OLLI May 2025, East Asian Fossil review by Charles J Vella, PhD.

Number of Homo species: 12

- Homo sapiens
- Homo habilis
- <u>Homo rudolfensis</u>
- Homo erectus
- <u>Homo ergaster</u>
- Homo antecessor
- Homo heidelbergensis
- <u>Homo floresiensis</u> (nicknamed "the hobbit")
- Homo luzonensis
- <u>Homo neanderthalensis</u> (Neandertals)
- <u>Homo naledi</u>
- (Homo denisova) No current species designation
- (Homo gautengensis)
- <u>(Homo cepranensis)</u>

<u>Shoebox</u>: Entire Denisovan fossils (4) as of 2019; today (5) Denisova 2, 3, 4, 8, 11, and 25.



As of 2025, <u>10 Denisovan</u> <u>fossils;</u> DNA or protein proved D

No DNA for H. Juluensis

Name 🕈	Fossil elements [‡]	Age 🕈	Discovery +	Place +	Sex and age	Publication +	Image 🔶	
Denisova 3 (also known as <i>X</i> <i>Woman</i>) ^[25] [14][2]	Distal phalanx of the fifth finger	76.2– 51.6 ka ^[9]	2008	Denisova cave (Russia)	13.5-year- old adolescent female	2010	S S 2	5 r
Denisova 4 ^{[25][20]}	Permanent upper 2nd or 3rd molar	84.1– 55.2 ka ^[9]	2000	Denisova cave (Russia)	Adult male	2010		
Denisova 8 ^[13]	Permanent upper 3rd molar	136.4– 105.6 ka ^[9]	2010	Denisova cave (Russia)	Adult male	2015		
Denisova 2 ^[11]	Deciduous 2nd lower molar	194.4– 122.7 ka ^[9]	1984	Denisova cave (Russia)	Adolescent female	2017		
Xiahe mandible ^[16]	Partial mandible	> 160 ka	1980	Baishiya Cave (China)		2019		
Denisova 11								

nm

Denisova 11 (also known as <i>Denny</i> , Denisovan x Neanderthal hybrid) [26]	Arm or leg bone fragment	118.1– 79.3 ka ^[9]	2012	Denisova cave (Russia)	13 year old adolescent female	2016	24.75mm
Denisova 13 ^[27]	Parietal bone fragment	Found in layer 22 ^[27] which dates to ~285±39 ka ^[10]	2019	Denisova cave (Russia)		pending	
TNH2-1 ^[19]	Permanent lower left 1st or 2nd molar	164–131 ka	2018	Tam Ngu Hao 2 cave (Laos)	3.5 to 8.5 year old female	2022	
BSY-19- B896-1 (Xiahe 2)	Distal rib fragment	48–32 ka	1980	Baishiya Cave (China)	Unknown	2024	
Denisova 25 ^[12]	Molar	200 ka	2024	Denisova cave (Russia)	Male	pending	

Xiahe jaw from Baishiya Cave, Tibet: 169 Ka: the first time an ancient human had been identified solely through proteins.



Discovered evidence of at least five Denisovans in the cave.

Xiahe, Tibet, 1980 discovery: Denisovan jaw via Proteinomics



A male Denisovan mandible from Pleistocene Taiwan -- Takumi Tsutaya, et al., 2025



The Penghu 1 jawbone lay undiscovered on the seafloor off Taiwan until a fishing net dredged it up in 2010. The jawbone belonged to a Denisovan male; via protein analysis

Penghu 1 hemi-jawbone



No evidence for australopiths outside of Africa

The Asian origins model argues for an even earlier hominin dispersal out of Africa and into Eurasia, possibly an australopithecine, from which Homo erectus originated, which in turn spread throughout Eurasia and ultimately back to Africa.

*** As there is no currently validated presence of australopithecines outside of Africa, there is not much support for the Asian origins model.



3. Continuity of regional traits: ancestry or external gene flow

Homo erectus is the hominin species that is first known to have inhabited Asia and also the first hominin fossil found in Asia, with the discovery from Trinil (Site 44) in 1891.

Peking Man: Hominin fossils and archaeological materials found in <u>Zhoukoudian</u> during the 1920s and 1930s form the basis of what we <u>understand to be Homo erectus morphology</u>:

Quick review of H. erectus

Homo erectus morphology: Fully upright, bipedal, hominin (but difference between tall Turkana boy and short Dmanisi fossils)

Modern skeletal limb proportions: Longer legs, shorter arms (opposite of apes)

Skull: low, flat, long (football shaped) and low forehead, postorbital constriction, robust, sagittal keel, thick torus (thickened areas of bone) around the cranium (supraorbital, angular, and occipital torus), angled (not rounded) back of skull, thick cranial bones; not as prognathic (face extending) as earlier species; small to large brain size

Most Asian skulls are only skull caps, with no faces or mandibles; cranial vaults survive effluvial transport; also very few skeletal remains



Expansion out of Africa

- At glacial pace of population expansion of <u>16 km per generation</u>, Homo erectus could move from east Africa to east Asia in <u>25,000 years</u>.
- No early Homo (habilis or rudolfensis) has been discovered outside of Africa.
- Oldest African H. erectus is Drimolen at 2.0 Ma. 2nd oldest <u>ER 3733</u> dated to 1.8 Ma.
- Acheulean tools in Africa date to 1.7 Ma.
- 1992, Dmanisi mandible dated to 1.8 Ma
- Modjokerto & Sangiran, Indonesia fossils dated to 1.5 & 1.6 Ma.
- ► 2018, Shangchen, China: 2.1 Ma stone tools
- Clearly implying that a new kind of Homo had arrived.

Homo erectus Out of Africa

- Earliest in Africa = 2.0 Ma (*H. ergaster*)
- Dmanisi, Georgia = 1.8 Ma (H. erectus)
- Continental Asia = 1.4 Ma
- Island of Java, SE Asia = 1.0 Ma
- Spain = 800 Ka (H. antecessor?)
- Philippines = 700 Ka (H. luzonensis)
- Flores = 600-90 Ka (H. floresiensis?)

Homo erectus

► The bulk of known remains date between 1.8–1.0 Ma.

- The earliest of these hominins come from Africa
- The earliest African *H. erectus* quickly disperse into Western and Southeastern Asia, where they first appear between 1.7–1.8 Ma.
- Island Southeast Asia is the only region, at present, where <u>H. erectus</u> fossils persisted throughout the entire Pleistocene, suggesting that this region may play a unique role in the evolution of the species.
- The latest *H. erectus* on Java likely implicates the <u>role of intermittent</u> isolation and local adaptation in the longevity of the species.



Fossil evidence shows that by 1.8 Ma to 500 Ka, hominins of this species had spread from Africa to China, Europe, the Republic of Georgia, India, Java

Origin of H. erectus

All earlier Homo fossils are from east and south Africa.

- Consensus was the H. ergaster/erectus originated in Africa
- Possible ancestor = H. habilis; but also overlapped
- Dmanisi erecti at 1.8 Ma raised issues because at that time oldest H. erecti were also 1.8 Ma and Dmanisi had more primitive morphology; but now African H. erectus at 2.0 Ma
- Dmanisi: smallest brain size in H. erectus: 546 to 730 cc (4.8–5.4 ft)

Discovery of stone tools at Shangchen in China at 2.1 MA - ? as to species; if H. erectus, did they migrate back to Africa?

Descendants of H. erectus

Classic theory: H. erectus evolved into H. heidelbergensis, who evolved into MHs and Ns in Africa

While genetics gives 550 to 765 Ka as common range for LCA of MHs, Ns, and Ds, Altai N genetics implies about 800 Ka;

A speciation at 800 Ka would imply that <u>H. erectus could be direct</u> ancestor of both <u>MHs and Ns</u>, not ancestor of H. heidelbergensis; <u>less</u> <u>likely</u>







Variation in H. erectus

- Eastern H. erectus: Chinese and South Asian erecti, except larger brained Java erecti
- Western H. ergaster: E. Africa, 1.9 to 1.2 Ma, i.e. Turkana boy; maybe Dmanisi
- Brain size: Dmanisi <600 cc vs Java at 1200 cc; over time greater brain size</p>
- Larger browridges and occipital ridges in Eastern erecti
- P. Rightmire: greater variation within regions; variation between China and Java is as great as Africa vs East
- But no greater variation than in other Homo species

H. erectus migrations

► Turkana boy: tall (5'5"), slim, hunting herd animals; Acheulean tools

But Dmanisi: short, small brain, Oldowan tools

Acheulean tools in Africa at 1.7 Ma

Followed the herds

Dennell: Savannahstan

Ileret footprints: 20 individuals; 110 lb average; modern push off from toe

lleret erecti footprints





Turkana boy:

Now 5'5", not 6' Modern longer limbs

But core is not modern:

Larger rib cage – deeper & wider

flaring pelvis



- H. erectus accomplishments
- Modern limb proportions
- Modern upright gait
- ► Use of fire

More complex Acheulean technology, requiring planning; but still Oldowan use at Gona at 1.5 and 1.25 Ma

First in temperate climate zones

Seagoing?

Chris Stringer: Skull Differences

Pronounced Supraorbital Torus: "Shelf like"





Thick <u>keel of bone</u> runs along midline of skull

Skull widest toward the base



From Franz Weidenreich, "Morphology of Solo Man" 1951 Understanding Physical Anthropology and Archaeology, 9th ed., p. 227

African OH 9 linked to eastern erecti



Daka calvarium: Ethiopia, 800 Ka; linked to eastern erecti





Variation within Asia.

Chinese and Indonesian H. erectus:

- Vault size in Asian *H. erectus* ranges from about <u>800 cc to over 1,251 cc</u>, with a <u>gradual increase in mean cranial capacity with time</u>.
- Asian H. erectus possess a long, low vault that, when viewed superiorly, is strongly pear-shaped.
- The most marked differences between Chinese and Indonesian H. erectus faces relate to relative prognathism. Indonesian faces (Sangiran 17 and 27), have been reconstructed to be much more prognathic than Chinese.
- The relatively narrow frontal (postorbital constriction) and occipital (biasterionic) breadth, coupled with a relatively large brain size, separate the Chinese morph from the Indonesian samples; early and late Indonesian morphs do not separate from one another

- Note the difference in the shape of the cranium.
- ► On the top, Indonesian *H. erectus*

African H. ergaster has a more globeshaped braincase



H. erectus doubled its brain size over 2 M years


Shovel-shaped upper incisors in both *H. erectus* & Neandertals



Krapina Neandertal maxilla, photograph © Milford Wolpoff



From left to right: skulls of *Homo erectus*, *Homo heidelbergensis*, *Homo neanderthalensis* and *Homo sapiens*. The braincase of *H. erectus* was more elongated than that of later humans. It had a prominent brow ridge, like *H. heidelbergensis*.







Homo erectus cranium





Zhoukoudian

The hominin fossils from Zhoukoudian were first announced as <u>Sinanthropus pekinensis (Black 1927)</u>. Because they were similar to those from Indonesia that were <u>called Pithecanthropus erectus</u>.

The <u>Sinanthropus pekinensis fossils were merged into Pithecanthropus</u> <u>erectus</u> (Weidenreich 1943), which in turn was later <u>changed to Homo</u> <u>erectus (Mayr 1950)</u>.

The dating of the hominin activity in the Zhoukoudian (Site 58) cave has yielded various results: from earlier estimate of 578 ka to 230 Ka to more recent 800 ka to 400 Ka

Numerous names – ultimately, all H. erectus

- Fossils in Asia have been given various names, especially the discoveries made during the early years of paleoanthropology:
 - Pithecanthropus modjokertensis,
 - ▶ Pithecanthropus erectus,
 - ▶ Pithecanthropus robustus,
 - Pithecanthropus dubius,
 - Meganthropus palaeojavanicus,
 - ► Javanthropus soloensis,
 - Sinanthropus pekinensis, and
 - ► <u>Sinanthropus lantianensis</u>.

All = Homo erectus

Naming issues, but ultimately all H. erectus

Although these names take the binomial format of a genus and a species name, they were not given as a biological classification at the level of species, but rather as referents of different fossil samples.

Early scholars such as Franz Weidenreich had already recognized the morphological similarities shared by hominin fossils in Asia, although Mayr is credited for subsuming all the fossil materials from Asia under a single species, Homo erectus (Mayr 1950). *** Human Evolution in Asia: Taking Stock and Looking Forward
-- Sang-Hee Lee and Autumn Hudock, 2021

A brief recent 2021 review of human evolution in Asia;

In the history of modern paleoanthropology, Asia occupied a marginal space in the second half of the twentieth century, secondary to the attention given to Europe and Africa.

The attention it did receive was shaped by Eurocentrism and colonialism.

Yunxian (now Yunyang): 1 and 2 crania = H. erectus





<u>Yunyang</u> crania = H. erectus

Earlier than Zhoukoudian are the two badly deformed crania from Yunxian (now Yunyang), Hubei, dated to <u>1.15 Ma</u> with magnetostratigraphy, <u>or even</u> later at 800 ka based on paleomagnetism and paleosol.

The two crania are nearly complete with facial bones, which is rare in Asian fossil hominin materials.

Morphological studies have been limited due to <u>deformation</u> during the fossilization process; a virtual reconstruction shows features characteristic of <u>Homo erectus</u>, similar to those seen in the earlier Gongwangling and the later <u>hominins from Zhoukoudian</u>.

CJV: also designated as H. heidelbergensis, or Denisovan

Yunxian: 2 distorted crania, 581 Ka

The associated fauna indicated a Middle Pleistocene (781 to 126 Ma) age for the site, and the initial ESR dates placed the deposits at <u>581 ka</u>, though it <u>may be possible the fossils are actually much older</u>, dating to the Early Pleistocene.

About 10 percent of the lithic artifacts were refit, suggesting that the site served as a temporary camp where knapping occurred and that fluvial influences were likely minimal

Yunxian 2 reconstruction



Feng, et al., 2024

Yunxian 2 endocranial reconstruction



Fig. 2. Reconstruction of the endocranial cast of Yunxian 2. (A-F) Anterior, posterior,

Yunxian: H. erectus+, 1100 cc

- Although the two Yunxian hominin crania are flattened (likely due to sediment compaction), they are relatively intact, though the crania are missing the mandibles and most of the teeth.
- In general, the crania are <u>considered representative of H. erectus</u>: generally <u>big and robust</u>, with pronounced postorbital constriction and with the cranial breadth widest at its lowest area. However, a <u>few</u> features are reminiscent of more advanced mid-Pleistocene Homo and even early modern humans, including a midfacial region that is flatter and more orthognathic.
- Tianyuan Li and colleagues (1991) suggested that the <u>cranial capacity of</u> the second skull was around 1,100 cc, placing it between the averages for H. erectus and midPleistocene Homo.

► A recent fossil discovery is from <u>Hualongdong</u>, Anhui (Site 11), China.

The materials are reliably dated to between <u>275 and 331 ka</u> using uranium-series dating, compatible with the faunal remains.

Morphological features of Hualongdong are shared with other Asian specimens of similar dates, including a low vault, frontal keel, and smaller molars.

Hualongdong



Indonesian fossils: Trinil, Sangiran, Ngandong

From Southeast Asia, following the discovery of the fossil materials in <u>Trinil (Site 44), Java, in 1891 by Dubois, more fossil materials were</u> found from the sites along the Solo River, such as Sangiran (Site 36) and <u>Ngandong (Site 28)</u>. However, the provenience of the Javanese specimens has proven to be problematic, making it extremely difficult to settle on a date.

New discoveries have continued to be reported from Java, Indonesia. <u>Sambungmacan 4 has an endocranial volume of 1,006 cc, within the</u> range of other Javanese Homo erectus, (Skull IX = 870 cc; date between 800 ka and 1.5 Ma, but it is not reliable due to the unclear provenience).

Sangiran, 1 Ma -- Solo Man





Ngandong,

Sambungmacan



Asian hominin morphological traits

Asian hominins show a combination of traits that continue through the Pleistocene, including sagittal keel, interparietal bone, laterally flattened femur, shovel-shaped incisors, frontal suture, small nasal cavity, high frequency of third molar agenesis, decreasing premolar and molar size, low nose, and round infraorbital cavity. The traits are mostly cranial, as few postcranial elements have been found.

These traits are sometimes mistaken as unique in Homo erectus and consequently used as diagnostic features.

Although not all of these traits are unique to Asia, they occur together more frequently in Asia. Some may have originated in Africa and become prevalent in Asia; shovel shaping in incisors may be one example.

Patterns of variation in H. erectus in Asia

Continuity of traits does not mean an absence of change. There is variation in Asian H. erectus.

There are complexities in the pattern of morphological variation through time in Homo erectus.

Some researchers have noted regional differences between

the northeastern group, like the fossils from Zhoukoudian, China, and

<u>the southeastern group, like the fossils from Java, Indonesia;</u>

Others have argued that there is no significant difference between the two samples.

Morphological differences

Continental differences between the African Homo erectus and the Asian Homo erectus can answer the question of whether Homo erectus can be considered a single polytypic (multiform) species with a list of diagnostic traits.

The morphological differences seen in the African and Asian Homo erectus samples include reduced postorbital constriction with a higher cranial vault and a narrower supraorbital torus.

However, not all Asian fossils are uniform in morphology, with some matching more closely to African specimens.

<u>Supraorbital torus</u>: Dmanisi 5, Sangiran 17, Peking Man, Sambungmachan



Mechanical Stress/Bent Beam Theory:

The supraorbital torus acts as a "bent beam" when the anterior teeth are loaded during biting and chewing, concentrating stress on the eye sockets. The torus is believed to have developed in response to this stress, acting as a reinforcement to resist bending. The size and shape of the torus would have been proportional to the amount of stress it needed to withstand.

Turkana boy





African Turkana boy skull: 1.6 Ma, 8-12 year old





KNM-ER 3733, H. erectus: Koobi Fora, Kenya. ~1.8 Ma



African erecti: KNM-ER 3733 and KNM-ER 3883





Olduvai Gorge: OH 9

- Middle period *H. erectus,* ~1.5 Ma (? - found on surface)
- Olduvai; not found in situ
- OH 9 Chellean Man Discovered by Louis Leakey in 1960 at Olduvai Gorge (Tanzania).
- Oldest known early <u>human fossil specimen</u> with a brain size larger than 1000 cubic centimeters.



(Heberer, 1963; Rightmire, 1979)

CT scans of OH 9







OH 9: largest *H. erectus* skull



KNM-ER 42700; smallest <u>H. erectus</u> cranium



a, Anterior, b, left lateral, c, posterior, d, superior and e, inferior views of KNM-ER 42700 (scale bar, 5 cm). f, Anterior, g, occlusal and h, right lateral views of KNM-ER 42703 (scale bar, 2 cm).

fig_tab/nature05986_F1.html

H. erectus Cranial variability:

OH 9 (largest) vs KNM-ER 42700 (smallest)









CJV: Cranial capacity ranges

- H. floresiensis, 417-426 cc
- H. naledi, 465 to 610 cc
- **H. erectus:** ave 950-1000 cc
- OH 9, African H. erectus, 1067 cc
- Dmanisi, 546 to 730 cc
- Gongwangling/Lantian, 780 cc; 1.8 Ma oldest Asian fossil
- **H. erectus**: ave 950-1000 cc
- Ngawi 1, Java, 959 cc
- ZKD, Peking Man, 1058 cc; Skull X: 1225 CC

H. erecti

Sangiran 2, 10, 12, 38, 800-1050 cc

Sangiran 17, 1000 cc

Sambungmacan, 1035, 917, and 1006 cc.

Hexian, 1025 cc

Yunxian: 1100 cc

Dali, 1120 cc

Narmada, India, 1,155 and 1,421cc

Ngandong, 1013 to 1251cc

Ngandong 6/H. e. soloensis: 1251 cc = largest, latest surviving, H. erectus

H. erecti

- Maba, 1300 cc
- Jinniushan, 1330 cc
- Xujiayao, 1700 cc
- Xuchang, 1800 cc = largest Chinese, ~110 Ka
- Modern Human = 1350 cc (900-2000 range)
- Wajak 1 & 2, 1230 and 1370 cc
- WLH 50, Australian MH, 1590 cc
- Neandertal = 1450 cc (1172 1740 range)

Different theories about H. erectus

If African Homo erectus/ergaster dispersed to Asia, the earliest Homo erectus samples from both regions should be similar (having recently shared a common ancestor) and then diverge with time if there was little gene flow.

▶ <u>Debate:</u>

- Whether Homo erectus is a polytypic (multiform) species with a worldwide distribution,
- whether there are multiple species in the fossil sample currently recognized as Homo erectus (Wood, Stringer), or
- whether Homo erectus should be subsumed under Homo sapiens (Wolpoff, Wu)
- These debates reflect <u>differences in the theoretical outlook and the challenges</u> of dealing with the complexities of a worldwide lineage with geographical and temporal variations.
Changes over time

There are both regional/continental differences, as well as <u>changes over</u> time.

Between the

earlier, traditional Asian Homo erectus represented by the Zhoukoudian sample and

▶ the later Homo erectus,

including the later Indonesian materials from Ngandong and

▶ the late Middle Pleistocene materials from southern China,

differences are in the posterior cranial vault and the degree of prognathism.

Regional vs temporal variation

However, the uneven distribution of fossils across time and space confounds the overall patterns of variation:

► The earliest fossils are mostly from Southeast Asia,

followed by the northeastern samples such as Zhoukoudian,

with the latest fossils again from Southeast Asia.

Hence, it is difficult to differential changes through time versus regional differences.

Jinniushan

Asian fossil data are predominantly cranial, with very few postcranial elements.

An exceptional case of a fairly complete skeleton was found from example, <u>Jinniushan</u>, Liaoning (Site 13), excavated in 1984. Although it was first reported as a male, a subsequent study argued that it is a <u>female</u>.

Jinniushan has the largest body size of any known female hominin, with an estimated stature of 5'5" based on the ulna. The large body size and relatively short limbs are compatible with cold adaptation.

The Jinniushan cranium shows cranial traits that are a mixture of archaic and modern human traits. Dated between <u>310 ka and 200 ka</u> based on uraniumseries dating.

Jinniushan, 268 Ka, 1,330 cc; similar to Dali skull







Ulna

<u>Dali</u>, 260 Ka, 1120 cc

Fossil hominins in Asia are often described as having a mixture of archaic (Homo erectus) and modern (Homo sapiens) features.

One such example, <u>Dali</u>, is particularly notable as <u>one of the few complete</u> <u>skulls</u> from the Middle Pleistocene.

Dali was found in 1978 in Shaanxi Ruohe River, with a reliable date of <u>260 ka</u> <u>based on loess</u>, in association with scrapers.

Dali was <u>classified as archaic Homo sapiens</u> and <u>shows a mosaic of Chinese</u> <u>Homo erectus traits</u>, <u>European and African Homo heidelbergensis traits</u>, <u>and</u> <u>Chinese modern human traits</u> (cranial size = 1,120 cc; facial structure)

Dali cranium





Harbin vs Dali craniums



Neandertal traits: Maba, Xuchang, and Xujiayao

Researchers characterize some traits in Asian fossil materials as <u>Neanderthal morphology</u>.

Maba, Guangdong province, <u>resembles Neanderthals</u> in the supraorbital torus and cranial shape. Has traumatic lesion.

The two Xuchang crania discovered in Xuchang, Henan, show a mixture of Neanderthal, Homo erectus, and Homo sapiens features, along with a cranial capacity of <u>1,800 cc</u> by virtual endocast reconstruction. The Xuchang hominins are dated to <u>125–105 ka</u>



Neanderthal morphology is also reported in fossil hominins from <u>Xujiayao</u>, Shaanxi found in the 1970s. The date is not settled, with estimates at 16 ka, 370-260, and 500 Ka.

The Xujiayao fossils show a mixture of Homo erectus and archaic Homo sapiens traits, and the Xujiayao mandible has a retromolar space, which is a characteristic of Neanderthals.

Maba and Xuchang





Reasons for N morphology

- Neanderthal morphology in a hominin fossil from Asia can be explained by several hypotheses.
- 1 One is that what is known as a Neanderthal morphology may have a broader distribution and is not unique to Neanderthals.
- 2 Alternatively, this could reflect the <u>level of gene flow among hominin</u> populations in Eurasia.
- CJV: 3 Ns/Ds were in China? La Quina lithics
- The identification of Neanderthal traits may be evidence of gene flow from western Eurasia during the Middle Pleistocene.

<u>Ngandong</u> = Last surviving H. erecti

Some fossils show continuity of archaic features through time within <u>Asia</u>.

- The <u>13 crania from Ngandong, Indonesia</u>, found in the 1970s, show remarkable similarities to the earlier Homo erectus materials from Sangiran.
- Their date is not settled, with reported dates ranging from <u>53–27 ka to</u> <u>117–108 ka (most accepted date)</u>.

► It is generally agreed that Ngandong is the latest Homo erectus.

Ngandong crania



Skulls IX and X

Skull XI

Skull VI

Skulls VII and VIII

Skull IX



Ngandong skulls, I-XI

<u>Ngandong</u> skulls, <u>last H. erecti,</u> <u>117–108 ka</u>





1943: Franz Weidenreich's Reconstruction of Homo erectus





Franz Weidenreich's artistic ability: anterior, posterior, lateral views of Ngandong skull XI







Skull X1



Dushan Cave, H. sapiens, 15 Ka

A <u>mixture of Homo erectus and Homo sapiens traits continues until the</u> <u>end of the Pleistocene.</u>

A recent discovery of a H. sapiens partial cranium and a mandible with dentition from Dushan Cave, Guangxi Zhuang Autonomous Region, is dated to 15 Ka at the Pleistocene–Holocene boundary,.

The dentition shows dental traits associated with Homo erectus as well as traits considered typical in Homo sapiens.

Dushan dentition



Chinese archaic H. sapiens

A mosaic of regional traits, worldwide traits, and traits from other regions are repeatedly found in the late Middle Pleistocene (300-150 Ka) Asian fossils.

The variation does not fit neatly in either Homo erectus or Homo sapiens.

This sample includes fossil hominins from China such as <u>Dali, Hexian</u>, <u>Jinniushan, Maba, and Xujiayao, as well as the skull from Narmada</u>, <u>India.</u>

Traditionally they have been called "archaic" Homo sapiens.

Shandingdong Man, 35 Ka, from Zhoukoudian Upper Cave = MH



Dated to 35 ka, <u>Shandingdong</u> (Zhoukoudian Upper Cave) (Site 37) fossils were excavated in the 1930s.

Like the Zhoukoudian Homo erectus fossils, the original fossils from the Zhoukoudian Upper Cave have been lost.

High-quality casts, meticulous descriptions, drawings, and measurements that Franz Weidenreich made remain and have been studied

Early dispersal of MHs in China?

That these are modern humans is not disputed.

Continuity dispute; the question is the relationship between the Upper Cave at Zhoukodian and earlier hominins, and that between the Upper Cave and modern Chinese.

Further south, the <u>hominin teeth found in Longtanshan Cave</u>, Yunnan (Site 18), dated to between <u>82 ka and 60 ka, raise the possibility of an</u> <u>early dispersal of MHs into inland Asia</u>.

However, the early dates of some of these sites have been questioned.

MHs in Japan and Korea: later hominins

Modern human fossils were found at several sites in Japan including Yamashita-Cho, Minatogawa, and Shirao-Saonetabaru Cave.

The fossil sites from the Japanese archipelago all date to the terminal Pleistocene (~12 Ka) and show more similarities with the Southeast Asians or Australo-Melanesians than with the Northeast Asians from Zhoukoudian Upper Cave.

Although fossil hominins are reported from the Korean Peninsula including Mandal, Ryonggok, and Turubong, a full assessment has yet to take place due to the uncertainty of dates and the limited access to the fossil materials.

Other discovery sites in SE Asia

The diversity in morphology and the mixture of archaic and modern features continue in Southeast Asia.

New discoveries were added from <u>Wajak 1 and 2 and Ngawi 1</u> from Java: a partial skeleton found in <u>Moh Khiew Cave</u>, Thailand, dated to ~26 ka; <u>Tabon</u>, Philippines; and <u>Penghu</u>, Taiwan.

Fossils from Niah Cave, discovered in 1958, were dated to 45–39 ka.

Tam Pa Ling, a limestone karst cave site in northern Laos, yielded hominin fossils argued to be modern humans. A partial cranium and several mandibles have been reported. The partial cranium has modern human morphology, while the mandibles show a mixture of archaic and modern features in a robust mandible with a chin. The date of <u>70–46 ka</u>.

Homo luzonensis

In Callao Cave, on Luzon island, Philippines, a third metatarsal was discovered in 2007 followed by additional elements of maxillary dentition, manual and pedal phalanges, and a femoral shaft. Dated to 67 ka, the mixture of archaic and modern features in the fossil material was deemed to warrant a new hominin species, Homo luzonensis. As in the case of Homo floresiensis, the site is east of the Wallace Line; the island was not connected to Southeast Asia even during the times of the lowest sea levels.

No cranium; just teeth and finger and limb bones

Future research may illuminate whether the hominins reached these islands by accident or with the technology of maritime navigation.

Mata Menge and Liang Bua, Flores: Hobbits

The debate surrounding the Liang Bua hominins, Flores, Indonesia, took a new turn with data from <u>Mata Menge</u>, Flores, supporting the idea that the Liang Bua hominin was not an exceptional outlier but a member of a lineage with a long history dating to the early Middle Pleistocene.

While the first decade since the <u>discovery of Liang Bua 1</u> in 2003 was focused on <u>whether the cranium is a pathological outlier or a valid basis</u> for a new species Homo floresiensis, the new discoveries from Mata Menge are adding weight to the position that it is indeed a new species.

Mata Menge vs Flores jaws



Gene flow

Modern humans did not have a singular point of origin in time or space; instead, modern humans have multiple ancestors and multiple origins, while gene flow maintains shared similarities across continents.

Gene exchange, be it as gene flow (within a species) or introgression (between species), is maintained between archaic populations and modern populations; gene exchange is also maintained between different regional populations while local extinctions and replacements shaped regional evolutionary histories

Ancient DNA research answers some questions

Throughout the 1990s in the United States and Europe, <u>the modern</u> <u>human origins debate was characterized by two competing models</u>, each with an emphasis on a different body of evidence.

The <u>multiregional evolution model (Wolpoff et al. 1984)</u> was supported by <u>the fossil data showing regional morphological traits</u> throughout the Pleistocene.



The recent African origin model (Stringer & Andrews 1988) was supported by the genetic data compatible with modern humans originating as a new species within the last 200 thousand years.

In particular, the <u>first studies based on the ancient DNA extracted from</u> <u>Neanderthal fossils, first mitochondrial and then nuclear DNA, repeatedly</u> <u>showed that Neanderthals did not contribute to the genetic makeup of</u> <u>modern humans (Green et al. 2006, Krings et al. 1999).</u>

First N Genome

The publication of the first Neanderthal genome (Green et al. 2010) showing gene flow between Neanderthals and modern humans became a turning point. Showed MHs had <u>1-2% N DNA</u>.

Research shows <u>admixture between archaic ancestral humans in</u> <u>Eurasia</u> (including the Neanderthals) and modern humans.

There is now an agreement that modern humans have multiple ancestral populations. The concepts of introgression and admixture (interbreeding) have become mainstream in the debate on the origin of modern humans.

Genetic exchange everywhere

In the past 10 years, genetic research has converged with the arguments based on fossil materials in agreeing that there was a genetic exchange between modern humans and archaic humans in Europe and Asia.

There was <u>always a consensus about the continuity in Africa as a place of origin for modern humans.</u>

The <u>conclusions drawn through genetics overlapped with the position based</u> on fossil morphology that there was indeed admixture between the preexisting <u>Asian populations and modern humans and that modern humans in Asia have</u> <u>multiple ancestors.</u>

The point of contention is in the magnitude: How much interbreeding occurred?

Paleogenetics: DNA without much morphology

Paleogenetics played an important role in the mainstreaming of the idea of multiple ancestry and hybridization, especially the ancient DNA from the Neanderthal fossils and the Denisovan DNA.

The <u>discovery in the Denisova Cave started a new era in</u> paleoanthropology, where a <u>new group of hominins was announced</u> based on molecular data without much morphology.

In addition to the Neanderthals and the Denisovans, yet another archaic lineage was posited to have left genetic signals of admixture in Ds.

Bias toward European data

The bias toward the European data needs to be addressed soon.

** Paleogenomic research of the Asian fossil materials is much fewer in number compared to the case in Europe; so far only two Asian fossils have been genetically analyzed. Although very few early African fossils have had aDNA extracted.

** One is the <u>Tianyuan</u> hominin, which shows a complex genetic connection to the modern humans of today. Tianyuan 1 is <u>a partial skeleton</u> including a mandible discovered in 2003 near Zhoukoudian. AMS dating on the faunal remains that accompanied the hominin fossil femur yielded a date of <u>39–44</u> <u>ka</u>. The <u>Tianyuan cranium shows modern facial features but also similarities</u> <u>with Jinniushan and Neanderthals, possibly a result of cold adaptation</u>

Tianyuan hominin, early MH, 39-44 Ka, 4-5% N DNA



Ancient DNA analysis found Tianyuan to be more closely related to modern Asians than to past and present Europeans.

4-5% N DNA
Tianyuan man genetics: DNA from Belgium

Tianyuan man is <u>related "to many present-day Asians and Native</u> <u>Americans</u>" and had already diverged genetically from the ancestors of modern Europeans.

Tianyuan man also exhibits <u>a unique genetic affinity for GoyetQ116-1</u> from the Goyet Caves in Namur province, <u>Belgium, dated to 35 Ka</u>.

Shared a common ancestor: GoyetQ116-1 shares more alleles with Tianyuan man than does any other sampled ancient individual from West Eurasia. The GoyetQ116-1 specimen is inferred to have received 17-23% ancestry from an IUP-affiliated population distantly related to that one which also contributed to the Tianyuan man.

YDNA migrations



Mitochondrial DNA Migrations



<u>Ancestry related to the Tianyuan</u> man is defined as <u>Basal East Asian</u>; ancestry related to <u>Ancient East Asian</u>; ancestry related to <u>Ancient Northern East Asian</u>; ancestry related to <u>Ancient Southern East Asian</u>; ancestry related to <u>Ancient Guangxi population</u>



Salkhit skullcap, MH, 34 Ka

** The second Asian fossil with paleogenomics research is the Salkhit skullcap discovered in 2006 in eastern Mongolia.

Based on the somewhat archaic appearance and the extinct fauna found nearby, it was speculated to be <u>an archaic hominin</u>, <u>possibly Homo</u> <u>erectus</u>, and <u>was given the generic name Mongolanthropus</u>. <u>Morphological analysis aligned the specimen with Neanderthals or in</u> <u>between archaic and modern humans</u>.

Analysis of ancient mitochondrial DNA aligned the specimen with modern humans, supported by the radiocarbon date of <u>34 ka</u>.

Salkhit skullcap



Salkhit skullcap

2019 study: <u>Belonged to a modern human</u>, and its <u>mitochondrial DNA</u> (mtDNA) falls within the <u>modern human haplogroup N</u>, <u>commonly found</u> in <u>Eurasia</u>

However, <u>ancient DNA analysis of the nuclear DNA notes Modern</u> <u>human, Neandertal and Denisovan ancestry</u>.

What is notable is the mixture of archaic and modern features, which is repeatedly noted for many hominin fossils from Asia

** There has never been any aDNA from any Homo erectus fossils (CJV: except perhaps the 4% superarchaic DNA in Denisovans)

Admixed populations in China is norm

Modern humans in Asia, therefore, have come to existence from a dynamic admixture with local populations, rather than originating as a new single species from Africa.

** A model that posits Homo sapiens as a new species replacing every population (outside Africa) without any genetic exchange is refuted; admixed populations contributed to the evolution of modern humans.

The mixture of archaic and modern features can be explained by ancestry (or introgression, if different species).



THE

PALEOANTHROPOLOGY

OF EASTERN ASIA

CHRISTOPHER J. BAE



Author: Christopher J. Bae, PhD.

Christopher J. Bae is a paleoanthropologist at the University of Hawaii at Mānoa based in the Department of Anthropology. Director of Korean Studies.

He was a Korean orphan adopted to an American family.

Over the past three decades, he has been involved with a variety of multidisciplinary paleoanthropological field and laboratory research projects in eastern Asia, primarily Korea, Japan and China, but also expanding into Southeast Asia (Thailand, Myanmar).

Purpose of book

The purpose of this book is not to refute the argument about where the earliest hominins may currently be known from or where the evidence for the earliest stone artifacts may exist; based on current data, evidence to answer both questions is currently found in Africa.

Rather, the goal of this monograph is to synthesize and evaluate the <u>current state of the eastern Asian (including both East and Southeast</u> <u>Asia) paleoanthropological record</u> and place these findings in the context of broader theoretical debates.

Ryan J. Rabett, 2012 & Robin Dennell, 2020



From Arabia to the Pacific How Our Species Colonised Asia **Robin Dennell** 2

Prior major works on archaic humans in Asia

Robin Dennel's (2009) From Arabia to the Pacific volume covers some aspects of the eastern Asian Early and Middle Pleistocene record in his broad synthesis of the Asian (all-inclusive) record. Synthesis of the evidence of the earliest inhabitants of Asia before the appearance of modern humans 100,000 years ago

Ryan Rabett (2012) Human Adaptation in the Asian Palaeolithic which, though partially titled "Asian Paleolithic," is a synthesis of the <u>Southeast</u> <u>Asian record</u>, particularly events that occurred during the Late Pleistocene.

Robin Dennel

Robin Dennell (2020) recently discussed modern human origins in light of interactions between South and West Asia and eastern Asian dispersal routes, but only a few of the twelve chapters are dedicated to eastern Asia.

Edited volumes or special journal issues published in the past decade focus on or include different contributions of multidisciplinary paleoanthropological research in eastern Asia.

Bae focuses on Eastern Asia Paleoanthropological Record

There currently is no comprehensive text that evaluates specifically the eastern Asian paleoanthropological record from the beginning of the Early Pleistocene through the end of the Last Glacial Maximum.

The primary topics covered in this text are the

reasons eastern Asia may have once been considered the cradle of mankind (chapter 1);

<u>the geography, environment, and paleoenvironment of the region</u> (chapter 2);

what the earliest occupations in each of the regions resembled during the Early and first half of the Middle Pleistocene and who may have been the region's earliest inhabitants (chapter 3).

H. juluensis

Next covered is the <u>major human evolutionary events in eastern Asian</u> <u>prehistory</u> during the late Middle and Late Pleistocene, particularly in light of major debates current in paleoanthropology (chapters 4 and 5).

For instance, is there evidence for a third major hominin dispersal into the region, such as by mid-Pleistocene Homo (alternatively, H. juluensis)?

Speaking of which, who are the Denisovans (chapter 4), and can they be easily assigned to H. juluensis, who is discussed here for the first time as a new species (H. juluensis sp. nov.; see also Wu and Bae 2024)? If so, do we now have the skeletal biological side of the Denisovans?

Eastern Asia

How does the eastern Asian record contribute to a better understanding of the evolution of modern humans in the region (either through replacements or in situ evolution or some combination of those two processes)?

How do newly identified taxa like H. floresiensis and H. luzonensis fit in the evolutionary picture (chapter 5)? Chapter 6 examines the events that contributed to the spread of modern human foraging groups and topics like the origin of pottery and the megafaunal extinctions that roughly coincide with the Marine Isotope Stage 3–2 transition (30-25 Ka).

The final chapter presents a synthesis of the current state of the human evolutionary record of eastern Asia, particularly in its biotic setting, and in turn raises a series of questions that should help guide future research (chapter 7).

Asia as cradle of mankind?

Africa has not always been considered the cradle of mankind. But up until the past half century or so, many scientists argued that Asia may have served that role (Dennell 2001, 2009).

Part of the reason for the change in regional focus was due to the political instability in many areas of eastern Asia because of the Pacific Theater during World War II and the Korean and Vietnam Wars.

The other primary reason was simply the discovery of a plethora of evidence of Pliocene and Pleistocene hominin fossils and Early Stone Age archaeology sites in East and South Africa, which contributed enormously to the more recent view that Africa should be considered the cradle of mankind.

Eastern Asia as cradle of mankind

The finds by Raymond Dart (Taung Child) and Robert Broom (Mrs. Ples, Paranthropus) in South Africa beginning in the 1920s and 1930s and the Leakeys in East Africa starting in the 1930s further served to place Africa squarely in the center of human origins research.

Eastern Asia (which as defined here includes East and Southeast Asia) has played a long and critical role in paleoanthropology.

3 East Asian regions covered

- Traditionally, three regions of eastern Asia have been considered critical areas for early human evolution or at least for the development of paleoanthropological research in the region:
 - (1) Island Southeast Asia (Indonesia, Malaysia, Philippines);
 (2) Central Asia, primarily Mongolia;

 - ► (3) Zhoukoudian, outside Beijing.

They were once considered "cradles" of mankind.

Importantly, in order for modern humans to have peopled Australia and the Americas, they had to pass through eastern Asia first.

Thus, understanding the nature and timing of these hominin dispersals into eastern Asia facilitates a more thorough understanding of <u>what</u> morphological and/or behavioral characteristics were in place for these hominins to have succeeded in surviving their new environs.

Robin Dennell, 2012

Cambridge World Archaeolog

THE PALAEOLITHIC SETTLEMENT OF ASIA

ROBIN DENNELL



"A tour de force that examines the Lower and Middle Pleistocene occupation of Asia.

His book is the best resource available for information on Asian <u>paleoenvironments</u> relative to hominin evolution as of 2012.

Dennell's Paleolithic Settlement of Asia: earlier African species?

Dennell's Chapter 6 is a synthesis of the preceding chapters; it is based on a series of <u>data-informed alternative views and hypotheses on the</u> <u>Out-of-Africa model.</u>

** According to the author, the sparse and disparate faunal, fossil hominin, and archaeological evidence available at present from Africa and Asia pre-1 Ma makes it impossible to determine with certainty which hominin species was the first to leave Africa, and whether there may have been more than one.

Dennell: Which species left Africa

** According to Dennell, Homo ergaster or erectus, H. habilis, and certain Australopithecine species are all potential candidates as members of geographically expanding African habitats and faunas into what is now known as Asia.

Note that grasslands existed in Asia for millions of years before they became common in Africa. Like a giant grass corridor between Africa and Asia

In other words, <u>hominins were not "leaving Africa" with that intention</u>, instead <u>they became mobile components of certain habitats in Asia</u> that had to varying degrees <u>become more Africa-like</u>.

Out-of-Africa

** Second, <u>a one-way street perspective on Out-of-Africa scenarios is</u> probably not tenable.

** Hominin dispersals probably occurred repeatedly, and were likely multi-directional, with geographically and environmentally constrained dead ends, two-way movements, and cul-de-sacs.

In his book, Dennell presents an extended version of the Nature article which Dennell and Roebroeks published in 2005.

A Place in Time

Recent dating of the geology of Rising Star places *Homo naledi* in a period roughly 200,000-300,000 years ago, when multiple other hominin species were alive—including archaic forms of *Homo sapiens*. Today only one of those species still survives: us.



Australopithecus in Asia? H. erectus originated in China?

Dennell critiques the current Out of Africa 1 model for being built on three <u>"flimsy" points of observation</u> (i.e., Dmanisi, Nihewan, and Sangiran) and emphasizes the fact <u>that Southwest Asia is so poorly known</u> from the Late Pliocene and Early Pleistocene <u>that it is not yet possible to reject</u> <u>claims that:</u>

▶ 1) Australopithecus inhabited Asia

▶ 2) Homo erectus sensu lato (broad sense) originated there.

<u>Savannahstan</u>

In fact, the <u>paleoclimatic data suggest to Dennell that extensive</u> <u>grasslands which he calls "savannahstan" existed in Asia</u> from the Late Pliocene to the Early Pleistocene (2.6 Ma).

This landscape would have facilitated the movement of hominins and other fauna between Africa and Asia.

CJV: <u>The fossil record strongly indicates that Australopithecus species</u> <u>evolved solely in Africa. None of their fossils have ever been found</u> <u>outside of Africa. But who knows?</u>

Dmanisi 5 – H. erectus?







More ape like shoulders

Early Pleistocene "Savannahstan" to Middle Pleistocene "Aridistan"

Dennell's Chapter 7 highlights some of the <u>significant environmental</u> <u>changes that took place in Asia during the Middle Pleistocene</u>.

The climatic records of Asia are examined and the evidence for prolonged and more severe glacial periods is highlighted. The paleoclimatic data suggest that these longer colder glaciations in the northern hemisphere significantly weakened the Indian and East Asian monsoons.

Early Pleistocene "<u>Savannahstan</u>" to Middle Pleistocene "<u>Aridistan</u>"

Consequently, <u>Dennell suggests that the Early Pleistocene</u> <u>"savannahstan" gave way to a more fragmented and arid Asian</u> <u>landscape which he calls "aridistan."</u>

The implication of this environmental transformation is that Middle Pleistocene hominins and fauna faced formidable environmental barriers to dispersal and little exchange occurred during this time between Africa and Asia. Brief History of Paleoanthropological Research in Eastern Asia

Island Southeast Asia: Southeast Asia was considered a possible region for the cradle of mankind.

E. Haeckel: "missing link" between humans and ape, finding his <u>so-called Pithecanthropus alalus</u> ("speechless ape-man").

Eugene Dubois went in search of this "missing link" and found <u>Pithecanthropus erectus</u>. His findings were not accepted in <u>scientific community for a long time</u>.

Zhoukoudian and Java: northern & southern H. erectus

It was when <u>Sinanthropus fossils were found at Zhoukoudian</u> Locality 1 in China and <u>von Koenigswald discovered additional Pithecanthropus</u> <u>fossils from multiple sites in Java</u> that the scientific community began to more <u>seriously consider these fossils from eastern Asia as the "missing</u> <u>link".</u>

Based on what we know now, in a sense Homo erectus (the original Sinanthropus and Pithecanthropus fossils were later collapsed into one taxon, does represent a missing link (or transitional hominin) between H. sapiens and H. habilis and/or the older australopiths.

Human Evolution, ~1900


Who knows why we should not use "missing link" terminology?

- Originally referenced non-evolutionary thinking related to the religious concept of the Great Chain of Being
- It implies a linear, ladder-like evolution, which is inaccurate, as evolution is more like a branching tree with multiple lineages existing simultaneously
- The fossil record is not complete, and the absence of certain fossils doesn't mean a "missing link" exists; it simply means that those fossils haven't been discovered yet.
- Use "transitional" fossils or hominins

Missing link vs Transitional fossil

CJV: Dr. Bae interestingly uses the outdated "missing link" terminology.

- While often used interchangeably in popular discourse, a "missing link" refers to a <u>hypothetical</u>, single organism that perfectly bridges the gap between two distinct evolutionary groups, whereas a "<u>transitional fossil</u>" is a <u>real fossil</u> that exhibits characteristics of both an ancestral and descendant species, representing a step in the evolutionary process.
- Scientists largely avoid using "missing link" as it implies a linear, simplistic pre-evolutionary theory and is often used by creationists to challenge evolutionary theory.