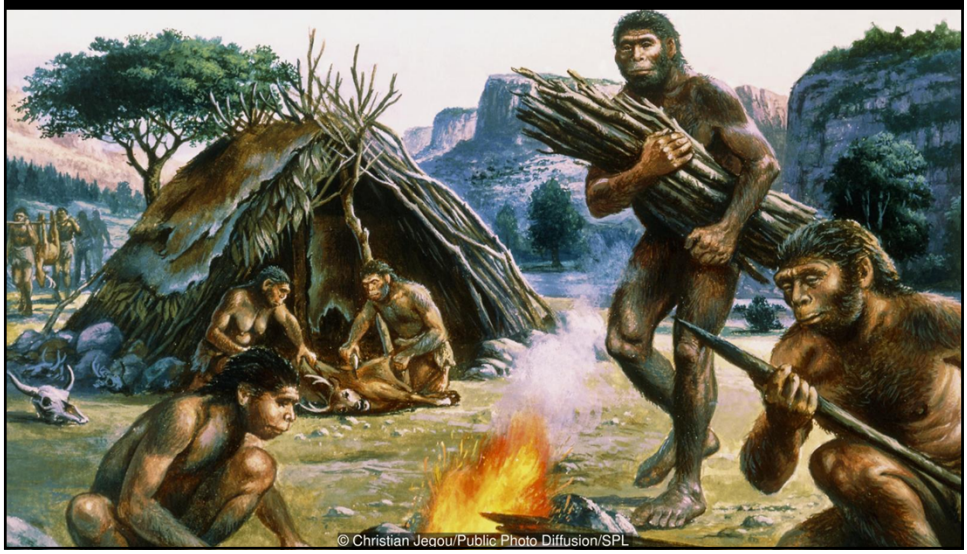
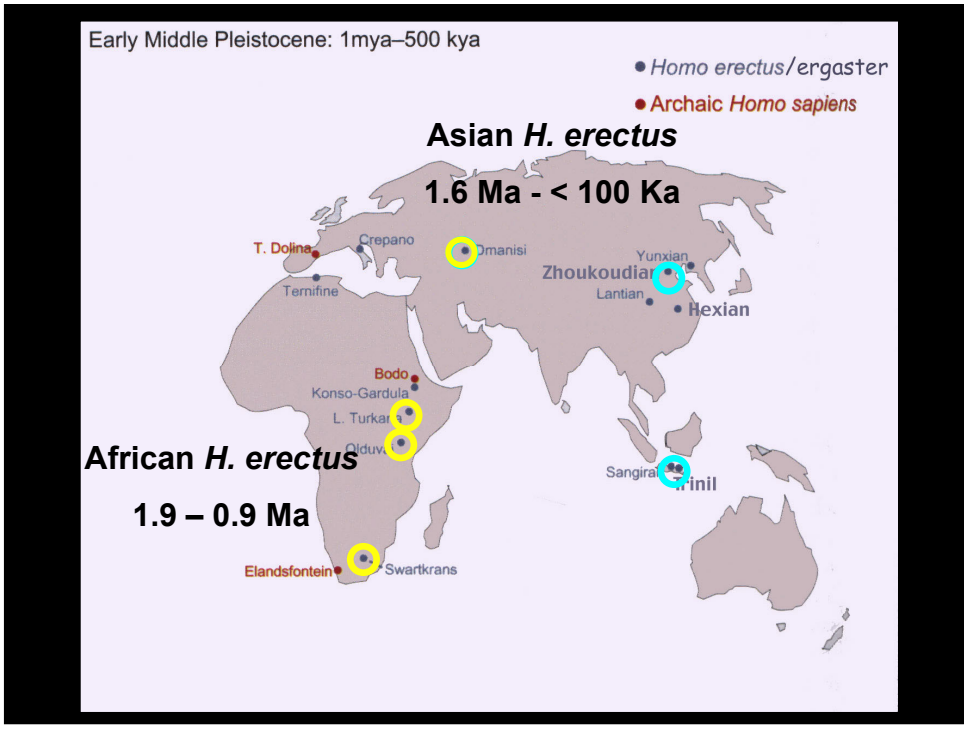
Homo erectus (& H. ergaster)



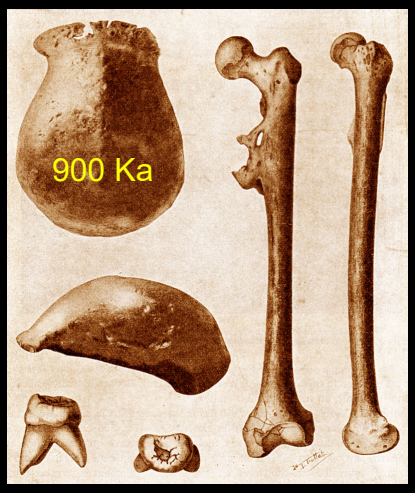
1



2

"*Pithecanthropus erectus*" (1894)

Eugene Dubois



Pithecanthropus erectus = "upright ape-like man"

Now known as *Homo erectus*

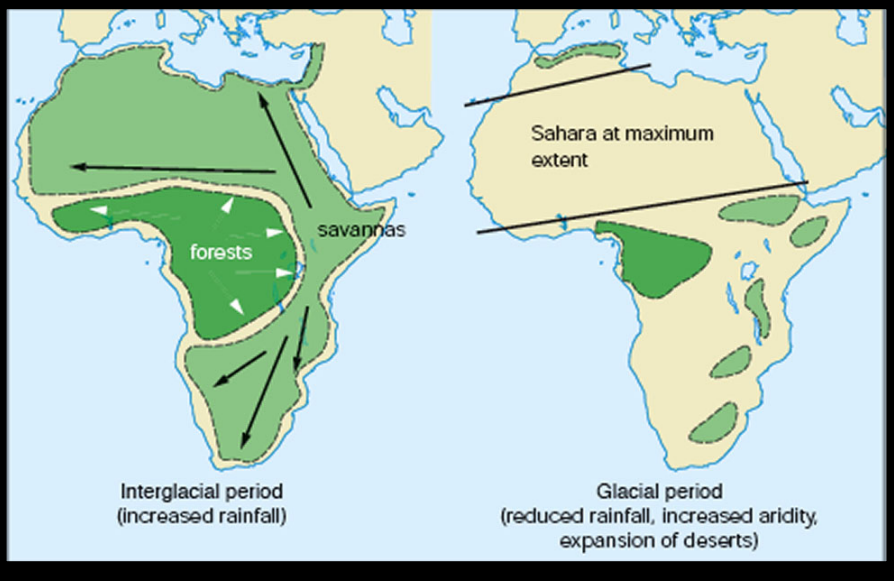
3

Homo erectus in SE Asia

- Known from sites in Java
  - Trinil
  - Sangiran
  - Modjokerto
  - Ngandong
- Earliest known evidence at 1.6 Ma at Sangiran
- Latest known evidence at 50-30 Ka(?) at Ngandong
- How did *H. erectus* get there?

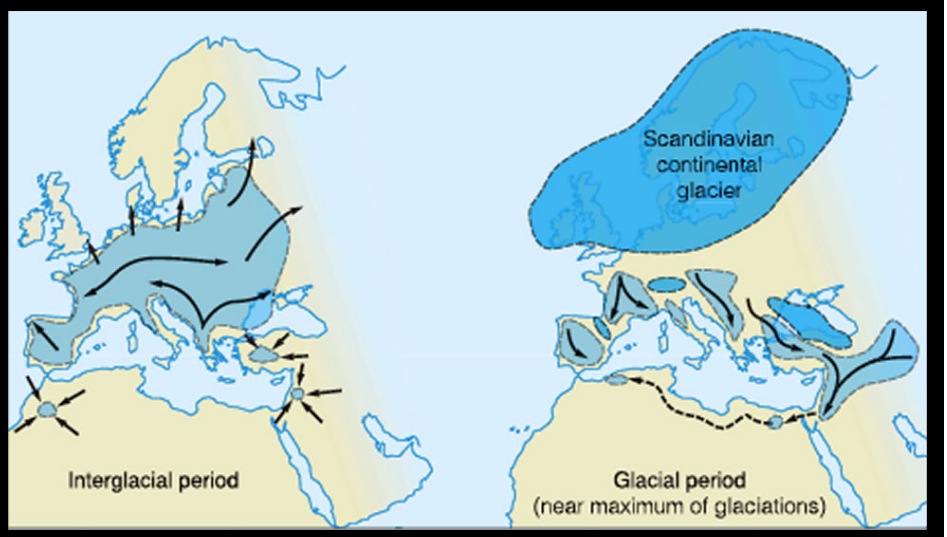
4

Changing Pleistocene environments in Africa



5

Changing Pleistocene Environments in Eurasia

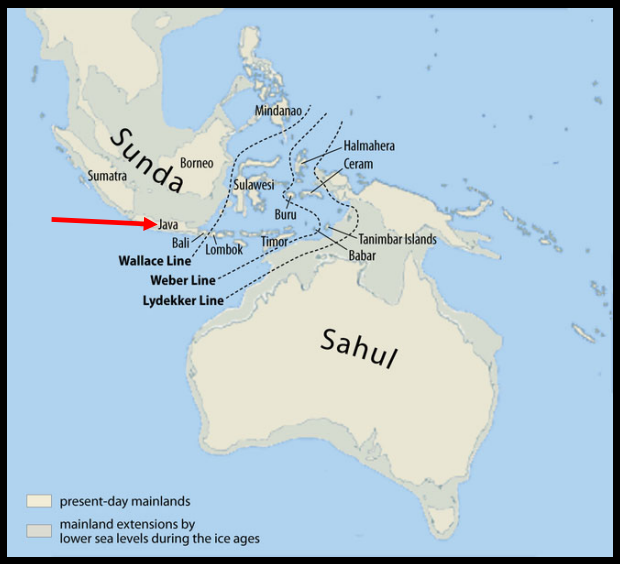


6

How did *Homo erectus* get to Java?

7

How did *H. erectus* get to Java?



- Low sea levels during glacial periods
- Land bridge between continental Asia and Java (Sunda Shelf)

8

H. erectus from SE Asia

Ngandong (50-30 Ka)

Sangiran 2

Solo

Trinil 2 (900 Ka) (type specimen)

9

Later discoveries: Site of Zhoukoudian, China
周口店遗址

Photo by Tianyuan Zhang, BMC '15

10

Zhoukoudian, China

- Limestone cave system at Dragon Bone Hill 龙骨山
- Main cave (Zhoukoudian cave): *Sinanthropus pekinensis* aka *H. erectus,* "Peking Man"
- Upper cave: *H. sapiens*

Photos by Tianyuan Zhang, BMC '15

11

Zhoukoudian, China

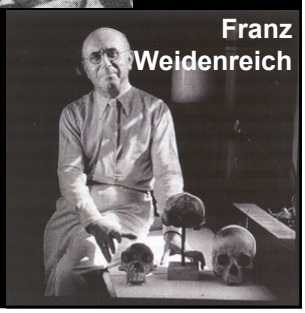
- *Sinanthropus pekinensis*, "Peking Man" fossils, first found and described in 1929
- 780 – 250 Ka
- 200 hominin fossils
- > 40 individuals

Davidson Black

Pei Wenzhong

Location where the first skull was found

Photo by Tianyuan Zhang



12

Zhoukoudian, China

- Work stopped in 1937: Second Sino-Japanese War
- Fossils extensively measured, described, cast, packed up and sent to the US for safe keeping
- US marines escorted fossils on a train that reached Chinese coast on December 7th, 1941
  - Day of attack on Pearl Harbor
  - Marines were captured, fossils lost

"Peking Man"

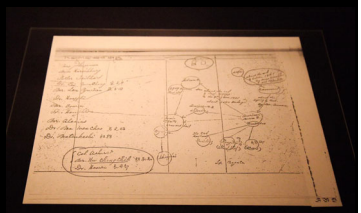
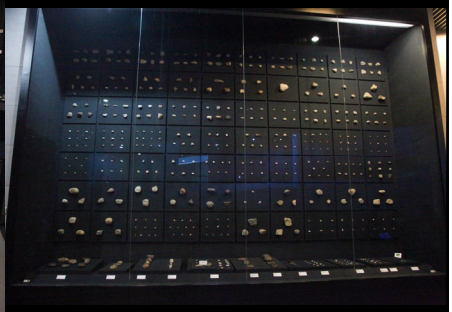


Photo by Tianyuan Zhang

13

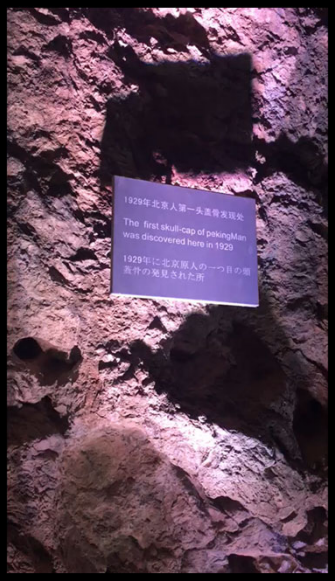
Zhoukoudian, China



Photos by Tianyuan Zhang

14

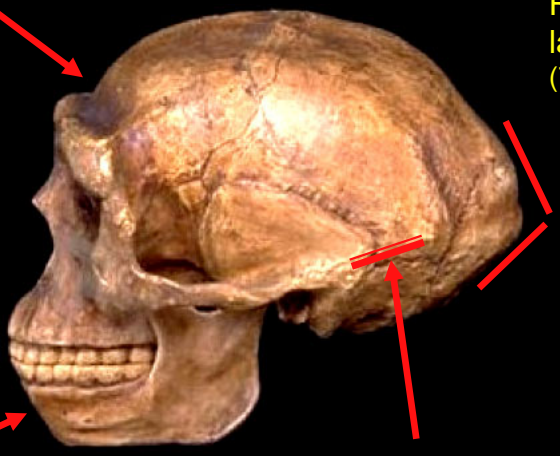
Zhoukoudian, China



Videos by Tianyuan Zhang

15

Homo erectus



Low forehead
Supratoral sulcus

Long & low braincase

Relatively larger brain (750 - 1250 cc)

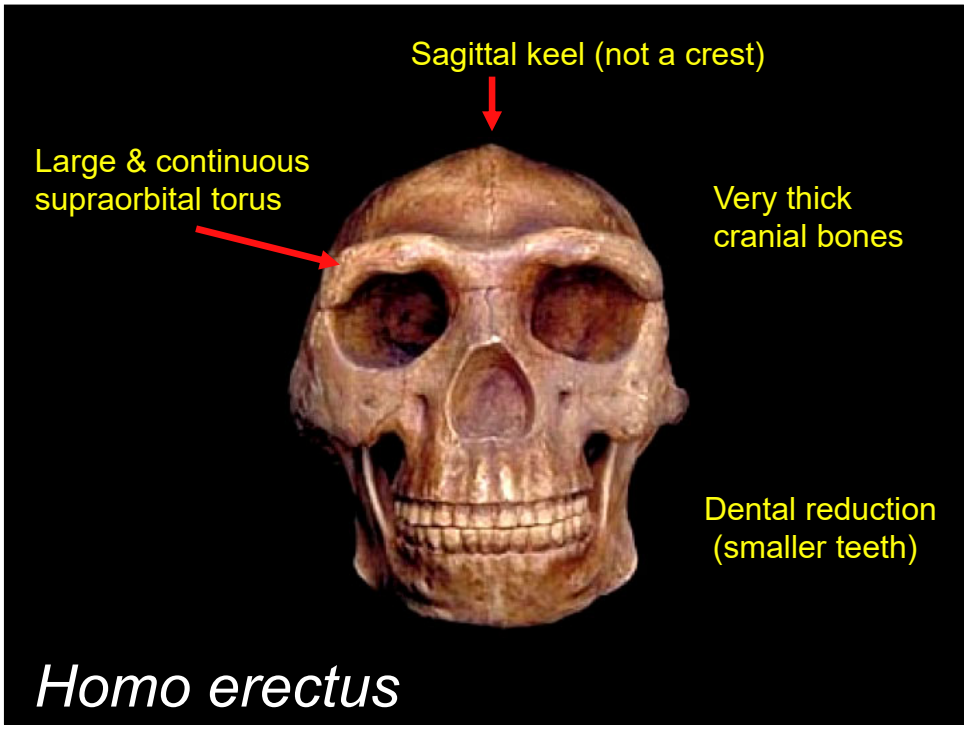
Less facial prognathism

Angled occipital, prominent nuchal crest

No chin

Angular torus (lateral reinforcement)

16



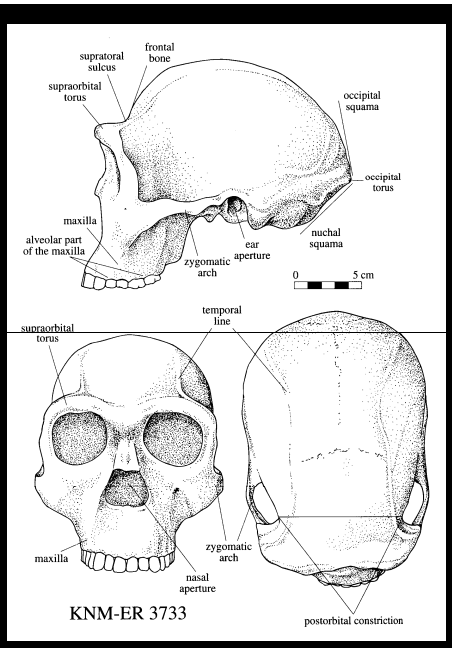
17

Derived features

Larger brain
Smaller, less prognathic face
Forward facing nasal aperture
Reduced cheek teeth & robusticity of jaw
Larger body size

Ancestral features

Browridges (continuous)
Postorbital constriction
Receding forehead
Broad, flat face
No chin



Homo erectus

18

African *Homo erectus* (sometimes called *H. ergaster*)

- Koobi Fora & West Turkana, Kenya
- Olduvai Gorge, Tanzania
- Drimolen and Swartkrans, S. Africa

- 2 Ma (oldest)
- 900 Ka (youngest)

19

Homo erectus in Africa

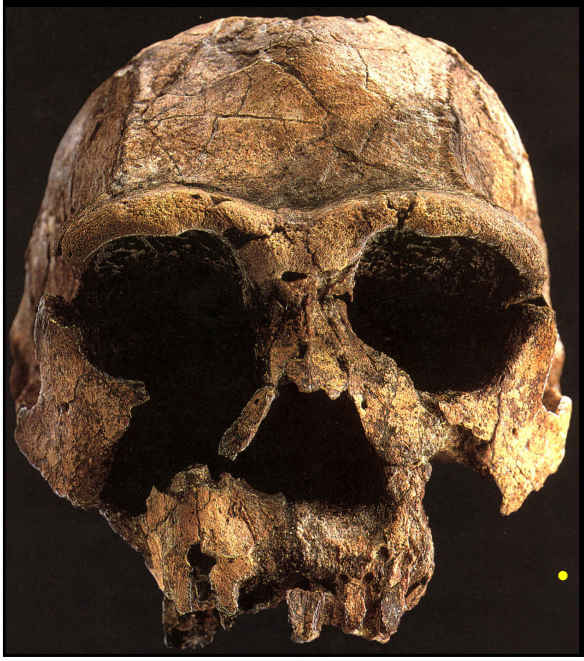
OH 9

(1.47 Ma, brain 1067cc)

- Dates from 1.9 Ma to 900 Ka
- Overlaps in time with early *Homo* & *Paranthropus*
- African *Homo erectus* also known as *Homo ergaster*

20

KNM-ER 3733 face



- Face not as robust as Asian *H. erectus*
- Less prognathic (than early *Homo*)
- Prominent, but more slender browridges
- AKA - *Homo ergaster*

21

KNM-ER 3733 cranium

22

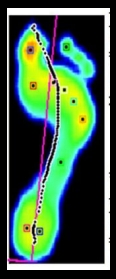
Ileret specimens

KNM-ER 42700

- 1.55 mya, Ileret, Kenya
- 690 cc – small end of *H. erectus*

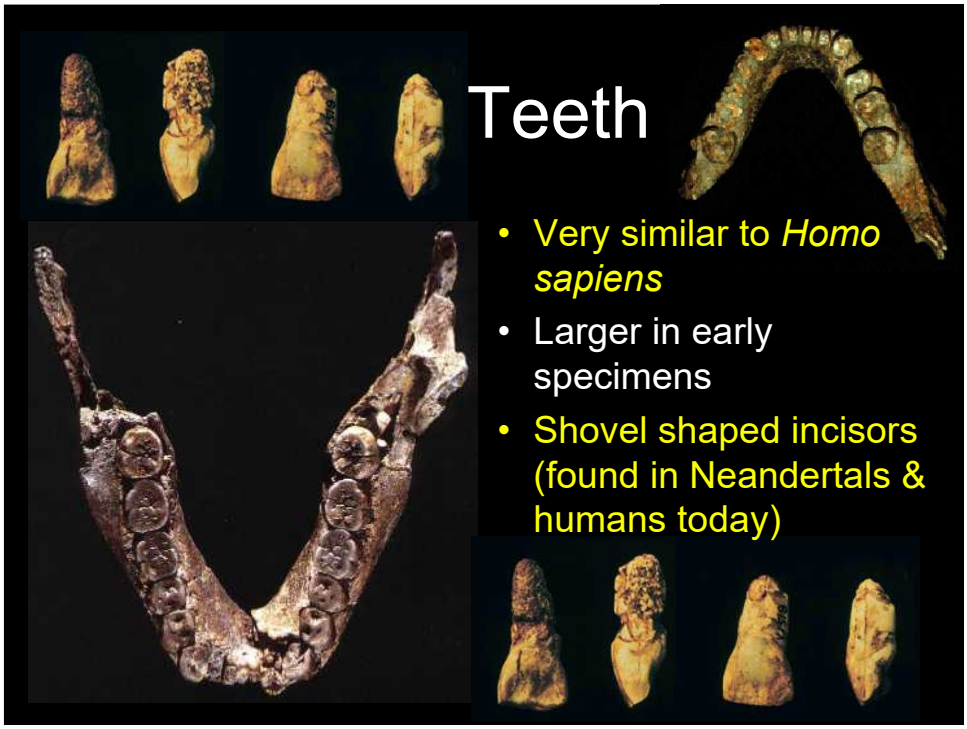
23

Ileret footprints

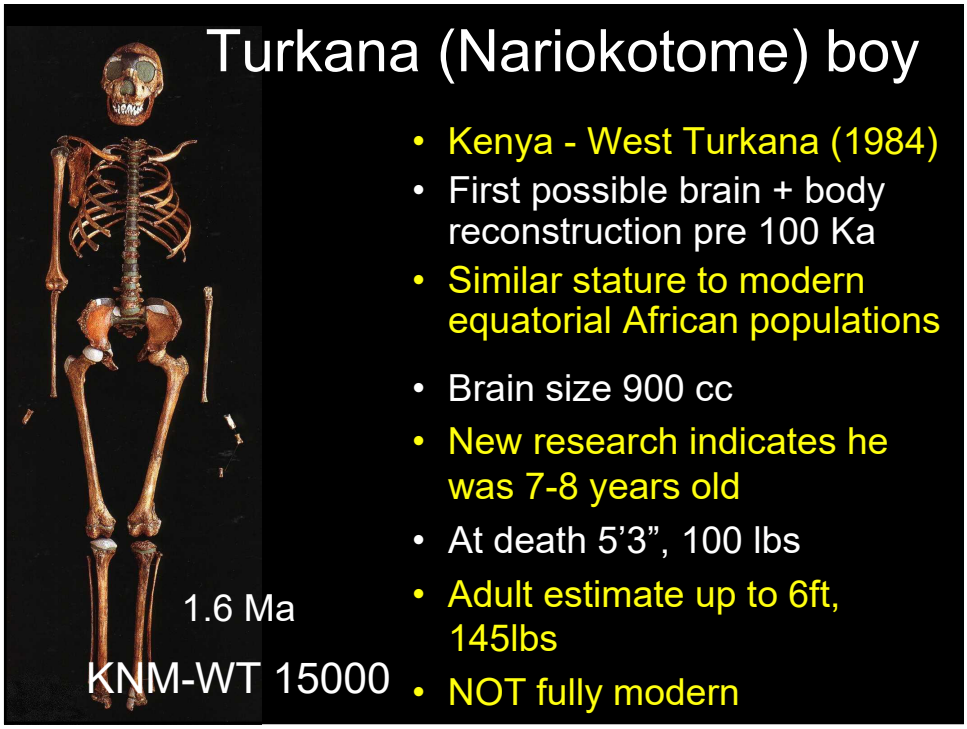


- 1.5 Ma, five sites within 1.5 km (Hattala et al., 2016): 97 hominin tracks, 15-23 individuals
- Fully modern human-like (unlike Laetoli)
- Mean body mass: 48.9kg ± 9.6kg (*H. erectus*)

24


Teeth
• Very similar to *Homo sapiens*
• Larger in early specimens
• Shovel shaped incisors (found in Neandertals & humans today)

25


Turkana (Nariokotome) boy
• Kenya - West Turkana (1984)
• First possible brain + body reconstruction pre 100 Ka
• Similar stature to modern equatorial African populations
• Brain size 900 cc
• New research indicates he was 7-8 years old
• At death 5'3", 100 lbs
• Adult estimate up to 6ft, 145lbs
• NOT fully modern
1.6 Ma
KNM-WT 15000

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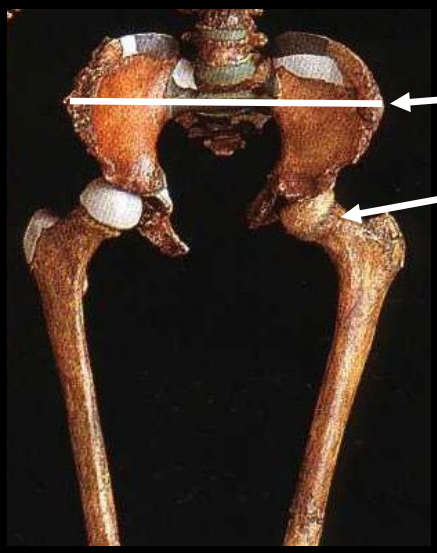
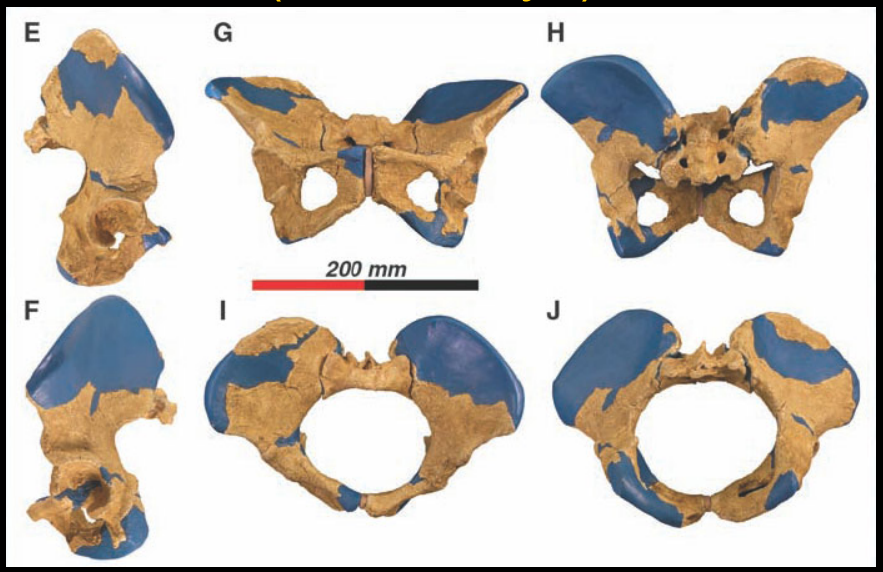
Closer look at pelvis & femur



- Pelvis is narrower (but ilia still flare laterally)
- Elongated femoral neck
- Brain development not completed in womb? New discoveries challenge that idea.

27

Female pelvis from Gona, Ethiopia (1.4-0.9 mya)



28

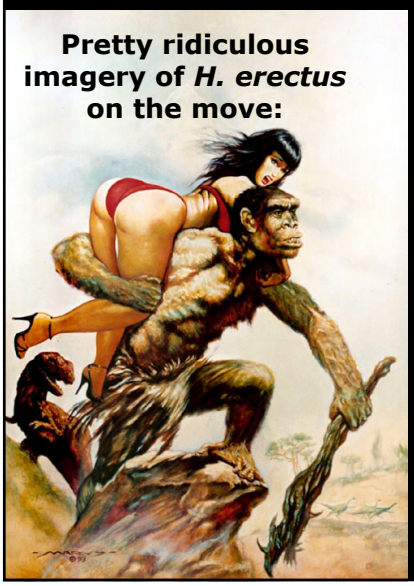
Gona pelvis

BSN49/P29a-d
1.4-0.9 Ma

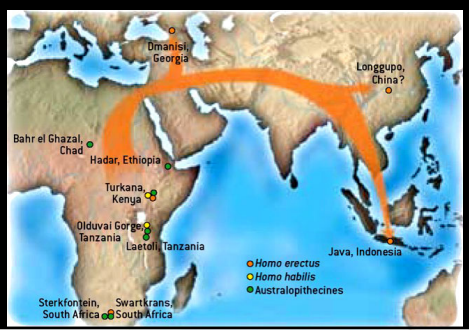
- Short female (120-146cm, 4-5')
- Very broad – broad trunk
- Large pelvic inlet, very large outlet
- Gave birth to large-brained babies!
- Not fully modern

29

Homo erectus out of Africa (Out-of-Africa I)



- Leaves Africa 2-1.8 Ma
- Increase in population numbers?
- Adaptive flexibility to exploit different habitats?



30

Ubeidiya, Israel (?)

- ~1.4 Ma
- Abundant stone tools (Acheulean)
- Fauna
- Small fragments of hominid cranial vault and tooth
- *H. erectus*?

31

Dmanisi, Republic of Georgia (Caucasus)

32

Outside Africa: Dmanisi (1.77 Ma)

Brain size
600 – 780 cc

33

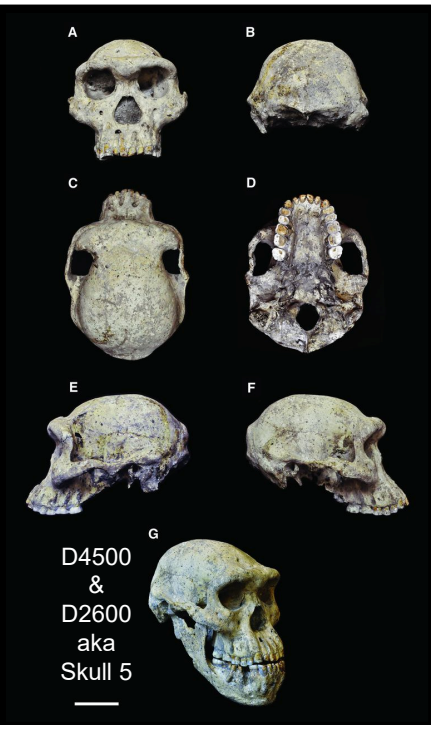
Dmanisi

- Since 1991 until 2013:
  5 crania, some postcrania
- 1.75 Ma
- Small brain: 600-800 cc
- Similar to African *Homo erectus*, but more primitive/ancestral traits
- Gracile face
- Thin browridge
- Short stature

34

Skull 5 (2013)

- 546 cc
- Low, long cranium
- Large zygomatic arches (right broken)
- Large, prognathic face
- Procumbent incisors
- Postcrania: 146-166cm, 47-50kg (4'9"-5'6", 103-110lbs)

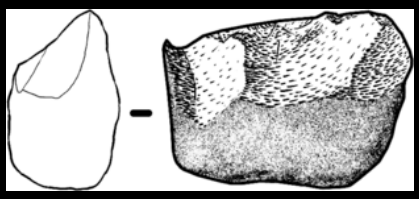


35

Is *H. erectus* now too variable?

36

Dmanisi



- > 1000 Oldowan tools
- Initial pre-Acheulean dispersal out of Africa?
- Dispersal not driven by technological innovation

- 2004 – edentulous skull
  - Lived for several years without teeth
  - Help from others?

D3444

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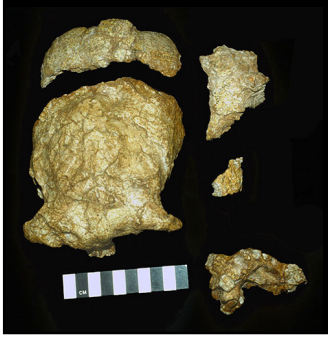
Earliest finds from China



- Yuanmou, 1.7 Ma: two incisors
- Lantian (Gongwangling), 1.63 Ma: cranium
- Artefacts from Nihewan basin: 1.6-1.7 Ma
- Artifacts from Shangchen, Lantian county: 1.26-2.12 Ma!
  - Flaked (cores) and flakes, and unmodified rocks (manuports, hammerstones)
  - Earlier dispersal?

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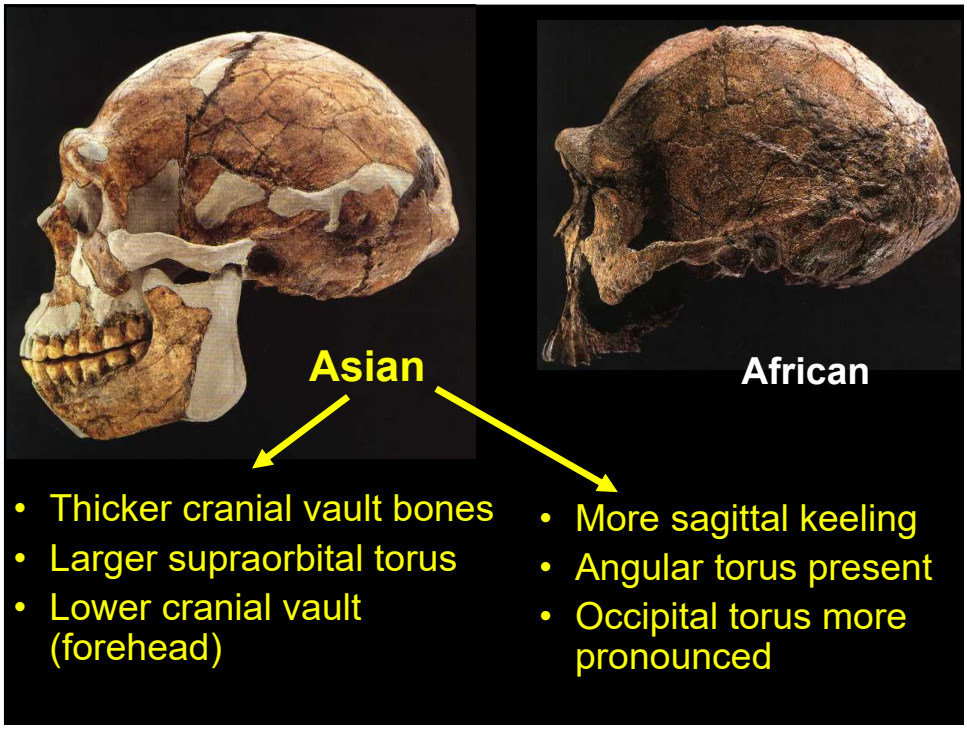
Asian
African
• Thicker cranial vault bones
• Larger supraorbital torus
• Lower cranial vault (forehead)
• More sagittal keeling
• Angular torus present
• Occipital torus more pronounced

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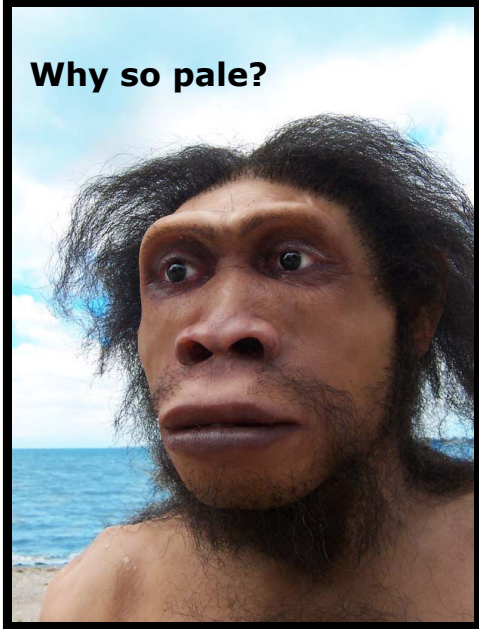
H. erectus reconstructions

40



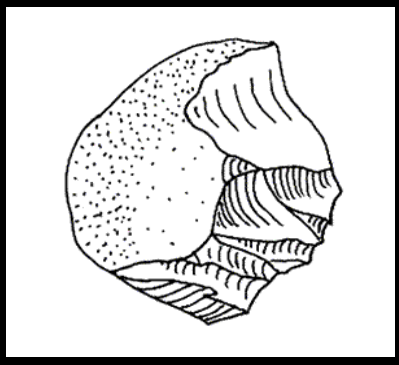
African (*H. ergaster*) Asian (*H. erectus*)

41

Reconstructing *H. erectus* behavioral ecology

- Tool use
- Meat-eating
- Fire?

42



Oldowan tool

(from ~2.6 Ma)

Biface (handaxe) tool

from ~1.76 Ma
(Kokiselei, Kenya)

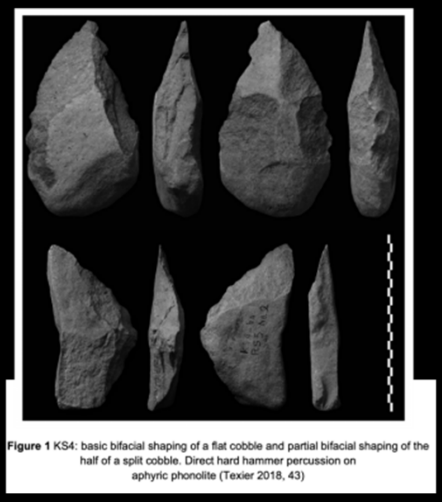


Figure 1 KS4: basic bifacial shaping of a flat cobble and partial bifacial shaping of the half of a split cobble. Direct hard hammer percussion on aphyric phonolite (Texier 2018, 43)

43

Acheulean (St Acheul, France)

Bilateral symmetry

- First appear ~1.76 Ma
- Lasted >1 million years
- Cores, not flakes
- Bifaces: hand axes, picks & cleavers

- More standardized appearance & design
- Preconceived shape – mental template?
- Very evident in symmetry of hand axes?

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Acheulean (St Acheul, France)

Bilateral symmetry

- Teaching?
- Or… properties of raw material turn everything into a shape we call a handaxe!
- Knapping an elongated pebble leads to this shape, even if flakes removed at random (Raskin & Reeves)
  - Flake-core technology after all?

45

What are the tools used for?

- In most cases we don't know what a tool was used for even though we call them 'choppers', 'scrapers', etc.
- Small percentage of tools suitable for microwear analysis

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Potential uses of hand axes

Butchering

Digging

Bark stripping

Hunting

Source of flakes

Nick Toth

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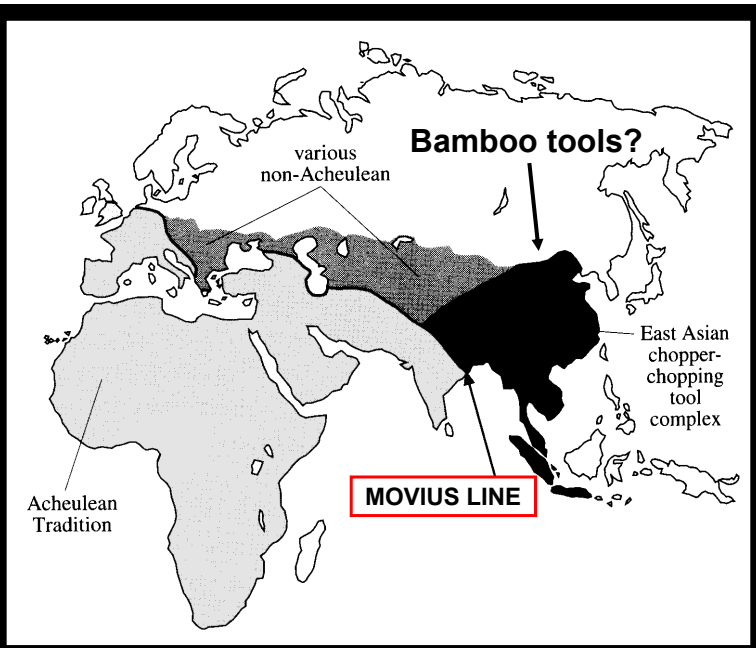

Homo erectus stone tool traditions

48

Newer finds from China

- Large stone bifaces dated to ~ 800 Ka
- Possibly independently developed

http://humanorigins.si.edu/research/asian-research/bose-china

49

Controlled use of fire

- First evidence for controlled use of fire?
- Baked earth at Koobi Fora 1.6 Ma
- Charred bones at Swartkrans 1.5-1 Ma

Photo by Tianyuan Zhang

- Burnt wood and artefacts at Gesher Bnot Ya'aqov, Israel, 790-690 Ma
- Charred bones at Zhoukoudian 500-250 Ka (but no ash or charcoal – burning, but no hearths)

50

Homo erectus behavior
Big game hunting / Meat eating

- From irregular exploitation to regular part of diet
- Gathering still important!
- Later change from scavenging to hunting
- Due to greater seasonality in a temperate climate?
- Handaxes good for butchery

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Summary of *H. erectus* (*H. ergaster*)

- Originated sometime around 2 Ma, overlapped with late *Australopithecus* (SA) and *Paranthropus* (SA & EA)
- Probably the first hominin to leave Africa: spread to North Africa, South Africa, western Asia, China & Java between 2.0 and 1.5 Ma (possibly earlier)
- Scant evidence of European occupation
- Occupied cooler climates; probably used fire & ate meat
- Characterized by more sophisticated tool culture - the Acheulean
- Persisted till ~600 Ka in Africa where it gave rise to Middle Pleistocene *Homo*
- Persisted in East and Southeast Asia till 100 Ka, perhaps even more recently (50-30 Ka)

52