

Human Evolution

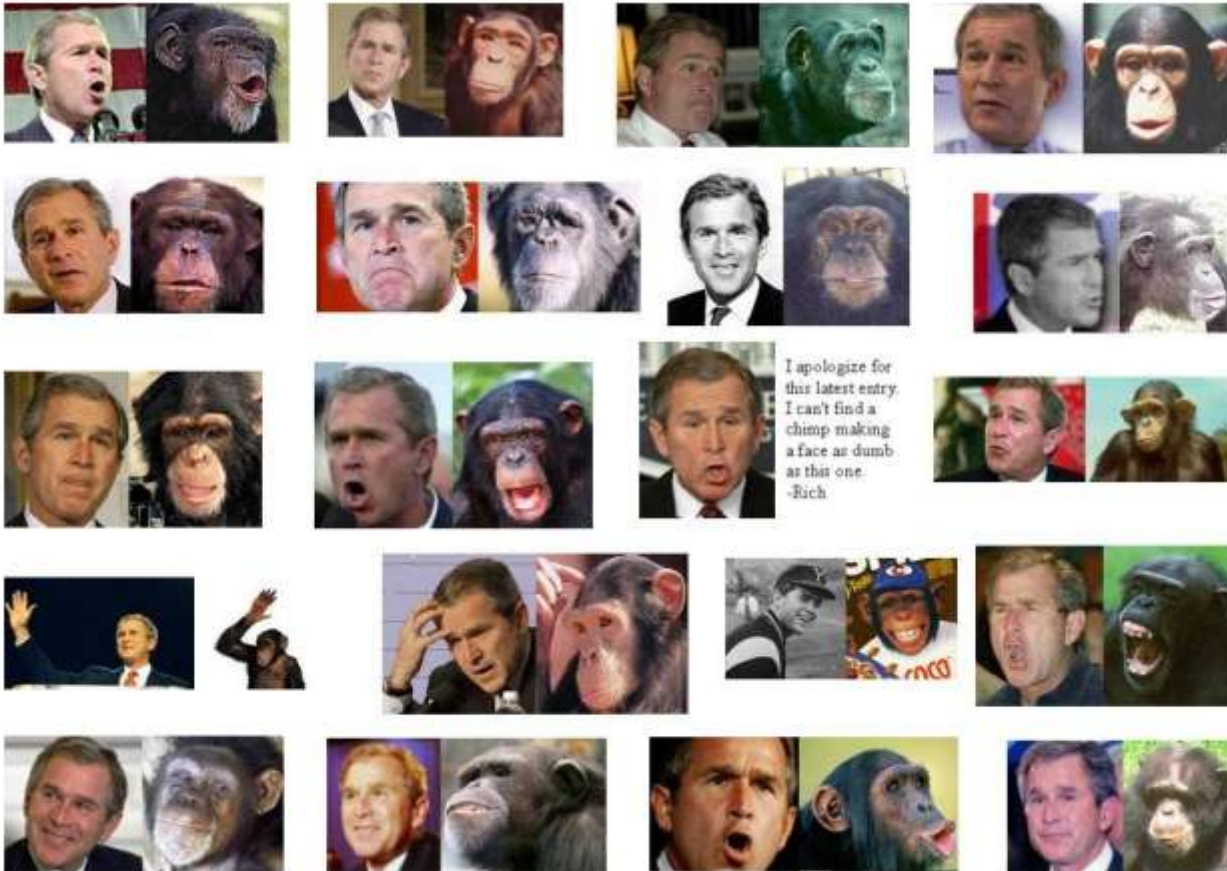
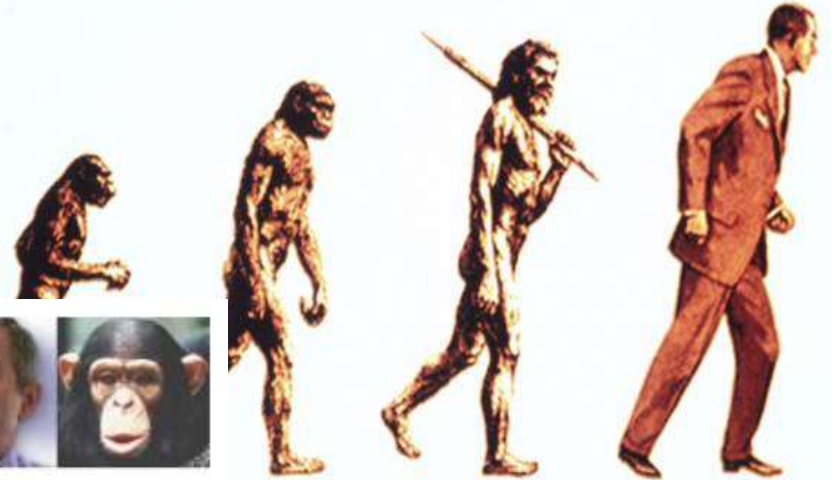
Chris Stringer

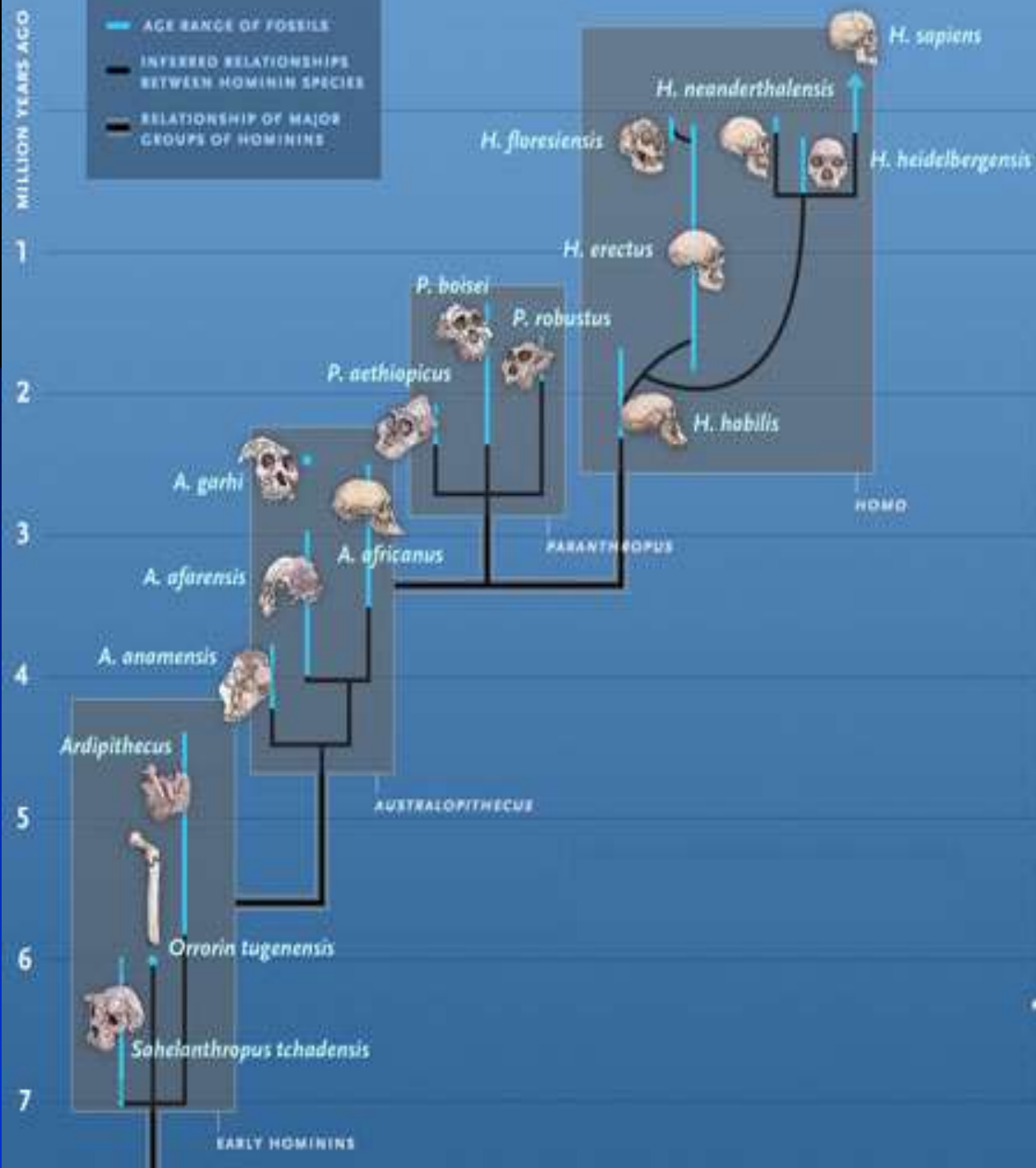
The Natural History Museum

London

Are we nearly there yet?

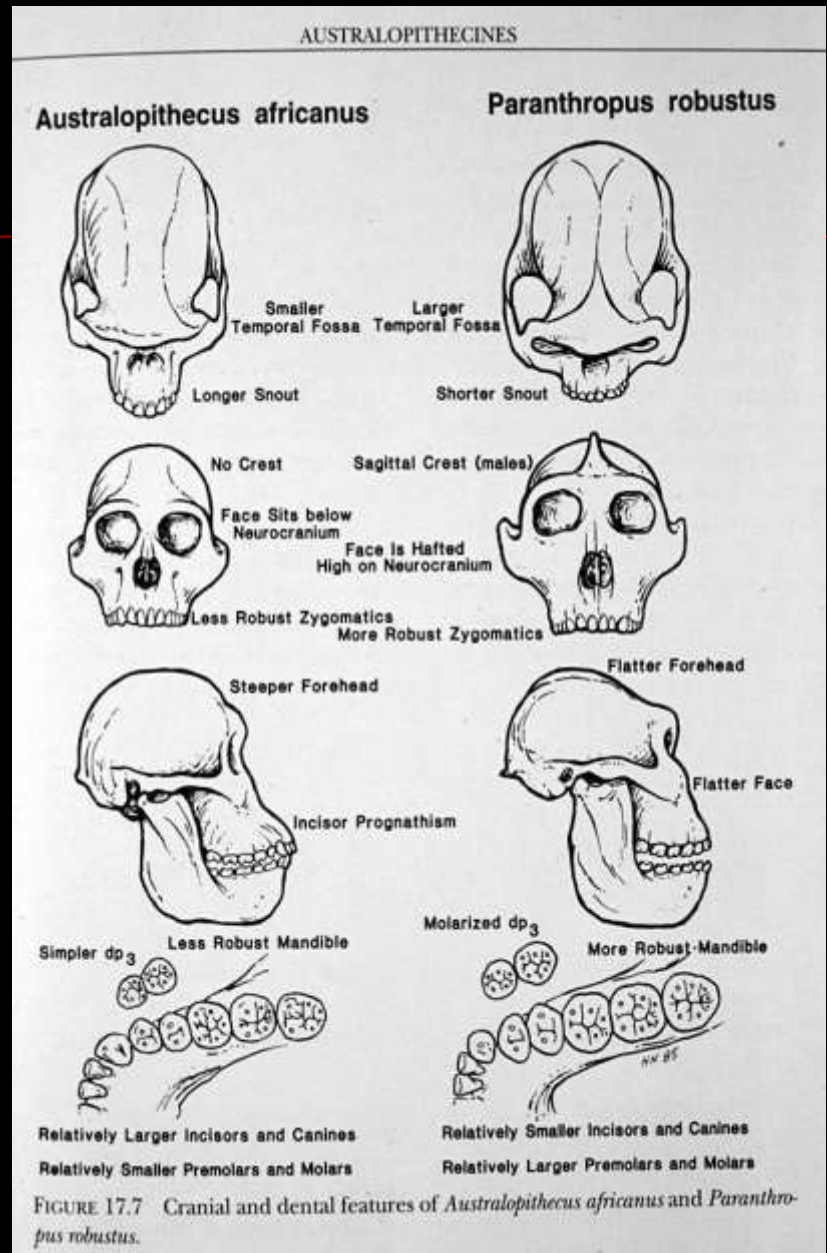
Are we nearly there yet?





WHO'S WHO IN HUMAN EVOLUTION

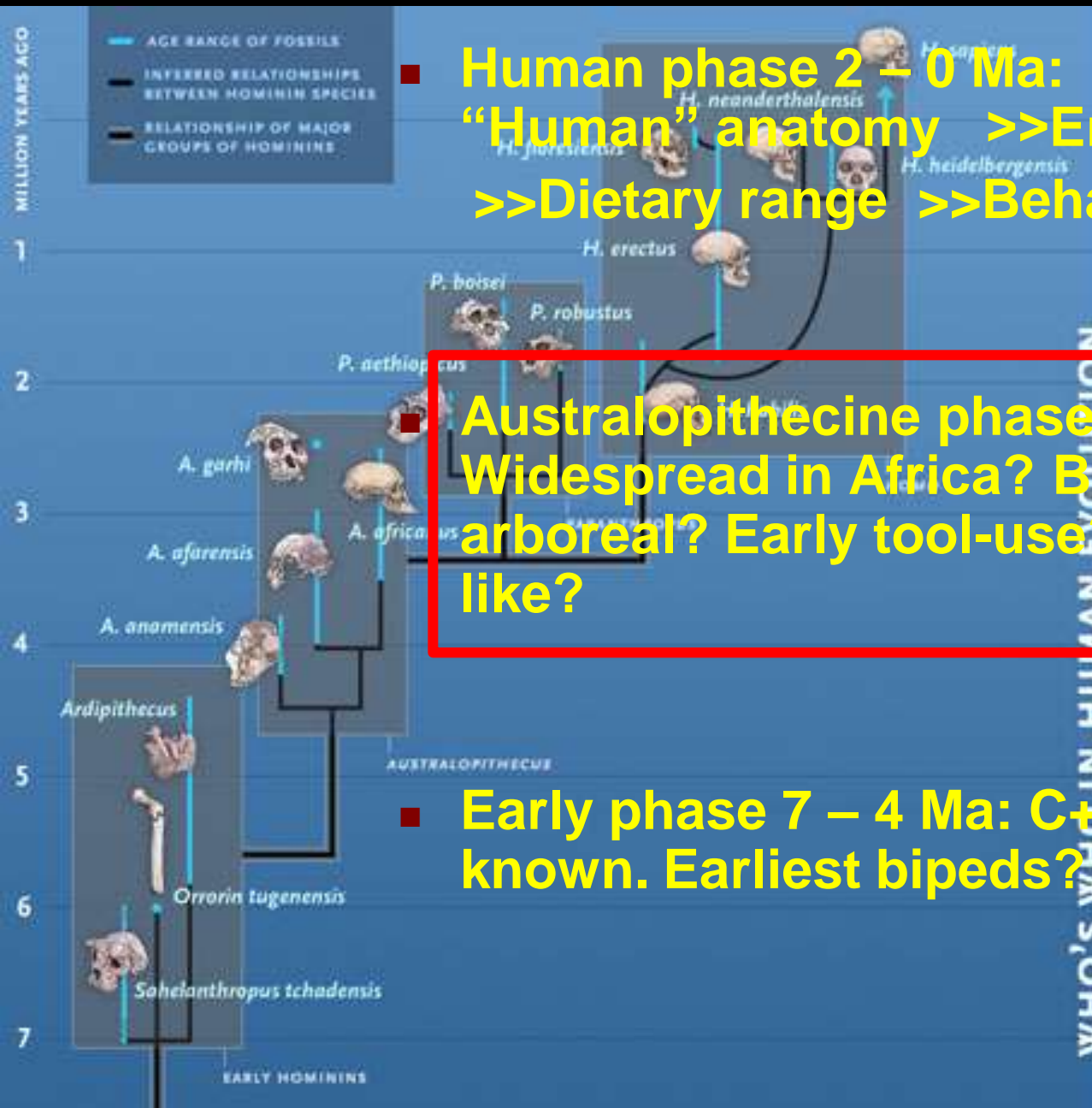
Paranthropus (Australopithecus) robustus



Australopithecines: thousands of fossils and at least 8 species in S., E. and C. Africa



“Phases” of human evolution



- Human phase 2 – 0 Ma: >>Global spread
“Human” anatomy >>Encephalised
>>Dietary range >>Behavioural complexity

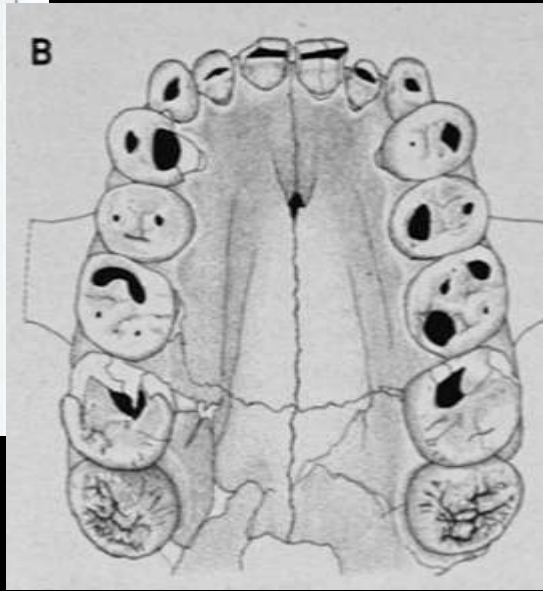
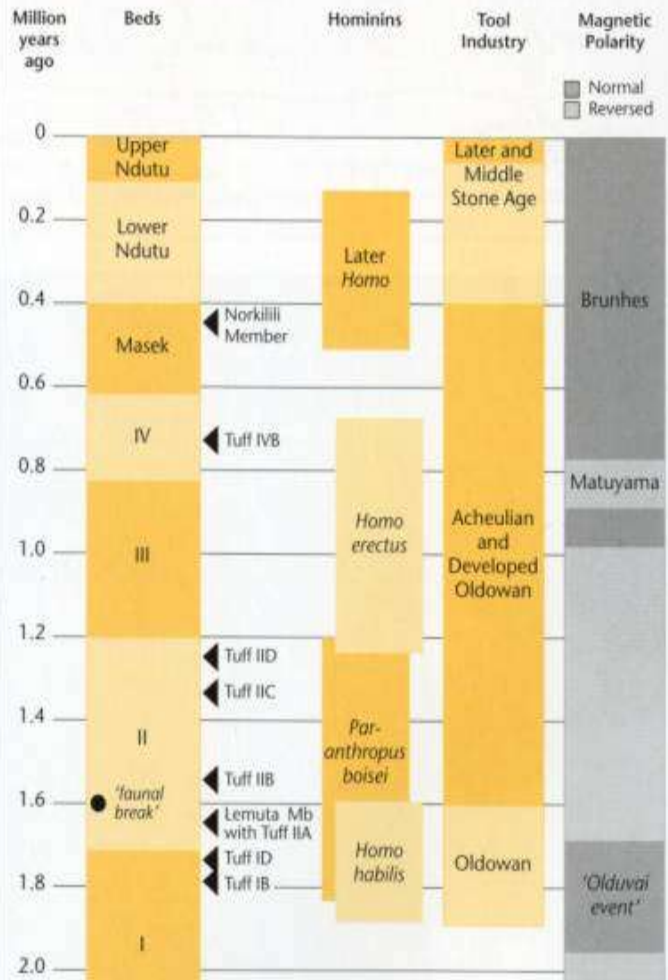
- Australopithecine phase 4 – 2 Ma:
Widespread in Africa? Bipedal but still partly arboreal? Early tool-use? Predom. still ape-like?

- Early phase 7 – 4 Ma: C + E. Africa. Still poorly known. Earliest bipeds? Largely ape-like?



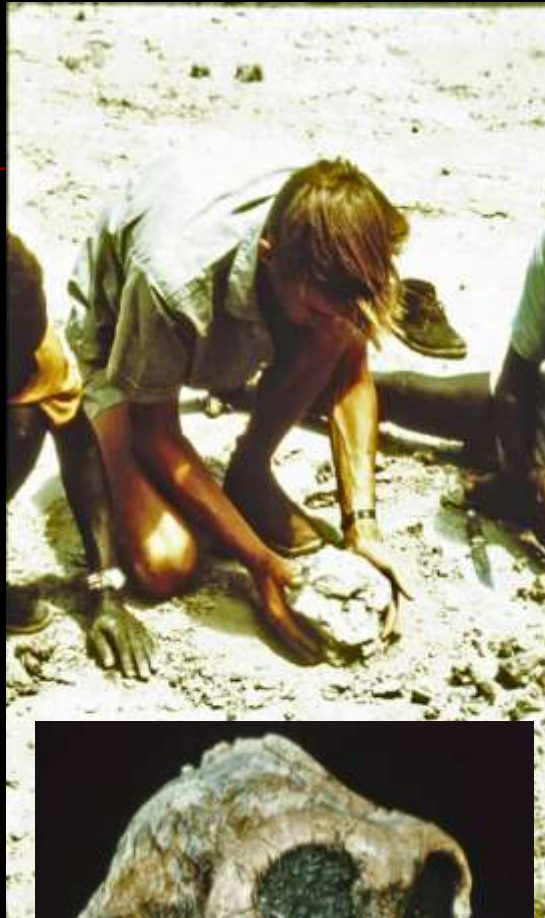
Olduvai Gorge and the Leakeys



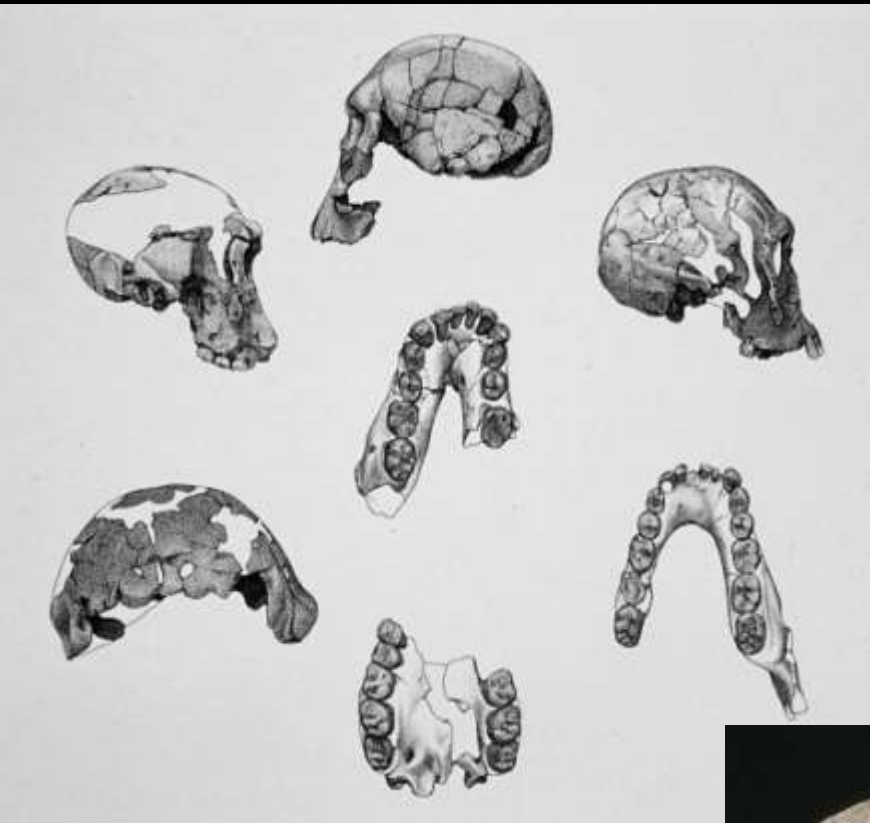


“Zinjanthropus”: human or australopithecine?

East Turkana (N. Kenya): 1.5 – 2.0 Ma



Homo habilis: one or more species?



Homo rudolfensis and *Homo habilis*?

Australopithecus sediba (Malapa Cave, S. Africa)



THE VIEW FROM MALAPA
Lee Berger's team suggests that the clearest line to *Homo* links *A. sediba* directly to *H. erectus*. If true, more primitive East African *Homo* fossils would represent a lineage that went extinct.

1 MILLION YEARS AGO (M.Y.A.)

A. robustus
South Africa

Australopithecus boisei
East Africa



A. sediba
South Africa

PROPOSED
VIEW OF
HOMO
ORIGINS

PREVAILING
VIEW

2 M.Y.A.

A. aethiopicus
East Africa

A. africanus
South Africa



A. garhi
Ethiopia

Hadar jaw
Ethiopia

3 M.Y.A.

A. afarensis
East Africa



Kenyanthropus platyops
Kenya

4 M.Y.A.

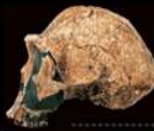
A. anamensis
East Africa

Ardipithecus ramidus
Ethiopia



Homo sapiens
Worldwide

H. heidelbergensis
Old World



H. neanderthalensis
Europe and Middle East

H. erectus
Old World



H. habilis
East Africa

H. rudolfensis
East Africa

- *Homo*
- *Kenyanthropus*
- *Australopithecus*
- *Ardipithecus*

A CROWDED FIELD
Two or possibly three species assigned to *Homo* coexisted in East Africa around 1.8 million years ago. (Some researchers view a few *H. habilis* fossils as a separate species, *H. rudolfensis*.) Larger brained *H. erectus* eventually gave rise to our own species.

EARLIEST TRACES?
A few fragments older than the Malapa fossils, notably a jawbone from Hadar in Ethiopia, have been described as *Homo*—calling into question a link between *A. sediba* and our genus. But Berger's team has challenged both the age of these fossils and their assignment to *Homo*.

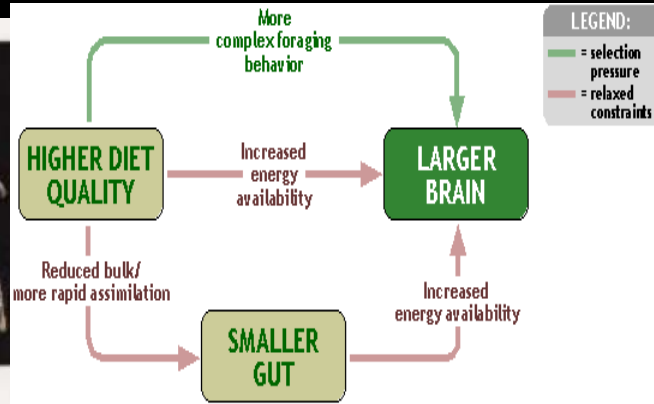
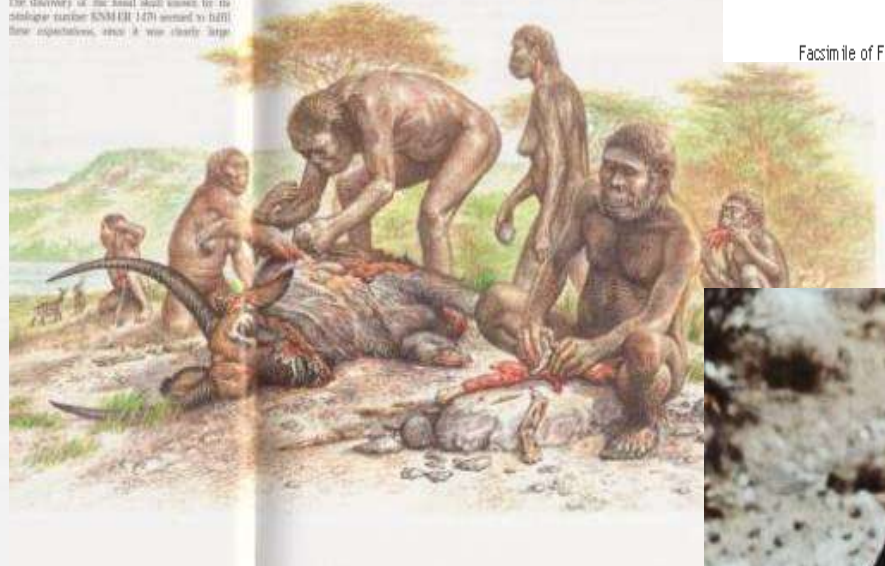


Becoming human

in a new species called *Homo habilis*, meaning 'handy', because of its assumed tool-making ability. He and his collaborators believed that this species represented the most ancient and primitive of all humans.

Fossil finds from Koobi Fora

Homo habilis was not well received by the scientific community. Some scientists felt that the material was not complete enough for definite opinions, others felt that it merely represented a new kind of australopithecine, while yet others felt that it consisted of a mixture of australopithecine and modern early human fossils. Nevertheless, *Homo habilis* gradually gained scientific credibility, and new finds were found at Olduvai and elsewhere. Louis's son, Richard, initiated a new research project in northern Kenya, in Koobi Fora, on the eastern side of Lake Turkana (formerly Lake Rudolf). He was soon rewarded with finds of stone tools like those found in the earlier layers at Olduvai Gorge, as well as the remains of several australopithecines, dated at nearly 2 million years old. So there was immediate speculation about whether *Homo habilis* could also be found there. The discovery of the fossil skull known by its catalogue number KNM ER 1470 seemed to fulfil these expectations, since it was clearly large.



Facsimile of Fig. 5, p. 207, Aiello and Wheeler [1995]. Copy

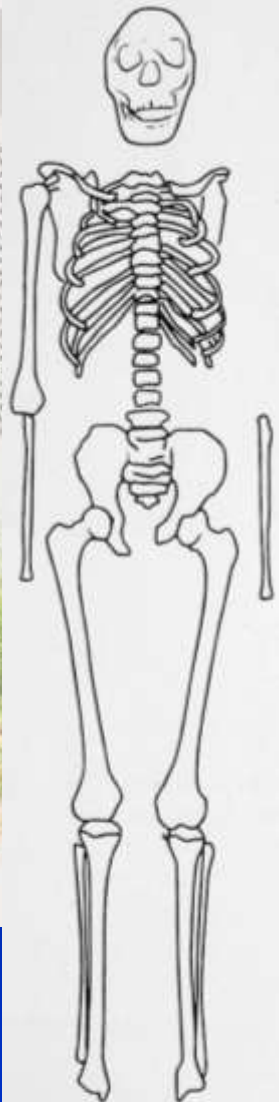
Meat, guts, and brains



Stone tools
~2.6 Ma



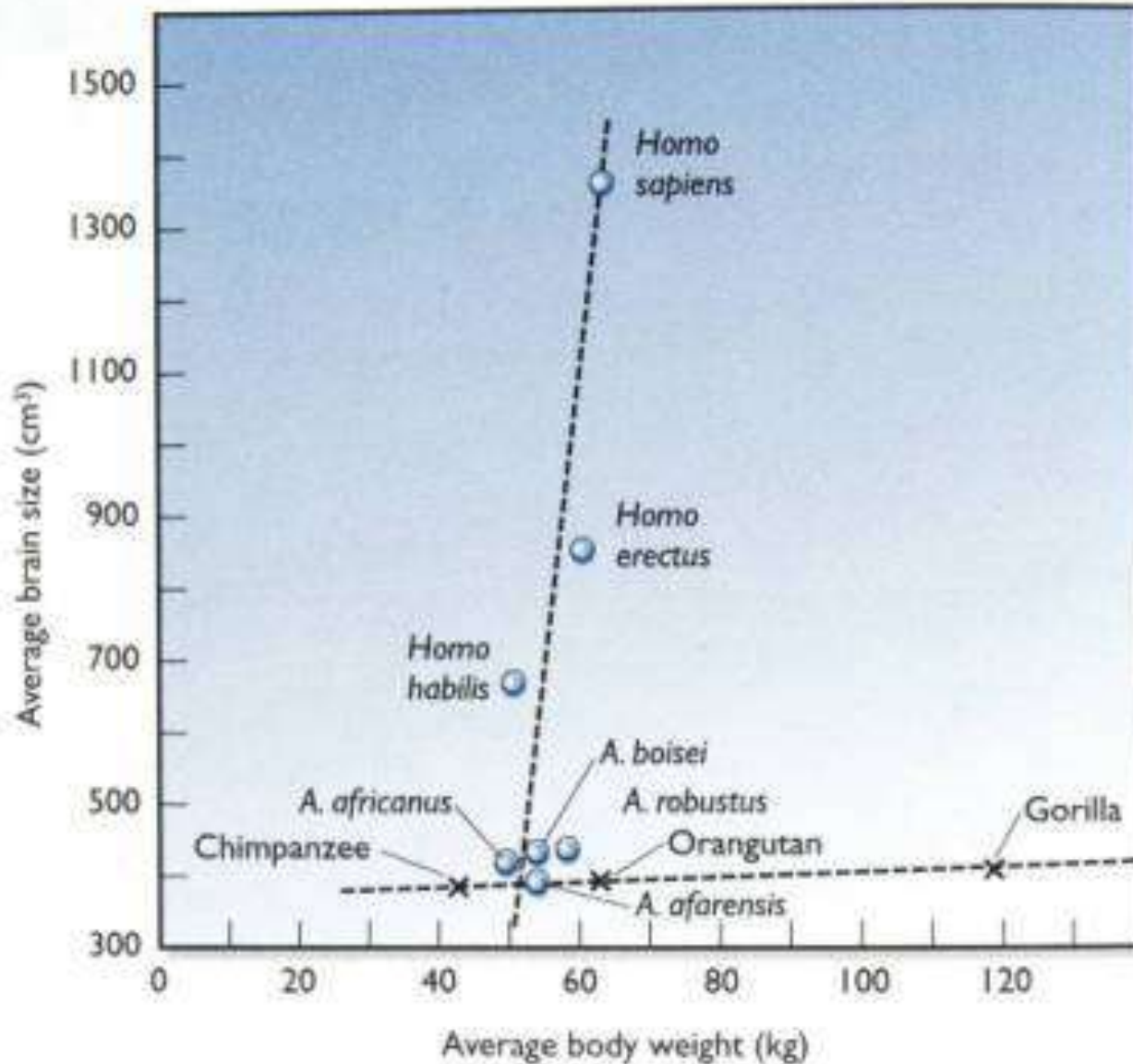
AL 288-1
Lucy
(320)



KNM-WT 15000
Nariokotome boy
(307)

Body shape

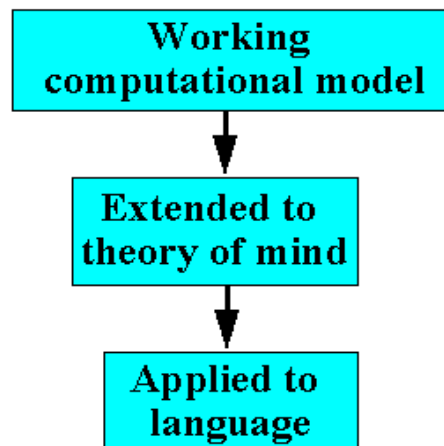
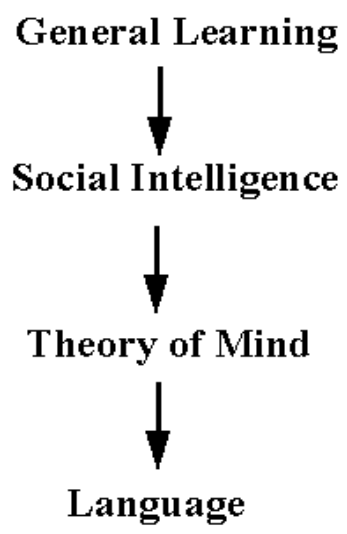
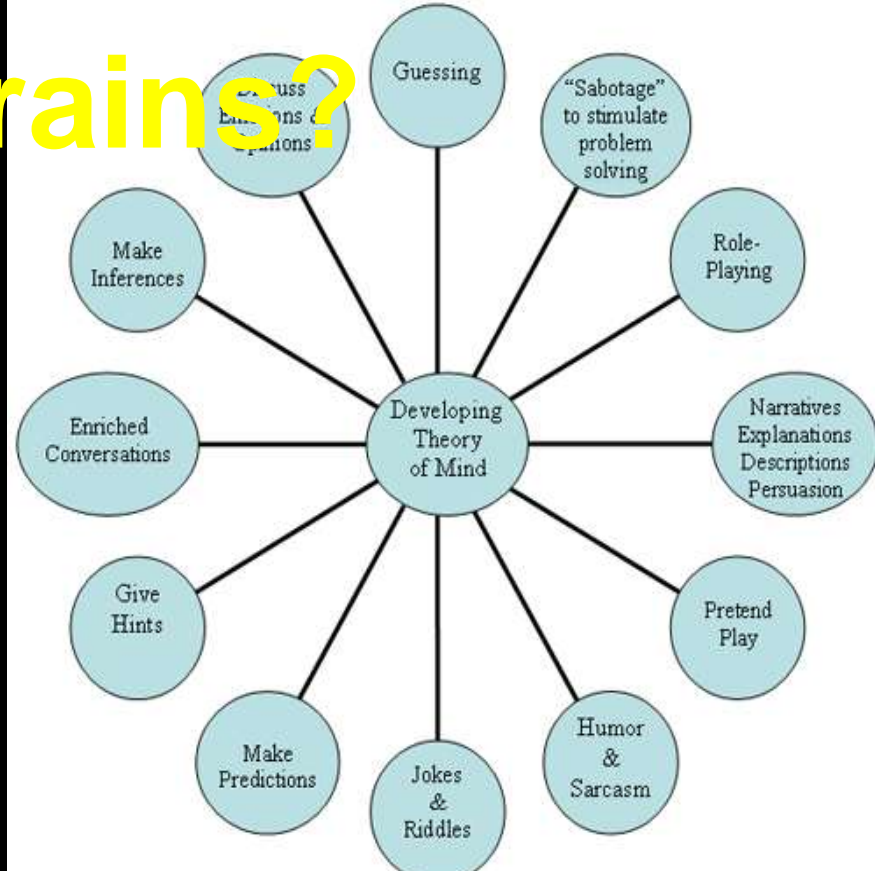
Brain size increase



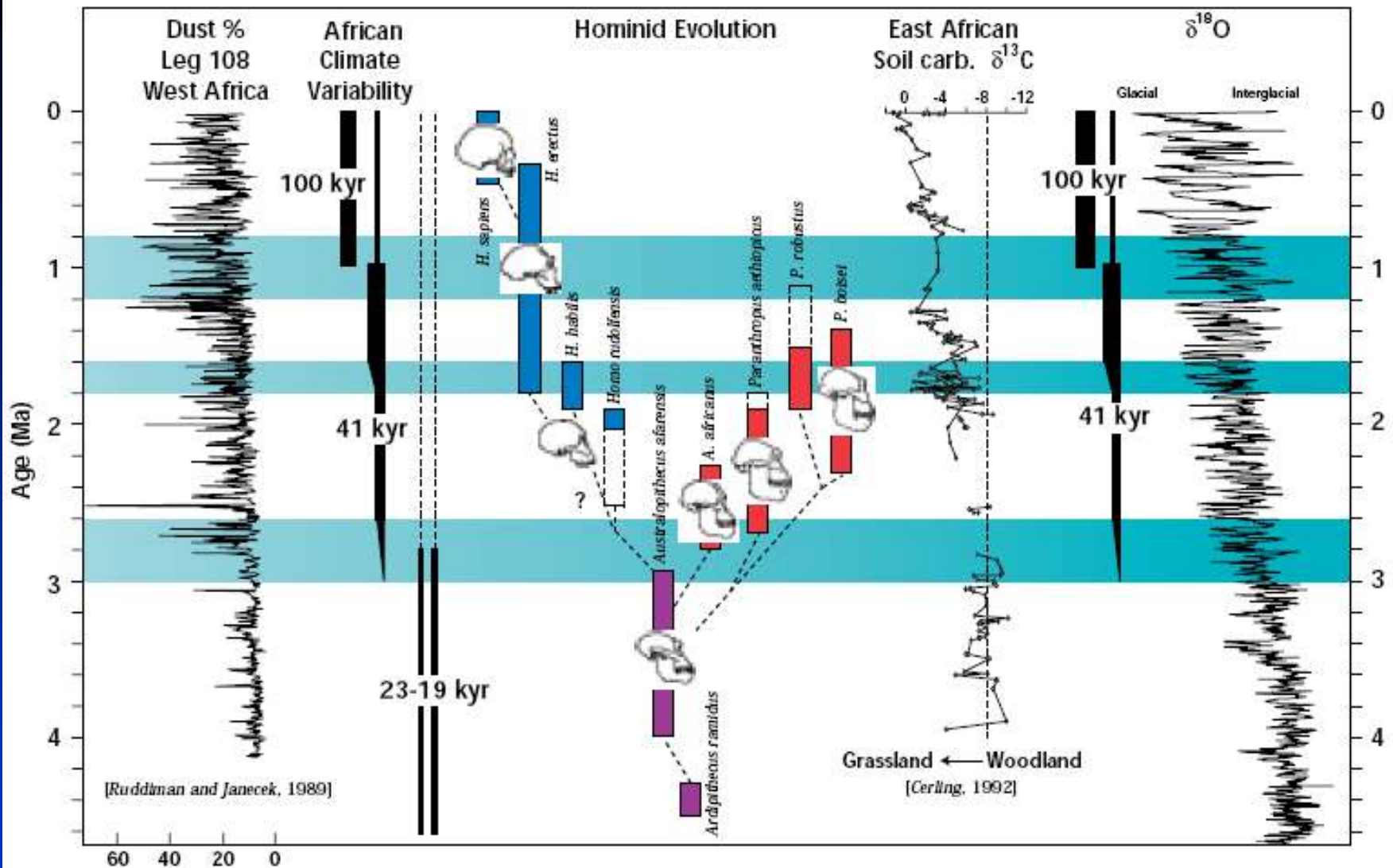
Social brains?



- Mammals
- Primates
- Great Apes
- Mankind



Did increasing African aridity drive Pliocene radiations?





**Foraging change
Dietary change
Technology?**

**Increased body
& brain size**



**Increased range/
dispersal potential**


**Ecological
change**

**Declining 1° productivity
Changing resource
distribution**



Early humans 1.5-1.8 Ma: Out of Africa 1

Homo erectus



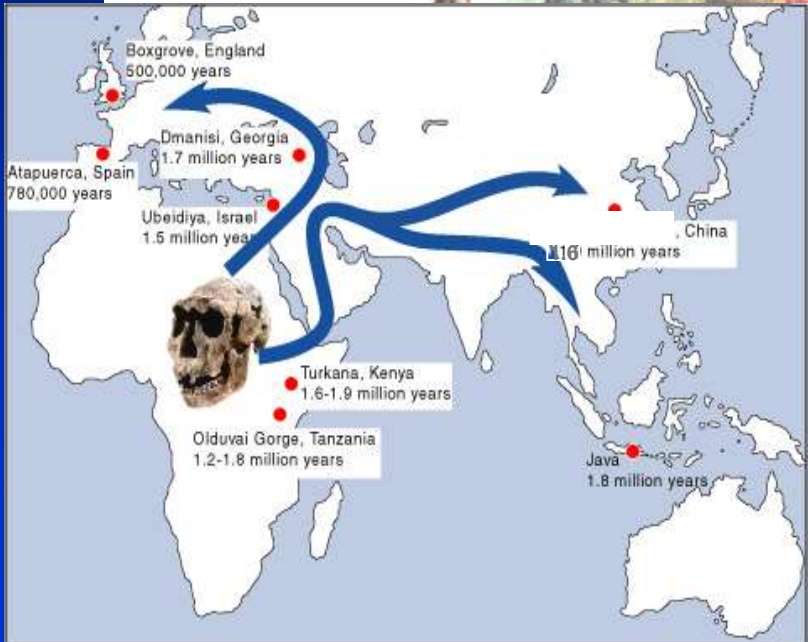
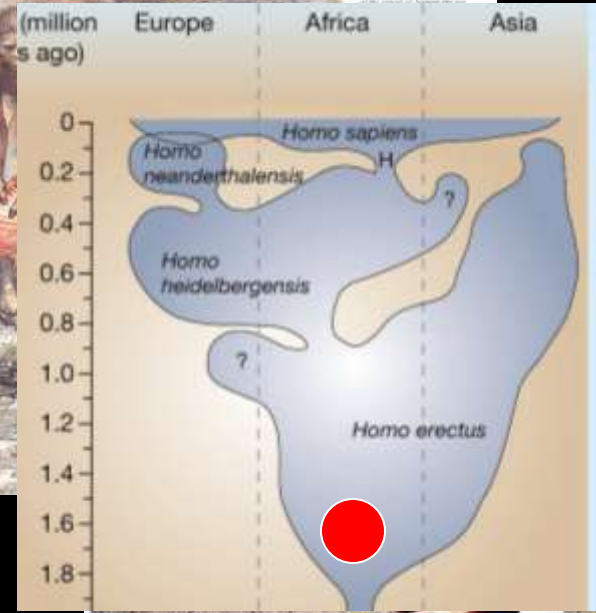
During the 19th century, a German biologist called Ernst Haeckel developed a series of hypothetical stages in human evolution. Based on his belief that the gibbon represented the closest living approximation to the ancient ape ancestor, Haeckel believed that Haeckel was wrong, and Asia, rather than Africa, was our ancestral homeland. He created one of the hypothetical pre-human stages (Pithecanthropus alalus (Ape man without speech), and argued that it would have lived in Southeast Asia. In 1865 a young Dutch doctor called Eugene Dubois decided to prove Haeckel right by finding actual evidence of the Pithecanthropus. He discovered a jawbone on an island closer to the island of Java in the Dutch East Indies, and subsequently within two years, he had found fossil evidence of a population stage in human evolution. His discovery included a thick, long and low skull cap, with a large brow ridge, and a very human-looking thigh bone. Accordingly, following Haeckel, he named his find 'Pithecanthropus', but gave it a different species name because of the upright posture he inferred from the femur — Erectus! He now knows this species as *Homo erectus* (Erect man), because it is generally recognized that it is indeed human.

Java and China
By 1936 more than 2000 remains of this species had been found in Java, and in new regions such as China. There, the site of Zhoukoudian, near Beijing, produced numerous erectus fossils which were initially assigned to 'Sinanthropus pekinensis' (Chinese man of Peking), but which were later associated with the fossils of Java Man in the accompanying *Homo erectus*. The characteristics of this species were now clear. The skull was relatively

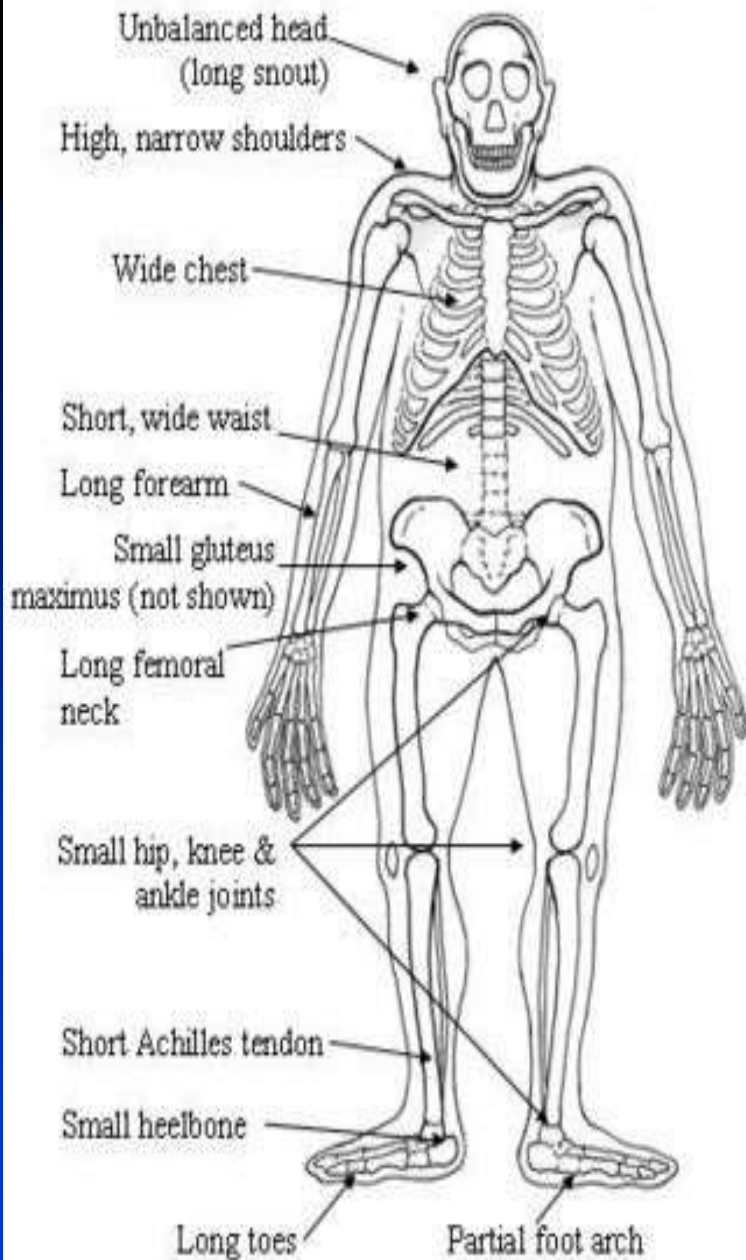
It has been theorized that Java Man might represent an early form of *Homo erectus* and is also assigned to *Homo erectus* and the more recent Haeckel and Haeckel's interpretation of Haeckel's theory.

It has been theorized that Java Man might represent an early form of *Homo erectus* and is also assigned to *Homo erectus* and the more recent Haeckel and Haeckel's interpretation of Haeckel's theory.

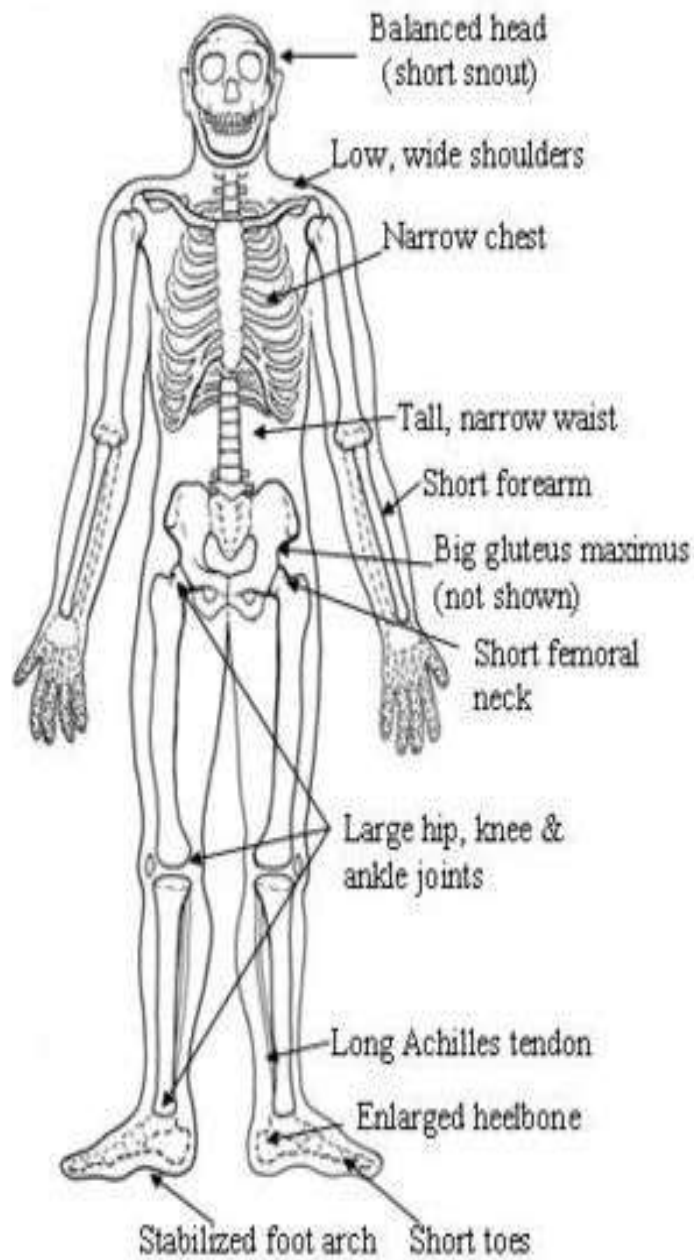
It has been theorized that Java Man might represent an early form of *Homo erectus* and is also assigned to *Homo erectus* and the more recent Haeckel and Haeckel's interpretation of Haeckel's theory.



Australopithecus afarensis
(walker & tree climber)

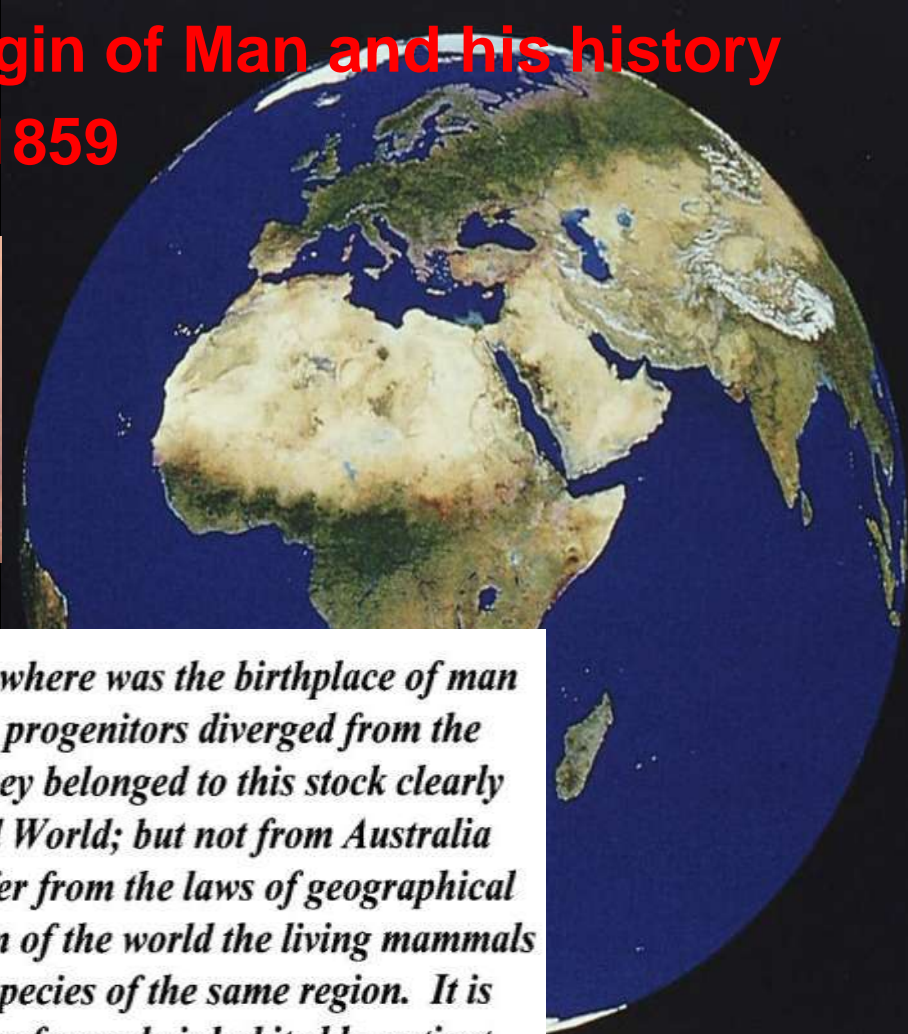
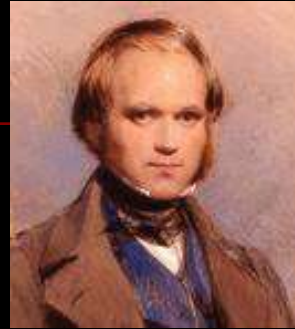
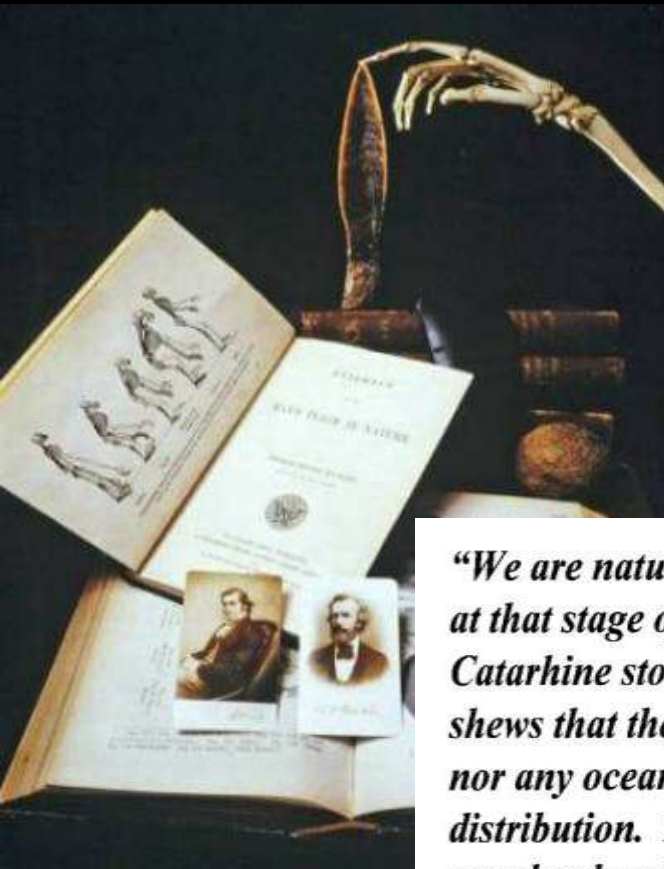


Homo erectus
(walker & endurance runner)



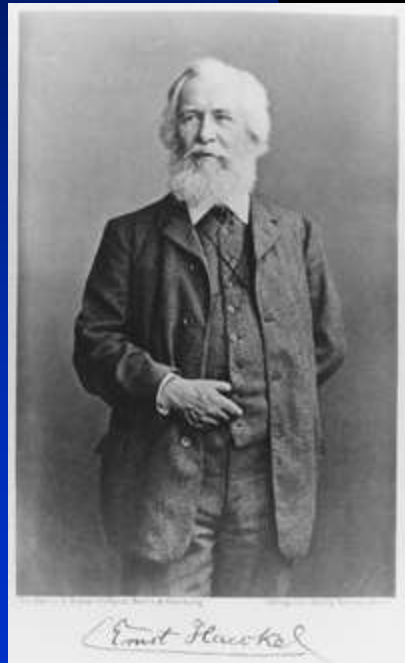
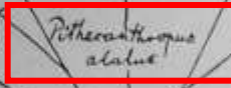
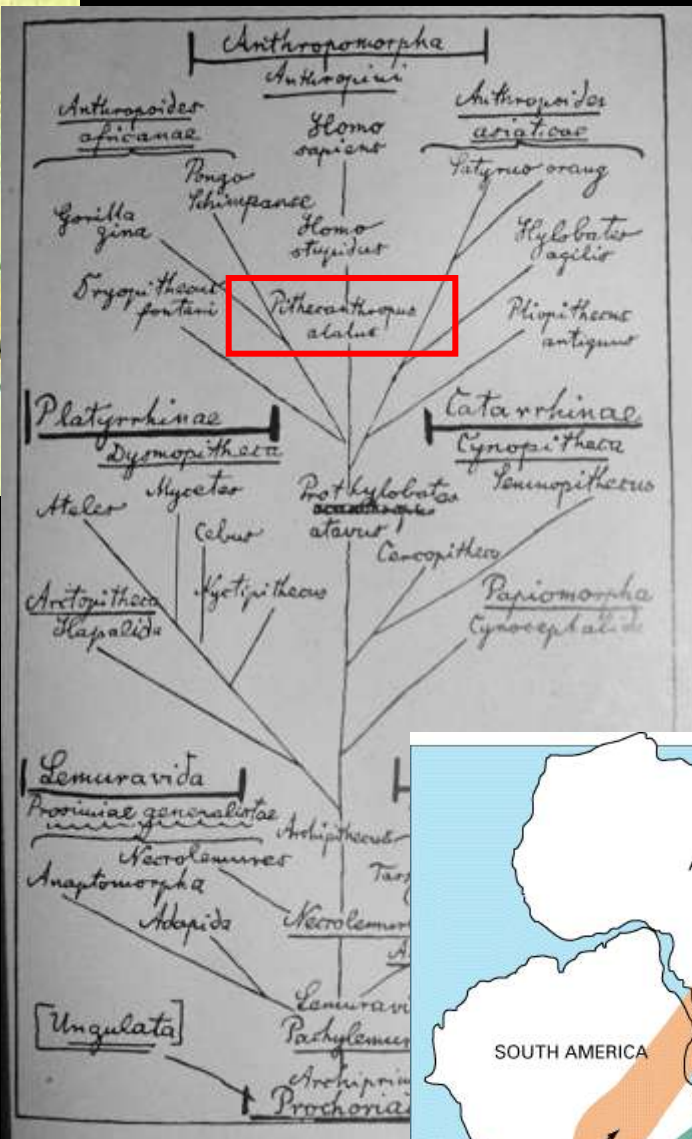
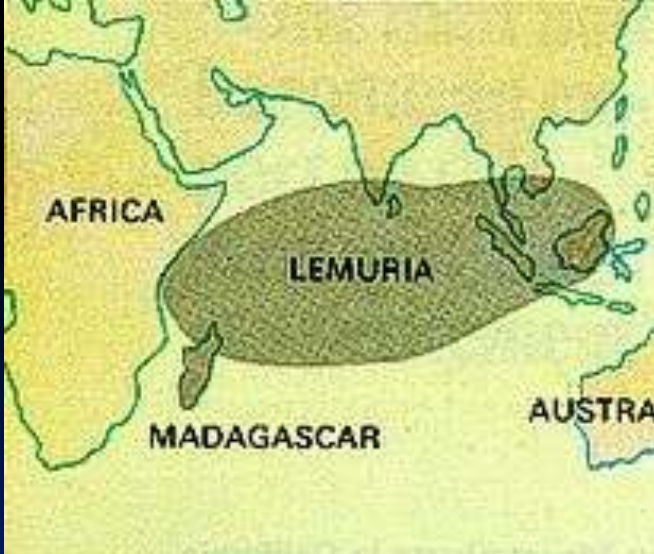
Light will be thrown on the origin of Man and his history

Darwin 1859

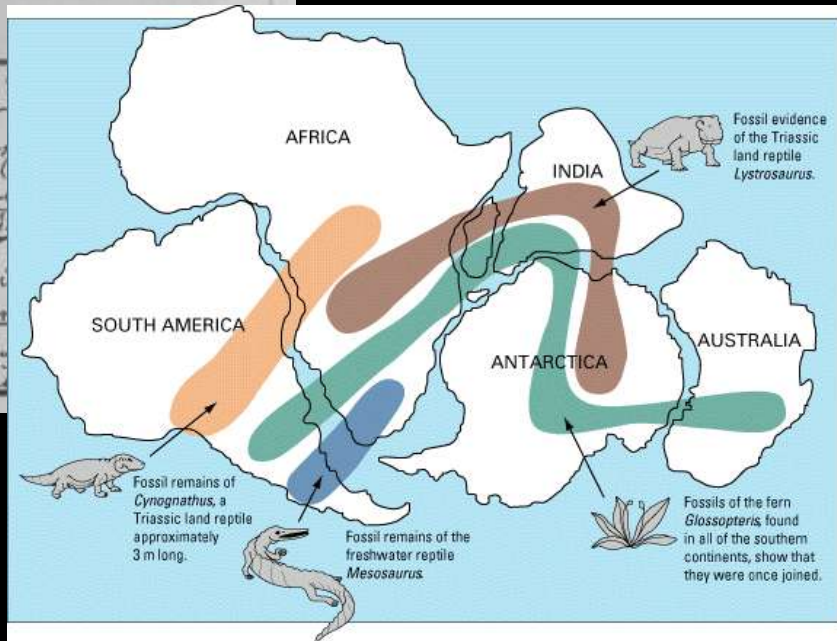


"We are naturally led to enquire where was the birthplace of man at that stage of descent when our progenitors diverged from the Catarhine stock. The fact that they belonged to this stock clearly shews that they inhabited the Old World; but not from Australia nor any oceanic island, as we infer from the laws of geographical distribution. In each great region of the world the living mammals are closely related to the extinct species of the same region. It is therefore probable that Africa was formerly inhabited by extinct apes closely allied to the gorilla and chimpanzee; and as these two species are now man's nearest allies, it is somewhat more probable that our early progenitors lived on the African continent than elsewhere. "

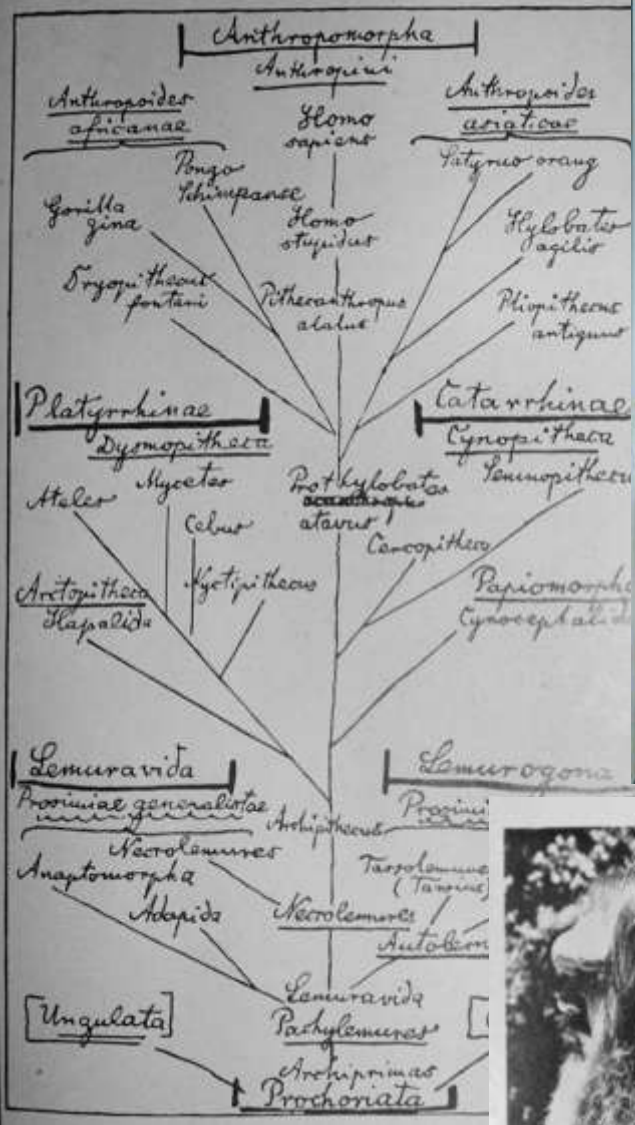
Descent of Man 1871 p. 199.



Ernst Haeckel (1834-1819)



Homo erectus



CRANIAL HAIR AND BROWRIDGES Grover S. Krantz

EARLY HOMO

Homo habilis

Homo erectus



Shorter Braincase
Larger Temporal Fossa
Longer Face



Long, Low Braincase
Smaller Temporal Fossa
Shorter Face



No Keel
Smaller Nose



Sagittal Keel
Larger Nose



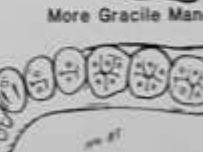
Smaller Brain
Torus



Bigger Brain
Occipital Torus



More Robust Mandible



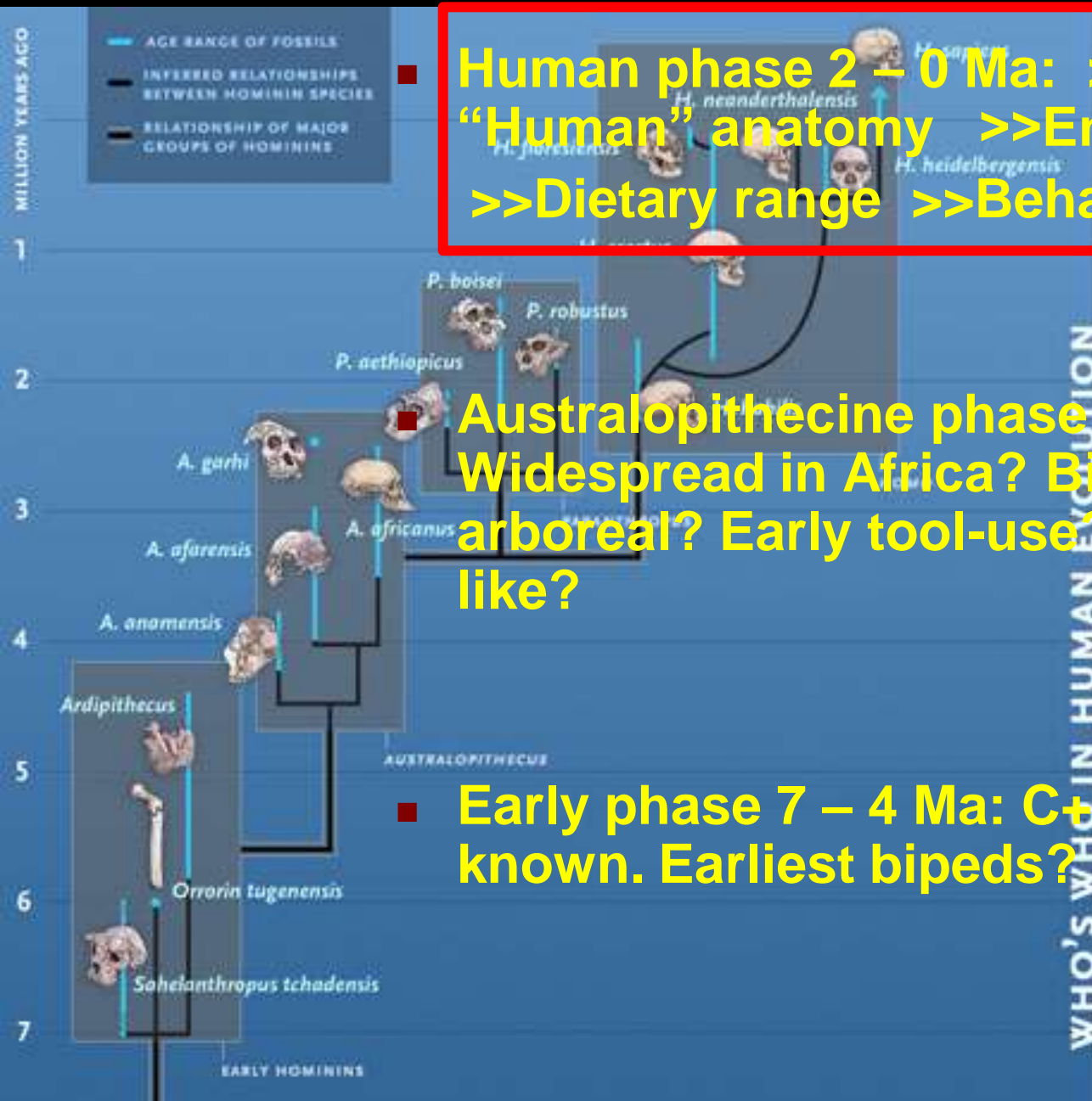
More Gracile Mandible

More Premolars and Molars

Smaller Premolars and Molars

FIGURE 17.15 Cranial and dental characteristics of *Homo habilis* and *Homo erectus*.

“Phases” of human evolution



■ Human phase 2 – 0 Ma: >>Global spread
“Human” anatomy >>Encephalised
>>Dietary range >>Behavioural complexity

■ Australopithecine phase 4 – 2 Ma:
Widespread in Africa? Bipedal but still partly
arboreal? Early tool-use? Predom. still ape-
like?

■ Early phase 7 – 4 Ma: C + E. Africa. Still poorly
known. Earliest bipeds? Largely ape-like?



Dmanisi, Georgia ~1.8 Ma

The first explorers?

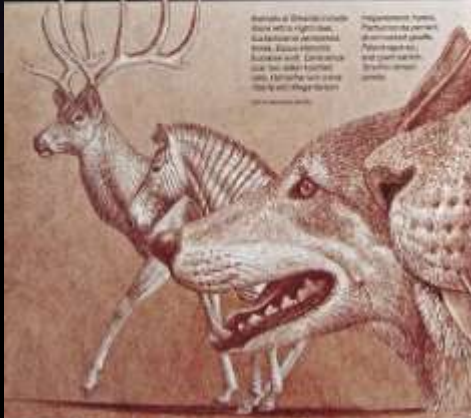
Always a crossroads, the village of Dmanisi (above) once overlooked the old Silk Road through the Caucasus region. Nearly 1.8 million years ago the site lay on a peninsula between the Black and Caspian Seas (map, right), along one of several land corridors into Eurasia. Humans could have moved out of Africa—and back into it—in multiple waves, reaching Java by at least 1.6 million

years ago. By one million years ago, *Homo* had spread across Eurasia, leaving bones and tools in its wake.



The emigrants

Humans weren't the only emigrants leaving Africa 1.75 million years ago. Hundreds of animal bones have been unearthed at Dmanisi, including stone tools, and 10 percent of them are African species. The first signs of emigration—beating machines (see here, far left) and stone-made grinders (see here, left)—are made up of species that scientists consider adaptable and opportunistic. They eat Cerealia such as wheat, millet, rice, and other grains, as well as other plants, which they'll eat in one of the human diets (left). Cats were a menace, but they may have scavenged human things, including and wrapping trash found here may have been used for scavenging the scraps that cats liked.



of the world's great food battles in that decade the same intercontinental battle took place, and mankind—they wanted to be there, too—along with thousands of other species such as weasels, the bear, and a mammoth 1.8 and 1.7 million years ago, the same landscape of human emigration. These dates are far beyond a typical scientific controversy. In the early 1990s, most scientists thought Homo erectus had departed Africa a million years ago. Then, in 1994, while visiting another dig in western Georgia, they got a call on the cell phone from Dmanisi. Another skull was coming out of the earth. They rushed back. The skull is now held in the Dmanisi collection.

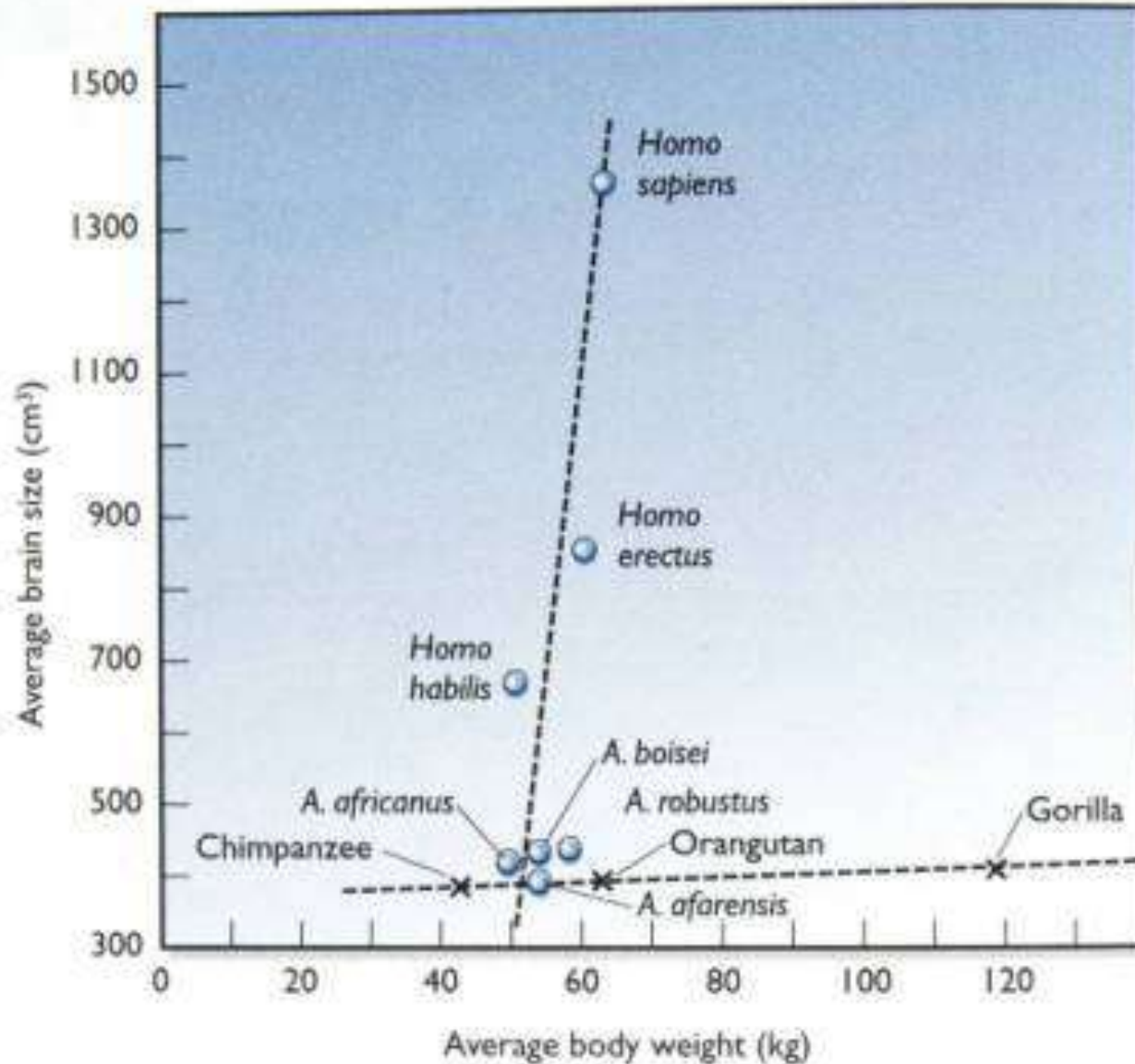
Usually fossil skulls are crushed African fossilized vegetation, but this one looked different. At one point, it was a skull, but it was a 200,000-year-old skull. Had it been a Homo erectus? Knowledge around the world. It didn't have tracks of a man, and it had those narrow, hollowed-out eye sockets. And the brain case was the size of an average three-toed sloth. It looks like a mixture of neanderthal, so scientists have long believed that the fossil from Georgia probably wasn't really so new as a typical Homo erectus.

Could it be that the first human intercontinental traveler wasn't a classic *Homo erectus*?

So that the new skull had the oblique face of Homo erectus, a small braincase with long, dangling ears, and a small primitive brain case 2.1 million years ago. The implications left here.



Brain size increase



Debate about the earliest human dispersals from Africa

An Asian perspective on early human dispersal from Africa

Robin Dennell & Wil Roebroeks 2005

Nature 438: 1099-1104

...it is time to develop alternatives to one of palaeoanthropology's most basic paradigms: 'Out of Africa 1'.



Flores



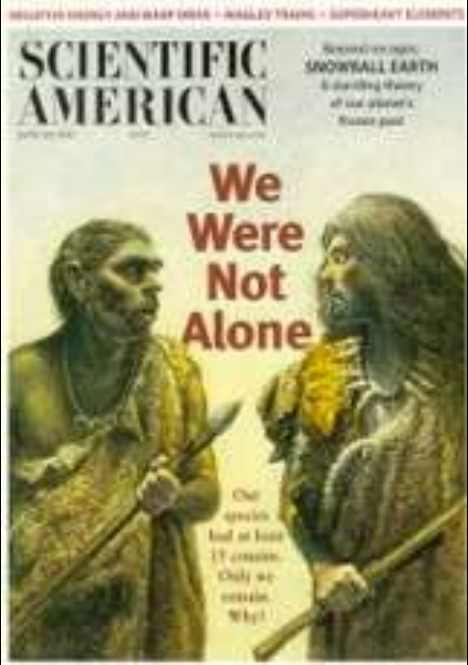
Dmanisi

SEEING A RANGE OF BONES IS HELPING SCIENTISTS FIT DMANISI INTO OUR EVOLUTIONARY JOURNEY.

Contingency (chance events)



The Game of Life — a game of chance?



Homo floresiensis



The skull of *Homo floresiensis*, believed to be a distinct species.

It is usually assumed that only one species of early human — *Homo erectus* — lived in Southeast Asia before modern people arrived there. Furthermore, up to now, *Homo erectus* fossils have only been identified in the region from the island of Java, in Indonesia. East of Java, towards New Guinea and Australia, it was thought that deep water had kept people from venturing any further until the ancestors of Australian Aboriginals used boats to try across the intervening chain of islands, some 60,000 years ago. This simple picture was challenged when it was reported a few years ago that 80,000-year-old stone tools had been found on the island of Flores, some 200 miles east of Java, but most experts assumed more evidence to back up the claim that ancient humans had migrated that far.

That evidence has now turned up in an extraordinary discovery from Flores. The skeleton (including a well-preserved skull of a seven-foot-tall "hominid" with a brain size of about 380 ml) about the same as that of a chimpanzee) has been excavated from the Liang Bua cave, together with stone tools, and remains of a pygmy form of an extinct

elephant called *Stegodon*. There are also bones of smaller animals, some of which have been burnt. Remarkably, the level in which the skeleton was found has been dated to only about 18,000 years ago, so modern people must have actually encountered this strange creature. What was, what was going on in Flores, and what happened to it?

Naming the new species
The Flores find is so unexpected that deciding what kind of creature it represents is not easy. The possibility that it was a single abnormal individual can be discounted because other similar remains have already been found in the cave. Although the top and hipbone suggest that it walked upright in a fundamentally human manner, as details of shape as well as size, the hipbone resembles those of the primitive australopithecines, who lived in Africa over 2 million years ago. Together with the very small brain size, this might suggest that this is actually some kind of australopithecine that migrated out of Africa long before the arrival of *Homo erectus*. Yet details of the skull, the shape of the face, the small teeth, the evidence of tool making and, perhaps, hunting, all suggest that the creature was fundamentally human. Thus the discoverers of the skeleton have named a new human species *Homo floresiensis* ("Man from Flores"), after its island home. They suggest it might be a descendant of *Homo erectus* that arrived early on Flores, perhaps using boats, and under completely unknown conditions evolved a very small size — a phenomenon known from other mammals, called island dwarfing. Alternatively, the dwarfing process would have occurred along the route to Flores, on one of the islands nearer to Java, such as Lombok or Sumbawa. As the skeletal remains are hardly fossilized, there is the possibility that DNA can be extracted from them, which could provide valuable insights into our relationship with both *Homo floresiensis* and its presumed ancestor *Homo erectus*.



It is also possible that DNA might be extracted from the few well-preserved, finger nail droppings and, if it survives, accurate.

Questions for future research
The remarkable discovery raises many questions for future research. One of these is how *Homo floresiensis* got to Flores. Could it have crossed really high-level waterfalls perhaps of bamboo to reach the island? This would certainly be surprising, because such behavior is thought to be exclusive to *Homo sapiens*. But the alternative — a short-lived land bridge that allowed very few species to cross, or accidental transport on natural rafts of vegetation — seems more reasonable.

A second question concerns the behavioral evidence from the Liang Bua cave. Some of the excavated stone tools are small and sophisticated, and there is evidence of the use of fire, and possible predation on young *Stegodon*. Was *Homo floresiensis*, with its specialized brain, really capable of such behavior? The answer to that question may only come from further excavations to evaluate the possibility that early modern humans also made sites on Flores, or later after 40,000 years ago, and could be responsible for some of the archaeological evidence left behind.

A third and especially intriguing question is: what happened to *Homo floresiensis*. Climate changes at the end of the Pleistocene may have affected its habitat, or modern humans might have killed it off directly or by outcompeting the resources on which it lived. There is also evidence of a massive volcanic eruption which devastated Flores about 23,000 years ago. However, there is the fascinating possibility that it was species like it (hominid) and fauna ancestor of the widespread legends of "wild men" living in the jungles of Southeast Asia. Whatever the truth, the very existence shows how little we still really know about human evolution in Asia.

Excavations at the site of the Liang Bua cave, Flores, Indonesia. The site is believed to be the home of *Homo floresiensis*. The skull of *Homo floresiensis* was found in the deep excavation area on the left against the cave wall. Excavation site on the right. Photo by © 2007, which means that early Homo, multiple instances of different skulls and hand tools had to be used.





The "Hobbit": *Homo floresiensis*



elephant, called *Stegodon*. There are also bones of smaller animals, some of which have been found

It is also possible that DNA might be recovered from the cave sediments, preserved droppings and, if it

might have been seen standing near the last known date of the site is the *Stegodon* species of elephant around 10,000 years ago in the island, as it is also linked to the *Megaceros*, if it could be extracted.

has been in progress in Liang Bua cave. The last bit of *Homo floresiensis* evidence in the dry weather area in the area of the cave wall, which was once a wall of 11 in 2010, which was then shown, also pictures of different this and last have had to



NATURE NOW

Nasty hobbits
(Homo britannicus)
 Bushman bones have been discovered, scientists reveal this week, shedding new light on the history of humankind. Evolving in dwarf form because of his isolated island habitat, the hobbit stood 3ft 3ins short and had a brain the size of a walnut. But not quite as tasty.

Fig 1 Teeth, as unearthed

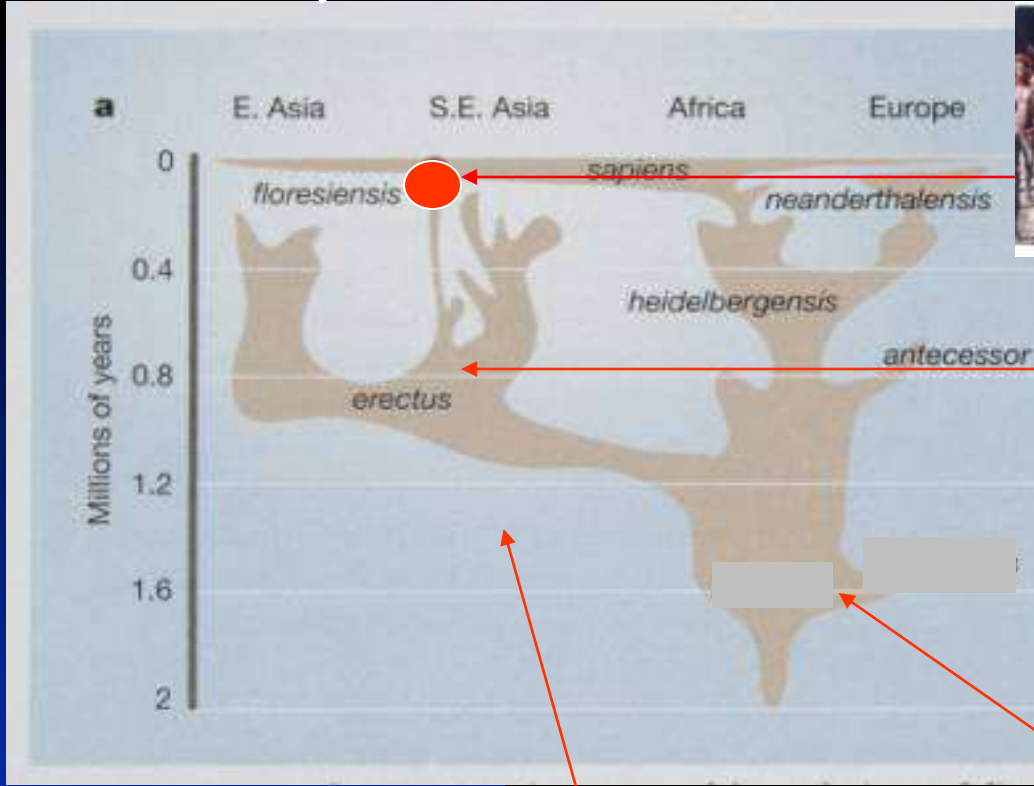
Bushman
Bush
Giant rat

Signed copies of Peter Brinkman's Nature Now FC: The Natural Selection are now available, while stocks last, for £22 (inc £10). Telephone 0870 2500900 or visit www.brinkmanfc.co.uk



Origins and evolution?

Lahr & Foley



Brown

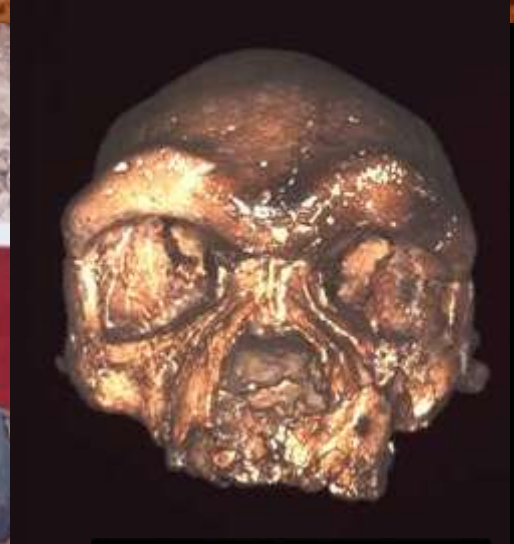


Reader



Dmanisi.org

The Asian story...



Getting to Europe...



© 2005 William Bowen
drwilliambowen@hotmail.com

Evidence of earliest human occurrence in Europe: the site of Pirro Nord (Southern Italy).

1.5
Ma?

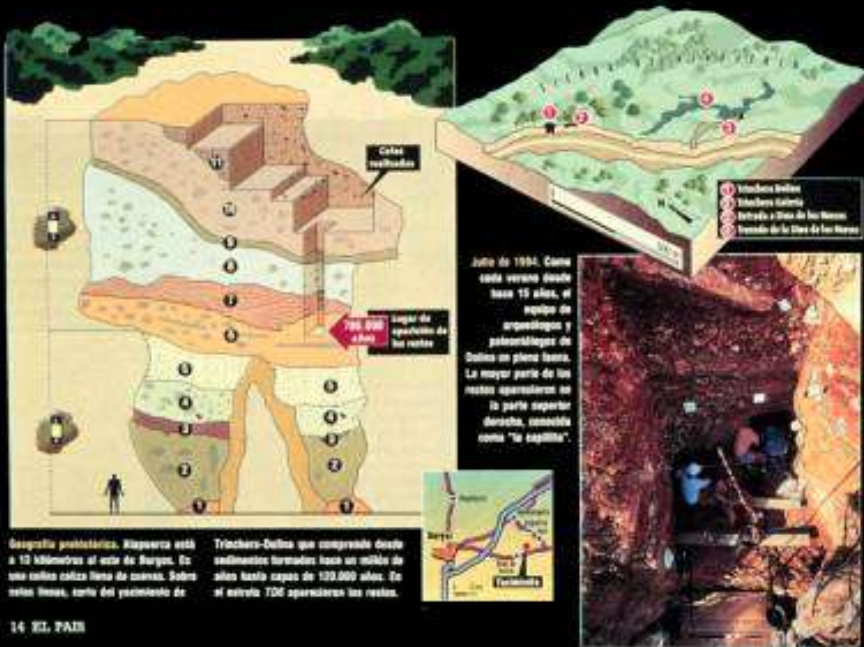
Arzarello M, Marcolini F, Pavia G, Pavia M,
Petronio C, Petrucci M, Rook L, Sardella R.



1.4
Ma?

**1.2 Million year old jawbone
found in Sima del Elefante
Atapuerca, Spain**





Homo antecessor 0.8Ma and possibly 1.2Ma?

Atapuerca Spain: Gran Dolina and Sima del

Elefante



Neanderthals and “Hobbit” extinct
Homo sapiens Out of Africa 2
Homo sapiens in Africa

Early Neanderthals in Europe

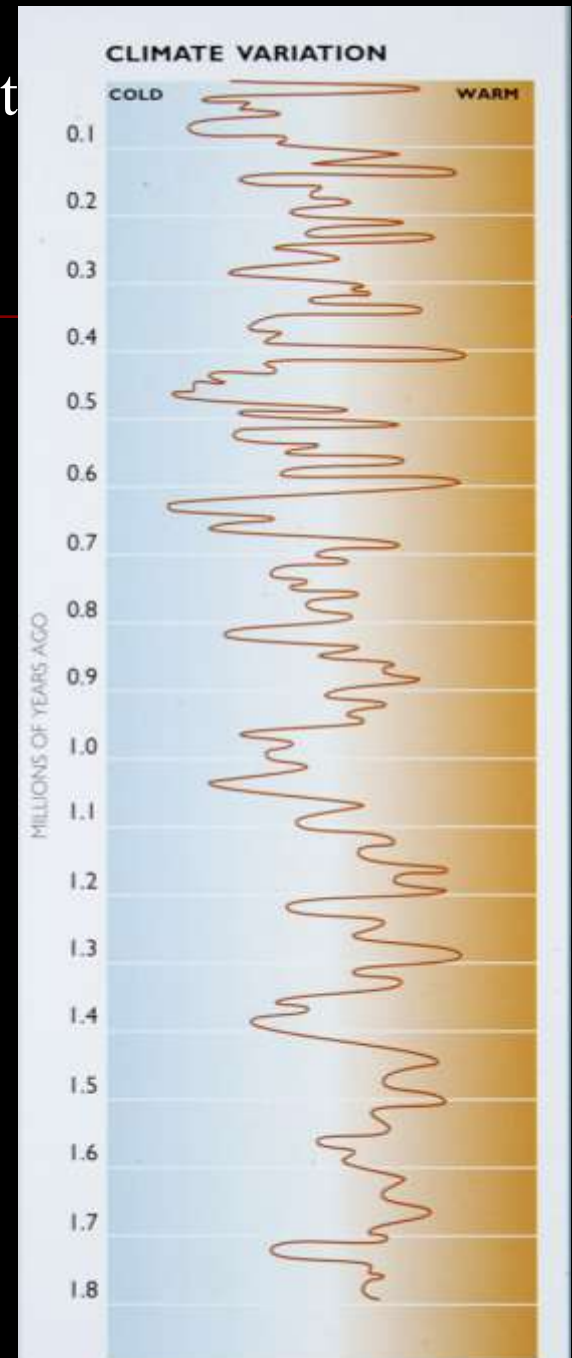
Changes in glacial intensity

First humans in N. Europe/Britain?

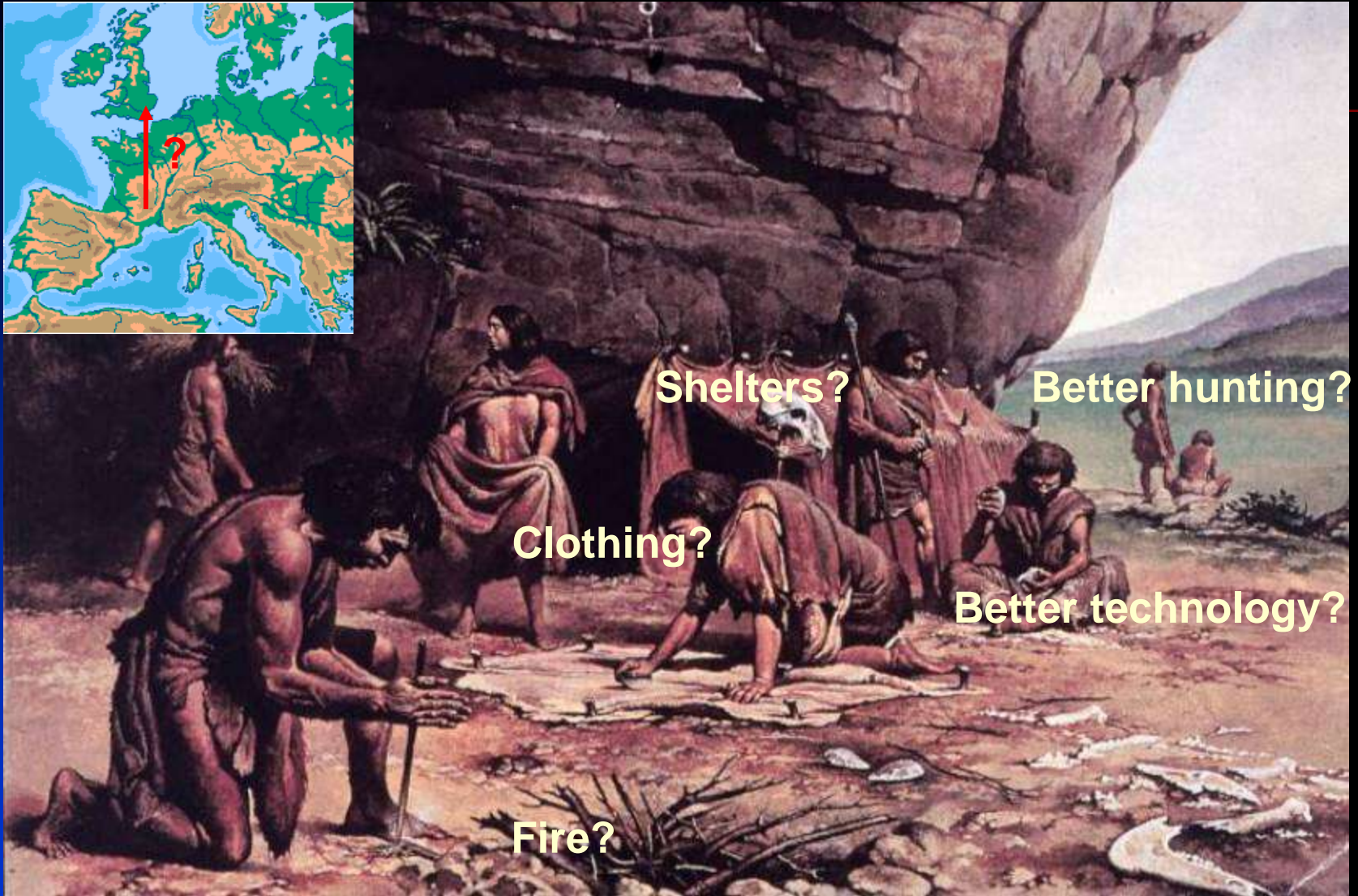
Some “recent” events in human evolution

First humans in S. Europe?

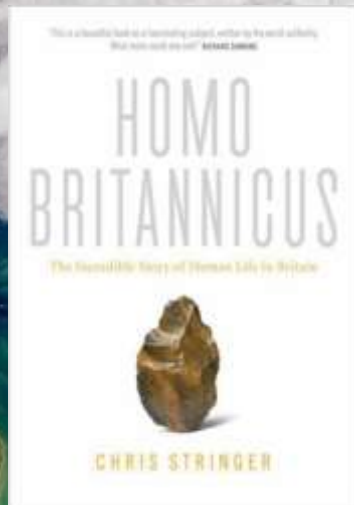
First humans in Far East?
Out of Africa 1?



How and when did people first get to Britain?



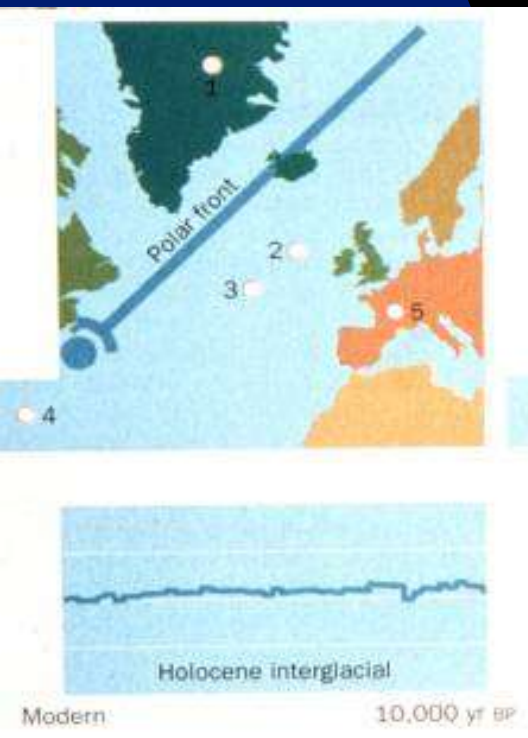
The Ancient Human Occupation of Britain



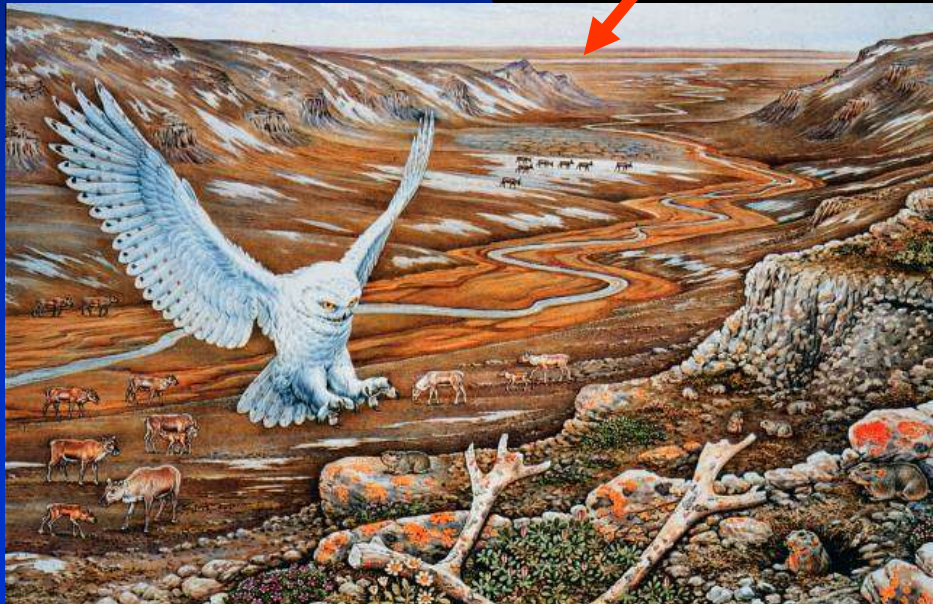
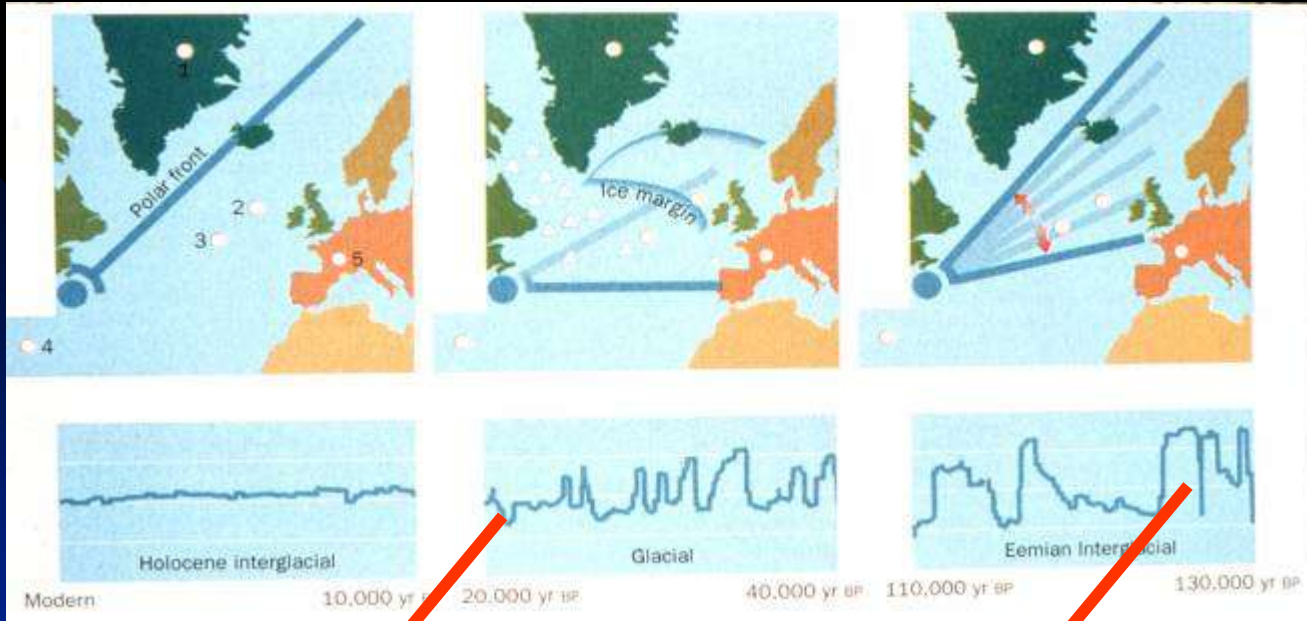
<http://www.ahobproject.org>

- When did people first arrive?
- Who were they?
- How did they get to Britain?
- What environments did they occupy?
- Was occupation continuous?
- When did our real ancestors arrive?
- When did Britain become an island?

An example of severe climate change in Britain: Three Cliffs Bay, Gower, S. Wales



The marginal position and extreme climates of Britain help us to distinguish and sequence events..



Happisburgh, Norfolk

Ostend Channel

Site 4

Site 5 → offshore

Site 2

Site 3 ~840/950ka?

Hill House River
sediments

Site 1



neguarian

July 8th 2010

Meet the Norfolk relatives



Judges: gay refugees must get asylum

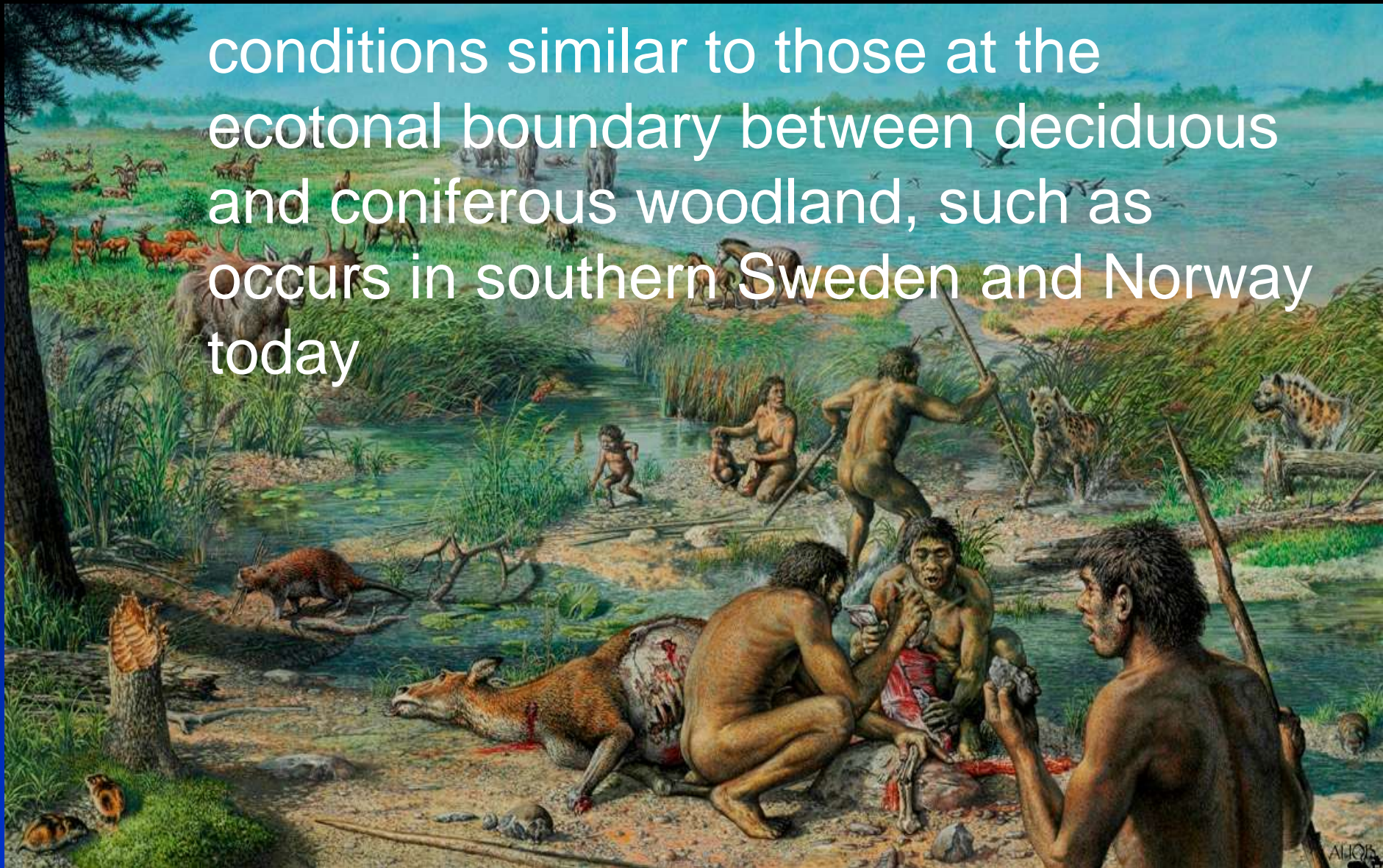
Alan Travis and Afua Hirsch

Supreme court judges yesterday predicted that "more and more" gay and lesbian refugees are likely to seek protection in Britain after a landmark legal ruling recognised the rights of asylum seekers.

Five supreme court justices said gay and lesbian asylum seekers should not be expected to "exercise discretion" in their home countries to avoid persecution. Their ruling met with cheers and applause from campaigners.

But the Home Office moved to dampen claims from anti-immigration groups that the ruling could lead to a massive exodus.

conditions similar to those at the ecotonal boundary between deciduous and coniferous woodland, such as occurs in southern Sweden and Norway today



Homo heidelbergensis
Homo antecessor

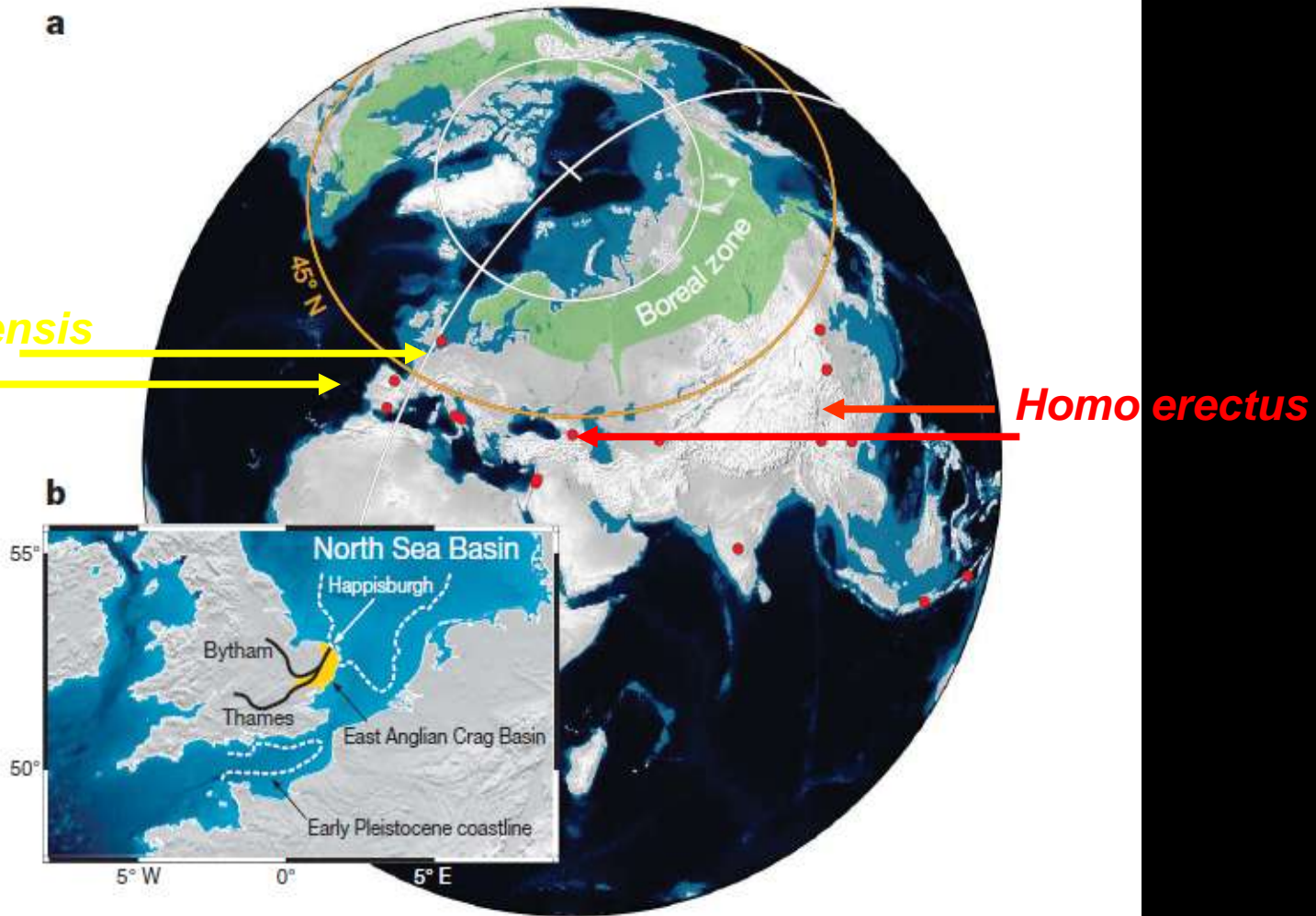
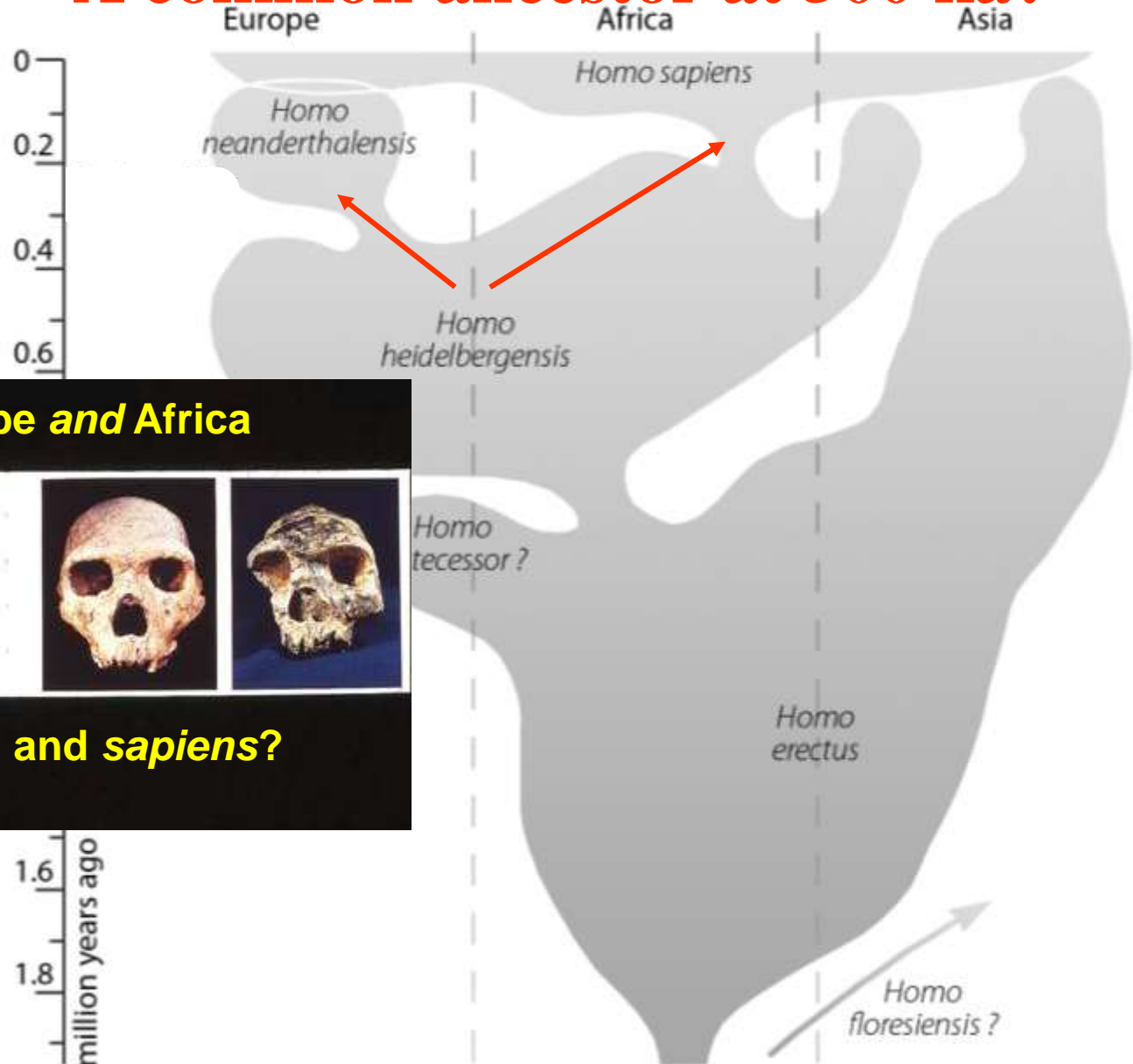


Figure 1 | Location of Habbisburgh and other Early Pleistocene archaeological sites in Eurasia. **a**, Key Early Pleistocene archaeological sites (red dots) in relation to 45° N and the present-day boreal zone. **b**, Reconstruction of the palaeogeography of northwest Europe at the time of the human occupation at Habbisburgh, showing the Thames draining into the North Sea ~150 km to the north of its present-day estuary.

Homo heidelbergensis Mauer ~600ka?



A common ancestor at 500 ka?



H. heid. in Europe and Africa



LCA of Nea. and sapiens?

1.6
1.8
million years ago

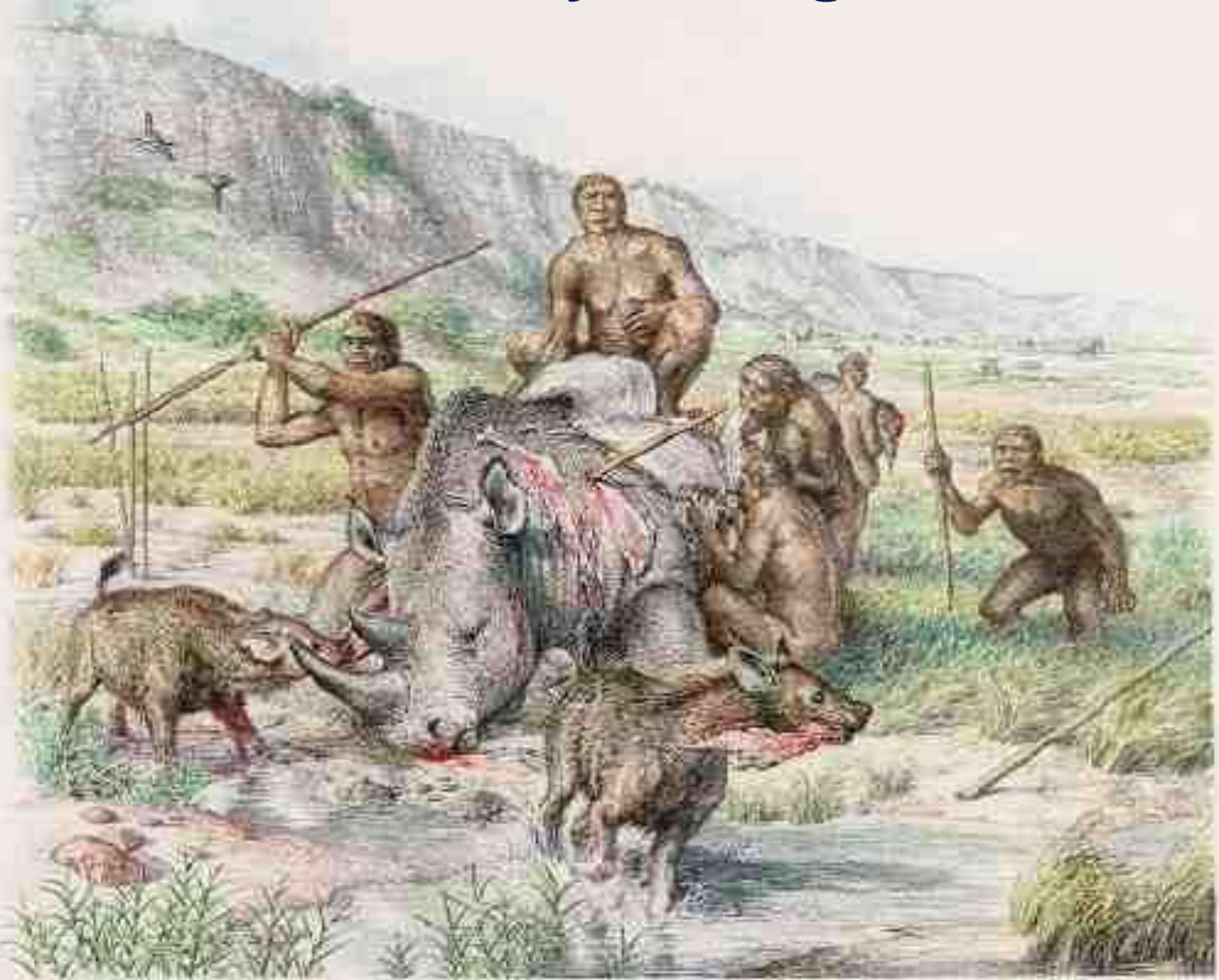
The Boxgrove Quarry



Boxgrove



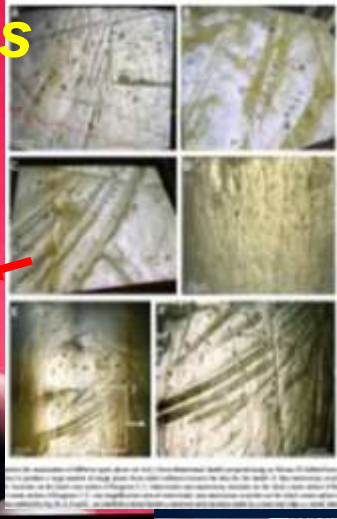
Sussex 500,000 years ago



**Boxgrove
~500ka**

Homo heidelbergensis

Site
(Right) This reconstruction of a male individual from Boxgrove is based on the large



People were also drawn by the presence of flint in the chalk cliffs – an excellent source of raw material from which they could produce the most characteristic stone tool found at Boxgrove – the handaxe, of which over 300 examples have been excavated. Because the hard surfaces at Boxgrove were repeatedly covered over by gently flowing water, covering them with a fine silt, these ancient surfaces have been preserved with only minimal disturbance. The preservation is so good that the exact places where people crouched down to make their stone tools have been preserved, so every flake of flint they struck off is still lying where it fell some half a million years ago. Not only that, but the bones of the animals they ate are also there, surrounded by tools, and often covered in butchery marks.

The handaxes, which are predomi-



The Boxgrove Project

Why does *heidelbergensis* brain size reach the modern range?



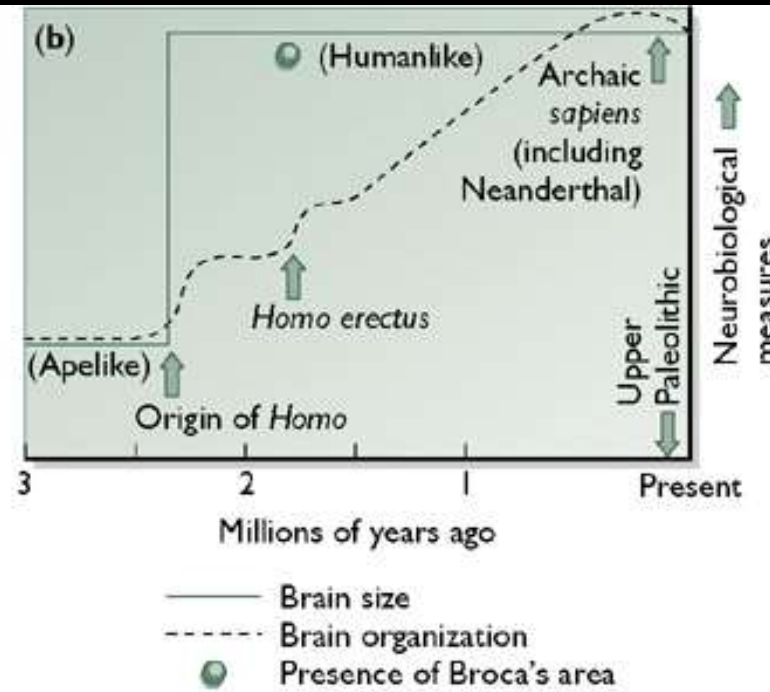
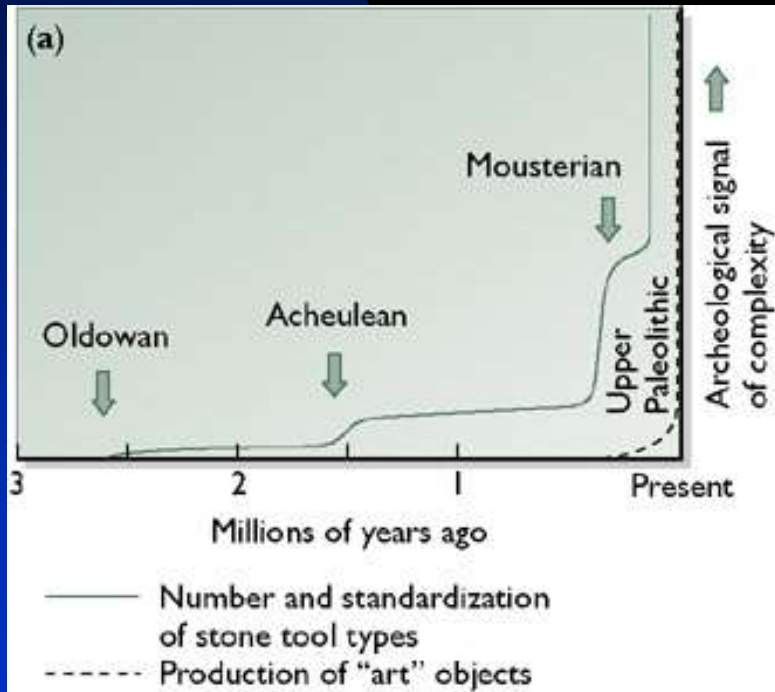
H. erectus (Sangiran)



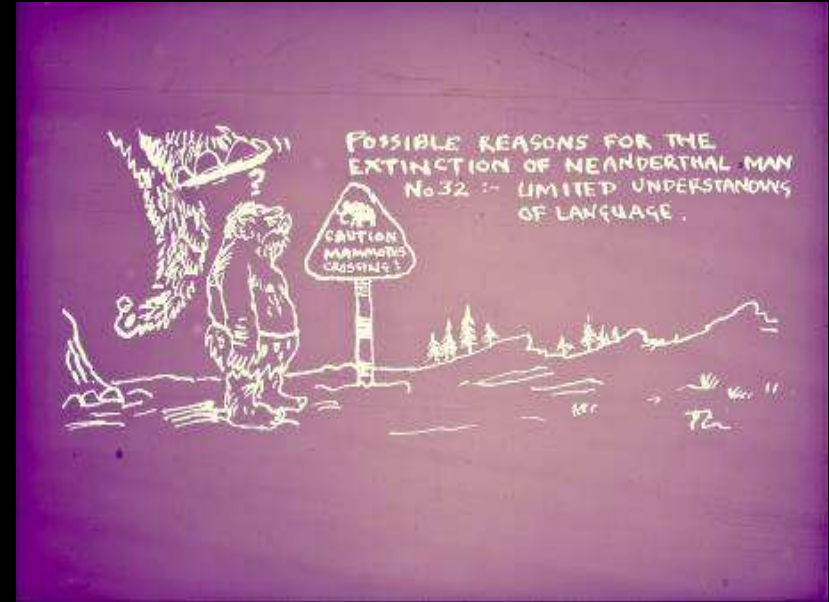
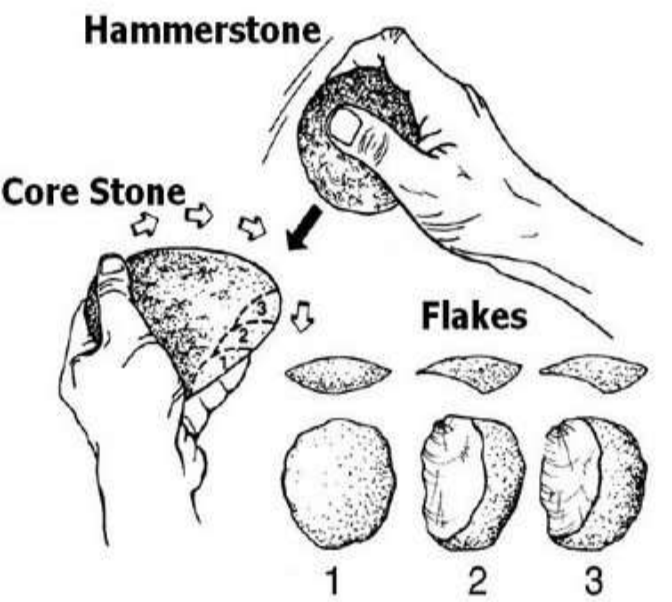
H. heidelbergensis (Broken Hill)

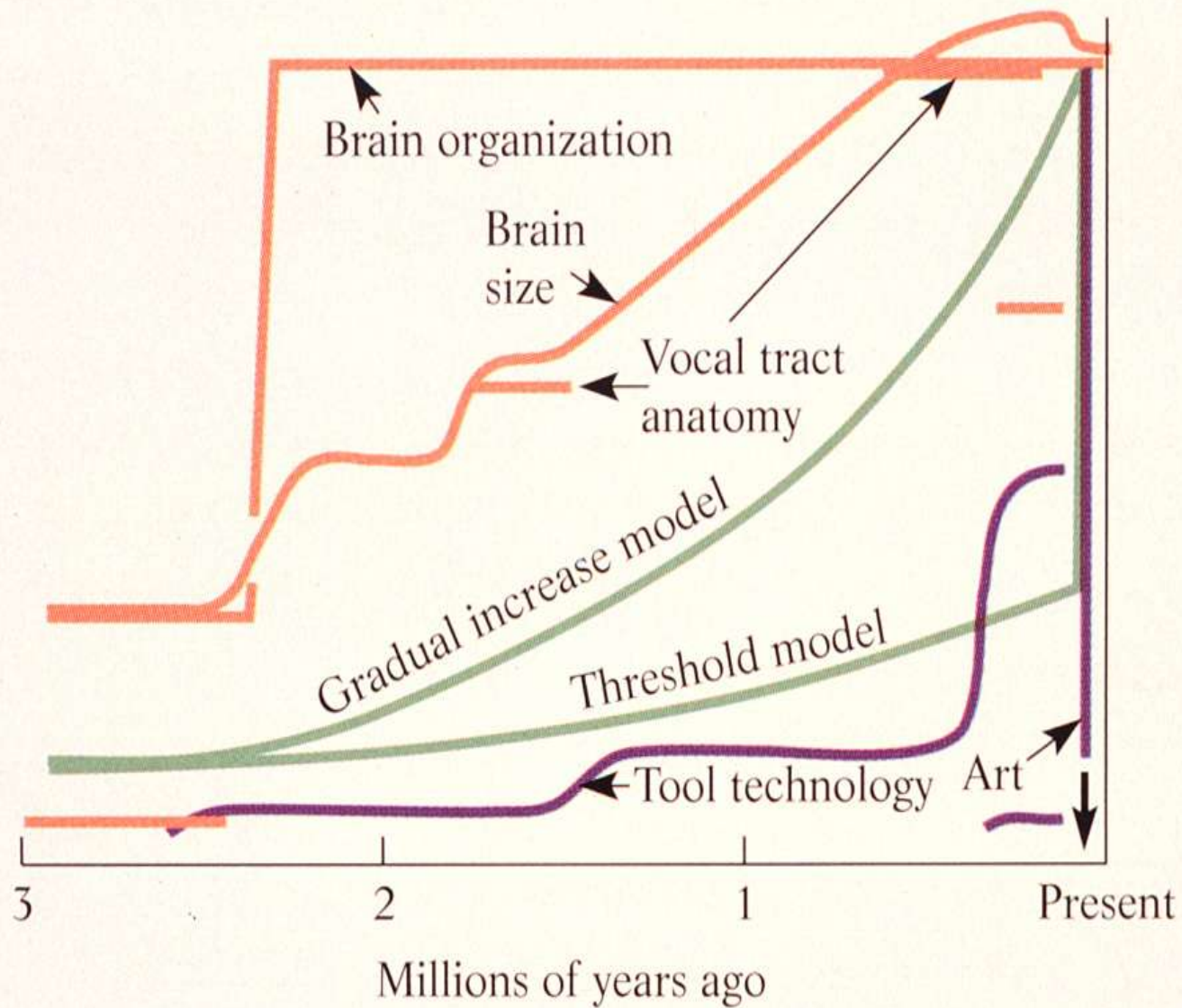
Technology and brain evolution

Archaeology suggests a late “explosion” in behavioural complexity...
...however, brain size shows a steadier increase



Language?





- Models of language emergence
- Archeological evidence
- Paleontological evidence

The Enigma of the Handaxe

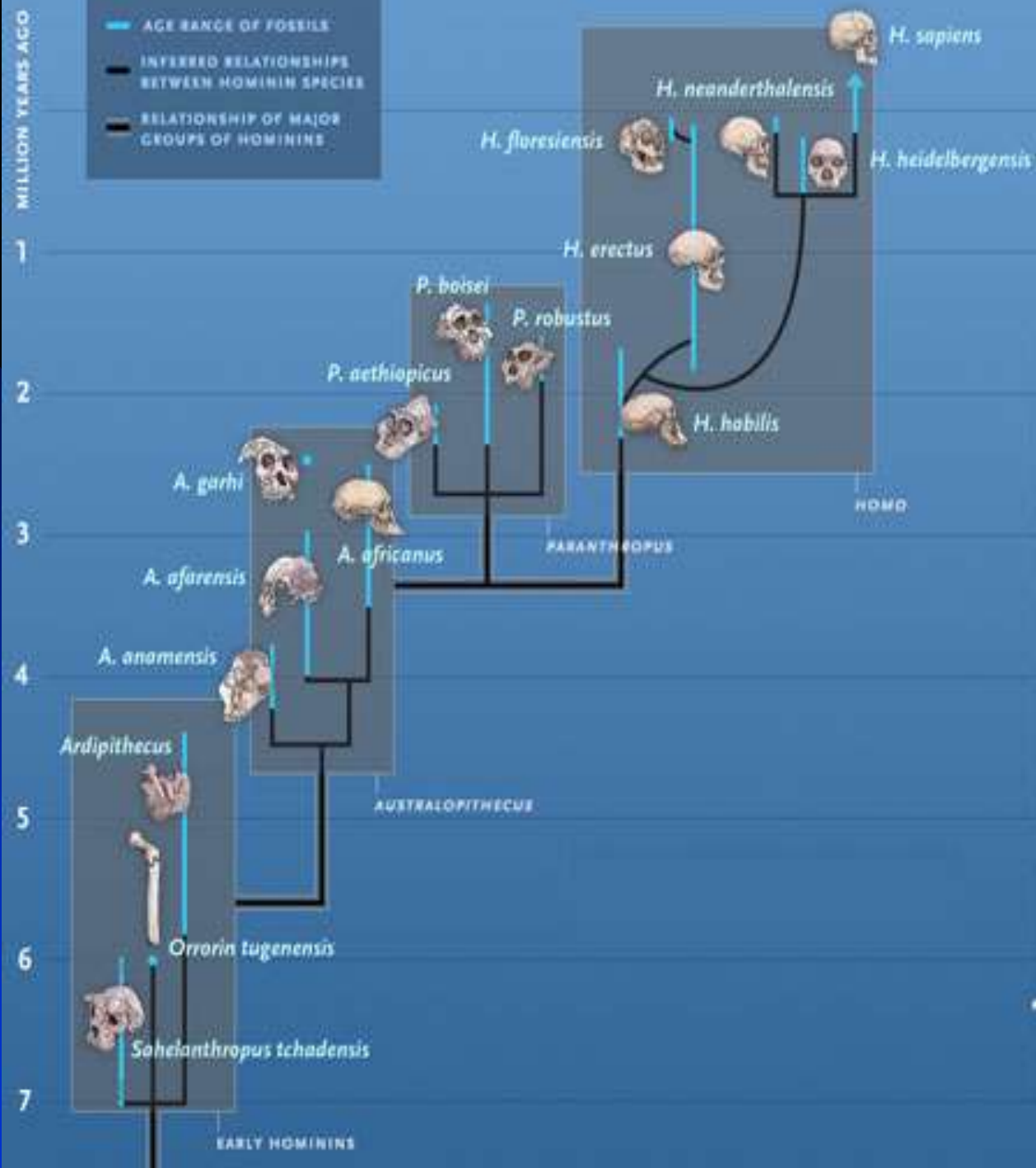
and spears.....



If they were talking to each other, they were saying the same thing, over and over and over...
Desmond Clark

The enigma of Schöningenen





WHO'S WHO IN HUMAN EVOLUTION

Our future is partly up to us....

