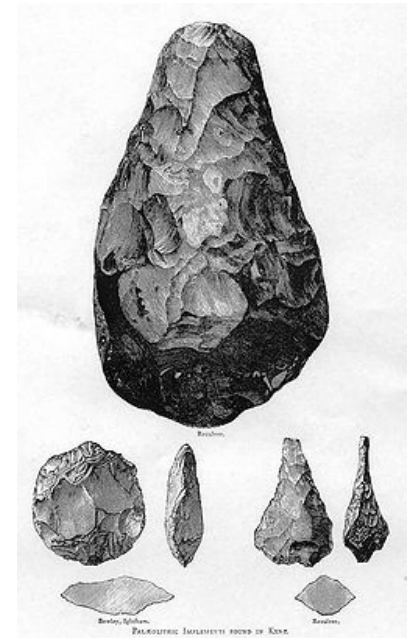




# Bones & Stones: A Preliminary Timeline



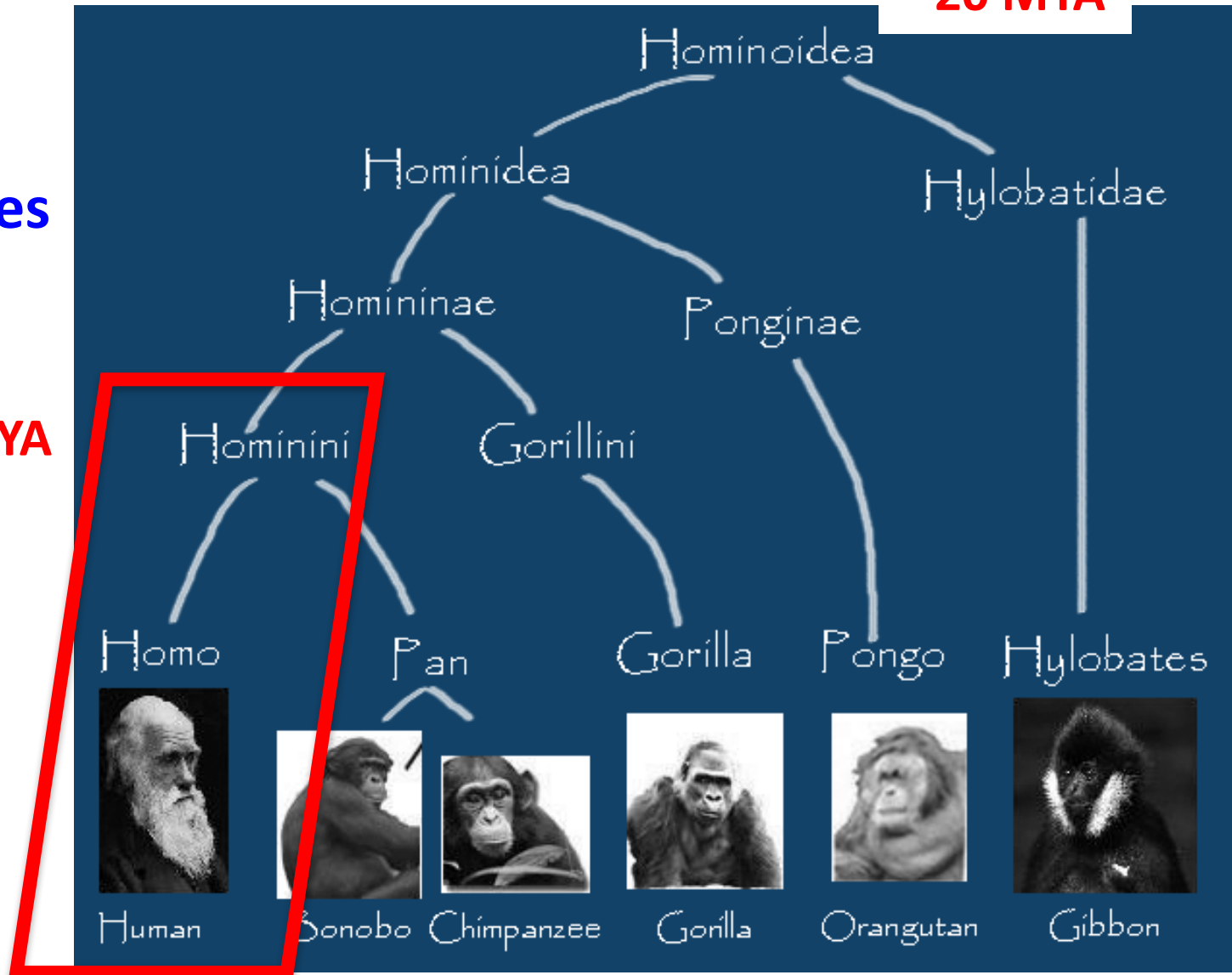
Cogs 184 \* Modeling Cognitive Evolution

# Primate Speciation

~ 20 MYA

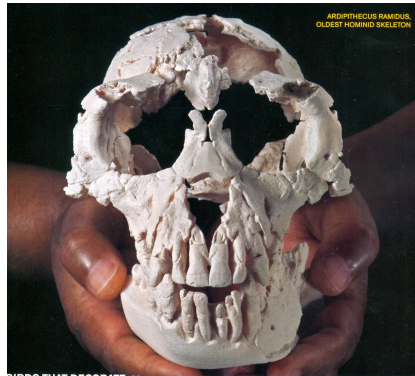
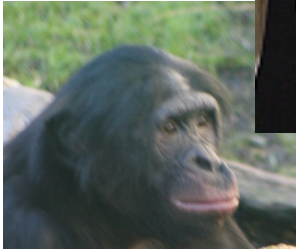
The Apes

5 to 7 MYA



# Hominid Brain Sizes

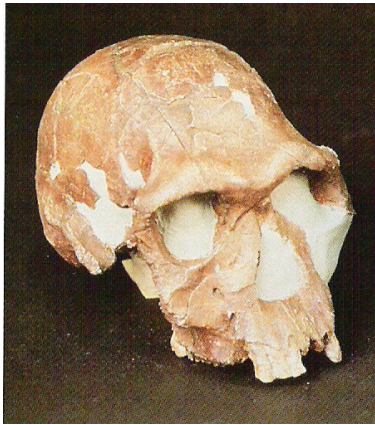
Modern  
Chimp  
360 cc



Ardi 360cc



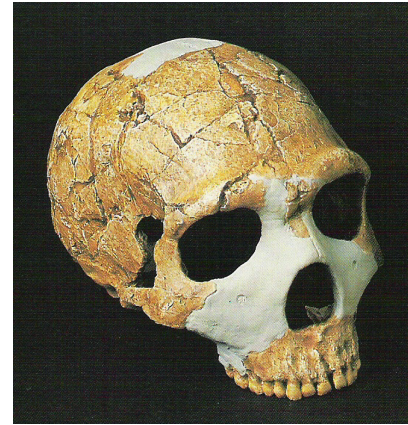
Lucy 400cc



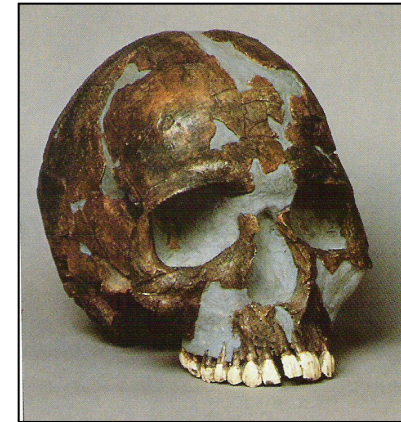
*Homo habilis*  
660 cc



*H. erectus*  
950 cc

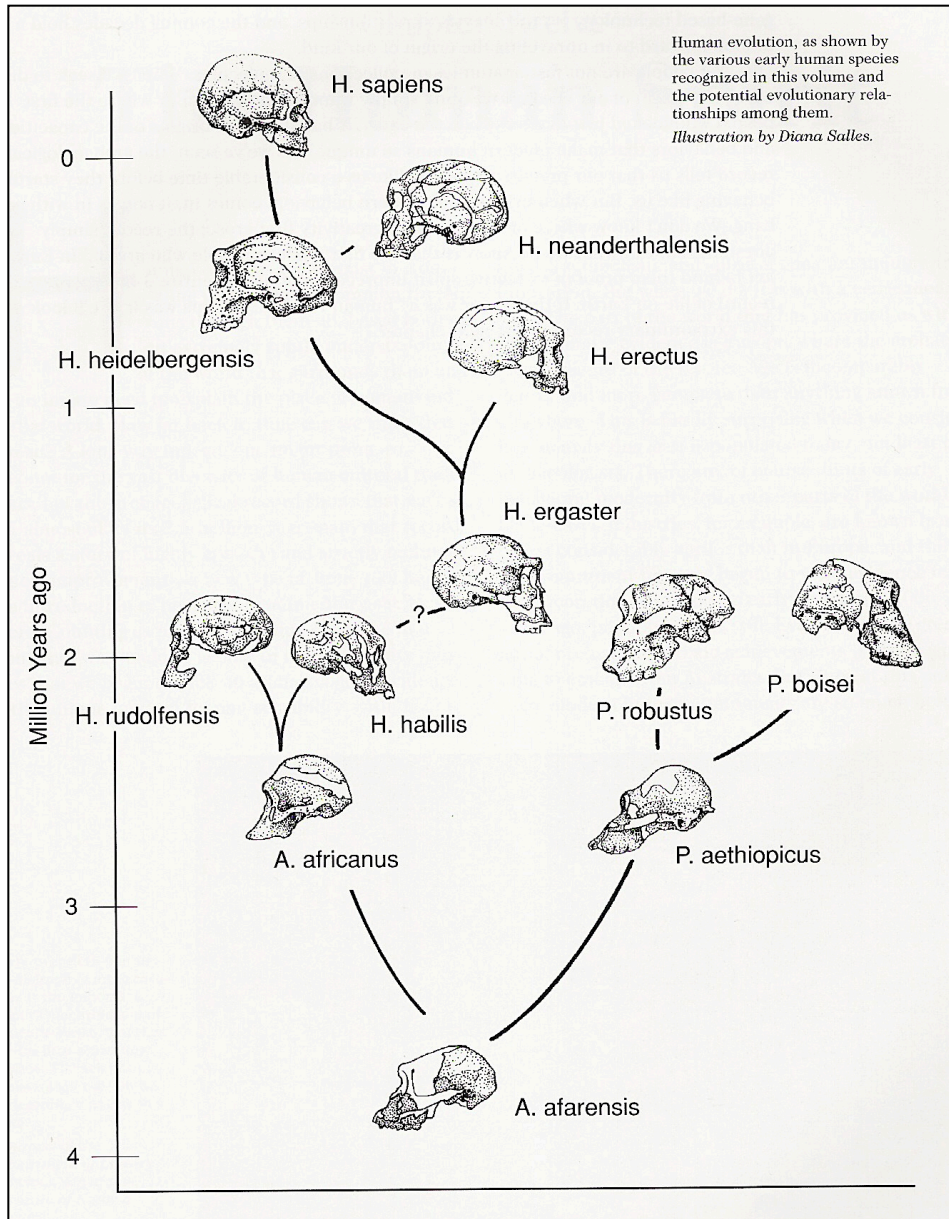


*H. neanderthalensis*  
1400 cc



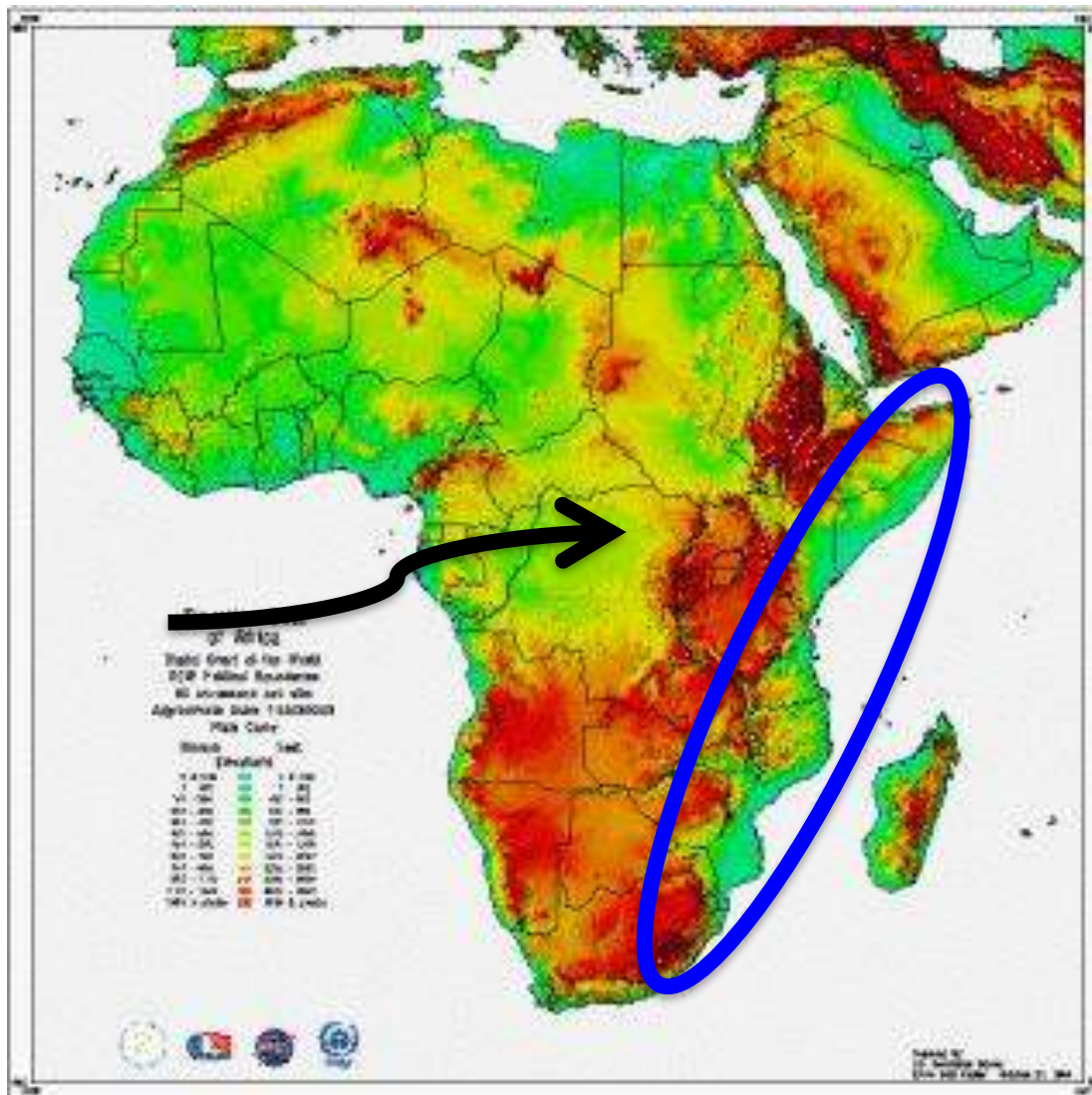
*H. sapiens*  
1300 cc

# Family Bush



For most of hominid prehistory, there have been multiple species simultaneously!

# Africa



## Dry East Africa

In the “Rain Shadow”

Storms pass eastward through equatorial jungles, but are stopped at barrier mountains

**Elevation:** Red = highest, Green = lowest

# Africa



**Dry East Africa**

In the “Rain Shadow”

Great Rift Valley

Scene of millions of years  
of hominid evolution

Climate

South Africa also key source

# WESTERN AFAR RIFT, ETHIOPIA



## Middle Awash Hominid Localities

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



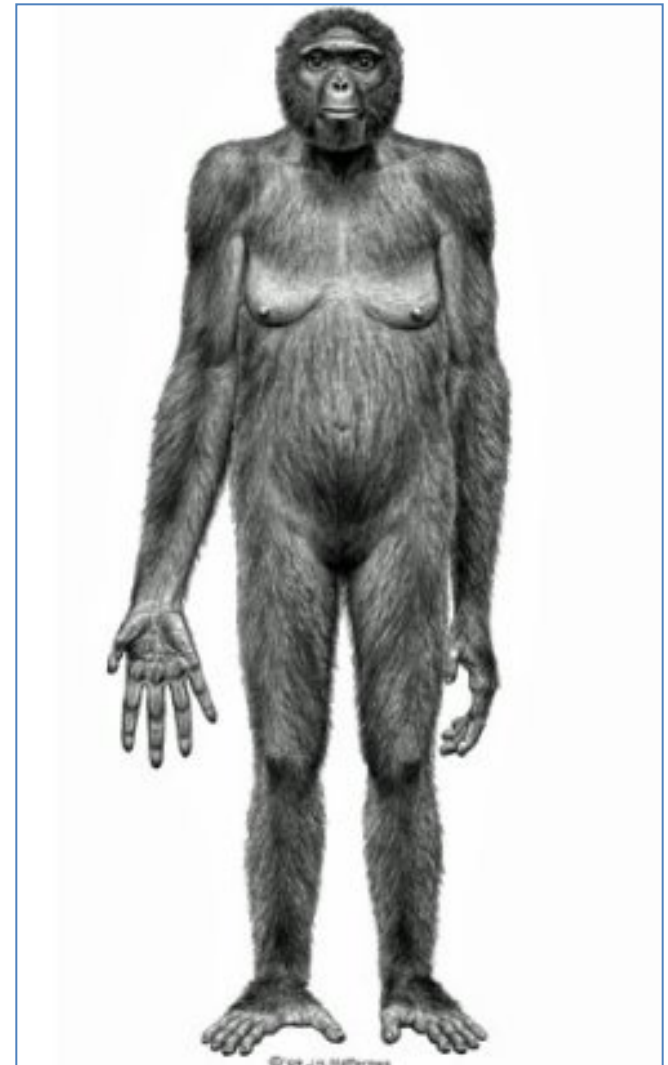
# ARDI

*Ardipithecus ramidus*

4.4 MYA

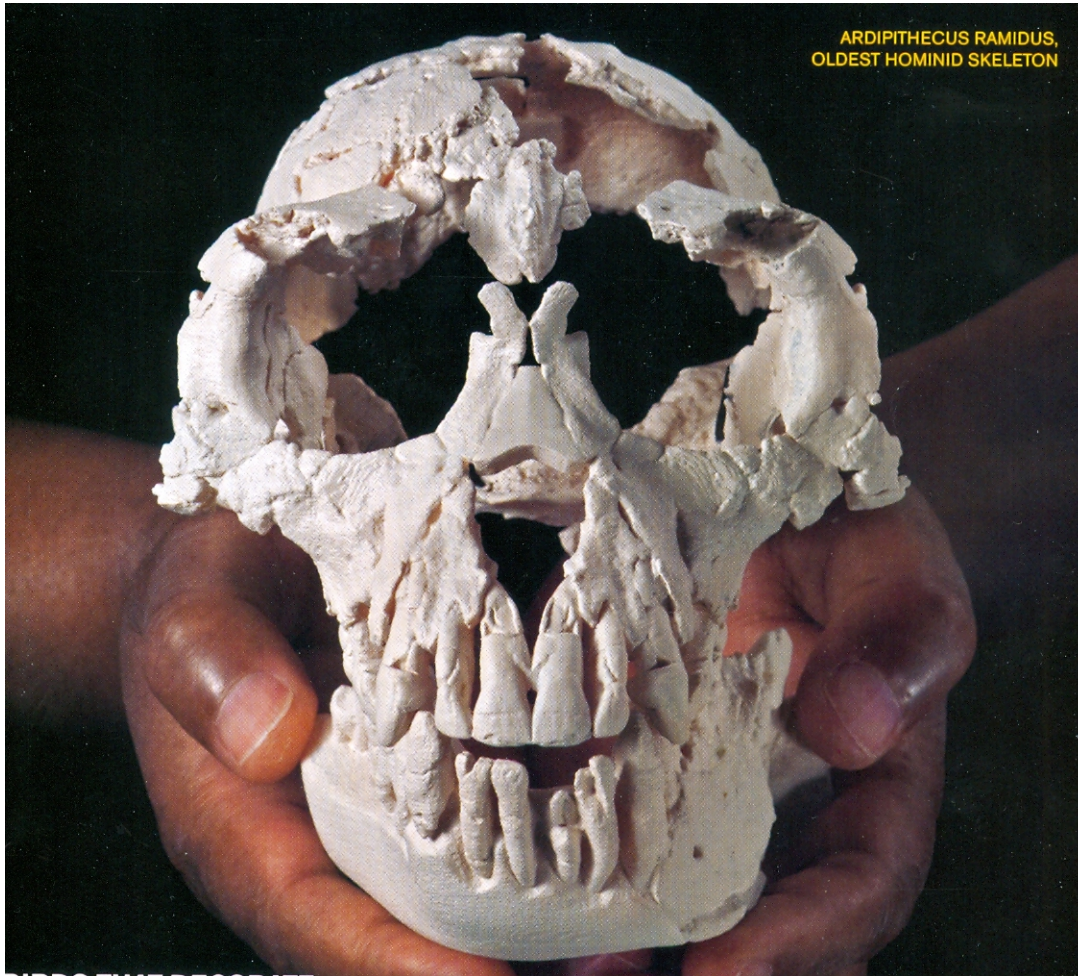


Ardi *Ardipithecus ramidus* 4.4 MYA



# Ardi *Ardipithecus ramidus* 4.4 MYA

Cranial capacity: 360cc



Both body size and  
brain size are ape-like



Ardi

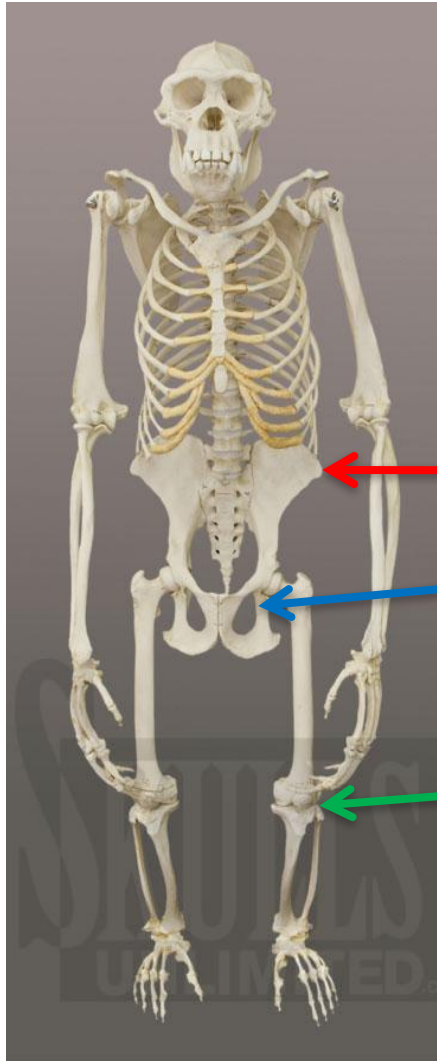
Bonobo

# Modern Human

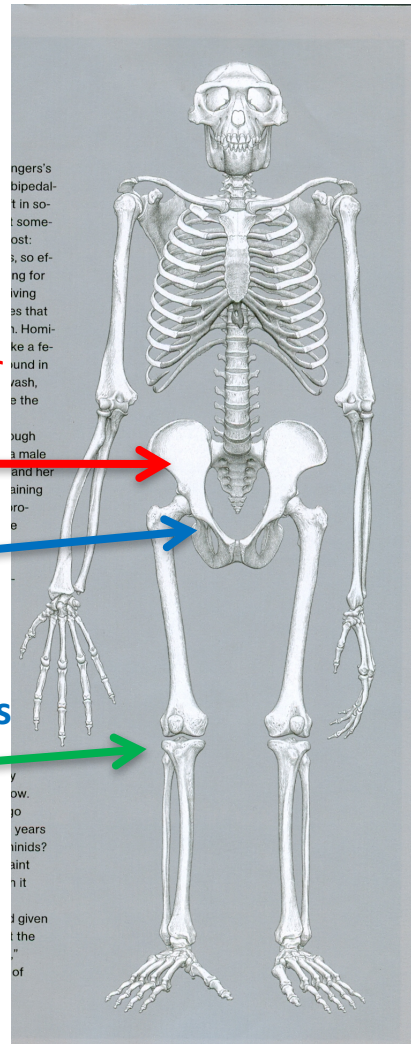
Compare especially pelvis &, knees -- Ardi more bipedal than ape

Tho less than human

## Modern Chimp



## Ardi

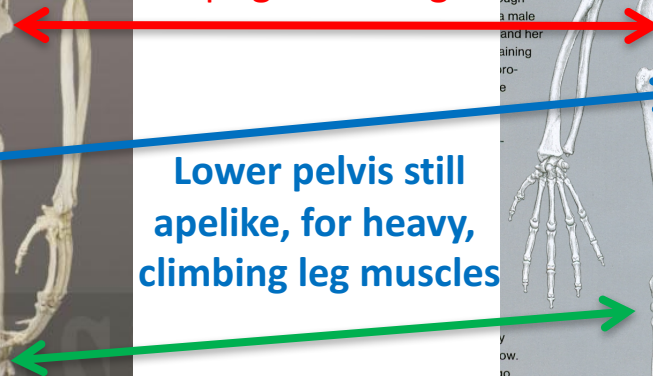


Ardi shows...

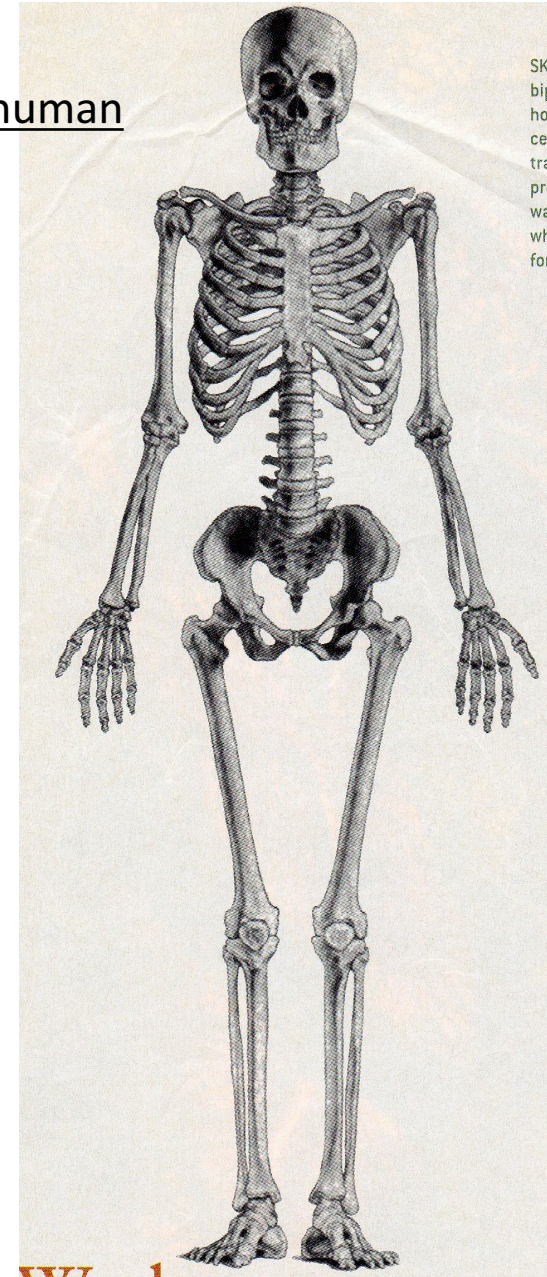
**Broadened & curved upper pelvis – attaches muscles for upright walking**

**Lower pelvis still apelike, for heavy, climbing leg muscles**

**Femur stacked on flattened tibia – for upright walking**

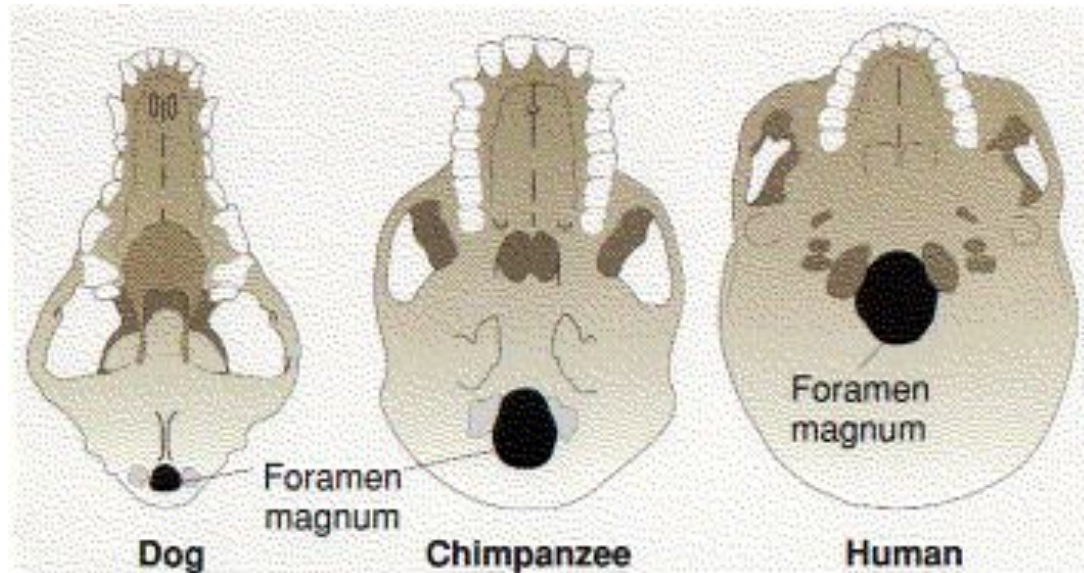


SKE  
bipe  
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form



Ardi *Ardipithecus ramidus* 4.4 MYA

**Foramen Magnum**, where spine enters skull,  
moves forward in hominid evolution



Ardi's Foramen Magnum is farther forward than in contemporary apes.

Another indication of a more upright stance

Ardi *Ardipithecus ramidus* 4.4 MYA



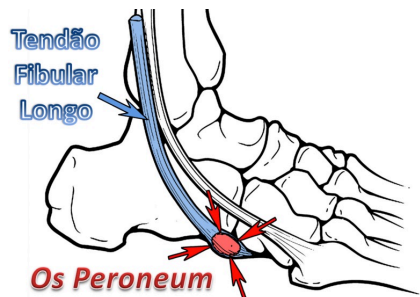
And yet...!

Still has opposable big toe – for climbing

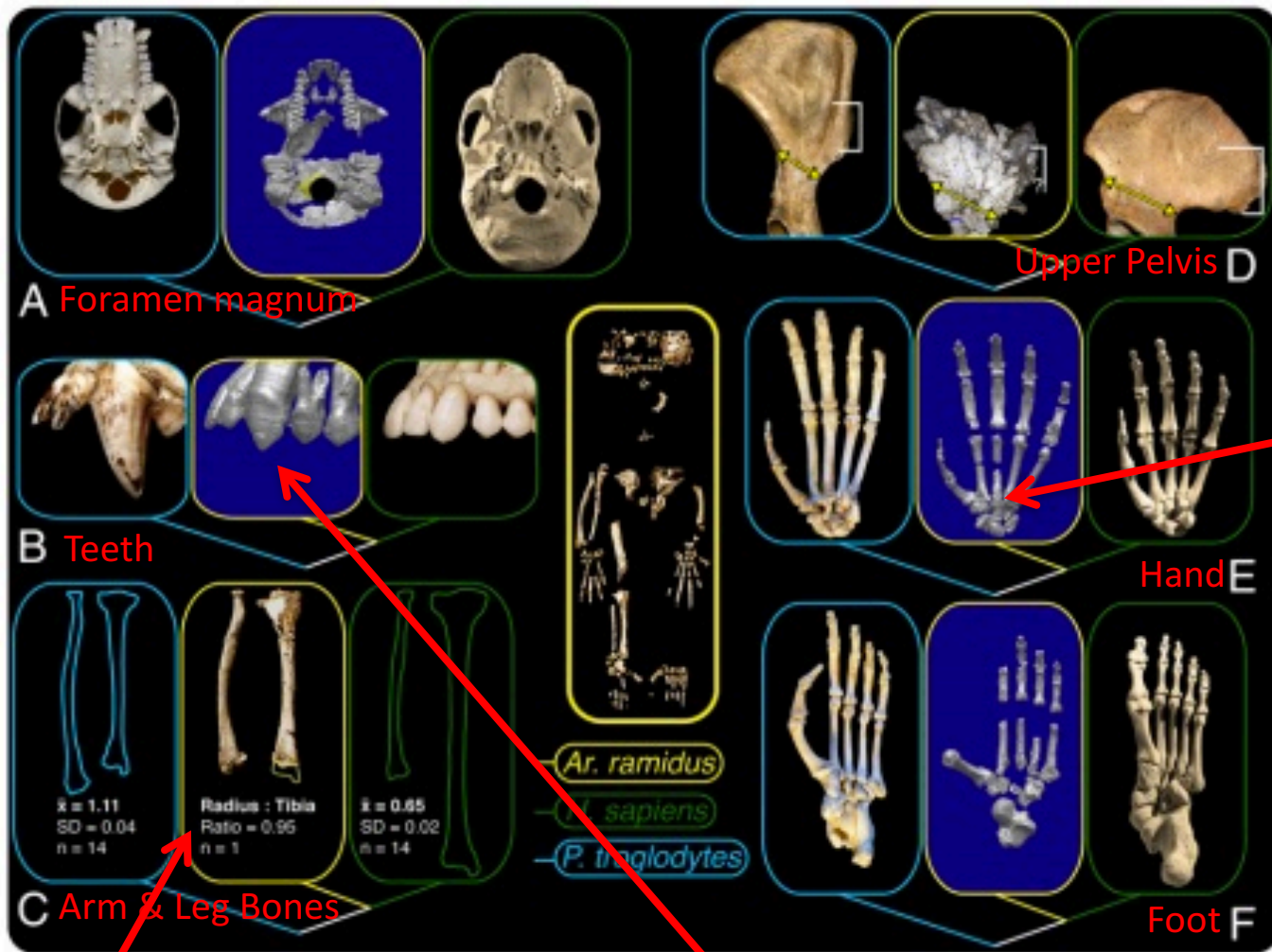
Tho some foot bones (e.g. *os peroneum*)  
more rigid than an ape's.



Human Foot



Ardi does not, as yet, have a true foot.



**Left box: Chimp**  
**Mid box: Ardi**  
**Right box: Human**

Shortened palm  
(not a knuckle-walker)



Chimp knuckle-walking

White et al., 2014

Legs become longer than arms



Reduced canines (esp in males)

Chimps (and other NHPs) have large canine teeth

**Fig. 1.** Evolution in different directions. *Pan troglodytes* (left boxes); *Ar. ramidus* (center boxes); *H. sapiens* (right boxes). Micro-CT renders on blue backgrounds. *Ar. ramidus* nests in the hominid clade based on uniquely derived character complexes shared exclusively with *Australopithecus* and *Homo*. In the skull (A), chimpanzees combine a primitively long posterior, and derived elongate anterior basicranium; hominids share derived shortened bases. In the dentition (B), hominids lost the primitive functional honing complex of fossil and modern great apes based on a projecting male canine (male *Ar. ramidus* dentition, ARA-VP-1/300, shown; there is no honing). In limb proportions (C), *Ar. ramidus* is primitive relative to the derived elongated arm of the chimpanzee and the lengthened leg of the human. Radius and tibia outlines adjusted to mean lengths; ARA-VP-6/500 tibia's missing distal end is conservatively restored per *SI Text, Note 2*. In the pelvis (D), hominids share broader, lower iliac blades (yellow arrows; white brackets show the superior and inferior extent of the sacrum's articular surface; short blue line on fossil indicates superior margin of hip joint). Note the low position of the sacral joint in hominids. The chimpanzee hand (E) bears elongate metacarpals and stiffening for climbing and suspension. Hominids primitively retain short metacarpals, whereas humans have shortened phalanges. The *Ar. ramidus* foot (F) shows a primitive midfoot that had not evolved into the shortened flexible structure of living apes; neither had it evolved into a modern human-like foot that functions both as a stiffened lever and a compliant shock absorber.

# *Australopithecus*

The first truly **Bipedal** hominid (3.6 MYA)



# LUCY

*Australopithecus afarensis*

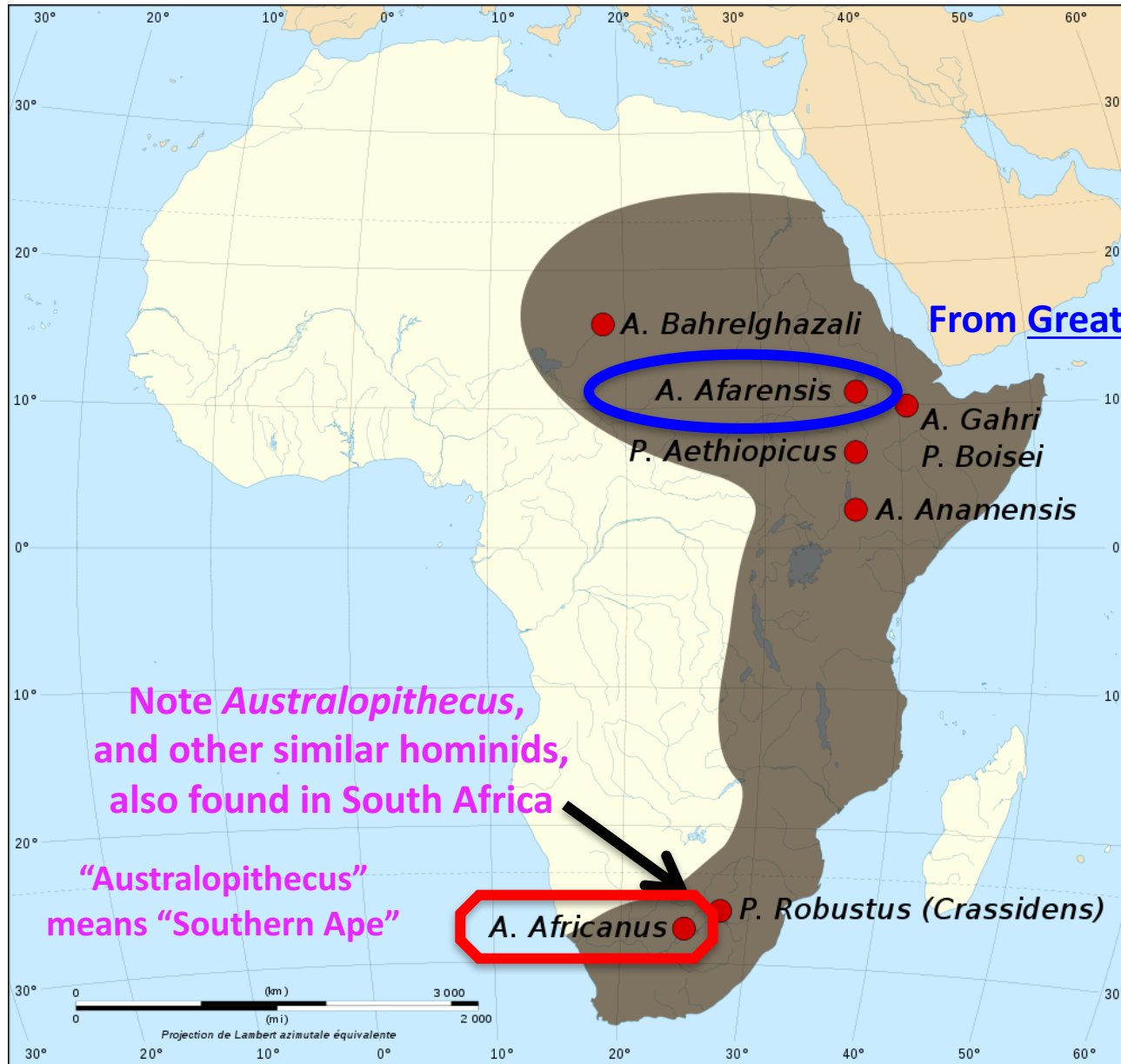
**3.4 MYA**



Lucy *Australopithecus afarensis* 3.4 MYA



# Lucy *Australopithecus afarensis* 3.4 MYA



From Great Rift Valley

Increasingly arid,  
savannah

Note *Australopithecus*,  
and other similar hominids,  
also found in South Africa

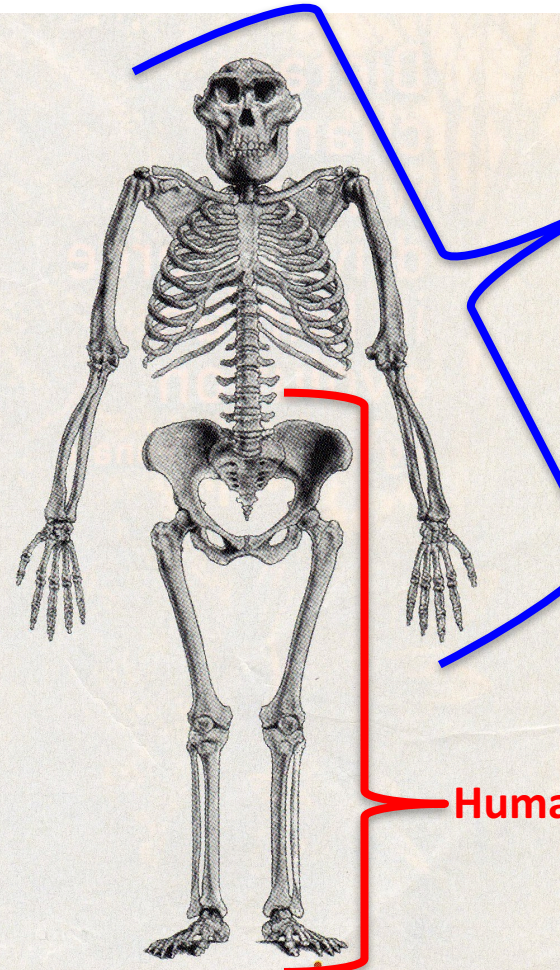
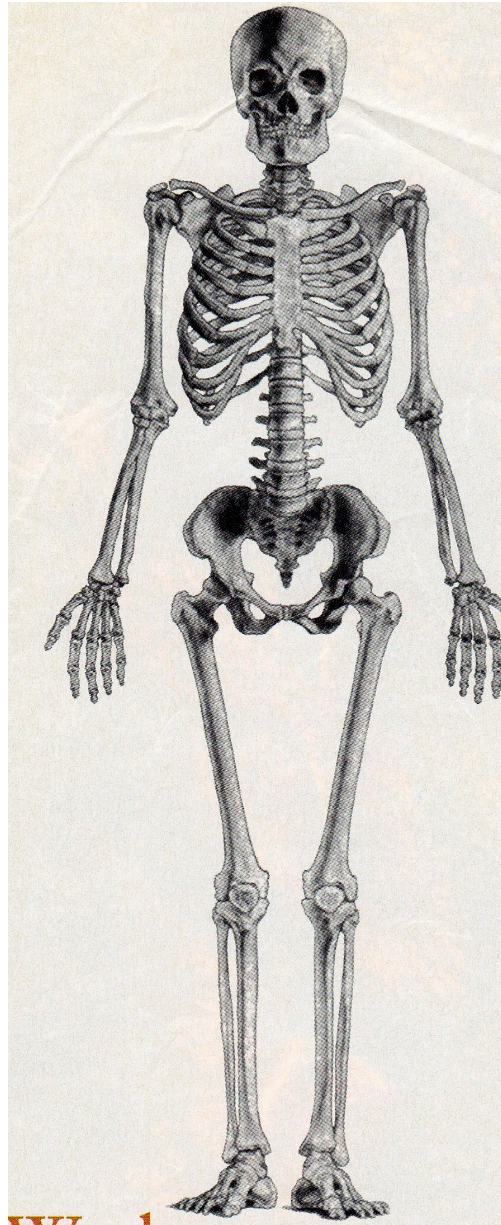
“Australopithecus”  
means “Southern Ape”

Note **error**:  
genus names  
should not be  
capitalized!

e.g:  
A. Africanus  
should be  
*A. africanus*

Lucy *Australopithecus afarensis* 3.4 MYA

*Homo sapiens*  
vs.  
*Australopithecus afarensis*

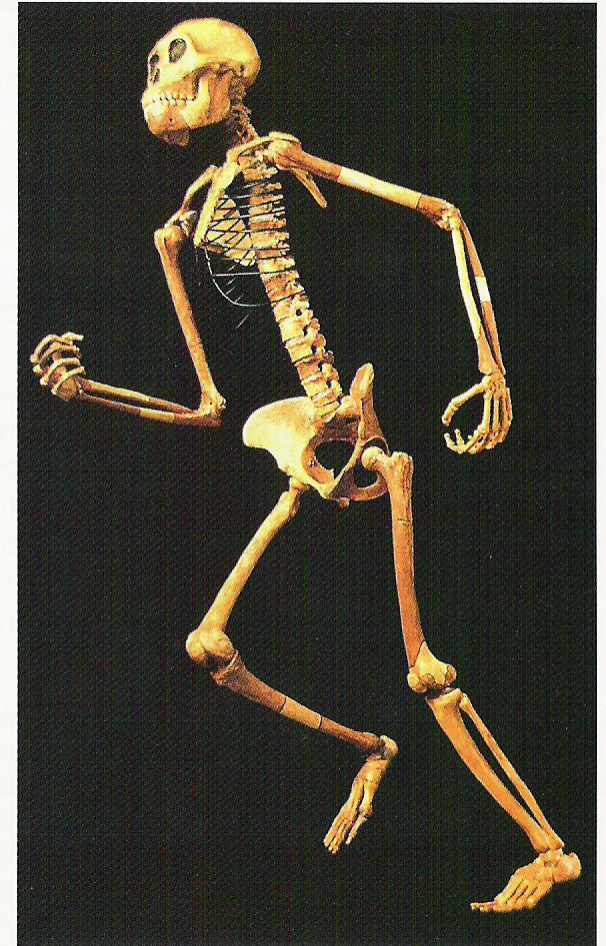


Ape-like

Human-like

# Lucy *Australopithecus afarensis* 3.4 MYA

Walked – and ran – the savannah



Brain slightly larger than Ardi – **400cc** (v. 360 cc Ardi)

# Lucy *Australopithecus afarensis* 3.4 MYA

Bipedal footprints 3.6 MYA  
(note these somewhat predate “Lucy”)



Sometimes seen as evidence for  
**Monogamy**



**Image  
error!**

NO  
sexual  
dimorphism  
(M & F body  
size equal!)

Which  
is actually  
further  
support for  
Monogamy

# Lucy *Australopithecus afarensis* 3.4 MYA

Sometimes seen as evidence for  
**Monogamy**

MONOGAMY  
provides context  
in which female:female  
(vs. male:male) competition  
for mates could arise



**Image  
error!**

NO  
sexual  
dimorphism  
(M & F body  
size equal!)

Which  
is actually  
further  
support for  
Monogamy

Lucy?



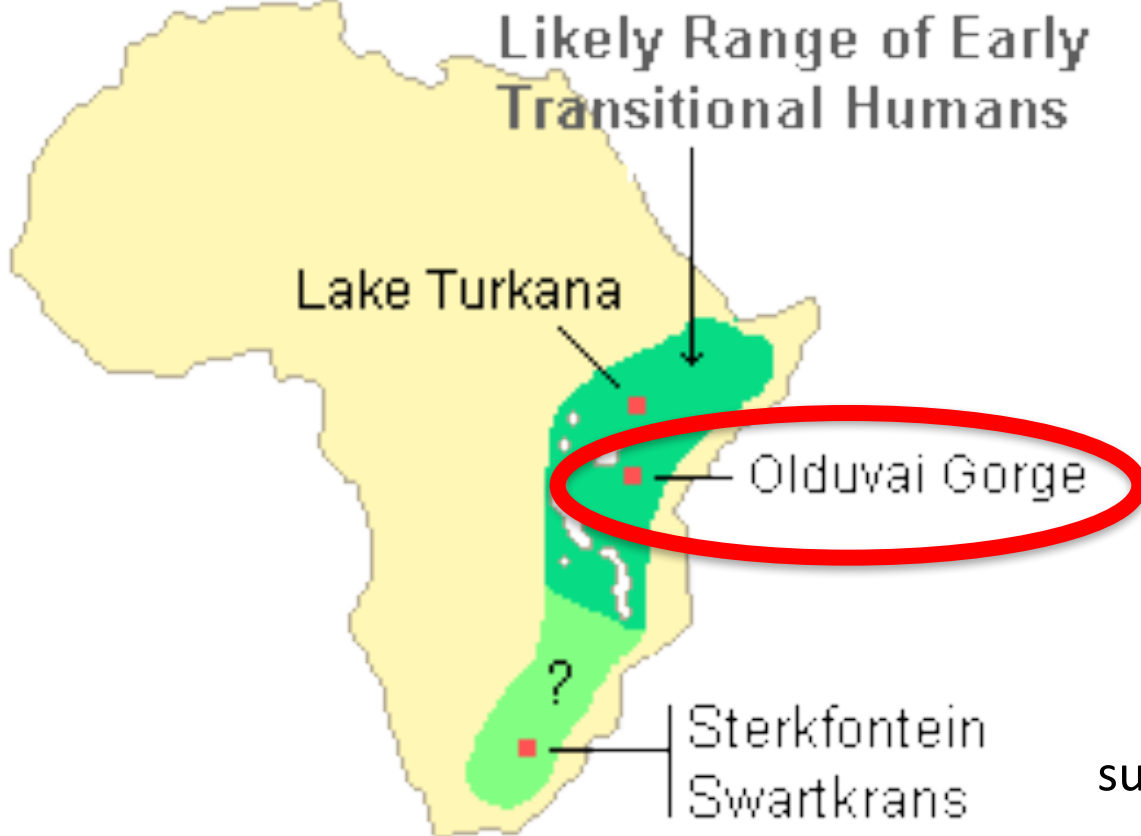
# **HANDY MAN**

*Homo habilis*

**2.5 MYA**



# Handy Man *Homo habilis* 2.5 MYA



Again, mainly from  
East Africa

During this period,  
see significant

**Climate Fluctuation,**  
including expansion/  
reduction in Lakes

Potts (2012) suggests  
such env. uncertainty selects for  
increased **Flexibility**  
(as suggestd by stone tools?!)

Handy Man *Homo habilis* 2.5 MYA

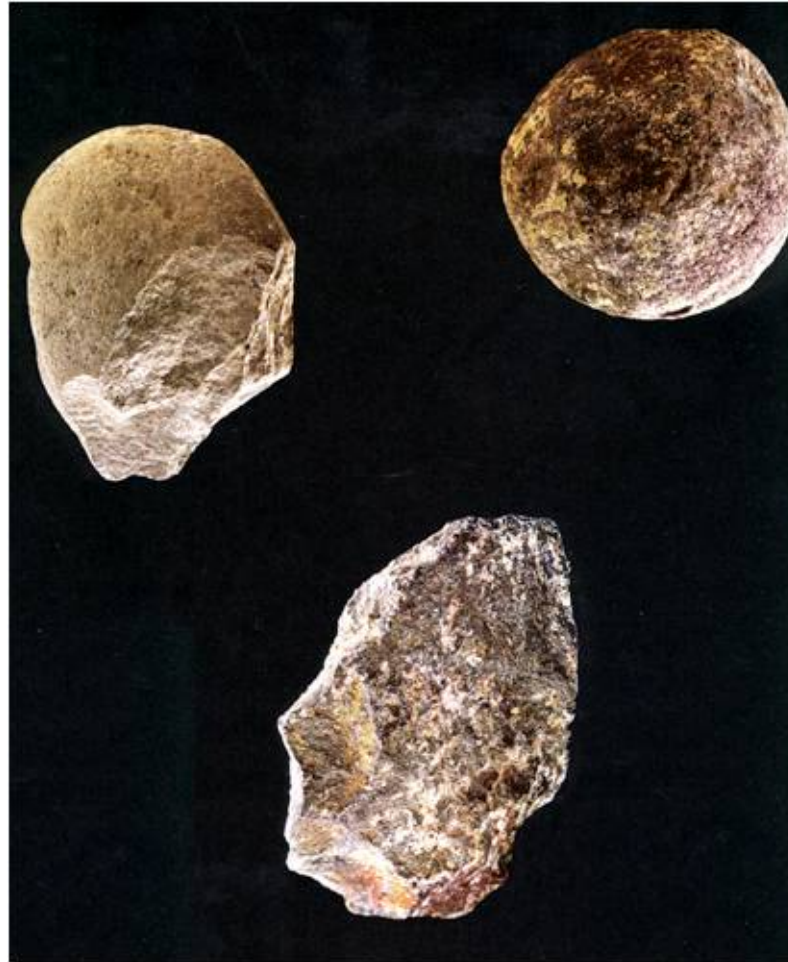
First Stone Tool Maker = "Homo"



Body size similar to *Australopithecus*, but brain larger, **660cc** (v. Lucy 400 cc)

Handy Man *Homo habilis* 2.5 MYA

## Oldowan Tools



Handy Man *Homo habilis* 2.5 MYA

## Oldowan Tools



Toolkit unchanged for ~ 1 million years....

Note: Some chimpanzees use (found) stones to crack nuts.

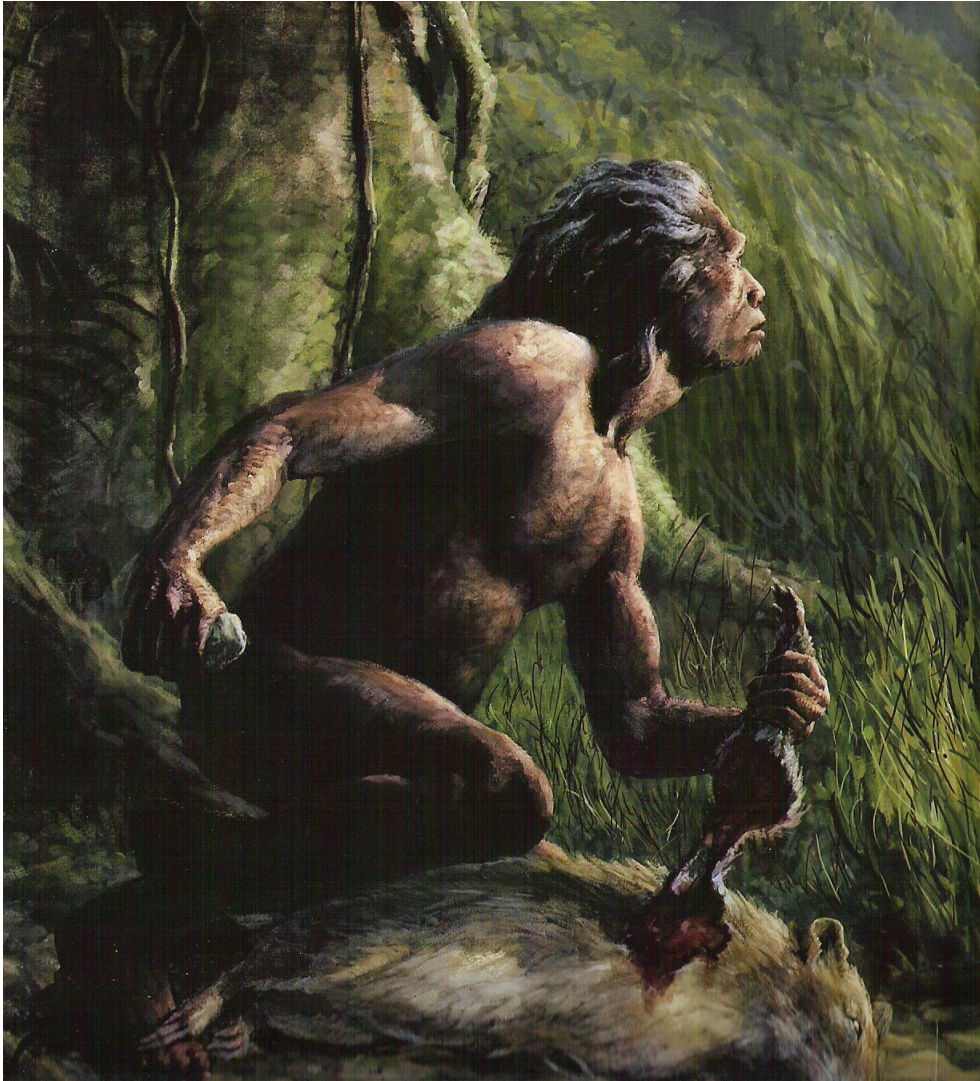


And, in fact use various **perishable** tools – as probably did Hominids before *Homo*!



But, apes do not use tools to make tools...

# Handy Man *Homo habilis* 2.5 MYA



## **Meat**

is now a more  
regular part of diet

...Hunters?

...Scavengers?

# **ERECTUS**

*Homo erectus*

*1.6 MYA*

*Homo erectus* 1.6MYA

Larger body (up to human-sized) and larger brain, **950 cc** (v. 660 cc in *H. habilis*)



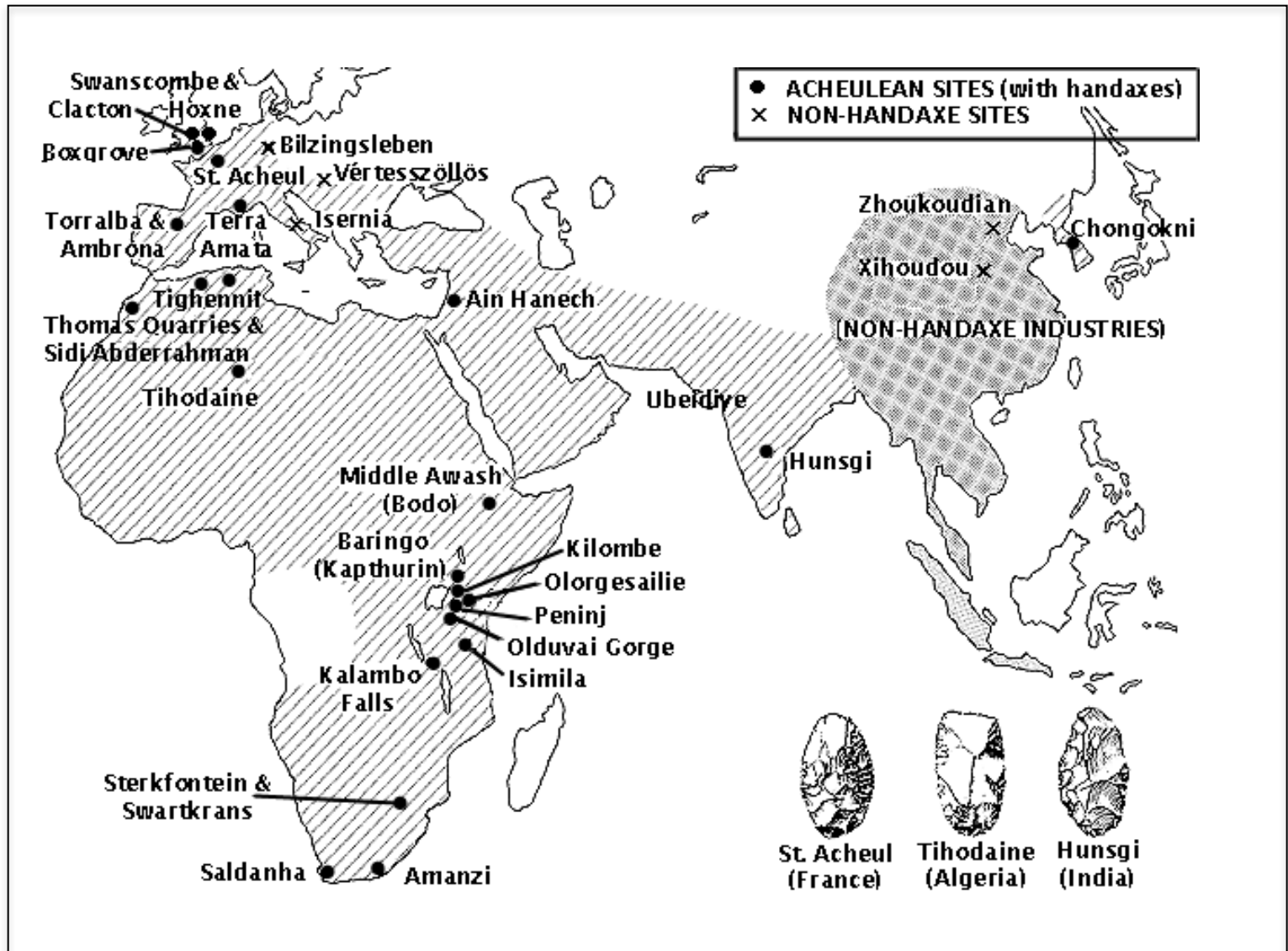
*H. habilis*



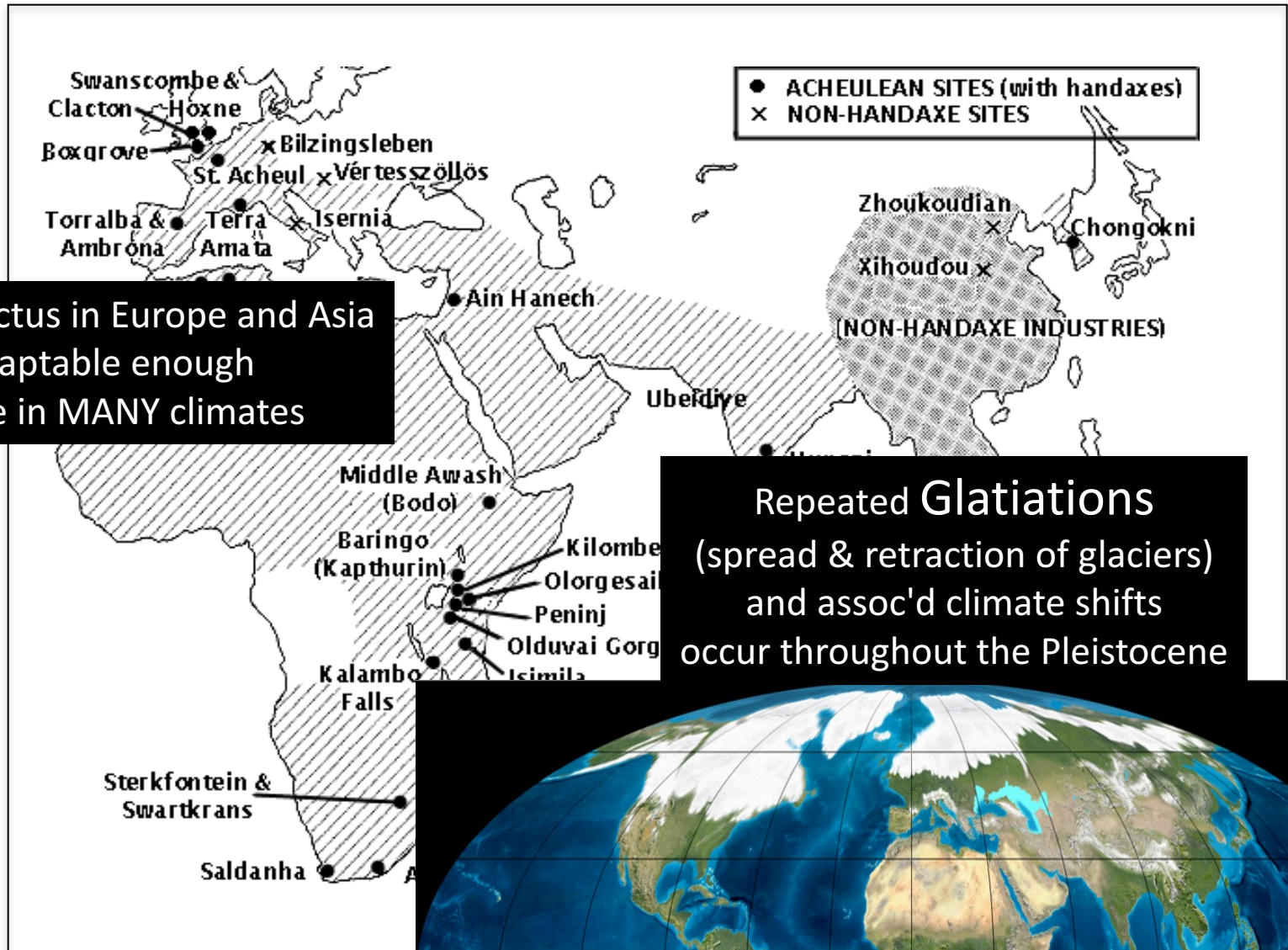
*H. erectus*



# *Homo erectus* - Out of Africa!



# Homo erectus - Out of Africa!



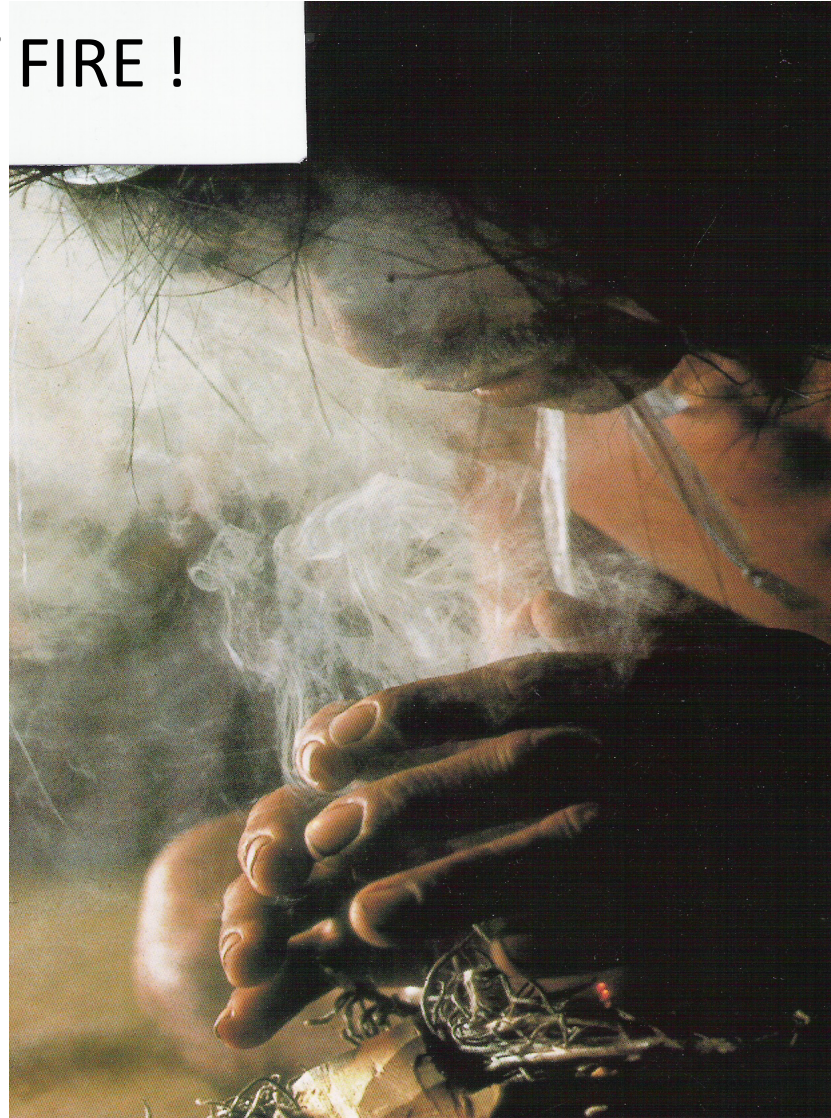
So, *H. erectus* in Europe and Asia adaptable enough to live in MANY climates

Repeated Glaciations (spread & retraction of glaciers) and assoc'd climate shifts occur throughout the Pleistocene

*Homo erectus* 1.6MYA

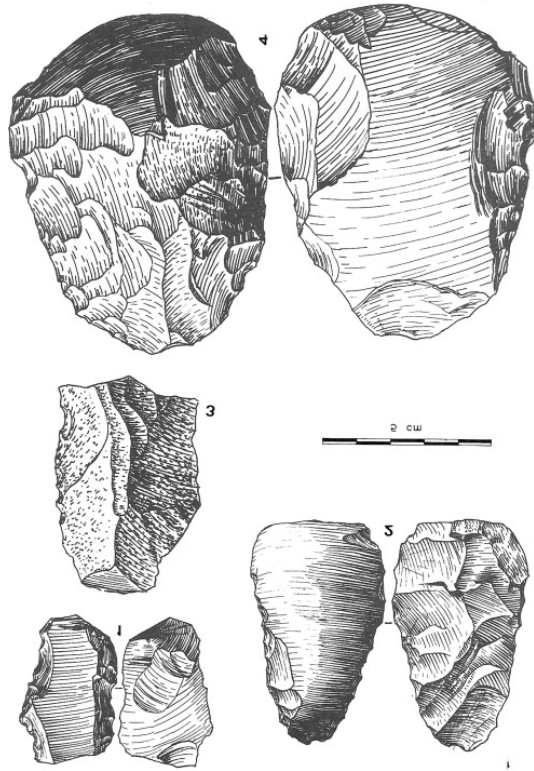
Control of FIRE !

“Mastery”  
of environment...



*Homo erectus*

1.6MYA



Discoid



Acheulean  
Tools

Bifacial Handaxe

Clearly more complex than Oldowan

But, like Oldowan, basic Acheulean tool kit  
unchanged for a million years



Given variability of habitats, is this indicative of a cognitive constraint??

*Homo erectus* 1.6MYA

Hunter-Gatherers, collaborative hunters

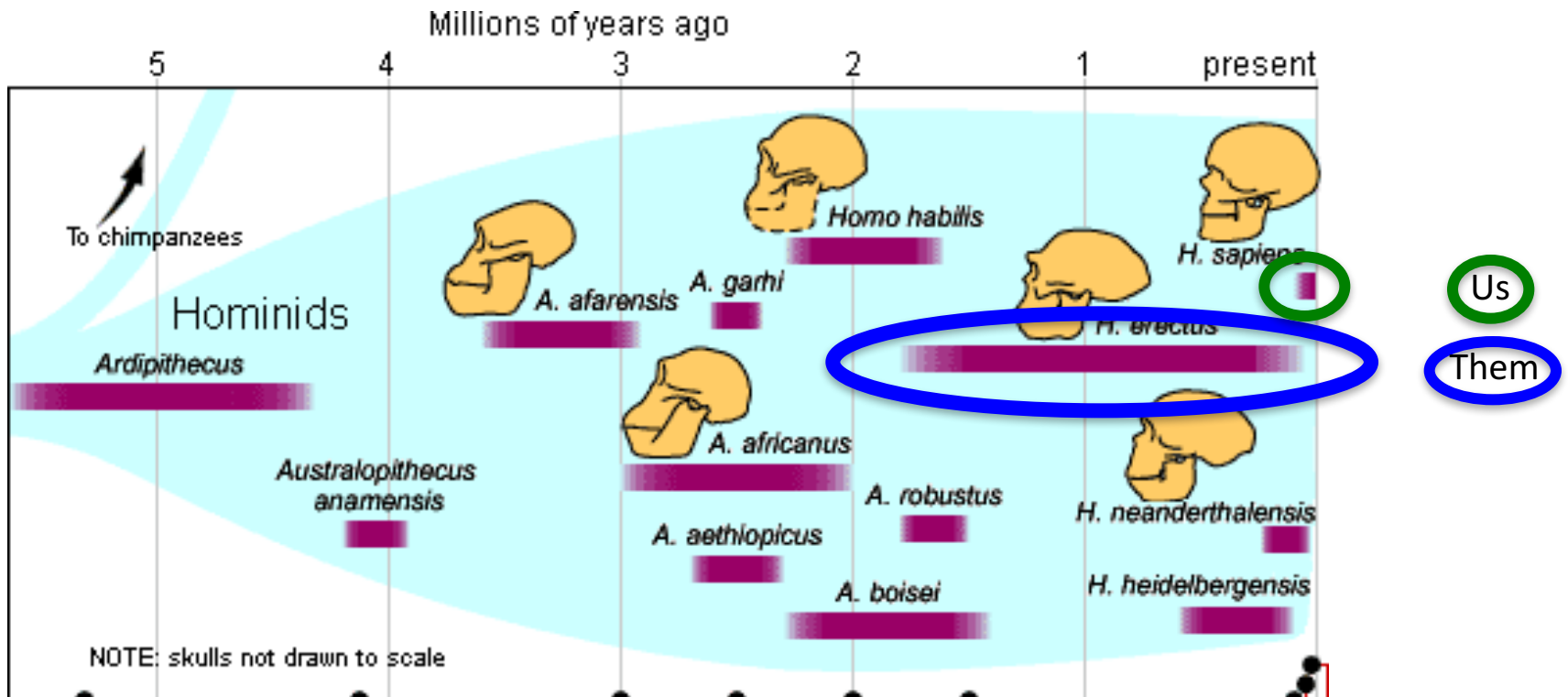
Shared Base Camp



Probably also (perishable) clothing, dwellings, non-stone tools, etc. etc.

# *Homo erectus*

**Most successful** (longest lasting) hominid ever! Over 1 million years...



# ARCHAIC SAPIENS

*Homo heidelbergensis*

*800,000 YA*

# Archaic Sapiens *Homo heidelbergensis* 0.8MYA

Hunted Big Game



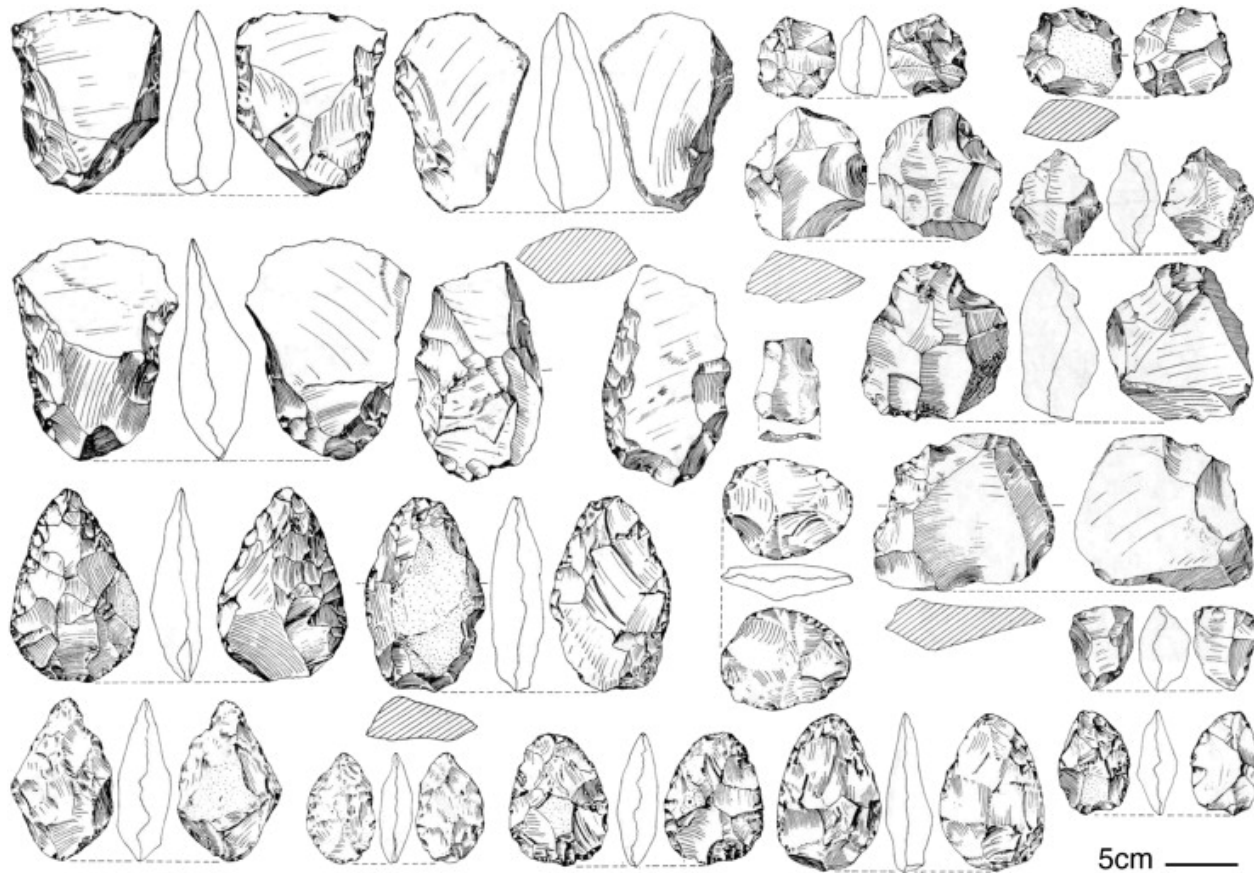
From **Eurasia**

First “new form” that emerged outside of Africa



# Archaic Sapiens *Homo heidelbergensis* 0.8MYA

But, despite larger brain - **1200cc** - continues making/using **Acheulean Technology**



Relatively little known – few fossils

# NEANDERTHAL

*Homo neanderthalensis*

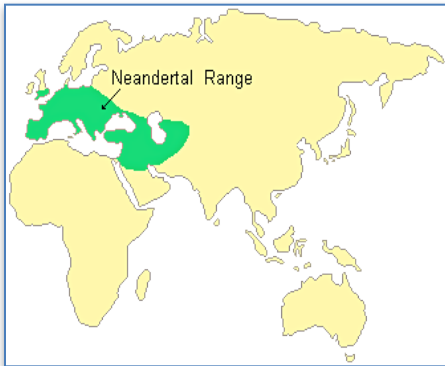
AKA

*Homo sapiens neanderthalensis*

**200,000 YA**

# Neanderthal *Homo neanderthalensis* 200,000 YA (0.2 MYA)

From Eurasia



Some argue, a cold-adapted *erectus*?

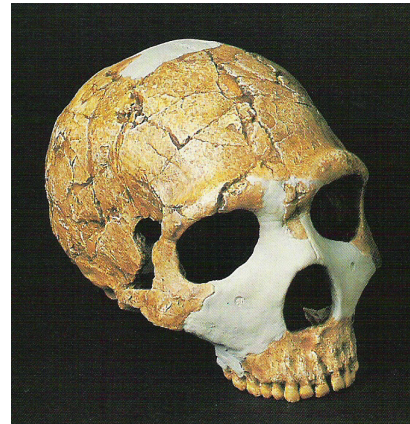
# Neanderthal

*Homo neanderthalensis*

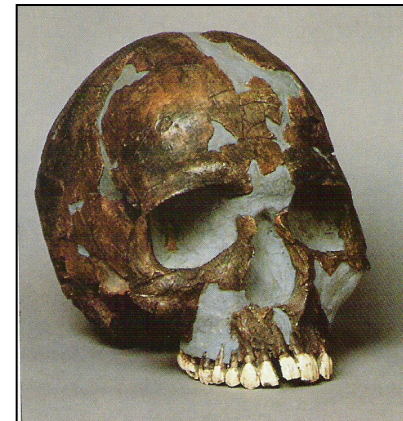
200,000 YA



Heavy bones, sloping brow, little chin



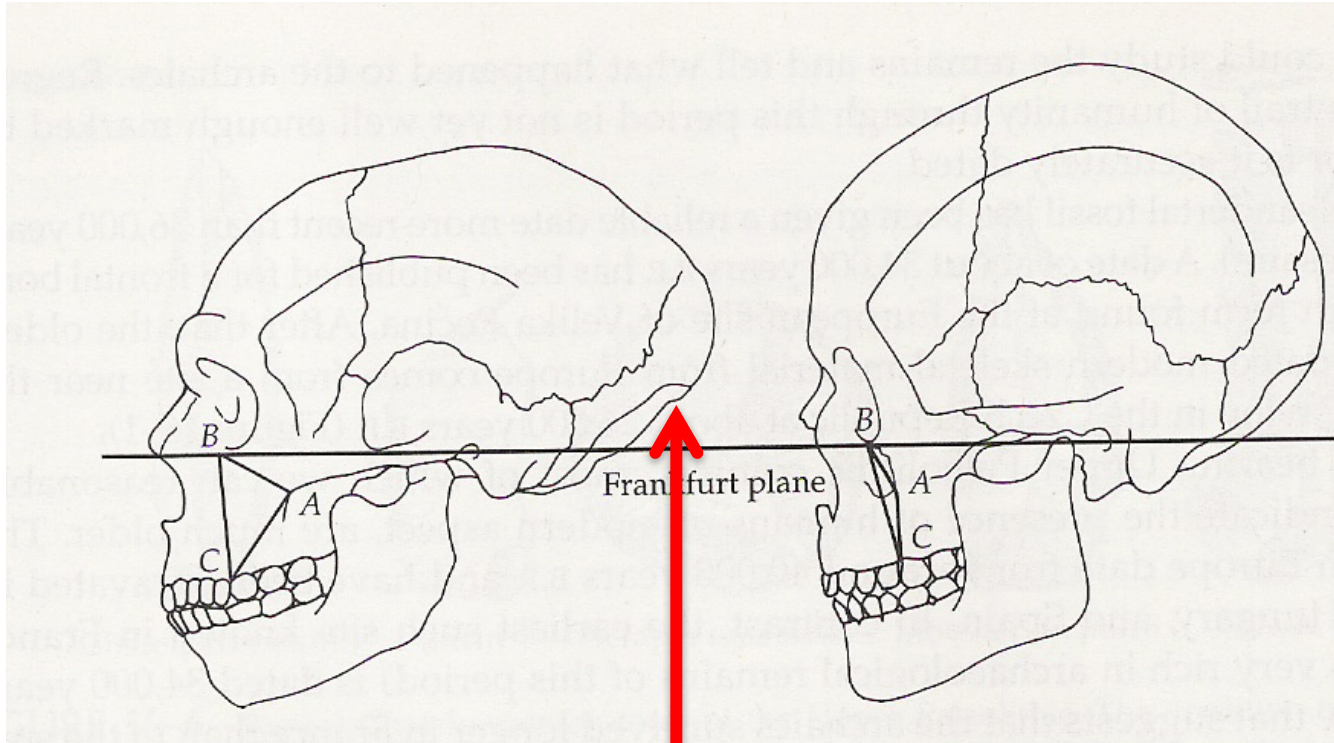
*H. neanderthalensis*



*H. sapiens*

# Neanderthal *Homo neanderthalensis* 200,000 YA

Brain larger than contemporary humans!  
(**1400 cc** vs. ~1300cc in us)



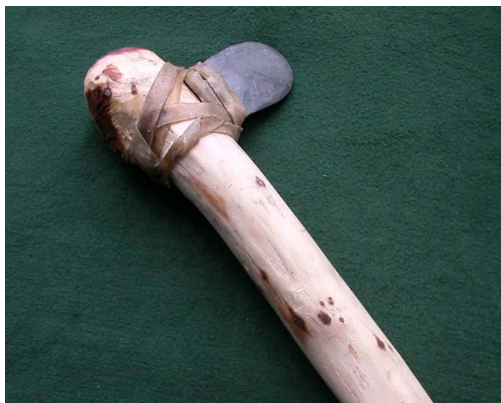
Includes “**Occipital Bun**”,  
not found in humans!

Controversy over whether/ to what extent  
they had articulate speech - ??

# Neanderthal *Homo neanderthalensis* 200,000 YA



## Mousterian Technology

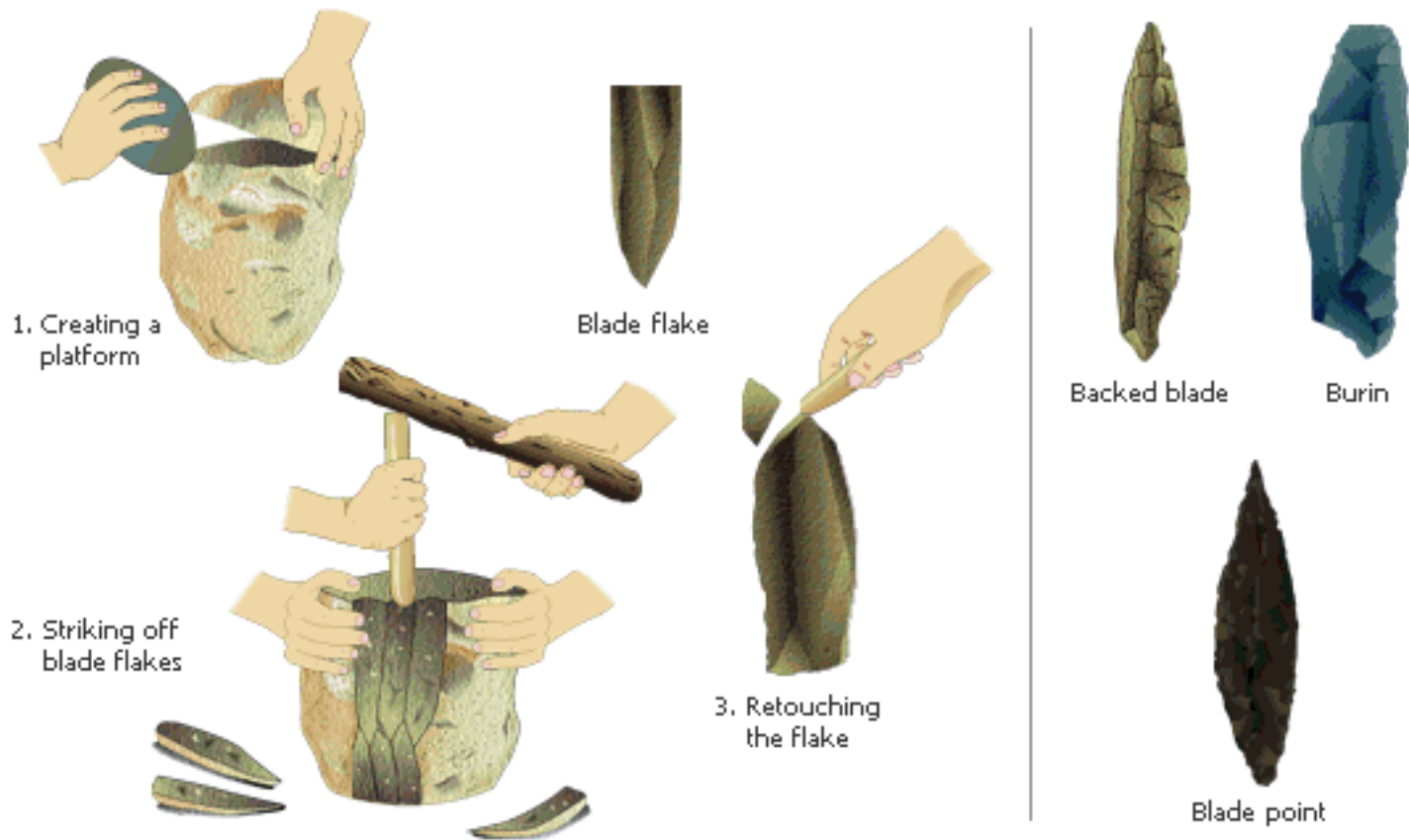


Neanderthal *Homo neanderthalensis* 200,000 YA

## Levallois Method

### Preparing the core –

Requires diff tools (& procedures) for preparing the stone than for knapping it



Neanderthal *Homo neanderthalensis* 200,000 YA

## Hafted tools!

Requires multi-step, hierarchically organized techniques



**Hunters** – diet more heavily dependent on meat than ever before



# Tool-making & using practices increase in complexity



*H. habilis*



*H. erectus*



*H. neanderthalensis*

Evidence of changes in **Cognitive** complexity

## Late Neanderthal (~30,000 YA) Jewelry

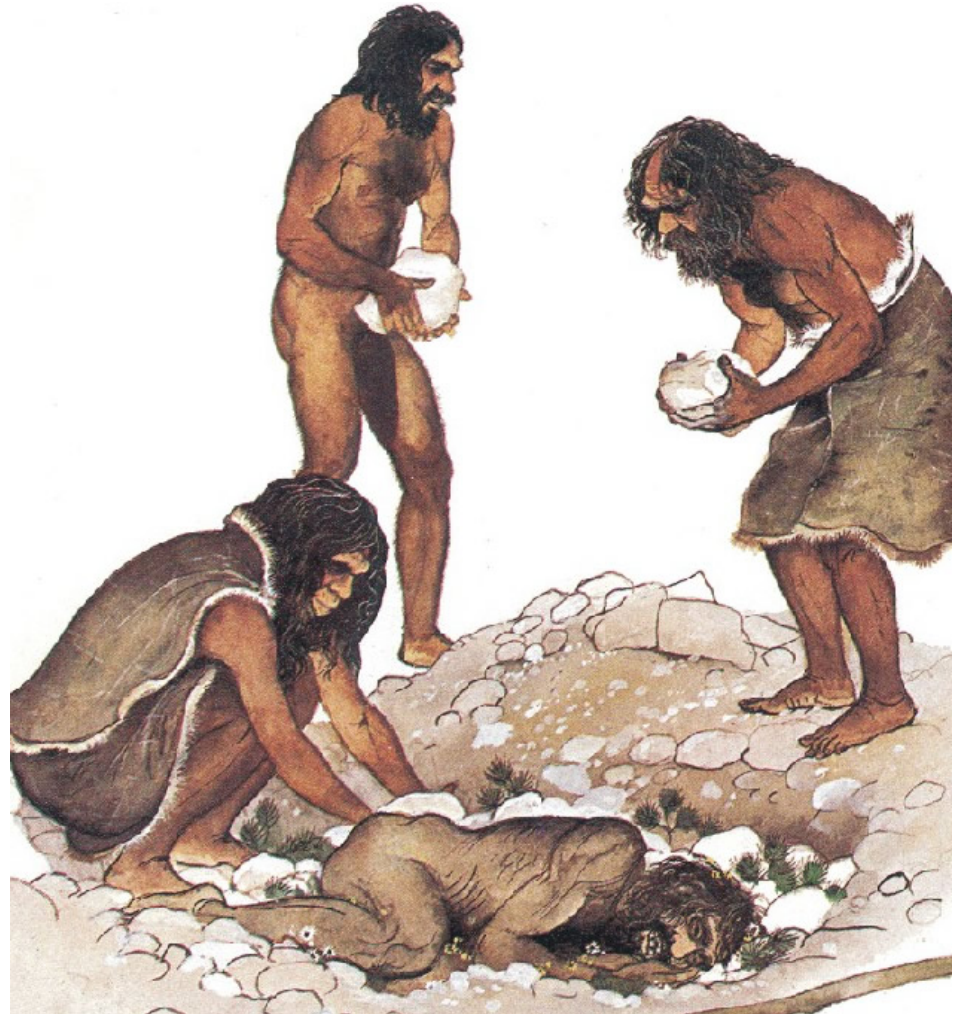


Neanderthal

*Homo neanderthalensis*

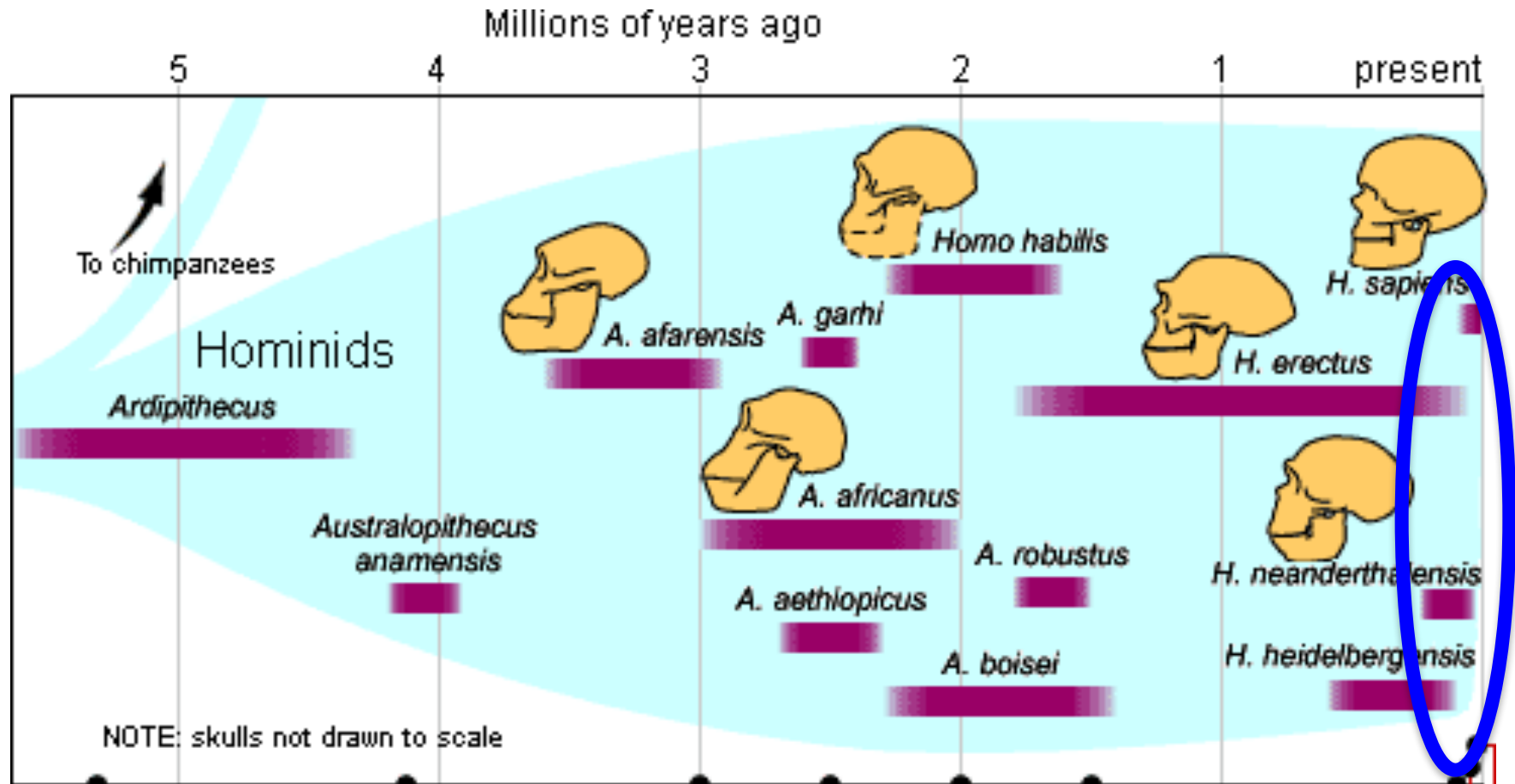
200,000 YA

## Burial



# *H. neanderthalensis* & *H. sapiens* co-occur

Overlap for about 120,000 years – until Neanderthals became extinct (?)



# **HUMAN**

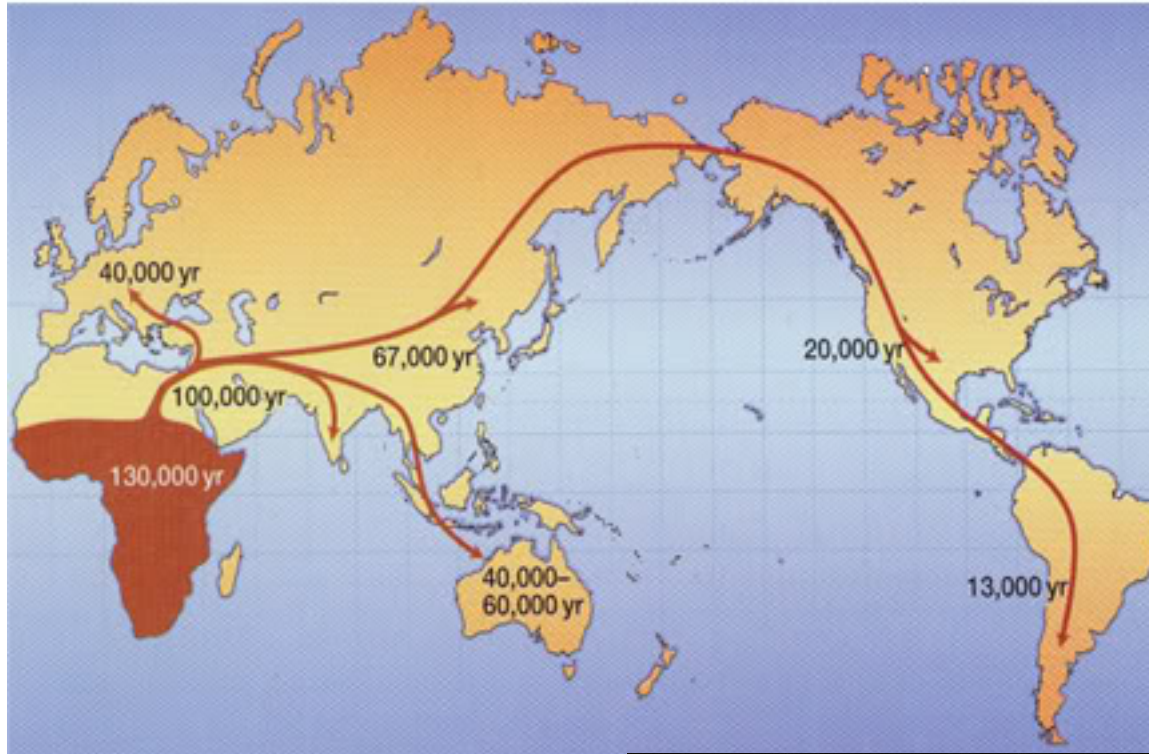
*Homo sapiens*

*~150,000 YA*

Humans

*Homo sapiens*

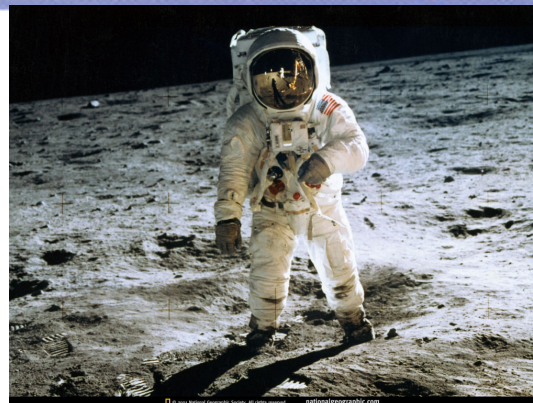
~150,000 YA



Per Mitochondrial DNA calculations, earliest *Homo sapiens* from **Africa**

So, like *H. erectus*, and unlike *H. neanderthalensis*, *H. sapiens* originated in Africa, then migrated into Europe & Asia

... and beyond!



Humans

*Homo sapiens*

~150,000 YA

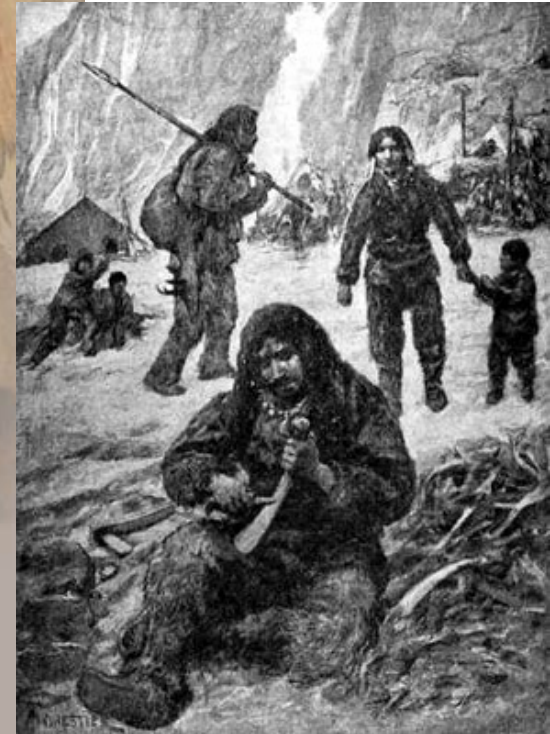
## SPEECH

Including specialized areas  
of large brain  
~1300cc



# Humans *Homo sapiens* 150,000 YA

Tools more variable & refined



Made of MANY different materials, for MANY different functions...





*H. habilis* **1**  
Oldowan Tech

*H. erectus* **2**  
Acheulean Tech



*H. neanderthalensis*  
Mousterian **3**



*H. sapiens*  
Upper-  
Paleo Tech  
**4**

Humans

*Homo sapiens*

150,000 YA



**ART!**

Cave paintings ~32,000 YA



Humans     *Homo sapiens*     150,000 YA

## MUSIC!

Oldest Flute Found from 35,000 YA

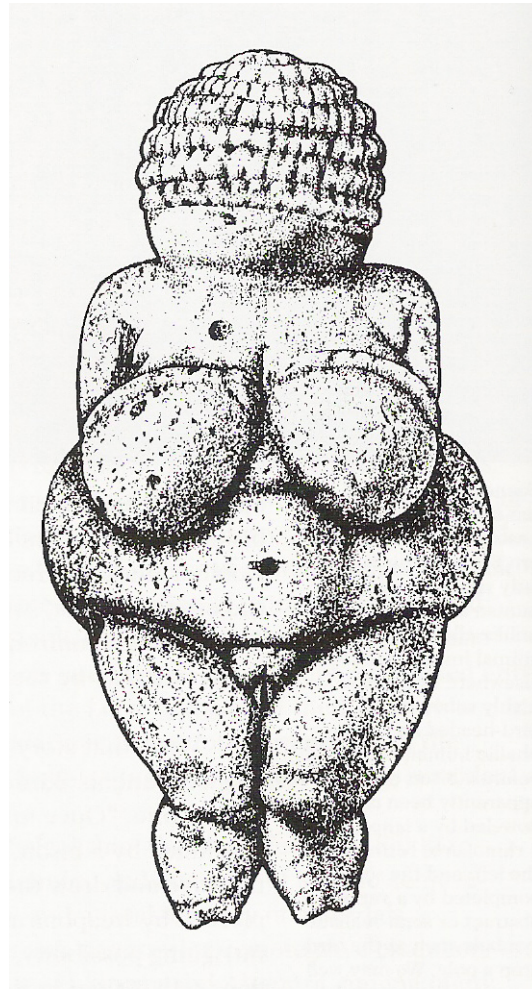


Although earlier forms (even before *H. sapiens*?) may have sung... ?!

Humans *Homo sapiens* 150,000 YA

First Religious Icon ~40,000 YA

## RELIGION



Presumably involved in  
some ritualized practice...

Future...?