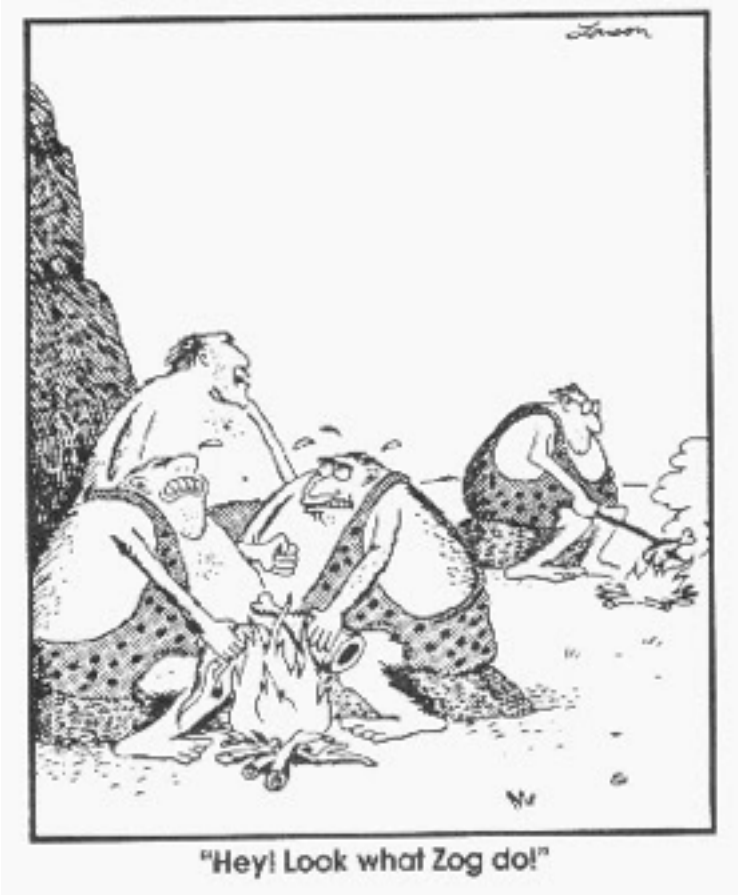
Anthro 101:
Human Biological Evolution

Lecture 15 & 16: *Homo erectus* to *Homo neanderthalensis*



Prof. Kenneth Feldmeier

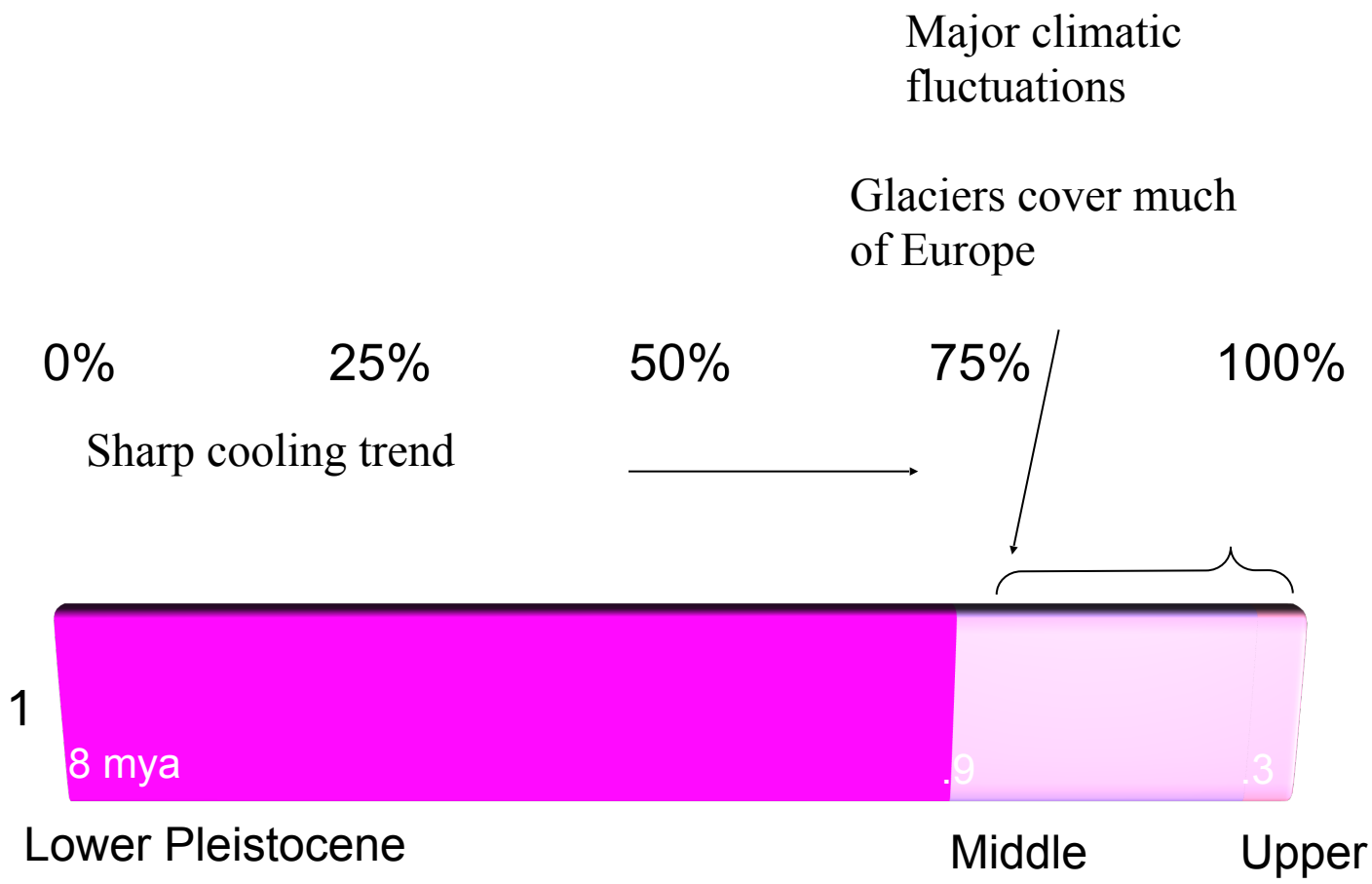
Reminder's

- Last Quiz….Thursday (5/14)
- Zoo extra credit due 5/21
- Next week The Genus Homo
  - Better tools
  - Language?
  - Larger Skulls
  - Office hours….come see me

Complex foraging a major part of later hominin evolution

- The genus *Homo* is marked by:
- More hunted meat and extracted foods
- More complex tools crucial for survival
- Longer juvenile period
  - learn foraging and tool skills
  - longer life span
- Greater paternal investment
  - → increased pair bonding, reduced dimorphism
- Origins of transmitted culture
  - foraging techniques
  - possibly language

Transition to later *Homo* occurred between the Pliocene & the Pleistocene



The shift towards more modern *Homo* begins about 1.8 mya (not modern humans yet)

- Hominins in Africa with:
  - Skull similar to earlier hominins
  - Taller body
  - Long legs and short arms
  - Slower growth rate, longer childhood
  - Reduced sexual dimorphism
  - Made Mode 2 tools
    - Acheulean hand axes

H. ergaster KNM ER 3733

The shift towards more modern *Homo* begins about 1.8 mya (not modern humans yet)

- Similar finds in C. Africa, S. Africa, Asia
  - first hominin found in Asia
- Classified as *Homo erectus* or *ergaster*
- We will call them *erectus*, but
  - earlier forms in Africa sometimes called ergaster
  - later forms in Asia sometimes called erectus

H. ergaster KNM ER 3733

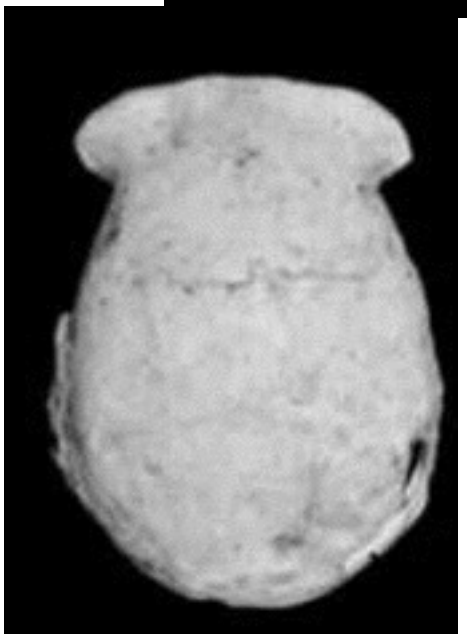
Quick Science Lesson

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

Homo erectus combined ancestral and derived traits

- Ancestral features
  - receding forehead
  - no chin
  - narrowing behind eyes
    - Post-orbital constriction

KNM-ER 3733



Dmanisi

Homo erectus combined ancestral and derived traits

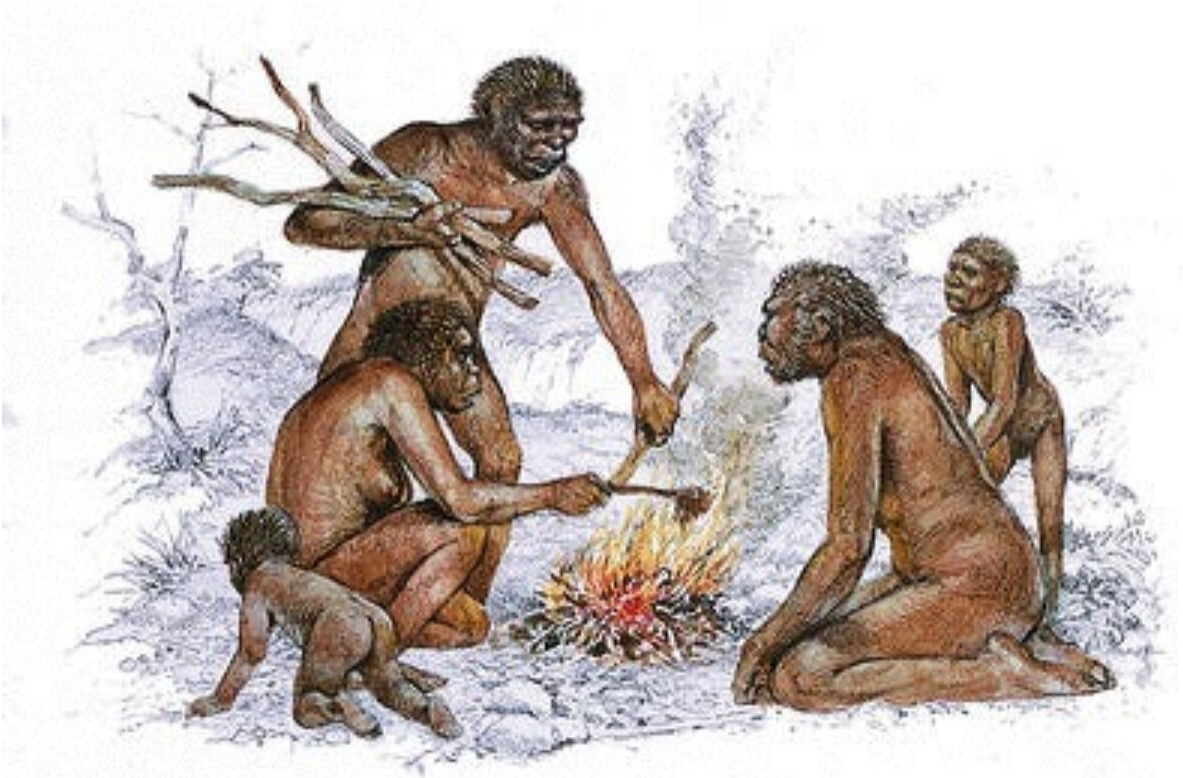
Derived features

- Occipital torus
- Thick brow ridges
- Thick skull
- Smaller, less protruding face
- Higher skull
- Smaller teeth
- Sagittal keel
- Shovel-shaped incisors
- Large orbits
- Wide lower skull
- Brain size ranged from 700 - 1200 cc

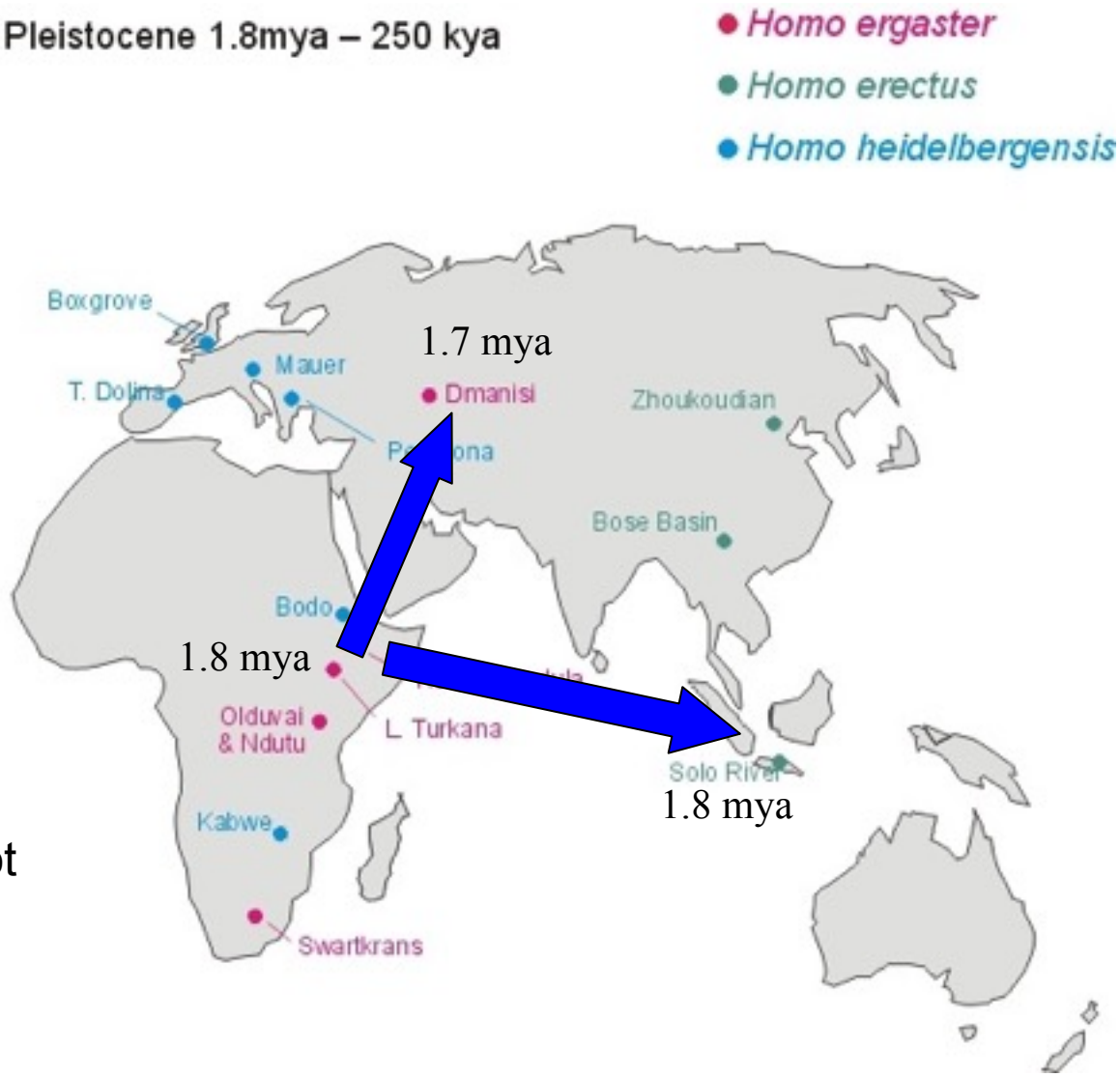
KNM-ER 3733

H. erectus mastered new subsistence skills

- First (so far known) to leave Africa
- More complicated stone tool kit - Acheulean tools
- Controlled fire (possibly very early, definitely later) 1-2 mya
- Relied more heavily on hunting - ate more meat



H. erectus 1st hominin to leave Africa in Lower Pleistocene



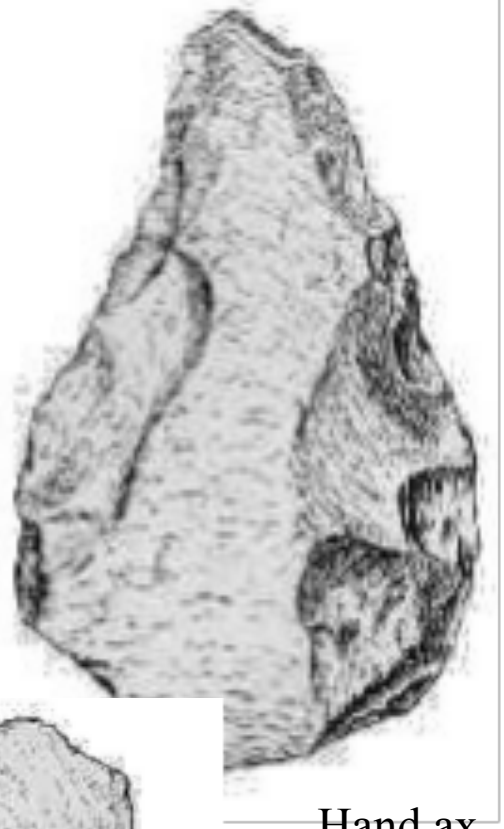
Why now and not earlier?

Technologically more advanced

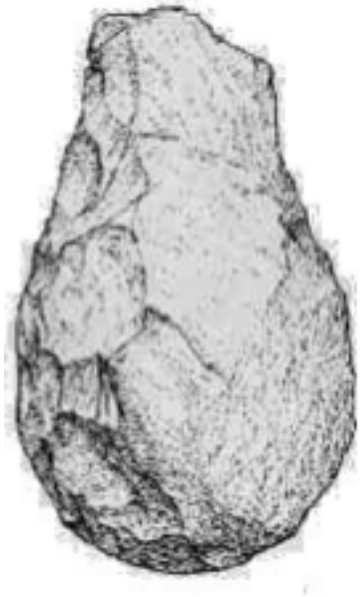
- 1.8 mya using Oldowan tools
- 1.7 - 1.4 mya **bifaces added to toolkit**

- **Bifaces** = round cores shaped to make flatter with longer cutting edge all around
  - Hand axe & cleaver

- Acheulean = Bifaces = **<u>Mode 2</u>**
- Acheulean + Oldowan = Early Stone Age



Hand ax



Cleaver

Check out how its made

- http://vimeo.com/64400056

Hand axes reveal something about minds and habits

- All have same Height:Width:Thickness proportions
- Unchanged for 1.5 million years
  - common plan in heads of toolmakers
  - Used for specific purposes in standard ways
  - Knowledge passed along by teaching and imitation

Hand axes probably used to butcher carcasses

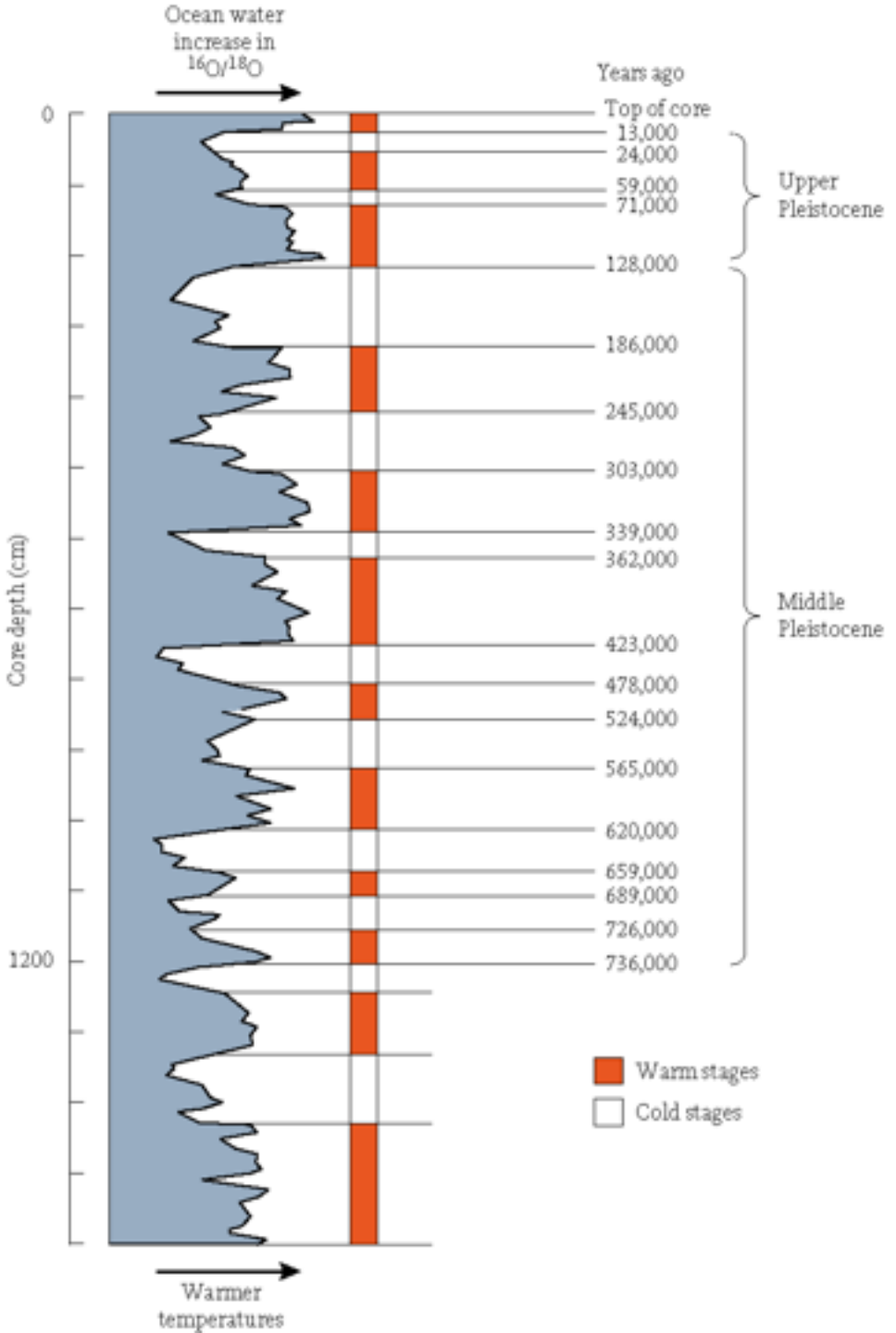
- well suited for cutting, dismembering animal carcass
- Wear patterns support meat processing
- Pointed end cuts through meat, rounded end fits in palm
  - Flakes maybe also used for cutting
- Biface holds sharp edge longer than flakes
- Longer cutting edge than a flake

Middle Pleistocene

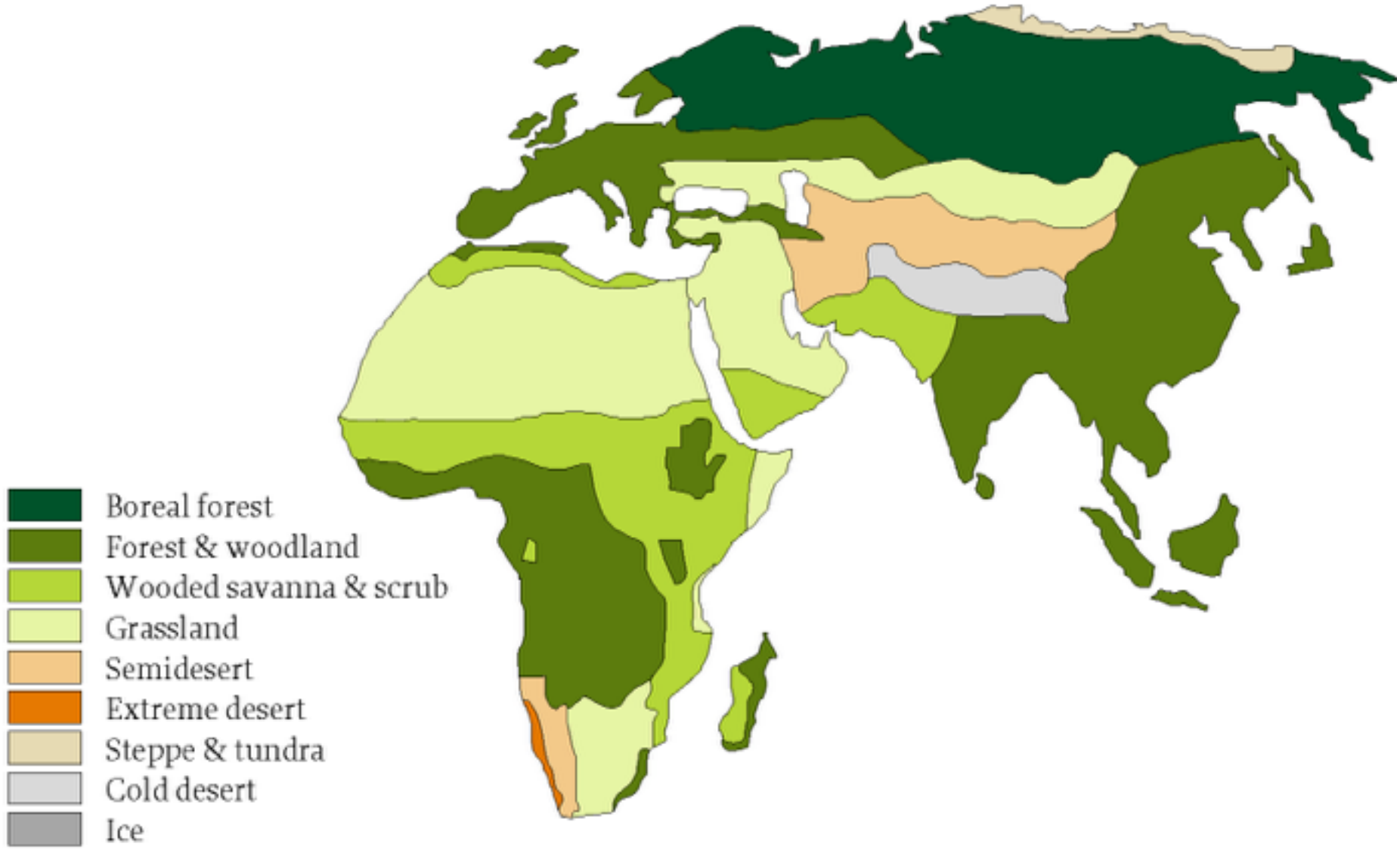
(900 – 300 kya)

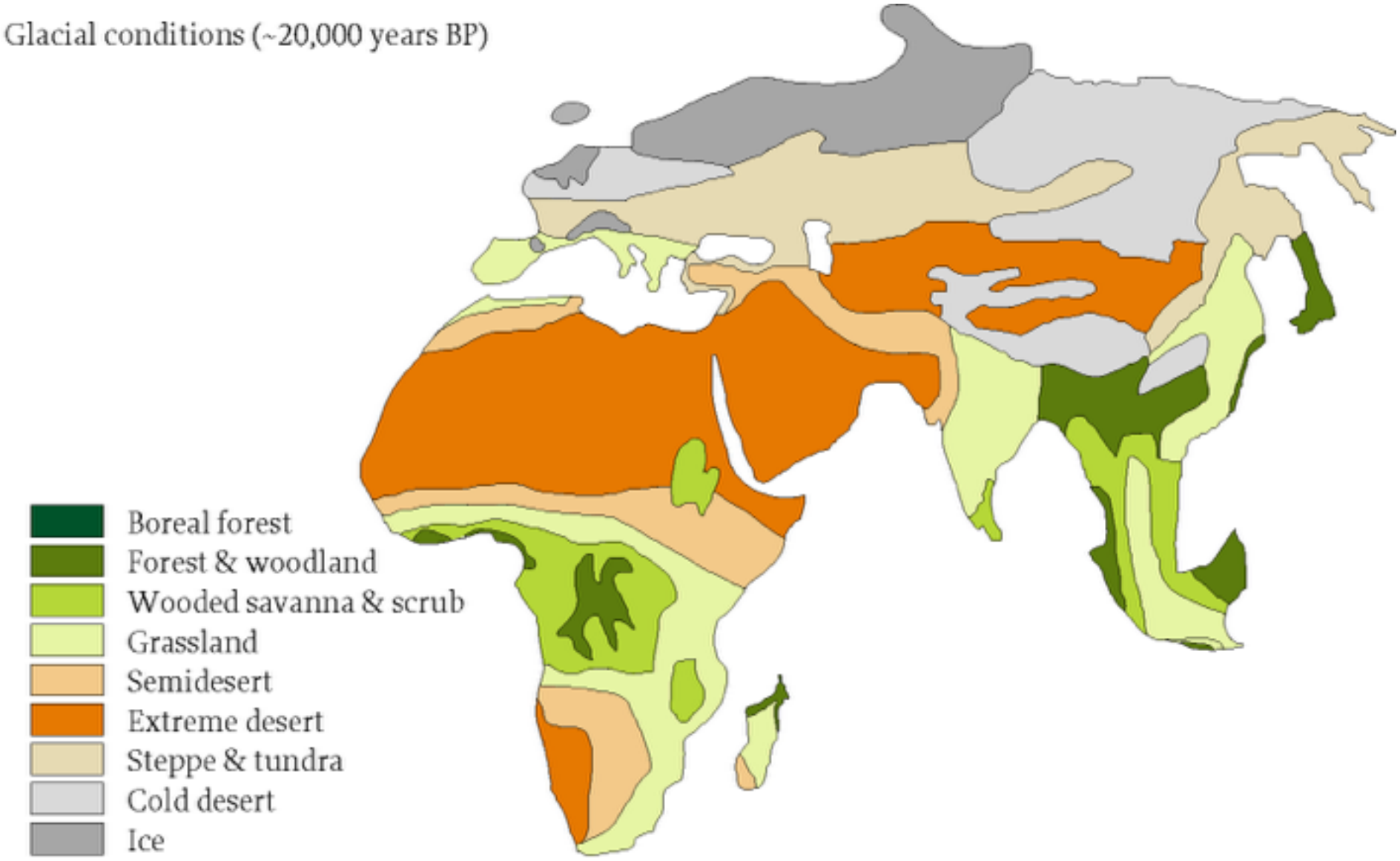
- Long, cold glacial periods
- Short, warmer interglacial periods

- Great variability in climate
- Next stage in hominin evolution occurred during this stage
  - More like modern humans than *Homo erectus*



Interglacial conditions (~7000 years BP)



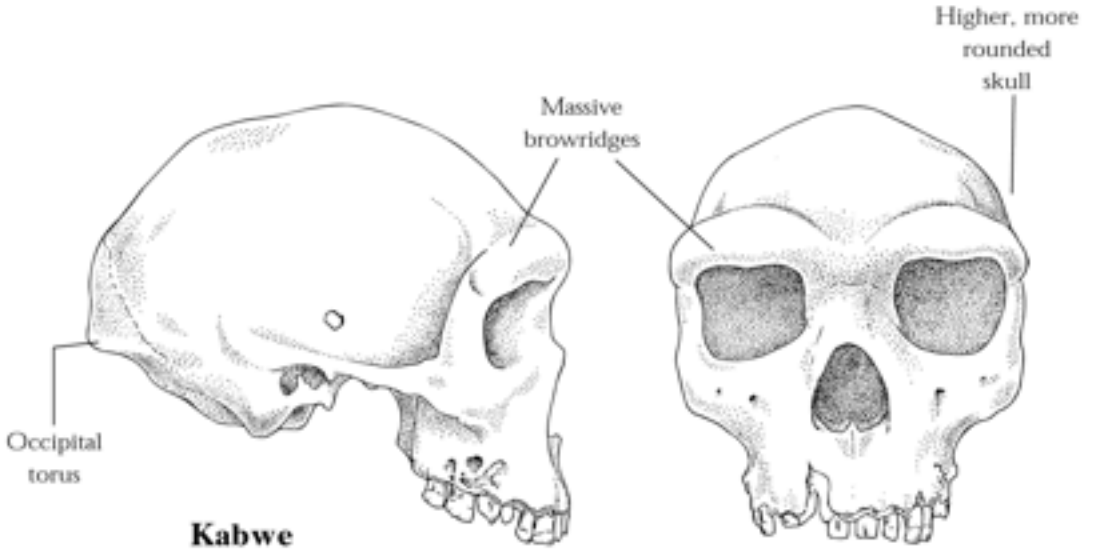

Glacial conditions (~20,000 years BP)
Boreal forest
Forest & woodland
Wooded savanna & scrub
Grassland
Semidesert
Extreme desert
Steppe & tundra
Cold desert
Ice

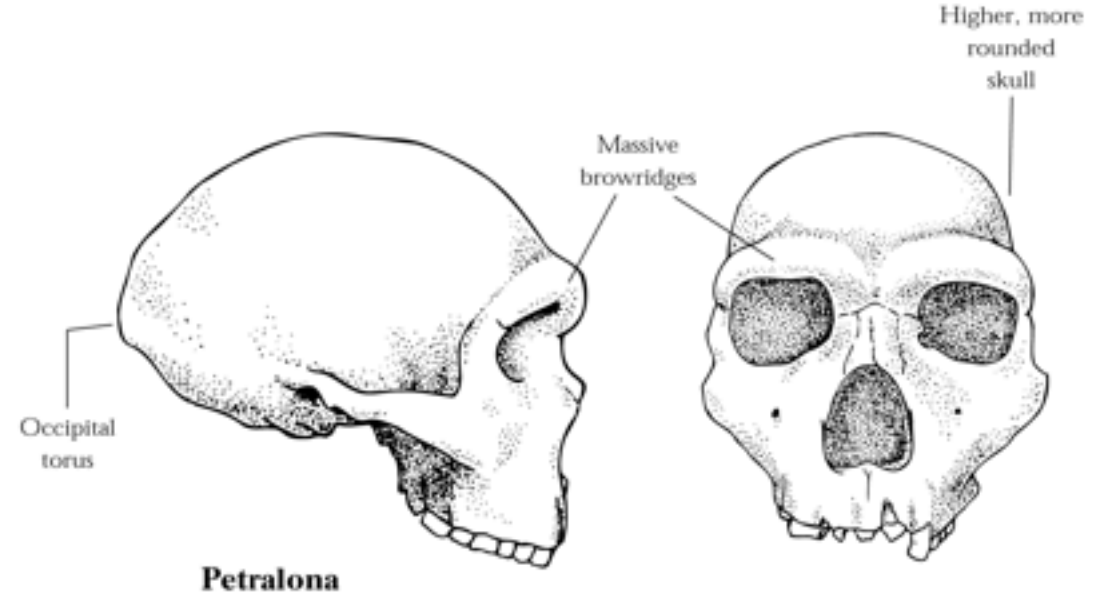
Emergence of modern features begins with *H. heidelbergensis* (approx. 800kya)

- **Ancestral features**
  - Large brow ridges
  - Thick cranial bones
  - Large, prognathic face
  - No chin
  - Robust bodies
- **Derived features**
  - Brain size 1200-1300 cc
  - Higher foreheads
  - More rounded skull
  - Sides of skull more vertical

H. Heidelbergensis identified as a new species of hominin (by some)

- **More Derived features** (compared to *H. erectus*)
  - Less prognathic
  - Smaller teeth
  - Smaller brow ridges, one over each eye
  - Flexed base of skull
  - Reduced postorbital constriction
  - Rounded occipital bone


Higher, more
rounded
skull
Massive
browridges
Occipital
torus
Kabwe

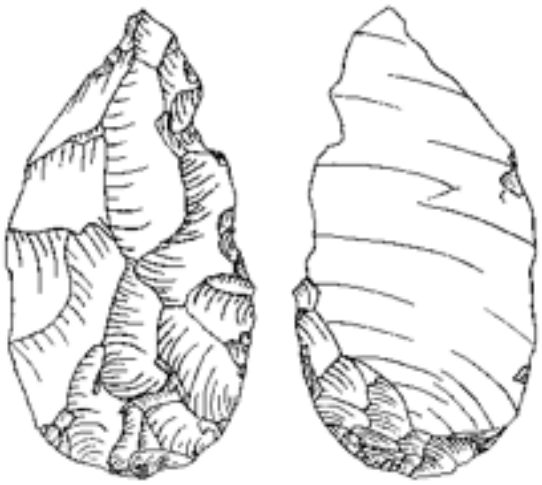

Higher, more
rounded
skull
Massive
browridges
Occipital
torus
Petralona

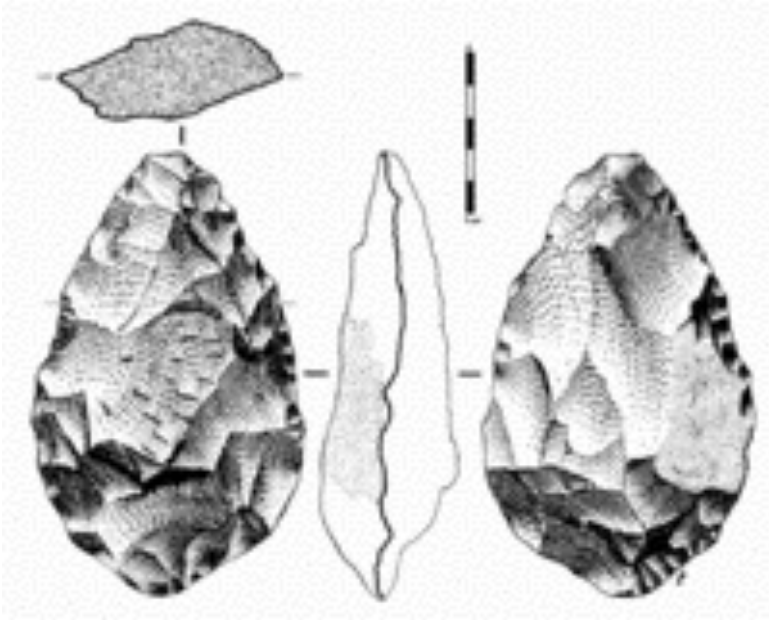
H. heidelbergensis hunted big game

- On Island of Jersey, piles of bones of mammoths and wooly rhino found at base of cliff
  - Some are adults, too big for most predators
  - Carcasses have been butchered with stone tools
  - Skull cavity opened, to extract brain tissue
  - Bones have been sorted by body parts
- Have also found wooden spears alongside masses of horse bones

H. heidelbergensis began making new kinds of tools

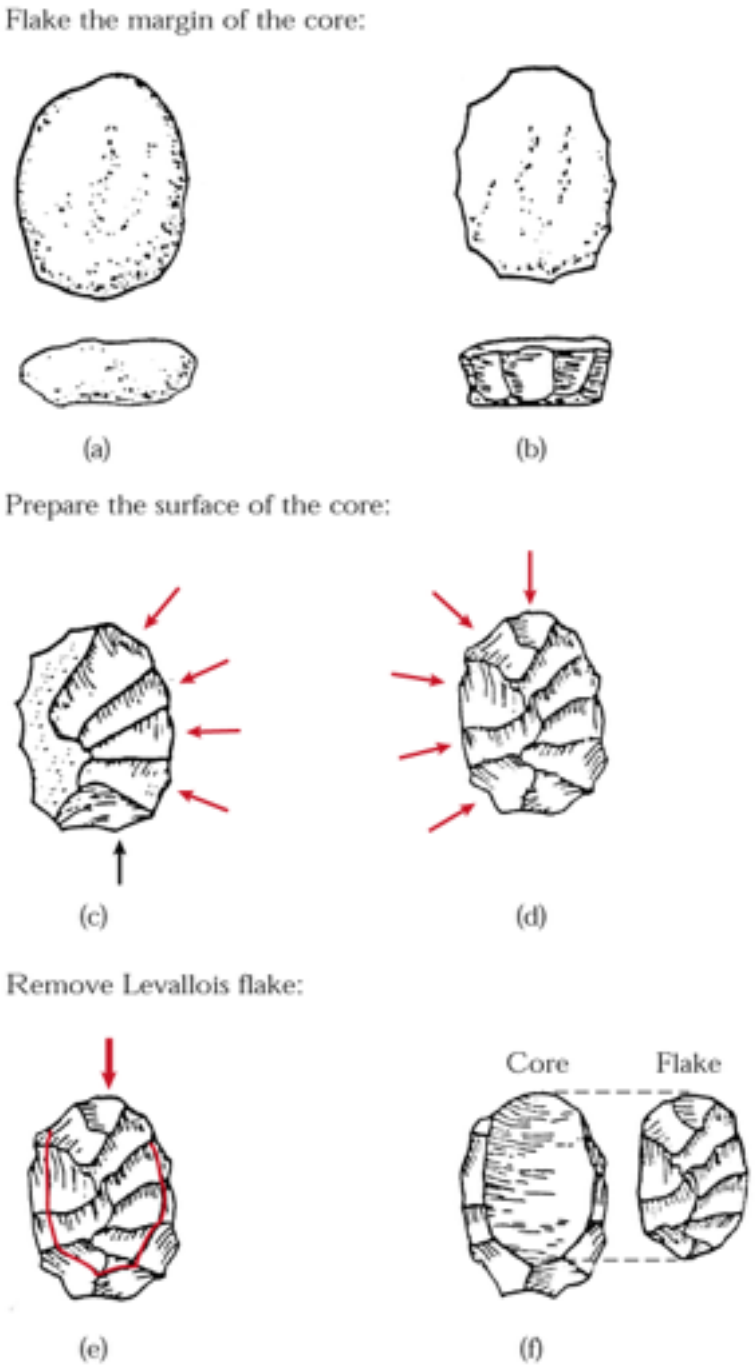
- Continued to make **Mode 2** till 150 kya
  - Oldowan & Acheulean
  - cores flaked along sides to extend cutting edge
  - 300 kya, *H. heidelbergensis* started making flake tools **Mode 3**





Levallois technique (Mode 3)

- Involves striking flakes from a prepared core
- A striking platform is formed at one end
- Core's edges are trimmed by flaking off pieces around the outline of the intended flake
- Large, symmetrical flakes are struck off of the core
- This method provides much greater control over the size and shape of the final flake
- More efficient use of available stone
- Greater level of planning & abstract thinking

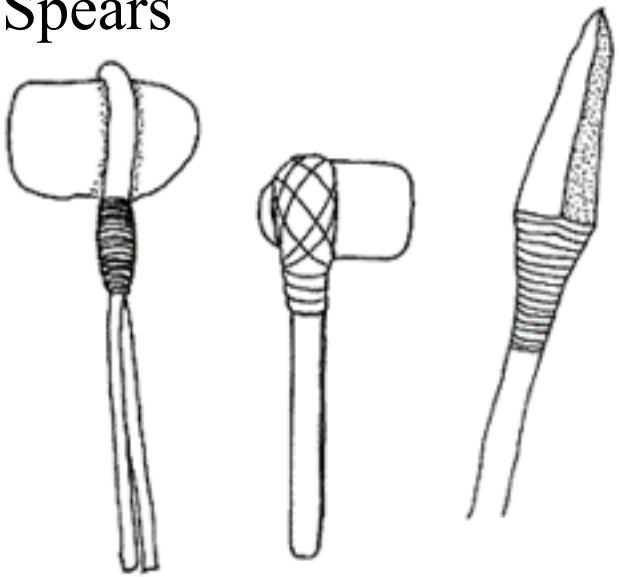


- http://commons.wikimedia.org/wiki/Category:Levallois_points

A variety of tool innovations

Some of these tools were hafted

- Wear patterns on tools suggest some were attached to a handle
- Greater force & greater safety
- Spears

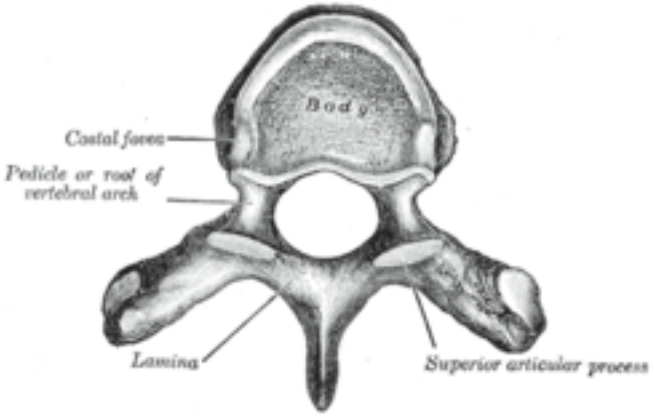


Lots of new materials and shapes

- Soft hammers (bone, wood)
- Retouched edges
- Stylized tool shapes
- Wider variety in toolkit

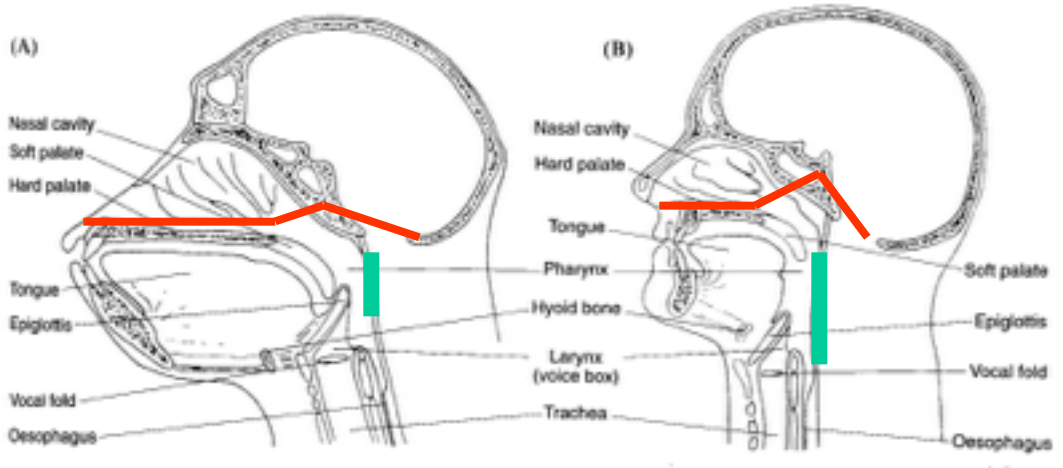
Social life of *H. heidelbergensis*

- Group size calculated to 131 people
  - As group size increases, takes more time to monitor relationships
- Intelligence & language could make this easier
  - *H. heidelbergensis* brain much larger than *H. erectus*
  - NOT clear WHY (social, ecological, technology)
    - Do have more sophisticated tools
- What about language?



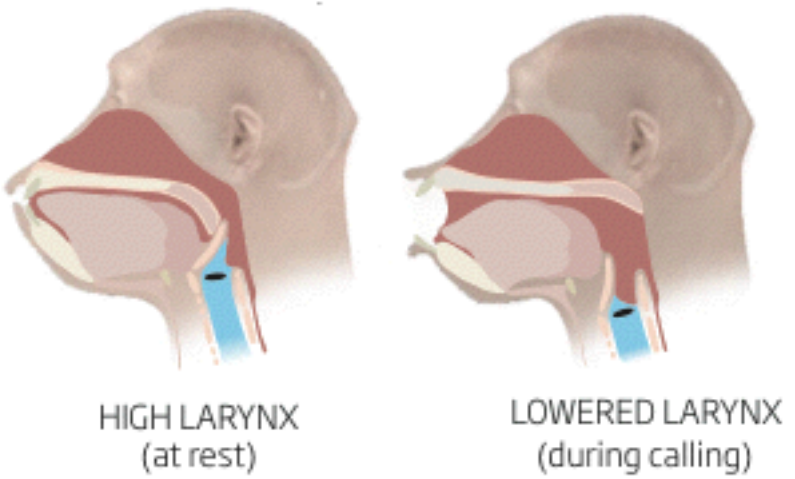
Physical adaptations for language

- **Cranial base flexed**
  - Longer larynx
  - Range of vowels

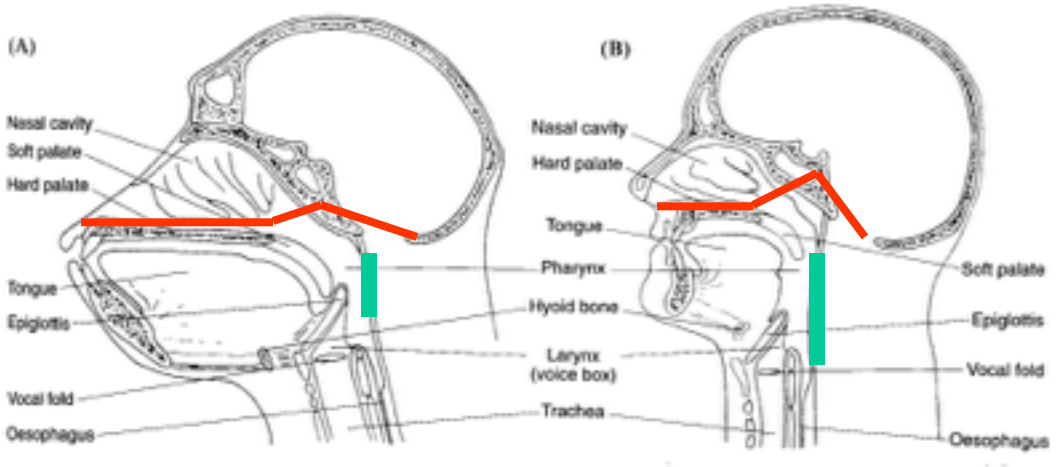


- Other species vowels more limited
  - Can produce nasally

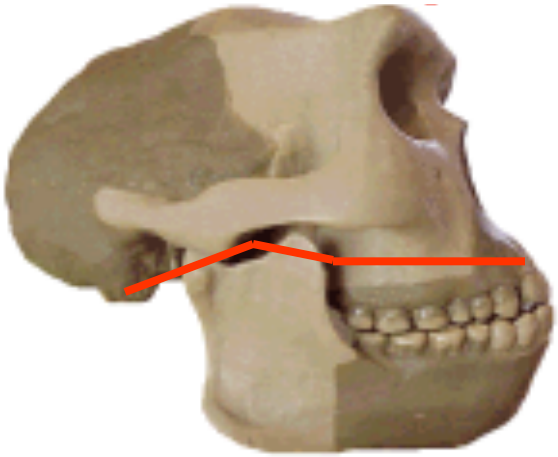
- Mammals
  - Lower their larynx while vocalizing
  - Same freedom of movement to produce range of sounds



Homo erectus language?



- Humans = flexed cranial base
- *H. erectus* = flatter
  - Short pharynx
  - Vowels limited
- Neanderthals also a bit flatter than modern humans



H. Erectus (java)

Physical adaptations for language

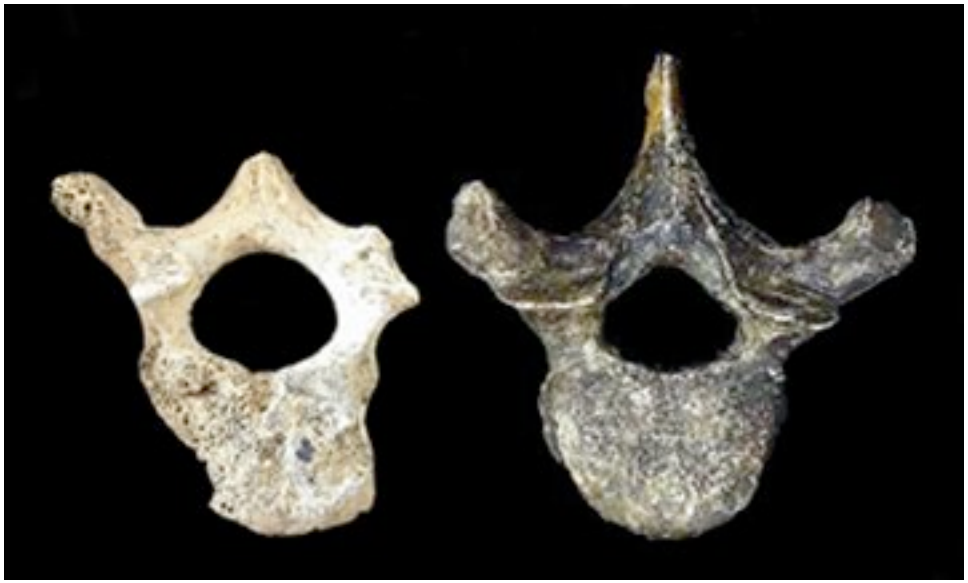
- **Vertebral canals**
  - Space in bone of vertebrae for nerves
  - Nerves in rib cage control breathing

- Chimps & some *Homo erectus* fossils have small openings
- Suggest limited breath control

- 2006 Dmanisi vertebra within modern human range

Homo erectus language?

- Dmanisi on left, similar to modern human canal
- H. erectus from Kenya on right, smaller like a chimp canal



Possible Language in *H. heidelbergensis*

- **Some evidence suggests could have used language**
  - Breath control
    - vertebral canals larger
  - Tongue innervations (lots of nerves to control it)
    - canals in mandible & skull
  - Length of pharynx
    - Flexed base of skull

Importance of Language

- http://www.ted.com/talks/mark_pagel_how_language_transformed_humanity

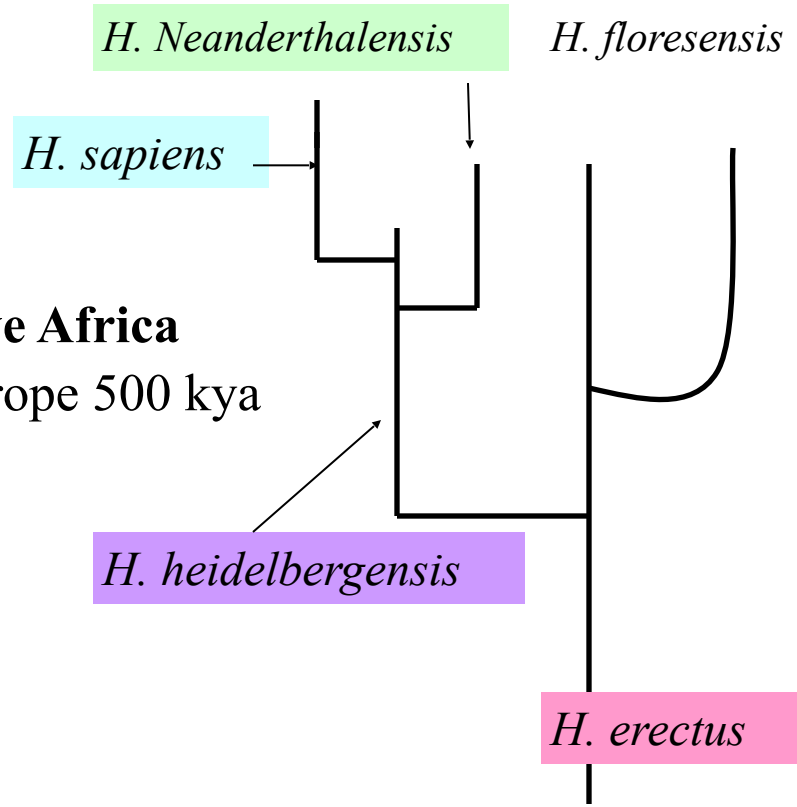
What About Language?

- Break up into groups and answer these questions:

- What do you guys think about the video?
- Is the guy right?
- Is Language the reason why we are such a successful species?
- What else is needed for cooperation?

The Hominin lineage – 1.8 mya to present

- *H. erectus* --> ***H. heidelbergensis*** **= 800 kya**
  - Speciation & divergence in Africa
  - H. erectus survived in Asia
  - H. erectus extinct in Africa

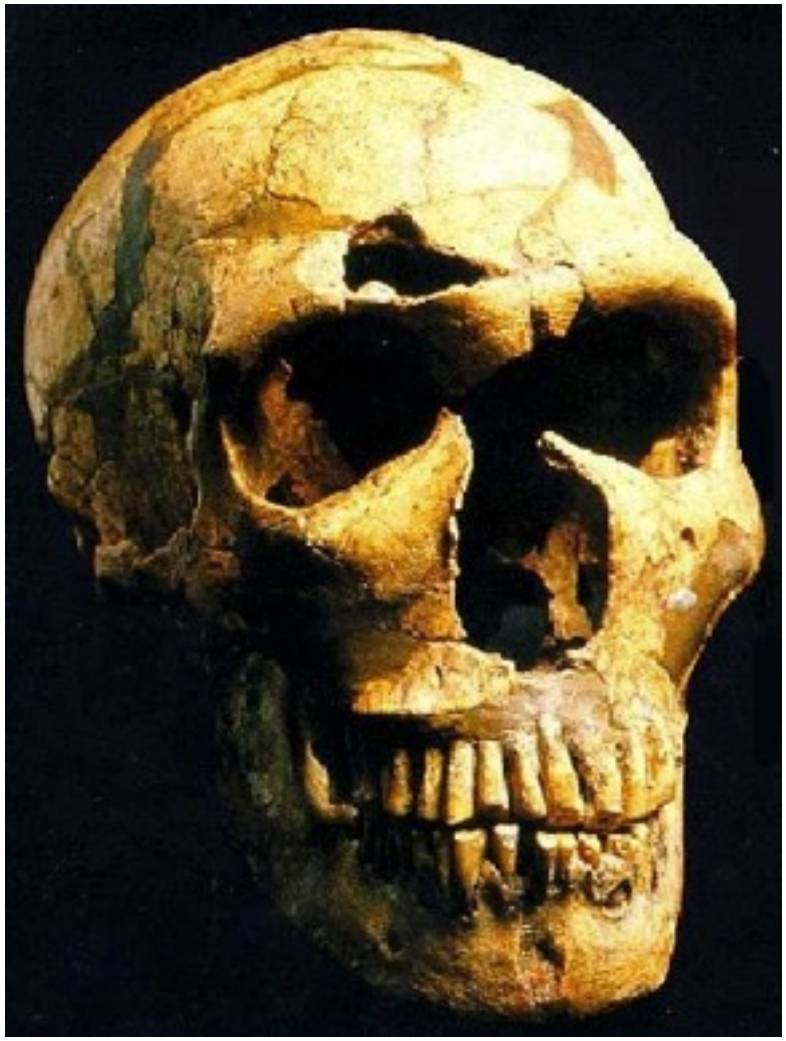


- ***H. heidelbergensis*** **the 2nd species to leave Africa**
  - Southern Europe 800 kya, northern Europe 500 kya
  - India & China by 600 kya

- H. heidelbergenesis gave rise to:
  - ***H. Neanderthalensis*** **300-150 kya**
  - ***H. sapiens*** **200 kya**

Homo neanderthalensis: 150 - 30 kya

- **Distinctive features**
  - Massive brows
  - Low forehead, long cranial vault
  - Very large face, mid-face bulge
  - Occipital bun at back of skull
  - Large, heavily worn incisors
  - Fused roots on molars
  - Shovel-shaped incisors
  - Short, muscular bodies
  - No chin
  - Gap behind 3rd molar



- https://www.youtube.com/watch?v=m4JWDW0yjKo

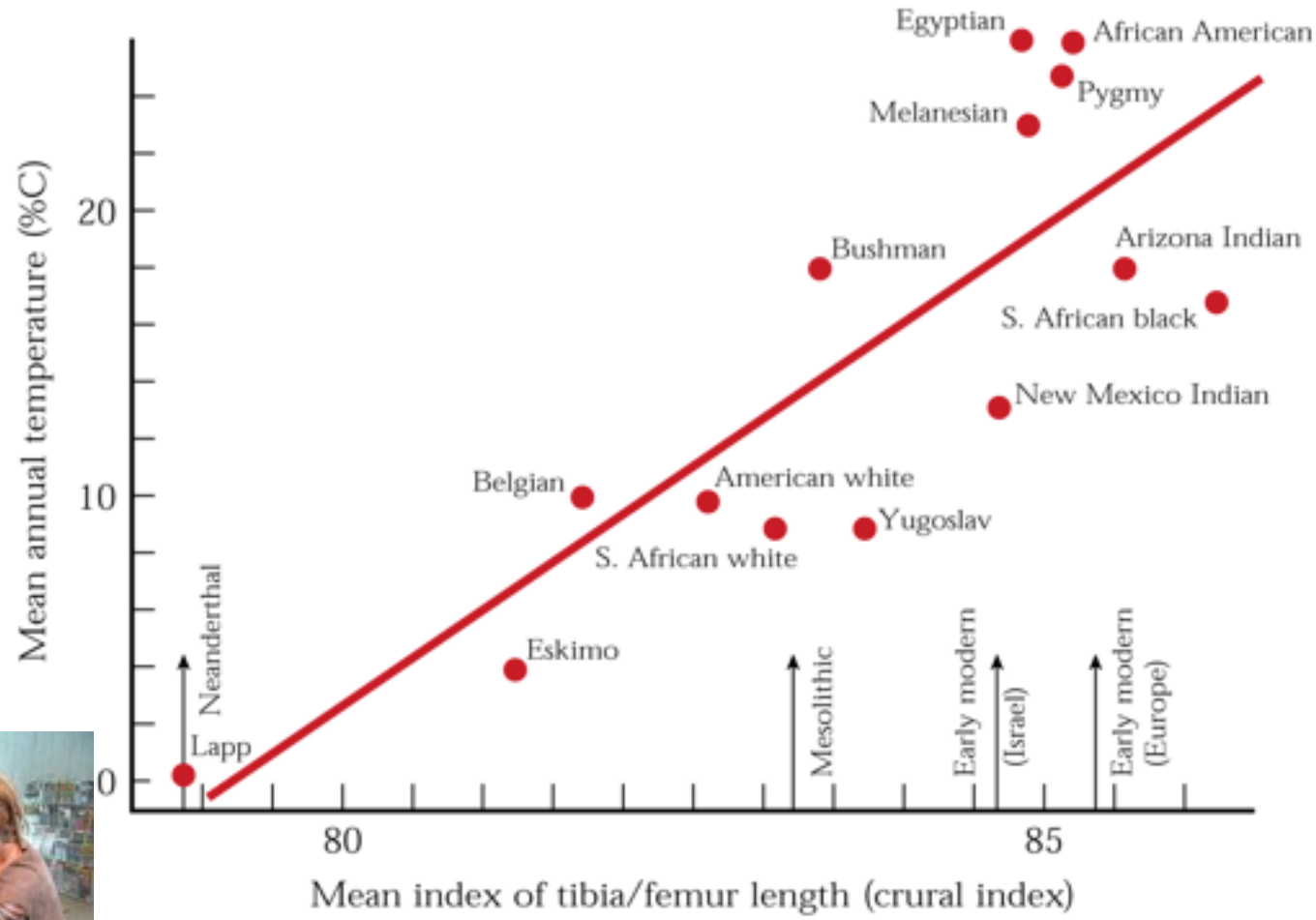
Neanderthals look like modern creatures in very cold places

- Animals in cold places are large and stocky, with short limbs
- Animals in hot places are smaller, thinner, longer limbed

M. fuscata, Japan

M. sinica, Sri Lanka

People in warm climates tend to have long limbs in proportion to height



Neanderthals were short and stocky, but not stupid

- Cranial capacity ave. = 1520 cc
  (modern humans ave. = 1400 cc)

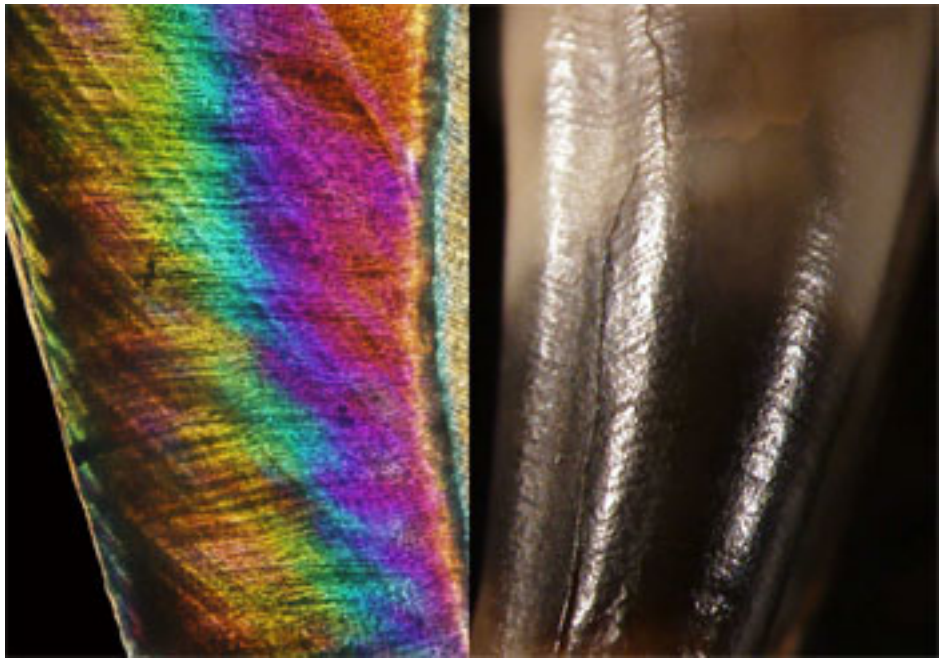
language likely

Neanderthals may have matured quickly

- Rate of enamel development on teeth
- Faster in Neanderthals than humans
- Neanderthals fully grown by 15 years old

- May have evolved to start reproduction sooner

- High adult mortality rate



Neanderthals were skilled toolmakers

- Made Mode 3 tools (**Mousterian** industry/ Levoillois technique)
- Continued to use Mode 2 (Acheulean tools)
- Wood spears
- hafted spear points
- Retouched edges

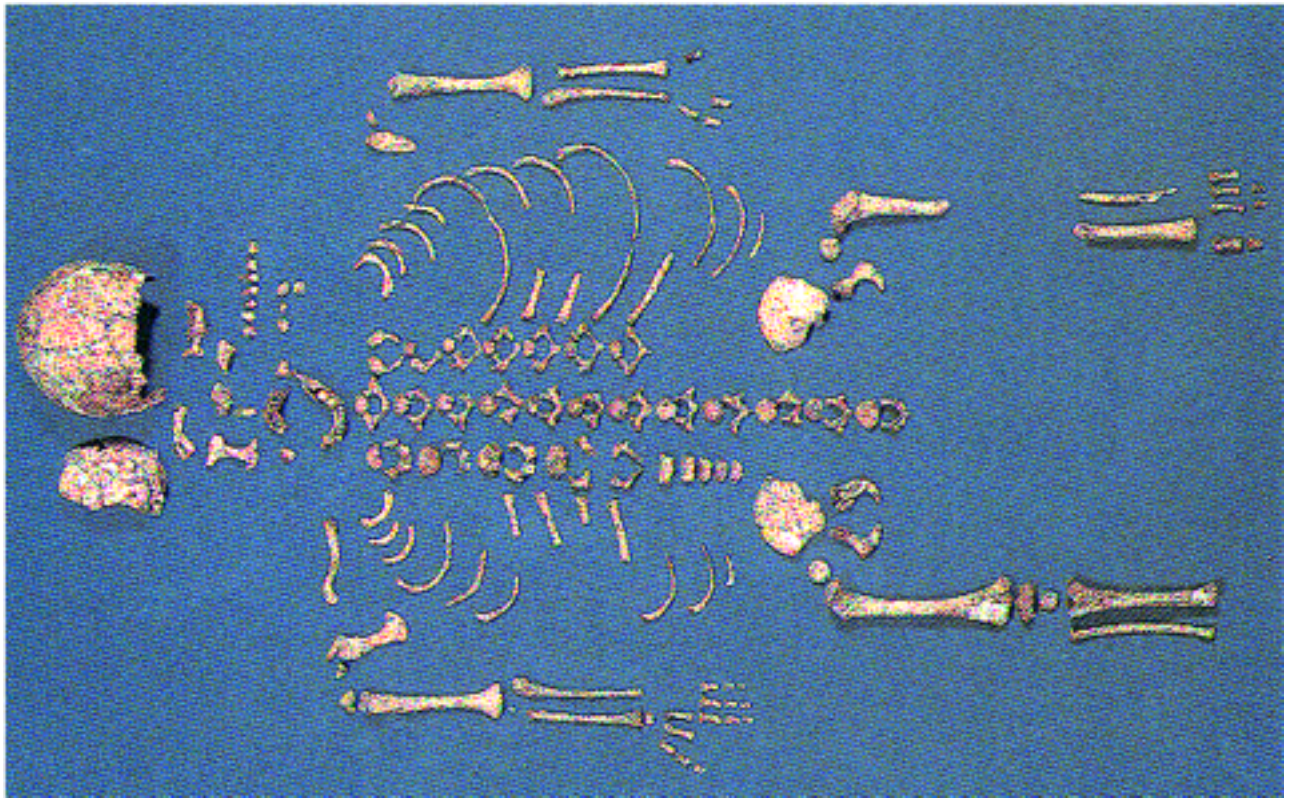
- Efficient use of stone
- Large variety of tool types
- Little bone or antler used at most sites

Neanderthals buried their dead

- Lots of nearly complete skeletons
- Lots of children found
- Maybe to avoid scavenging of bodies, maybe held cultural significance

- Some controversial evidence of ritual or ceremony at burial
  - Ochre?
  - Grave goods?
  - Fetal position?

Burials preserve rare skeletons of children



2-year old

Infant

Neanderthal life was hard and short

- 40-45 years maximum lifespan
- Many skeletons show evidence of disease, injuries
  - Arthritis, gum disease, fractured skull & neck, stab wounds, withered limbs
  - Run-ins with prey & predators?

Spear hole in skull

Gum disease & missing teeth

Some Neanderthals survived serious injuries and illnesses

- implies that Neanderthals cared for the ill and injured

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

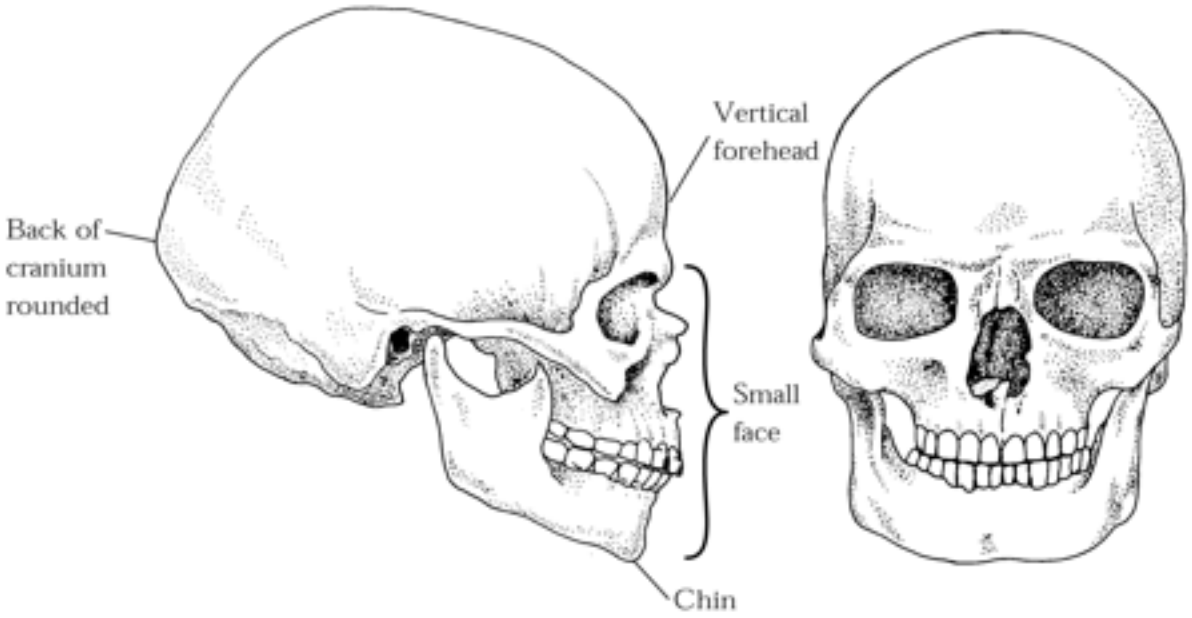
- **300 - 200 kya**, fragmentary fossil evidence in Africa
- Hominins seem to have robust features like *H. heidelbergensis*
- But they had larger brains (1400-1500 cc)

- 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

Set of derived traits characterize modern humans

- Face
  - Small

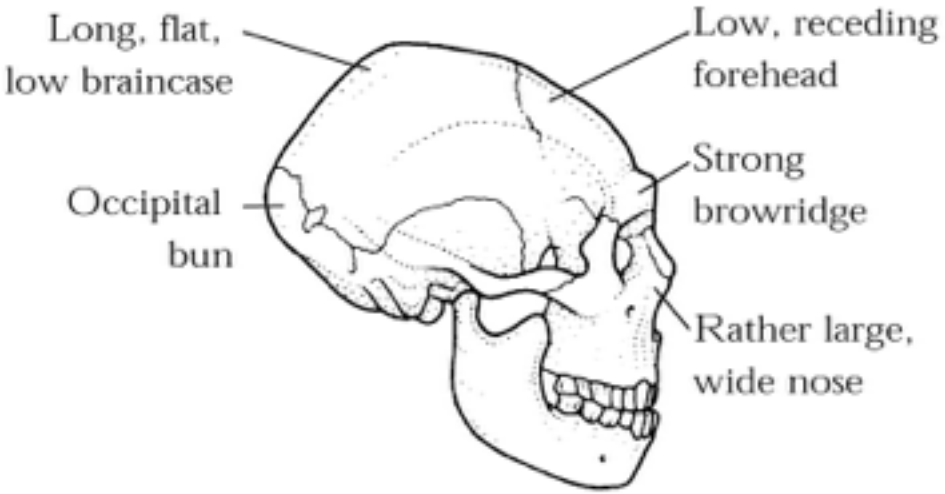


Set of derived traits characterize modern humans

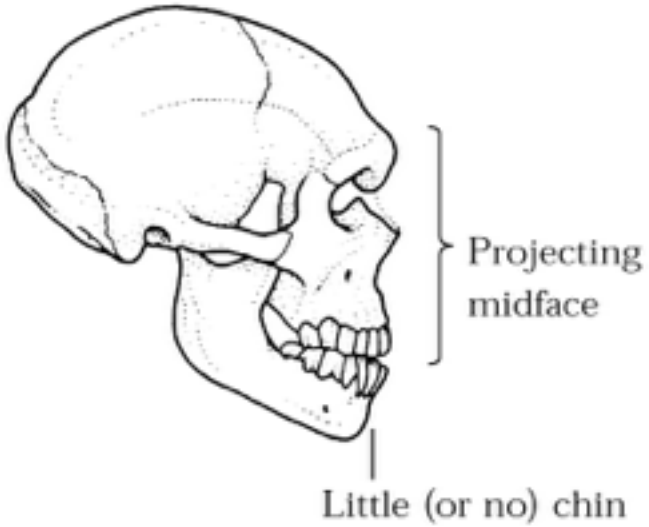
- Face
  - Small
  - High forehead
  - Small brow ridges
  - Protruding chin
- Skull
  - Rounded back

Set of derived traits characterize modern humans

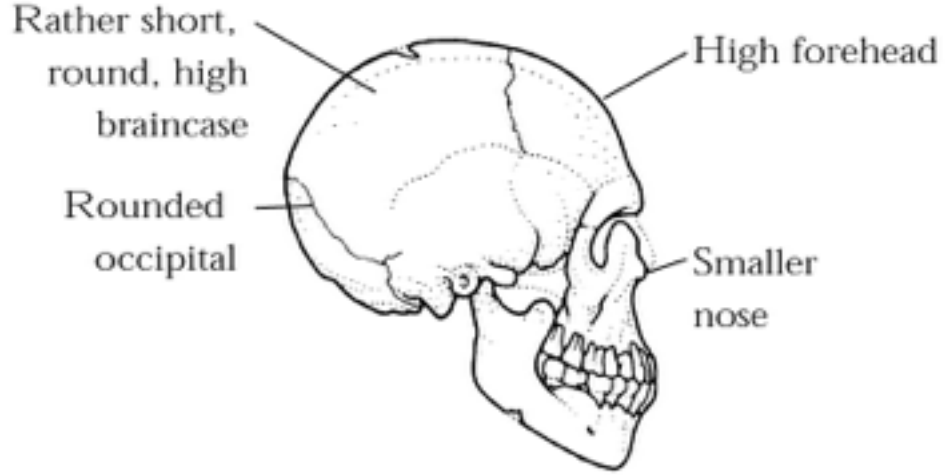
- Face
  - Small
  - High forehead
  - Small brow ridges
  - Protruding chin
- Skull
  - Rounded back
- Teeth
  - Small
- Skeleton
  - Less robust than Neandertals
  - Longer limbs, slighter bones



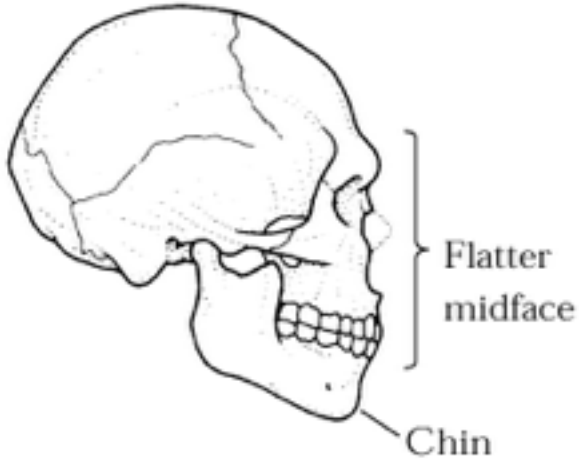
Shanidar 1



La Ferrassie 1



Qafzeh 9



Predmost 3