

Homo sapiens:
Emergence of Modern Humans
Part 2

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APRIL 28, 2021

Covid Long haulers: real neuropsychological deficits

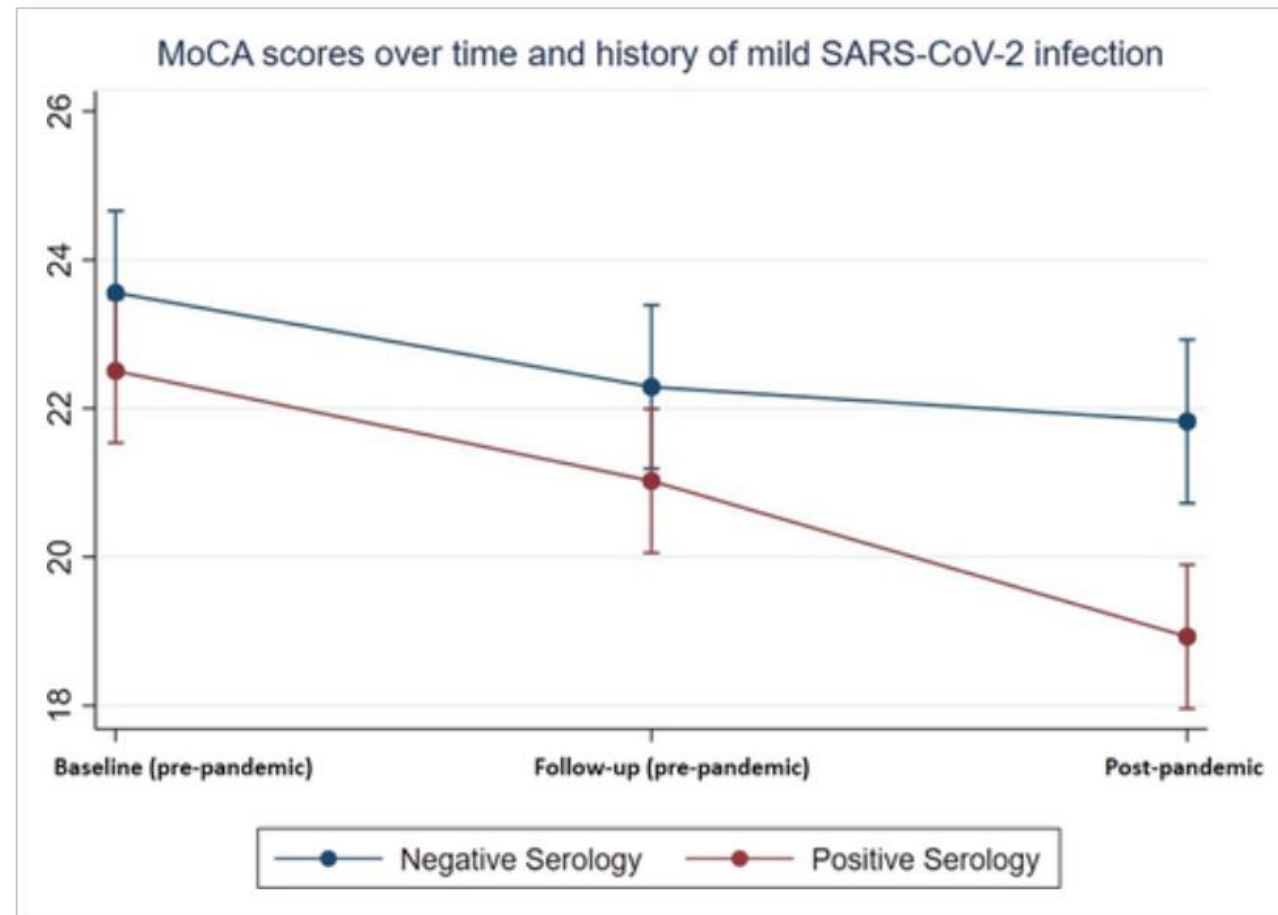


FIGURE 1

[Open in figure viewer](#)

[PowerPoint](#)

Science

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T. REX TALLY

*A Natural History of the most
prodigious beast on
earth*



Rarity of fossils: T Rex as model

- ▶ Based on living specimens:
- ▶ Estimate that *T. Rex*:
 - ▶ abundance at any one time was ~20,000 individuals,
 - ▶ persisted for ~127,000 generations,
 - ▶ total number of *T. rex* that ever lived was ~2.5 billion individuals,
 - ▶ fossil recovery rate of 1 per ~80 million individuals
 - ▶ 1 per 16,000 individuals where its fossils are most abundant.

New books

- ▶ **The World Before Us: The New Science Behind Our Human Origins Hardcover** – August 24, 2021
- ▶ by Tom Higham

1 - Collection of unusual stones: 22 Calcite crystals, 105 Ka



- ▶ **105 ka ago**, humans living on Ga-Mohana Hill (South Africa) collected at least 22 calcite crystals (smooth, white, and rectangular).
- ▶ **No natural cause has been found that caused the deposit of this set, nor the usefulness of these objects, so a symbolic motif is associated with them.**
- ▶ Likewise, **42 fragments of ostrich eggshell** have been found, remains of possible water containers? (located 665 km from coast): reveal that technological innovations occurred beyond its coast.

Humans Thrived in Water-Rich Kalahari

Discovery challenges the idea that the origins of our species were linked to coastal environments.



Non-utilitarian collected objects at Ga-Mohana Hill North Rockshelter and in southern Africa.

2 - Little Foot: *Australopithecus prometheus*, StW 573



A special J of Evol issue to Little Foot analyses from a global research group,

Little Foot: multi-team analysis of pectoral girdle

- ▶ **Little Foot**: A **near-complete skeleton of an Australopithecus** individual much older than most other human ancestors. The creature, probably an old female, stood about 4 feet tall with long legs suitable for bipedal motion when it lived some 3.67 million years ago.
- ▶ Called “Little Foot” because the first bones recovered consisted of a few small foot bones, the remains were discovered in a cave in South Africa in the 1990s. **Little Foot is older and more complete than Lucy.**
- ▶ A long-awaited, **high-tech analysis of the upper body** of famed fossil “Little Foot”: focused on **pectoral girdle, which includes collarbones, shoulder blades and joints.**

Little Foot

- ▶ Legs of Little Foot show humanlike traits for upright walking, the shoulder components are clearly apelike, supporting arms surprisingly well suited for suspending from branches or shimmying up and down trees.
- ▶ Little Foot's shoulder was probably a good model of the shoulder of the common ancestor of humans and other African apes like chimpanzees and gorillas
- ▶ Its pectoral girdle suggests a creature that climbed trees, hung below branches and used its hands overhead to support its weight.

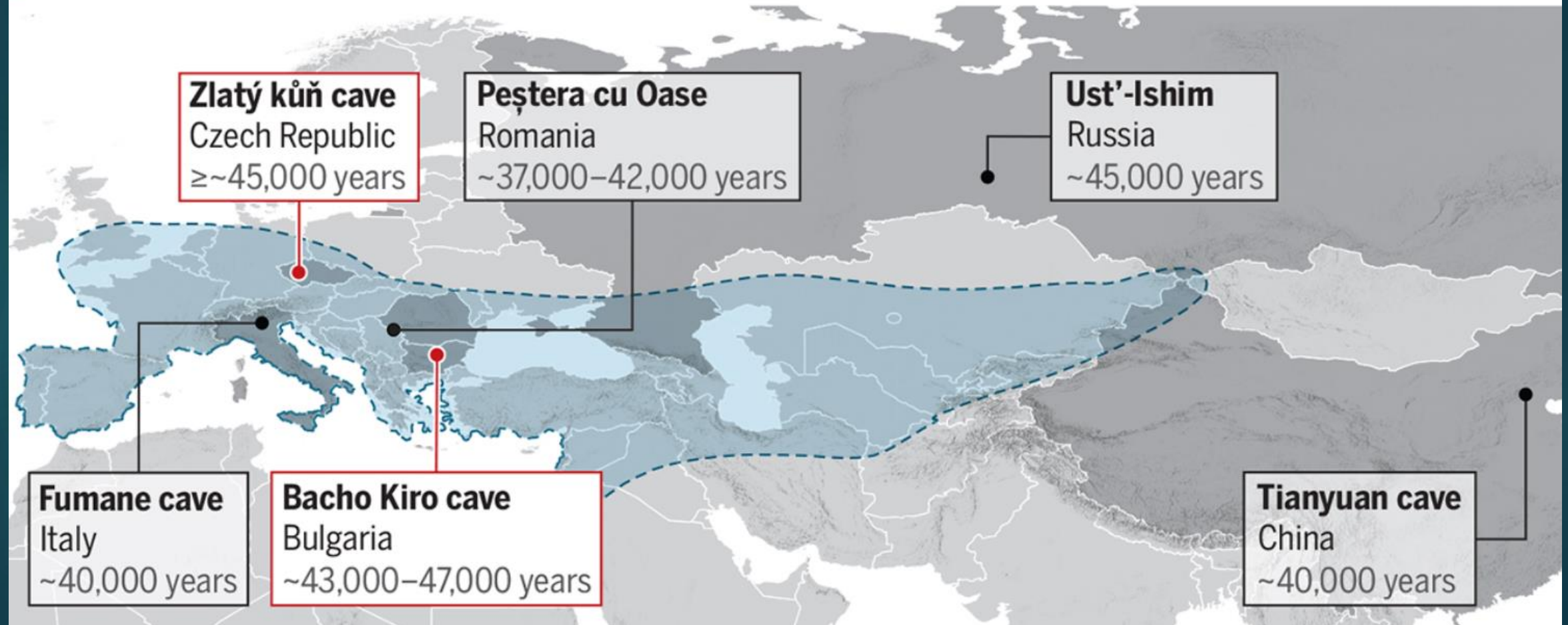
3 - Scarcity of MH DNA

- ▶ There is a scarcity of genetic information of MHs from the period between around 47,000 and 40,000 years ago, known as the Initial Upper Palaeolithic, and no *Homo sapiens* DNA at all from before this period.
- ▶ The early Eurasians carried Neanderthal DNA. This mix probably originated from mixing between the groups in the Middle East 50,000–60,000 years ago.
- ▶ But a 2015 study³ of the genome of the 40,000-year-old Romanian individual, from a site called Peștera cu Oase, held a surprise: a Neanderthal ancestor in the past four to six generations, suggesting that humans interbred with Neanderthals in Europe, too.
- ▶ How common was MH and N mixing?

Modern humans on the move

Findings from new sites (red) add to the handful of ancient DNA studies of the mysterious modern humans who first ventured into Eurasia and the Neanderthal homeland (blue).

● Estimated Neanderthal geographical range



Earliest MH genomes

- ▶ A complete DNA genome has been produced from:
 - ▶ 1 - ~45 Ka remains of **Ust'-Ishim**, a **Siberian** individual who showed **no genetic continuity to later Eurasians**
 - ▶ 2 - ~40 Ka **East Asian** individual from **Tianyuan** whose genome is more closely related to many present-day Asians and Native Americans than to Europeans.
 - ▶ 3 - **From Europe**, only the partial genome of **Oase 1** and dated to ~40 ka has been recovered, and this showed **no evidence of shared ancestry with later Europeans**.
 - ▶ However, **Oase 1 carried more Neanderthal ancestry (6–9%)** than other modern human genomes sequenced to date, owing to admixture with **Neanderthals that occurred within the six generations before the individual lived**.

Two new articles from Paabo lab: Earliest MHs in Europe

- ▶ New genetic studies of three 45 Ka individuals from Bacho Kiro Cave, Bulgaria and one similarly aged skull from a Czechian hill site known as Zlatý kůň (Golden Horse).
- ▶ Bacho Kiro MH tooth & fragmentary bones = 45,930 and 42,580 dates; with UP tools
- ▶ Only the Bacho Kiro individuals have living descendants and they're found in surprising places—in East Asia and the Americas
- ▶ Both groups have Neanderthal DNA.
- ▶ Among the Bacho Kiro humans, evidence seems to show that when modern humans moved into Europe they commingled with Neanderthals longer, and later, than is commonly believed.

Earliest MHs in Europe

- ▶ These individuals were among the earliest modern humans to live in Europe, but had no relation to humans now known as European
- ▶ Populations, represented by the Oase1 and Ust'Ishim individuals, show no detectable affinities to later populations, whereas groups related to the Bacho Kiro Cave individuals contributed to later populations with Asian ancestry
- ▶ These groups got largely replaced in Western Eurasia by subsequent migrations of people. But they are closely related to the human groups that gave rise to later East Eurasians and Americans—including present-day populations.

Earliest MHs in Europe

- ▶ It is striking that all four of the European individuals who overlapped in time with late Neanderthals and from whom genome-wide data have been retrieved had close Neanderthal relatives in their family histories. This suggests that mixing between Neanderthals and the first modern humans that arrived into Europe was perhaps more common than is often assumed.
- ▶ The individuals carry 3.4 to 3.8 % Neanderthal DNA in their genes, which suggests more than a one-off mating far back in their family history -- Neanderthal ancestors just six or fewer generations back.
- ▶ The chromosome segments — which shorten in successive generations — were considerably longer; and **mixing occurred in Europe, not the Middle East**

Zlatý kůň skull



The skull of a modern human female individual from Zlatý kůň (Marek Jantač)

4 - Zlatý kůň, Czech

- ▶ Second study: genome from skull of a single modern human female from the Zlatý kůň, Czechia site found in the early 1950s.
- ▶ In Europe, the modern human expansion preceded the disappearance of Neanderthals from the fossil record by 3,000–5,000 years.
- ▶ This individual shows substantial Neanderthal ancestry of three percent, and has exceptionally long N segments. This is a good indication that MHs had very recent admixture with Neanderthals.
- ▶ No genetic trace left of them -- The Zlatý kůň individual doesn't seem to contribute to later human groups, nor do others of the handful of examples sequenced so far, like the 45 Ka Ust'-Ishim from Siberia and the 40 Ka Oase 1 from Romania

Zlatý kůň, Czech

- ▶ Bacho Kiro remains represent a population that once lived across Eurasia, but vanished from Europe and lived on in Asia.
- ▶ “Not all fossil humans represent ancestors of living populations, or populations that left genetic descendants,” says Rick Potts. “That may be more the rule than the exception and the genomics is really highlighting that.”
- ▶ Complete fossil skulls (and their endocasts) are extremely rare.
- ▶ The Zlatý kůň woman’s Neanderthal ancestry goes back considerably longer: 70–80 generations, or perhaps 2,000–3,000 years

5 - 2021: Brain endocast study

- ▶ Because brain tissues rarely fossilize, changes in brain size, shape, and organization are gleaned from brain endocasts (replicas of the inner surface of the braincase)
- ▶ There have been debates on whether humanlike brain organization emerged concomitantly with the appearance of the genus *Homo*.
- ▶ Long held view that humans' frontal lobe developed at the transition from *Australopithecus* to *Homo*, which happened roughly 2.8 million to 2.5 million years ago
- ▶ New study by Ponce de León et al. (2021) challenge this view by suggesting that *Homo erectus* in Dmanisi, Georgia at 1.85 to 1.77 Ma ago showed a primitive organization of the brain, with a smaller frontal lobe.

Internal structure of the brain case, and inferred brain shape (endocast)



Endocasts

- ▶ Fossil endocasts: imprints representing cerebral gyri and sulci, as well as vascular structures surrounding the brain.
- ▶ **Ponce de León**: Detailed 3D reconstructions of brains of 81 chimpanzees, 27 bonobos, 43 gorillas and 32 orangutans, along with the endocasts of 110 modern humans and 40 hominins based on CT imaging
- ▶ A backward shift of the precentral sulcus over evolutionary time reliably indicates that the Broca region in front of it became expanded during human evolution

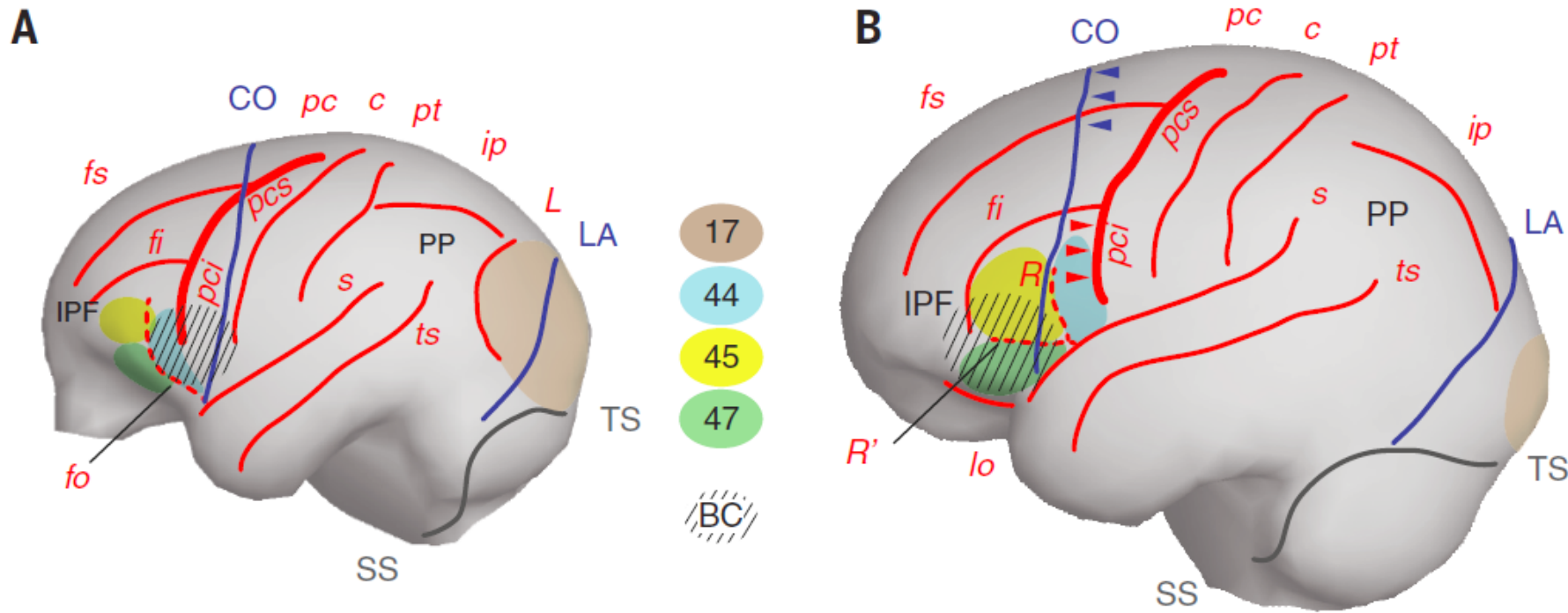


Fig. 1. Topographical relationships between neurocranial and brain structures on endocasts of great apes and humans. Cranial sutures are indicated in blue, cerebral sulci in red, and brain regions in other colors. **(A)** In great apes, the precentral sulcus (pc) crosses the coronal suture (CO), such that its inferior portion (pci) is located anterior to CO. The lunate sulcus (L) marks the anterior border of the primary visual cortex (Brodmann area 17). **(B)** In humans, evolutionary expansion of the inferior prefrontal cortex (IPF) resulted in a shift of the pci toward the posterior side of CO (red arrowheads). Concomitant expansion of the parietal bone resulted in anterior shift (blue arrowheads) of the apical portion of CO. Expansion of the posterior parietal cortex (PP) resulted in fragmentation and eventual disappearance of L. Numbers indicate

Areas 44 & 45
(blue, yellow) =
Broca's area =
Expressive
language,
stone tool
making,
memory
retrieval

Broca's: in
apes, only area
44; in humans,
areas 45 & 47

Inferior frontal
lobe expansion
== posterior shift
of the inferior
precentral
sulcus (pci)

Table 1. Endocranial features of early *Homo* fossils. Fields marked as “–”

| Region | Specimen | Label* | Geological age (Ma) | ECV (cm ³) | |
|--------|------------------------|--------|---------------------|------------------------|-----|
| Africa | KNM-ER 1470 | 1470 | 2.03 | 752 | |
| | KNM-ER 1805 | 1805 | 1.75 | 582 | |
| | KNM-ER 1813 | 1813 | 1.78 | 509 | |
| | KNM-ER 3733 | 3733 | 1.65 | 848 | |
| | KNM-ER 3883 | 3883 | 1.65–1.50 | 804 | |
| | WT 15000 | WT15K | 1.60–1.50 | 750 | |
| | DAN5/P1 | DAN5 | 1.60–1.50 | 598 | |
| | OH 9 | OH9 | 1.50 | 983 | |
| | KNM-ER 42700 | | 1.55 | 732 | |
| | BOU-VP-2/66 | BOU | 1.00 | 998 | |
| | UA-31 (Buia) | | 1.00 | 995 | |
| | Bodo | Bodo | 0.6 | 1250 | |
| | Kabwe | Kabwe | 0.30 | 1325 | |
| | <i>Au. sediba</i> MH1 | MH1 | 1.98 | 420 | |
| | <i>H. naledi</i> DH1,3 | DH | 0.34–0.24 | 460 | |
| | West Asia | D2280 | D1 | 1.77 | 730 |
| | | D2282 | D2 | 1.77 | 650 |
| D2700 | | D3 | 1.77 | 601 | |
| D3444 | | D4 | 1.77 | 641 | |
| D4500 | | D5 | 1.77 | 546 | |

| Region | Specimen | Label* | Geological age (Ma) | ECV (cm ³) |
|-----------------|-------------------|-------------|---------------------|------------------------|
| Europe | Steinheim | St | 0.40–0.30 | 1200 |
| | Petralona | Pe | 0.40–0.30 | 1170 |
| Northeast Asia | Zhoukoudian XII | Z12 | 0.77 | 1030 |
| | Hexian | Hex | 0.40–0.30 | 1025 |
| Southeast Asia | Trinil 2 (P I) | | <1.0 | 940 |
| | Sangiran 2 (P II) | Sa2 | ~1.3 | 813 |
| | Sangiran 9 | Sa9 | ~1.3 | 870 |
| | Sangiran 17 | Sa17 | ~1.3 | 1004 |
| | Bukuran | Buk | <1.49 | 850 |
| | Mojokerto | Mojo | <1.49 | 630 |
| | Sambungmacan 3 | Sm3 | 0.30–0.20 | 917 |
| | Sambungmacan 4 | Sm4 | 0.30–0.20 | 1006 |
| | Ngawi | Ngawi | 0.50–0.00 | 1000 |
| | Solo 4 (Ng 5) | So4 | 0.117–0.108 | 1000 |
| | Solo 5 (Ng 6) | So5 | 0.117–0.108 | 1251 |
| Solo 6 (Ng 7) | So6 | 0.117–0.108 | 1013 | |
| Solo 10 (Ng 13) | So10 | 0.117–0.108 | 1231 | |
| Solo 11 (Ng 14) | So11 | 0.117–0.108 | 1090 | |
| LB1 (Liang Bua) | LB1 | 0.07 | 426 | |

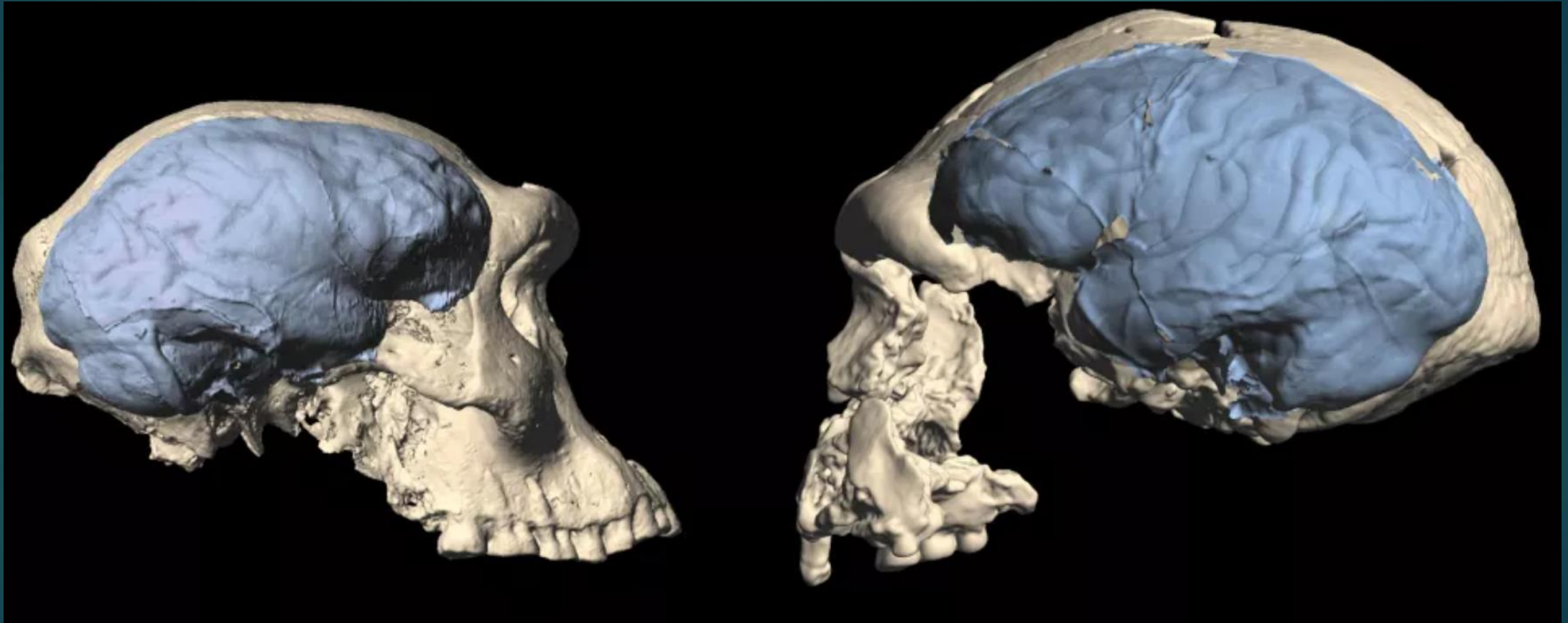
Frontal organization in endocasts

- ▶ The *earliest Homo endocast specimens* are from African and Asian localities that date to less than 1.8 Ma, leaving a gap of about 1 Ma in our knowledge of human brain evolution.
- ▶ In terms of frontal organization, this 1 Ma break in the usable fossil record is crucial. Early hominins that wandered in Africa before 2.8 Ma show a relatively ancestral organization of this frontal region, whereas imprints on later human endocasts indicate a derived human condition (frontal becomes larger and expands more posteriorly).
- ▶ New study challenges the theory that modern frontal organization emerged with early Homo.

Frontal lobe

- ▶ Hominin fossil-bearing site of Dmanisi is exceptional for its geographical (Europe) and chronological (1.85 to 1.77 Ma) contexts, one of the earliest dispersals of *Homo* out of Africa
- ▶ Endocast of *H. erectus* at about 1.8 Ma reflects a primitive organization of the frontal lobes, whereas later *H. erectus* specimens in Southeast Asia and Africa show a derived condition
- ▶ What kind of selection pressure may have been responsible for the reorganization of the frontal lobes?

Homo erectus: Dmanisi vs Sangiran



Frontal lobes

- ▶ Earliest members of the genus *Homo* had a primitive frontal lobe organization, featuring an ape-like anterior location of the inferior precentral sulcus relative to the coronal suture.
- ▶ Derived frontal lobe organization emerged relatively late during the evolution of *Homo*, between 1.7 and 1.5 Ma—not at the transition from *Australopithecus* to *Homo*, but clearly later than the first dispersals of *Homo* from Africa.
- ▶ The most parsimonious scenario is that the first *Homo* populations to disperse from Africa, (probably as early as 2.1 Ma), retained the primitive frontal lobe organization, as represented in Dmanisi.

Frontal & Parietal reorganization

- ▶ Endocranial shape change associated with frontal lobe reorganization reveals differential expansion of the inferior prefrontal cortex and also of the posterior parietal and occipital cortex. This pattern indicates that the anterior and posterior cortical association areas evolved in tandem rather than in sequence.
- ▶ The Southeast Asian H. erectus fossils, now dated to <1.5 Ma, represent a second dispersal, after the derived frontal lobe morphology emerged in Africa between 1.7 and 1.5 Ma.
- ▶ The earliest evidence for Mode II (Acheulean) technocultures in Africa [1.76 Ma] largely coincides with incipient frontal lobe

Dmanisi endocasts, 1.8 Ma



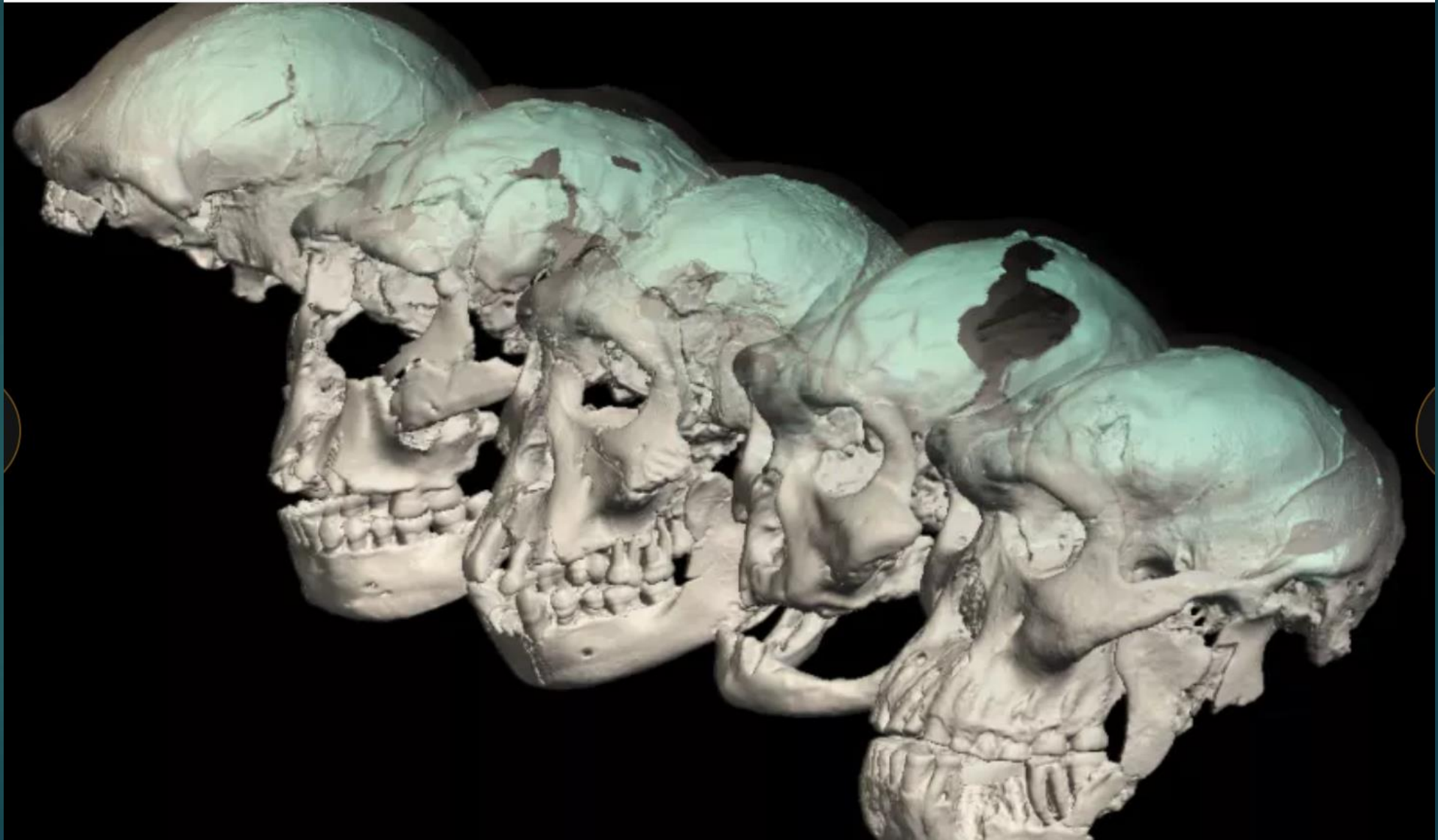
Dmanisi

- ▶ They conclude that the Dmanisi people (and hence early *Homo*) had not evolved a large frontal cortex (possibly, a lack of expansion of the Broca's region).
- ▶ So, they suggest that an expansion of the frontal lobe happened after the origin of our genus. Such expansion, associated with later hominids after 1.5 My, would have involved the frontal and the parietal lobes at once.
- ▶ The **earliest populations of our genus *Homo*** had quite primitive ape-like **brains**, like their ancestors, the Australopithecines. This includes fossils associated with *Homo habilis* and early *Homo erectus*.

Dmanisi brains

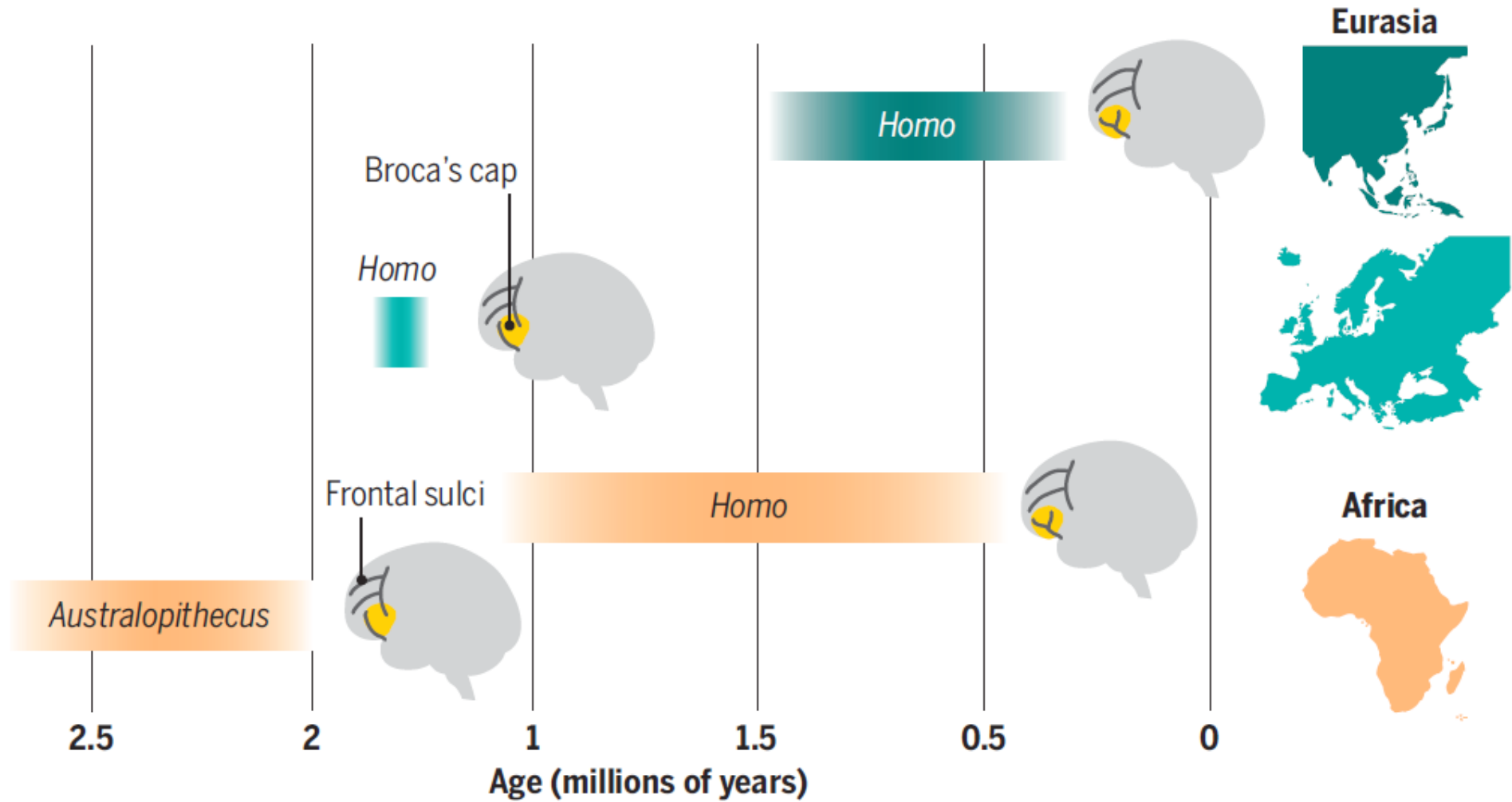


Dmanisi endocasts

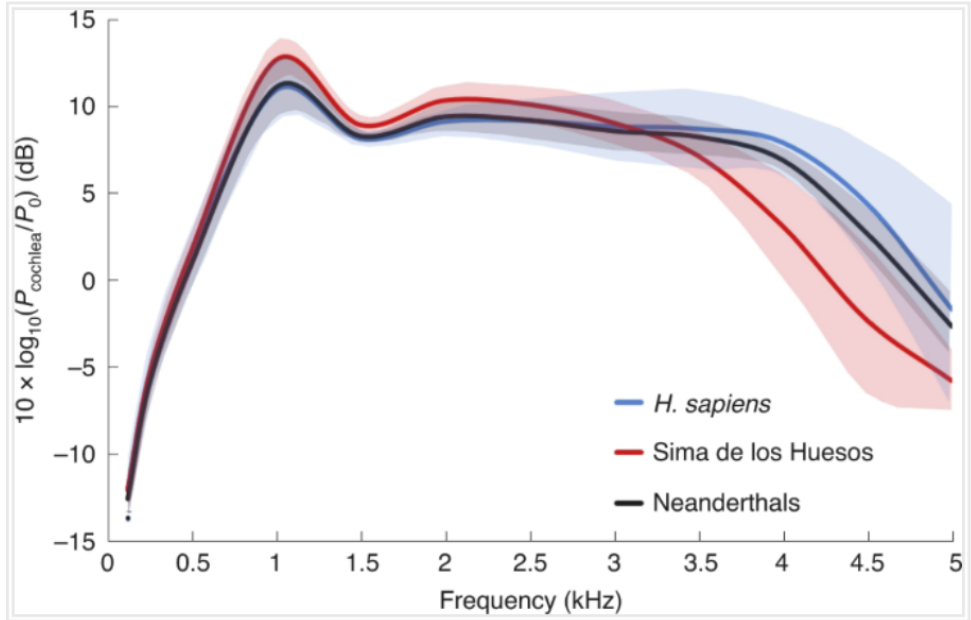


An evolutionary scenario for the hominin frontal lobes

The evolutionary scenario is based on the evidence of brain changes preserved in the fossil record and investigated by Ponce de León *et al.* Dark gray curves indicate the position of the frontal sulci.



6 - Five Neanderthal ear channels: speech hearing capable



Resulting hearing model for Homo sapiens, Sima de los Huesos hominins, and Neanderthals. Source: Conde-Valverde M et al (2021)

- ▶ The internal structure of the ear of five Neanderthals (La Chapelle-aux-Saints, Amud, La Quina 5, Krapina 38 and Krapina 39), compared to **10 modern humans and 3 hominins from the Sima de los Huesos**.
- ▶ Audiogram of Neanderthals is even more similar to that of modern humans than to those of the Sima.
- ▶ Neanderthals and sapiens share a wide band of frequencies in which we hear very well.
- ▶ We have a "broadband" ear, unlike the rest of **primates**, which have a peak at 1 KHz and then their hearing worsens, while Sapiens and Neanderthals maintain good hearing until another peak of sensitivity close to 4-5 KHz, which is the one corresponding to the emission of the most complex sounds in our speech

6 - *H. naledi* and Dinaledi chamber

- ▶ New geological study of Dinaledi chamber- Jessie L. Robbins, et al., 2021: the minimum age of *H. naledi* is ~241 ka.
- ▶ Thus, *H. naledi* entered the cave between 241 ka and 335 ka, during a glacial period, at which time clastic sediments inside the cave were undergoing erosion.
- ▶ *H. naledi* would probably have entered the cave through an access point in the roof of the Postbox Chamber and made its way along a SW trending fracture towards the Dragon's Back and Dinaledi Chambers.

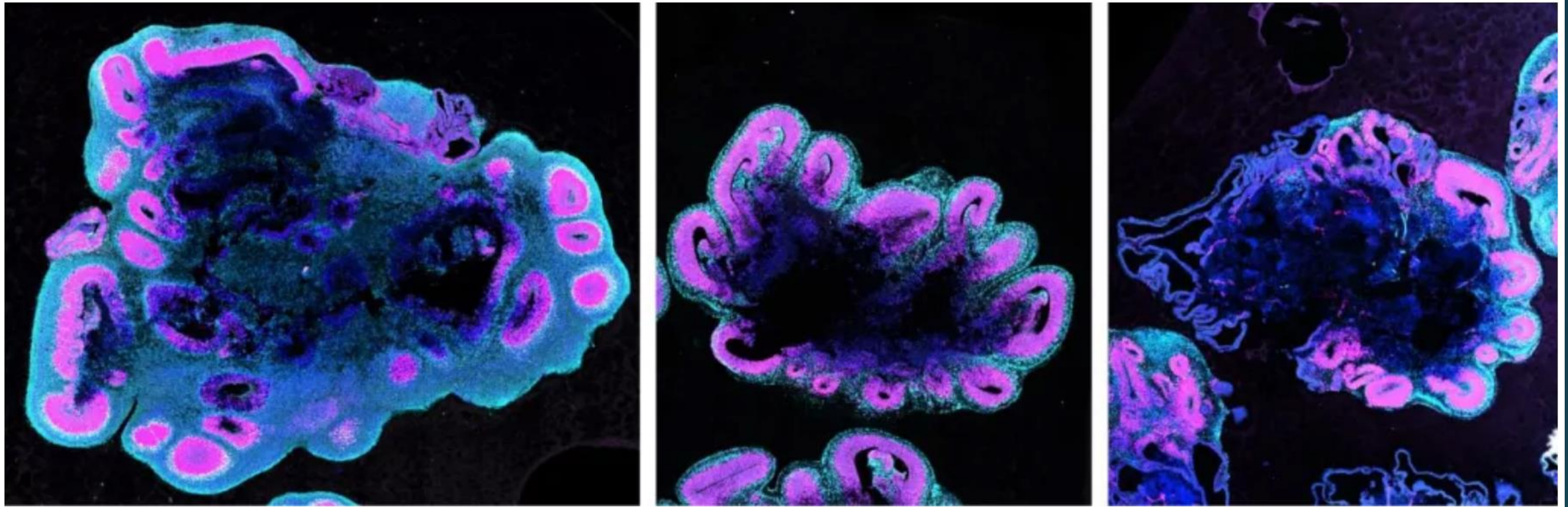
7 - Early evidence for symbolic behavior in the Levantine Middle Paleolithic

- ▶ A 120 ka old engraved aurochs bone shaft from the open-air site of Neshar Ramla, Israel
- ▶ Production of deliberate, abstract engraving on bone or stone materials is a rare phenomenon. It is now widely accepted that both anatomically modern humans and hominins that predate them have produced deliberate engravings associated with symbolic behavior.
- ▶ Within the Levantine Middle Paleolithic context, only five examples of intentional engravings are known thus far.
- ▶ An aurochs bone fragment that bears six deep, sub-parallel incisions, recovered at the open-air Middle Paleolithic site of Neshar Ramla in Israel. The item, found in an anthropogenic accumulation of artifacts in Unit III of the site, was dated to early Marine Isotope Stage 5 (ca. 120 ka).
- ▶ Intense on-site knapping activities with predominance of the centripetal Levallois reduction method and by intense exploitation of aurochs and tortoises

At 120 ka old, this is the oldest engraved object in the Levant.



8 - Secret of large brains: An early cell shape transition drives evolutionary expansion of the human forebrain



Human brain organoids (left) grew much bigger than gorilla organoids (middle) and chimpanzee organoids (right). Here the organoids are shown at 5 weeks old. (Image credit: S.Benito-Kwiecinski/MRC LMB/Cell)

Human brain = 1,500 cc in adulthood, roughly three times the size of the 500 cc gorilla brain or the 400cm³ chimp brain.

Brain organoids: Secret of large brains

- ▶ Using lab-grown mini-brains, scientists have figured out why humans have bigger brains than those of apes.
- ▶ Human brains are about three times bigger than the brains of chimpanzees, our closest living relatives. Doubled in size over last 2.5 M years.
- ▶ Silvia Benito-Kwiecinski grew "minibrains" of chimpanzees, gorillas and humans in the lab (this is the first time a gorilla brain organoid has ever been made).
- ▶ Early in brain development, creation of neural progenitor cells, which are stem cells that will eventually turn into brain cells. The more times progenitors divide, the more neurons that will eventually form. Human neural progenitor cells take a couple of days longer to mature into final spindle-like shape, producing more brain cells.
- ▶ Delay of the activation of ZEB2 gene seems to be required; it switches on later in human tissue, allowing the cells to divide more before they mature.

9 - What fueled humans' big brains? Decline in prey size

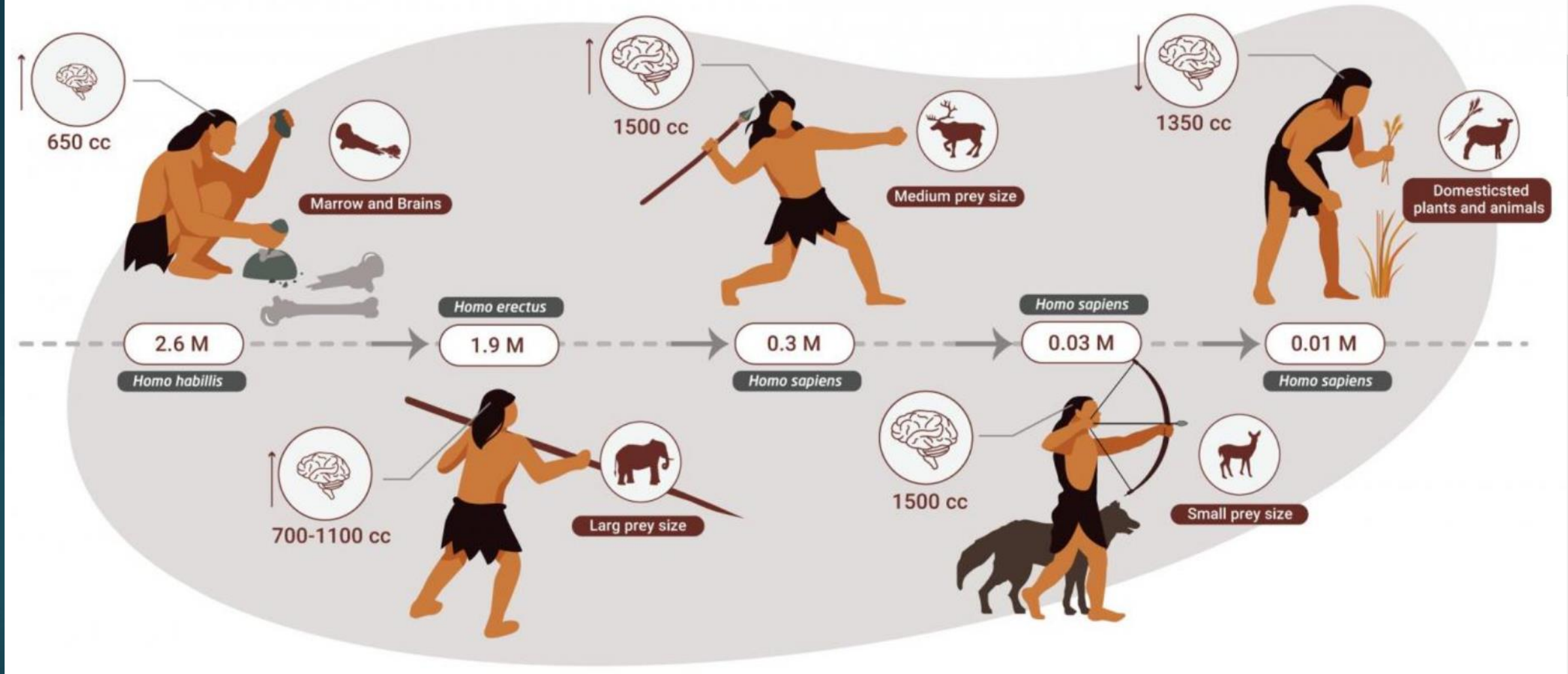
- ▶ Two 2021 Israeli studies (Ben-Dor; Barkai): Between 2.6 Ma and 11 Ka, the brains of humans and their relatives grew larger -- Prey Size Decline as a Unifying Ecological Selecting Agent in Pleistocene Human Evolution
- ▶ 2021 study of human trophic (food chain) level: new hypothesis as to why: As the largest animals on the landscape disappeared, the scientists propose, human brains had to grow to enable the hunting of smaller, swifter prey.
- ▶ This hypothesis argues that early humans specialized in taking down the largest animals, such as elephants, which would have provided ample fatty meals. When these animals' numbers declined, humans with bigger brains, who presumably had more brainpower, were better at adapting and capturing smaller prey,

Apex predators

- ▶ Reviewed 25 lines of evidence from about 400 scientific papers from different scientific disciplines, dealing with the focal question: **Were stone-age humans specialized carnivores or were they generalist omnivores?**
- ▶ Evidence from our fat metabolism, stomach acidity level, genome evidence for fat consumption; humans specialized in hunting large and medium-sized animals with high fat content
- ▶ Only starting about 85,000 years ago in Africa, and about 40,000 years ago in Europe and Asia, a gradual rise occurred in the consumption of plant foods as well as dietary diversity

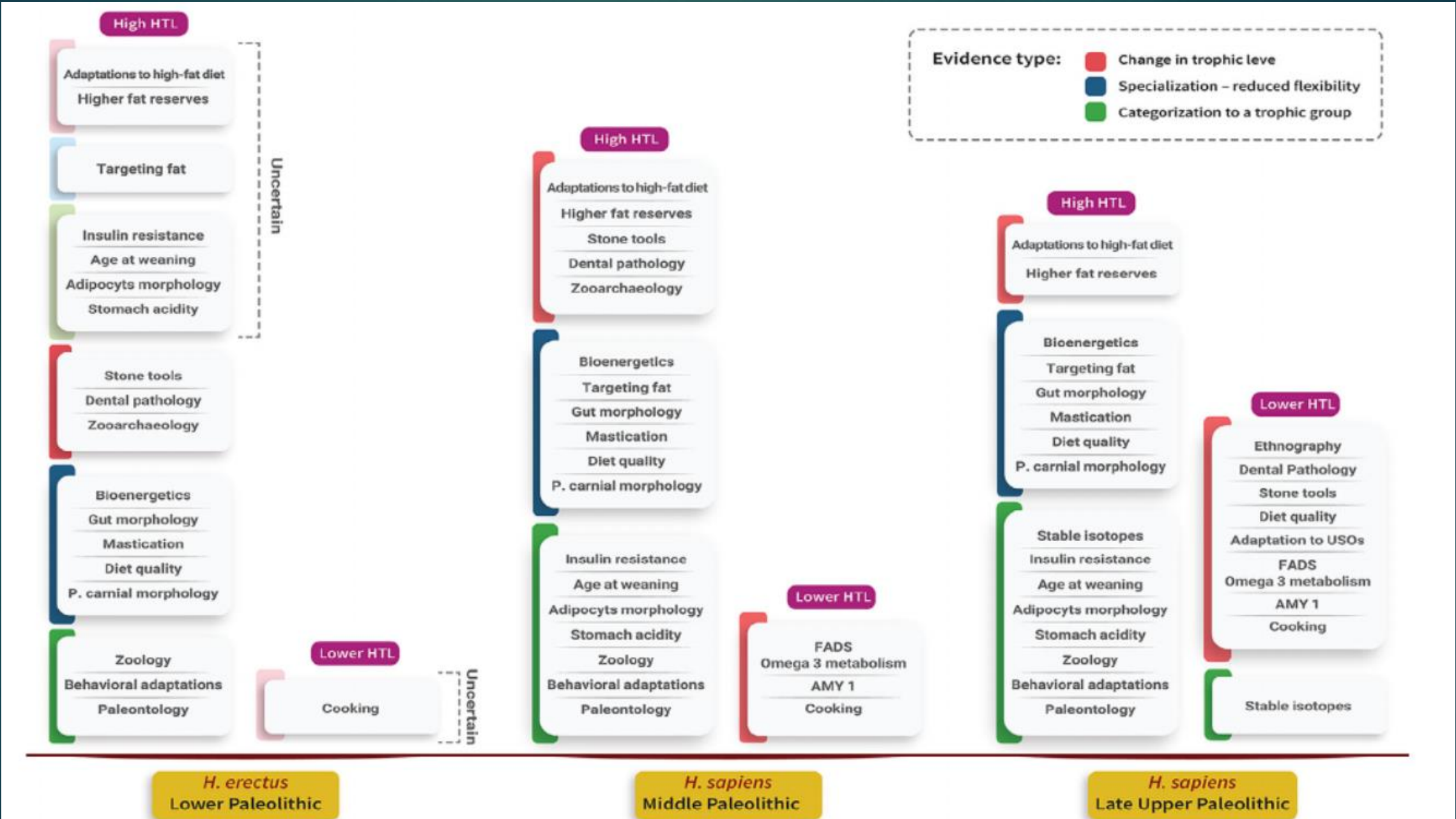
What fueled humans' big brains?

- ▶ Ultimately, adult human brains expanded from an average of 650 cc at 2 million years ago to 1,500 cc on the cusp of the agricultural revolution about 10,000 years ago.
- ▶ The hypothesis also explains why brain size shrank slightly, to 1,300 cubic cm, after farming began: The extra tissue was no longer needed to maximize hunting success.
- ▶ Human ancestors, starting with *Homo habilis* and peaking with *Homo erectus*, spent the early Pleistocene as expert carnivores, taking down the biggest, slowest prey (megaherbivores) that Africa had to offer.
- ▶ Modern humans are better at digesting fat than other primates, indicating an adaptation for eating fatty meat.

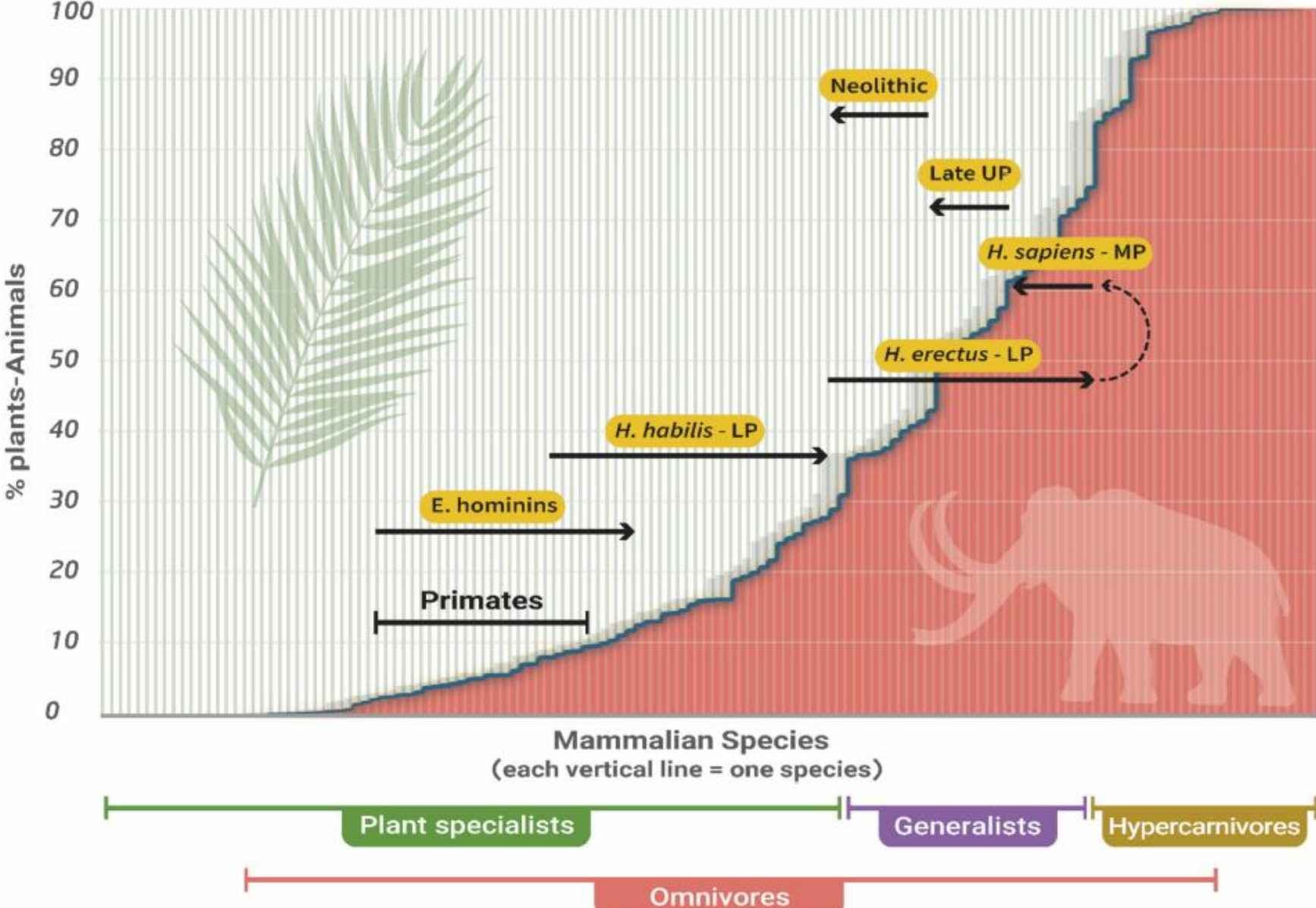


Humans were an apex predator for about two million years. Only the extinction of larger animals (megafauna) in various parts of the world, and the decline of animal food sources toward the end of the stone age, led humans to gradually increase the vegetable element in their nutrition, until finally they had no choice but to domesticate both plants and animals - and became farmers.

A list of evidence by human trophic level, human species, period, and type of evidence



Proposed evolution of the human trophic level during the Pleistocene



Prey Size Decline as a Unifying Ecological Selecting Agent in Pleistocene Human Evolution

- ▶ Human species' tools and lifestyle are consistent with a shift from large prey to small prey. In Barkai's fieldwork in Africa, for example, he has found *Homo erectus* sites strewn with elephant bones, which disappear at later sites from between 200,000 and 400,000 years ago. The human ancestors at those more recent sites seemed to have been eating mostly fallow deer.
- ▶ It's not clear what caused this decline, but it could have been climate change, human hunting or a combination of the two. As the biggest, slowest, fattiest animals disappeared from the landscape, humans would have been forced to adapt by switching to smaller animals.

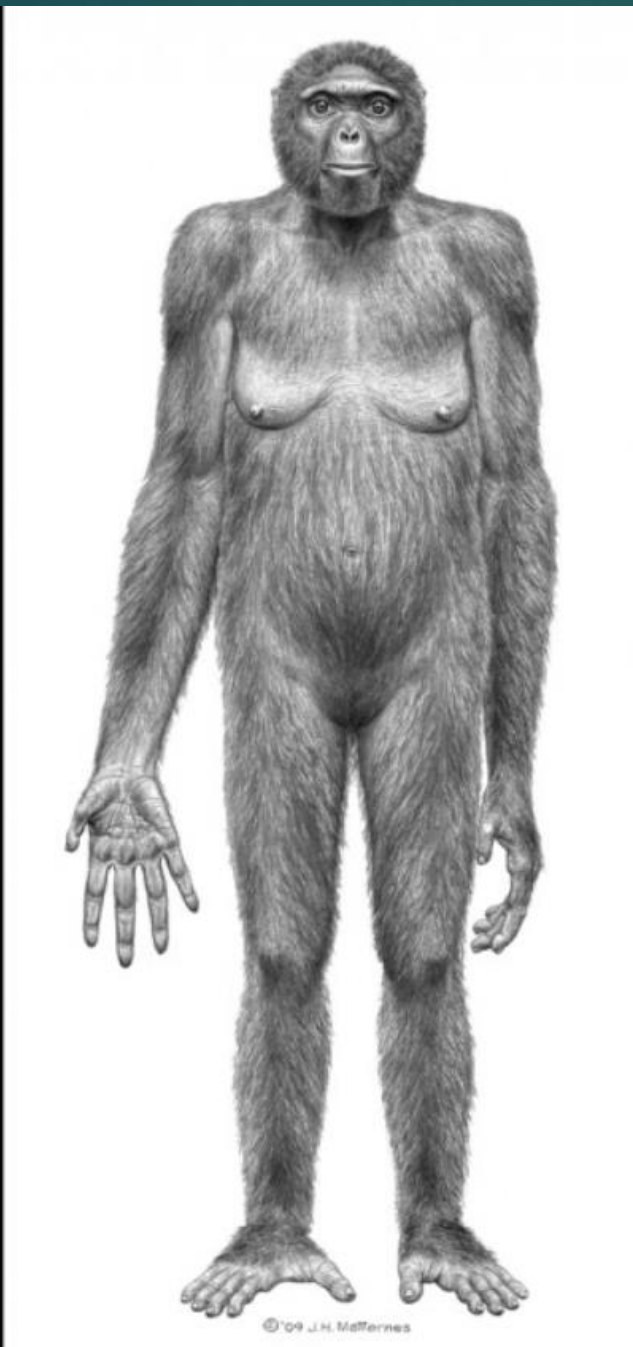
Brain and prey size

- ▶ Smaller prey would have put evolutionary pressure on human brains to grow larger because hunting small animals would have been more complicated, given that smaller prey is harder to track and catch.
- ▶ These growing brains would then explain many of the behavioral changes across the Pleistocene. Hunters of small, fleet prey may have needed to develop language and complex social structures to successfully communicate the location of prey and coordinate tracking it.
- ▶ Better control of fire would have allowed human ancestors to extract as many calories as possible from smaller animals, including grease and oil from their bones.
- ▶ Tool and weapon technology would have had to advance to allow hunters to bring down and dress small game, according to Barkai and Ben-Dor.

Critiques of this trophic hypothesis

- ▶ Richard Potts: one-explanation theories don't do well; it's not clear whether early humans hunted megaherbivores at all. There are human cut marks on large-mammal bones at some sites, but no one knows whether the humans killed the animals or scavenged them.
- ▶ Brain shape also evolved over the Pleistocene, and some human relatives — such as *Homo floresiensis*, which lived in what is now Indonesia between 60,000 and 100,000 years ago — had small brains. *H. floresiensis* hunted both small elephants and large rodents despite its small brain.
- ▶ John Hawks: The human family tree was complicated over the course of the Pleistocene, with many branches, and the growth in brain size wasn't linear. Nor were the declines in large animals.

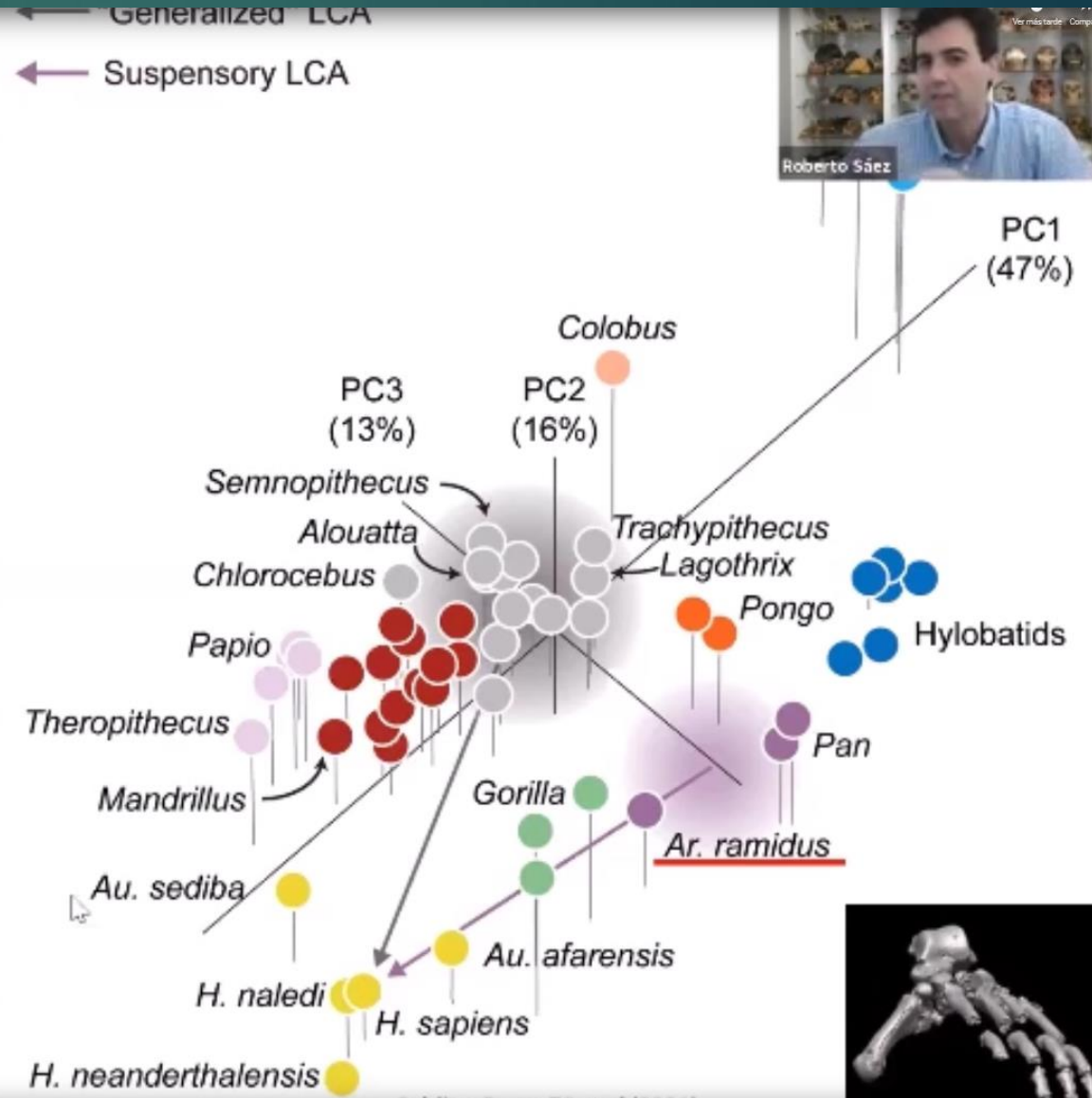
Ardi



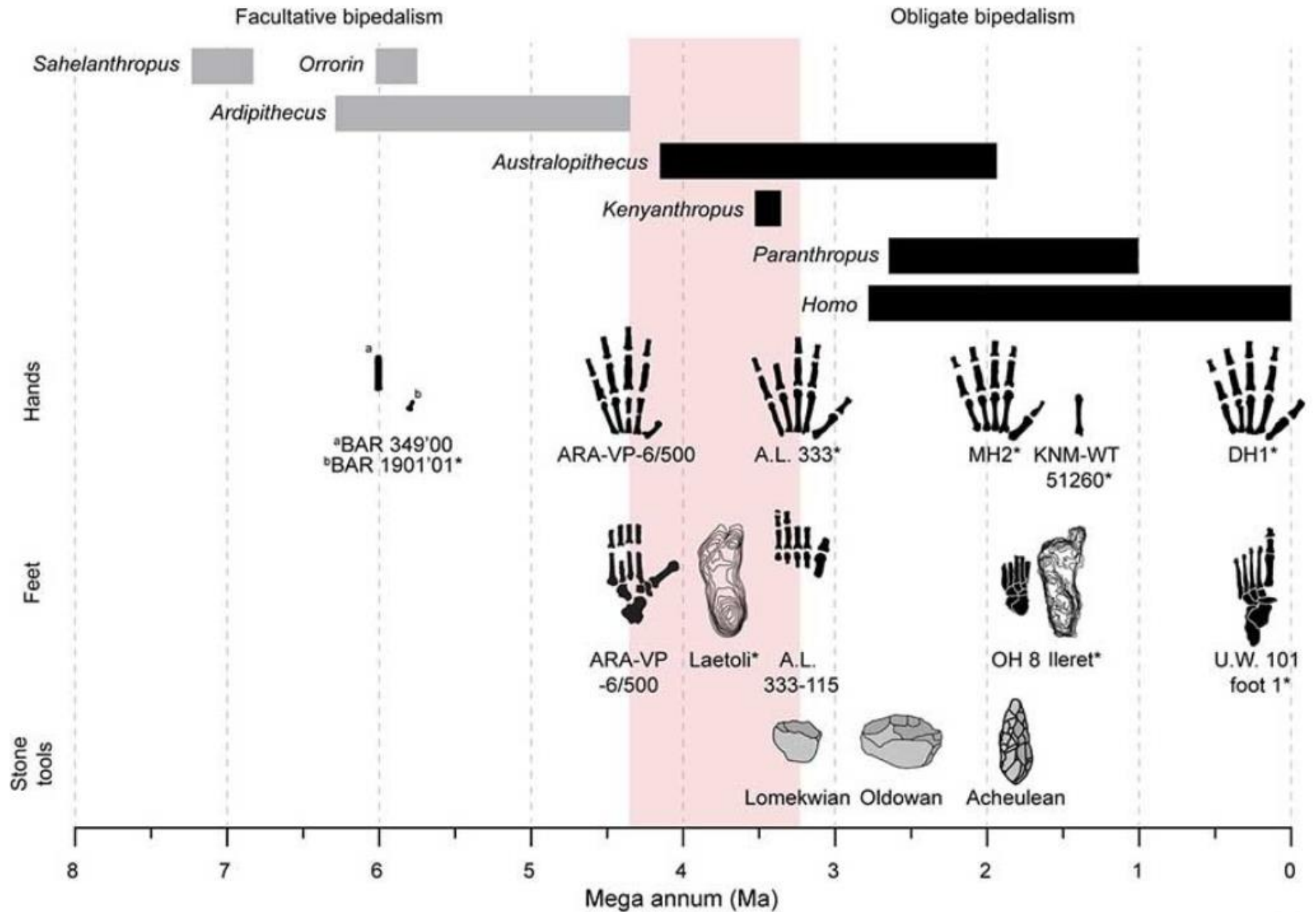
10 - 2021 Thomas Prang study: Ardi's hands

- ▶ Ardi's skeleton uniquely combines ape-like climbing features with human-like upright walking features.
- ▶ Hand fossils showing a more humanlike design and grip first appeared in a later hominid, *Australopithecus afarensis*.
- ▶ Thomas Prang has previously argued that *Ar. ramidus* had a foot that most closely resembles those of present-day chimps and gorillas.
- ▶ If so, then Ardi and her compatriots, who were close in size to chimps, most likely split their time between walking on all fours and moving through trees, he argued April 2019 in *eLife*.
- ▶ In stark contrast to Prang's conclusions, Tim White who discovered and studied Ardi's remains contend that *Ar. ramidus* was built neither like chimps nor humans.

Ardi's hand: more like chimps



Ardi had hands suited for climbing trees and swinging from branches



Critique: Bones of contention

- ▶ But **Ardi's fossil female's palm and forearm were much shorter than those of chimps**, Morgan Chaney says. Combined with her distinctive wrists, her arms would have **allowed only for grasping branches while moving slowly in trees**. **Ardi's forearm structure was not that of a knuckle-walker**. Prang's earlier analysis of Ardi's feet also falls short of demonstrating a chimp like design,
- ▶ Ardi's relatively **long mid-foot, which is ill-suited to climbing, was not accounted for in Prang's statistical analysis**. Similarities in body mass between Ardi and **chimps**, rather than a close evolutionary relationship, at least **partly explain the chimp like foot measurements that Prang cites**.
- ▶ Based on her overall body design, **Ardi walked upright**, Chaney and colleagues argue. She combined **a long lower pelvis that stabilized a straight-legged stance with an apelike, opposable big toe**. Ardi climbed trees cautiously and rarely hung or swung from branches, those researchers hold.

11 - New reconstructions of Lucy and Taung Child

Lucy



Taung
Child



The new facial reconstructions, made from pigmented silicon casts, of Lucy (left) and the Taung child (right).
(Image credit: R. Campbell, G. Vinas, M. Henneberg, R. Diogo)

Taung reconstruction choice: more ape like or more human like

Ape like



Humanlike



These two facial reconstructions of the Taung child (without hair and pigment) show how the 3-year-old may have looked with more ape like features (left) versus more humanlike features (right).

12 - Horses pass mirror test, measure of self awareness

- ▶ **Mirror self-recognition (MSR)**, investigated in primates and recently in non-primate species, is **considered a measure of self-awareness**.
- ▶ **Mirror test** = Untrained response to a visual body mark detected using a reflective surface.
- ▶ **First evidence of MSR at group level in horses**: Fourteen horses were used in a 4-phases mirror test (covered mirror, open mirror, invisible mark, visible colored mark). After engaging in a series of contingency behaviors (looking behind the mirror, peek-a-boo, head and tongue movements), our **horses used the mirror surface to guide their movements towards their colored cheeks, thus showing that they can recognize themselves in a mirror.**

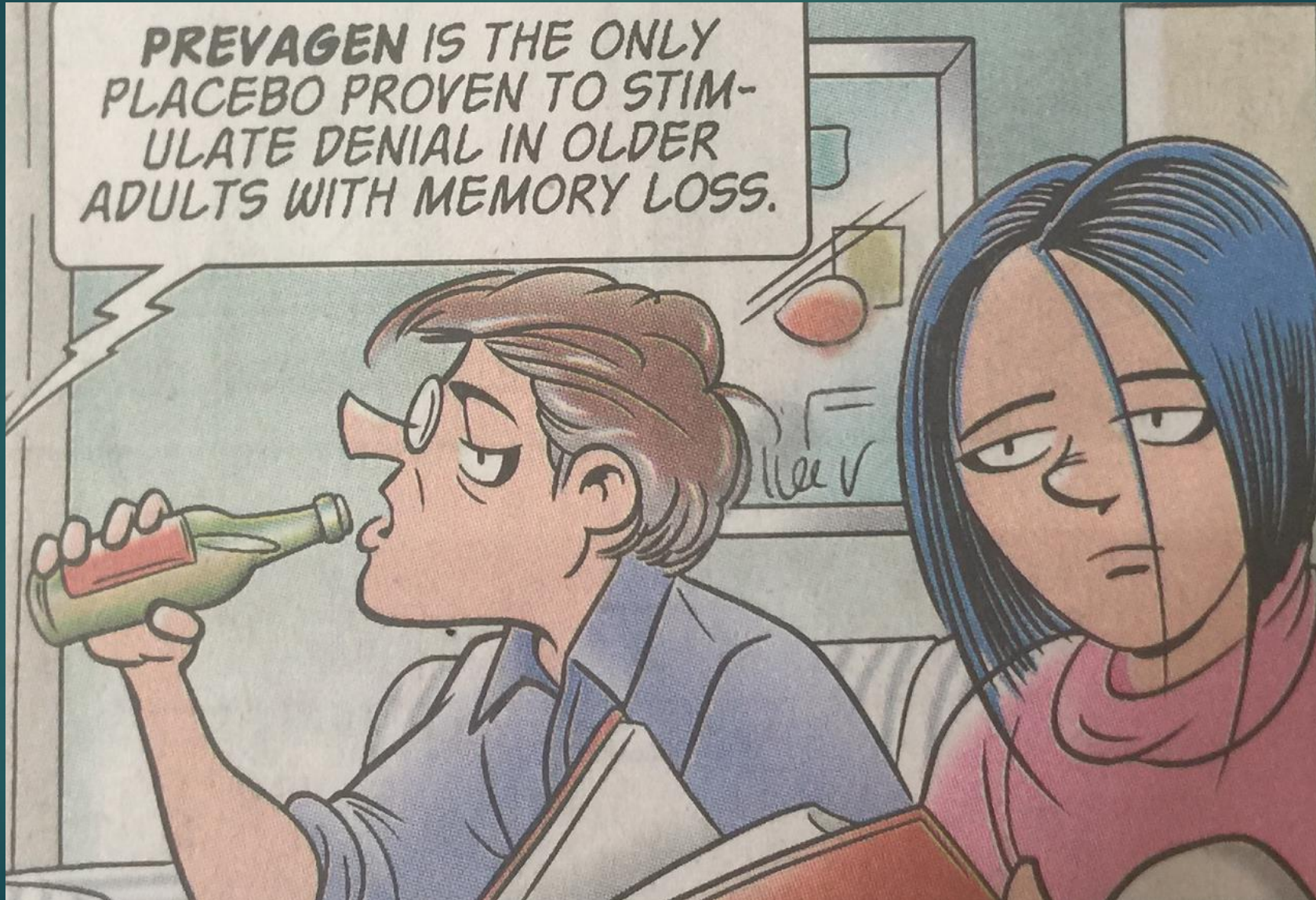
Horses pass mirror test

- ▶ Horses spent a longer time in scratching their faces when marked with the visible mark compared to the non-visible mark. This finding indicates that horses did not see the non-visible mark and that they did not touch their own face guided by the tactile sensation, suggesting the presence of MSR in horses.
- ▶ MSR is not an all-or-nothing phenomenon that appeared once in phylogeny and that a **convergent evolution mechanism can be at the basis of its presence in phylogenetically distant taxa.**
- ▶ MSR found in: humans, chimps, dolphins, elephants, magpies, cleaner wrasses

13 - Cuttlefish passed Marshmallow test: waited 90 seconds to get more favored snack



Doonesbury: Prevagen – fake jellyfish memory supplement



13 - Tools

- ▶ Oldest 3.3 Ma
- ▶ Oldowan for 1.5 Ma
- ▶ Acheulean from 2 Ma for 1 M years
- ▶ But **1% of animals (9 classes) use tools**: orangutan spear fishing, capuchin nut crackers, mollusks, octopus, corvids
- ▶ **Cultural transmission in MHs**: we teach
- ▶ **Cultural transmission depends on population size**: more efficient transfer of information:
 - ▶ when Tasmania separated from Australia, lost barbed fishing technology and reverted to shoreline foraging
- ▶ Having hands have been a major reason for our path

Cultural transmission: Dolphins using sponge masks: 50%, only females, taught, 6 generations (Sponging Eve)



Animal tool use



Gender segregation in giraffe herds; Male Giraffes necking:



Winner penetrates loser; homosexuality = 94% of all male giraffe sex; don't know why

Neanderthal footprints at 100 Ka



The fossilized footprints discovered on a beach in southern Spain are thought to be more than 100,000 years old and may be the earliest Neanderthal footprints found in Europe. (Image credit: Mayoral et

14 - Neanderthal kids frolicking at the beach

- ▶ Around 100 Ka, a group of Neanderthals with children in tow walked along the coast of what is now southern Spain, leaving behind footprints as they padded through the sand.
- ▶ Fossilized footprints at Matalascañas: at least 87 Neanderthal footprints (a total of 36 individuals—including 11 children and 25 adults); and ones left by a youngster “jumping irregularly as though dancing.”
- ▶ Of these 26 adults, 5 were female, 14 were male and 6 were of undetermined sex. On average, they stood between 4 and 5 feet tall; **two smallest markings measured just 5.5 inches long**, speculate that a 6-year-old child left these petite prints behind.
- ▶ 7 of the fossilized marks corresponded with children, while 15 were created by adolescents and 9 by adults.

15 - DNA from cave dirt traces Neanderthal upheaval



Researchers excavating Estatuas cave in Spain found a long record of Neanderthal DNA in the sediments.

First nuclear DNA in dirt

- ▶ B. Vernot, et al., 2021: Unearthing Neanderthal population history using nuclear and mitochondrial DNA from cave sediments
- ▶ Paleogeneticists have managed to extract ancient DNA from the bones or teeth of just 23 archaic humans, including 18 Neanderthals from 14 sites across Eurasia (mostly in Europe), 4 Denisovans, and the offspring of a Neanderthal mother and a Denisovan father
- ▶ In 2017, it was found that hominin mitochondrial DNA (mtDNA) can be recovered from Pleistocene sediments. The vast majority of mammalian DNA in sediments is non-hominin; 90% dominance of microbial DNA.
- ▶ Study used automated DNA extraction, library preparation and hybridization capture

Unearthing DNA

- ▶ Looked at dirt at the Denisova and Chagyrskaya caves in Siberia and Estatuas cave in Atapuerca, Spain. All three sites yielded Neanderthal nuclear and mtDNA
- ▶ Estatuas cave in northern Spain was a hive of activity 105,000 years ago. Artifacts show its Neanderthal inhabitants hafted stone tools, butchered red deer, and may have made fires. They also shed, bled, and excreted subtler clues onto the cave floor: their own DNA.
- ▶ Developed new genetic probes to fish out hominin DNA, allowing them to ignore the abundant sequences from plants, animals, and bacteria. Then, they used statistical methods to home in on DNA unique to Neanderthals and compare it with reference genomes from Neanderthals in a phylogenetic tree.

Unearthing DNA

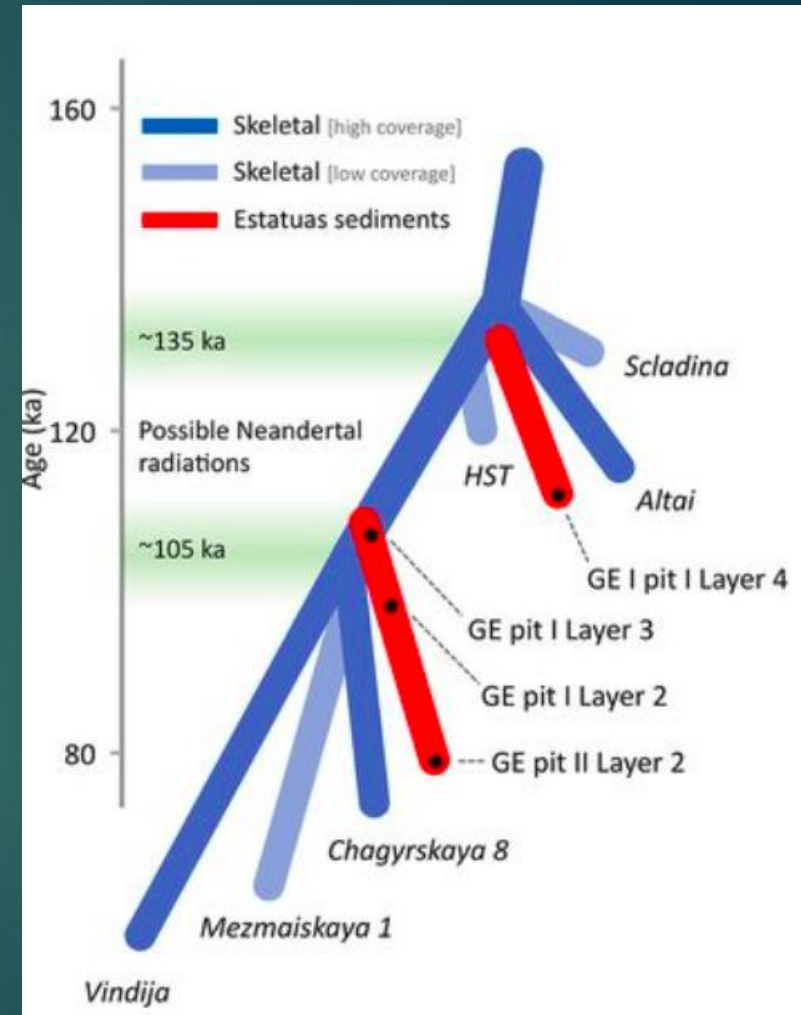
- ▶ Could identify hominin mtDNA fragments with significantly elevated frequencies of cytosine (C) to thymine (T) substitutions at ends,
- ▶ Included in their probe design 98,887 'hominin diagnostic' sites, which are fixed-derived in hominins, chimpanzees and bonobos, which differentiated hominin vs non-hominin mammalian DNA at 96% accuracy level

Unearthing DNA

- ▶ The sequences reveal the genetic identity and sex of ancient cave dwellers and show that one group of Neanderthals replaced another in the Spanish cave about 100,000 years ago, perhaps after a climate cooling.
- ▶ Found DNA from multiple Neanderthals in Estatuas cave.
 - ▶ Nuclear DNA from a Neanderthal male in the deepest layer, dating to 113 Ka, linked him to early Neanderthals who lived 120 Ka in Denisova cave and in caves in Belgium and Germany.
 - ▶ But two female Neanderthals who lived in Estatuas cave later, at 100 Ka, had nuclear DNA more closely matching that of later, "classic" Neanderthals, including those who lived less than 70 Ka at Vindija cave in Croatia and 60 to 80 Ka at Chagyrskaya

Neandertal radiations

- ▶ Two distinct radiations of Neandertal populations:
 - ▶ *Mezmaiskaya 1*, *Vindija 33.19*, *Chagyrskaya 8* and *Estatuas* pit II/Layer 2 and pit I/Layers 2 and 3 **diverged from each other approximately 100–115 ka**,
 - ▶ whereas the *Altai*, *HST*, *Scladina* and *Estatuas* pit I/Layer 4 Neanderthals, and the lineage leading to *Vindija 33.19* and *Chagyrskaya 8*, **diverged from each other ~135 ka ago**



Neanderthal radiation

- ▶ These radiation events therefore occurred during the early part of the Late Pleistocene and may be associated with changes in climate and environmental conditions during the last interglacial.
- ▶ The typical Neanderthal morphology evolved in several stages, with the last N form stage, the “classic” Neanderthals, appearing around 100,000 years ago. It seems plausible that the latter transition could be linked to the younger population radiation (100-115 Ka) detected in this study.
- ▶ At the same time, the more plentiful mtDNA from Estatuas cave shows declining diversity.
 - ▶ Neanderthals in the cave at 113 Ka had at least three types of mtDNA.
 - ▶ But the cave's Neanderthals at 107 to 80 Ka had only one type.

Unearthing DNA

- ▶ Juan Arsuaga suggests Neanderthals thrived and diversified during the warm, moist interglacial period that started at 130 Ka.
- ▶ At 110 Ka, temperatures dipped suddenly as a new glacial period set in. Soon after, all but one lineage of Neanderthals disappeared. Members of the surviving lineage repopulated Europe during later, relatively warm spells, with some taking shelter in Estatuas cave.
- ▶ Those survivors and their descendants include the “famous” classic Neanderthals, such as skulls from Vindija and La Ferrassie in France.
- ▶ These had bigger brains—up to 1750 cubic centimeters (cc)—than earlier Neanderthals (1400 cc).

Homo sapiens:
Emergence of Modern Humans
Part 2

CHARLES J VELLA, PHD

APRIL 28, 2021

AMHs: Mortality and disease

- ▶ Vital statistics (birth, death rates) of Upper Paleolithic are hard to get.
- ▶ Study: 76 Eurasian UP skeletons and series of 163 Moroccan skeletons:
 - ▶ common mortality pattern resembled that of most later historic hunter-gatherers:
 - ▶ high child mortality,
 - ▶ women died before age 40 (childbirth risks),
 - ▶ men died before 50-60
- ▶ But UP had longer lives than any prior species;
 - ▶ more older people, who retained survival klg
 - ▶ modern Hadza women have more children because of living grandmothers
- ▶ Skeletons rarely show evidence of serious accidents or disease

Mortality and disease

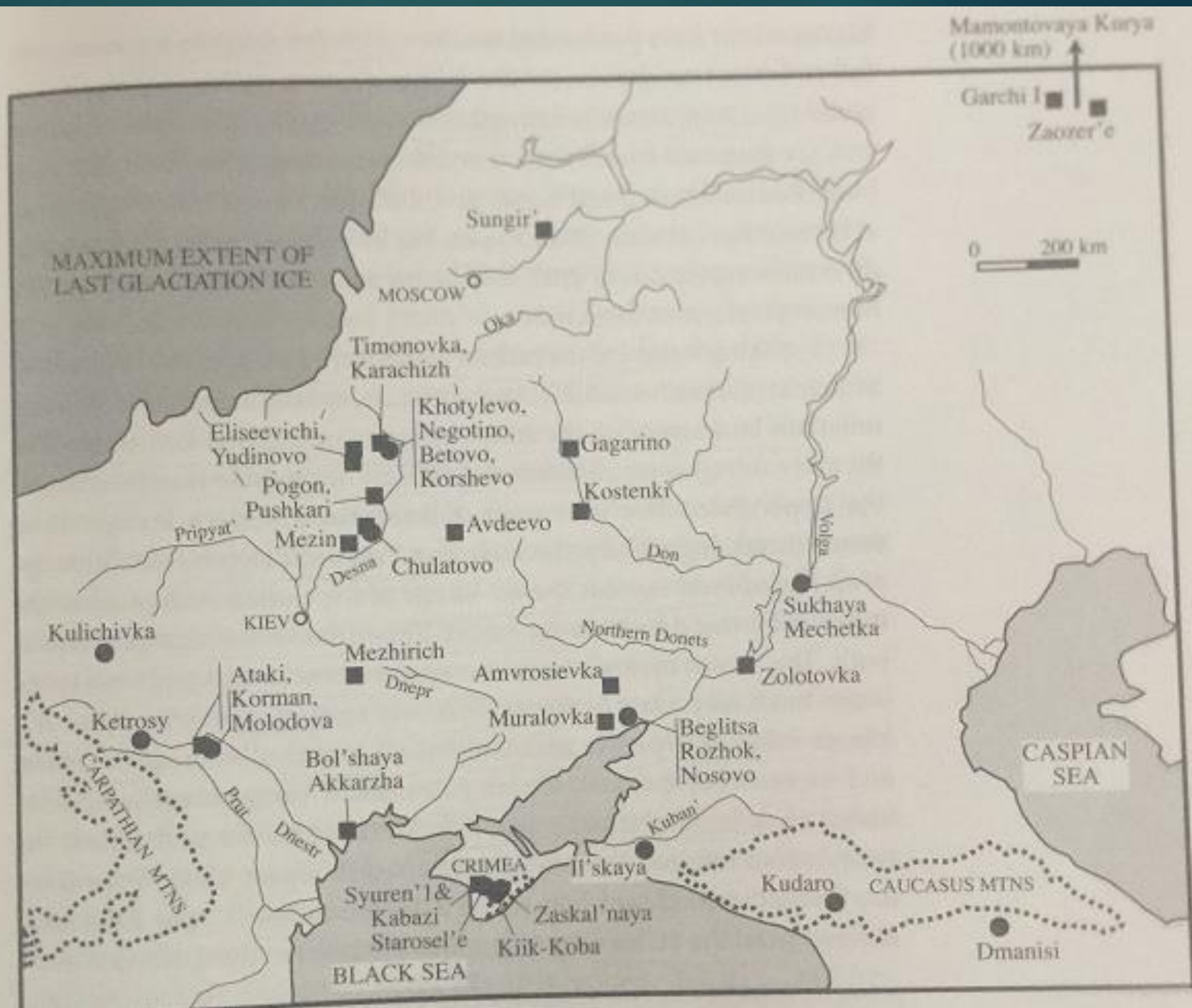
Modern Humans, 40 Ka to 10 Ka:

- ▶ Some evidence of dwarfism, fungal infections, dental abscesses, hydrocephalus
- ▶ With **less contained populations**, no **pandemics and wars**, until after agriculture starting in 10 Ka
- ▶ **Old skeletons**, like Old Man of Cro-Magnon, indicated **caring for elderly and injured**; Dolni Vestonice face sculpture indicates left facial eye droop

AMHs: LP Population Expansion: the East

- ▶ LP populations were denser and greatly extended their geographic ranges
- ▶ Easternmost Europe:
 - ▶ Mousterian sites are primarily in western and SE Europe
 - ▶ At first, not in harsher climated Eastern Europe
 - ▶ but Sungir' burial at 56° N in 26 Ka indicates they could live there
 - ▶ None in E Europe are more advanced Aurignacian
 - ▶ Neandertals in central and Western Europe

AMHs:
In
colder
Eastern
Europe &
Russian
UP
sites



Eventually in all earth environments

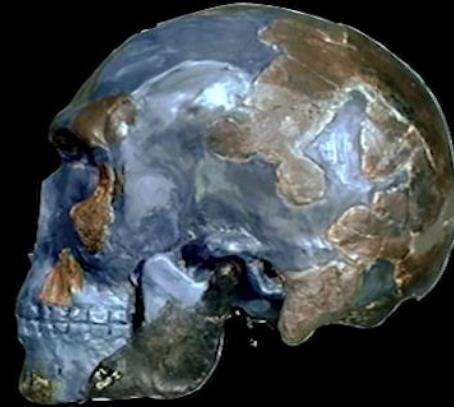


Cladistically Human, not anatomically or behaviorally modern yet

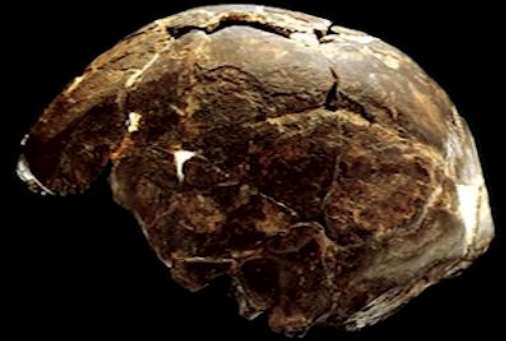
A sub-Saharan origin of extant humans ca. 200 ka?



Herto, Ethiopia (160 ka)



Omo Kibish, Ethiopia (195 ka)



Laetoli H18, Tanzania (120 ka)

LP expansion

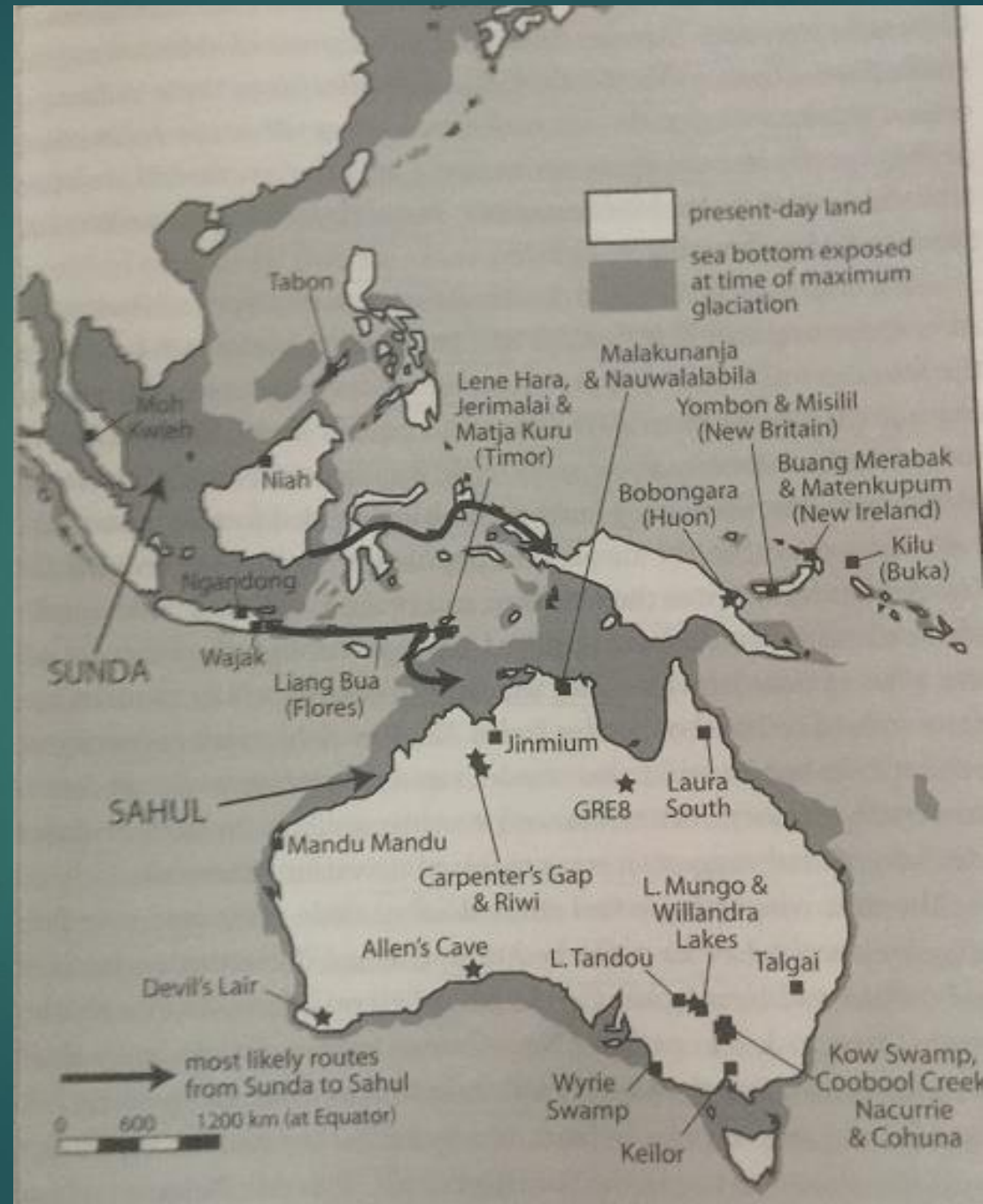
- ▶ **Reason for expansion out of Africa:** almost certainly response to ecological changes and expansion of other predator and prey animals out of Africa. Follow the herds. Tracking their subsistence animals.
- ▶ **Siberia:**
 - ▶ 8 sites of Mousterians in SW Siberia before 40 Ka (Denisova, Okladnikov, Kara-Bom, etc.);
 - ▶ Japan colonized by 35-30 Ka (via land bridge from Siberia to Sakhalin Island);
 - ▶ Okinawa by 35 Ka;
 - ▶ South Siberia by 30-20 Ka (Mal'ta open-air site, 25-20 Ka, with blades and antlers abounding);
 - ▶ most Middle UP in Siberia were in temperate Siberia (55°N)

AMHs: LP Population Expansion

- ▶ **Siberian Late LP** after 20-18 Ka:
 - ▶ in all 3 major climate zones, temperate, subarctic, and arctic;
 - ▶ 20 excavated sites, simple, transitory housing;
 - ▶ highly mobile lifestyle focused on migratory herds of reindeer and bison
- ▶ In its entirety, **40-35 to 10 Ka Siberian Late UP** differed from its west Asian and European counterparts in detail, but shared routine manufacture of bone, ivory and antler artifacts; art and ornaments; elaborate burials; lived like their European contemporaries; subsisting on gregarious herbivores under glacial climatic conditions

AMHs: Sunda-Sahul

Stars = oldest well-
documented sites



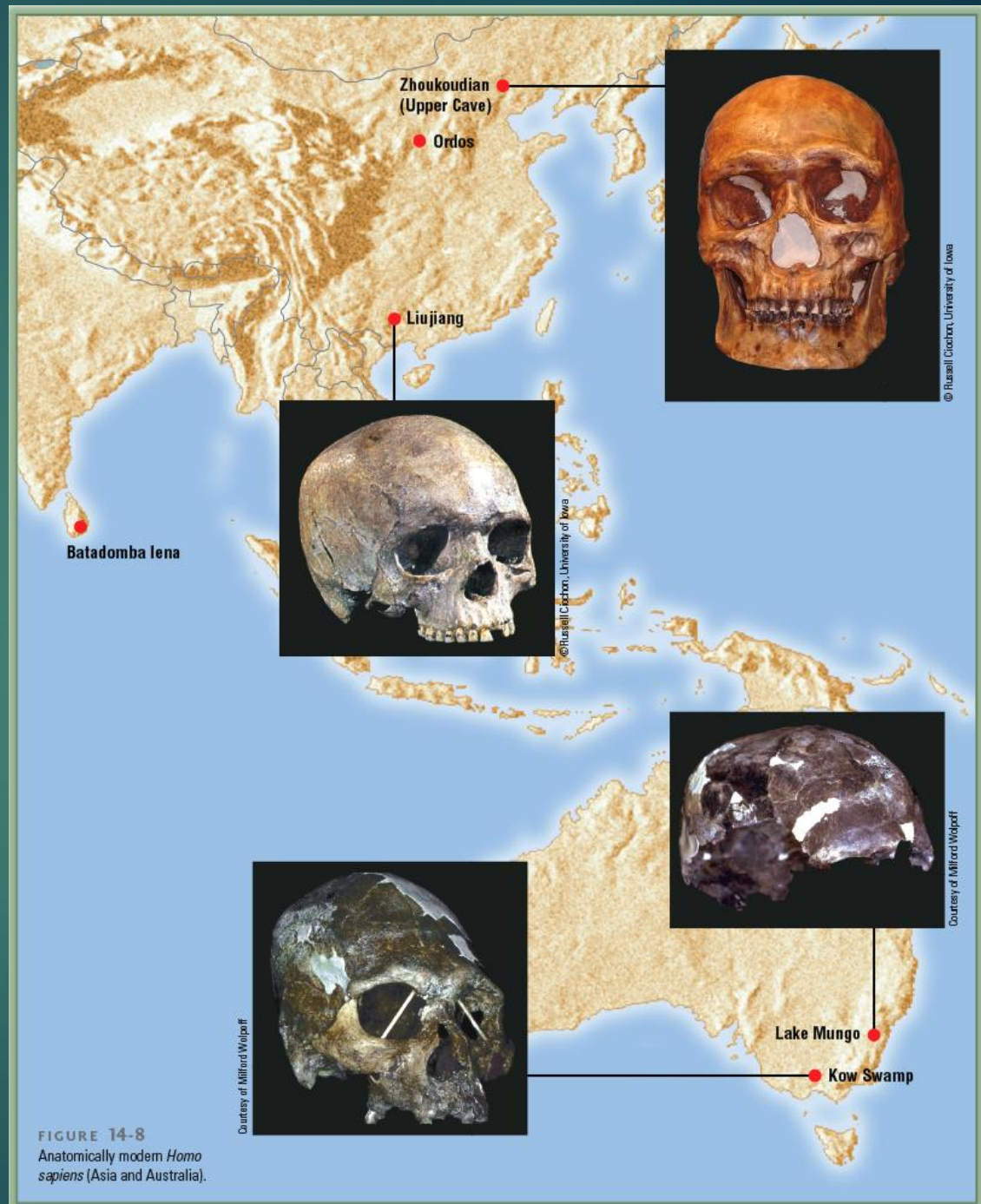
AMHs: Australia, New Guinea, & Tasmania (Sahul)

- ▶ Australia has not been connected to another continent since 70 Ka: distinct marsupial animals
- ▶ **Sunda land** = Malay Peninsula, Sumatra, Java, Borneo, Bali and islands;
- ▶ **Wallace line** separation
- ▶ **Sahul land** = Tasmania, New Guinea, Australia; they were always separate
- ▶ Some **open sea travel required**; at least one voyage of 70-90 km and 3 others of 30 km; had to sail on boats for several days; such craft taken as evidence of AMH

Settlement of Australia

- ▶ **Several settlements of humans in Australia** have been dated around 49,000 years ago.
- ▶ Luminescence dating of sediments surrounding stone artefacts at Madjedbebe, a rock shelter in northern Australia, indicates **human activity at 65 Ka**
- ▶ **Genetic studies appear to support an arrival date of 50–70,000 years ago.**
- ▶ **Australia:** AMHs by 65 Ka; MHs were only hominins in Sahul (Australia); **reached the interior by 25-20 Ka**
- ▶ The **earliest anatomically modern human remains found in Australia** (and outside of Africa) are those of **Mungo Man**; they have been dated to **42 Ka**.

Anatomically Modern *Homo sapiens* (Asia and Australia).



Homo sapiens, Australia, by 65 K



Lake Mungo Australia

Homo sapiens, Mungo III male, 30K



Kow Swamp 1



Kow Swamp 5

Homo sapiens

(Kow Swamp 1)

Discoverer: Alan Thorne & Phillip Macumber

Locality: Kow Swamp, Victoria, Australia

Date: 1967-1968 Age: 10 Ka

AMHs in Asia: Sahul & Oceania

- ▶ MHs in Sahul (Papua New Guinea, Australia, Tasmania) by 65-40 Ka; water locked up in polar glaciers produced low levels of water and dry connections between landmasses now separated by water; if at 40 Ka, then in Sunda (SE Asia & Indonesia) before then; **needed rafts**
- ▶ If *H. erectus* dates for Ngandong, Java, are correct (143 Ka), then overlap between AMH, Denisovans and late *H. erectus*
- ▶ Remember *Homo floresiensis* on Flores (100-60 Ka): temporal overlap does not mean range overlap – lived at same time, but not same place
- ▶ By 35-30 Ka, MHs in the Pacific; islands in Oceania

Australia

- ▶ Dispersal along the Southern route out of Africa via India and Indonesia.
- ▶ Australia occupation at 65 Ka; New Guinea at 40 Ka
- ▶ Australian rock art: Jinmium rock shelter at 10 Ka, thousands of circles
- ▶ Skeletons in southern Australian: Lake Mungo 1 cremation at 25 Ka; Lake Mungo 3, at 61 Ka (oldest), more gracile; high vaulted, thin boned, smooth brow, spherical skulls with flat face

Australia

- ▶ **Kow Swamp skeleton**, 26-19 Ka: low vaults, thick walls, flat and receding forehead, strong browridge, projecting faces; **more robust features**
- ▶ **These differences due to possible founder effects.**
- ▶ **Range of skull variation is extraordinary**; multiple theories; possibly more than 1 migration vs. robustness due to adaptation to aridity of their ecology

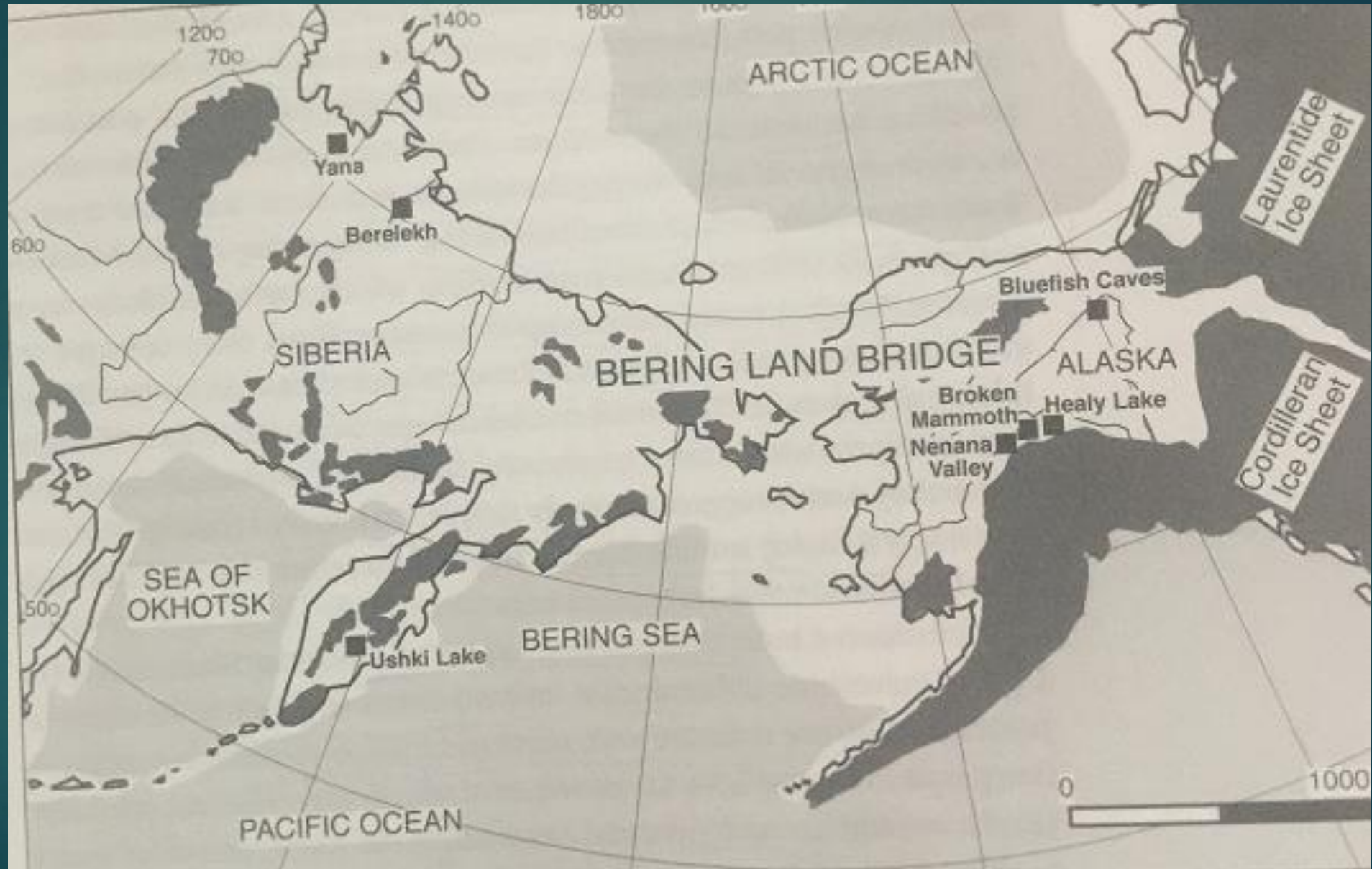
Australia

- ▶ Arrival of AMHs linked to extinction of major Australian vertebrate groups between 51 and 40 Ka:
 - ▶ all 19 marsupial species with body weight above 100 Kg,
 - ▶ 22 of 38 with wgt in 10 -100 kg range,
 - ▶ 3 large reptile species,
 - ▶ and a ostrich sized flightless bird

AMHs: LP Population Expansion: The Americas

- ▶ Native American peoples have numerous oral histories of their origins.
- ▶ President **Thomas Jefferson** theorized about the Asiatic origins of Native Americans.
- ▶ Population source and route are undisputed. Timing of migration has been the debate.
- ▶ Oldest unequivocal sites date to 13-12 Ka; older sites may be absent
- ▶ Antiquity of human occupation south of Alaska has been hotly debated for decades

AMHs: Bering Land Bridge



AMHs: LP Population Expansion: The Americas

- ▶ Last Glaciation: 75 to 10 Ka
- ▶ Canada, Alaska, Northern US covered by Laurentide glacier, 3 miles thick in places
- ▶ **Beringia**: 1000 km wide land bridge across the Bering Strait between Asia and America; caused a 100 meter drop in sea level. **Ice began to melt circa 14 Ka**; land bridge severed by 10 Ka.

Peopling The Americas

- ▶ Except between 20 and 13 Ka, **ice-free corridor** linked southern N America with ice-free areas of Alaska and Canada's Yukon, providing potential migration route. But may have been inhospitable.
- ▶ Historically **the leading theory for decades held that a single group of hunters from East Asia swept into the Americas after the LGM on the trail of big game animals** and gave rise to all Indigenous peoples in this part of the world today.
- ▶ **First Americans were Siberian UP people who extended their range eastward**, just like saiga antelope, yak, and other N Asian species

Genetics of the Americas

- ▶ New genetic studies have shown that the process of populating the Americas was far more complex than previously understood. Significantly, we now know that multiple ancient populations contributed to the ancestry of Indigenous peoples, not just one.
- ▶ For much of the 20th century, the so-called Clovis First model of Indigenous origins dominated the field of archaeology.
- ▶ These fluted Clovis spearpoints appeared abruptly south of where the ice sheets were around 13,000 years ago, sometimes in association with the remains of megafauna such as mastodons, mammoths and bison. People migrated from Siberia to North America across the now submerged Bering Land Bridge after the LGM, moving swiftly down a corridor along the eastern Canadian Rocky Mountains, then spread rapidly southward to populate South America in about 1,000 years.

Non-Clovis

- ▶ Eventually archaeological sites predating the first appearance of Clovis tools came to light. One such site is Monte Verde in southern Chile, which dates to 14,200 years ago. The artifacts found there—tools made of stone, wood and bone—are nothing like the Clovis toolkit. So non-Clovis people reached S America first.
- ▶ All genomic studies rule out the possibility that the First Peoples mixed with Europeans or Africans or any other populations before 1492.
- ▶ Approximately 36,000 years ago, a group of people living in what is now East Asia became increasingly isolated. By about 25,000 years ago, however, they were genetically distinguishable from the ancestors of contemporary East Asians. This isolated group of Ancient East Asians contributed the majority of ancestry to the First Peoples of the Americas.

Ancestral Branches: Ancient North Siberians

- ▶ Another ancestral branch of hunter gatherers emerged around 39,000 years ago and lived at the Yana Rhinoceros Horn site in what is now northeastern Siberia 31,600 years ago. This area is situated in the western part of Beringia.
- ▶ Genetics of 2 baby teeth of this genetic group known as the Ancient North Siberians, who thrived in extremely challenging environments.
- ▶ The Ancient North Siberians spread throughout northern and central Siberia. Remains of a child who lived at a site known as Mal'ta document their presence in south-central Siberia 24,000 years ago.
- ▶ There is essentially no archaeological record in northeastern Siberia between around 29,000 and 15,000 years ago

- ▶ Two main branches of the First Peoples' ancestry—the Ancient East Asians and the Ancient North Siberians—converged around 25,000 to 20,000 years ago and interbred, shortly after the start of the LGM. Their meeting occurred as part of a migration from Siberia in response to this environmental change, in eastern Eurasia or Beringia. They were initially isolated for several thousand years during the LGM; where this refugium was during the LGM is debated.
- ▶ The two ancestral population split into at least two branches between about 22,000 to 18,100 years ago. One branch, named the Ancient Beringians, has no known living descendants. The other, known as the Ancestral Native Americans, gave rise to First Peoples south of the Laurentide and Cordilleran ice sheets.

Ancestral Branches



encountered each other is unknown. Putative traces of humans at Bluefish Caves in the Yukon and Lake E5 and Burial Lake in Alaska hint that they might have met in eastern Siberia. Other possible meeting spots include central and northern Beringia and eastern Eurasia.

(C) The ancestral population that resulted from this merger went on to split into two branches between about 22,000 and 18,000 years ago. One of these branches, the Ancient Beringians, has no known living descendants. The sites of Upward Sun River and Trail

Ancestral Branches

- ▶ A. Ancient North Siberians contributed ancestry to First Peoples, among other populations. DNA from this group has been recovered from the Mal'ta and Yana Rhinoceros Horn sites.
- ▶ B. An isolated subgroup of East Asians contributed the majority of ancestry to the First Peoples.
 - ▶ Around 25,000 years ago these Ancient East Asians and the Ancient North Siberians converged. Exactly where they encountered each other is unknown.
 - ▶ Putative traces of humans at Bluefish Caves in the Yukon and Lake E5 and Burial Lake in Alaska hint that they might have met in eastern Siberia. Other possible meeting spots include central and northern Beringia and eastern Eurasia.
- ▶ C. The ancestral population that resulted from this merger went on to split into two branches between 22 Ka and 18 Ka ago. One of these branches, the Ancient Beringians, has no known living descendants. The sites of Upward Sun River and Trail Creek Cave may document their presence in Alaska.
- ▶ D. The other branch, known as the Ancestral Native Americans, gave rise to the First Peoples south of the Laurentide (Canada & eastern US) and Cordilleran (Western Canada & US) ice sheets.

Native Americans

- ▶ This branch of Ancestral Native Americans was probably itself subdivided into multiple distinctive groups during the LGM.
- ▶ After the LGM, Ancestral Native Americans moved southward and split into at least three branches. The first branch to diverge is represented by a single genome from a woman who lived on the Fraser Plateau in British Columbia about 5,600 years ago.
- ▶ The other two branches encompass all the currently known genetic diversity of populations south of the ice sheets. The Northern Native Americans branch includes the ancestors of Algonquian, Na-Dené, Salishan and Tsimshian peoples.

Native Americans

- ▶ The **Southern Native Americans branch** includes the ancestors of Indigenous peoples distributed broadly throughout South America, Central America and much of North America.
- ▶ **Experts disagree** over when, where and how these populations dispersed into the continents. To date, there are **three major competing scenarios** for this process.
- ▶ Scenario 1 - The most conservative archaeologists stand by what is essentially an **updated version of the Clovis First model**. **Swan Point site in central Alaska is the key** to understanding the peopling of the Americas. Dated to about **14,100 years ago**, it is the **oldest uncontroversial site in eastern Beringia**, and its **stone tool technology** is said to show **clear links to the Diuktai culture in Siberia**, as well as Clovis tools.

- ▶ **Scenario 1: A Late Peopling:**
- ▶ Some archaeologists maintain that the people who made distinctive spearheads initially found in Clovis, N.M., and later discovered at sites such as Anzick in Montana were the first humans to establish themselves successfully in the Americas.
- ▶ The **Swan Point site in Alaska** figures importantly in their argument because it contains stone tools that appear to link the older Diuktai culture in Siberia to the Clovis culture in North America. Proponents of this so-called **Clovis First model** hold that people entered the Americas well after the **Last Glacial Maximum**, traveling down the ice-free corridor that formed as glaciers retreated.
- ▶ These researchers **reject pre-Clovis sites** as invalid or unrelated to contemporary First Peoples.



Native Americans - Dispersals

- ▶ **Claim NA ancestors did not migrate across the Bering Land Bridge into Alaska until between 16,000 and 14,000 years ago.** They maintain that **Clovis** represents the first successful establishment of humans in the **Americas**, with people traveling down the so-called ice-free corridor that formed as glaciers retreated,
- ▶ **Under this model, sites predating Clovis are either rejected as invalid** or attributed to people who did not contribute culturally or biologically to subsequent Indigenous populations.
- ▶ **Scenario 2: Other archaeologists emphasize the importance of pre-Clovis evidence**, including remains found half a world away from central Alaska at the Page-Ladson site in **northern Florida** - 14,450-year-old mastodon bones and broken knife.

Native Americans - Dispersals

- ▶ On balance, the evidence suggests that the first humans to enter the Americas did not take the ice-free corridor in.
- ▶ The most likely alternative route is via boat along the western coast, which would have become accessible about 17,000 to 16,000 years ago. A coastal route also fits genetic evidence for the Southern Native American expansion better.
- ▶ The best-supported models for population history currently show that the Southern Native American group diversified rapidly into regional populations throughout North, South and Central America between about 17,000 and 13,000 years ago. Travel by water along the coast would better explain the speed and timing of these population splits than the slower overland route would.

Native Americans - Dispersals

- ▶ One variant of this early coastal peopling scenario allows that humans may have been present in the Americas during or even slightly before the LGM, perhaps as early as 20,000 to 30,000 years ago. Putative evidence of pre-LGM occupation comes from several sites in Mexico and South America, including Pedra Furada in northeastern Brazil. But most of the archaeological community remains skeptical about these sites
- ▶ Scenario 3: The third major scenario is radically different. A small group of scholars believes that people reached this part of the world at an extremely early date. This claim rests in large part on 130,000-year-old mastodon remains excavated from the Cerutti Mastodon site in California. Damage patterns on the bones were interpreted as the result of butchering. Stones found at the site were interpreted to be manufactured tools. First people to arrive were probably *Homo erectus*. Most reject this scenario. Unsupported by genetics.

- ▶ **Scenario 2: An Early Coastal Peopling**
- ▶ Other archaeologists place **great importance on pre-Clovis sites**, arguing that they document **human presence throughout the Americas well before Clovis technology appeared** and before the ice-free corridor opened up.
- ▶ These scholars contend that **people probably instead traveled by boat along the western coast starting around 17,000 years ago or possibly as early as 20,000 to 30,000 years ago**, if the controversial claims for evidence of such ancient human activity at **Pedra Furada and Chiquihuite Cave** are to be believed.



- ▶ Scenario 3: **An Extremely Early Peopling**
- ▶ A **small number of researchers** believe that humans reached **the Americas far earlier**. They point to the **Cerutti Mastodon site**, which is said to preserve **butchered mastodon bones and stone tools from 130,000 years ago**. If these remains really are the result of such ancient human activity, they would indicate that the first people to arrive in this part of the world were **probably *Homo erectus* rather than *Homo sapiens***. Most scholars reject this claim.



Americas

- ▶ As things stand in 2021, most archaeologists and geneticists agree that humans were established in the Americas by at least 14,000 to 15,000 years ago, but they disagree on exactly which pre-Clovis sites are legitimate and therefore how early people may have entered the continents
- ▶ There are perhaps several dozen publicly available complete genomes from contemporary and ancient Indigenous peoples. These genomes are unevenly distributed; most are from Central and South America and the northern parts of North America. There are few complete genomes from the present-day U.S., the result of Indigenous peoples' justified distrust in researchers
- ▶ Investigators are also looking beyond human genomes to DNA from alternative sources such as the bacteria and viruses that are associated with people
- ▶ Our models are provisional, subject to revision in light of changing evidence.

The Americas

- ▶ **Oldest known American skeletal remains, 11-8 Ka:**
 - ▶ North American skulls resemble S Asian, Ainu people of S Japan, or Polynesians;
 - ▶ South American remains, more like Australian or Sub-Saharan African;
 - ▶ Indicative of complex migration pattern from NE Asia
- ▶ **Kennewick Man from WA state, 1998:**
 - ▶ ownership controversy;
 - ▶ Dna proved it was Native American (mtDNA haplogroup X2a and the Y DNA haplogroup Q-M3)

The Americas

- ▶ Both genes and physical characteristics imply that **historic Native Americans derive overwhelmingly from northeast Asians**, who share same mtDNA and Y Dna chromosomes haplotypes
- ▶ Striking similar in **derived “Mongoloid” form of skulls**, featuring broad, short braincases; broad, flat faces with high, frontally directed cheekbones; narrow noses
- ▶ **High frequency of “Sinodonty” dental traits**; shovel shaped crown in upper incisors; upper 3rd molars unusually small; lower first molars with extra third root, and 5 cusped lower 2nd molars; very different from SE Asian and Polynesian dental pattern

Settlement of the America

- ▶ Indigenous peoples of the Americas have been linked to Siberian populations by linguistic factors, the distribution of blood types, and genetic DNA
- ▶ The source populations for the migration into the Americas originated from an area somewhere east of the Yenisei River (Russian Far East).
- ▶ The common occurrence of the mtDNA Haplogroups A, B, C, and D among eastern Asian and Native American populations has long been recognized, along with the presence of haplogroup X.

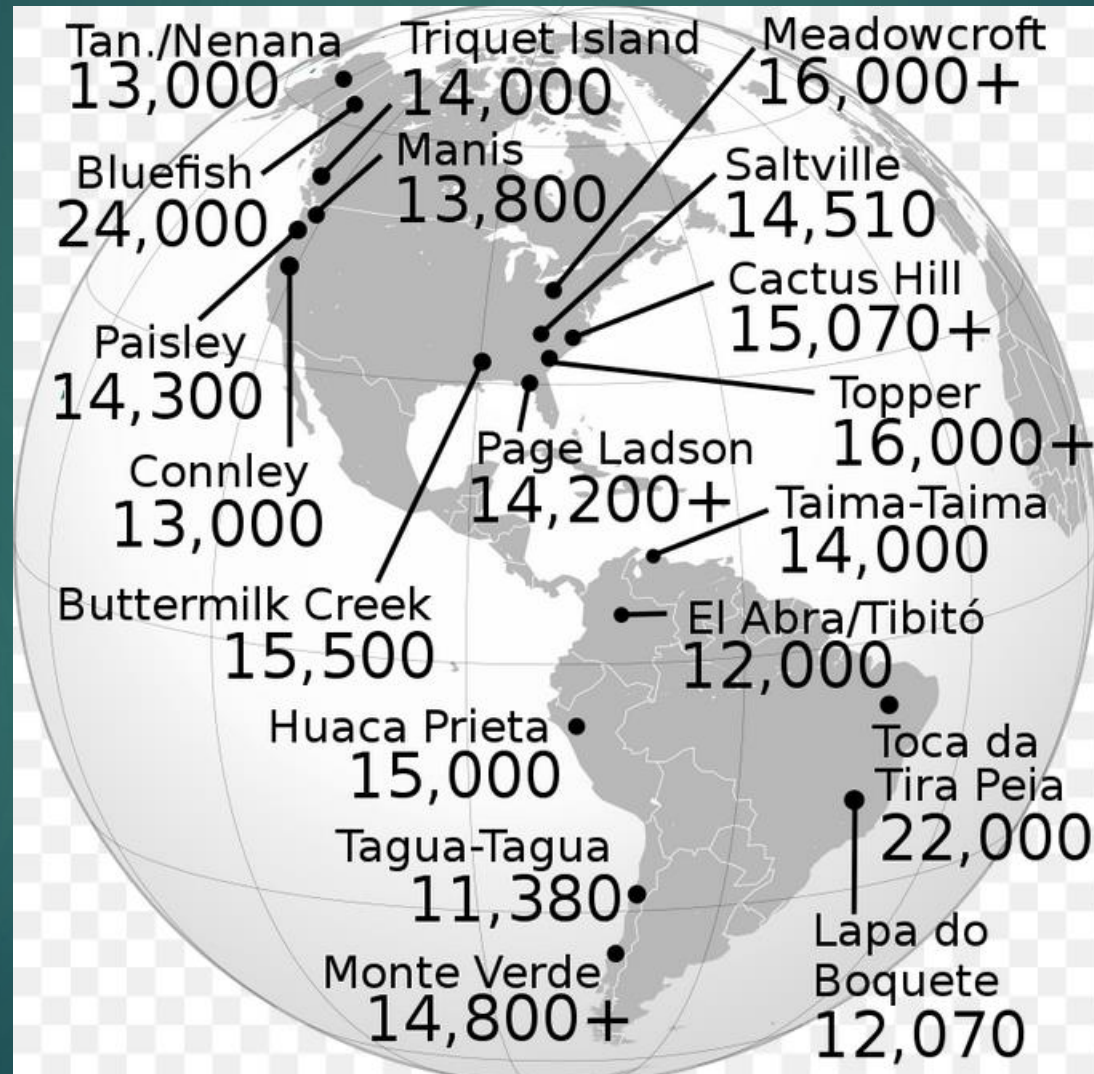
Settlement of the America

- ▶ As a whole, the **greatest frequency of the four Native American associated haplogroups** occurs in **the Altai-Baikal region of southern Siberia**. Some subclades of C and D closer to the Native American subclades occur among Mongolian, Amur, Japanese, Korean, and Ainu populations
- ▶ **Significant migrations are the bane of genetic studies**. May explain above. Populations living today in an area may not be original group there; not descendants of original colonists. Or multiple migrations with only the last leaving genetic mark.
- ▶ Issue of genetic studies and Native American belief in their origin stories.

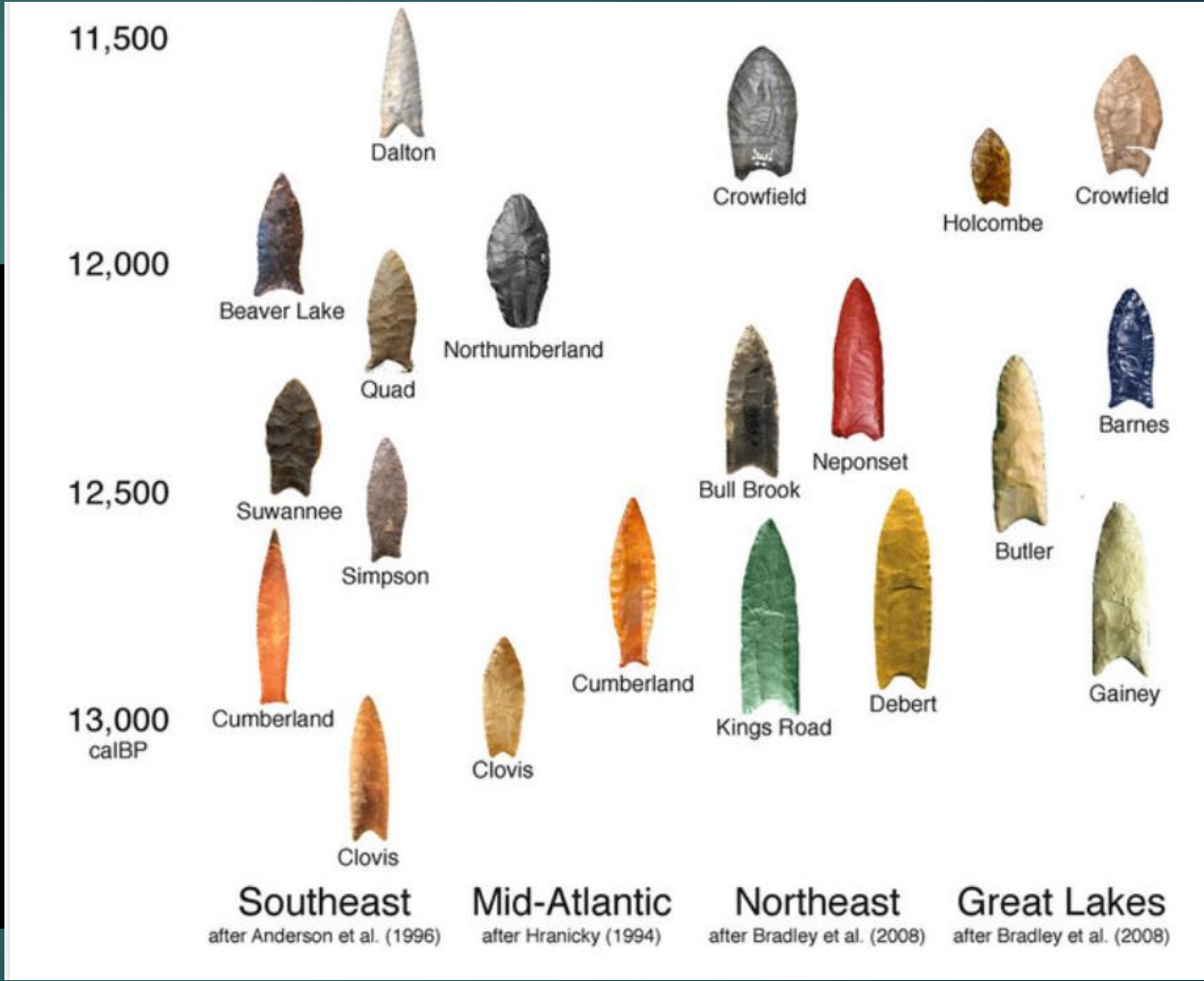
Settlement of the America

- ▶ **Routes to America:** internal land and coastal routes
- ▶ A **dog bone from Wrangel, Alaska is dated to 10 Ka**, making its owner the oldest dog known in the Americas, Its genome related to oldest 23 Ka Siberian dogs; That's a clue that dogs—and their humans—left Siberia and entered the Americas thousands of years before North America's glaciers melted.

Map of the **earliest securely dated sites** showing human presence in the Americas, 16–13 ka for North America and 15–11 ka for South America



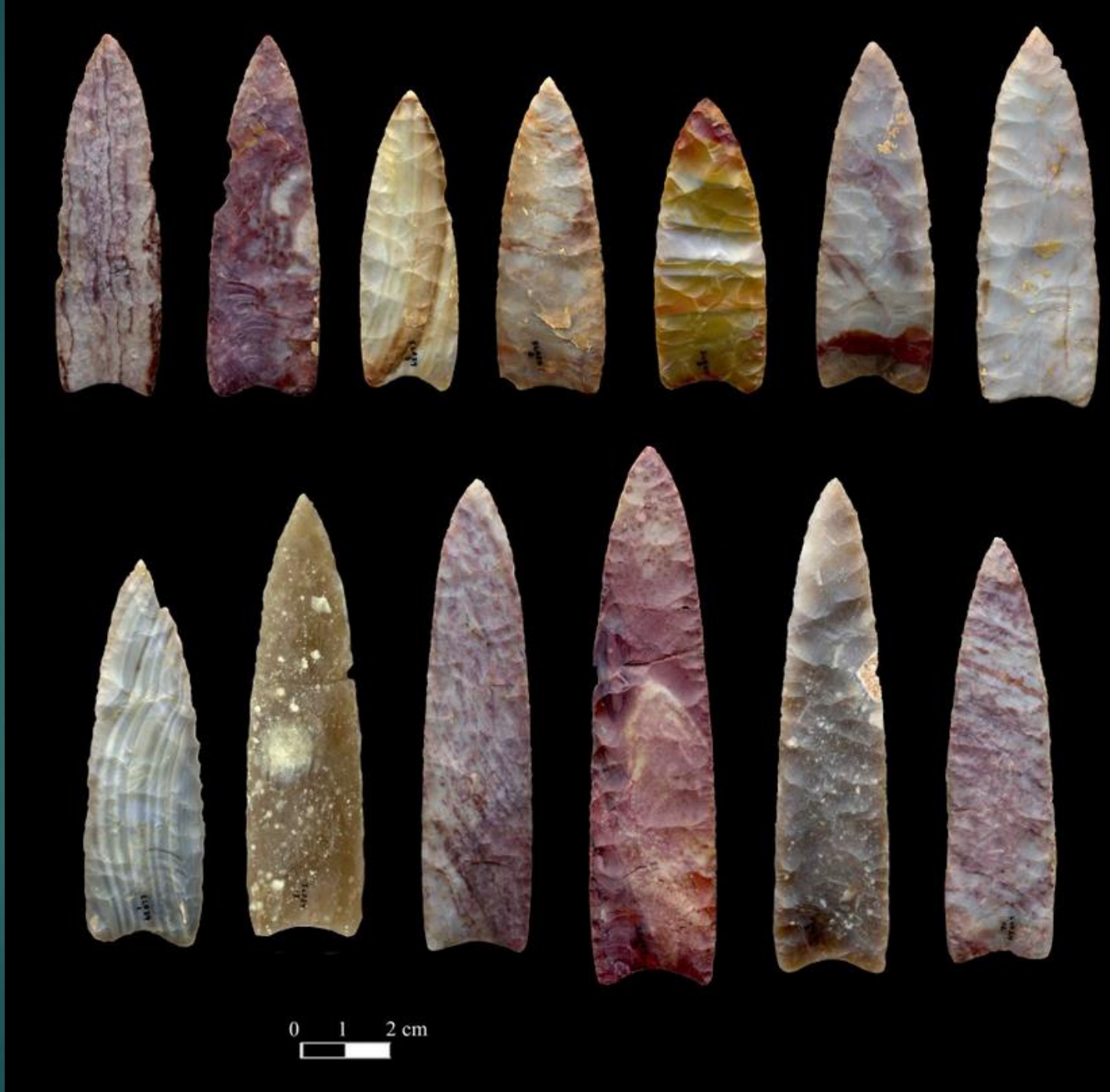
Clovis points: first American invention?



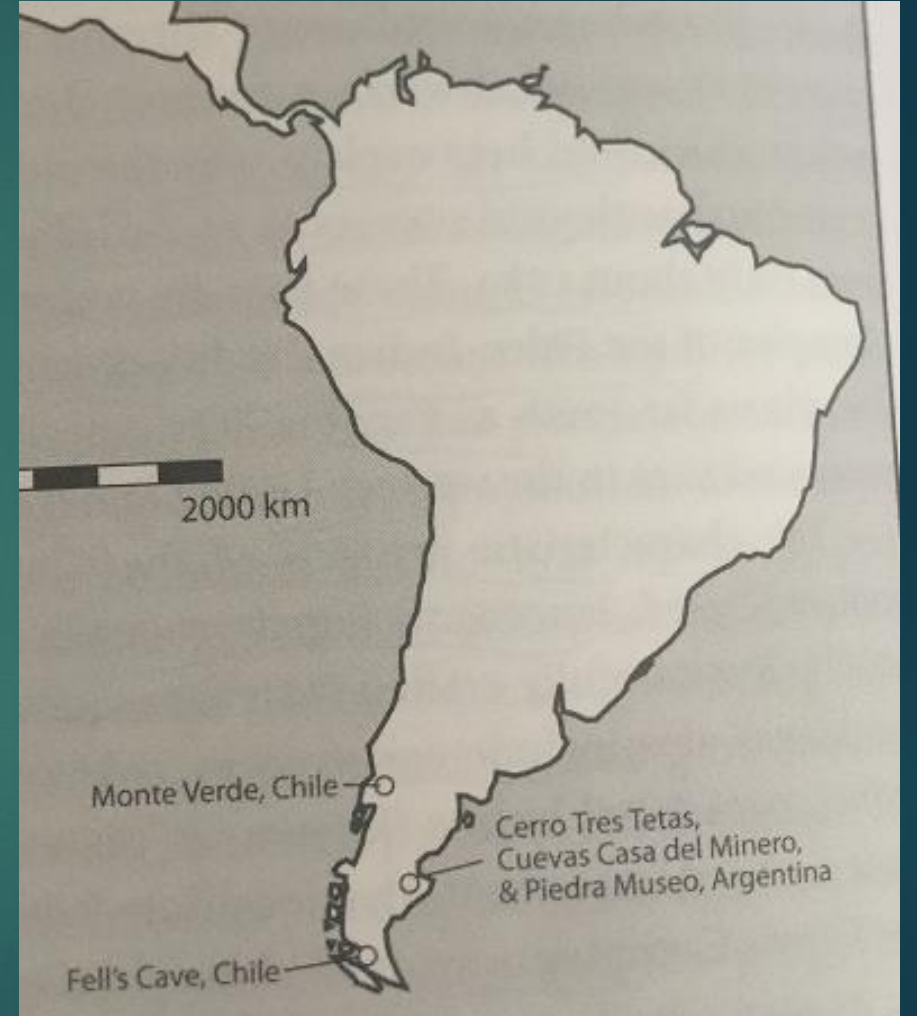
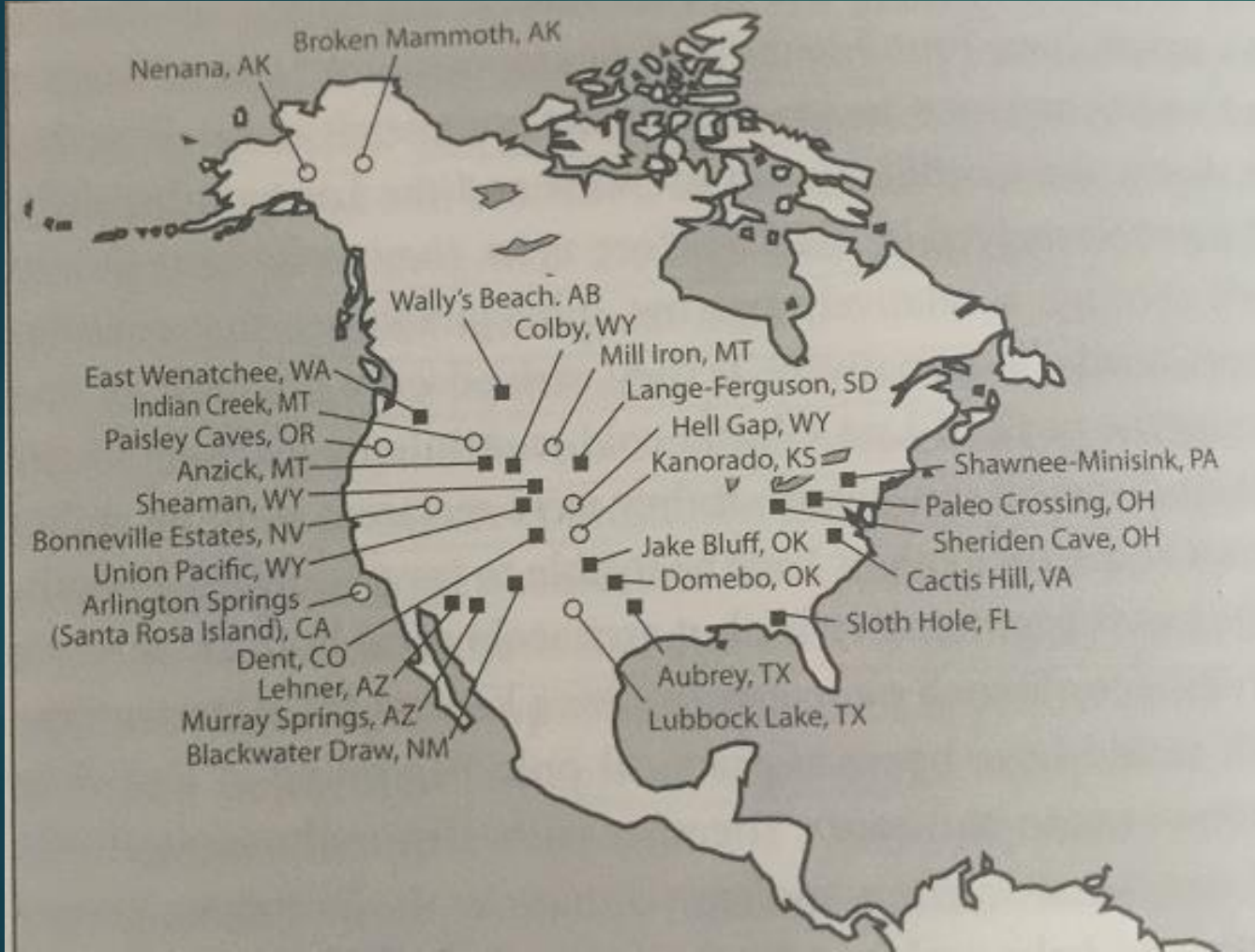
Clovis
points:

13,300 to
12,800
years ago

Mammoth
&
Mastodon
hunters



AMHs: Clovis Culture locations



Clovis Culture onward

- ▶ The "Clovis first theory" refers to the 1950s hypothesis that the Clovis culture represents the earliest human presence in the Americas, beginning about 13,000 years ago
- ▶ Evidence of pre-Clovis cultures has accumulated since 2000, pushing back the possible date of the first peopling of the Americas to 33,000 years ago
- ▶ Characteristic artifacts of Clovis Complex were bifacial, concave-based, lanceolate, fluted projectile points

Clovis culture

- ▶ Clovis people did not migrate to South America; but other groups reached its tip by 11 Ka
- ▶ North American Megafauna Extinction:
 - ▶ Ecological shock of human arrival (combined with climate change to present interglacial) may explain why North America lost 35 large mammal genera (mammoth, horses, camels);
 - ▶ More than 70% of its total between 12 and 10 Ka;
 - ▶ More in South America

Folsom points:

smaller;
no more
Mammoth

75 species
disappeared

Human vs
climate change
theories



Pre-Clovis Claims

- ▶ **Serious pre-Clovis contenders** south of ice sheet are mostly in South America
 - ▶ Los Toldos Cave in Argentine Patagonia at 12.6 Ka
 - ▶ Tagua-Tagua in central Chile, 11.4 Ka
 - ▶ Monte Verde, Chile, 12.5 Ka
 - ▶ Taima-Taima, Venezuela, 13 Ka
 - ▶ Pedra Furada, Brazil, over 20 Ka

- ▶ Mostly based on **stone tool datings**.

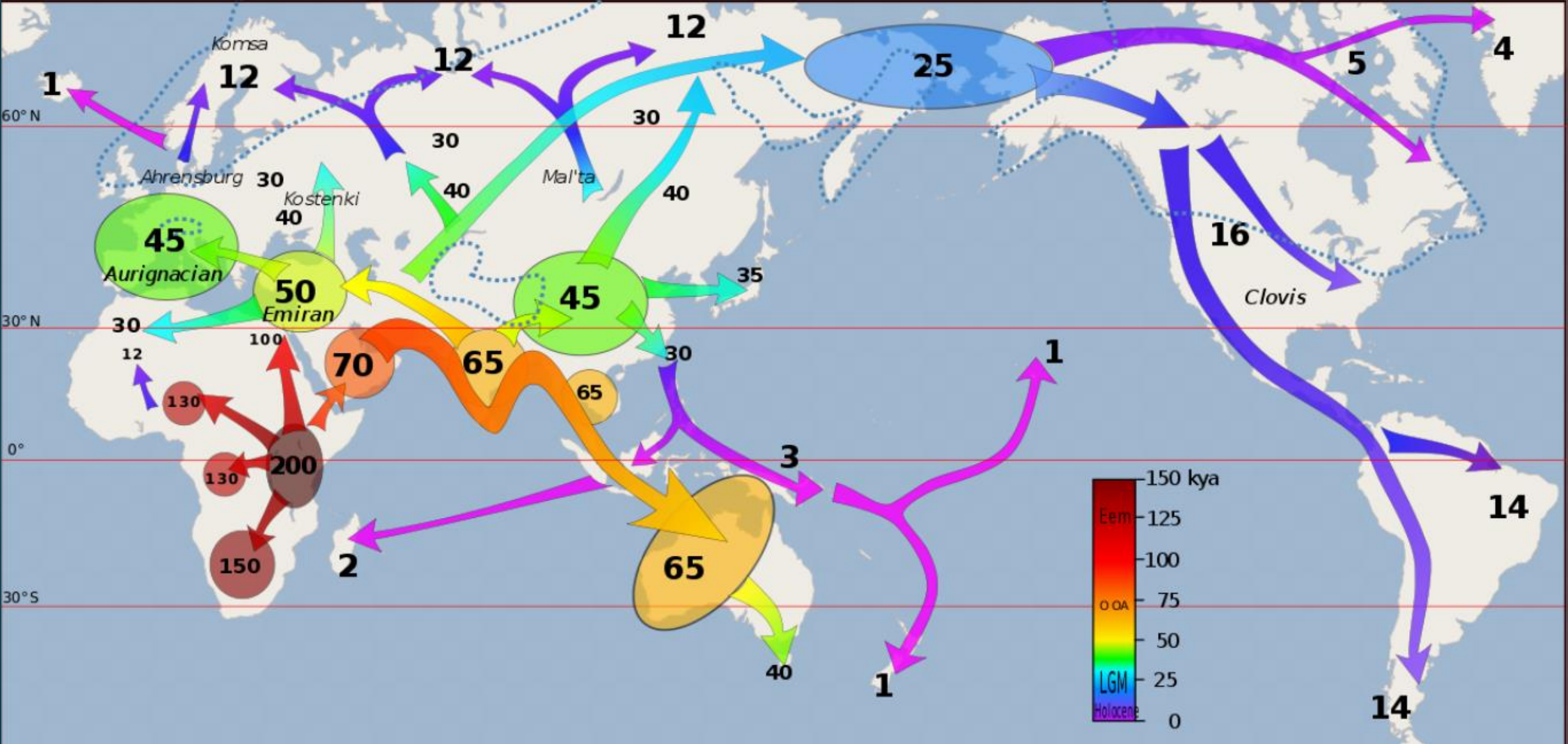
Pre-Clovis Claims

- ▶ Meadowcroft cave shelter near Pittsburgh, PA dated to 19.6 Ka
- ▶ By Christopher Columbus's arrival, 1000 Native American languages
- ▶ Derived from 3 basic proto languages:
 - ▶ Amerind, most widespread;
 - ▶ Smaller Na-Dene, and Aleut-Eskimo languages.
 - ▶ Three separate migrations?

AMHs: R. Klein's Conclusions

- ▶ Fossil and archeological records suggest that **MH anatomical form evolved before modern capacity for culture.**
- ▶ **Earliest AMH were not significantly different from their nonmodern predecessors; explains why they did not leave Africa.**
- ▶ **Klein's theory: Only between 60 and 40 Ka did they develop fully modern capacity for culture and begin final spread to Eurasia.**
- ▶ **This last conclusion is highly debated.**

Modern human migration out of Africa showing approximate dates



First Villages: Neolithic revolution

- ▶ 12 Ka is usual date for beginning of agricultural or Neolithic revolution
- ▶ Prior to this, hunting and gathering
- ▶ Then plant and animal domestication; first in “Fertile Crescent” at 10 Ka, Meso America at 9 Ka, and in China at 7 Ka
- ▶ **Population rise** as consequence from 10 M at onset to 100 M by 4 Ka
- ▶ **Current theory** is that hunter-gathers established sedentary communities prior to onset of agriculture, in a more gradual process

First Villages: Neolithic revolution

- ▶ Settled communities based on hunting and gathering gave way to mix of the latter plus some domestication and then to fuller agriculture, i.e. hunt gazelle, then domesticate sheep and goats, then plant agriculture
- ▶ Large theoretical influence of !Kung San study of 1960s of hunting as primary method of life, “Man the Hunter” model.
- ▶ Later 1980s evidence of more variability in hunting-gathering societies. Many characteristics associated with farmers – sedentism, elaborate burials, social inequality, occupational specialization, long-distance exchange, tech innovation, warfare – are all found among foraging groups.

First Villages

- ▶ **Neolithic period** involved increasing sedentism (practice of living in one place for a long time), social complexity, gradual adoption of plant and animal domestication.
- ▶ But **in some cases, plant domestication preceded sedentism**, esp. in New World; i.e. gourds grown in Mexico at 9 Ka, preceding settlement by 1000 years.
- ▶ **In Europe**, population migration was important to the spread of agriculture (**demic expansion model**); later challenged, with the idea of agriculture spreading more than populations migrating.

Causes of transition

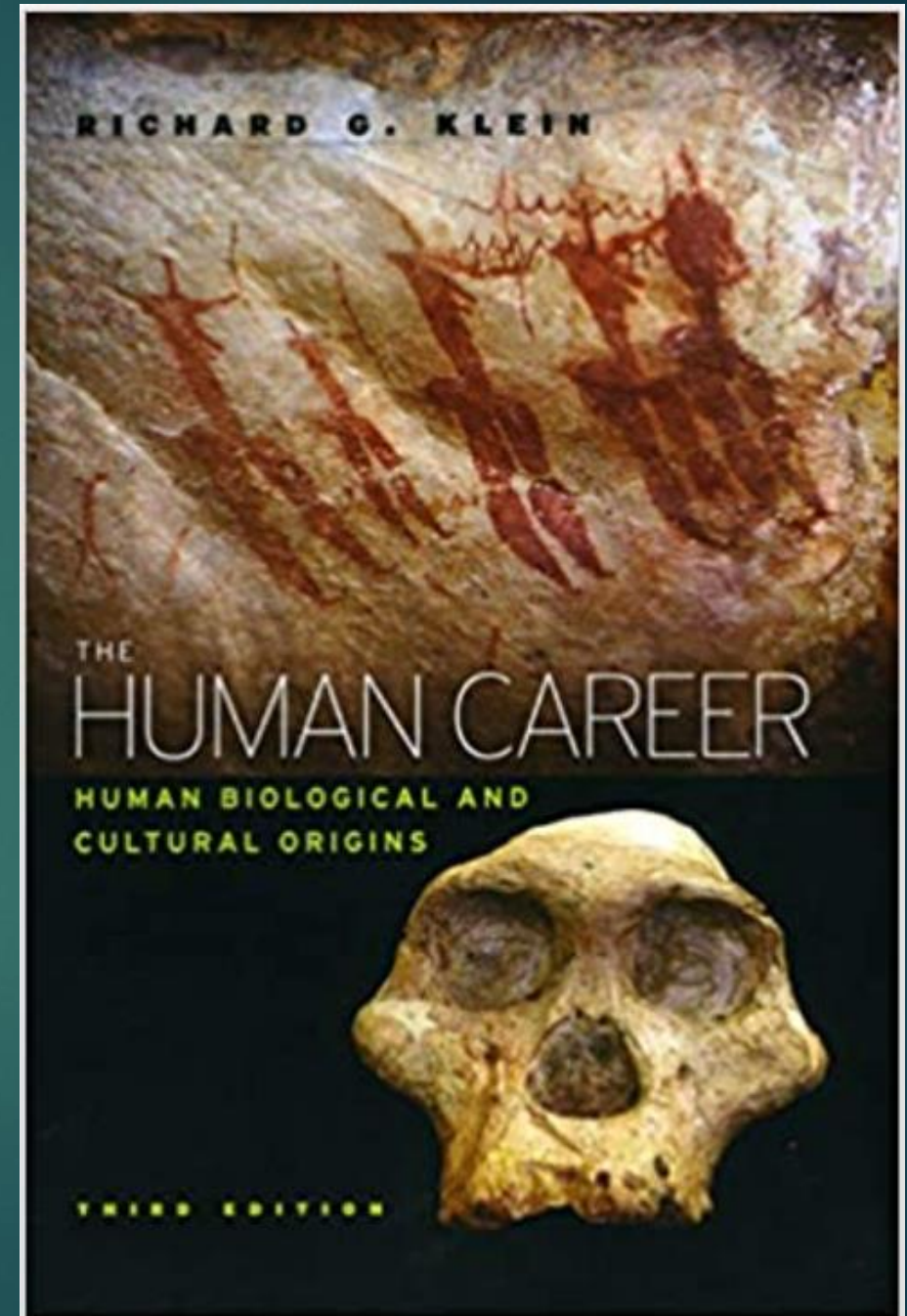
- ▶ Transition to food production in period of few thousand years. Raised question of global causation. Two factors: population pressure and climate change (end of glaciation)
- ▶ Other theory is that social complexity was triggered by sedentary agriculturalism.
- ▶ Physiological changes: with agriculture, people got smaller and there is less sexual dimorphism
- ▶ Agriculture changed humanity.

Impact of MHs

- ▶ From small, isolated groups, living at low population densities, to larger social units: lead to cohesion via languages, religions, cultural variables. Development of significant social hierarchies and greater inequalities.
- ▶ Spread of agriculture lead to major dispersals. Along with spread of Indo-European languages, and pathogens. Forest clearance, etc.
- ▶ Same anatomy continued, but culture accelerated dramatically. It was culture that drove human species into becoming a geological force that threatens the earth itself and the potential extinction of multiple species.
- ▶ Unfortunately, habitat, species, and planet destruction is our ongoing heritage, unless we begin to take it seriously.

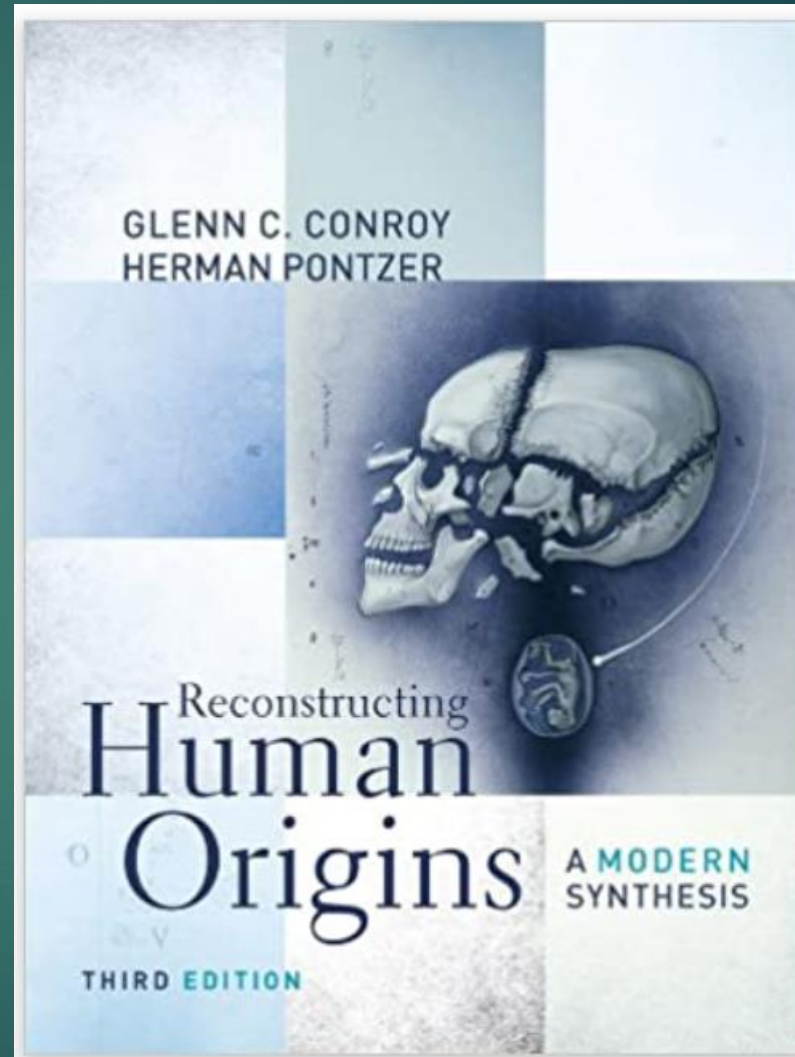
Human Career, Richard Klein: The definitive textbook (1024 pp) on human evolution as of 2009

- A note of thanks:
- I have used this textbook as my guide for my human evolution lectures



Reconstructing Human Origins, 3rd ed, 2013: Glenn Conroy & H. Pontzer

- My second guide
- Highly recommended by Bernard Wood
- Only 672 pp.



Homo Sapiens Part III & IV

- ▶ + Behavioral Modernity Debate
- ▶ Fossil data from Africa
- ▶ + Jebel Irhoud
- ▶ Out of Africa vs Multiregionalism
- ▶ + African Multiregionalism Controversy
- ▶ MH Migrations
- ▶ MH Entry into Europe
- ▶ + African Refugia
- ▶ Asia
- ▶ Brain evolution
- ▶ Life History Variables
- ▶ Language
- ▶ Climate
- ▶ Tools

Emergence of MHs



March of Progress graphic

- ▶ 2 fundamental errors:
- ▶ Implies we know path from early apes to MHs: we do not
- ▶ It implies teleology, direction, evolutionary “progress”, destiny
- ▶ Evolution functions without any of those. It has no direction

- ▶ Evolution is a tinkerer based on available variation:
- ▶ 'Do what you can, with what you have, where you are' – Teddy Roosevelt (and evolution's process)

Our extinction (sorry, no author citation)

- ▶ “Once we have clarified where we come from and where we are, it is clear that it is not very important to know where we are going either. Millions of species have gone extinct in the past, and we will not be the first or the last to do so.
- ▶ Eternal species simply do not exist. So we can be calm: sooner or later, we will have to leave the turn to whoever remains.
- ▶ Waiting for the end, we can ask ourselves how to occupy the time that we have left and how we can take advantage of our transitory presence.
- ▶ But also in this case, if we want to shed light with the flashlight of evolution, we will have to do it according to its canons and guidelines.
- ▶ For example, remembering that the only true value of natural selection is not strength, beauty, cunning, or sympathy, but carnal and gross reproductive success.
- ▶ Whoever makes more children will increase their representatives in the genetic parliament of the following generations.

Our extinction

- ▶ As simple as that.
- ▶ For there to be evolution, someone has to have a reproductive advantage so obvious that it displaces, genealogically, everyone else, in the short or long term. This is something that, in nature, can occur relatively easily in small populations (more sensitive to the transmission of an advantageous genetic combination), when there are sudden colonization's of distant territories by a few brave (founder effect) or when a few survive some colossal disaster (bottleneck effect).
- ▶ The probability that an evolutionary change will spread is much higher when there are small groups.
- ▶ Our vast and globalized species currently suffers from a powerful genetic inertia that dilutes any attempt at evolutionary variation.
- ▶ The possibility of some kind of biological evolution will only take place if something very serious suddenly resizes the world population terribly, leaving few representatives, perhaps carriers of some advantage that has guaranteed their survival. “

Debate over Human Modernity: 300 Ka to 50 Ka

- ▶ **African Stone Ages** (overlaps European LP, MP, UP):
 - ▶ Lomekwi = 3.3 Ma
 - ▶ ESA = 3 Ma to 300 Ka, Oldowan/Acheulean toolkits, *H. erectus*
 - ▶ **MSA = 280 to 50 Ka, early *H. sapiens* +**
 - ▶ LSA = 50 to 12 Ka, *H. sapiens*
- ▶ Darwin in *Descent of Man* identifies 3 unique human traits:
 - ▶ tools,
 - ▶ fire use,
 - ▶ language

The MH Behavioral/Cultural Explosion: 100-35 Ka

- ▶ *Homo sapiens* had large brains but did not show significant creativity or intelligence for first 100,000 years.
- ▶ Only between 100,000-35,000 years ago did the following appear:
 - Advanced culture.
 - Sophisticated tools.
 - Long-distance transport.
 - Social networks.
 - Large dwellings.
 - Tailored clothing.
 - Rituals.
 - Art.

Traits of Modern Human Behavior = European

- ▶ Archaeologists have been nearly universally agreed that the Upper Palaeolithic of southwestern France was the archaeological yardstick for theory of “Behavioral Modernity”
- ▶ Theory:
 - ▶ Neanderthals made the Middle Palaeolithic Mousterian artifacts and
 - ▶ *H. sapiens* made the Upper Palaeolithic “symbolic” artifacts.
- ▶ “Modern behavior” trait list was not really suitable for tropical Africa; unclear which African species to attribute the MSA toolkits
- ▶ “Modern behavior” has always been a very particular version of how we like to think of ourselves. But we have judged Neandertals by it; implying they were inferior.
- ▶ It intimates the old progressive concept of evolution, the march of progress.

Behavioral modernity: The trait list model

- ▶ Use of symbolism and planning capabilities
- ▶ Nonfunctional material culture, i.e. shell beads, pigments/ocher
- ▶ Development of newer styles of stone tools: standardization in artifact types, blade technology, worked bone and other organic materials,
- ▶ Personal ornaments and art or images,
- ▶ Structured living spaces,
- ▶ Ritual,
- ▶ Economic intensification, enlarged geographic ranges and expanded exchange networks
- ▶ This **trait list approach** to identify the origins of modern behavior has been **criticized** because the archaeological record of only one region, the **Upper Paleolithic of Europe**, is used as a standard to infer modern behavior for all other time periods and areas.

Paul Mellars, 1991: Archeological evidence of modern behavior

- ▶ Archeological features of transition from MP Ns to UP MHs in Europe:
 - ▶ Stone tools: flakes to blades, more standardization
 - ▶ Increase in the variety and complexity of tools
 - ▶ Tools made of bone, antler and ivory
 - ▶ Increase in regional variety of tools
 - ▶ Appearance of beads, pendants, & other ornaments
 - ▶ Naturalistic art, especially representational art
 - ▶ Changes in economic and social organization
 - ▶ Hunting of particular animals
 - ▶ Increase in population size
 - ▶ Structured settlements with huts, tents

N Demise: Superiority of MHS caused N demise

- ▶ In my Neandertal talks, reviewed P. Villa and W. Roebroeks critique of explaining N demise via “MH Superiority Complex theory”:
- ▶ Virtually all explanations for the disappearance of the Neandertals from the Eurasian record point in one way or another to the arrival of *Homo sapiens*, anatomically modern humans (AMH), in Europe and western Asia
- ▶ The disappearance of the Neandertals is routinely explained
 - ▶ in terms of the “superiority” of modern humans,
 - ▶ who had developed, in Africa, complex cultural traditions
 - ▶ due to superior cognitive capacities which allowed them to expand globally and replace all other hominins

Nine MH Superiority Complex hypotheses

- ▶ 1. Ns did not have “complex symbolic communication systems” and “fully syntactic language”, while AMH did.
- ▶ 2 Neandertals had limited capacity for innovations.
- ▶ 3. Neandertals were less efficient hunters.
- ▶ 4. Neandertal weaponry was inferior to AMH projectile technology.
- ▶ 5. Neandertals had a narrow diet, unsuccessful in competition with AMH with their more diverse diets.

MH Superiority Complex hypotheses

- ▶ 6. Ns **did not use traps and snares** to capture animals
- ▶ 7. Ns had **smaller social networks**.
- ▶ 8. Ns had **smaller regional populations** when AMH entered Neandertal territory
- ▶ 9. Hafting by AMH required complex procedures indicative of modern cognition, while **Neandertals hafting was a simple procedure using naturally available glues**.

Modern Human Superiority?: N had symbolic ability

- ▶ P. Villa and W. Roebroeks believe that none of their 9 hypothesis regarding MH superiority are supported by adequate archaeological data.
- ▶ There was no significant differences between the African MSA data used to support MH superior cognition and the later Middle Paleolithic record of N behavior.
- ▶ **Finlayson:** entire “modern behavior” package was found in Ns
- ▶ Neandertals were clearly the equivalent of Homo sapiens at the time of their disappearance.

Replacement causation: Behavioral Modernity

- ▶ The ultimate mechanism for MH replacement of other hominins is widely considered to be a behavioral difference between nonmodern and modern populations that lent an adaptive advantage to moderns.
- ▶ Currently the disagreement is over the origin, age, and spread of modern human behavior
- ▶ Evidence for what constitutes Behavioral Modernity has been the goal.

Replacement causation: Behavioral Modernity

- ▶ The collective idea appears to be that we can develop a litmus test for modern human behavior grounded in material correlates of specific behaviors considered to be unique to or indicative of a modern human intellect.
- ▶ Timing of MH development: Many discussions portray these behavioral traits as arriving as a package, while others have argued that there could have been incremental addition over time

Origin of Modern Human Behavior -- C. Henshilwood & C. Marean, 2003

- ▶ Burial of the dead with rituals
- ▶ Art, ornamentation, and decoration
- ▶ Symbolic use of ochre
- ▶ Worked bone and antler
- ▶ Blade technology
- ▶ Standardization of artifact types
- ▶ Artifact diversity

Origin of Modern Human Behavior -- C. Henshilwood & C. Marean, 2003

- ▶ Complex hearth construction
- ▶ Organized use of domestic space
- ▶ Expanded exchange networks
- ▶ Effective large-mammal exploitation
- ▶ Seasonally focused mobility strategies
- ▶ Use of harsh environments
- ▶ Fishing and fowling

2003: Traits used to identify Modern Human Behavior

Applied to Africa:

- ▶ Burial of the dead as an indicator of ritual; grave goods
- ▶ Art, ornamentation, and decoration; representational art; figurative art (cave paintings, petroglyphs, dendroglyphs, figurines); jewelry; shells routinely drilled and strung as necklaces; utilitarian objects that are incised and decorated
- ▶ Symbolic use of pigment (such as ochre) and jewelry for decoration or self-ornamentation
- ▶ Worked bone and antler
- ▶ Blade technology
- ▶ Standardization of artifact types
- ▶ Artifact diversity
- ▶ Musical instruments

2021: CJV compilation of 7 found lists in the literature: 26 Traits Used to Identify Modern Human Behavior

- “Symbolic” ability
- Planning capacities; expanded memory
- Inventiveness and capacity for innovation
- Complex linguistic abilities
- Figurative art (cave paintings, petroglyphs, dendroglyphs, figurines); Jewelry for decoration or self-ornamentation
- Systematic use of pigments (ochre, etc.)

2021: CJV compilation of 7 found lists in the literature: Traits Used to Identify Modern Human Behavior

- ▶ Larger population sizes – faster transmission of culture
- ▶ Larger scale social networks as shown by large transport distances of raw materials
- ▶ Transport of resources over long distances; Expanded exchange networks
- ▶ Ubiquitous burial of the dead; with rituals; Postmortem modification common
- ▶ Sites made or modified for ritual activities
- ▶ Fishing and fowling
- ▶ Use of fishhooks, barbed weapons and harpoons; netting, snares

2021: CJV compilation of 7 found lists in the literature: Traits Used to Identify Modern Human Behavior

- Using bone and ivory material for tools
- Thin blade technology
- Diversity, standardization, and regionally distinct artifacts
- Composite tools; hafting technology
- Projectile technology: Spearthrower (lightweight spears), bow and arrow
- Heat treatment of lithic raw materials;
- More efficient hunting strategies
- Exploitation of a broader range of resources (plants and marine)

2021: CJV compilation of 7 found lists in the literature: Traits Used to Identify Modern Human Behavior

- ▶ Organized use of domestic space
- ▶ Complex hearth construction (stone circles, ventilation methods)
- ▶ Seasonally focused mobility strategies; Klg of seasonal food resources
- ▶ Environmental flexibility; Expansion into new eco-niches; Use of harsh environments (deserts, high & cold altitudes)
- ▶ Effective large-mammal exploitation

Origin of Modern Human Behavior: Critiques of trait lists for behavioral modernity

- ▶ Christopher S. Henshilwood (2003): Trait lists:
 - ▶ (1) Many are empirically derived from and context-specific to the richer European record, rendering them problematic for use in the primarily tropical and subtropical African continent.
 - ▶ (2) They are ambiguous because other processes can be invoked, often with greater parsimony, to explain their character.
 - ▶ (3) Many lack theoretical justification.
 - ▶ In addition, there are severe taphonomic problems in the application of these test implications across differing spans of time
- ▶ Neandertal Paradox: If Ns were cognitively inferior, how did they survive in harsh climates of Eurasia for 300 K and why did it take MHs so long to colonize Eurasia, when they had colonized the East by 80 to 65 Ka?. Finlayson believes in Fortress Europe: Ns kept them out

Origin of Modern Human Behavior: Trait critique

- ▶ **Trait-list approach** to identifying modern human behavior in the archaeological record is **inherently flawed**.
- ▶ Many of the traits can be explained as the result of other processes that **have nothing to do with behavioral modernity**, such as climatic variation and resource and labor intensification
- ▶ **Eurocentrically derived approach**: Most of the traits involved are drawn from the long recognized patterning in the **western European archaeological record**; a trait list based, for purely historical reasons, on the European Upper Paleolithic; it detracts from their applicability elsewhere, particularly to widely varying African environments
- ▶ **Importance of ecological context**: modern hunter-gatherer technological complexity is known to decrease from arctic to tropical environments; In environments with prolonged cold seasons, hunter-gatherers must store food to make it through long periods of limited food availability; vs Africa - less severe shifts in wild food availability.

Origin of Modern Human Behavior: Other explanations for a trait

- ▶ **Population pressure** may explain a number of traits.
- ▶ **Bone tools**: more labor intensive; in Africa, appear only after 25 Ka; antler in Europe
- ▶ **Taphonomic sensitivity** – some objects do not preserve as well; virtually all of them involve the presence or absence of material remains that are subject to the taphonomic vagaries of time-sensitive differential preservation,
- ▶ **Seasonal mobility**: lacks justification because it falls within the behavioral abilities of other mammals with dramatically smaller brains; intellectual capacity to map temporal shifts in resource abundance

What is correct on Trait list

- ▶ Very broad agreement that social intelligence and symbolically organized behavior are modern human behaviors and therefore that the aspects of the trait list dealing with symbolic behavior may be on the right track. Chase and Dibble (1987) point out a fundamental thread shared by all modern societies despite their “cultural” differences: **behavior is mediated by symbolism.** Language is prerequisite.
- ▶ **Modern human behavior is defined here** as behavior that is mediated by socially constructed patterns of symbolic thinking, actions, and communication that allow for material and information exchange and cultural continuity between and across generations and contemporaneous communities.
- ▶ The key criterion for modern human behavior is not the capacity for symbolic thought but the **use of symbolism to organize behavior**

Behavioral modernity

- ▶ **Behavioral modernity** is a suite of behavioral and cognitive traits that is claimed to distinguish current *Homo sapiens* from other anatomically modern humans, hominins, and primates.
- ▶ Most scholars agree that **modern human behavior indicate cognitive capacity for:**
 - ▶ abstract thinking
 - ▶ planning ability
 - ▶ symbolic behavior (e.g., art, ornamentation),

J. Hawks: N vs MH modern behavior activity comparison

- ▶ ~100 Ka and after: N sites and MP activities are similar to MSA MH in Africa
- ▶ Similar **spatial organization in home sites**
- ▶ Similar **transport of material** (but African MHs longer distances, i.e. obsidian in Ethiopia)
- ▶ Use of **grains**: In Africa, 80 Ka, storage of grains; Ns were using grains 100 Ka
- ▶ Use of **shells**: MHs = Blombos, S Africa, 75 Ka & Qafzeh Cave in Israel, circa 92 Ka; and Skhul Cave; and Ns circa 100 Ka; Morocco, 300 Ka – all of these indicate an innovation that defused across Africa along multiple coastal areas
- ▶ **Pigments**: In Europe, Ns at 200 K and esp. at 50 Ka; in Africa, 80 Ka
- ▶ Some of these cultural developments persisted and some did not

Origin of Modern Human Behavior: Trait critique

- ▶ The **two features** that Henshilwood and Marean favor as telltale signs of modern behavior are
 - ▶ external symbolic storage (Examples of recognizable external symbolic storage include art work, personal ornamentation, lithic style, and the social use of space. Incised ochre at Blombos) and
 - ▶ the use of style to negotiate group identity (different styles of projectile points).
- ▶ McBrearty: Cognitive capacity for modern behavior was present in earliest *H. sapiens* but that it took a few hundred thousand years to put together the package that we now recognize as modern behavior. Technological complexity itself is an indicator of modern behavior because it **implies the presence of social learning** (knowledge that a society accumulates over its history, combined with an ability to adapt to novel situations if required).

Origin of Modern Human Behavior: Conclusions

- ▶ CJV: modern human behavior did not suddenly emerge at ca. 50,000 years ago and cannot be defined by the simple presence or absence of items on a Eurocentrically derived trait list.
- ▶ Seeking evidence of continuity from presymbolic to symbolic material behavior and focusing on behavioral systems that require substantial amounts of cognitive ability will produce a better understanding of what modern human behavior is and help to identify when and where it developed

John Shea: Critique of traits lists

- ▶ Shea (2011), in a 30 page article, outlines a variety of problems with the “behavioral modernity” concept, arguing instead for “behavioral variability”, which better describes the archaeological record.
- ▶ The use of trait lists runs the
 - ▶ risk of taphonomic bias, where some sites may yield more artifacts than others despite similar populations due to bone deterioration; as well,
 - ▶ trait lists can be ambiguous in how behaviors may be empirically recognized in the archaeological record.
- ▶ He cautions that population pressure, cultural change, or optimality models, like those in human behavioral ecology, might better predict changes in tool types or subsistence strategies than a change from “archaic” to “modern” behavior.

Critiques of trait lists for modernity

- ▶ Shea (2011):
- ▶ In the strictest sense, it could be argued that no Palaeolithic population is 'modern'.
- ▶ Modern human complexity far exceeds anything present in MP or UP. No current archaeological index of modernity in use in this debate would be adequate to encapsulate contemporary diversity.
- ▶ We should discuss **behavioral and cognitive complexity** when we compare the modern human and Neanderthal records, **not the nonsensical issue of modernity** which Neanderthals could possess.
- ▶ Trait list approach **excludes many contemporaneous and present-day modern human populations that lack the exact set of criteria on which these appraisals of modernity are based**

Homo sapiens Is as *Homo sapiens* Was --

John J. Shea, 2011

- ▶ Paleolithic archaeologists conceptualize the **uniqueness of *Homo sapiens*** in terms of “**behavioral modernity**,” a quality often conflated with **behavioral variability**.
- ▶ The **former** is qualitative, essentialist, and a historical artifact of the European origins of Paleolithic research.
- ▶ The **latter** is a quantitative, statistically variable property of all human behavior, not just that of Ice Age Europeans.
- ▶ As an analytical construct, **behavioral modernity is deeply flawed at all epistemological levels.**

Homo sapiens Is as *Homo sapiens* Was

- ▶ This paper outlines the shortcomings of behavioral modernity and instead proposes a research agenda focused on the strategic sources of human behavioral variability. Using data from later Middle Pleistocene archaeological sites in East Africa, this paper tests and falsifies the core assumption of the behavioral-modernity concept—the belief that there were significant differences in behavioral variability between the oldest *H. sapiens* and populations younger than 50 Ka
- ▶ It concludes that behavioral modernity and allied concepts have no further value to human origins research.
- ▶ Research focused on the strategic underpinnings of human behavioral variability will move Paleolithic archaeology closer to a more productive integration with other behavioral sciences.

Behavioral variability vs modernity

- ▶ Our species differs from our nearest primate relatives in our capacity for **behavioral variability**.
- ▶ Paleolithic archaeologists have developed a habit of conflating “behavioral variability” with “behavioral modernity” and “behavioral complexity.” Behavioral variability and behavioral modernity are very different concepts.
- ▶ Variability is a measurable quality of all human behavior expressed in modality, variance, skew, and other quantitative/statistical properties. These qualities change through time and space, and they do not necessarily follow a preferred direction. Trends are recognizable only in hindsight, ex post facto.

Behavioral variability vs modernity

- ▶ Behavioral modernity implicitly assumes there is a trend to behavioral change in *H. sapiens* evolution, one in which earlier “behaviorally archaic” humans were transformed into more versatile “behaviorally modern” ones.
- ▶ This trend is nonreversible. Neither individuals nor populations can become “more archaic”/“less modern.”
- ▶ Model of evolution of modern human behavior assumes that the earliest *H. sapiens* were less capable of behavioral variability than we are today.
- ▶ No serious scientific investigation can begin by assuming that the null hypothesis (no significant difference between populations) is wrong

Critiques

- ▶ **Whole behavioral modernity trait discussion** is tinged with “progressivism”:
 - ▶ MHs are obviously better than prior group; old Victorian morality tale; ever-pervasive 19th century notion of inevitable “progress”;
 - ▶ inherent bias against the Neandertals; modern humans supplanted the Neandertals because of our species' superior intellectual capabilities (Yellowstone wolves replaced coyotes; because of higher IQ?)
- ▶ **Clive Gamble**: grand origins narratives are currently on hold, universal statements should be treated with caution, and local rather than global is currently king.

Symbolic capacity: how to judge

- ▶ Recent shift away from traits which were technological
- ▶ Problems
 - ▶ Spotty object distribution in space
 - ▶ Symbolic traits appear and then disappear; lots of UP had no evidence of symbolic traits; even S. African ability of Blombos & Pinnacle Point disappeared
- ▶ Paleolithic axiom: The first appearance of evidence for a behavior signifies the first appearance of the cognitive capacity for the behavior = not true
 - ▶ **Chauvet cave art**: one of earliest (32 Ka) caves with UP art, expected it to be primitive (1st capacity?); but it's as sophisticated as art from Magdalenian at end of UP; only a surprise if assume at 32 Ka a hardwired brain change giving a cognitive capacity; but capacity may have been there for long time; need to figure out how to recognize such a capacity

C. S. Henshilwood & C. W. Marean and R. Klein

- ▶ Later Upper Pleistocene model: Prior to the 1990s there was widespread agreement that **modern human behavior appeared only between 50 & 40 Ka; based on European record**; caused replacement of Neandertals by modern humans
- ▶ Klein: punctuated neural event, modern behaviors arrive as package; behavioral modernity revolution after 50 Ka caused by a genetic mutation
 - ▶ **MSA/MP**: simple material culture – no bone tools, little variation in tools, flakes, local sources; subsistence – no fish, birds, no hunting of adult animals, no seasonal acquisition, mostly scavenging, low population, no symbolic behavior; Klein rejects 77 Ka Blombos Cave dating
 - ▶ **UP Model's sole form of evidence**: alleged absence of those traits during the Middle Stone Age/Middle Palaeolithic and their appearance during the Later Stone Age/Upper Palaeolithic.

Origin of Modern Human Behavior: C. S. Henshilwood & C. W. Marean

- ▶ Recent development of models (McBrearty and Brooks 2000) proposing the development of MH behavior during or before the Middle Stone Age
- ▶ Advocates of these alternative models argue that Middle Stone Age and Middle Palaeolithic technology share some primitive features but differ in others
- ▶ Middle Stone Age technology is comparable to the Middle Palaeolithic in that it emerged from Late Acheulean prepared-core technology. The aim in the Middle Stone Age was to produce standardized blades, a distinctly Upper Palaeolithic feature.
- ▶ Formal bone tools are now documented for the African Middle Stone Age but not for the European Middle Palaeolithic.

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- ▶ Finally, it is argued that Middle Stone Age people had the capacity for symbolic behavior.
- ▶ Middle Stone Age sites often have high frequencies of pigments, and ochre is associated with coloration and the exchange of artifacts to maintain social relations.
- ▶ The use of space is similar to that in Later Stone Age cave sites (including, for example, individual domestic hearths surrounded by carbonized plant materials).
- ▶ The use of nonlocal raw materials is common, reflecting the addition of exchange value to tools and the promotion of social relations.

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- ▶ Three distinct alternatives for the origin of modern human behavior: an Earlier Upper Pleistocene model, a Later Middle Pleistocene model, and a gradualist model.
- ▶ Proponents of the Earlier Upper Pleistocene model (Deacon 2001, Foley and Lahr 1997, Foley 1998) argue that the best place to focus our attention may be the Acheulian/Middle Stone Age boundary, 250,000 years ago or earlier.
- ▶ One of the obvious problems with this view is the lack of sufficient evidence for human anatomical modernity at that stage.
- ▶ The Later Middle Pleistocene model would place the origins of modern human behavior nearer the end of the Middle Pleistocene, ~195 – 128 Ka (Deacon 2001, Deacon and Deacon 1999).

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- ▶ However, sites in Africa dating to the earlier Middle Stone Age are very rare, probably because populations were small and concentrated on now-submerged offshore platforms during stage 6.
- ▶ Both of these models are consistent with a punctuated event in which modern human behavior originated as a package.
- ▶ The obvious alternative is that modern behavior evolved gradually and piecemeal sometime during the Middle Stone Age.
- ▶ McBrearty and Brooks (2000) argue that many of the traits considered indicative of modern human behavior appear in the Middle Stone Age, primarily between 128 and 40 Ka.

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- ▶ The gradualist model is recognizable in the 1990s comments of Chase and Dibble (1990), Foley and Lahr (1997), Gibson (1996), McBrearty and Brooks (2000), and Renfrew (1996).
- ▶ Within these models there are **numerous potential alternatives on the specifics**. For example, one might argue that behavioral modernity evolved in the Levant first, since early modern humans were present there prior to 40,000 years ago.

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- ▶ However, researchers appear to be looking to Africa for the origin of modern human behavior. While the rationale for this African view may be strictly evidential, it may also result from habit: most major steps in human evolution occurred in this seemingly precocious continent.
- ▶ McBrearty and Brooks (2000) review the empirical record in Africa for these traits, and their discussion makes it clear that many of the traits are derived from the European archaeological record.