trinil Village Dubois found the skullcap, femur and molar of the Ape man *Pithecanthropus*(Asia Link – HOPSEA,2006).



* After the first discovery of the *Pithecanthropus erectus* by Dubois from the Trinil site, then followed by spectacular discovery of other human fossils from Sangiran, Kedungbrubus, Perning/ Mojokerto, Ngandong areas, in the years of 1930 – 1940.

* In the years 1950 - 1970 many hominin were also been found in Central Java from Sangiran site (mostly), Sambungmacan and Ngawi.

* In 1977 and 1978 Zaim found parietal fragments and two isolated premolars of human fossils in Patiayam Hills.

* In 2004 - 2015 the hominin fossils were also been found in Flores Island from Liang Bua Cave, and Mata Menge – Soa Basin.
* Recently, in 2016 during field investigation for Hascaryo's Ph.D study, a small piece of temporal fragment found by Zaim from conglomerate layer at a riverbank of Lusi River in Rembang area.

Hominin in West Sumatera

- An isolated human tooth fossil found from Lidah Ayer Cave - West Sumatra believed belongs to ***Homo sapiens***
- * Study of cave sediments from Lidah Ayer Cave contain of vertebrate and isolated human tooth fossils dated as 73-63 ky.

Hominin discoveries in Java - West Indonesia

- Sangiran
- Sambungmacan
- Kedungbrubus
- Trinil
- Ngandong
- Patiayam
- Mojokerto

Homo erectus

- Wajak → ***Homo sapiens***
- **Lusi Specimen** → ***H. erectus* or *H. sapiens*?**
- **Lidah Ayer Cave** → ***Homo sapiens***

Hominin discoveries in Flores - East Indonesia and Philippine

Flores Island → ***Homo floresiensis***

- Soa Basin : 700 ky. (Nature, 2016,534).
- Liang Bua : 100 ky (Nature Letter,doi:10.1038/nature17179)

Philippine → ***Homo luzonensis***

- Luzon Island : 67ky. (Nature, 2019, 568 , doi:10.1038/s41586-019-1067-9)

Taksonomi dan Evolusi berdasarkan Fosil Manusia Purba di Indonesia.

Hominid and hominin – what's the difference?

1homo

The most commonly used recent definitions are:

Hominoids – all apes. Gibbons, gorillas, chimps, orangs and humans .

Hominids – all modern AND extinct GREAT apes. Gorillas, chimps, orangs and humans, and their immediate ancestors. Not gibbons.

Hominin – Any species of early human that is more closely related to humans than chimpanzees, including modern humans themselves. (At this point, this includes the genuses homo, australopithecus, ardipithecus and paranthropus. These genuses can and do change as various new fossils are found, which either add new genuses, or cast doubt on existing ones. Homo and australopithecus are the two most definite).

Basically, Hominoid is more of a biological reference, while hominids and hominins are more archaeology/anthropology related.

It is important to note that the definitions for hominid and hominin have only been formally accepted fairly recently, so many older textbooks, could refer to early human species as hominids instead of hominins, or vice versa.

* Taksonomi Hominin di Indonesia.

* Fosil manusia purba tertua yang ditemukan dalam Formasi Sangiran (Pucangan) di Sangiran - Jawa Tengah dan Formasi Pucangan di Jawa Timur berumur Plestosen Awal (1,8 – 1,5 jtl), dalam taksonomi oleh Sartono (1996) dinamakan ***Pithecanthropus (Meganthropus) paleojavanicus.***

* Sedangkan yang lebih muda, berumur Plestosen Tengah (1,0 – 0,5 jtl) ditemukan dalam lapisan dari Formasi Bapang (Kabuh di Sangiran) dan Formasi Kabuh, di Jawa Tengah dan Jawa Timur oleh Sartono (1996) dinamakan ***Pithecanthropus erectus, Pithecanthropus modjokertensis.***

* Kemudian fosil manusia purba yang ditemukan di Daerah Ngandong dalam sedimen Undak Sungai berumur sekitar 50 ribu tahun lalu (Akhir Plestosen Akhir) oleh Sartono (1996) dinamakan ***Pithecanthropus erectus ngandonegensis, Pithecanthropus erectus soloensis.***

* Sedangkan fosil manusia yang ditemukan dalam sedimen di Wajak di Tulungagung (Manusia Wajak) dan gua2 di pegunungan Selatan Jawa Tengah-Jawa Timur serta daerah lainnya di Indonesia berumur Plestosen Akhir - Holosen merupakan fosil manusia yang masuk dalam ***Homo sapiens.***

* Tatanama (Taksonomi) fosil manusia purba di Indonesia pada awalnya sangat komplek.

* Diawali dengan nama ***Pithecanthropus erectus*** oleh Dubois pada tahun 1892 pada pertama kali ditemukannya di Indonesia.

* Dasar pemberian nama tersebut adalah ciri **anatomi, morfologi** dan **morfometri** karena menurut Dubois, secara anatomi morfologi tengkorak masih memperlihatkan adanya unsur "kera" (***pitheca***), namun volume otak dari tengkorak begitu pula dengan femur yang ditemukan sudah lebih besar dari kera, yang dimiliki manusia (***anthrop***), dan dari struktur femur-nya jika direkonstruksi memperlihatkan posisi berdiri yang sudah tegak (***erectus***).

* Oleh sebab itu maka Dubois meyakini bahwa fosil hominid yang ditemukan adalah milik "manusia kera yang sudah berdiri tegak" yang olehnya diberi nama ***Pithecanthropus erectus*** .

* Di daratan Cina juga ditemukan fosil tengkorak yang diberi nama *Pithecanthropus pekinensis*. Nama *pekinensis* adalah berdasarkan tempat ditemukannya fosil tersebut, **jadi bukan berdasarkan sifat atau ciri sebagaimana yang diberikan oleh Dubois (*erectus*), tetapi berdasarkan tempat atau lokasi ditemukan**.

* Tatanama (Taksonomi) fosil manusia purba selanjutnya menjadi semakin membingungkan, karena tidak hanya berdasarkan sifat anatomi, lokasi ditemukan, tetapi juga berdasarkan "kodefikasi" nomor dari kode katalog fosil tersebut, seperti: P1, P2.....Pn berdasarkan P = "*Pithecanthropus* 1....n".

Ada juga kode lokasi seperti S1....Sn, S = "Sangiran 1...n"; Sm1....n,Sm1= Sambungmacan 1

* Perkembangan terakhir sejak tahun 1960-1970-an dari hasil peneitian terhadap fosil *cranial* (tengkorak termasuk gigi2nya) maupun *postcranial* para ahli paleontologi manusia dan paleoantropologi sepakat bahwa semua fosil *Pithecanthropus* **sudah merupakan manusia** (*anthrop*) yang **sudah berbudaya yang mampu membuat alat dengan berbagai bahan dan teknologi**, dan ini menunjukkan perilaku manusia sempurna yaitu ***Homo***, dan berdiri tegak (***erectus***) yang oleh sebab itu secara taksonomi menjadi ***Homo erectus***. Dengan demikian **maka nama *Pithecanthropus* tidak lagi digunakan.**

POLA EVOLUSI HOMININ INDONESIA

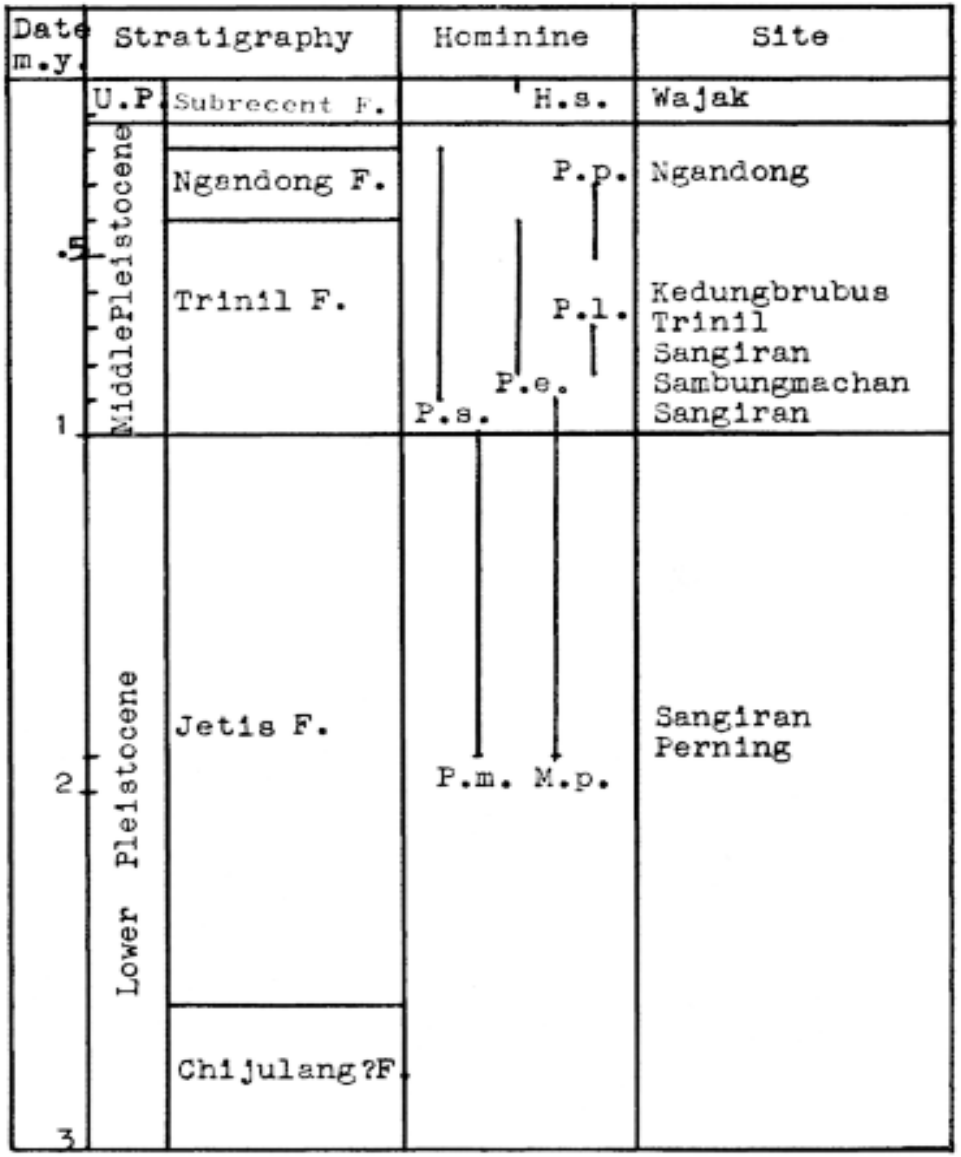
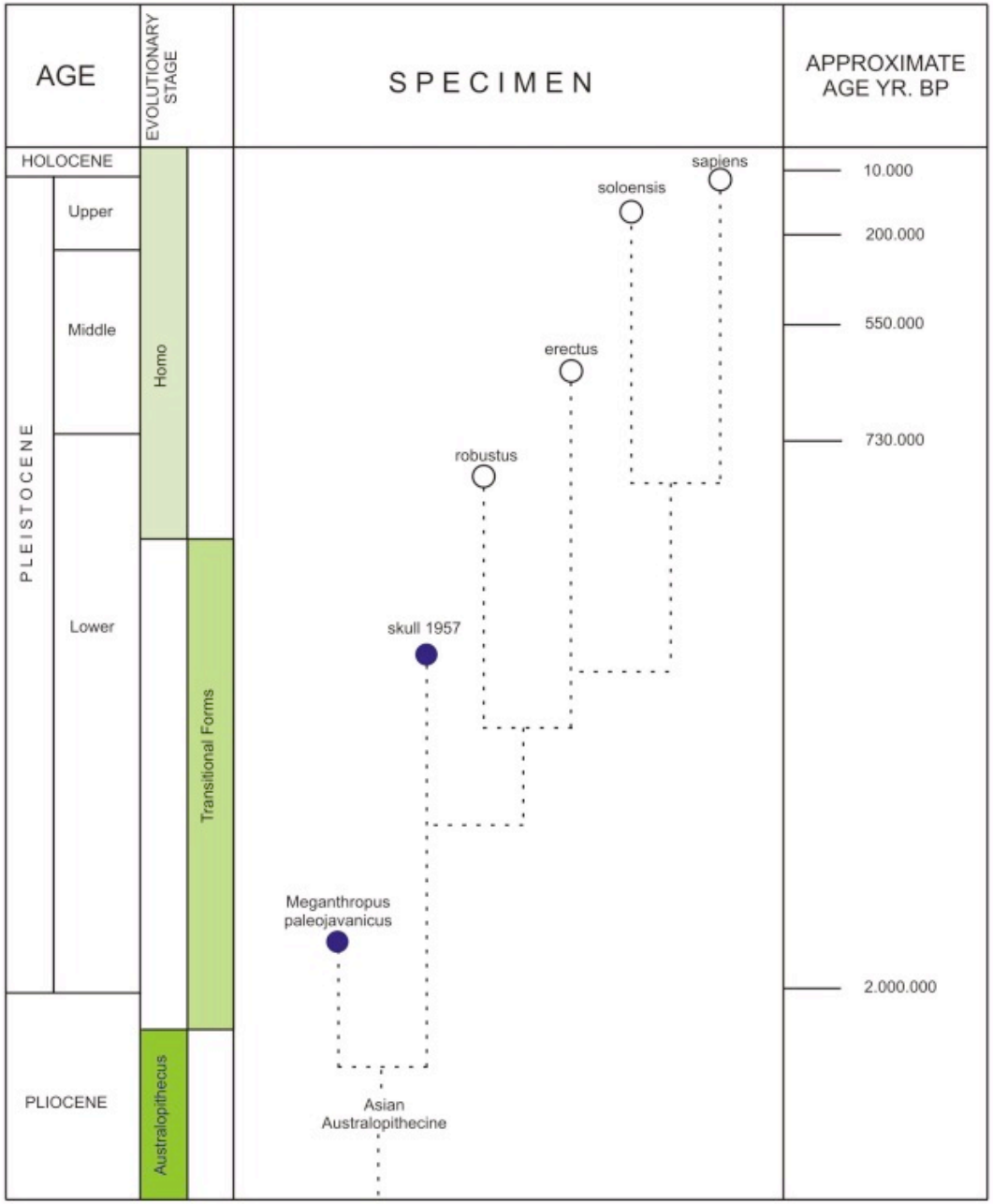


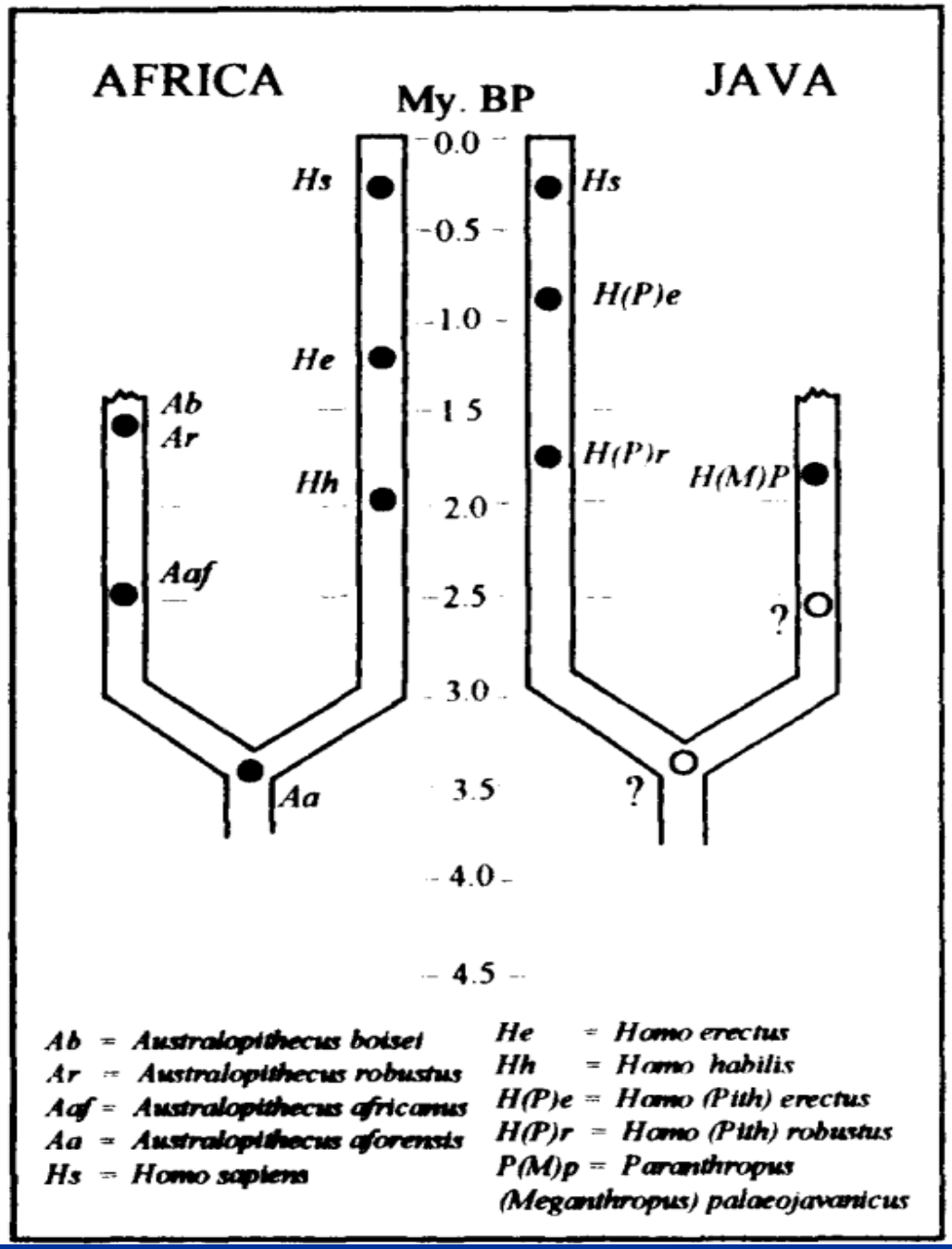
Diagram 1. — Hominids, their sites and chronology

m. y. = million years; U. P. = Upper Pleistocene; F. = fauna; H. s. = *Homo sapiens*; P. p. = *Pithecanthropus pekinensis*; P. l. = *Pithecanthropus lantianensis*; P. e = *Pithecanthropus erectus*; P. s. = *Pithecanthropus soloensis*; P. m. = *Pithecanthropus modjokertensis*; M. p. = *Meganthropus palaeojavanicus*.

Position of Indonesian Hominin in time and space (Jacob, 1975)

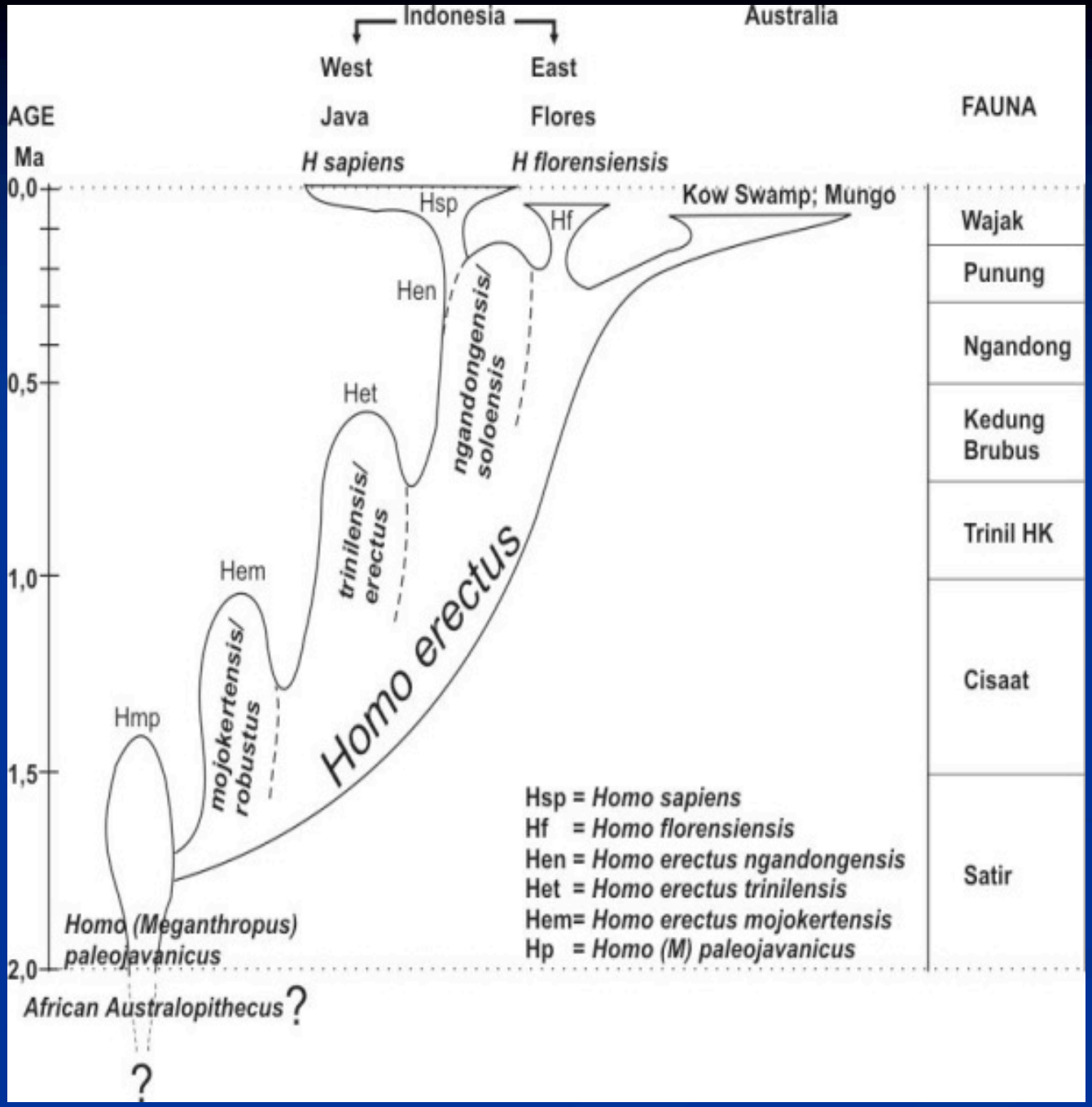


Evolutionary pattern of Javanese hominin (Sartono, 1996)

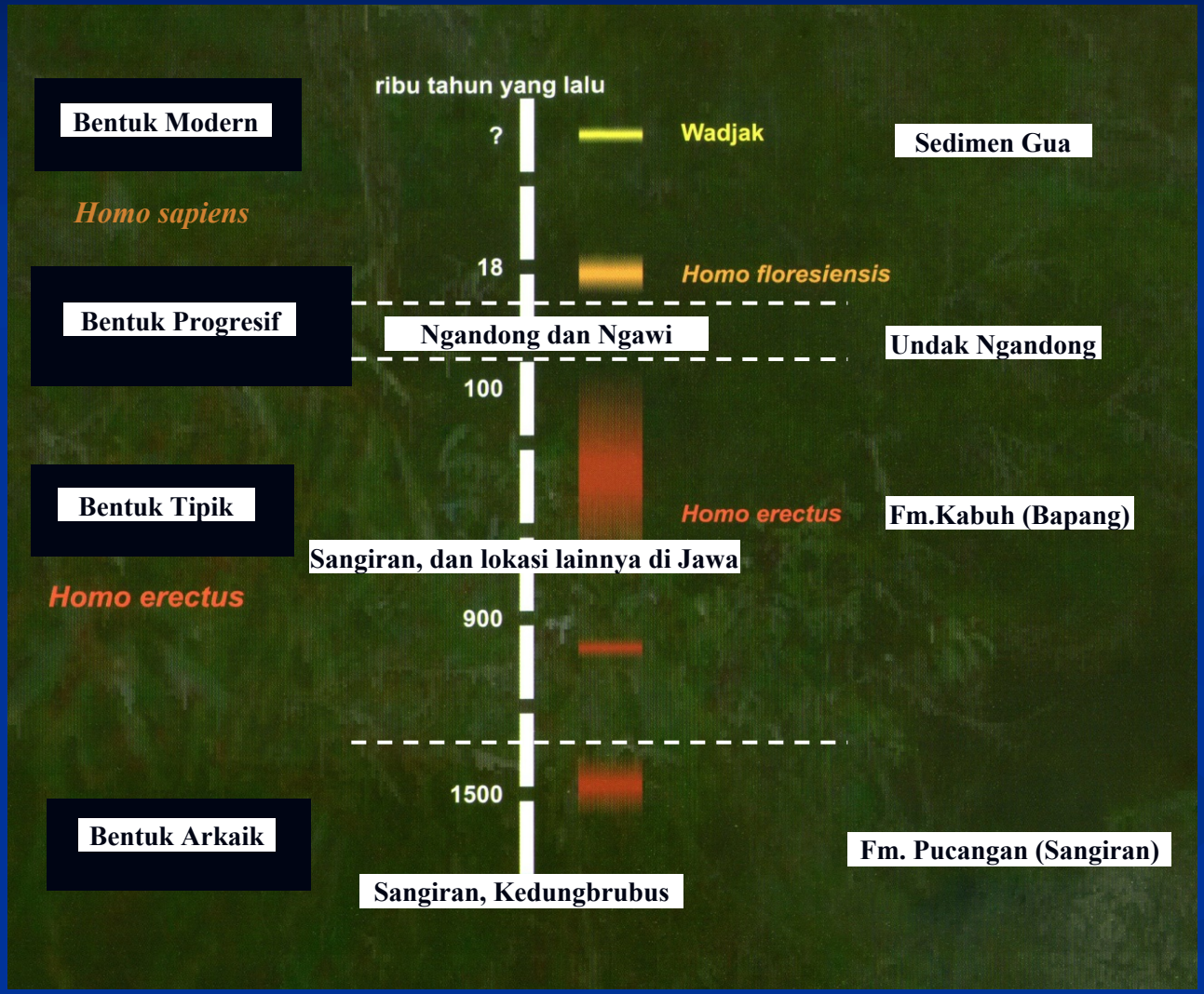


Comparison of evolutionary patterns of Africa and Javanese hominin (Sartono, 1996)

* Perkembangan terakhir sejak tahun 1960-1970-an dari hasil peneitian terhadap fosil *cranial* (tengkorak termasuk gigi2nya) maupun *postcranial* para ahli paleontologi manusia dan paleoantropologi sepakat bahwa semua fosil *Pithecanthropus* **sudah merupakan manusia** (*anthrop*) yang **sudah berbudaya yang mampu membuat alat dengan berbagai bahan dan teknologi**, dan ini menunjukkan perilaku manusia sempurna yaitu ***Homo***, dan berdiri tegak (***erectus***) yang oleh sebab itu secara taksonomi menjadi ***Homo erectus***. Dengan demikian **maka nama *Pithecanthropus* tidak lagi digunakan.**



Evolutionary pattern of Javanese hominin (Zaim, 2006)



Pola evolusi fosil Manusia Purba di Jawa (modifikasi dari Widyanto 2010)

* Melacak Perkembangan Manusia Purba di Jawa dan Indonesia:

Plestosen: Sangiran, Sambungmacan, Trinil, Kedungbrubus, Ngandong, Patiayam, Perning/Mojokerto, Lidah Ayer/ Sumatra Barat, Lembah Sungai Lusi/ Rembang dan Flores (?)

Holosen: Wajak/Tulungagung, Pacitan,

Plestosen:

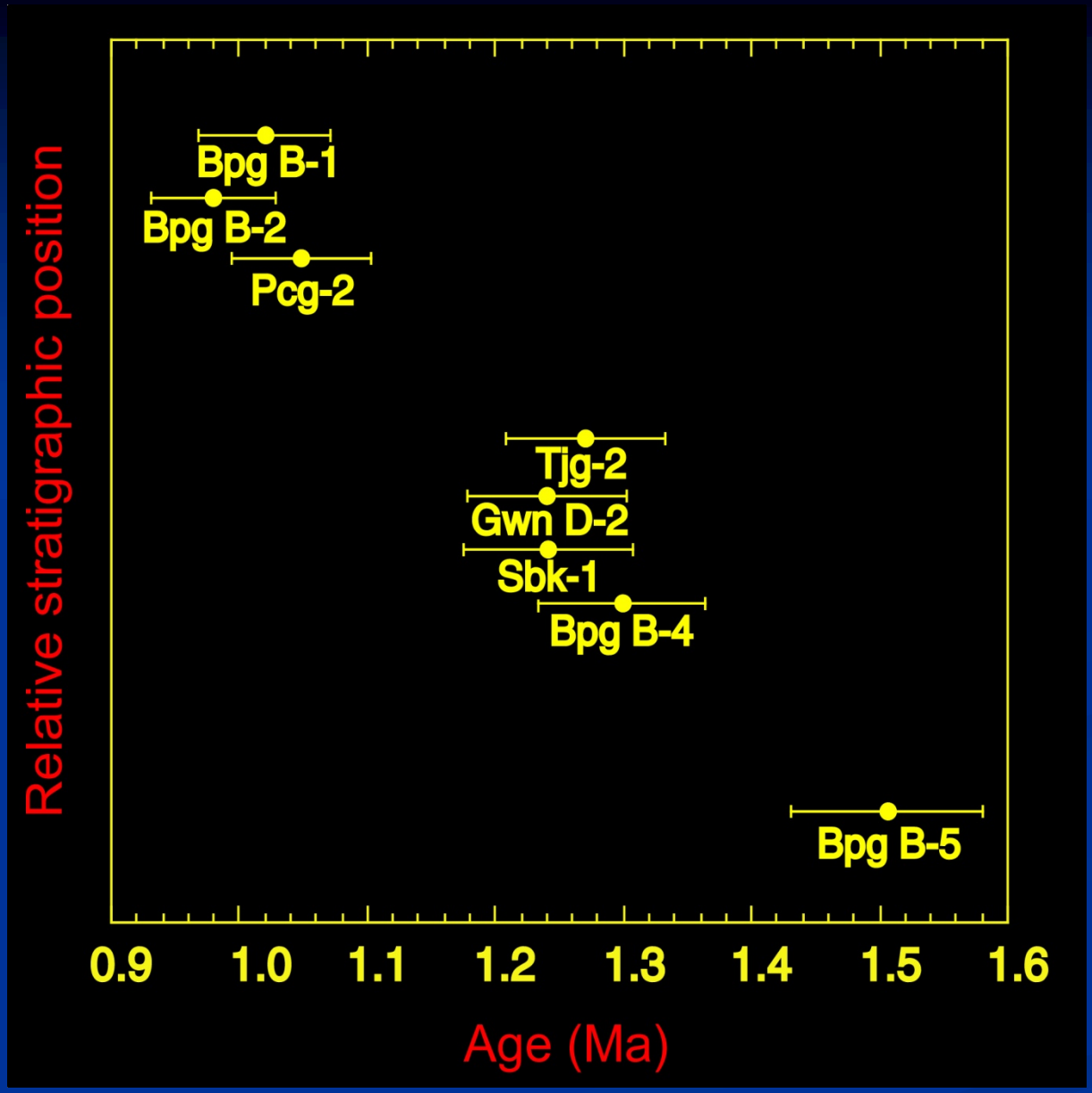
Sangiran, Sambungmacan, Trinil, Kedungbrubus, Ngandong, Patiayam, Perning/Mojokerto, Lidah Ayer/Sumatera Barat, Sungai Lusi/Rembang, Flores (?)

Plestosen:

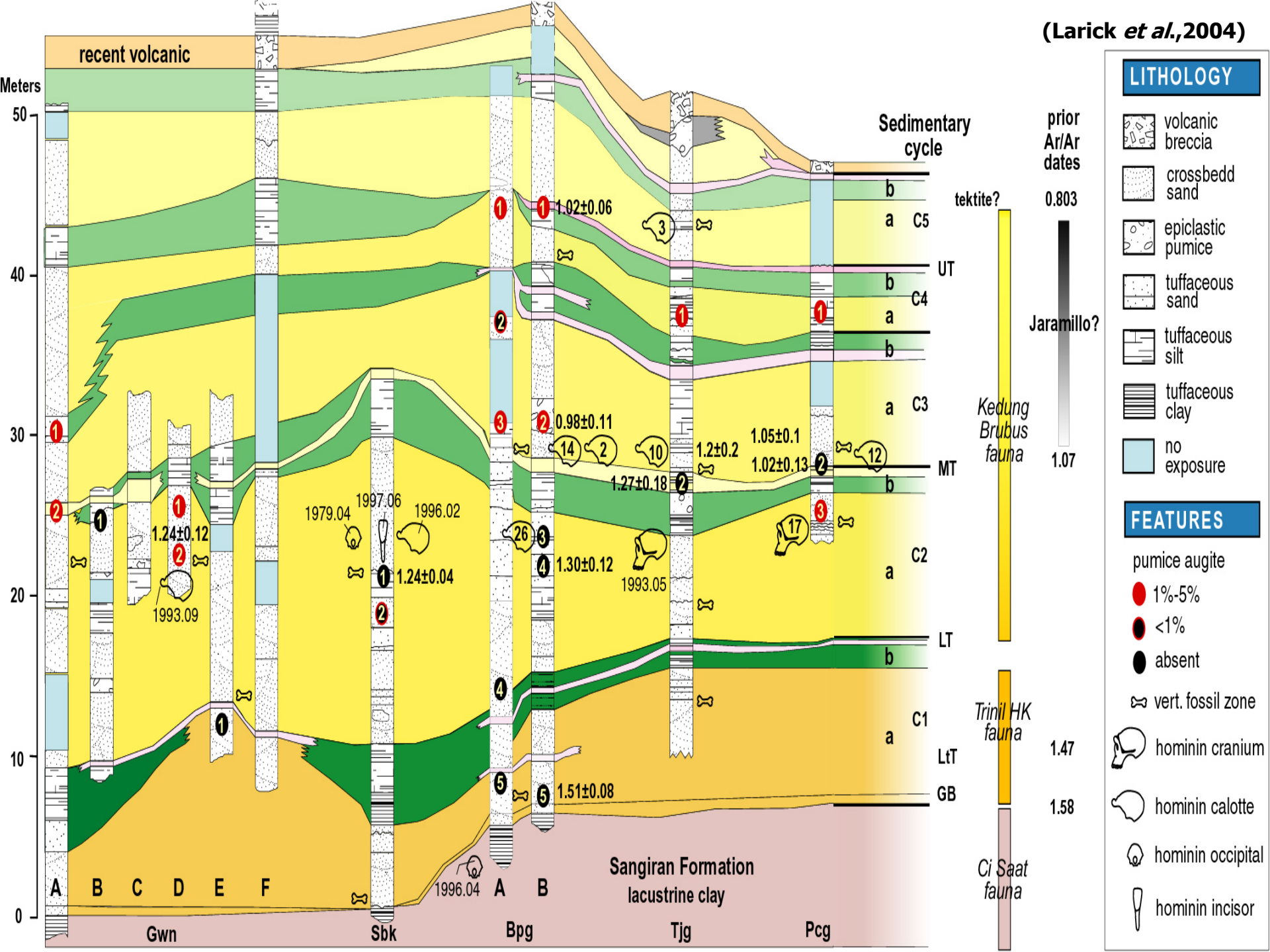
Sangiran, Sambungmacan, Trinil, Kedungbrubus, **Ngandong**, Patiayam, Perning/Mojokerto, **Lidah Ayer/Sumatera Barat, Sungai Lusi/Rembang, Flores (?)**

Sangiran :

Holocene		River Terraces	Gravel, sands and clays	Alluvial
	L	Pohjajar Fm.	Upper Lahar Breccia (Andesite)	Volcanic Products
Pleisto cene	M	Bapang Fm.	Cglmtes,X'bed Sandstones Clays – *Hominid & Vertebrates*	Fluvial
			"*Grenzbank Layers*" with *Hominid & Vertbrtes*	
		Sangiran Fm.	Black Clays &Tuffs *Hominid & Vertebrates*	Lake
	E		Lower Lahar Unit *Vertebrates*	Volcanic Products
Pliocene		Puren Fm.	Marls & Blue Clays	Shallow Marine



40Ar/39Ar estimated eruption age *vs* relative stratigraphic position for the Bapang Formation


(Larick et al.,2004)
recent volcanic
Meters
50
40
30
20
10
0
Sedimentary cycle
prior Ar/Ar dates
tektite?
0.803
Jaramillo?
1.07
1.47
1.58
Kedung Brubus fauna
Trinil HK fauna
Ci Saat fauna
b
a
C5
UT
C4
C3
MT
C2
LT
C1
LtT
GB
1.02±0.06
0.98±0.11
1.2±0.2
1.05±0.1
1.02±0.13
1.27±0.18
1.30±0.12
1.51±0.08
1.24±0.12
1.24±0.04
1993.09
1979.04
1997.06
1996.02
1993.05
1996.04
A
B
C
D
E
F
Gwn
Sbk
Bpg
Tjg
Pcg
Sangiran Formation
lacustrine clay
LITHOLOGY
volcanic breccia
crossbedd sand
epiclastic pumice
tuffaceous sand
tuffaceous silt
tuffaceous clay
no exposure
FEATURES
pumice augite
1%-5%
<1%
absent
vert. fossil zone
hominin cranium
hominin calotte
hominin occipital
hominin incisor

Sangiran Fm.

***Meganthropus paleojavanicus* v.K**

Sangiran 6 a,b,c
Sackenberg Musium Collection
Photographed by Axel Stolp

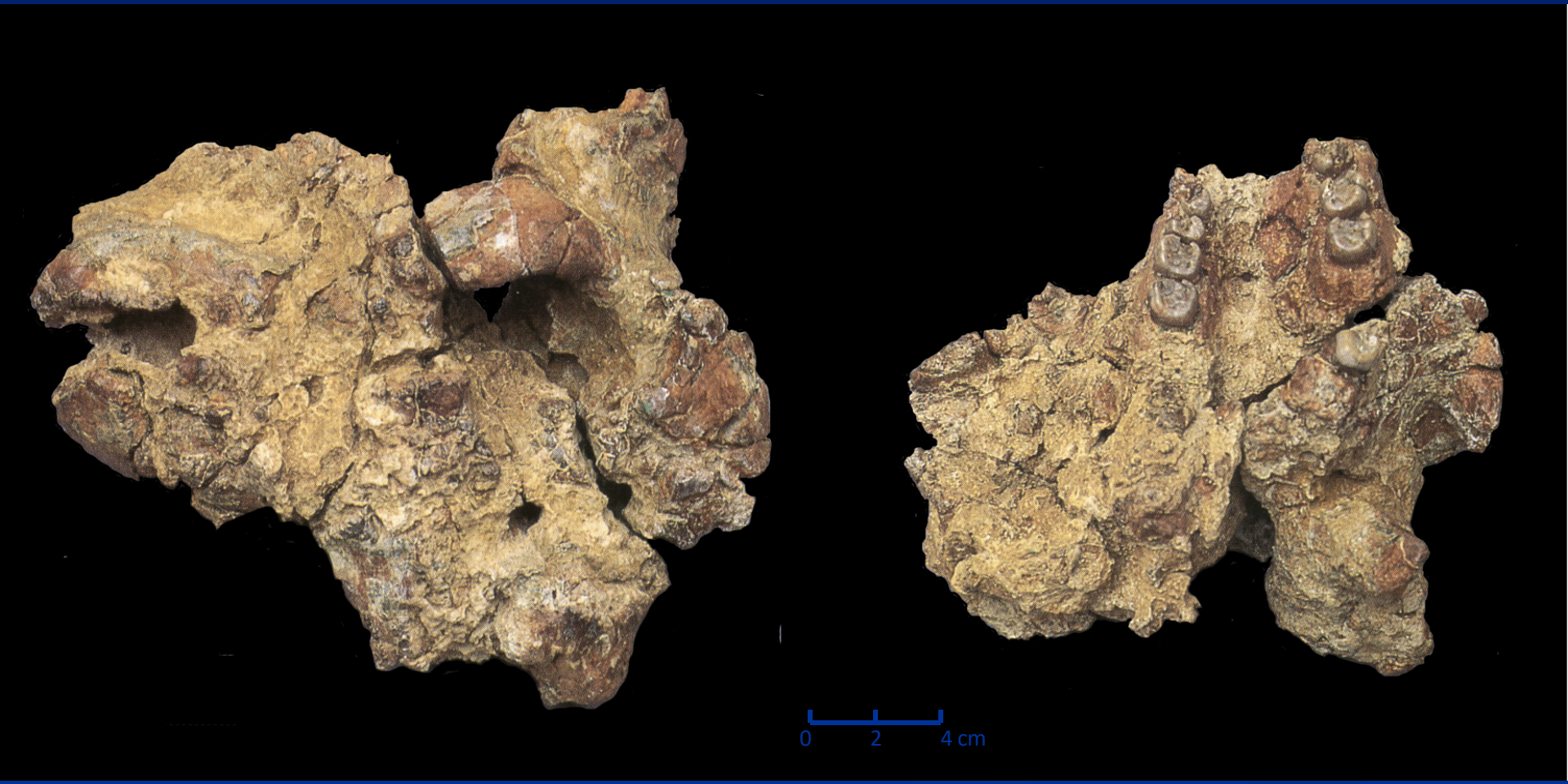
Sangiran Fm.

Sangiran 4
Sackenberg Musium Collection
Photographed by Axel Stolp

***Pithecanthropus erectus* v.K**

Jokotingkir – S 27

Sangiran Fm.



Homo erectus (Koleksi T.Jacob)

Homo erectus/*Meganthropus* (Koleksi T.Jacob / ITB)

Homo erectus (Koleksi ITB)

Tjg -1993.05/ Skull IX

***Homo erectus* (Koleksi ITB)**

Homo erectus (Koleksi ITB)

Fosil *maxilla* Fm. Bapang, Sangiran (Bpg-2001.04. Foto Y. Zaim 2010)

Journal of Human Evolution 61 (2011) 363–376

Contents lists available at ScienceDirect

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

New 1.5 million-year-old *Homo erectus* maxilla from Sangiran (Central Java, Indonesia)

Yahdi Zaim [a], Russell L. Ciochon [b,*], Joshua M. Polanski [c], Frederick E. Grine [d], E. Arthur Bettis III [e], Yan Rizal [a], Robert G. Franciscus [f], Roy R. Larick [g], Matthew Heizler [h], Aswan [a], K. Lindsay Eaves [f], Hannah E. Marsh [f]

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[b] *Department of Anthropology and Museum of Natural History, Macbride Hall, University of Iowa, Iowa City, IA 52242, USA*
[c] *Department of Anthropology, University of Arkansas, Fayetteville, AR 72701, USA*
[d] *Departments of Anthropology and Anatomical Sciences, Stony Brook University, Stony Brook, NY 11794, USA*
[e] *Department of Geoscience, University of Iowa, Iowa City, IA 52242, USA*
[f] *Department of Anthropology, University of Iowa, Iowa City, IA 52242, USA*
[g] *Helios Laser, 160 East 238th Street, Euclid, OH 44123, USA*
[h] *New Mexico Bureau of Mines and Mineral Resources, Socorro, NM 87801, USA*

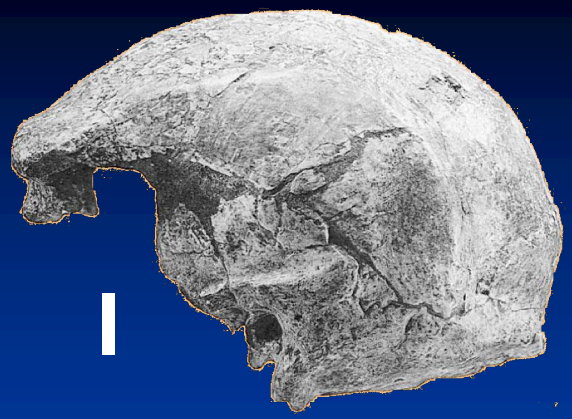
Publikasi Fosil *Maxilla* Bpg -2001.04, JHE-2011

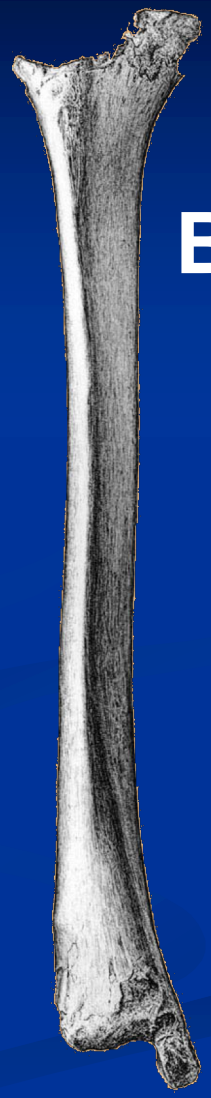
Plestosen:

Ngandong → 2008, 2010, 2014

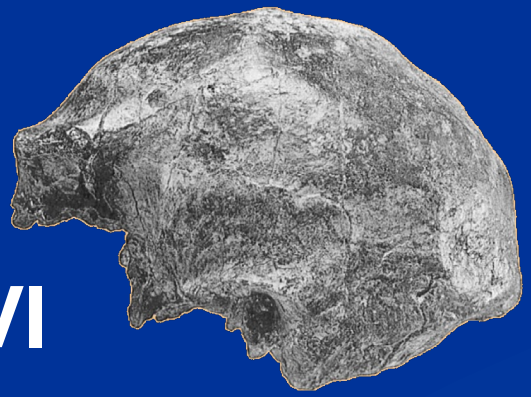
Sungai Lusi/Rembang, Flores (?)


1930s, Ngandong
Basal bone bed
Huffman, de Vos, Berkhout and Aziz, in prep





Homo erectus dari Teras Ngandong



Weidenreich 1951

Tim “Ngandong” dari ITB, *University of Iowa* dan *Texas University at Austin* (Foto Y.Zaim,2008)

Bangunan Belanda yang menjadi Kantor Kehutanan Ngandong pada 1930an (Foto Y.Zaim,2008)

Halaman Kantor Kehutanan Ngandong pada 1930an yang akan dieskavasi tahun 2008 (Foto Y.Zaim,2008)

Kebun Tebu di halaman Kantor Kehutanan Ngandong yang akan dieskavasi tahun 2008 (Foto Y.Zaim,2008)

Ngandong Today – looking west

Eskavasi Paleontologi di Ngandong -2008 (Foto Y.Zaim,2008)

Eskavasi Paleontologi di Ngandong -2008 (Foto Y.Zaim,2008)

Eskavasi Paleontologi di Ngandong -2008 (Foto Y.Zaim,2010)

Eskavasi Paleontologi di Ngandong -2008 (Foto Y.Zaim,2010)

Fosil Vertebrata dari Eskavasi Paleontologi di Ngandong - 2008

WEBINAR Prodi Teknik Geologi FITB - ITB

Rediscovery of the *Homo erectus* bed at Ngandong: Site Formation of a late Pleistocene hominin site in Asia.

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AAPA Conference – Beijing, 2009

WEBINAR Prodi Teknik Geologi FITB - ITB

Hasil Penelitian Ngandong
dipublikasi di Jurnal Nature, Desember 2019

Article nature

Last appearance of *Homo erectus* at Ngandong, Java, 117,000–108,000 years ago

https://doi.org/10.1038/s41586-019-1863-2

Received: 29 May 2019

Accepted: 4 November 2019

Published online: 18 December 2019

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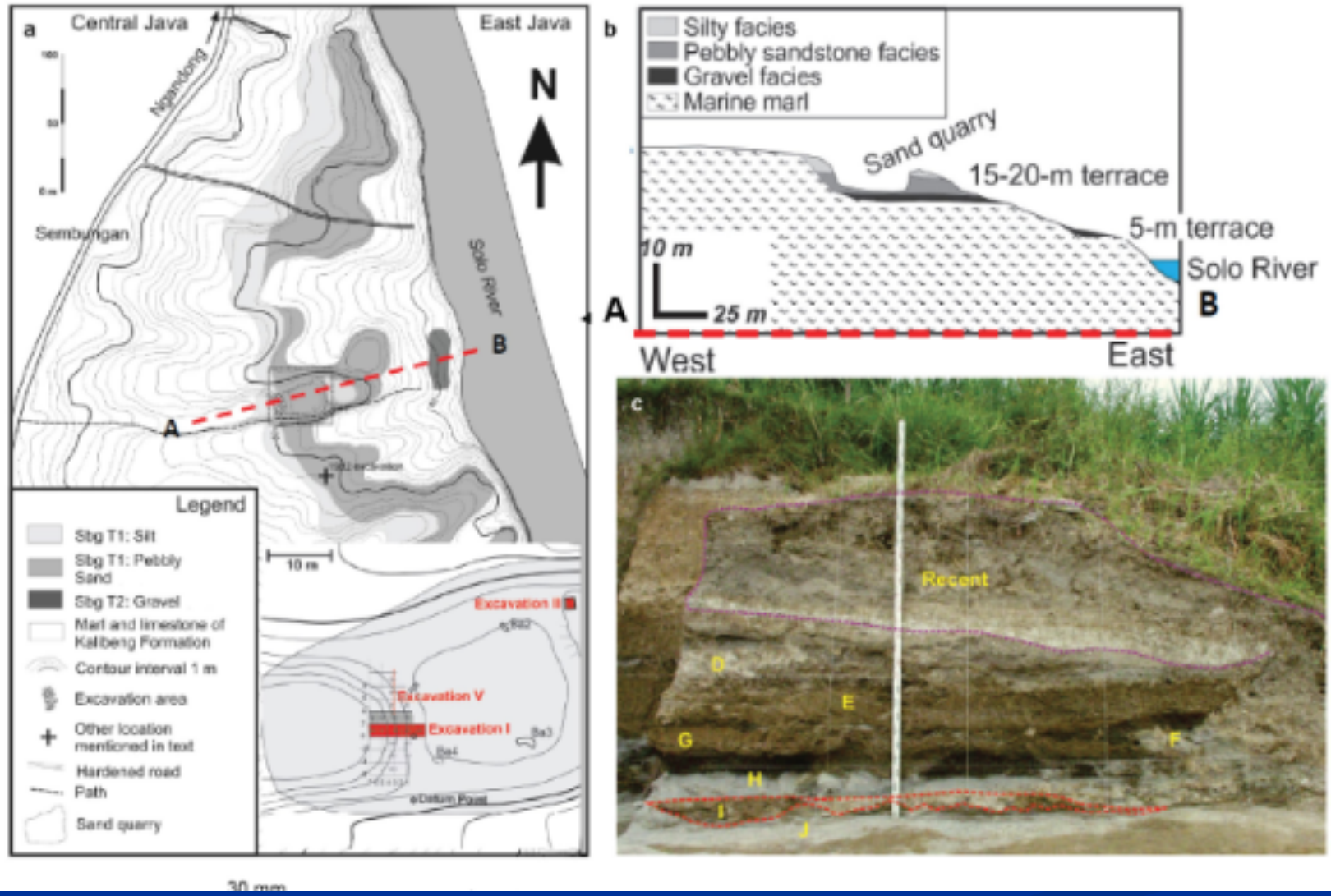

Studi Sedimentologi detil di Ngandong pada 2008 (Rizal,dkk, 2019)

Extended Data Fig. 6 | Photographs of 2008 and 2010 excavations at Ngandong including fossil discoveries. a, View of Ngandong site before the 2008 excavation, facing northwest. The orange string line marks the extent of the 1931–1933 excavations[3]. **b**, Collection of samples for optically stimulated luminescence dating, from facies B and C in pit A from 2008 (excavation unit H10a of the 2010 excavation). **c**, Bovid scapula and other fossils found in facies C in H10a from 2010. **d**, Excavations underway in excavation units H10a (foreground) and H10c (being dug) in 2010. **e**, Stratigraphy seen in the northwest wall of excavation unit H10a in 2010. Facies E is seen above the remnant of facies A, B, C and D, which are visible in the bottom half of this section. **f**, Exposed bone bed in facies A and C in excavation unit G09 from 2010. **g**, Fossils collected during 2010 excavation. Photographs **a**, **c** and **e** are by O.F.H. All other photographs are by R.L.C.

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Kegiatan Eskavasi di Ngandong pada 2008 dengan temuan Fosil Vertebrata (Rizal,dkk, 2019)

Extended Data Fig. 7 | Fauna from Ngandong recovered during the 2008–2010 excavations. a, Cervid antler, cf. *Axis* sp., specimen NDG 2306. **b**, Lower right M3, cf. *Bos* sp., specimen NDG 1134. **c**, Bovid incisor (lx), cf. *Bubalus* sp. NDG 1106. **d**, Bovid cervical vertebra (atlas), specimen NDG 2149. **e**, Bovid tooth (*Bubalus* sp.), specimen NDG 1131. **f**, Cervid tooth, cf. *Cervus* sp., specimen NDG 2074. **g**, Bovid tooth (*Bubalus* sp.), specimen NDG 1038. **h**, Bovid tooth (*Bubalus* sp.), specimen NDG 2569. **i**, Bovid tooth (*Bubalus* sp.), specimen NDG 1163. **j**, Artiodactyl canon bone, specimen NDG 2148. **k**, Artiodactyl hoof, specimen NDG 2199. Specimens NDG-1038, NDG-1163 and NDG-2569 (**e**, **g** and **i**) provided results for US–ESR age calculations (Extended Data Fig. 10). All photographs are by J.-P.Z.

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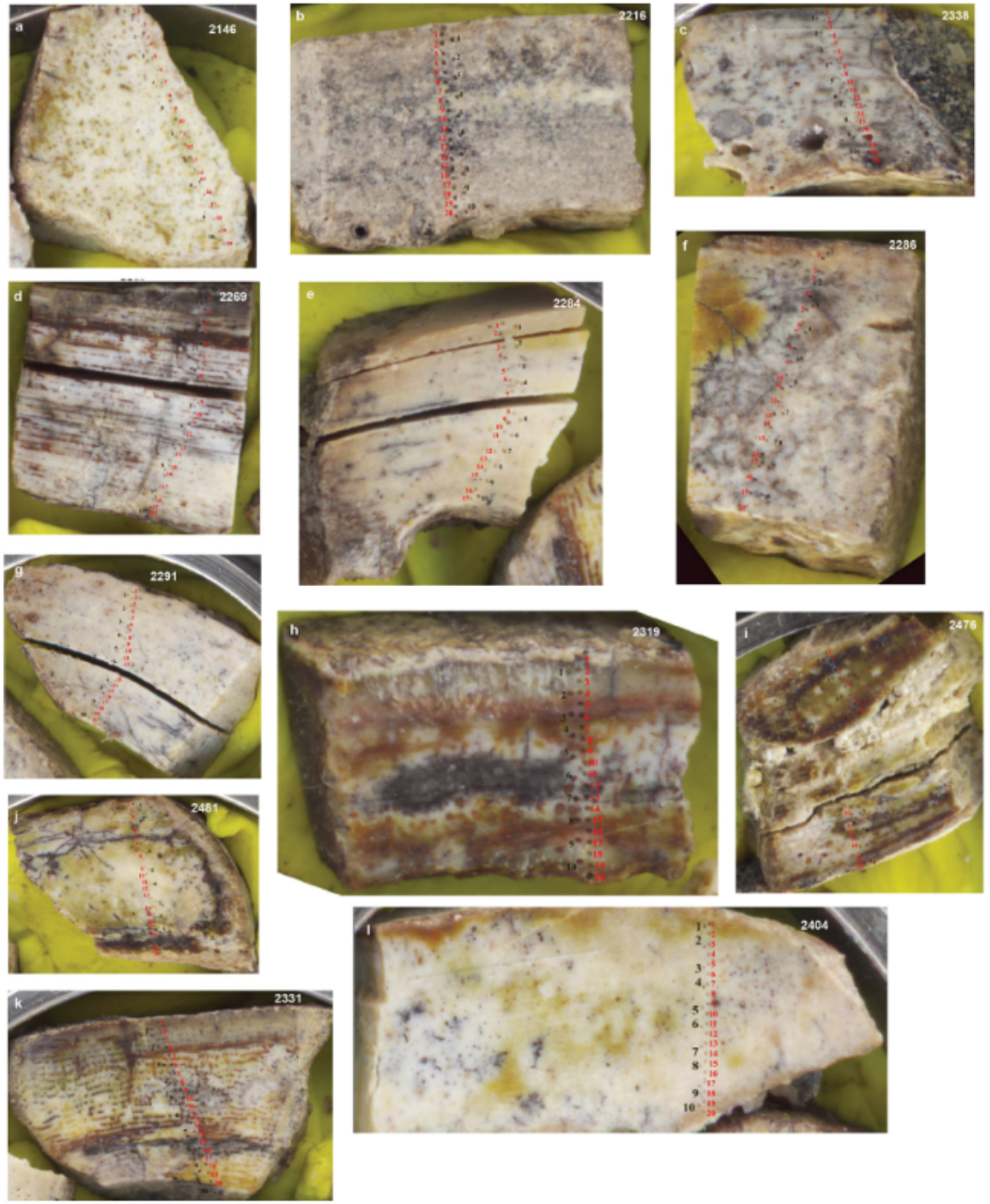
Fosil Bovidae dan Cervidae dari Eskavasi di Ngandong pada 2008. (Rizal,dkk, 2019)



Extended Data Fig. 9 | U-series-age depth dating of bone. a–l, Fossil bone recovered from the Ngandong excavations in 2010, displaying the track lines created by the LA-ICP-MS for U-series-age depth modelling. Bones were recovered from facies A and C. Figure 2 gives the locations of the bones. Specimen numbers (NDG) for each bone are listed in white in the top right corner.

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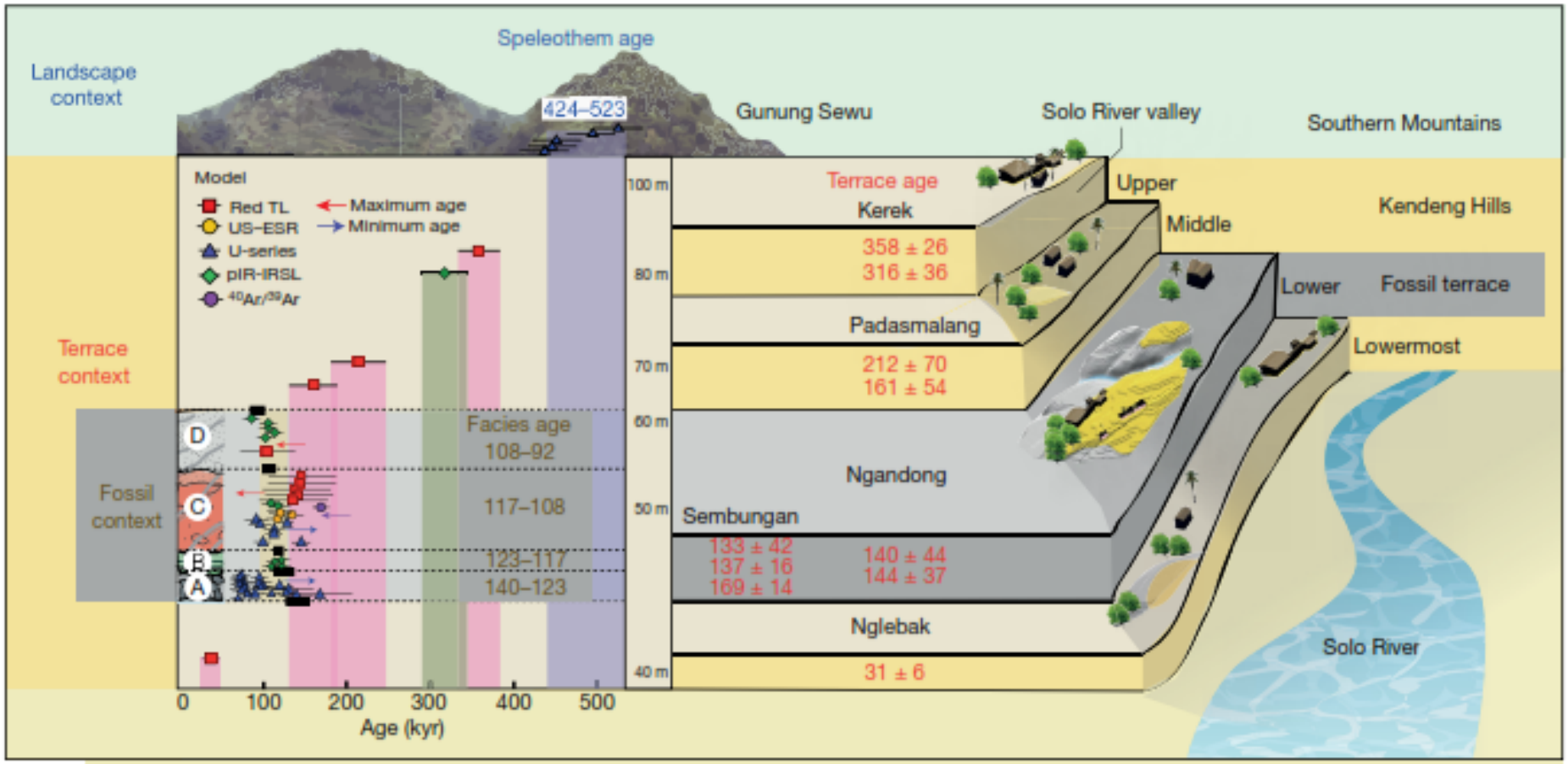
Pertanggalan U/Th pada fosil dari Eskavasi di Ngandong (Rizal,dkk, 2019)



Rekonstruksi Perkembangan Undak Sungai Bengawan Solo di daerah Ngandong dan sekitarnya (Rizal,dkk, 2019)

Article nature

Last appearance of *Homo erectus* at Ngandong, Java, 117,000–108,000 years ago

Plestosen:

Sungai Lusi – Rembang,

Lidah Ayer – Sumatera Barat

Lusi Specimen Age Dating Result

- Three Matrix samples have been dated (Hascaryo,2019):
    1. Lusi Formation (Kedung Cowek site, contains of hominin cranial fragment);
    2. Terrace 3 (Ngerancah site)
    3. Terrace 5 (Bandang site)
- By IR-OSL method
- Performed in *Luminescence Dating Laboratory, School of Geography, Environment and Earth Sciences* Victoria University of Wellington, Wellington, New Zealand

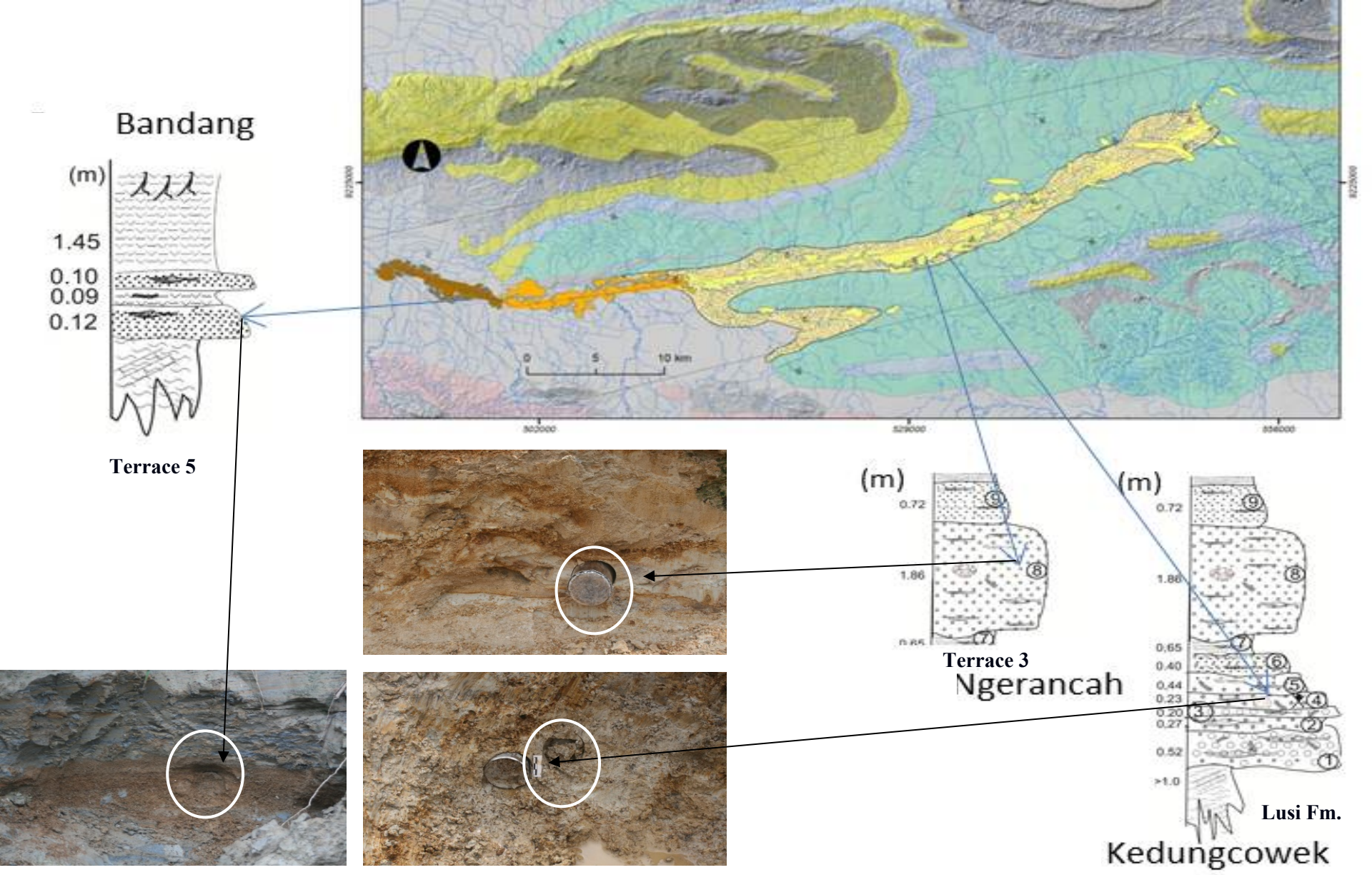
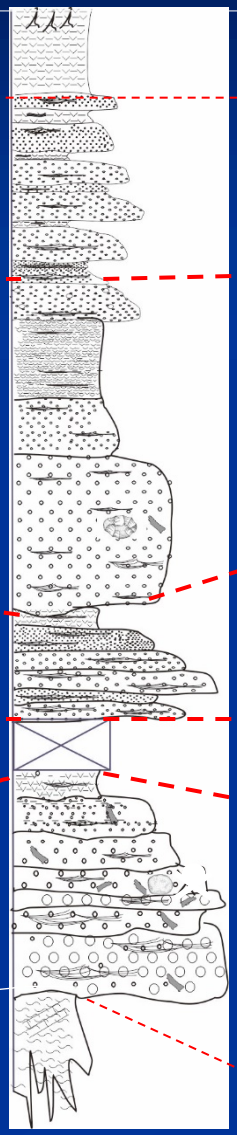


Figure : Sample location for age dating (Hascaryo,2019)

Table 1: Dating results of IR-OSL method performed in *Luminescence Dating Laboratory, School of Geography, Environment and Earth Sciences Victoria University of Wellington, Wellington, New Zealand* (Hascaryo,2019)

Laboratory Code Number	**Age by *luminescence* IR – OSL** (ka)	**Sample Location**	**Rock Unit**
WLL 1240	*8. 3 ± 1.4*	Bandang	Terrace T5
WLL 1239	*94.9 ± 12. 6*	Ngerancah	Terrace T3
WLL 1241	*131.5 ± 13.2*	Kedung Cowek	Lusi Fm.

Rock Unit	Age		Lithology	Description
Lusi Terrace 5	**8,3±1,4 ka**	Holocene		Sandstones and silt **contain of stone and bone tools**.
Lusi Terrace 4	**?**			Alternating of clay, silt and fine to coarse sandstones
Lusi Terrace 3	**94,9±12,6 ka**	Late Pleistocene		Alternating medium – coarse sandstones silt, and clay. with: *Bos bubalis*., *Cervus* sp., *Cervus axis.*, cf. *Orlitia borneoensis.*, cf. *Elephas hysudrindicus*., Crocodilus, **contain of stone and bone tools.**
Lusi Terrace 2	**?**			Alternating thin layers of conglomerate, fine – coarse sandstones and silt.
Lusi Terrace 1	**?**			Blank section
"Lusi Formation"	**131,5±13,2 ka**	Middle		Alternating of silt, fine – very coarse and conglomeratic sandstones. These sediments contain of vertebrate fossils: a piece of cranial fragment of **Hominid**, Bos sp., Axis sp., Cervus sp., Stegodon sp., Rhinoceros sondaicus., cf. Batagur sp., dan Croccodilus. Bones and **antler tools, as well as shell and stone tools**.
Mundu Formation	N 21	Plio-Pleistocene		Marine marl, grey to greenish white, rich with foraminifers

The Lusi Specimen:
A small fragment for human evolution in Indonesia.

- Supposed the hominin fossil – Lusi Specimen from Rembang area belongs to *Homo erectus*, then it could be as late *Homo erectus* has late Middle Pleistocene in age, equivalent to the late *Homo erectus* found in Ngandong.

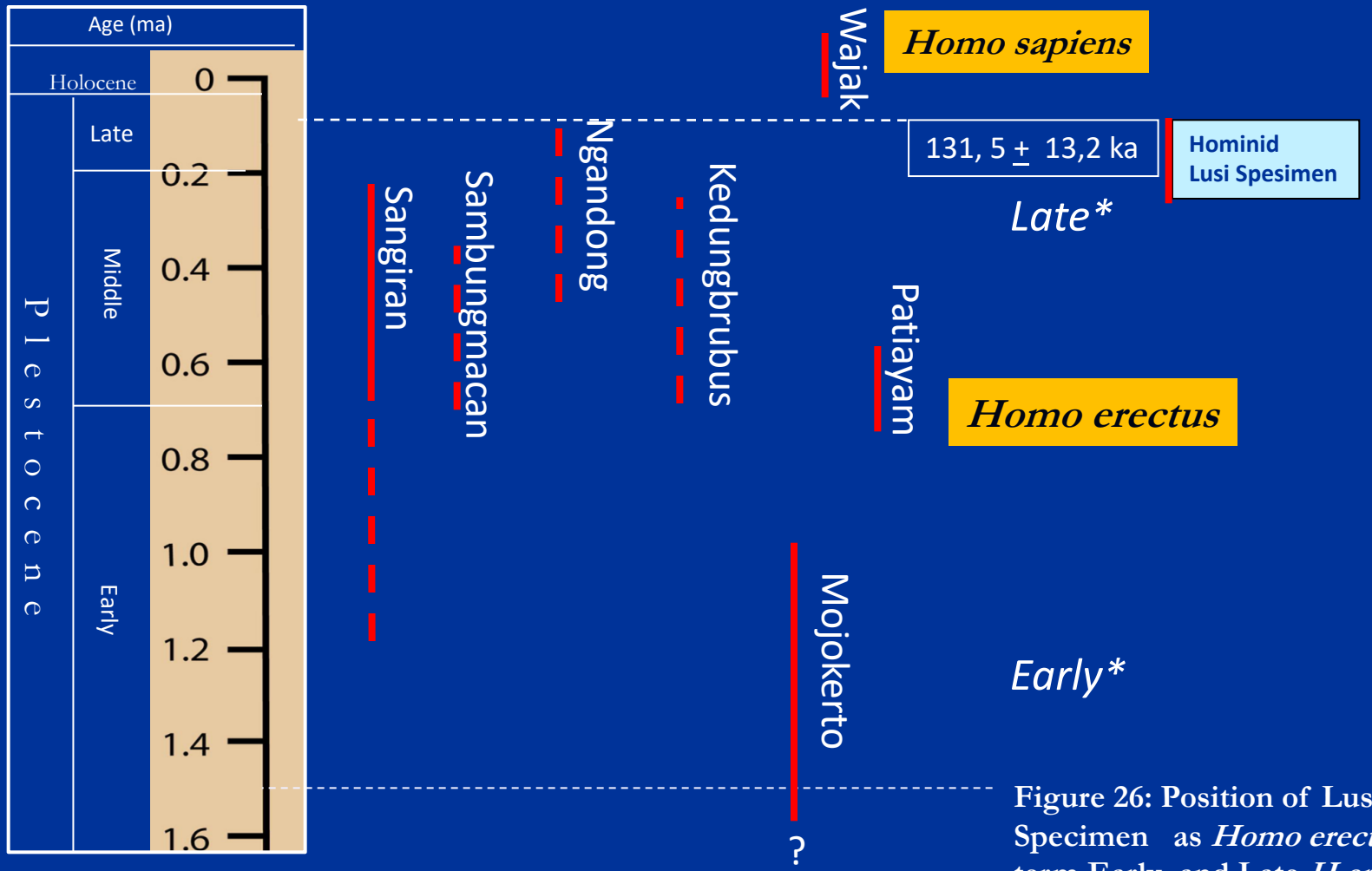


Figure 26: Position of Lusi Specimen as *Homo erectus.* The term Early and Late *H.erectus* after Polanski et al. (2016)

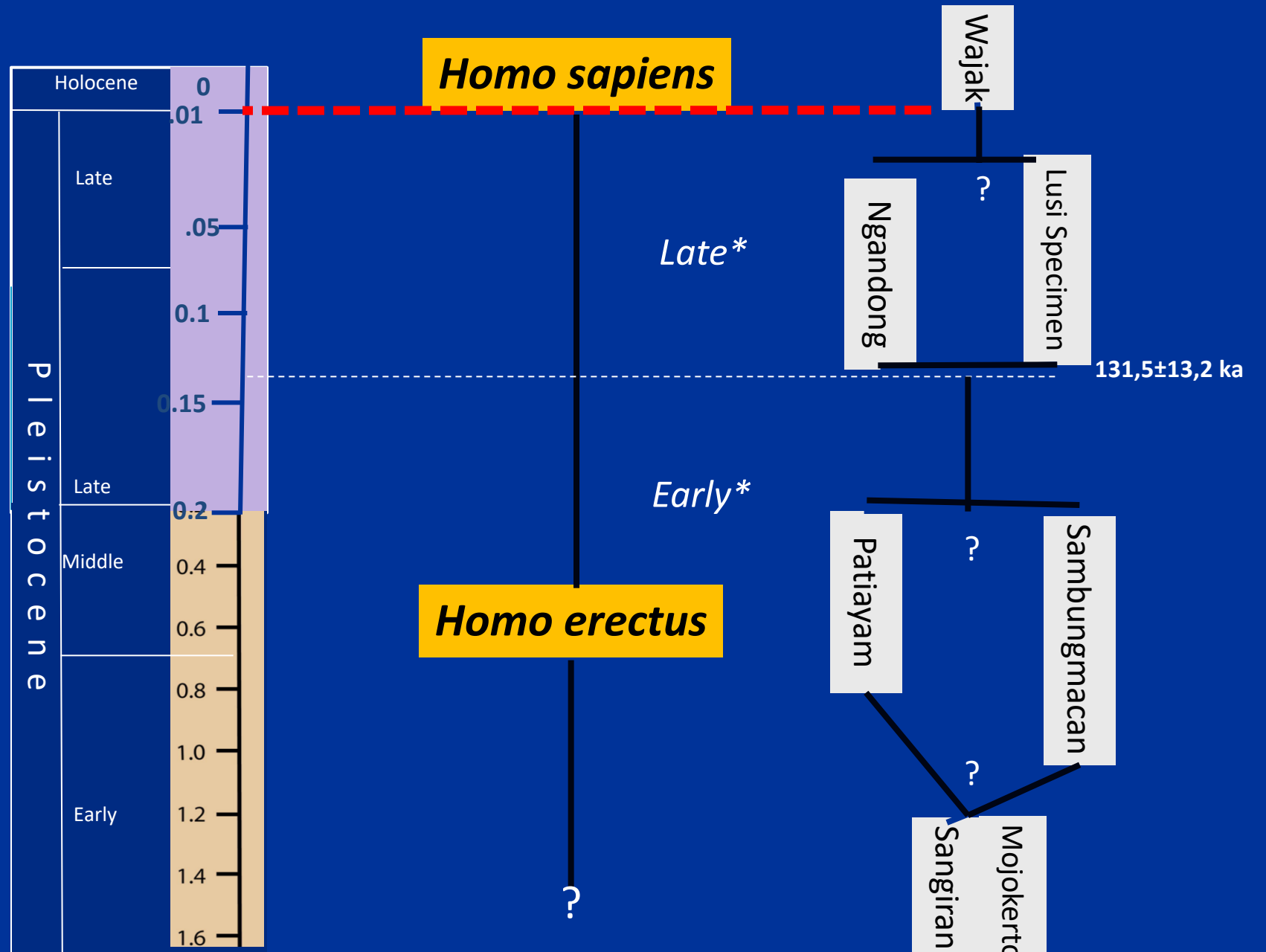


Figure 27: Position of Lusi Specimen as *Homo erectus*. The term Early and Late *H.erectus* after Polanski et al. (2016)

- If the specimen belongs to *Homo sapiens*, it must be for early *Homo sapiens* of late Middle Pleistocene in age as proposed by Hascaryo (2019), and this specimen must be an oldest *Homo sapiens* in Indonesia, even could be in South East Asia.

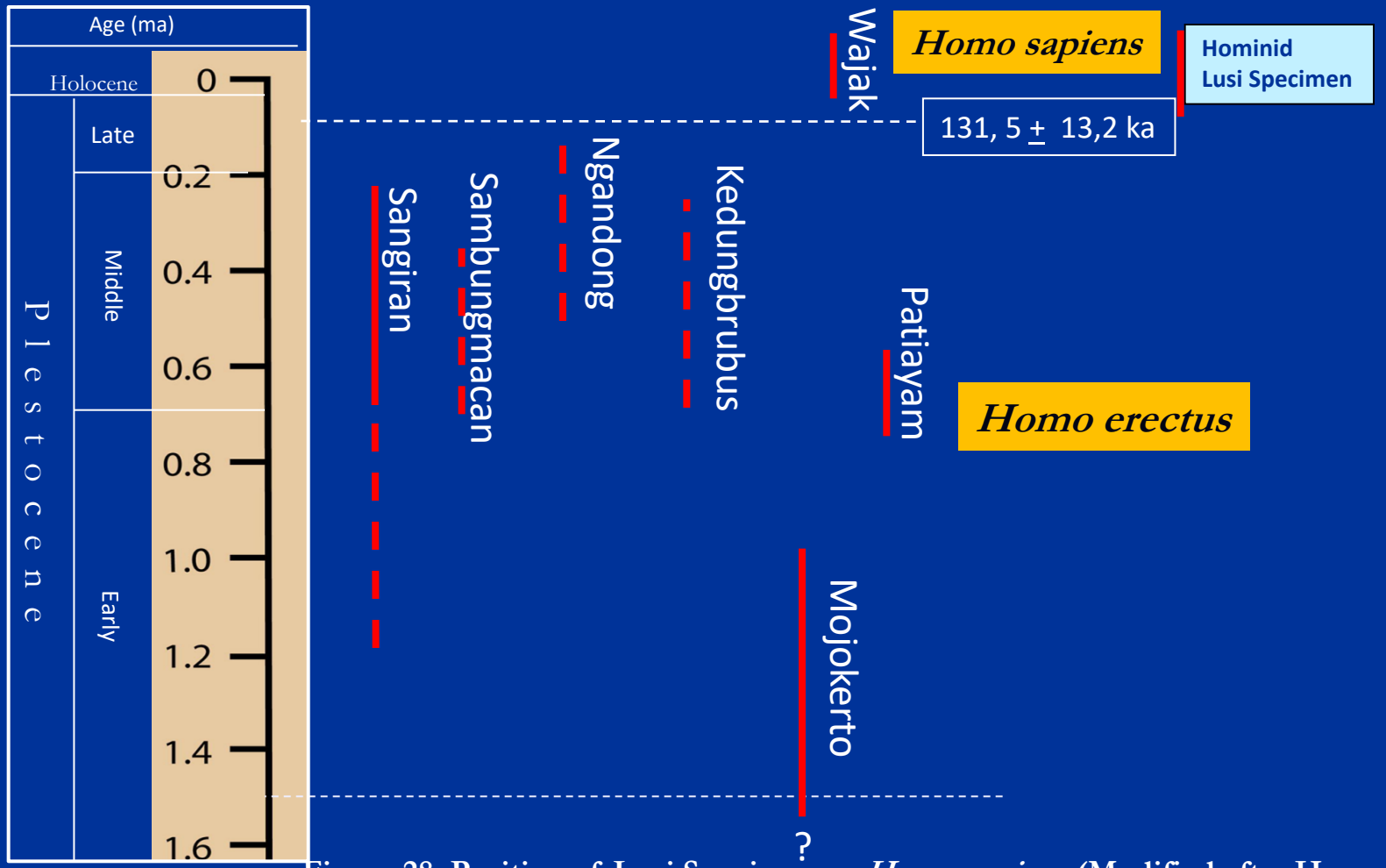


Figure 28: Position of Lusi Specimen as *Homo sapiens* (Modified after Hascaryo, 2019).

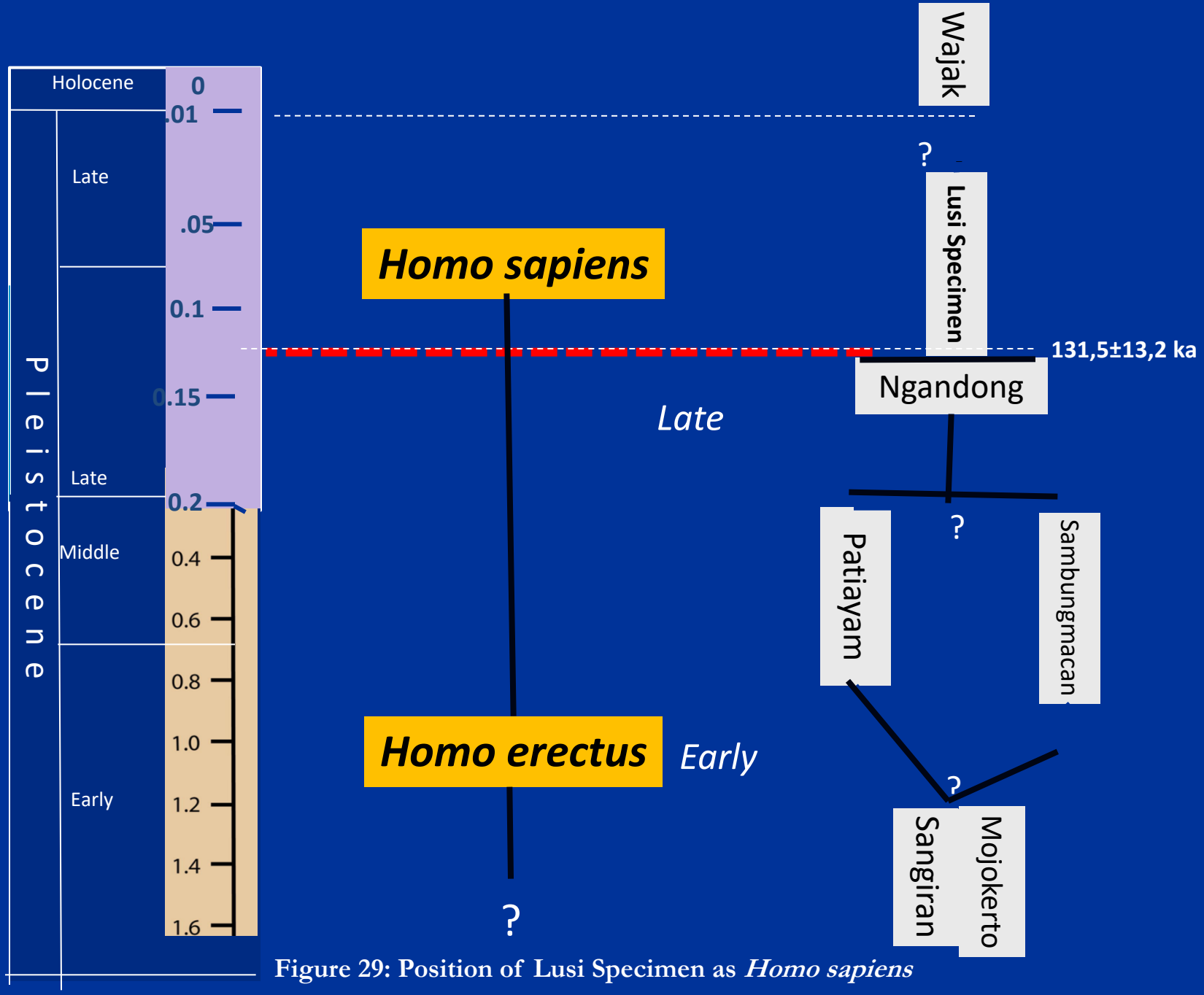


Figure 29: Position of Lusi Specimen as *Homo sapiens*

Plestosen: Ngandong → 2008, 2010, 2014
Sungai Lusi/Rembang, **Flores (?)**

* In 2004 first hominin fossils found in Flores Island from Liang Bua Cave, dated as 30 – 18 ky. However, this age then have been revised by redated as 100 – 60 ka. BP.(Sutikna,*et al*.,2016)

LETTER nature

doi:10.1038/nature17179

Revised stratigraphy and chronology for *Homo floresiensis* at Liang Bua in Indonesia

Thomas Sutikna[1,2]*, Matthew W. Tocheri[3,4]*, Michael J. Morwood[1]‡, E. Wahyu Saptomo[1,2], Jatmiko[1,2], Rokus Due Awe[1,2]‡, Sri Wasisto[2], Kira E. Westaway[5], Maxime Aubert[6,7], Bo Li[1], Jian-xin Zhao[8], Michael Storey[9], Brent V. Alloway[1,10], Mike W. Morley[1], Hanneke J. M. Meijer[4,11], Gerrit D. van den Bergh[1], Rainer Grün[12,13], Anthony Dosseto[14], Adam Brumm[7,12], William L. Jungers[15,16] & Richard G. Roberts[1]

- In 2014/2015 in Flores Island the *Homo floresiensis* also been found from Matamenge – Soa Basin, dated of 700 ka. BP, (Brumm, *et al*.,2016)

LETTER nature

doi:10.1038/nature17663

Age and context of the oldest known hominin fossils from Flores

Adam Brumm[1,2*], Gerrit D. van den Bergh[3*], Michael Storey[4], Iwan Kurniawan[5*], Brent V. Alloway[3,6], Ruly Setiawan[3,7], Erick Setiyabudi[5], Rainer Grün[1,8], Mark W. Moore[9], Dida Yurnaldi[3,7], Mika R. Puspaningrum[3], Unggul P. Wibowo[3,5], Halmi Insani[5], Indra Sutisna[5], John A. Westgate[10], Nick J. G. Pearce[11], Mathieu Duval[12], Hanneke J. M. Meijer[13], Fachroel Aziz[5], Thomas Sutikna[3,14], Sander van der Kaars[15,16], Stephanie Flude[17] & Michael J. Morwood[3‡]

- The hominin was also found in Luzon – Philippine namely as *Homo luzonensis* dated 67 ka BP (Detroit, *et al*., 2019)

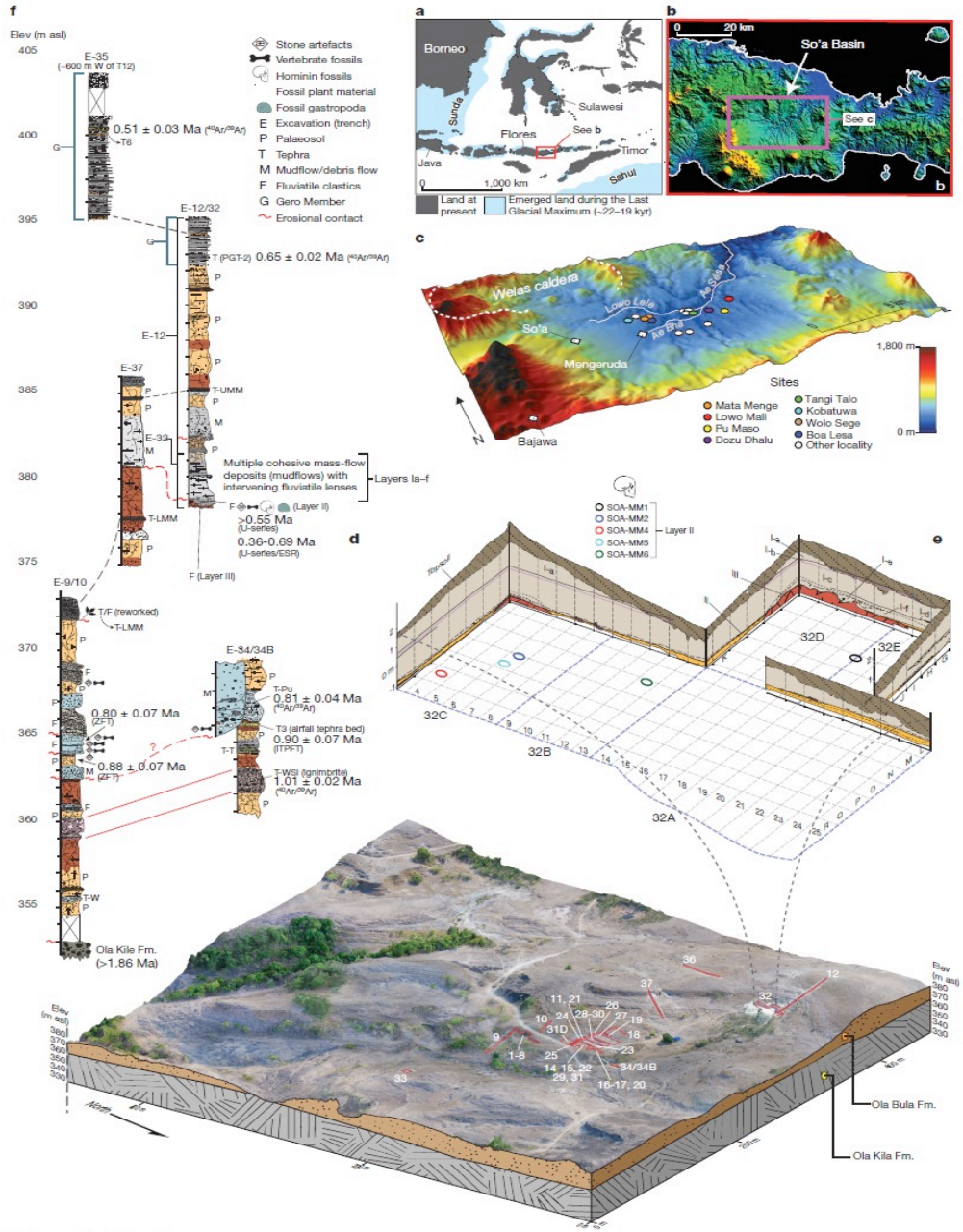


Figure 1 | See next page for caption.

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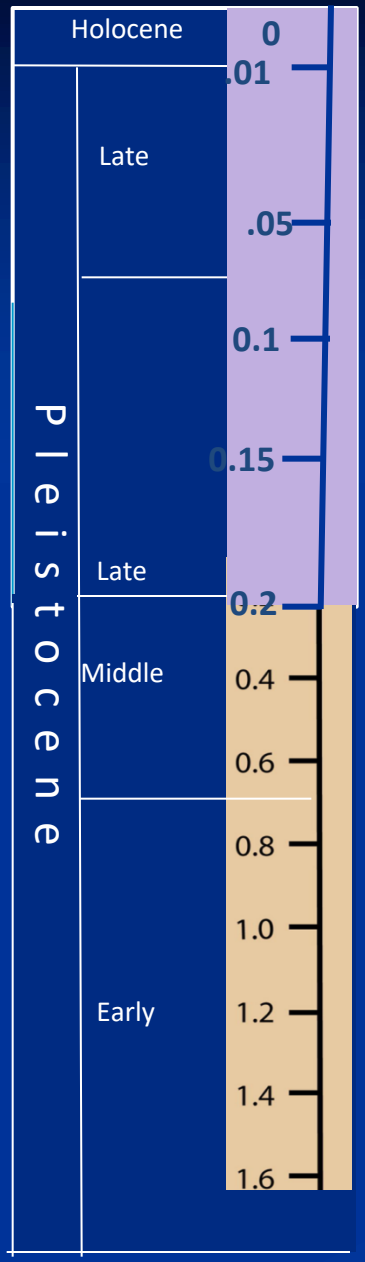
Data Stratigrafi Matamenge, Cekungan Soa-Flores (Brumm,dkk, 2016)



Soa Basin

Leang Bua

Luzon

Homo luzoniensis

Homo floresiensis

Figure :
Homo floresiensis from Flores Island and *Homo luzonensis* from Luzon, Philippine.

Plestosen:
Gua Lidah Ayer – Sumatera Barat

Tim “Lidah Ayer” dari ITB dan *Griffith University*
(Foto Y.Zaim,2016)

Figure: Lida Ajer cave - a small but well decorated front entrance (Westaway *et al. Nature* 1–4, 2017) (Photo credit Julien Louys and Gilbert Price)

Pintu masuk Gua Lidah Ayer yang sempit (Foto Y.Zaim,2016)

Di dalam Gua Lidah Ayer yang lembab (Foto Y.Zaim,2016)

Endapan breksi di dinding Gua Lidah Ayer, banyak mengandung fosil vertebrata (Foto Y.Zaim,2016)

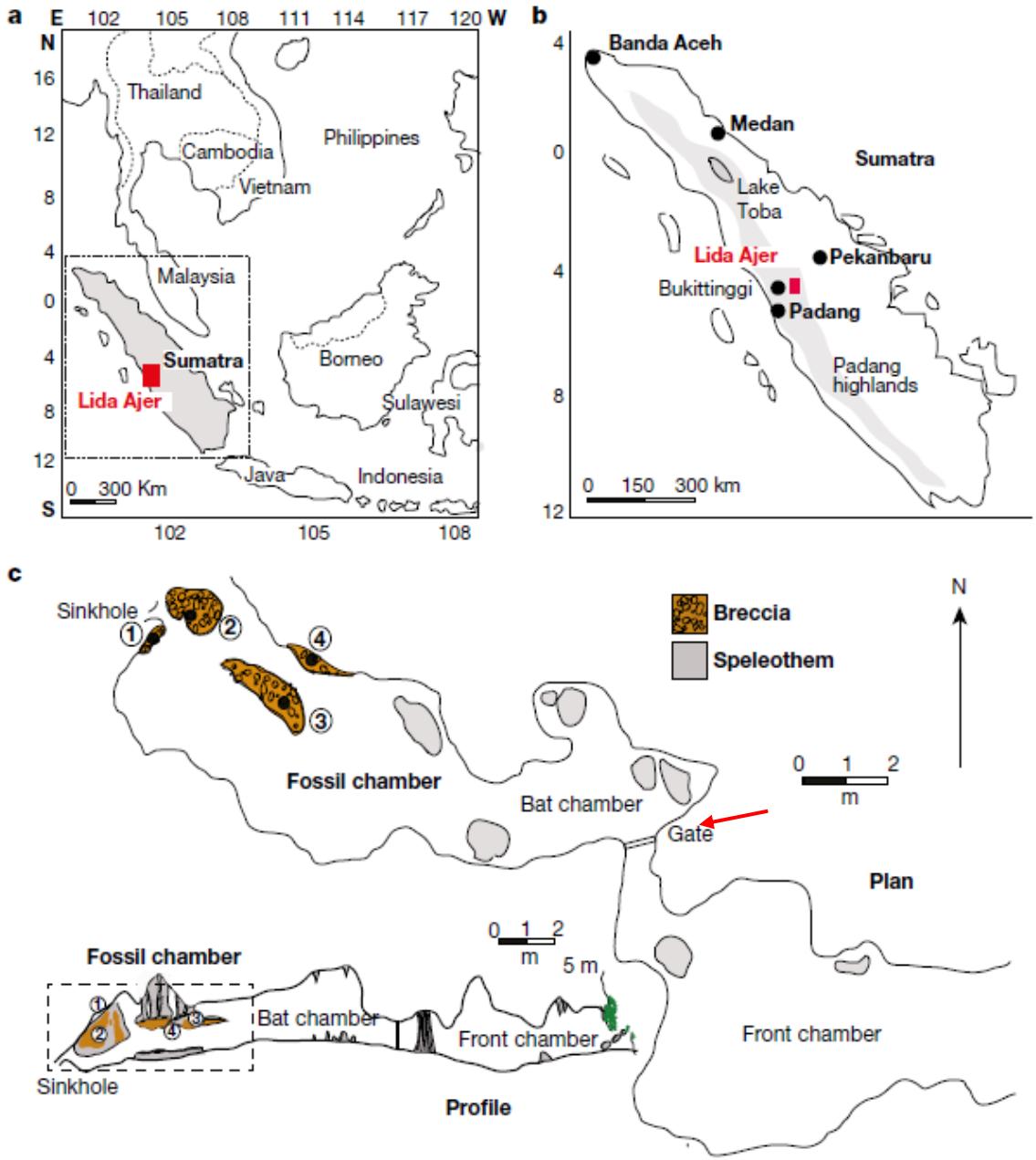


Figure 1 | Location of Indonesia, Sumatra and Lida Ajer cave and associated breccia. **a**, Southeast Asia illustrating the location of Sumatra (redrawn with permission from ref. 7). **b**, Sumatra island illustrating the location of Lida Ajer, close to the volcanic Bukit Barisan Mountains, in the belt of Carboniferous limestone. **c**, Cave plan and profile of Lida Ajer with its three chambers—front, bat and fossil chambers and the four sampling locations. The fossil-bearing breccia unit has been marked in brown with associated speleothem (flowstones, stalagmites and stalactites) marked in grey. The sampling locations—areas 1–4—are indicated on the plan and on the profile.

(Westaway *et al. Nature* 1–4, 2017)

nature

Hominin in West Sumatera

* An isolated human tooth fossil found from Lidah Ayer Cave West Sumatra believed belongs to ***Homo sapiens***

* Study of cave sediments from Lidah Ayer Cave contain of vertebrate and isolated tooth fossils dated as 73-63 ky.

LETTER nature doi:10.1038/nature23452

An early modern human presence in Sumatra 73,000–63,000 years ago

K. E. Westaway[1], J. Louys[2], R. Due Awe[3]‡, M. J. Morwood[4]‡, G. J. Price[5], J.-x. Zhao[5], M. Aubert[6], R. Joannes-Boyau[7], T. M. Smith[8,9], M. M. Skinner[10,11], T. Compton[12], R. M. Bailey[13], G. D. van den Bergh[4], J. de Vos[14], A. W. G. Pike[15], C. Stringer[12], E. W. Saptomo[3], Y. Rizal[16], J. Zaim[16], W. D. Santoso[16], A. Trihascaryo[16], L. Kinsley[17] & B. Sulistyanto[3]

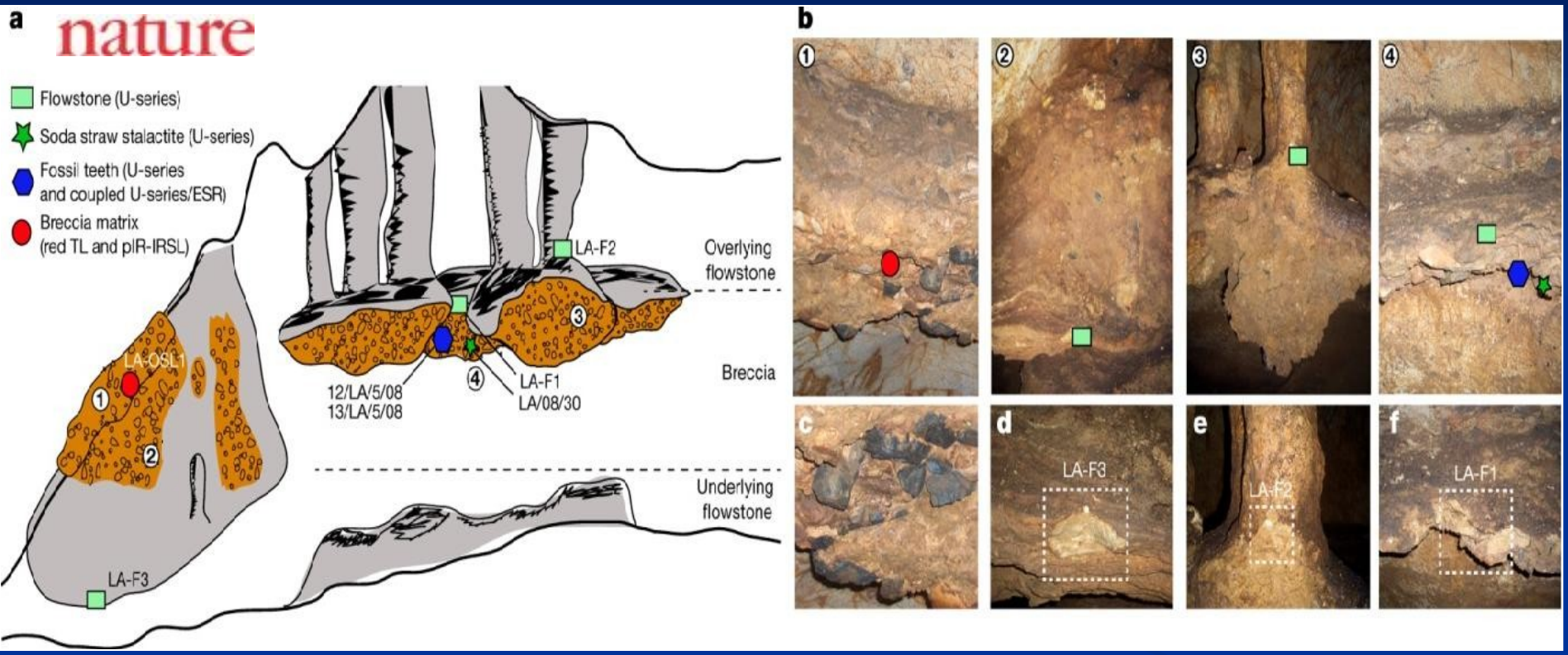
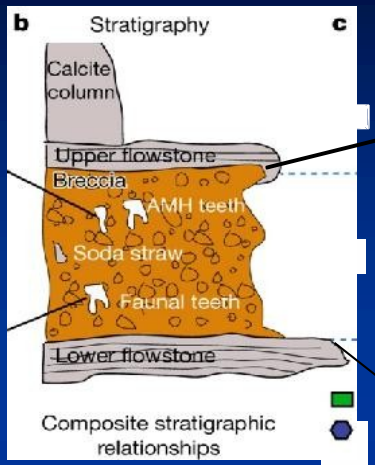


Figure: Lida Ajer breccia; structure and stratigraphic relationships (Westaway *et al. Nature* 1–4, 2017)

Figure: Lida Ajer cave deposits containing a wealth of fossils (Westaway *et al. Nature* 1–4, 2017).(Photo credit Kira Westaway)



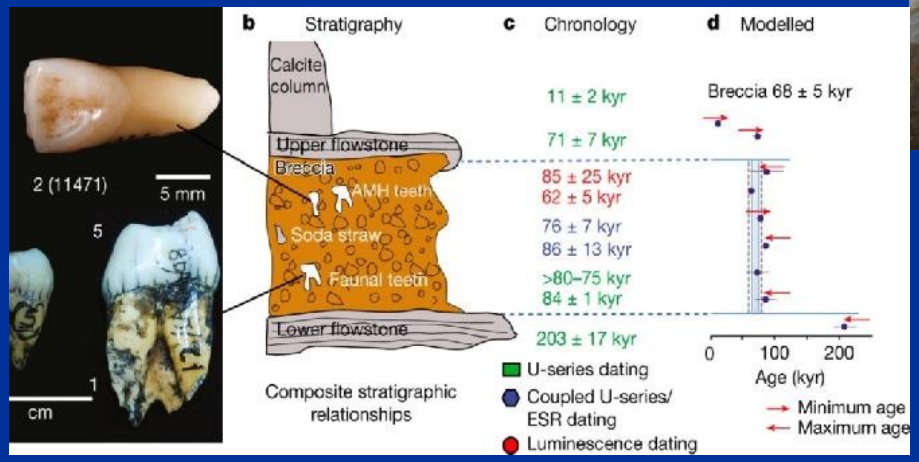


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Figure: Lida Ajer cave deposits containing a wealth of fossils and stratigraphic position of the dating samples (Westaway *et al. Nature* 1–4, 2017). (Photo credit Kira Westaway)

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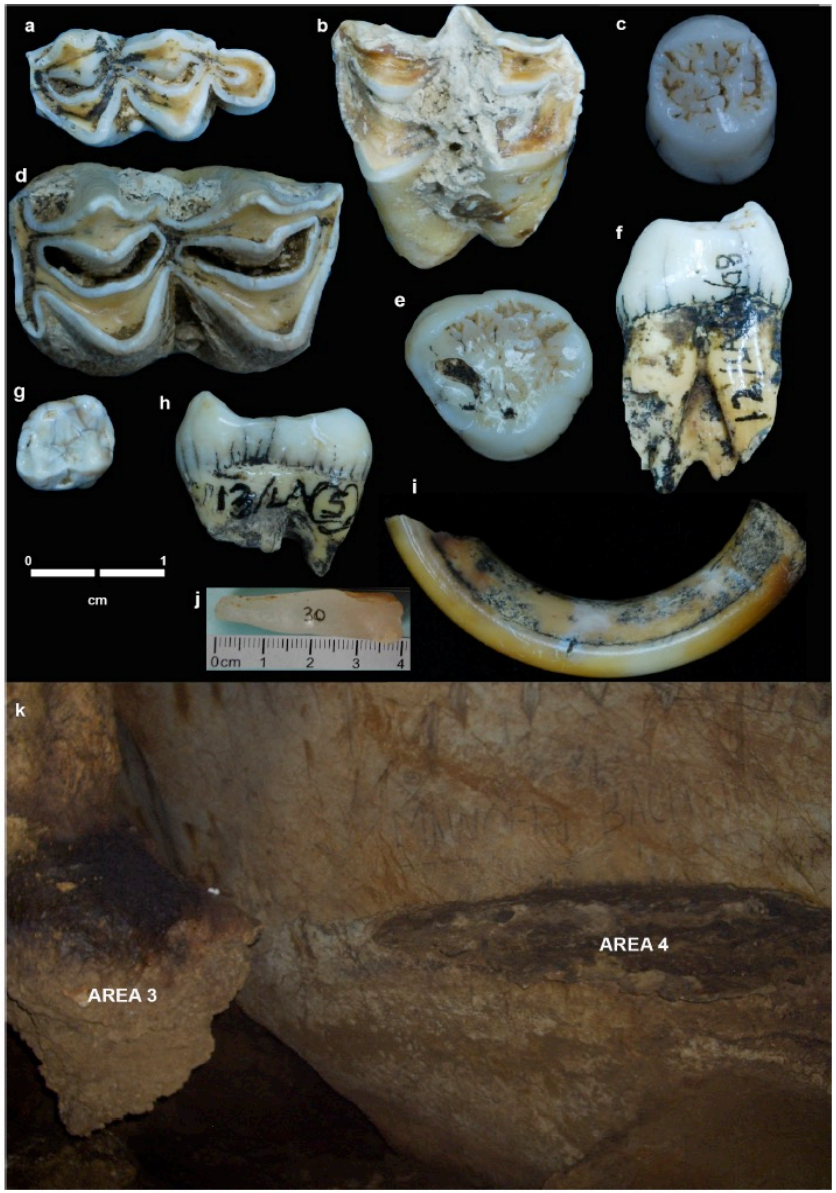

Extended Data Figure 2 | Fauna and speleothems from minor excavations at Lida Ajer in 2007. a, Cervid sp. **b**, Cervid sp. **c**, *Pongo* sp., upper premolar. **d**, *Rusa* sp. **e**, *Pongo* sp., molar. **f**, *Pongo* sp., molar mesial view from **c**. **g**, Siamang gibbon, molar. **h**, *Pongo* sp., molar mesial view from **e**. **i**, *Hystrix* sp. **j**, Soda straw stalactite samples LA08-29 (own scale on photograph). **k**, Photograph of areas 3 and 4 in the cave where the majority of fossil fauna were discovered.

Figure: The fossils taken from Lida Ajer cave deposits (Westaway *et al. Nature* 1–4, 2017).(Photo credit Kira Westaway)

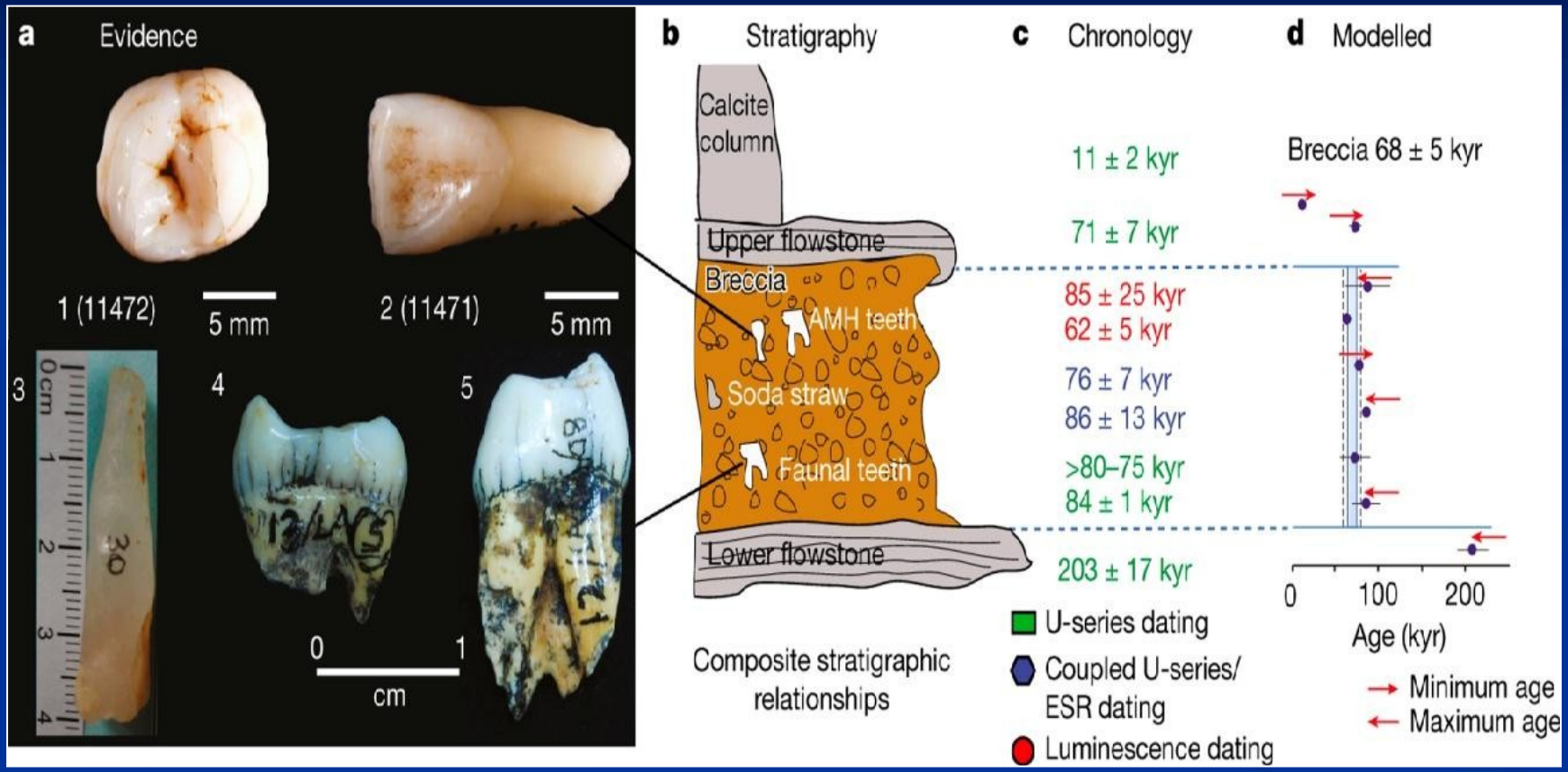

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Figure: A summary of the results from the Lida Ajer cave analysis (Westaway *et al. Nature* 1–4, 2017).

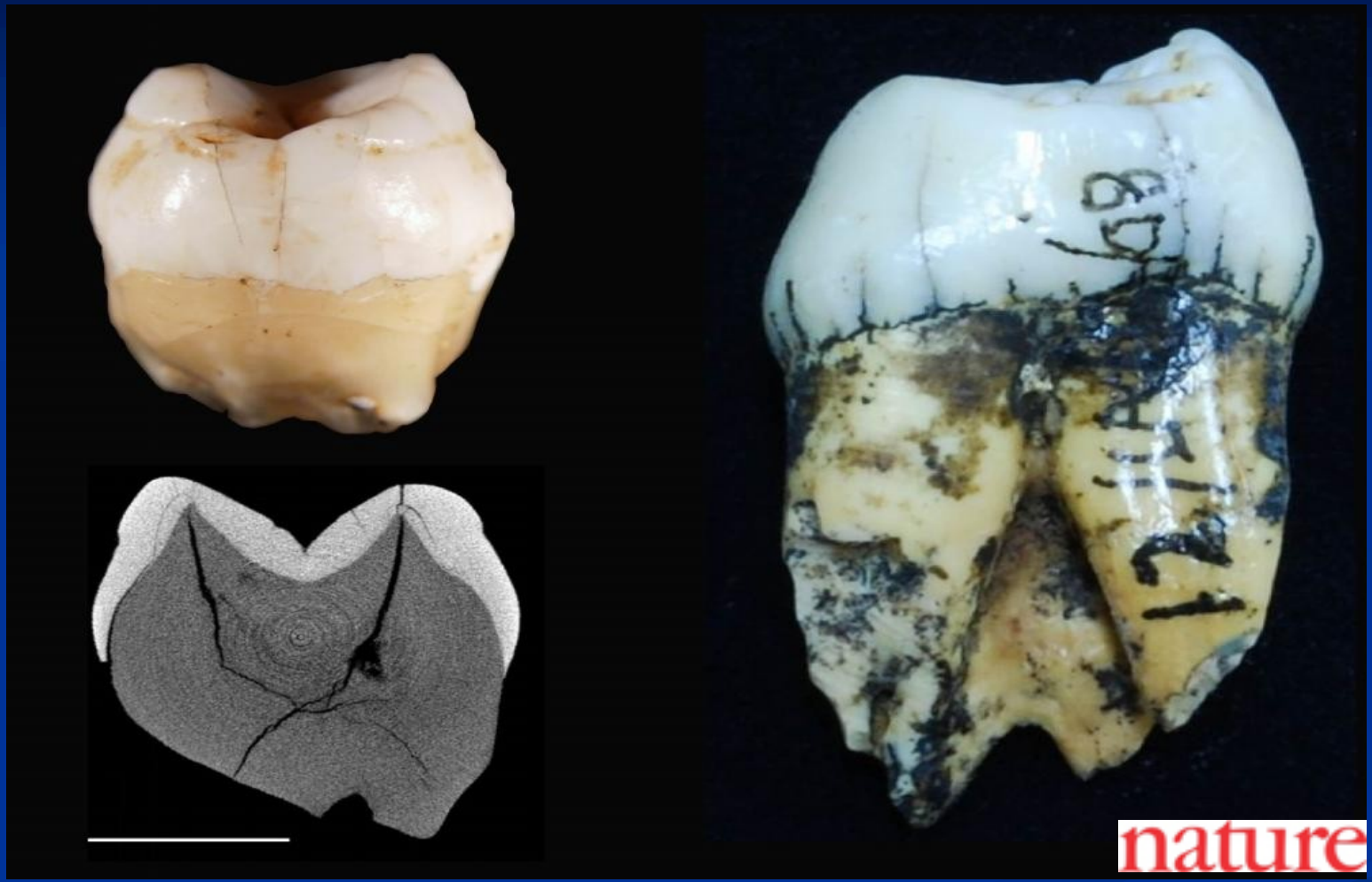
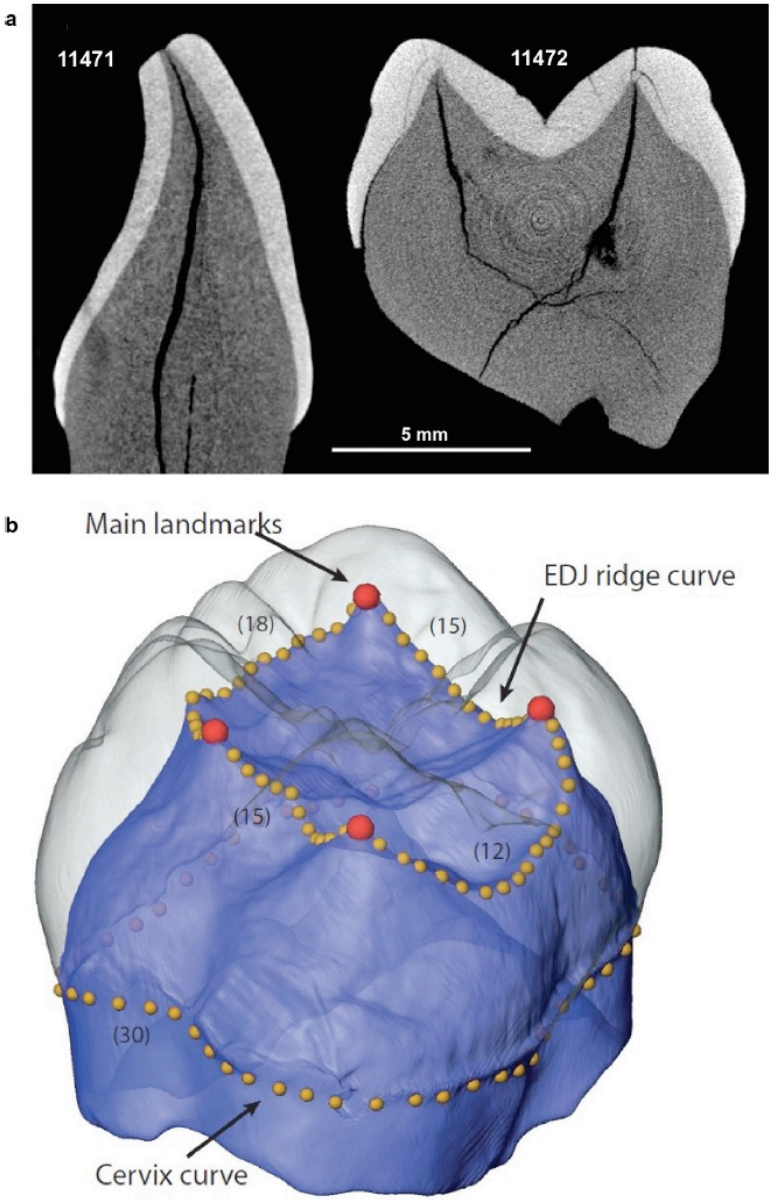
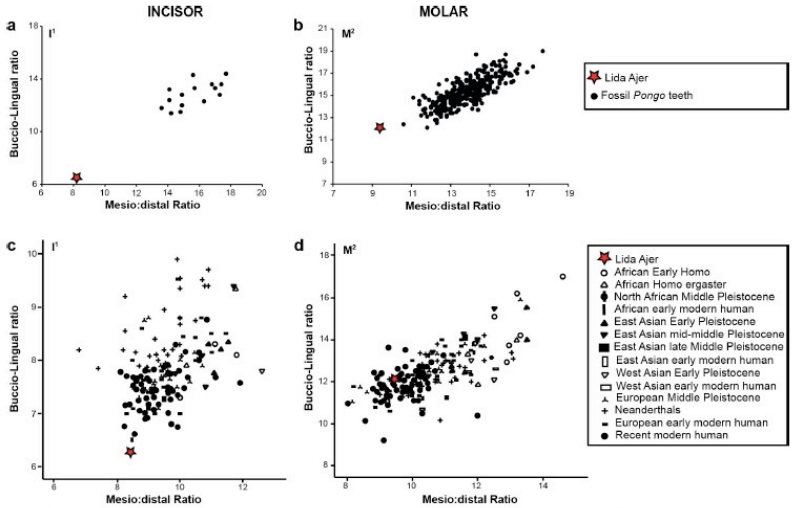


Figure: Lida Ajer modern human tooth (left top) with its corresponding scanned image (left bottom) compared to an orangutan tooth (right). Photo credit Tanya Smith and Rokus Awe Due. (Westaway *et al. Nature* 1–4, 2017).

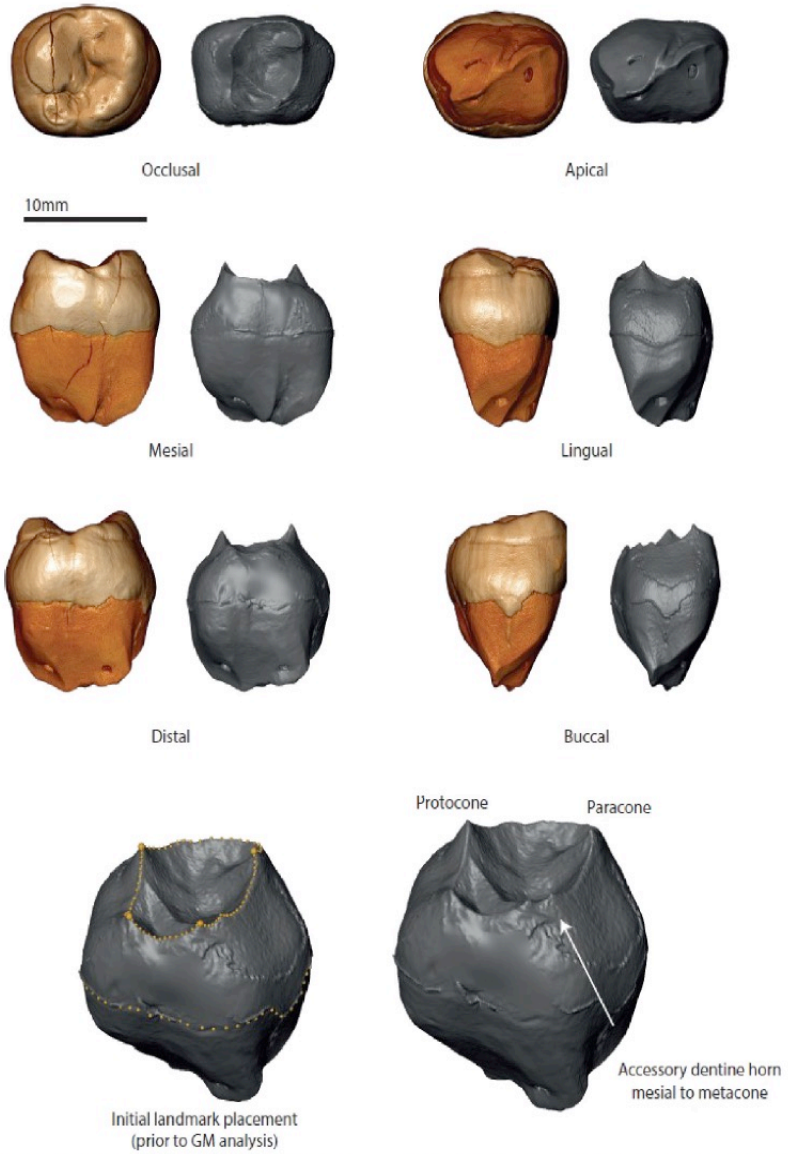


Extended Data Figure 4 | Micro-CT of the Lida Ajer teeth. a, Virtual sections of the Lida Ajer teeth. The labio-lingual section of the incisor is shown on the left, the bucco-lingual section through the mesial molar cusps is shown on the right. Scale bar, 5 mm. **b**, EDJ anatomical landmarks. Landmark protocol for geometric morphometric analysis of EDJ shape. Numbers in brackets represent the number of equidistantly spaced landmarks between main landmarks (red spheres) and around the cervix.

Figure: Scanned image of Lidah Ayer modern human tooth (top) and EDJ Anatomical Lanmarks immage (bottom) (Westaway *et al. Nature* 1–4, 2017).



Extended Data Figure 3 | The fossil human teeth from Lida Ajer Cave and associated metrics. **a**, **b**, The incisor (**a**) and molar (**b**) mesio:distal ratio versus bucco:lingual ratio metrics plotted against data from 37 and 353 fossil *Pongo* teeth[15], respectively. **c**, **d**, The incisor (**c**) and molar (**d**) data are plotted against the full range of *Homo* teeth from African early *Homo* to recent modern (data from ref. 73). In all four plots, the Lida Ajer teeth are denoted by a red star, with the key for symbols in **c**, **d**, representing the different human teeth is indicated on the right. **e**, **f**, The incisor (**e**) and molar (**f**) from Lida Ajer.



Extended Data Figure 5 | Internal and external structure of the Lida Ajer teeth. Top, CT-based volume renderings of the external surface (left) and surface models of the EDJ (right) of the Lida Ajer molar in six anatomical views. Bottom, initial landmark placement (yellow spheres) capturing the main dentine horns, EDJ ridge and cervix (left) and noting the presence of an accessory dentine horn mesial to the metacone (right).

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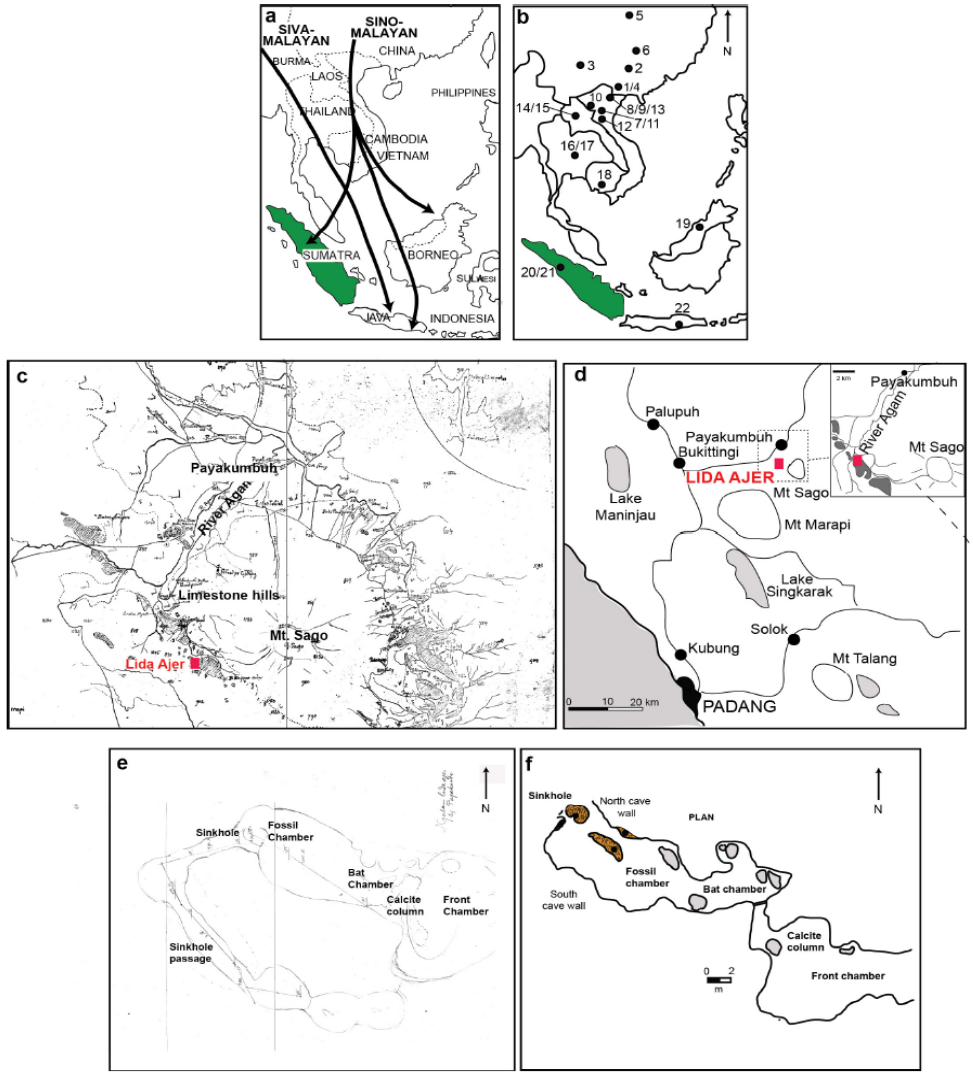
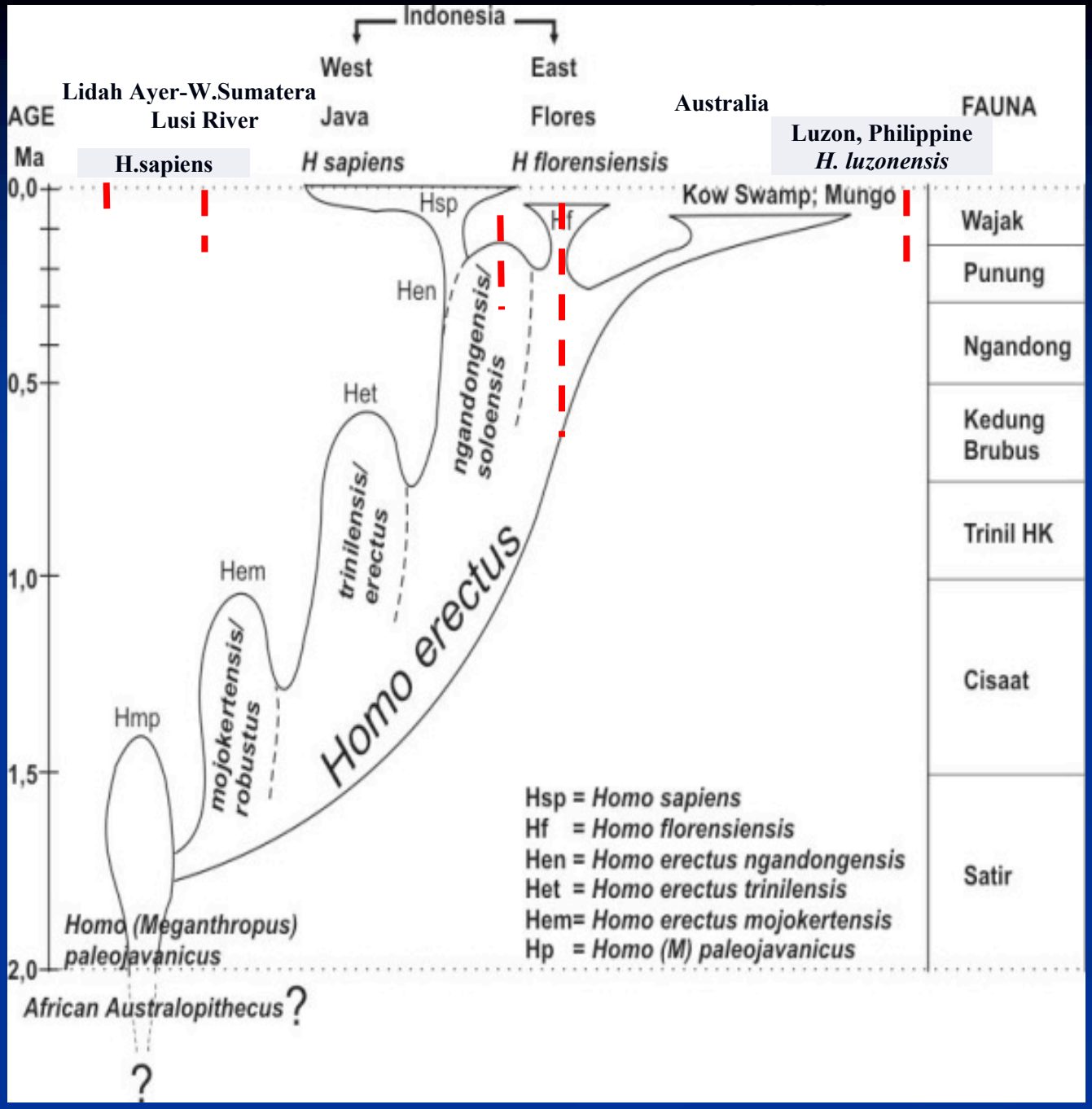


Extended Data Figure 1 | Southeast Asian fossil sites and Dubois' Lida Ajer. a, Corridor of dispersal of fauna into southeast Asia during periods of connection (redrawn with permission from ref. 7). **b**, The main fossil faunal sites in southeast Asia. In southern China: 1, Luijiang; 2, Liucheng; 3, Hoshantung; 4, Hei-Tu'ung; 5, Changyang; 6, Hsing-an. In Vietnam: 7, Lang Trang; 8, Tham Khuyen; 9, Thung Lang; 10, Hang Hum; 11, Ma U 'Oi; 12, Tham Om; 13, Keo Leng. In Laos: 14, Tham Hang; 15, Tham P'a Loi. In Thailand: 16, Thum Wiman Nakin; 17, Thum Phra Khai Phet. In Cambodia: 18, Phnom Loang. In Borneo; 19, Niah Cave. In Indonesia: 20, Lida Ajer; 21, Sibrambang; 22, Punung (redrawn with permission from ref. 7). **c**, Dubois' field sketches of Lida Ajer cave location copied directly from his field notebook—now housed in Leiden (with permission from the Naturalis, the Netherlands). His rough sketch of the cave location close to Payakumbuh village has had annotations added to make the features clearer. **d**, Our map of the cave location for comparison, note the similar relationship between Mount Sago, River Agam and Lida Ajer. **e**, Dubois' plan of the cave, annotations have been added to identify the chambers discussed in the text. **f**, Our plan of the cave for comparison, with the only differences being the absence of the sinkhole passage on our plan (unmapped).

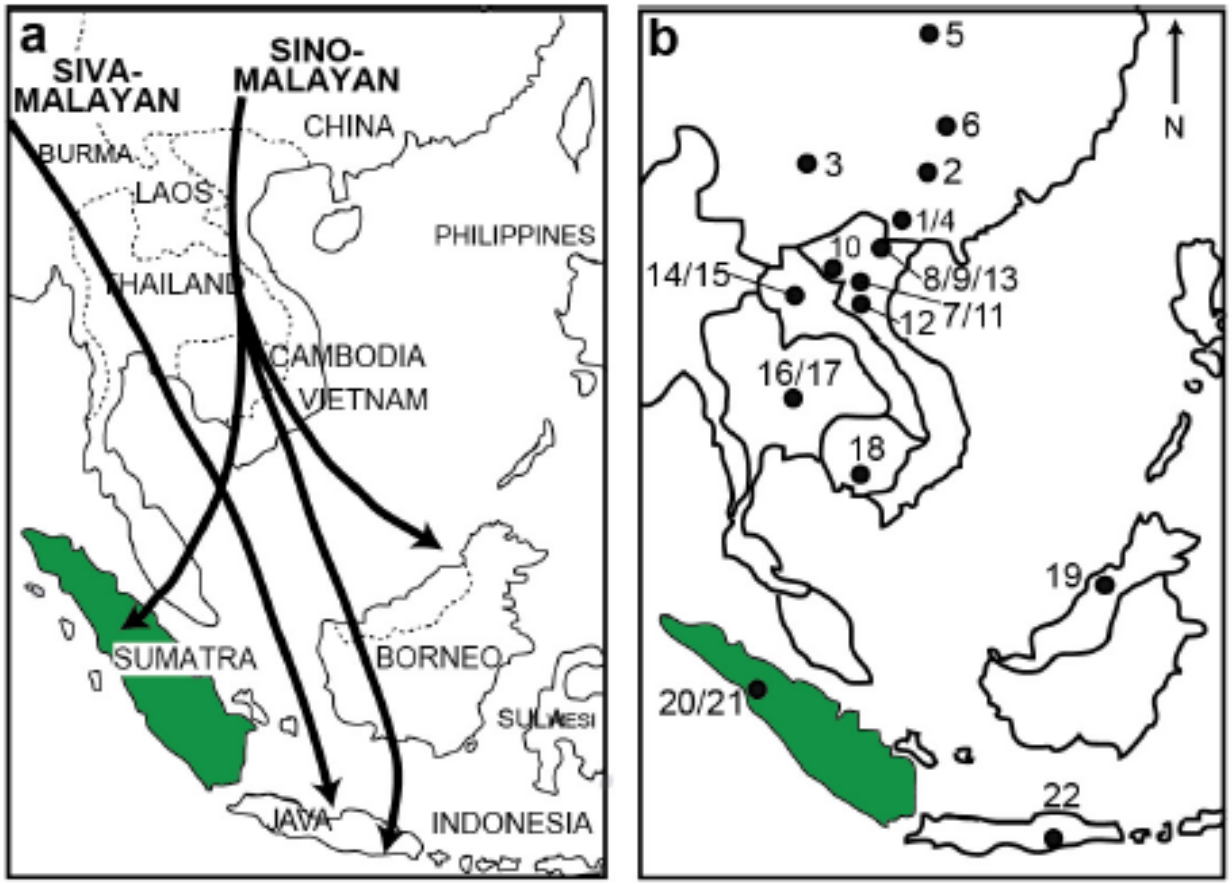
Jalur migrasi *Homo sapiens* pada 73-63 ky sampai di Gua Lidah Ayer, Sumatra Barat **(Westaway *et al. Nature* 1–4, 2017).**

* Kesimpulan



Evolutionary pattern of Asia-Pacific hominin (modified after Zaim, 2006)

RESEARCH LETTER nature



Jalur migrasi *Homo sapiens* pada 73-63 ky sampai di Gua Lidah Ayer, Sumatra Barat **(Westaway *et al. Nature* 1–4, 2017).**

* It is believed that there were two different evolution lines in Indonesia:

- an evolution trend developed in West Indonesia

and

- an evolution trend were existed in East Indonesia.

* In the point view of human evolution in Indonesia, it seems that there is no relationship of evolution trend of *Homo erectus* to the *Homo sapiens* in Java with the existence of *Homo floresiensis* found in the Flores Island and *Homo luzonensis* from Philippine

* Or, if there is any relationship, still has a puzzle:

"Is there any relationship of both *H.floresiensis* and *H.luzonensis* with *H.erectus* and *H.sapiens* in Java…?".

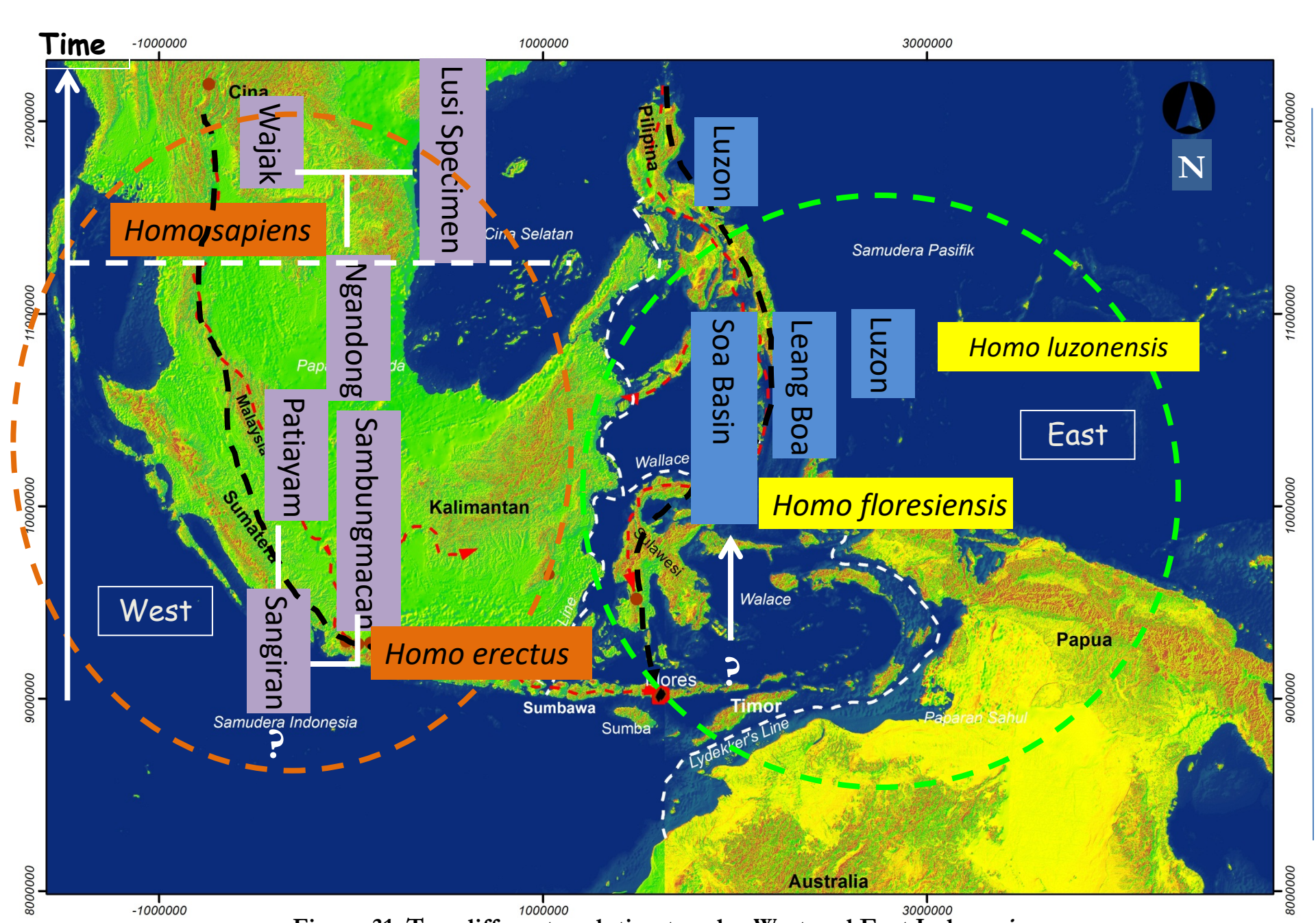


Figure 31: Two different evolution trends : West and East Indone*sia*

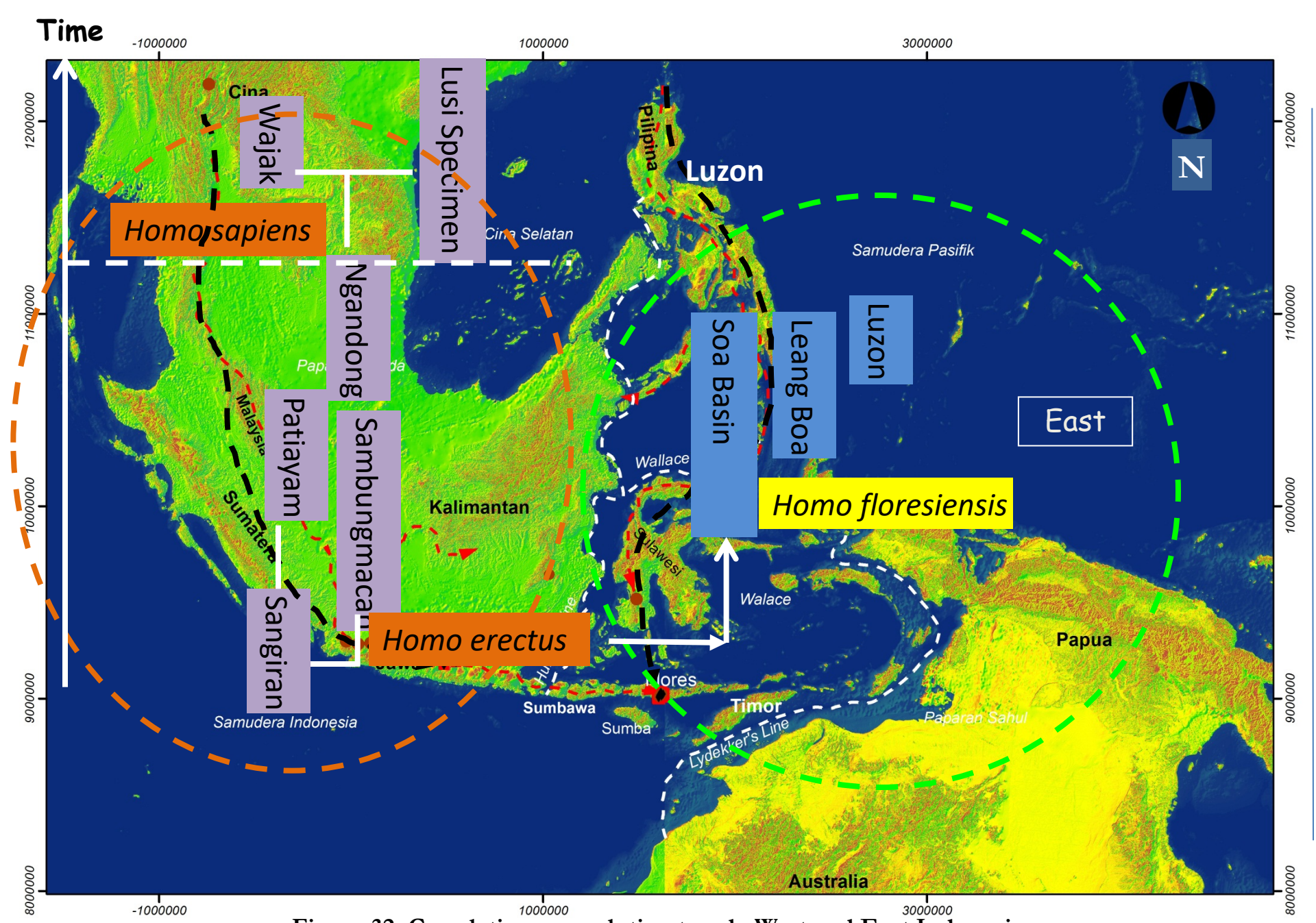


Figure 32: Correlation on evolution trend : West and East Indonesia

Terima kasih disampaikan kepada:

- Dekan FITB,
- Kaprodi Teknik Geologi,
- Seluruh Panitia Penyelenggara, termasuk Mbak Mika yang telah memandu presentasi ini,
- Semua Peminat Materi ini,

Semoga berguna.....

TERIMA KASIH

Senja di Pantai Ujunggenteng, Sukabumi Selatan –Java Barat (Foto YZ)

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