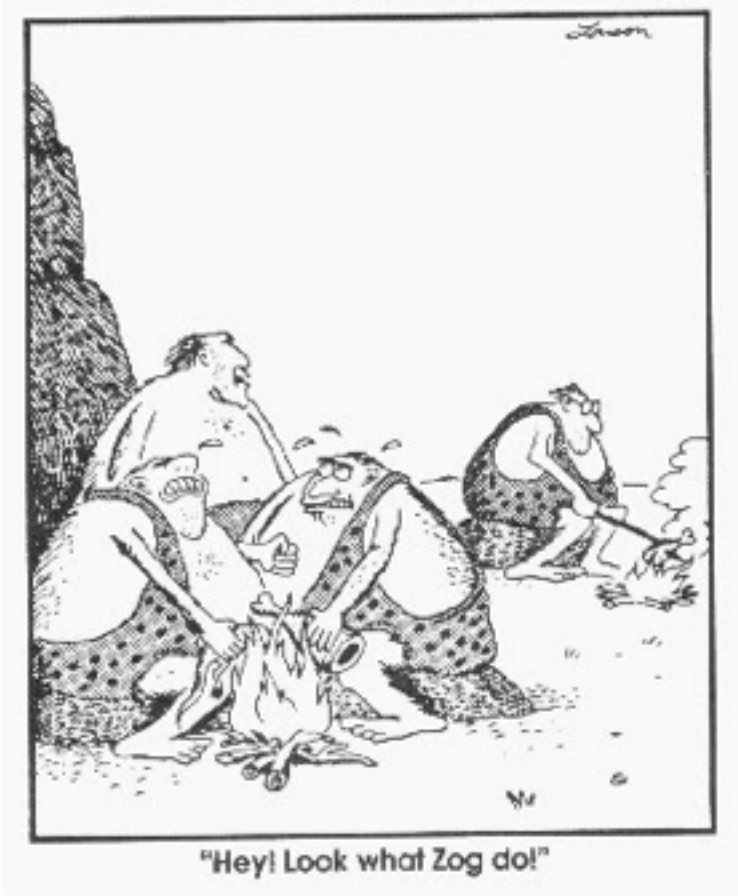
Anthro 101:
Human Biological Evolution

Lecture 17 & 18: *Homo sapiens*



Prof. Kenneth Feldmeier

While Neanderthals 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

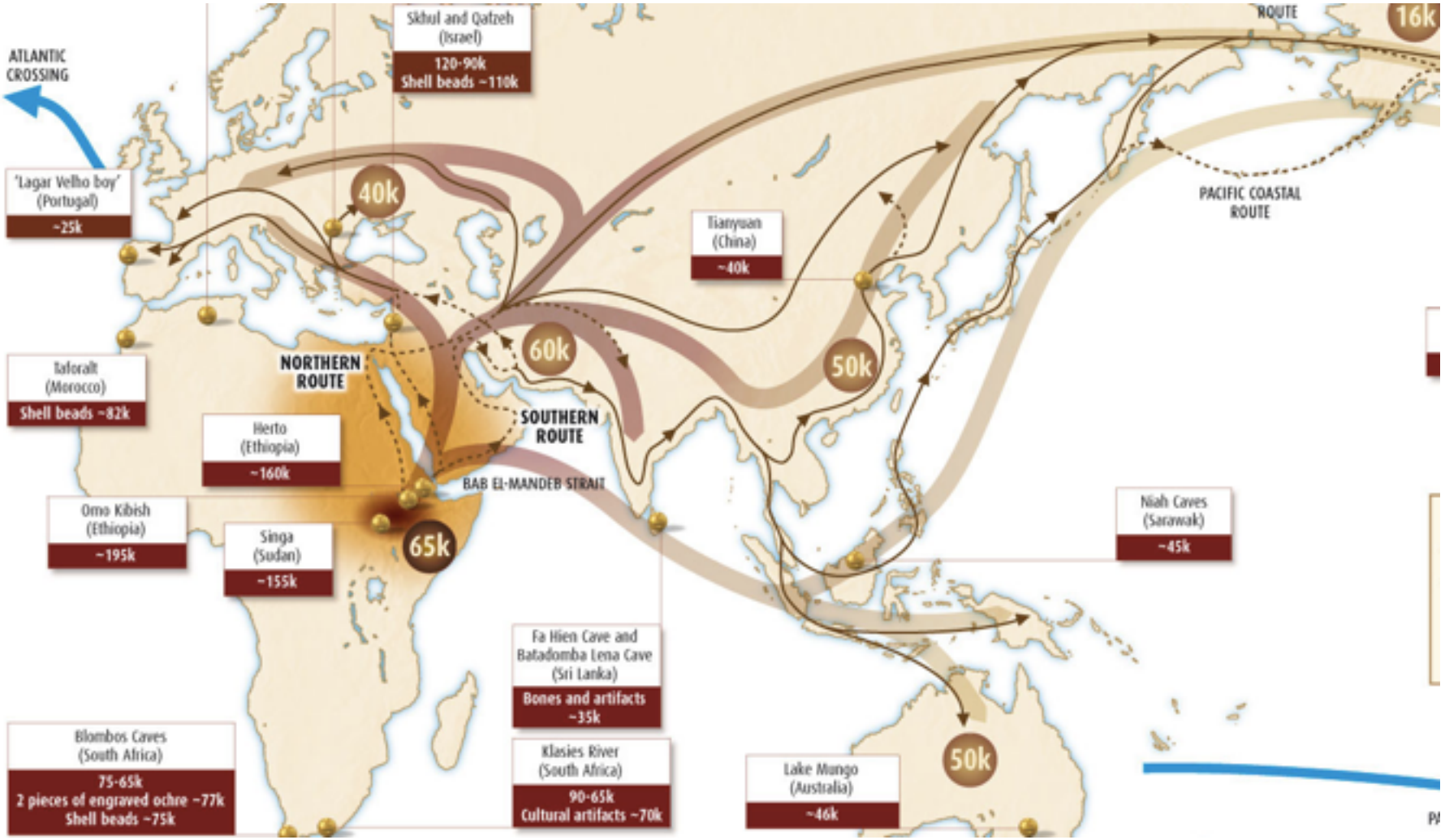
Australia (50 kya - came via south Asia)

- 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



Great Documentary about Our Journey

- Nova: First Peoples
- http://www.pbs.org/first-peoples/home/

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

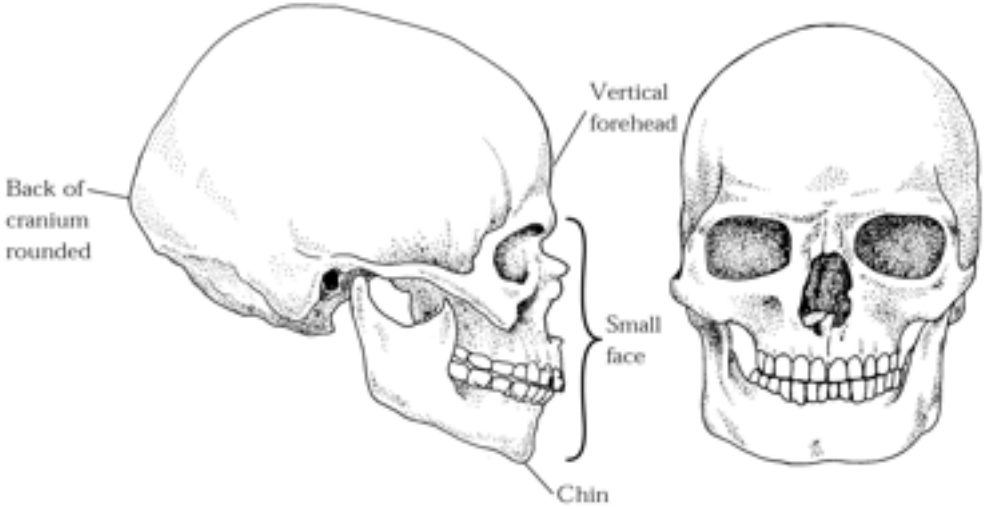
Americas (15 kya? <u>Likely</u> much earlier)

- 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

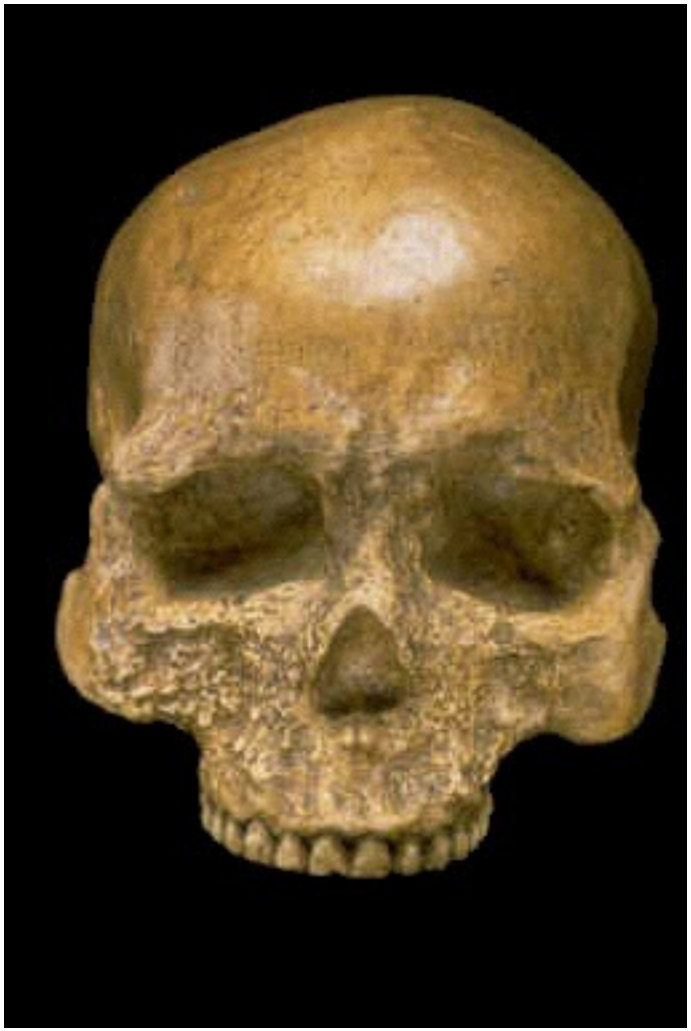
- Face
  - Small
  - High forehead
  - Small brow ridges
  - Protruding chin
- Skull
  - Rounded back
- Teeth
  - Small
- Skeleton
  - Less robust than Neanderthals
  - Longer limbs, slighter bones



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

- Neanderthals 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?



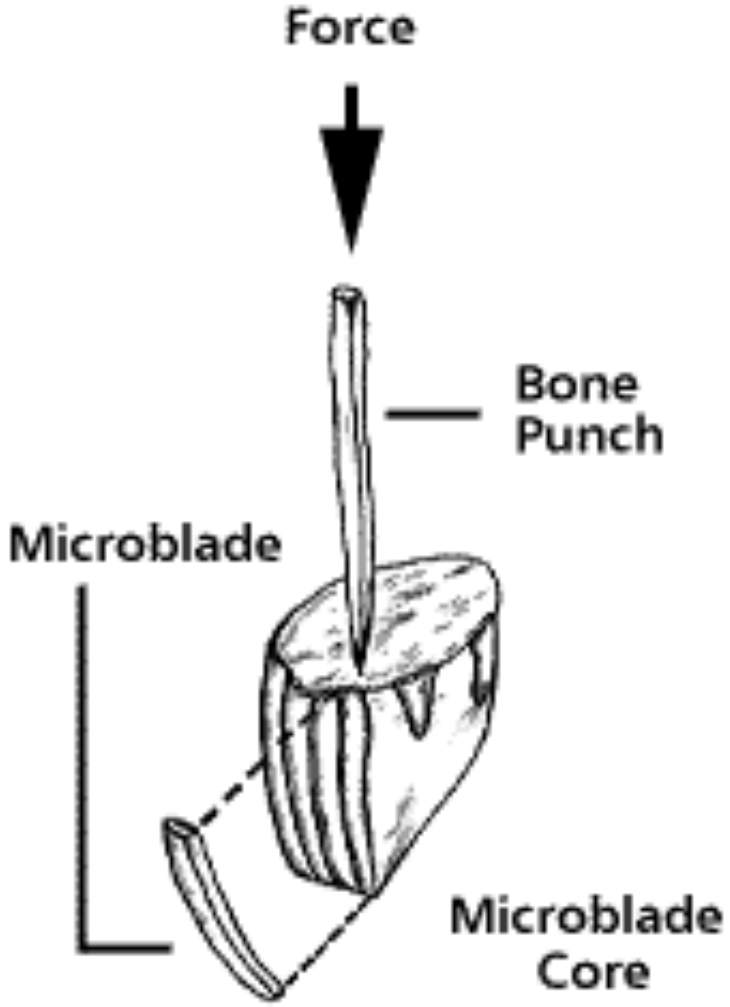
- https://www.youtube.com/watch?v=PP94gmrIcdY

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 (UP) industries (≈40-10 kya) in Europe, N. Africa, parts of Asia

How to make a microblade

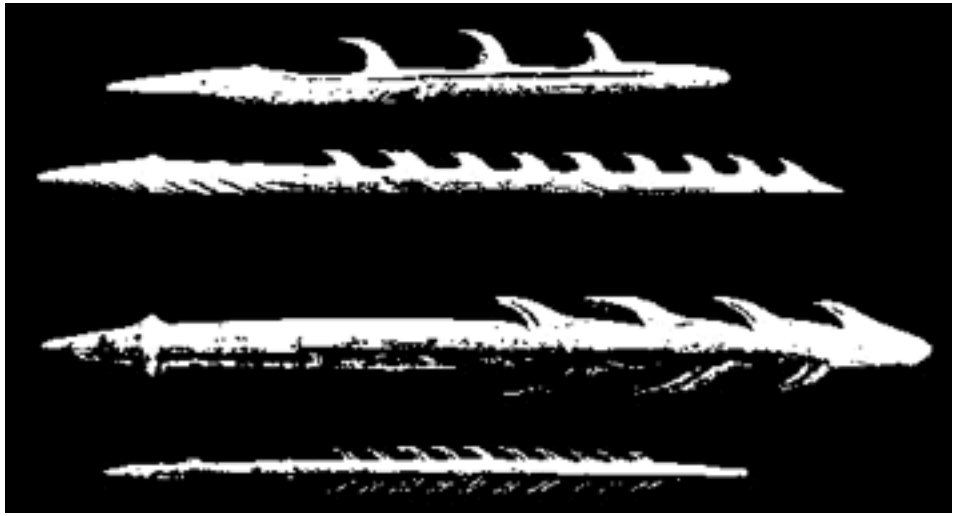


The technology of Homo sapiens is more complex

New materials used in making tools

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

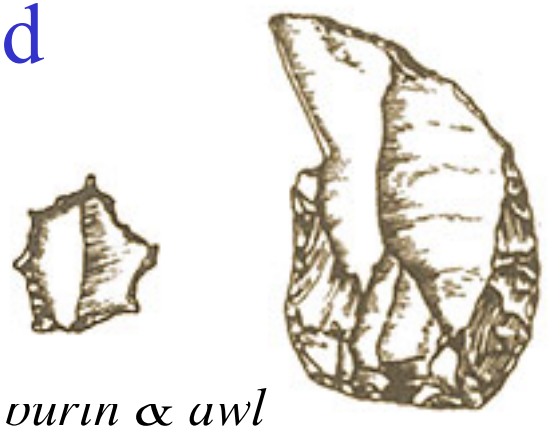
Solutrean bone awl



Magdalenian barbed points

Tool kits became more diversified

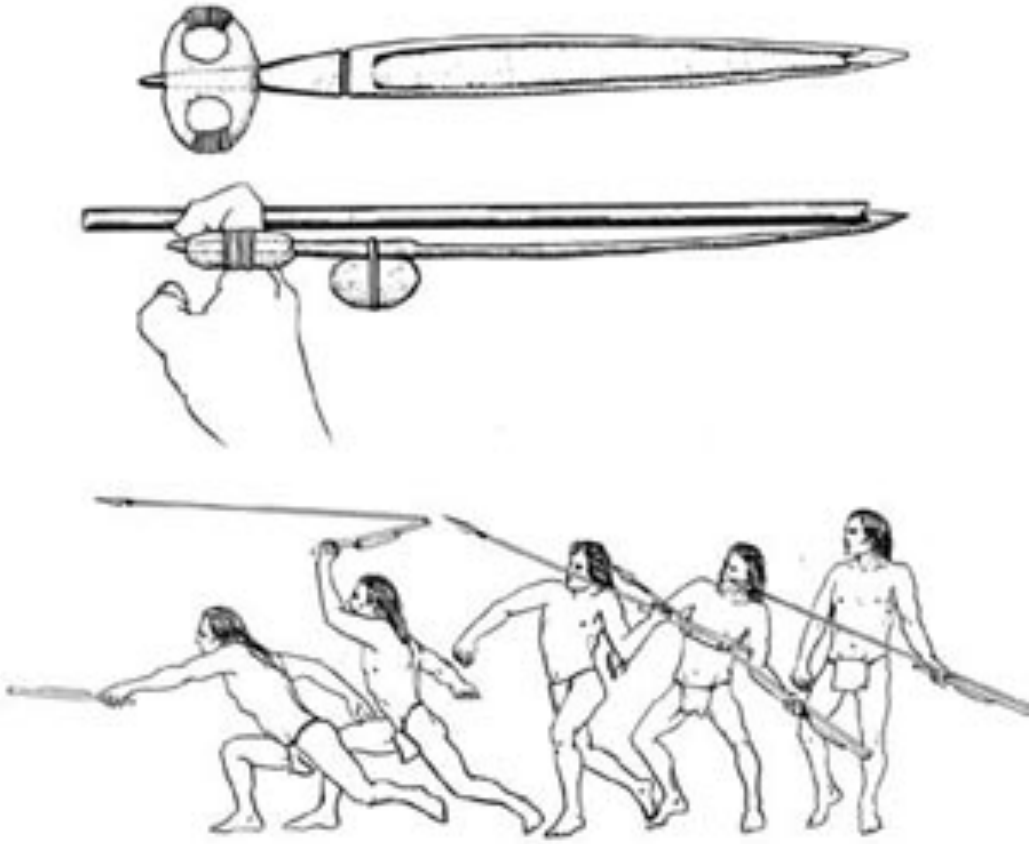
- People made larger variety of tools
  - Chisels = burin = cut bone, antler
  - Drills
  - Throwing sticks = atlatl
  - Scrapers
  - Various points
  - Knives
  - Needles
  - harpoons
- Tool types are stereotyped
  - Mental model of finished tool



burin & awl

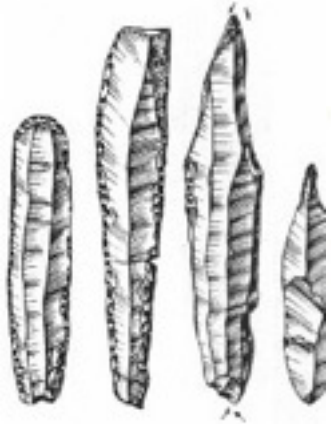
Antler harpoon & blade scraper

Atlatl: improve spear throwing distance

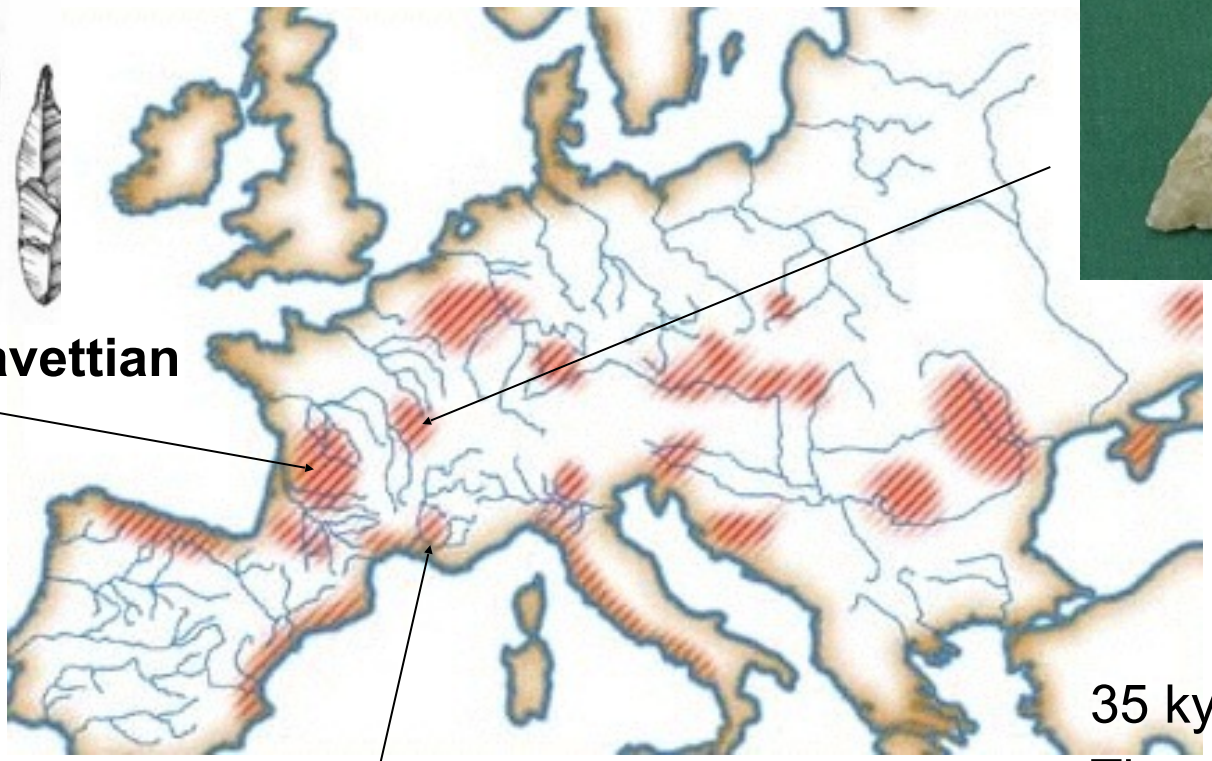


- https://www.youtube.com/watch?v=hjV7lYP6hRw

Tool industries vary across space and over time: UP



27 kya: **Gravettian**



21 kya:
Solutrean

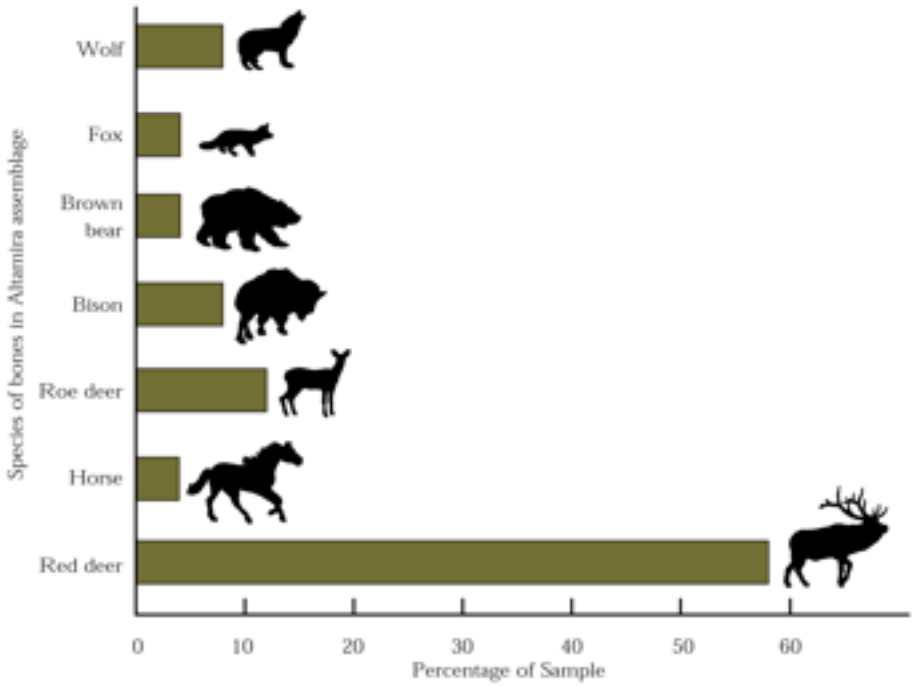
35 kya: **Aurignacian**
Throughout Europe

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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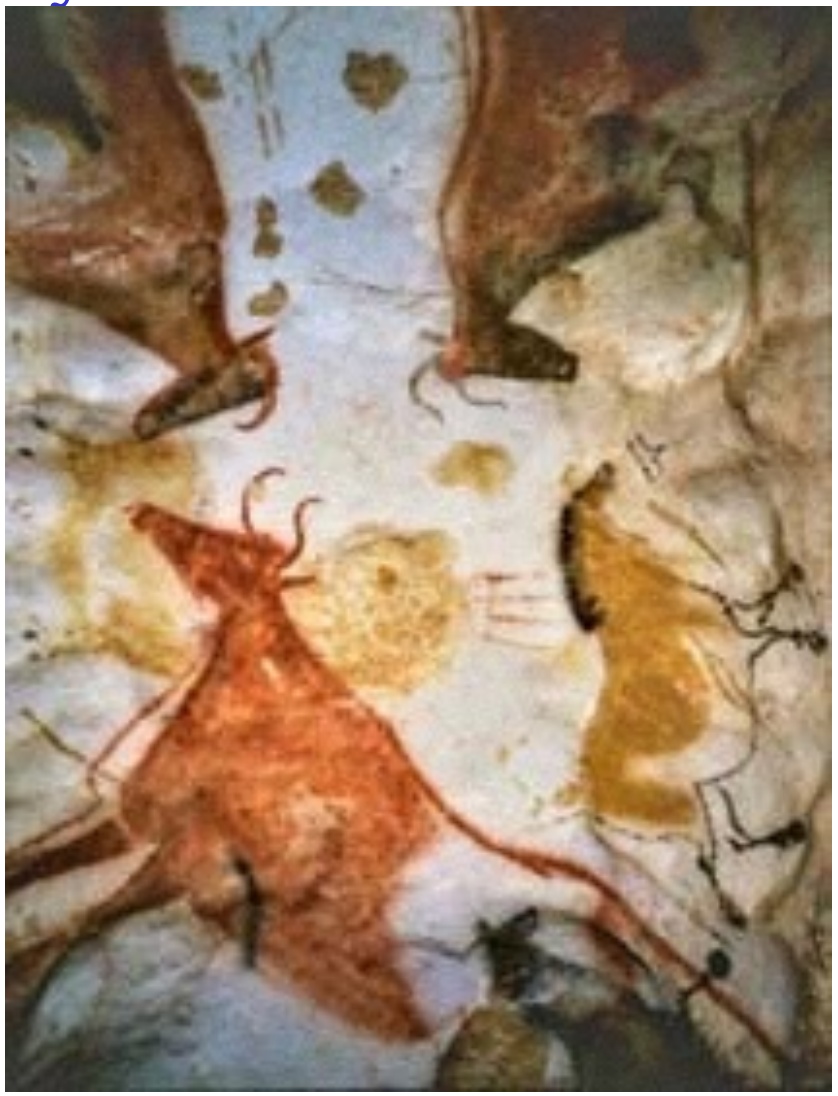


Famous paintings from Lascaux, France, are dated to 17 kya

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

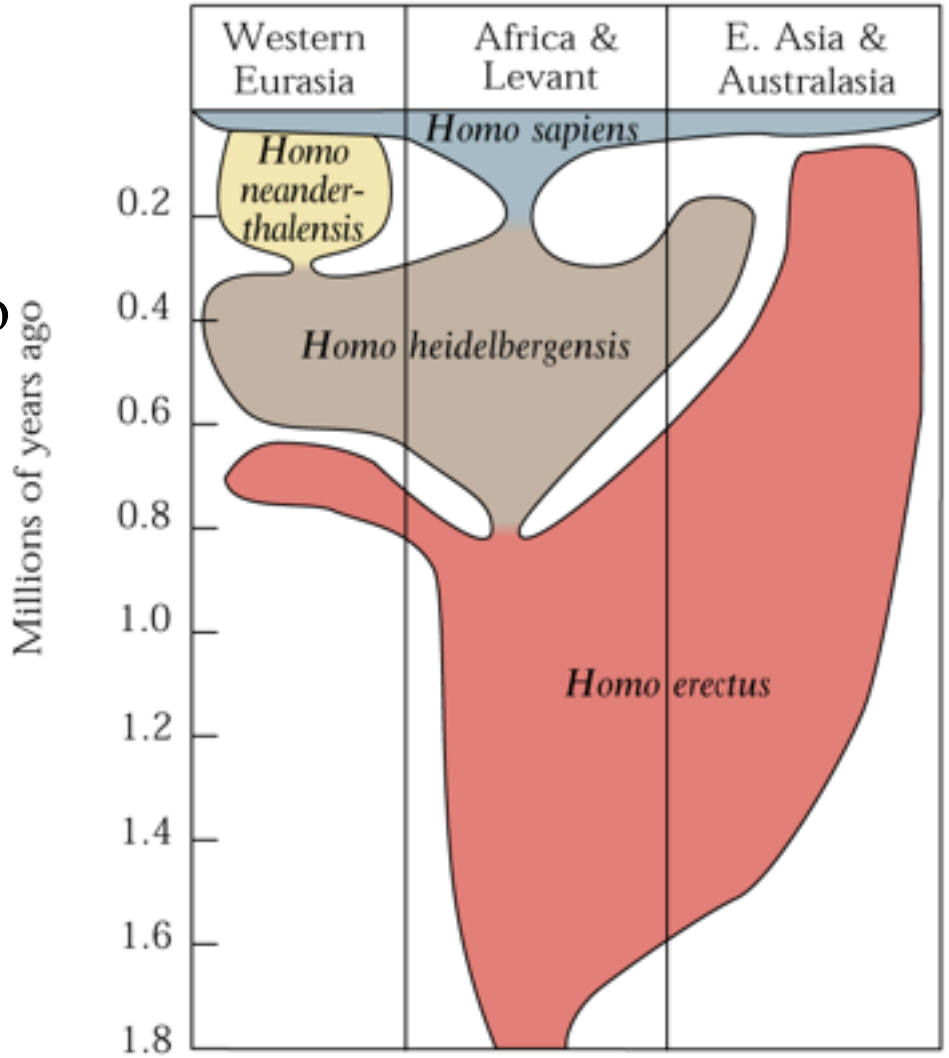
MSA peoples expanded their range to all of African

- 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

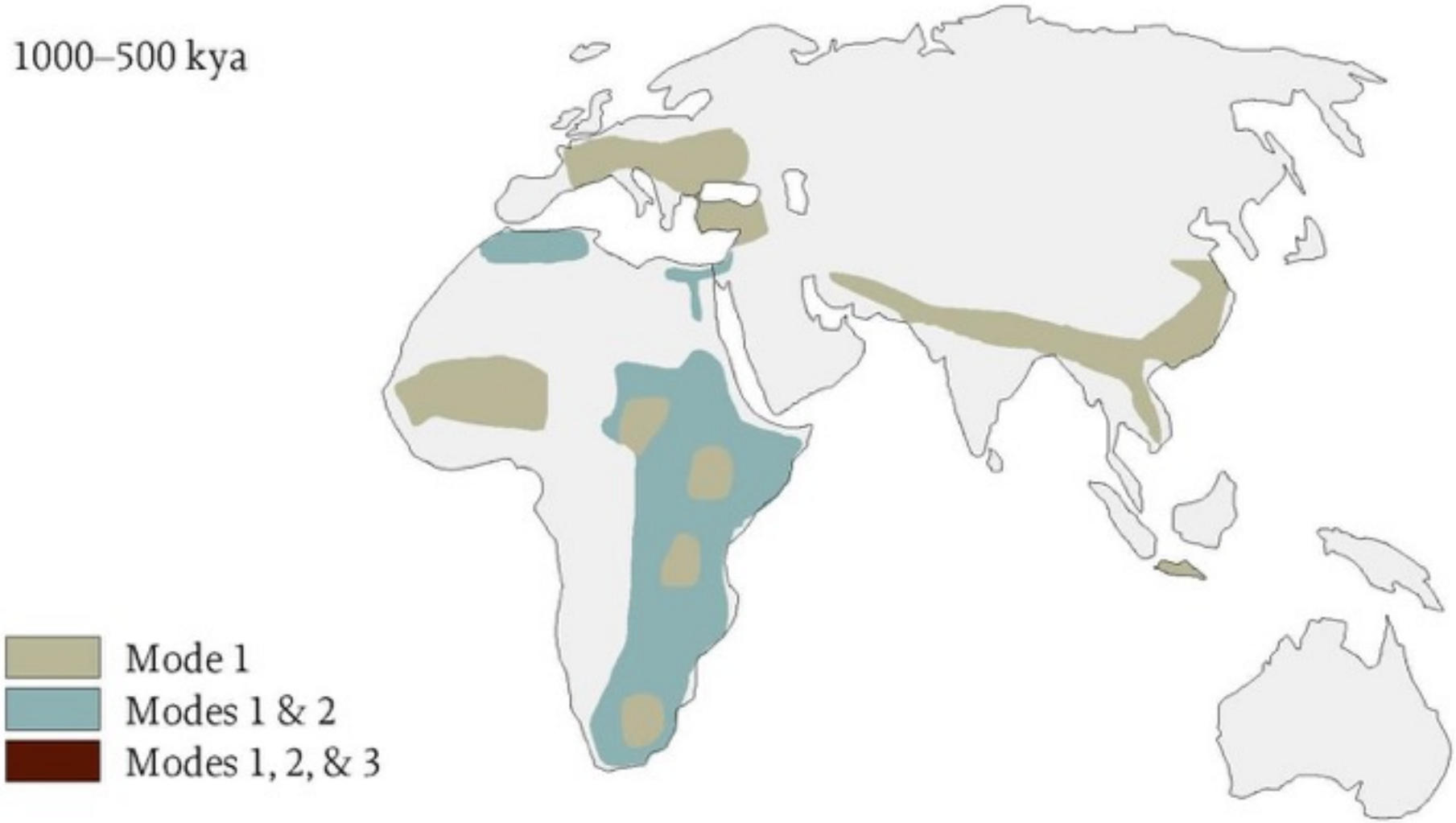
Out of Africa Model

- 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

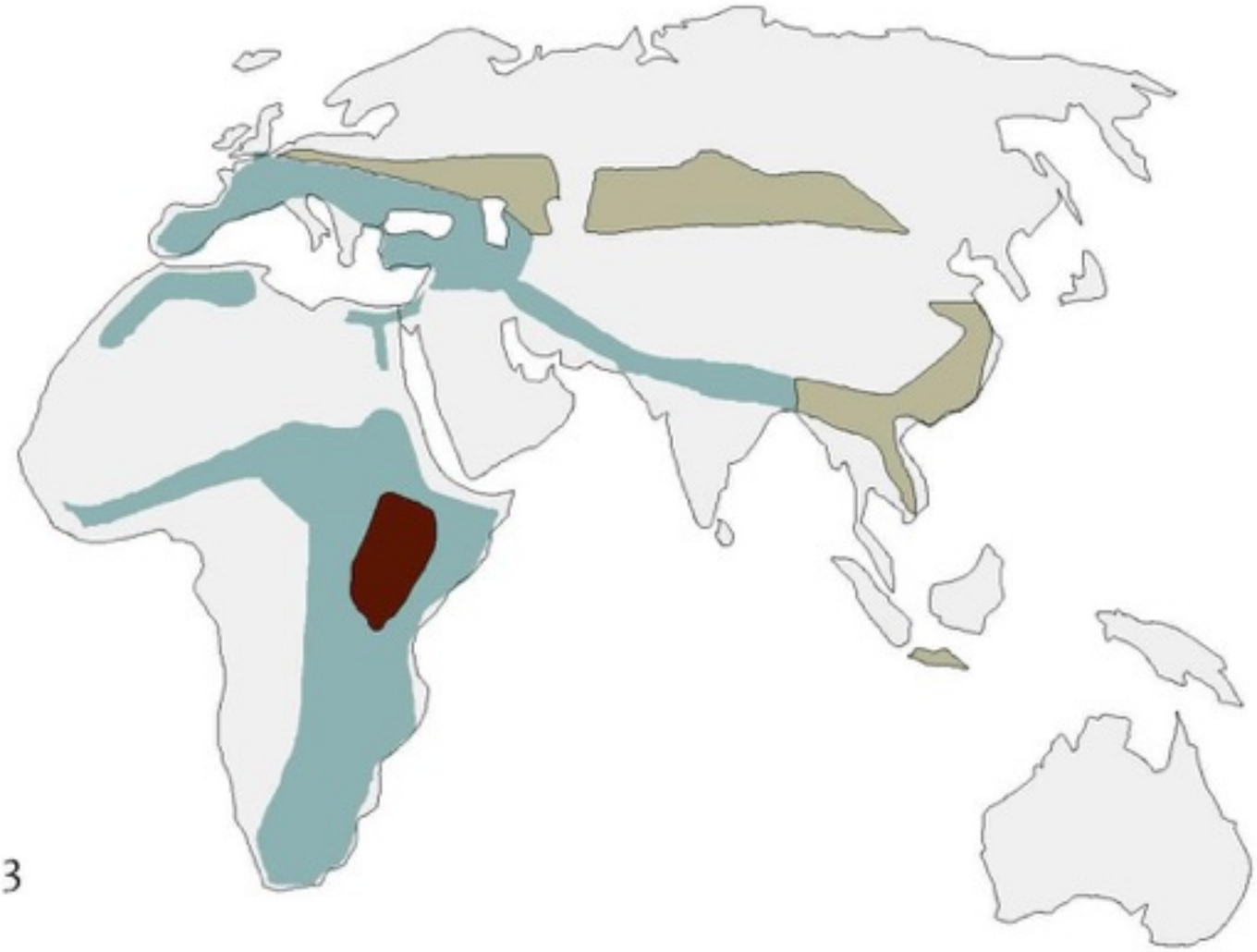


Evidence for this pattern of evolution and migration

- 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
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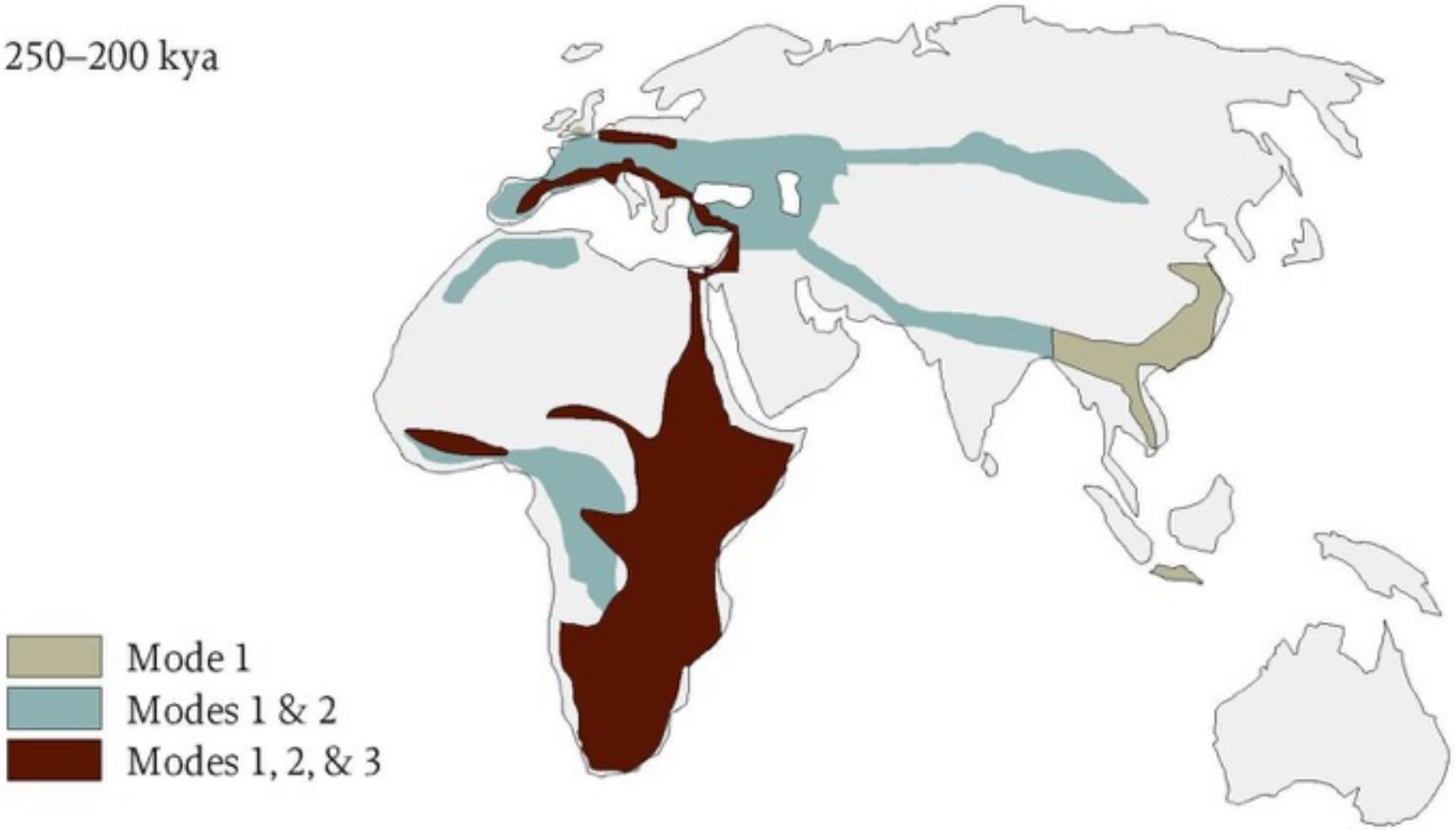
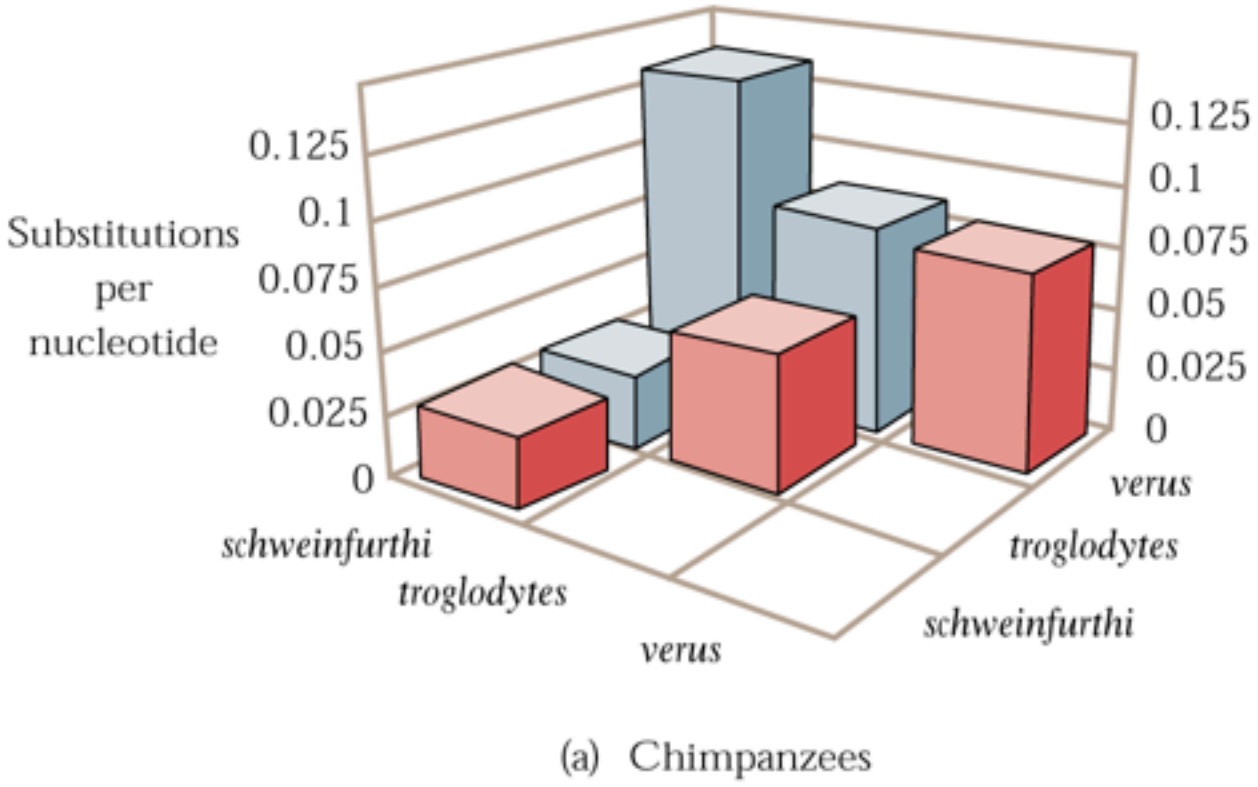

250–200 kya
Mode 1
Modes 1 & 2
Modes 1, 2, & 3

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

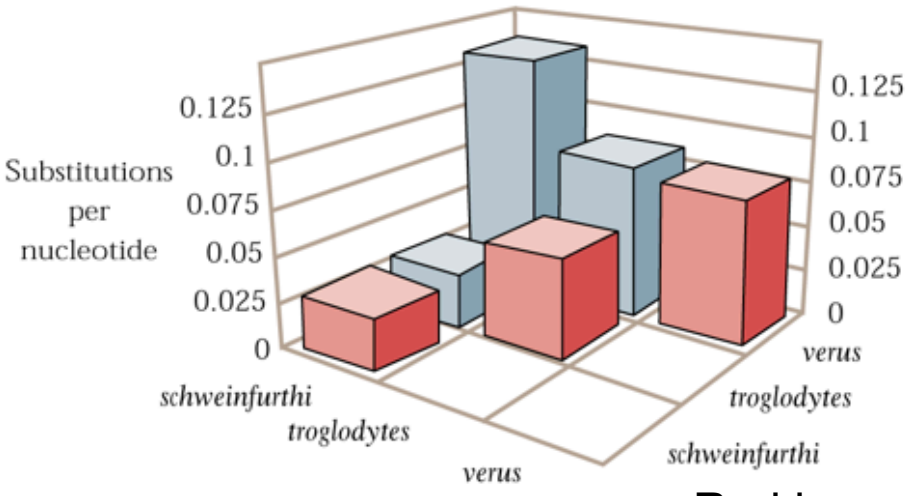


(a) Chimpanzees

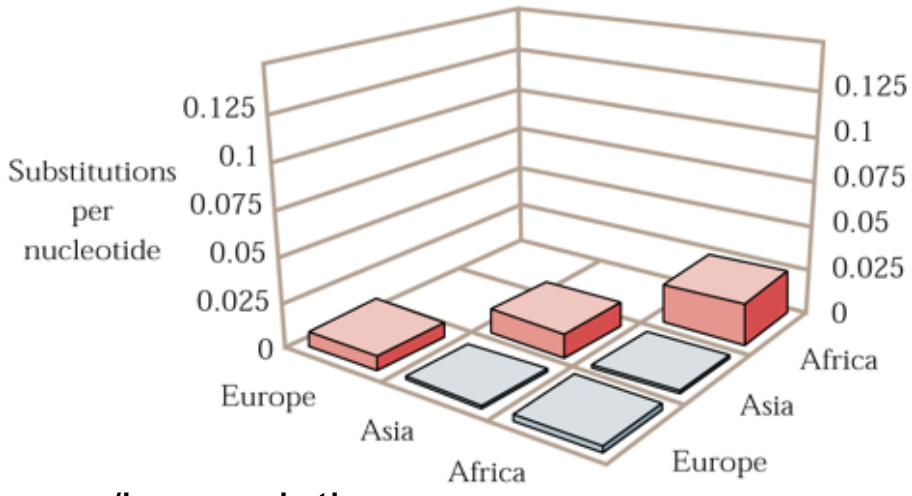
Red bars = variation within population
Blue bars = variation between populations

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



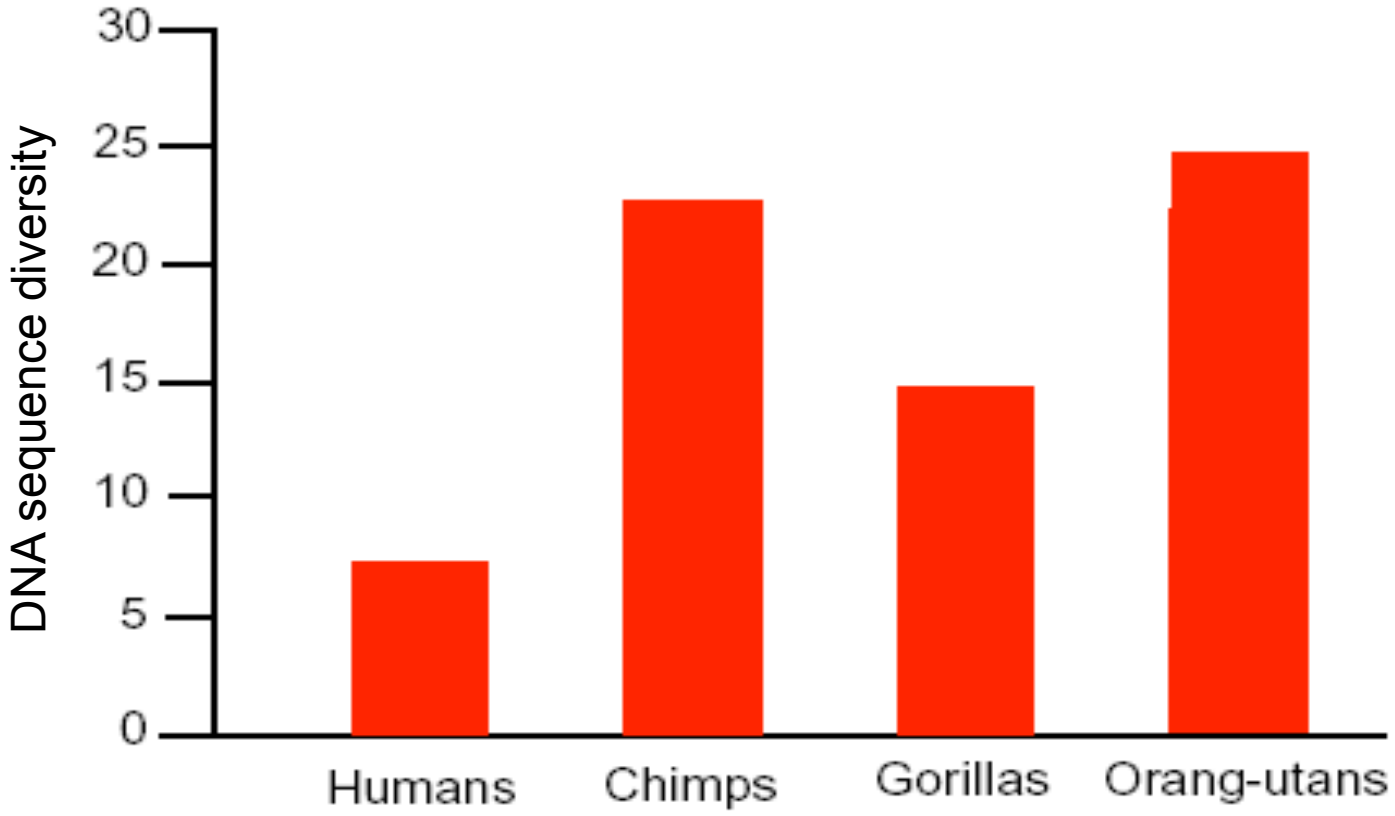
(a) Chimpanzees



(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



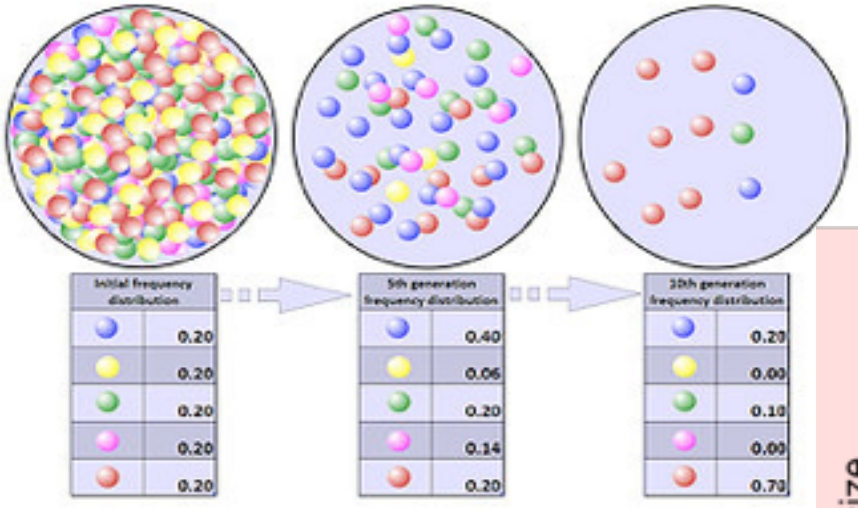
Why do humans have so little variation?

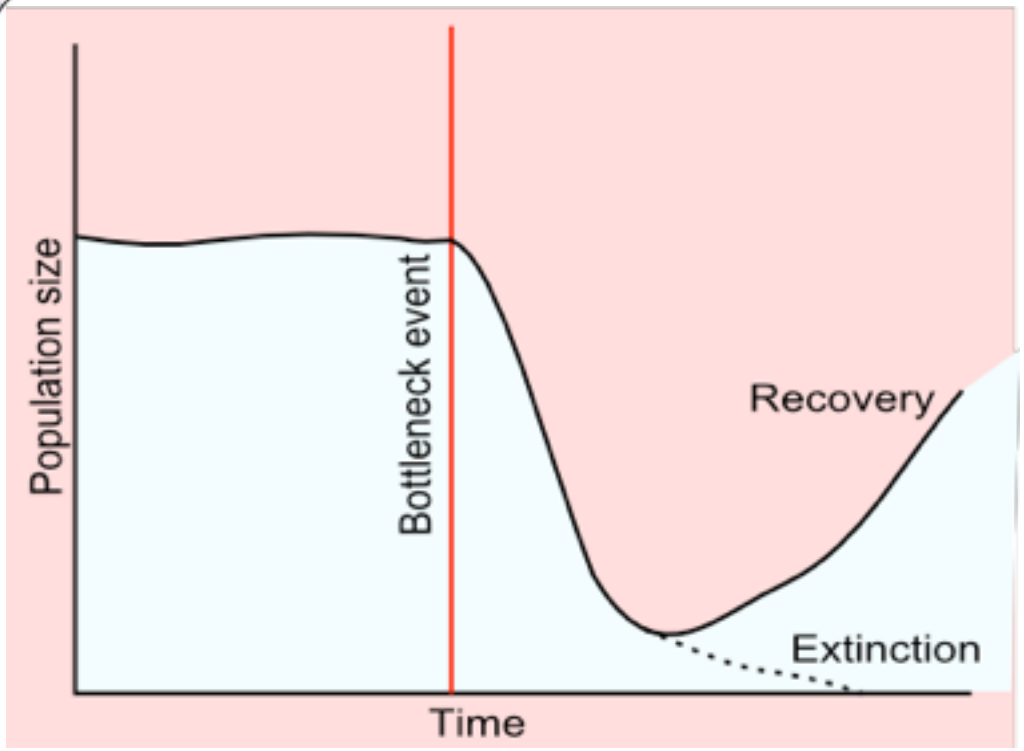
- Human populations may have gone through an evolutionary **bottleneck** and then expanded quickly

- 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





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

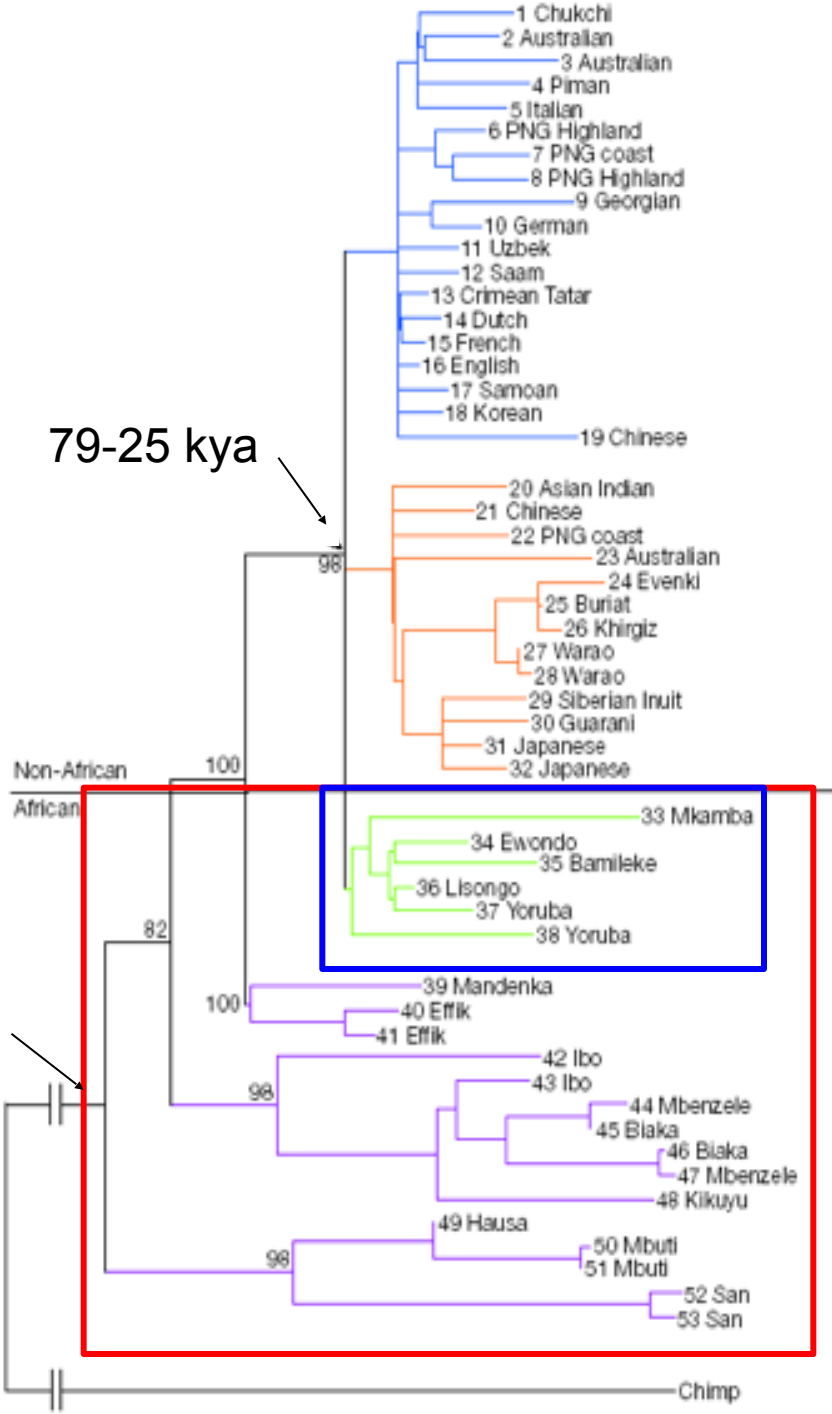
- Greatest mtDNA variation among African populations
- Less mtDNA variation as move further away from Africa

- **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

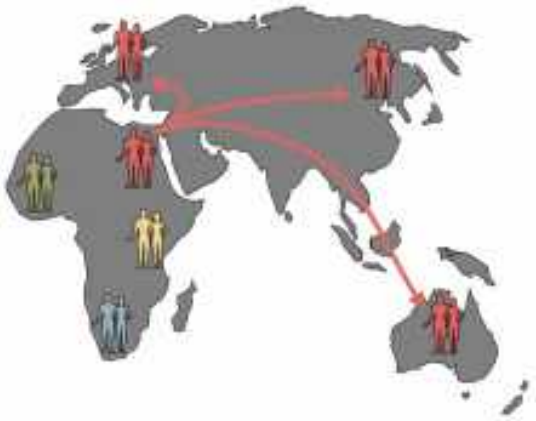
220-120 kya



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

Molecular data tell us that non-Africans are all descendants of people that moved out of Africa about 50 kya



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

50 kya–present: Dispersed human populations diverge.

Over the last 50ky humans have diversified

- Human morphology varies
  - Height and body proportions
  - Skin color
  - Hair color and texture
  - Facial features
- Human physiology varies
  - Lactose absorption
  - Hemoglobin types
  - Susceptibility to diseases
- Human behavior varies
  - Subsistence strategies
  - Social organization
  - Beliefs, values, etc.

Variations among humans can be due to: genetic differences or environmental differences

- Genetic variation
  - Differences caused by variation in genes inherited from parents

- Environmental variation
  - Differences caused by environmental factors
  - Differences caused by culture

- Both of these interact to generate our variation
- Difficult to distinguish between these two causes because parents and children share genes and environment