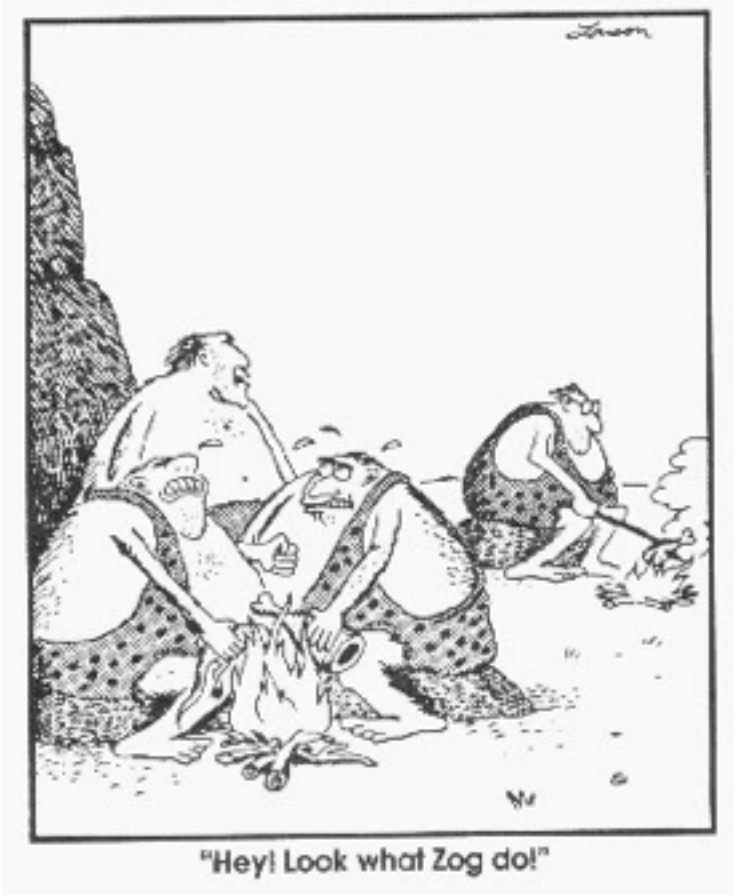
Anthro 101:
Human Biological Evolution

Lecture 17 & 18: *Homo sapiens*



Prof. Kenneth Feldmeier

Final is Friday!

- Study guide is up on the website
- Please ask me any question
- Meet me before or after class an I can help you study!

While Neandertals were evolving in Europe, hominins in Africa were becoming more like us

- **300 - 200 kya**, fragmentary fossil evidence in Africa
- Hominins seem to have robust features like *H. heidelbergensis*
- But they had larger brains (1400-1500 cc)

- Soon after this, *H. sapiens* appears in Africa and Middle East

- Neandertals & human overlap in Near East
  - Neandertals during glacial periods
  - Humans during interglacials
  - Both using MSA tools

From Africa, *H. sapiens* continues to spread

Asia & Southeast Asia (south Asia - 70 kya…. Eurasia 50 kya)

- Archaic hominins date from 250 - 100 kya
- Modern humans arrive after they are gone

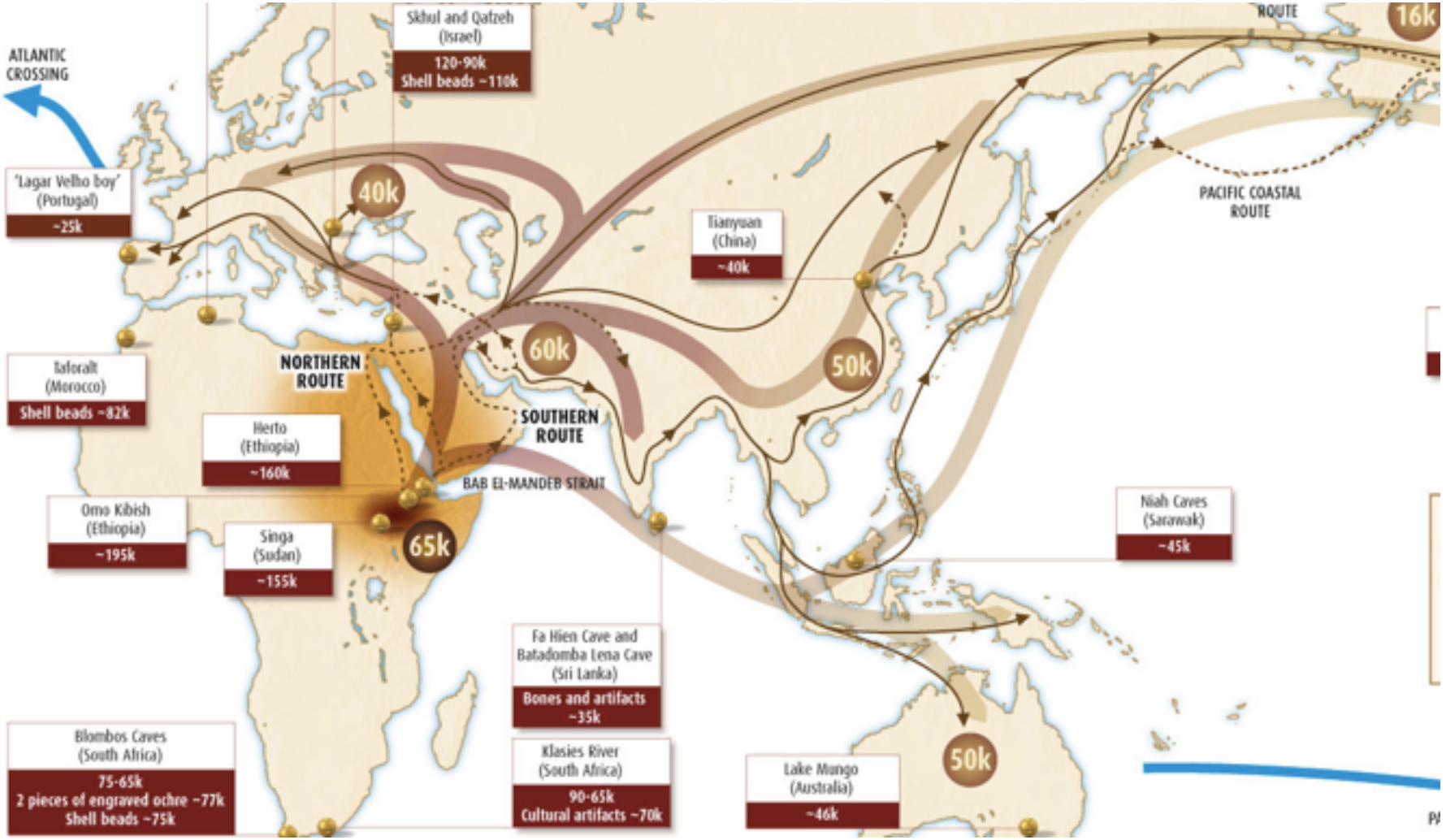
Australia (50 kya - came via south Asia)

- Modern humans in Australia before Europe & mainland Asia
- Crossed huge gaps of open water
  - H. floresiensis only other species to do this

Europe (40 kya)

- First tool & skeletal evidence for *H. sapiens*
- Upper Paleolithic tools (Aurignacian)
- Tropical body proportions for post-cranial skeletons

Global Migration of Modern Humans



From Africa, *H. sapiens* continues to spread through the old world

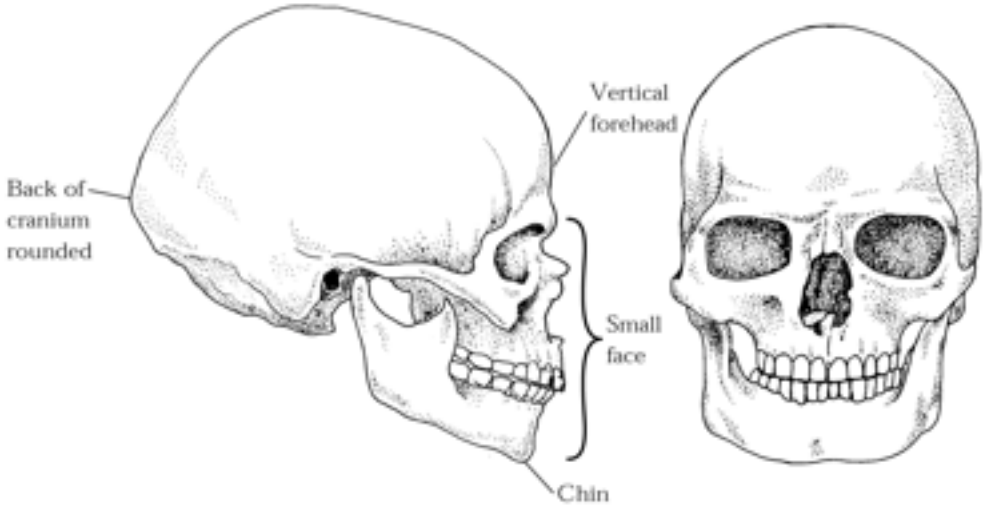
Americas (15 kya? <u>Likely</u> much earlier)

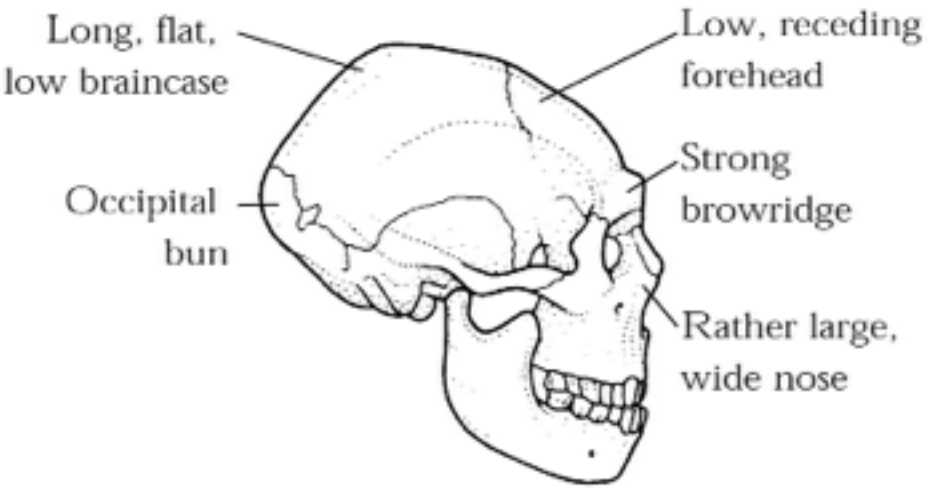
- Arrived from Siberia across exposed land bridge
  - only possible after 13,500
- Traveled via boats along coast from Siberia (earlier wave)
  - several waves of migration

13 August 2007
NewScientist.com news service
Heather Pringle "Americas most ancient mariners."

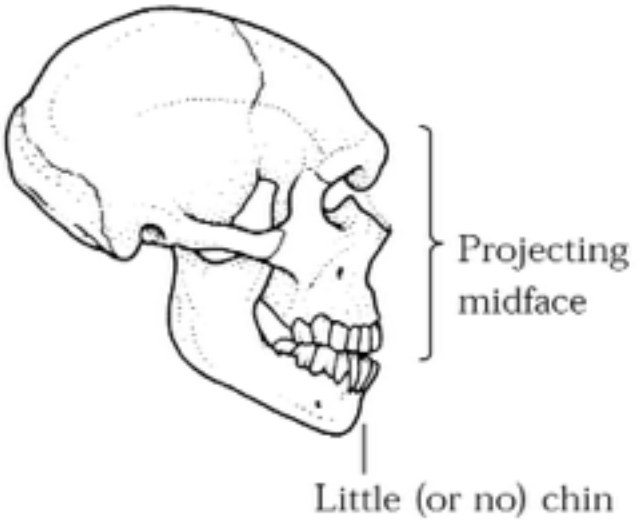
Set of derived traits characterize modern humans

- Face
  - Small
  - High forehead
  - Small brow ridges
  - Protruding chin
- Skull
  - Rounded back
- Teeth
  - Small
- Skeleton
  - Less robust than Neandertals
  - Longer limbs, slighter bones

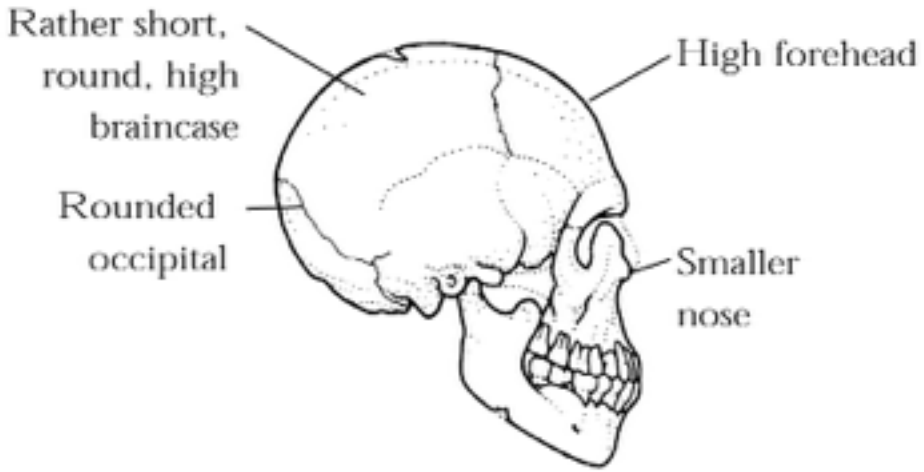




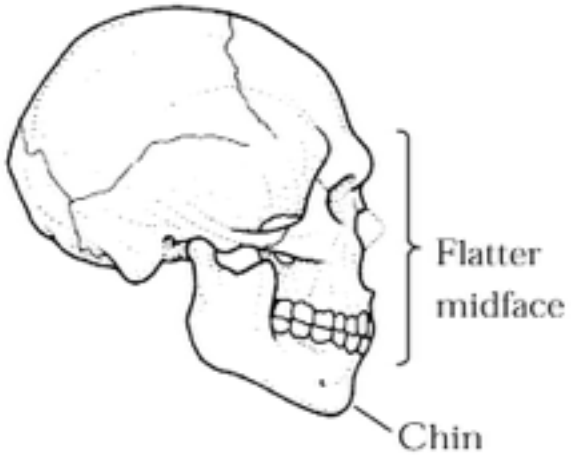
Shanidar 1



La Ferrassie 1



Qafzeh 9

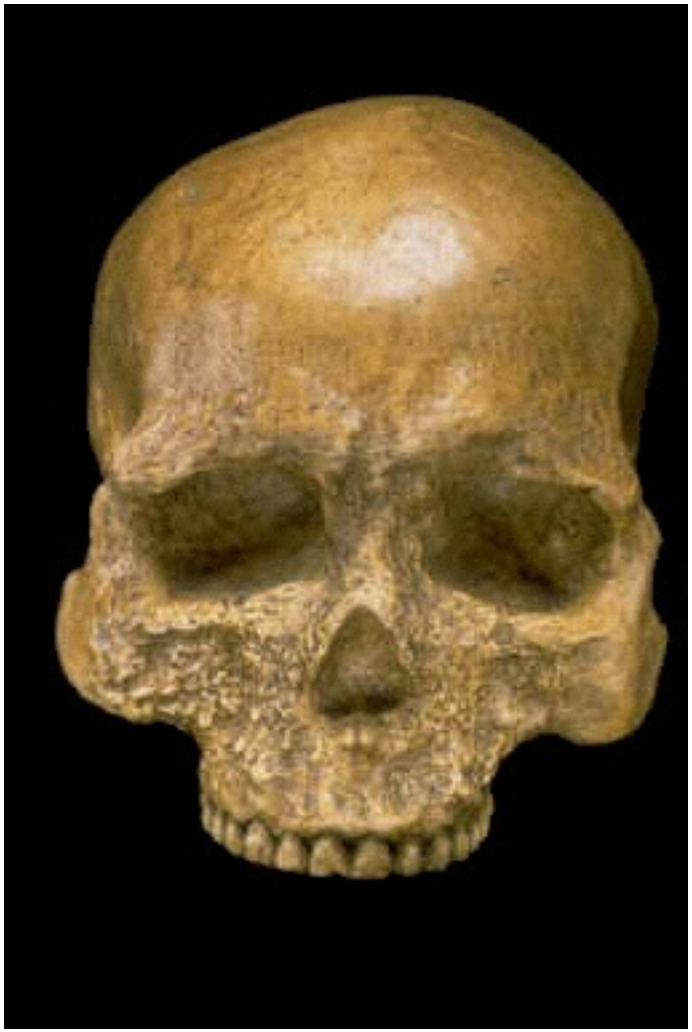


Predmost 3

By 30 kya *Homo sapiens* are the sole surviving members of the hominid lineage

- Neandertals have disappeared from Europe
- *H. erectus* and *H. heidelbergensis* have disappeared from Asia
- *H. sapiens* is in Africa, Europe, Australia, and probably Asia

- Where did we come from?
- What makes us human?



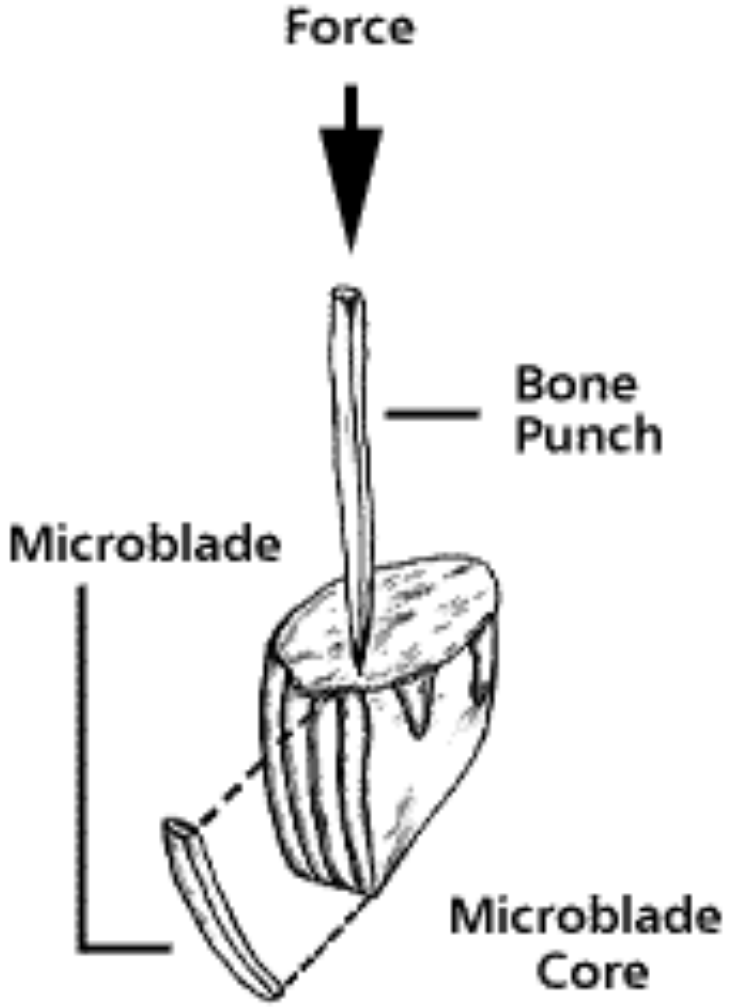
- https://www.youtube.com/watch?v=PP94gmrIcdY

What makes use human?
The technology of *H. sapiens* is more complex

- Began making blade tools (Mode 4)
- Blades have longer cutting edge
- Blades are more difficult to make
  - More preparation
  - More finishing strokes
  - More time
- Microliths

- These are called the Upper Paleolithic (
  (≈40-10 kya) in Europe, N. Africa, parts of Asia

How to make a microblade

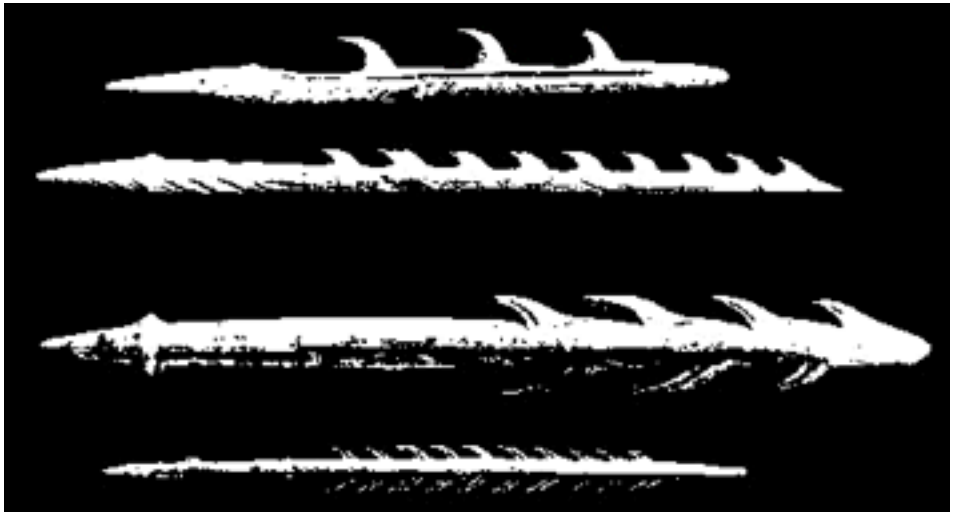


The technology of Homo sapiens is more complex

New materials used in making tools

- Middle Paleolithic = stone, some bone
- Upper Paleolithic = stone, bone, antlers, ivory, teeth

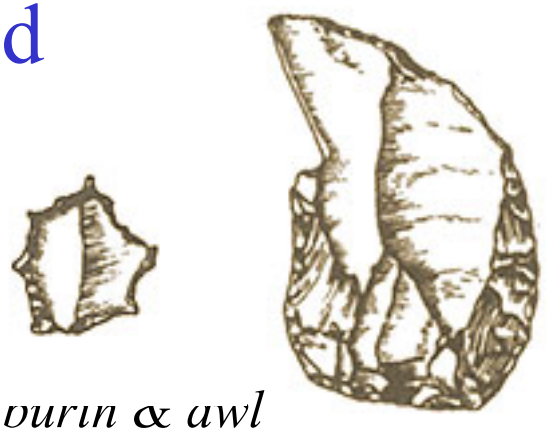
Solutrean bone awl



Magdalenian barbed points

Tool kits became more diversified

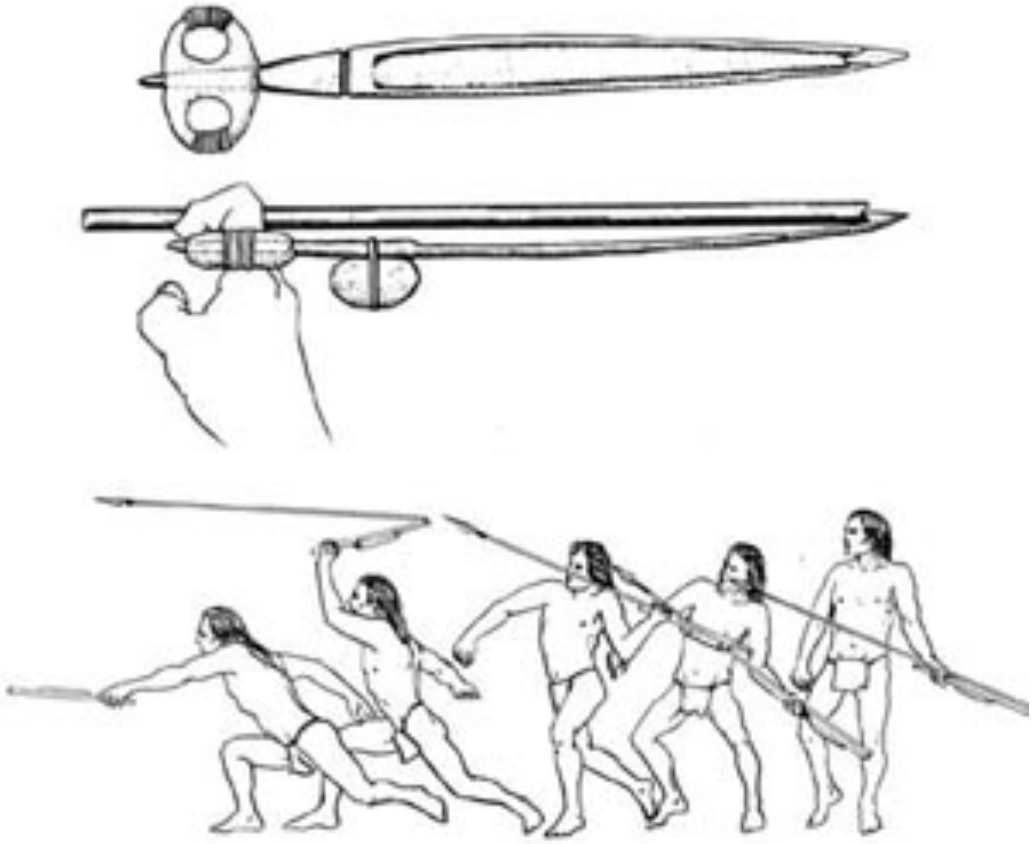
- People made larger variety of tools
  - Chisels = burin = cut bone, antler
  - Drills
  - Throwing sticks = atlatl
  - Scrapers
  - Various points
  - Knives
  - Needles
  - harpoons
- Tool types are stereotyped
  - Mental model of finished tool



burin & awl

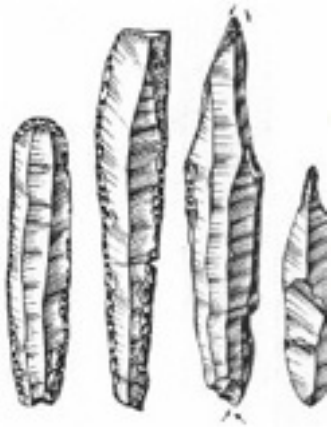
Antler harpoon & blade scraper

Atlatl: improve spear throwing distance search for this on YouTube!



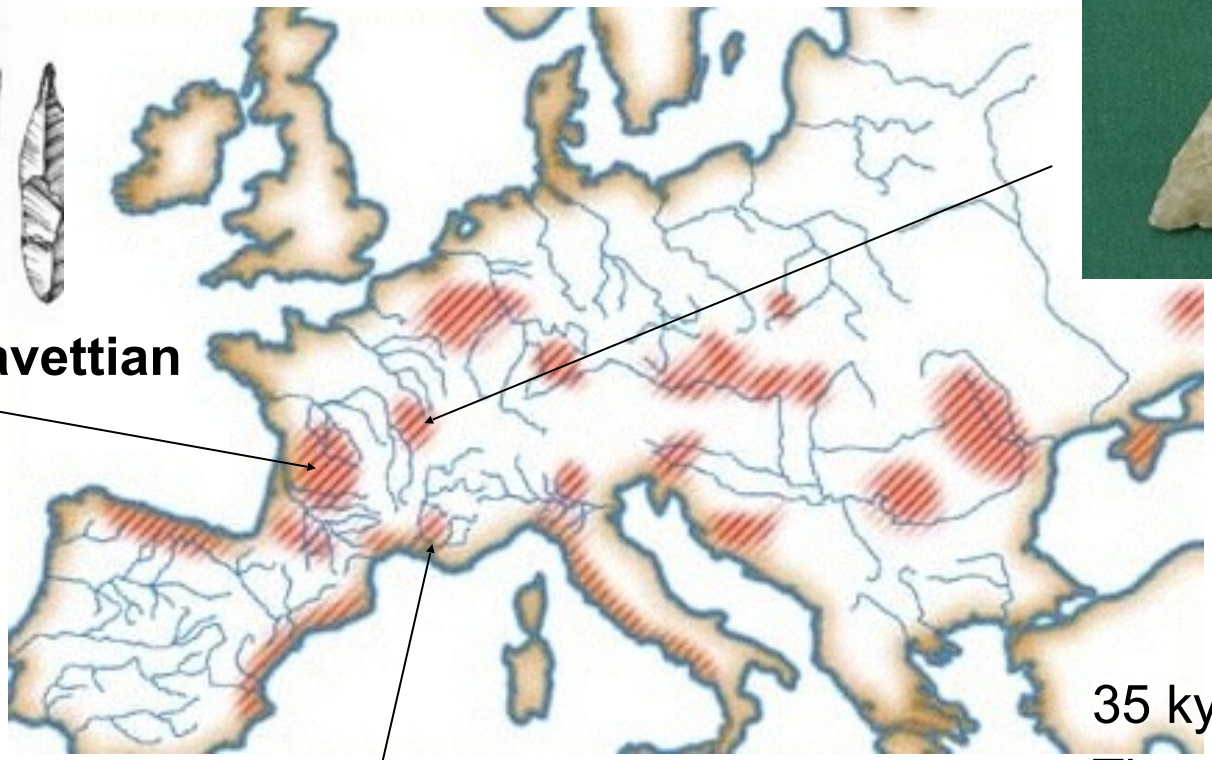
- https://www.youtube.com/watch?v=hjV7lYP6hRw

Tool industries vary across space and over time: UP



27 kya: **Gravettian**

21 kya:
Solutrean



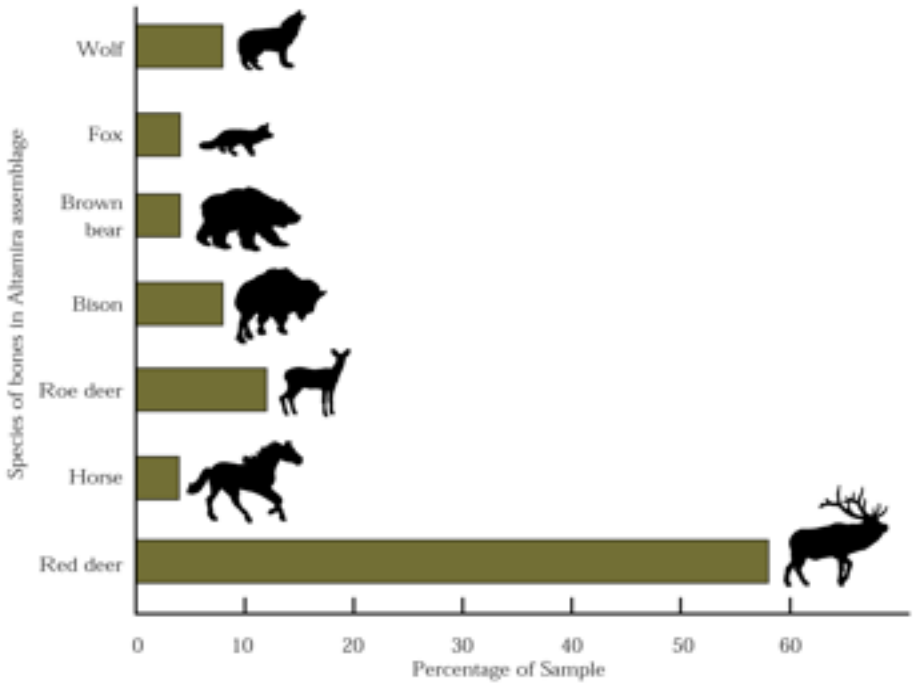
35 kya: **Aurignacian**
Throughout Europe

16 kya: **Magdalenian**

The tools part of a more complex economy

- Materials transported long way from source - 100's of miles
  - In other industries, tools transported only few miles
  - UP people may have traveled long distances or formed trading networks

- Wider range of prey species
  - Hunted large herbivores
  - Fish & shellfish
  - Hunted birds
- Ate variety of vegetable foods



Upper Paleolithic people made clothing

- Some of the tools may have been used for sewing
  - Needles, awls
- People made clothing, probably out of animal skins
- Decorated clothing with beads

UP peoples may have coped with environment better

- Had longer life spans than Neanderthals (< 40)
  - UP men sometimes lived to 60
  - UP women occasionally lived past 40
  - Childhood mortality very high
- Less vulnerable to injury and disease
  - Show less evidence of trauma, illness
  - May have been better nourished
  - May have managed encounters with dangerous animals better

UP peoples buried their dead, sometimes with ceremony

- Burials were common
- Some people buried with objects from everyday life
  - ornaments
  - Tools
  - ochre

= status markers?

= social hierarchy in UP society?

- May have had concept of life after death

Upper Paleolithic burial with ivory beads, ochre sprinkled over the body, and a carved mammoth ivory headband - from Sungir 23 kya

UP Peoples were the first artists

- Carvings

Engraving of horse on bone

UP Peoples were the first artists

- Ornaments

UP peoples were the first artists

- Musical instruments

UP Peoples were the first artists - Venus figures

Oldest cave paintings from Le Chauvet, France, 32 kya

Famous paintings from Lascaux, France, are dated to 17 kya

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Complex signature of modern human behavior

- **Ecology**
  - Extend range into new areas
  - Greater diet breadth
- **Economy and social organization**
  - Long distance exchange of raw materials
  - Hunt large, dangerous animals
  - Scheduling and seasonality in resource use
  - More advanced extractive foraging
- **Technology**
  - Blades, microliths
  - Hafting and composite tools
  - Tools in new materials, e.g. antler
  - Regional variation in tool styles
  - Iron pyrite to make fire
- **Symbolic behavior**
  - Self adornment
  - Decorated objects
  - Images and representation
  - Burials with grave goods

The "Human Revolution" in the Upper Paleolithic

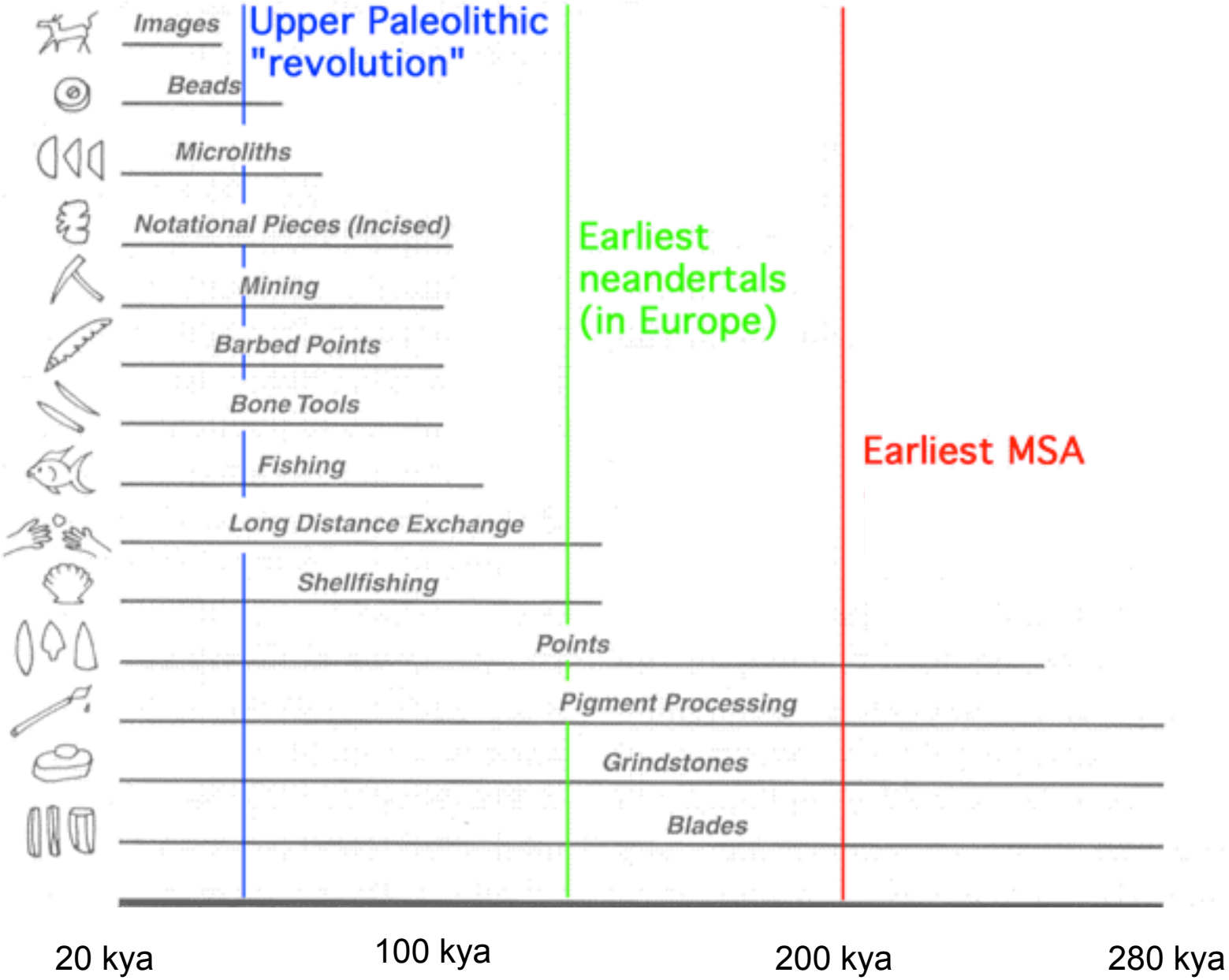
- All these things suggest an explosion in human culture

- Some argue that despite "modern" bodies our minds were not yet modern
  - 60 - 40 kya complex artifacts appear
  - Cognitive reorganization or mutation
    - Likely multiple abilities snowball & build up to…
  - Increased creativity, innovation, intelligence

MSA peoples expanded their range to all of African

- Ability to survive in more challenging habitats is evidence of cognitive sophistication and social complexity

- MSA peoples used desert areas
  - Sites were not confined to areas adjacent to water source
  - Suggests use of water containers
- MSA peoples used tropical forests
  - Hard to make a living in tropical forests
  - No modern human groups able to subsist entirely on forest resources (horticulture)
  - MSA peoples seem to have lived in tropical forests

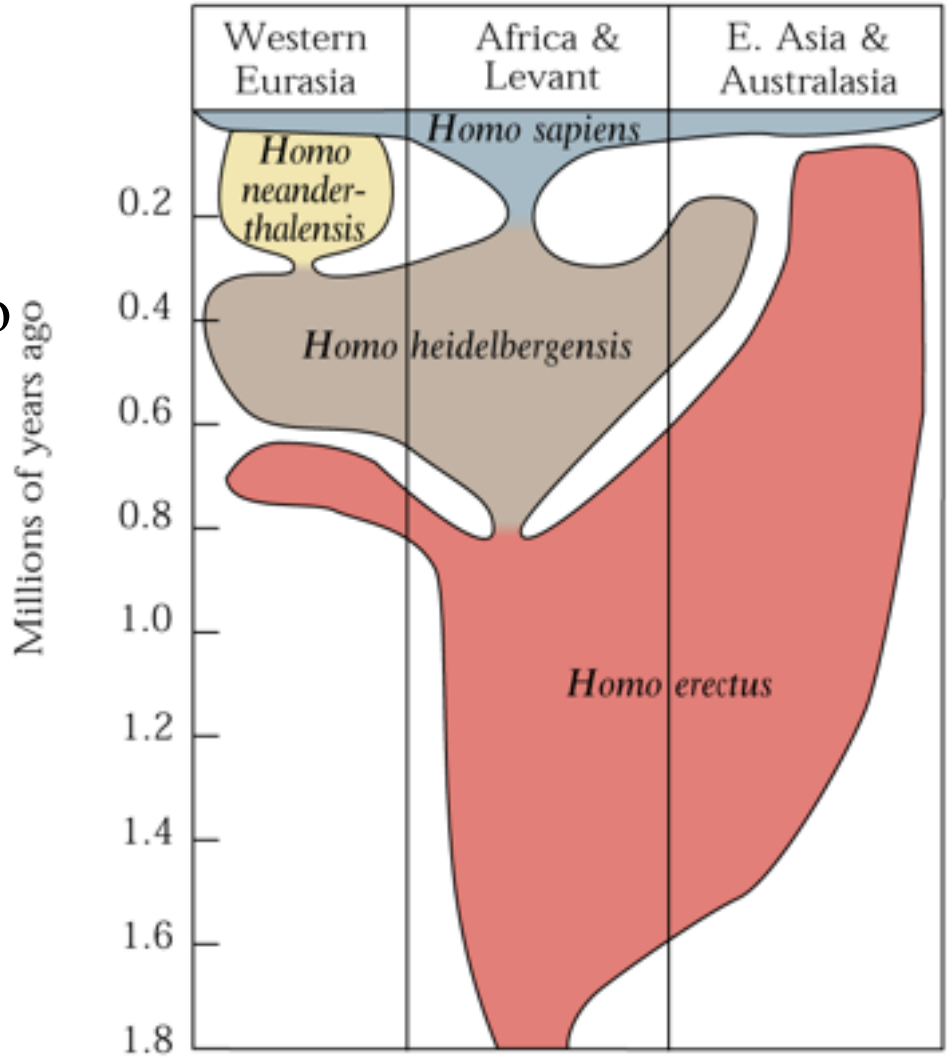

Images
Upper Paleolithic "revolution"
Beads
Microliths
Notational Pieces (Incised)
Earliest neandertals (in Europe)
Mining
Barbed Points
Bone Tools
Earliest MSA
Fishing
Long Distance Exchange
Shellfishing
Points
Pigment Processing
Grindstones
Blades
20 kya
100 kya
200 kya
280 kya

African Evolution, European Revolution

- Elements of human "revolution" were assembled bit by bit in Africa over last 250 kya
- Cognitive advances (probably) did not suddenly come into existence, but evolved gradually along with technology
  - Still hotly debated
  - Likely some genetic changes around 50kya
- Sudden change seen in European record implies replacement of Neanderthals by African populations of *Homo sapiens*

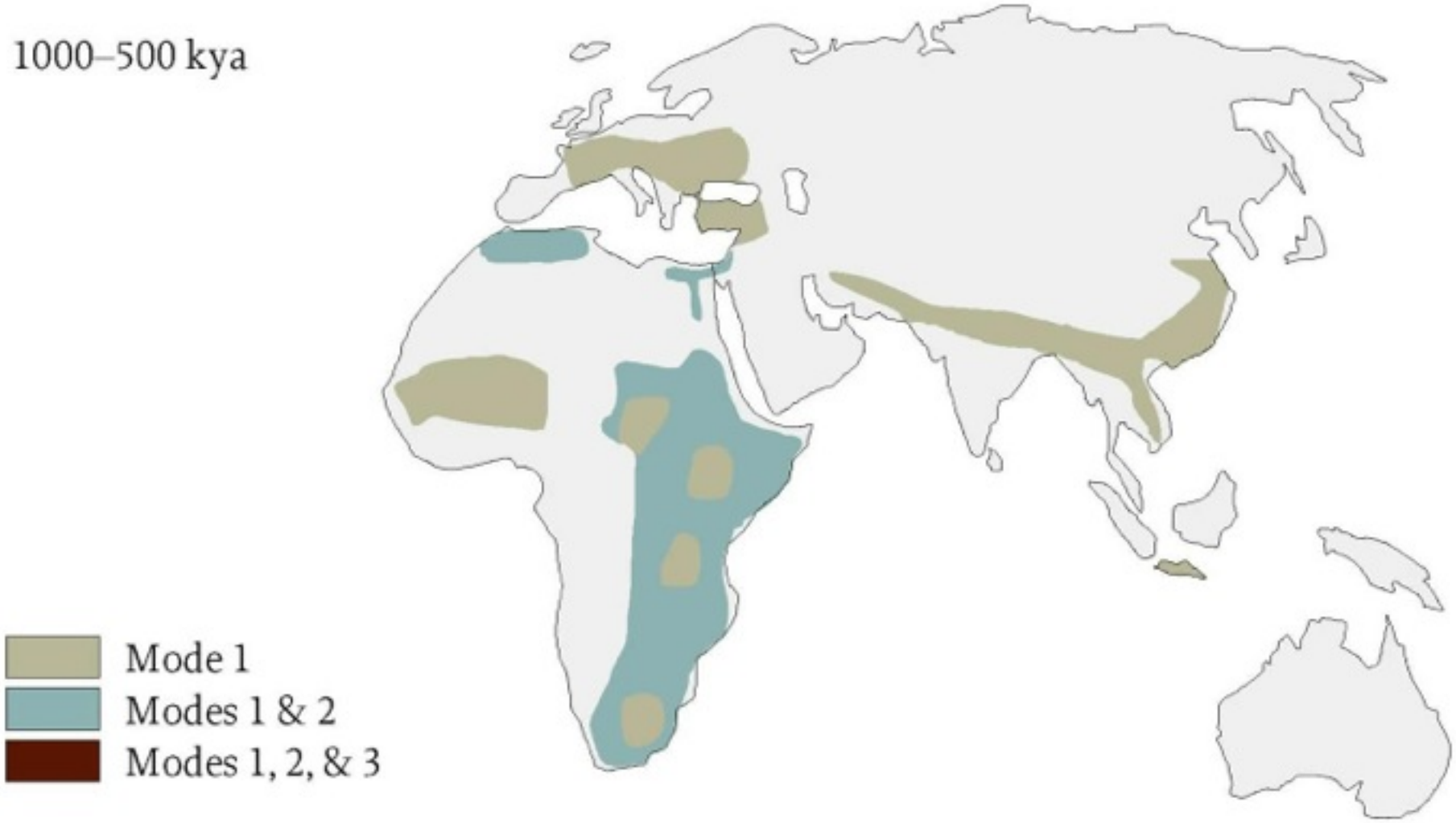
Out of Africa Model

- African and Asian forms of Lower Pleistocene hominids = *H. erectus*
- *H. erectus* in Africa gave rise to *H. heidelbergensis*
- *H. heidelbergensis* gave rise to *H. neanderthalensis* in Europe and *H. sapiens* in Africa
- *H. sapiens* replaced other hominin species

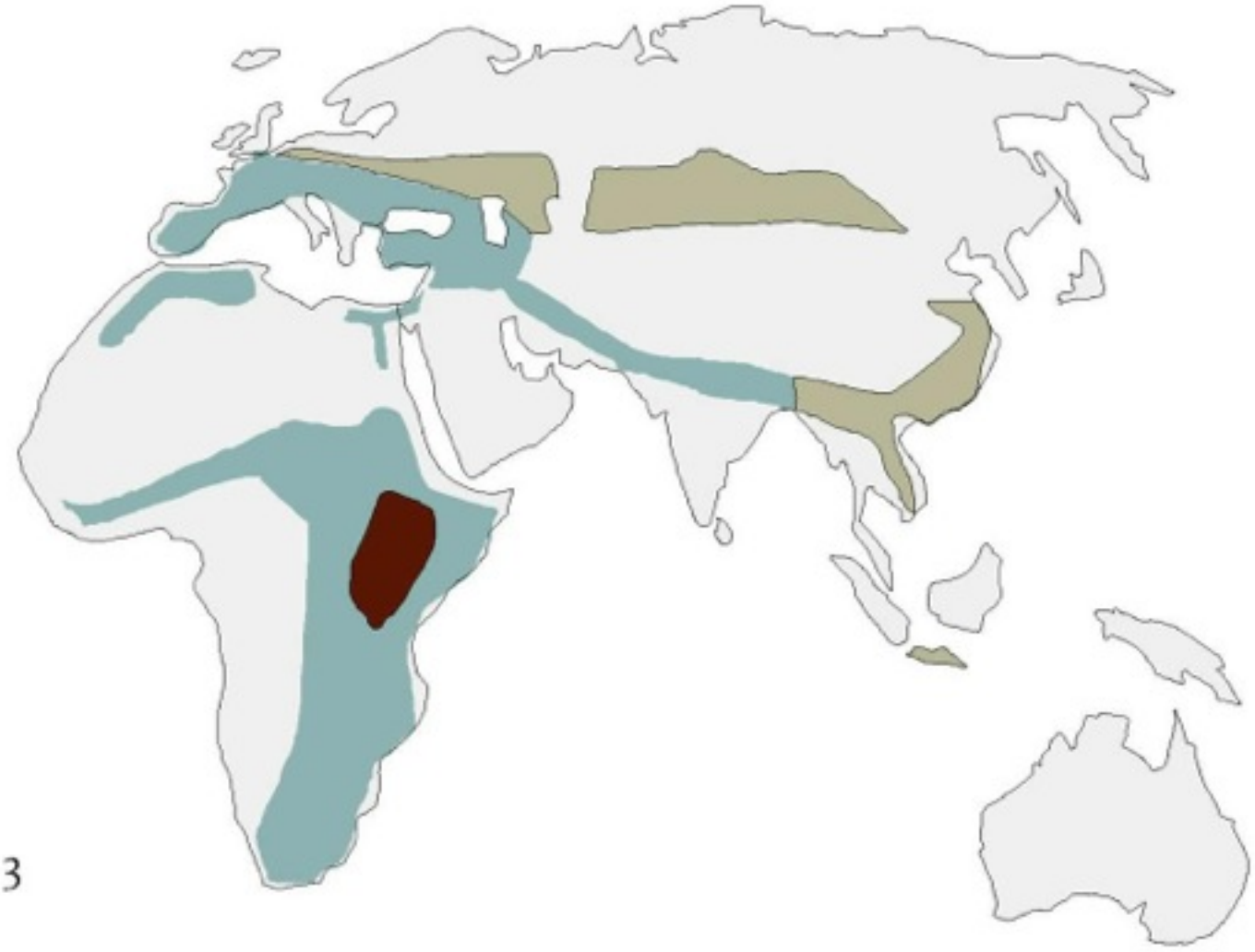


Evidence for this pattern of evolution and migration

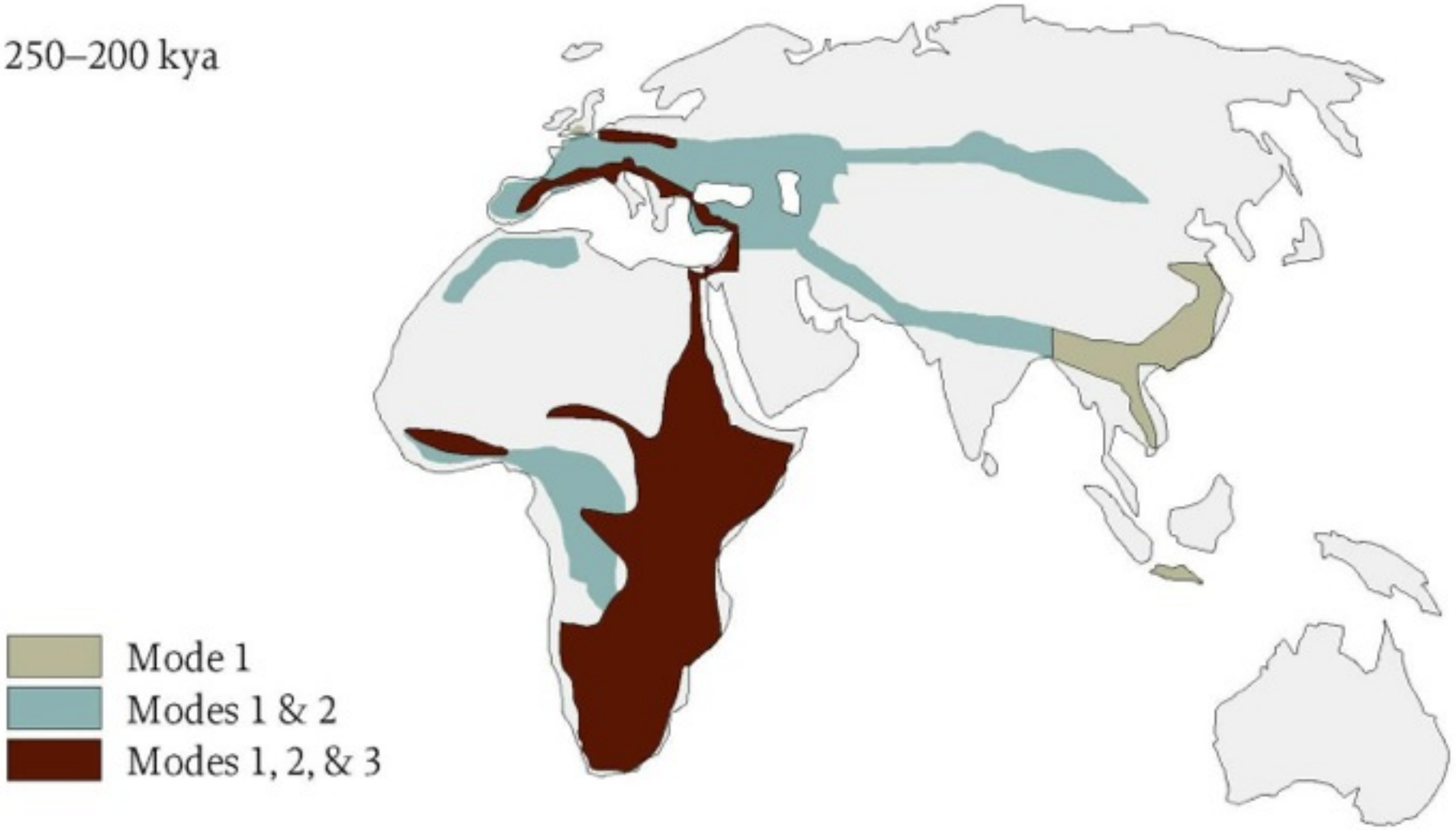
- Fossil evidence
- Genetic data
- Tool distributions
  - **same** general timeline as fossil evidence
  - **Each successive wave of tool diffusion coincides with a warming period, facilitating migration out of Africa**


1000–500 kya
Mode 1
Modes 1 & 2
Modes 1, 2, & 3

500–250 kya



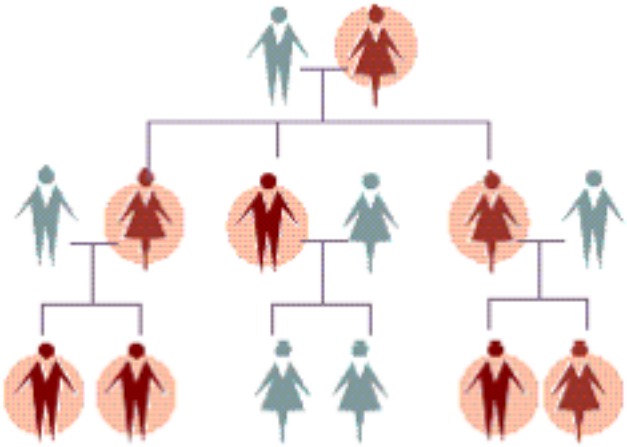
Mode 1
Modes 1 & 2
Modes 1, 2, & 3


250–200 kya
Mode 1
Modes 1 & 2
Modes 1, 2, & 3

Genetic Data: mtDNA

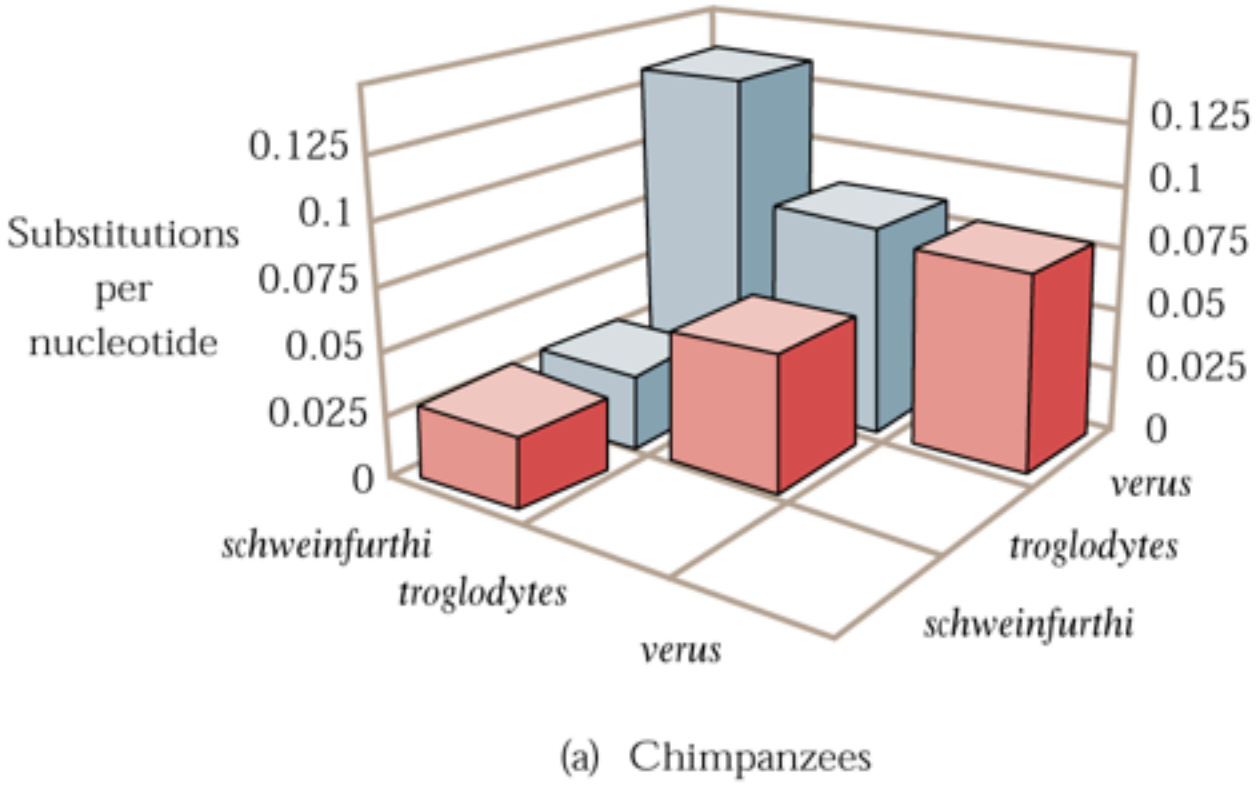
mtDNA is useful for reconstructing evolutionary events

- Found in the mitochondria
- Inherited only through maternal line
  - No recombination
  - All change is product of mutation
- Mutation occurs at constant rate
  - Changes accumulate rapidly
- Many copies present
  - Hundreds of mitochondria per cell
- Compare mtDNA between people
  - Tally up number of difference
  - Differences = genetic diversity



We can compute amount of genetic variation within a population and also amount between populations

- Consider 3 chimpanzee populations
- There is generally more variation between populations than within them

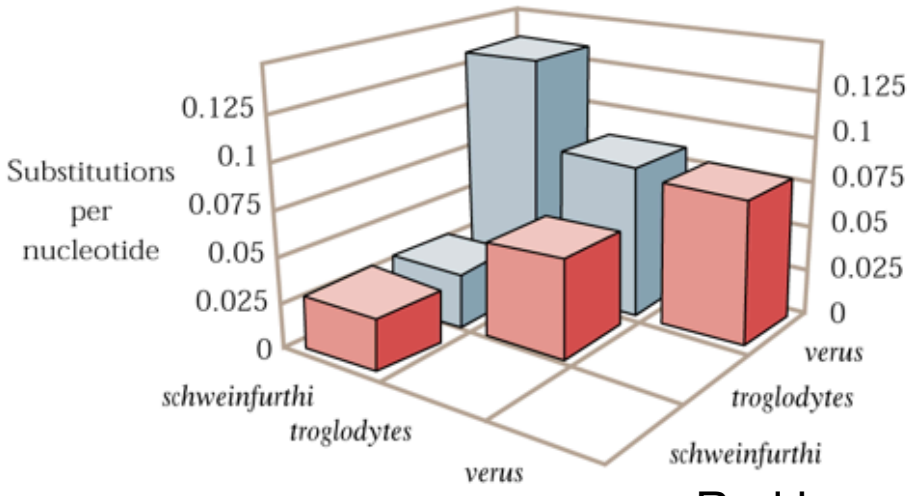


(a) Chimpanzees

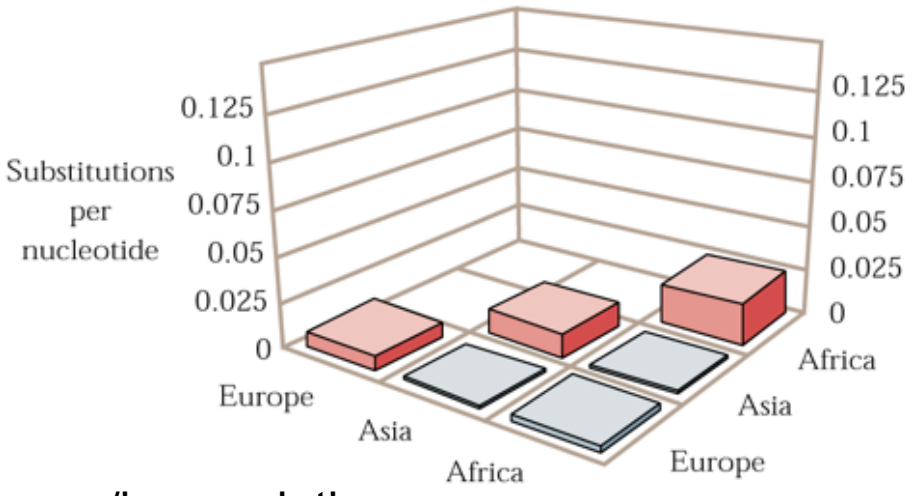
Red bars = variation within population
Blue bars = variation between populations

Compare amount of genetic variation between humans from Africa, Asia, and Europe

- Humans more variation within populations than between them
  - 2 humans from same population more similar than 2 chimps from same population
  - 2 humans from different population more similar than 2 chimps from same population



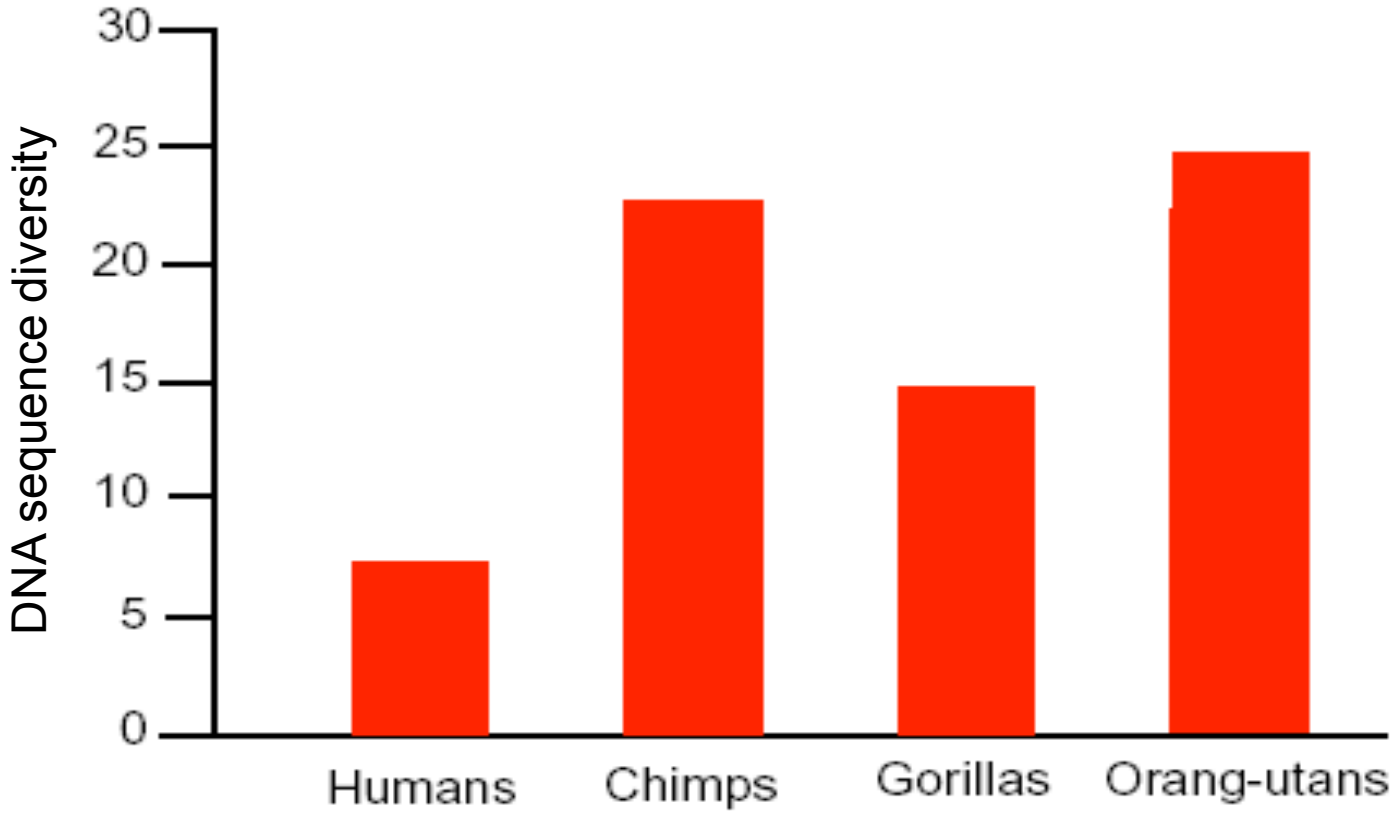
(a) Chimpanzees



(b) Humans

Red bars = var. w/in population
Blue bars = var. b/t populations

Compared to all of the other Great Apes, humans have very little genetic variation



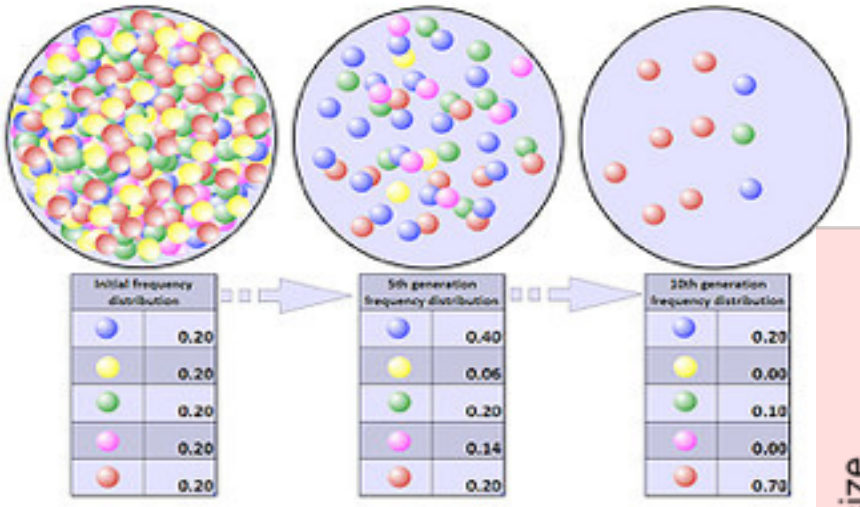
Why do humans have so little variation?

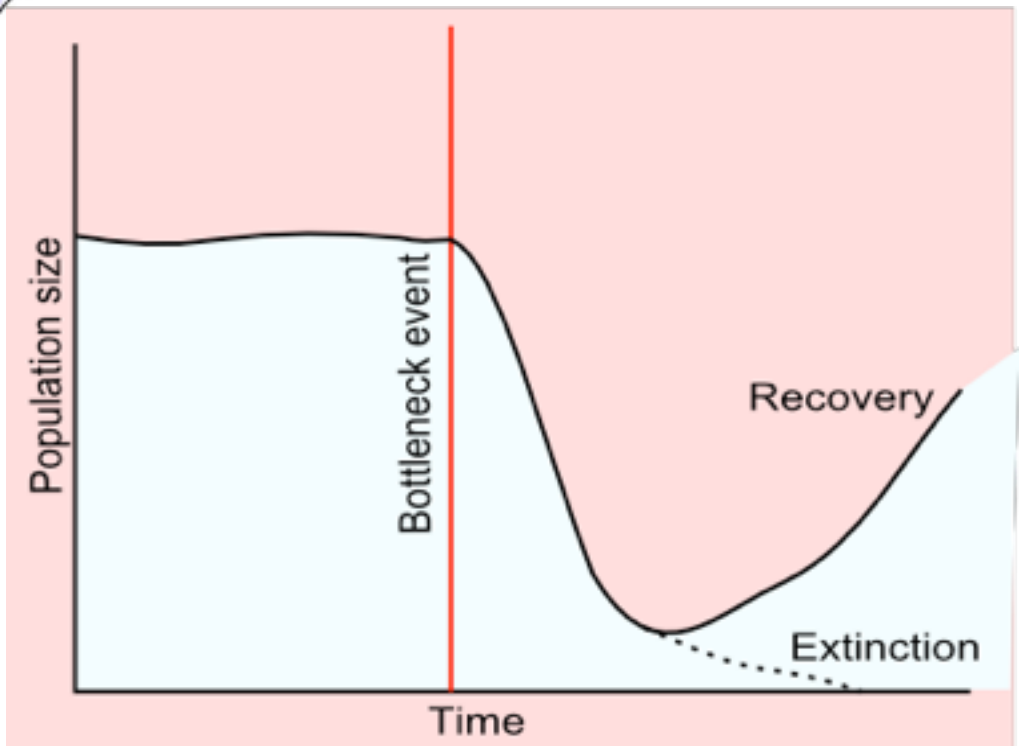
- Human populations may have gone through an evolutionary **bottleneck** and then expanded quickly

- Mutation introduces variation slowly
- If population grows quickly, it will take a long time to reach equilibrium level of variation

- **Suggests that human population expanded rapidly from small population sometime in the very recent past**

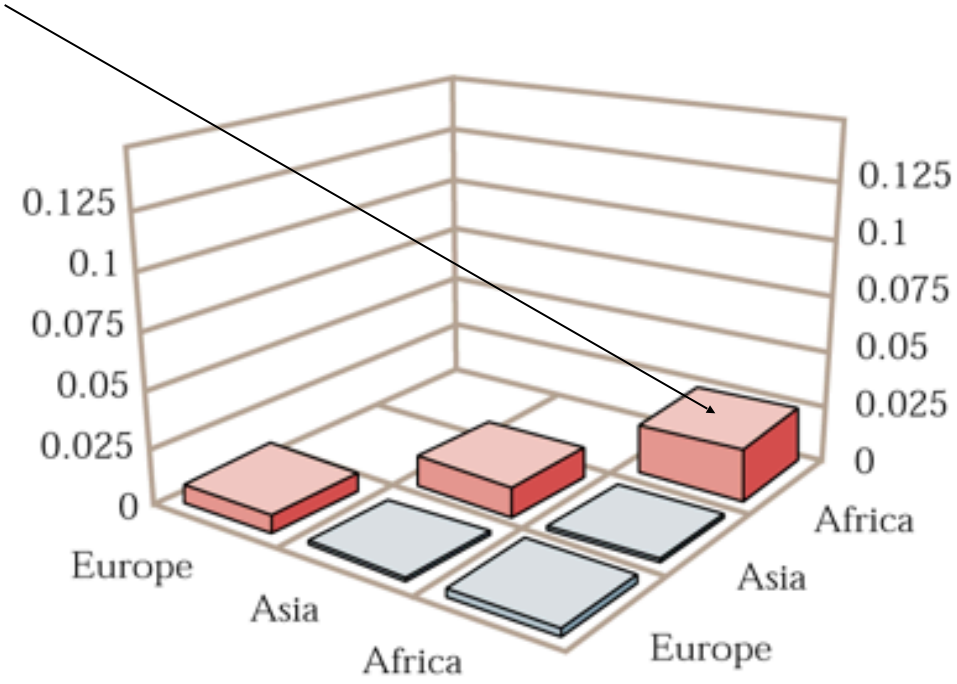
Genetic diversity & population size crashed, population size increases rapidly, but genetic diversity recovers slowly





The pattern of variation in mtDNA is also informative

- African sample is more variable than Asian or European sample
- Analyses of nuclear DNA show same pattern
- What could have produced this pattern?



100 kya: Anatomically modern humans evolve and disperse throughout Africa.

100–50 kya: Dispersed human populations diverge within Africa.

Out of Africa

50 kya: People from one African population migrate to Eurasia and Australasia.

50 kya–present: Dispersed human populations diverge.

Mitochondrial DNA also tells us the history of human groups and migrations

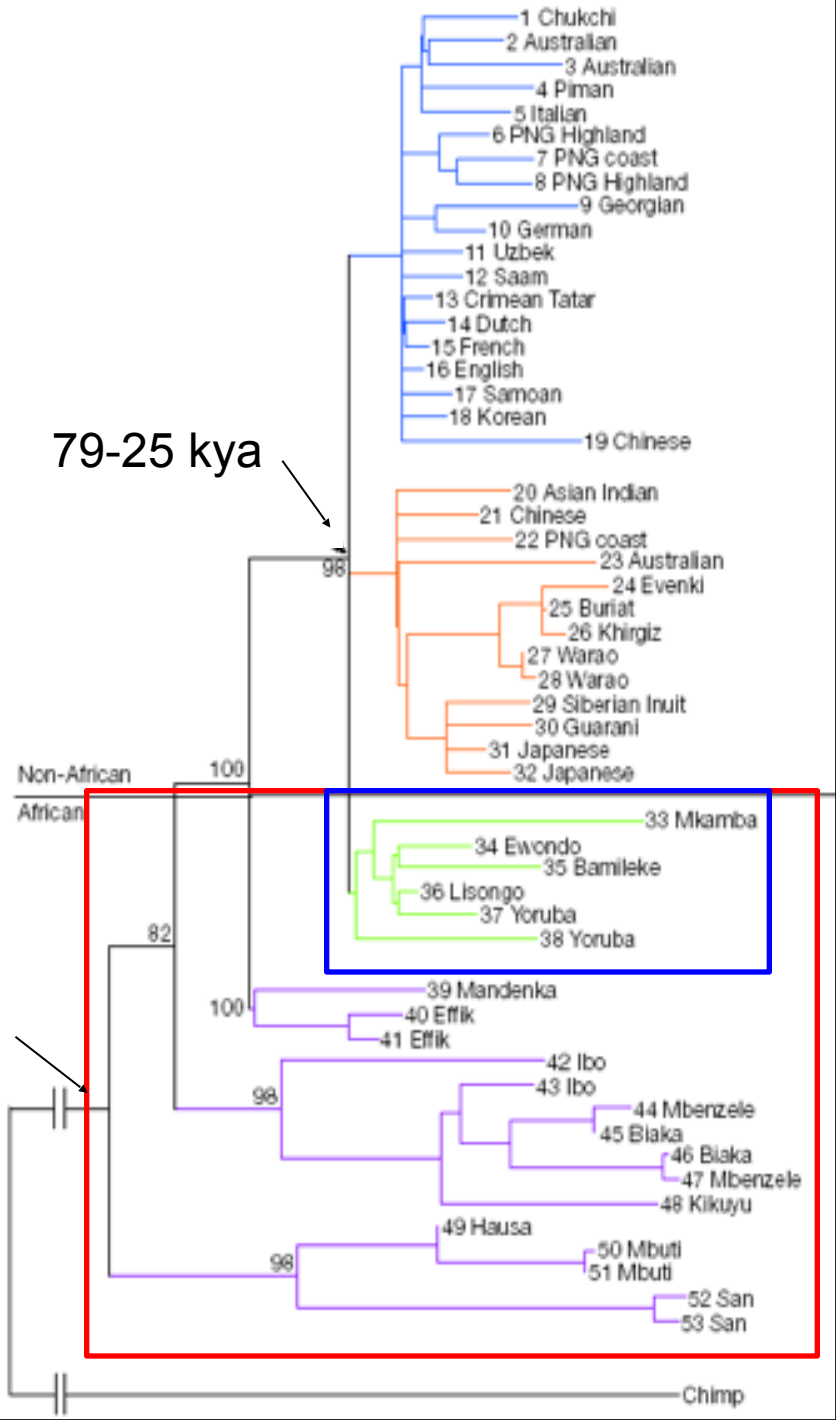
- Greatest mtDNA variation among African populations
- Less mtDNA variation as move further away from Africa

- **Use pattern of variation to build gene trees of human populations**
  - The trees provide branching pattern
  - The tree also allows us to assign dates when lines split

What does the tree tell us?

- Deepest branches are in Africa
- One African branch links Africans with rest of world
- Humans originated in Africa
- Human lineages diversified in Africa
- Then, some Africans left and gave rise to peoples of rest of world

220-120 kya



mtDNA and Y-chromosome evidence fits the fossil record of modern human origins

- Individuals with Neanderthal-like traits appear in Europe 300 kya
  - Climate data suggest that Neanderthals became isolated in Europe
- About 250-130 kya, anatomically modern humans appeared in Africa
- By 90 kya, modern humans were living at sites in the Middle East
  - During this period, climatic conditions permitted movement between Africa and Middle East