



Modern
humans II -
Expansion in
Eurasia

Paleoanthropology Bi8610

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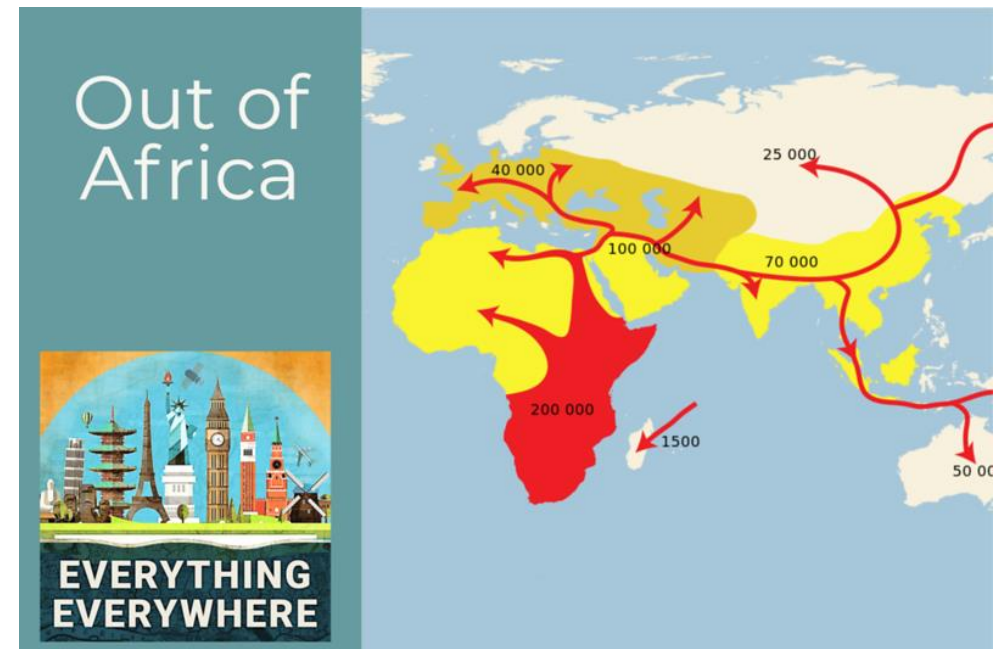
Origins of (AMH): 2 basic hypotheses:

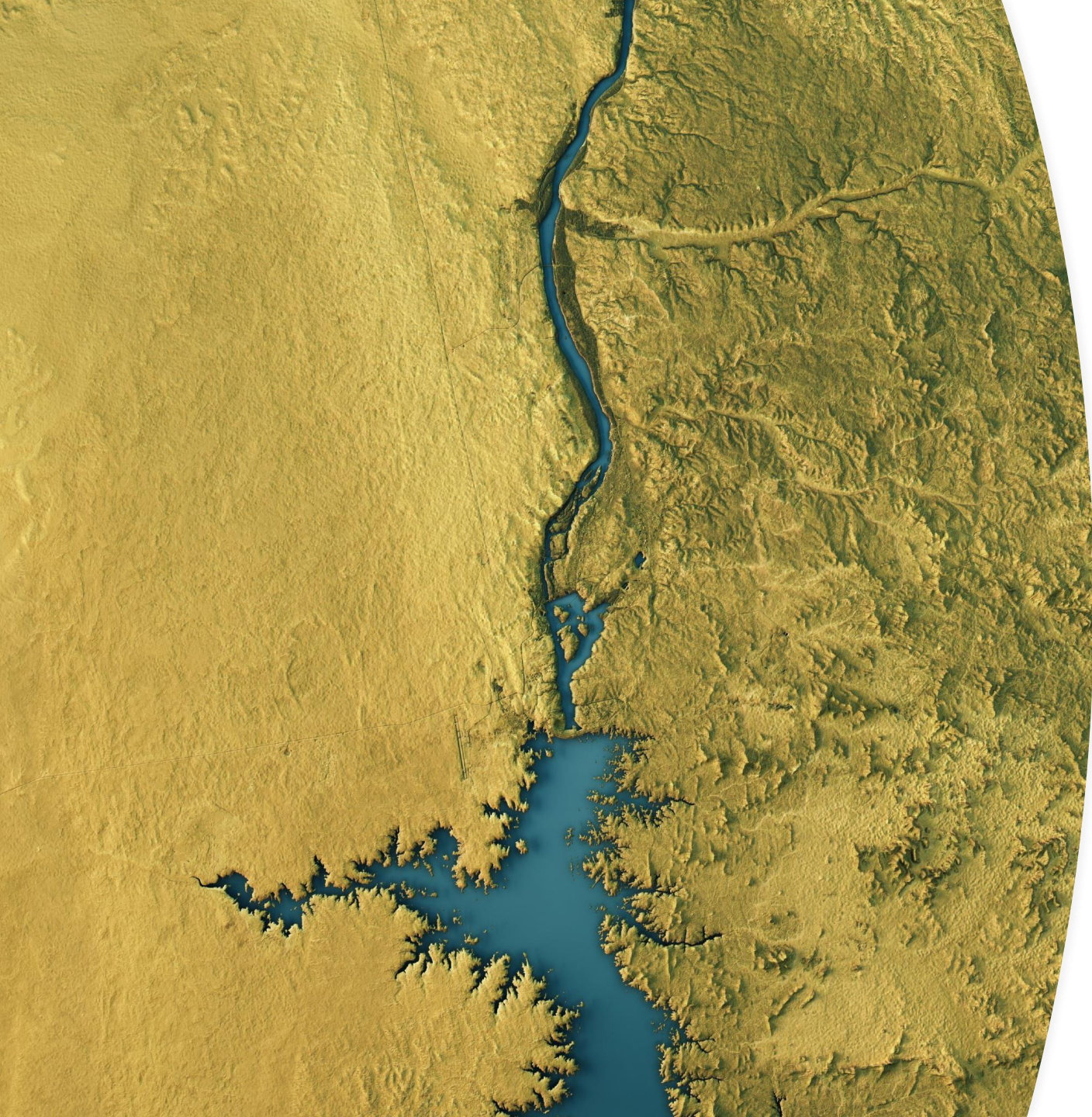
'Multiregional evolution'

- ❑ based on the apparent similarity of skeletal remains of Homo erectus & H. sapiens.
- ❑ trace the origins of all modern populations back to an African source, whence it gradually spread over Eurasia.
- ❑ observable regional variants are viewed as:
 - consequence of environmental differences
 - emerging through genetic drift & bottlenecking

'Out-of-Africa'

modern humans evolved comparatively recently from a small population in Africa, which totally replaced the archaic hominids.





Agenda

I. Dispersal throughout Eurasia

1. Europe
2. East, Southeast and North Asia

II. Last Glacial Maximum

1. Eurasia
2. Americas

I. Dispersal throughout Eurasia

- Europe

- East, Southeast and North Asia



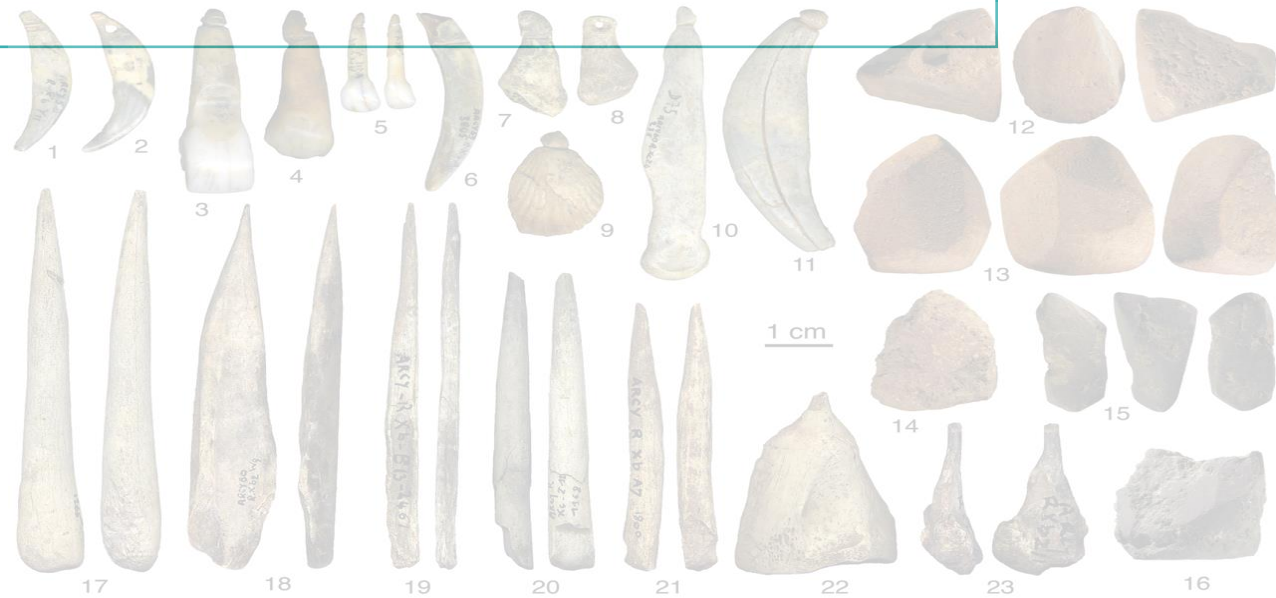
Northern Eurasia: One Flew East...

The initial expansion of anatomically modern humans (AMH) occurred during a hyperarid event in Africa that occurred 135-75 ka.

Large-scale AMH spread in northern Eurasia started during the Middle Weichselian glacial maximum and proceeded during the subsequent mild interstadial (60-40 ka ago).

This expansion which encompassed the polar regions & southern Siberia proceeded at a remarkably rapid pace, suggesting the entire area being taken up by uniform 'periglacial' landscape, equally suitable for AMH habitation.

The 'transitional' industries (Chatelperronian, Szeletian, Streletian etc) have seen archaeological manifestations of early AMH expansion.

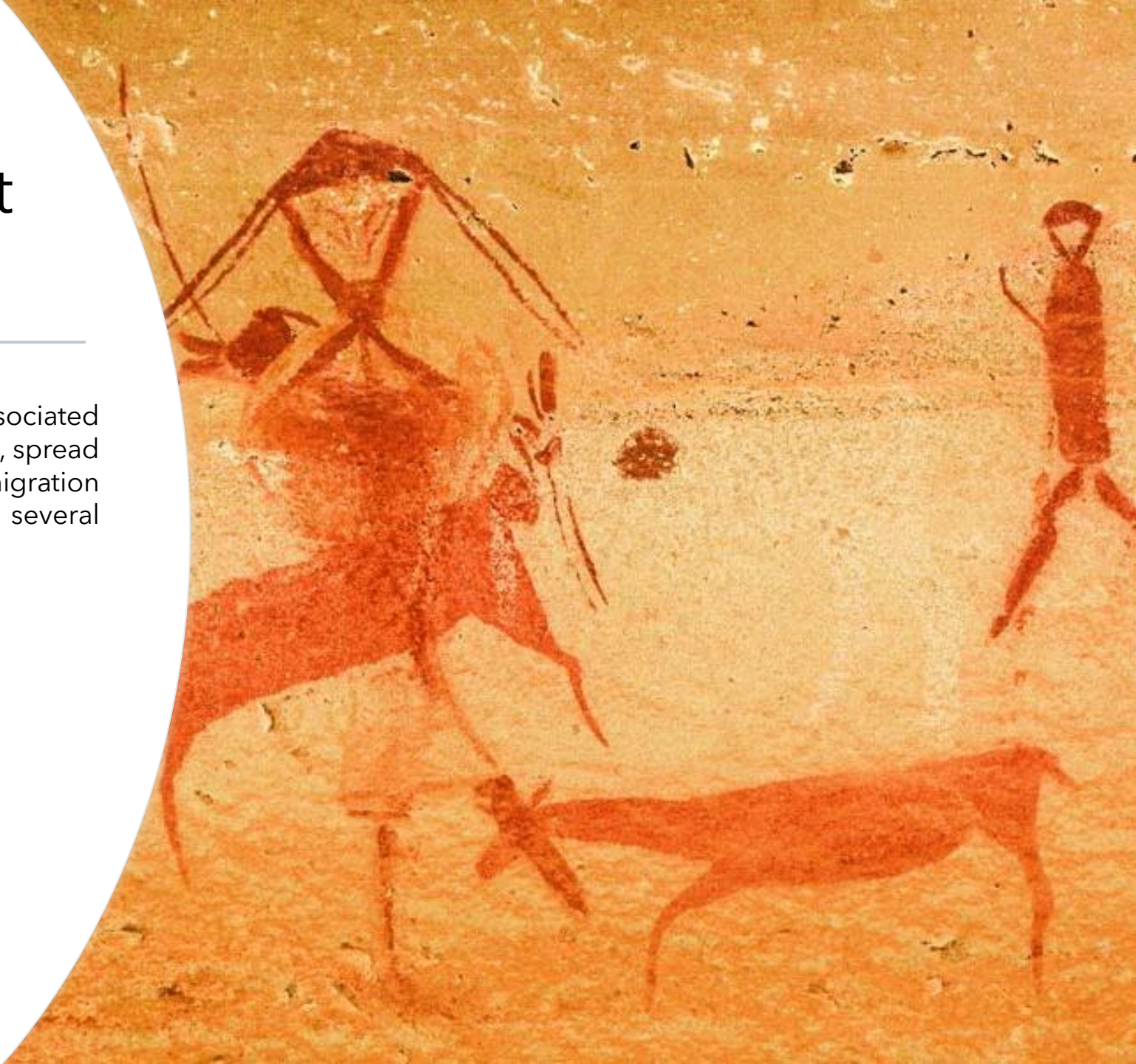


I. Dispersal throughout Eurasia

- ❑ The population brought to South Asia by coastal migration appears to have remained there for some time, during roughly 60,000 to 50,000 years ago, before spreading further throughout Eurasia
- ❑ This dispersal (beginning of the Upper Paleolithic) gave rise to the major population groups of the Old World & the Americas

I. Dispersal throughout Eurasia

- ❑ Towards the West, Upper Paleolithic populations associated with mitochondrial haplogroup R and its derivatives, spread throughout Asia and Europe, with a back-migration of M1 to North Africa and the Horn of Africa several millennia ago



I. Dispersal throughout Eurasia

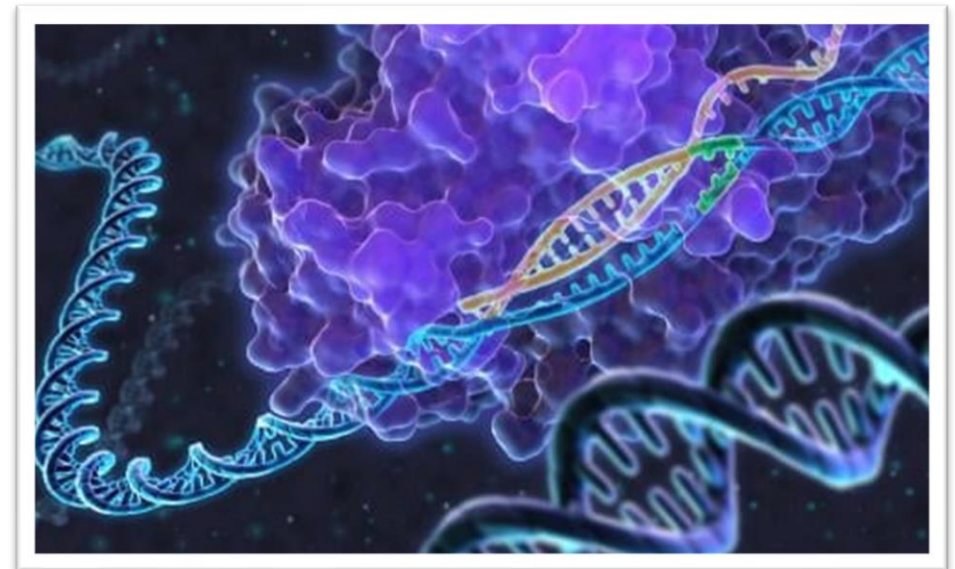
- ❑ After 40,000 years ago: Presence in Europe is **certain**
- ❑ possibly as early as 43,000 years ago: rapidly replacing the **Neanderthal** population
- ❑ before 47,000 years ago: significant interbreeding with Neanderthals



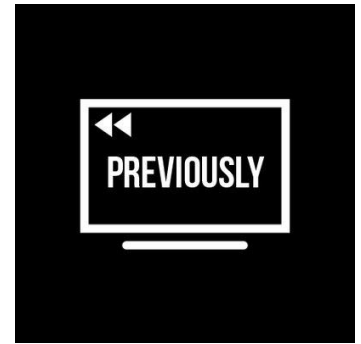
Dispersal throughout Eurasia: Mitochondrial DNA

Genetic bottlenecks are stochastic events that limit genetic variation in a population and result in founding populations that can lead to genetic drift.

Evidence that modern humans have passed through at least one genetic bottleneck, in which genome diversity was drastically reduced



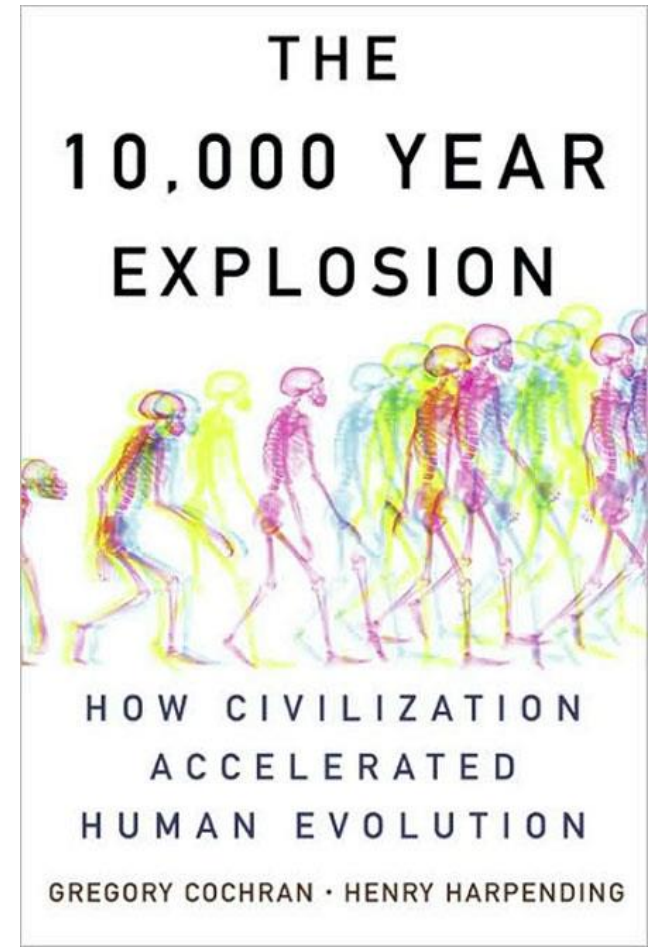
Dispersal throughout Eurasia: Mitochondrial DNA



- ❑ about 100,000 years ago
- ❑ humans spread from a geographically restricted area

then
with

1. **passage** through the geographic bottleneck
2. **dramatic growth** amongst geographically dispersed populations about 50,000 years ago, beginning first in Africa and thence spreading elsewhere



Dispersal throughout Eurasia: Climatological + geological support 'bottleneck'

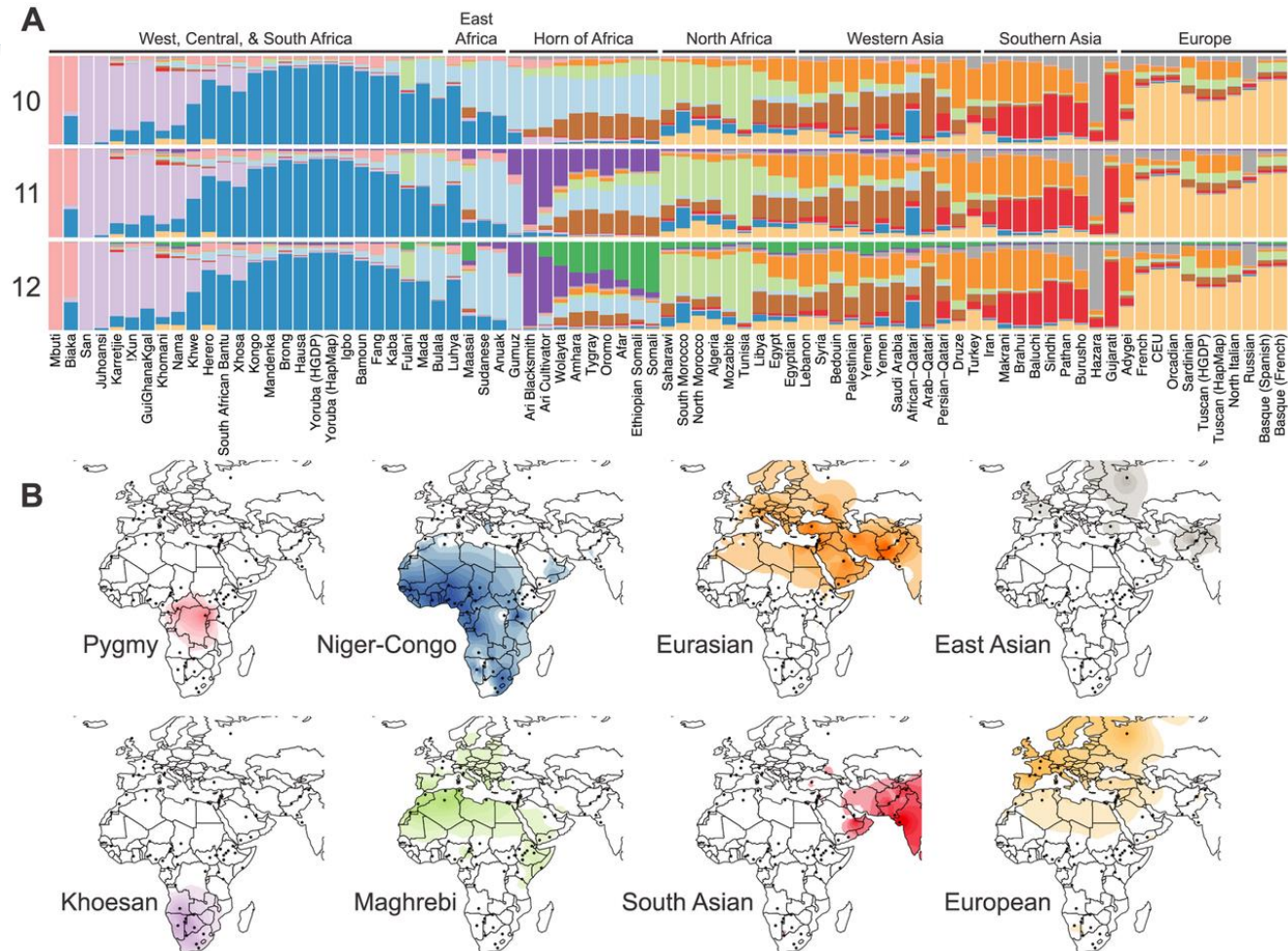
The explosion of Toba,

- the largest volcanic eruption of the Quaternary
 - may have created a 1,000 year cold period
 - potentially reducing human populations to a few tropical refugia
 - few 15,000 humans survived (estimations)
- genetic drift & founder effects may have been maximised
- The greater diversity amongst African genomes may reflect the extent of African refugia during the Toba incident

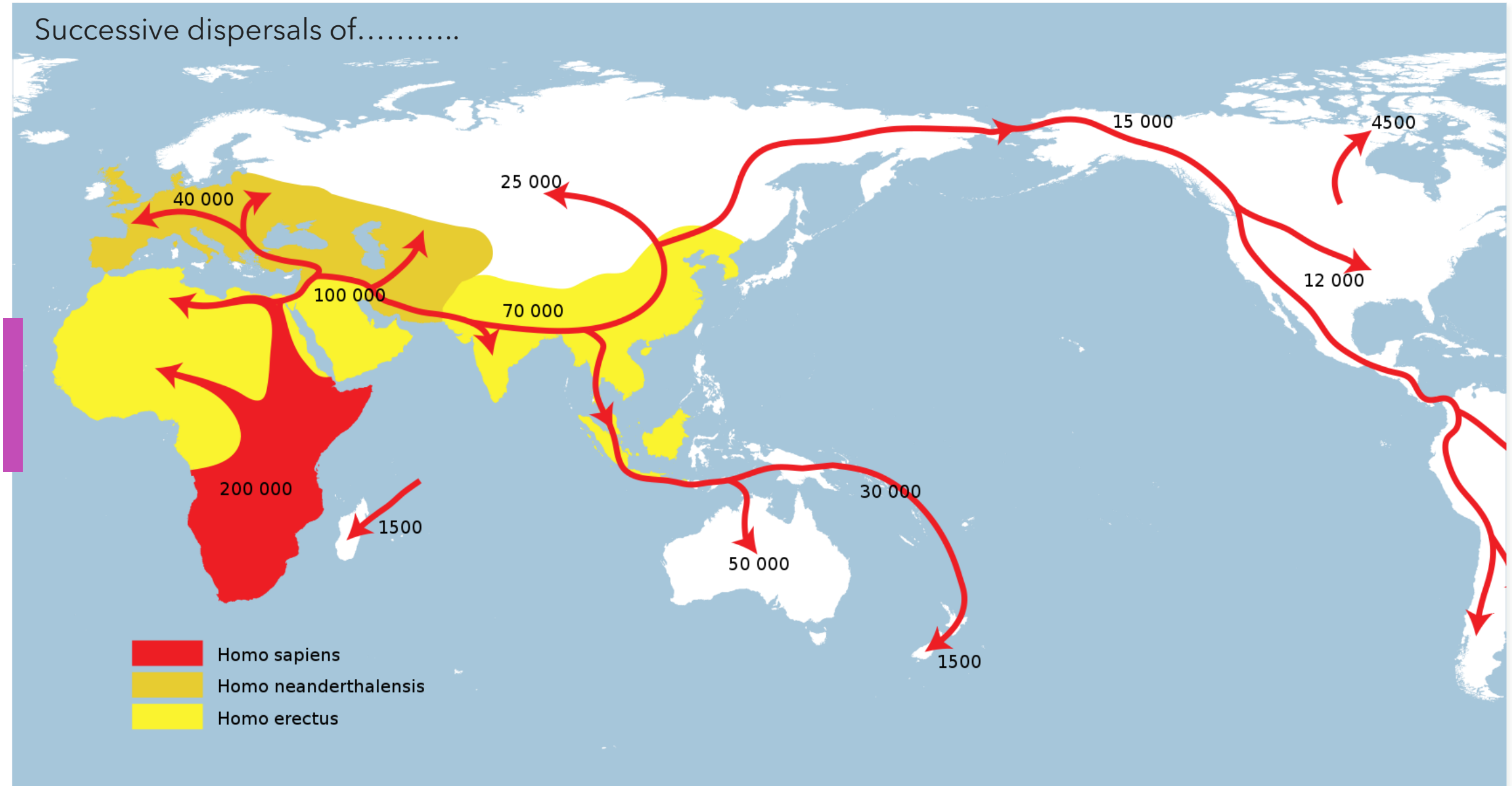
A founder effect, as related to genetics, refers to the reduction in genomic variability that occurs when a small group of individuals becomes separated from a larger population.



However, a recent review highlights that the single-source hypothesis of non-African populations is less consistent with ancient DNA analysis than multiple sources with genetic mixing across Eurasia



Successive dispersals of.....

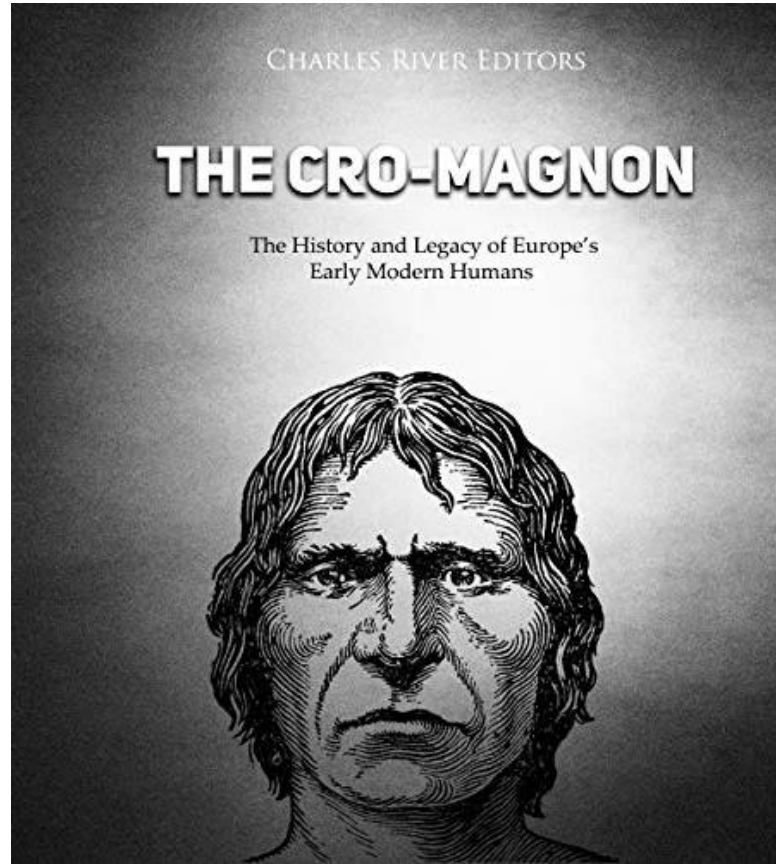
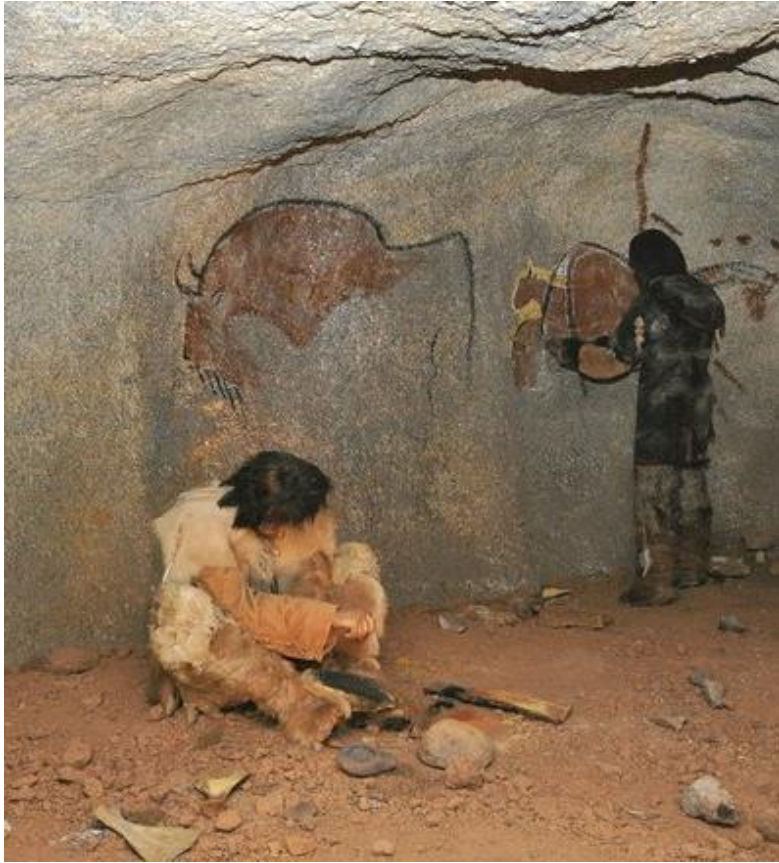


Europe vs Asia



1. Europe

- ❑ The recent expansion of AMH reached Europe around 40,000 years ago from Central Asia and the Middle East, as a result of cultural adaption to big game hunting of sub-glacial steppe fauna
- ❑ Neanderthals were present both in the Middle East & in Europe, and the arriving populations of AMH interbred with Neanderthal populations to a limited degree
- ❑ Populations of MH & Neanderthal overlapped in various regions such as the Iberian peninsula & the Middle East
- ❑ Interbreeding may have contributed Neanderthal genes to palaeolithic and ultimately modern Eurasians and Oceanians



Cro-Magnon are considered the 1st AMH in Europe

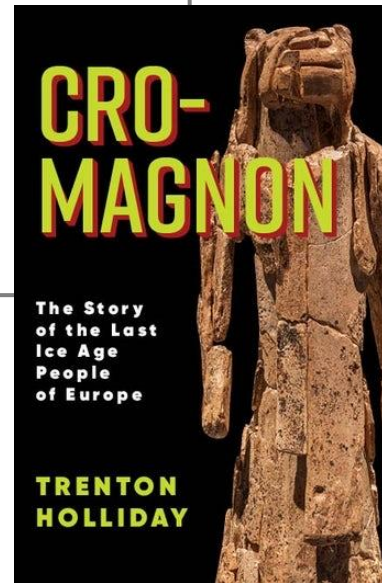
(Homo sapiens) - known as European Early Modern Humans (or EEMH),
the extent of their migration into Europe, the western Middle East, and north Africa up to 32,500 years before present



Up to 37,500 YBP



Up to 32,500 YBP

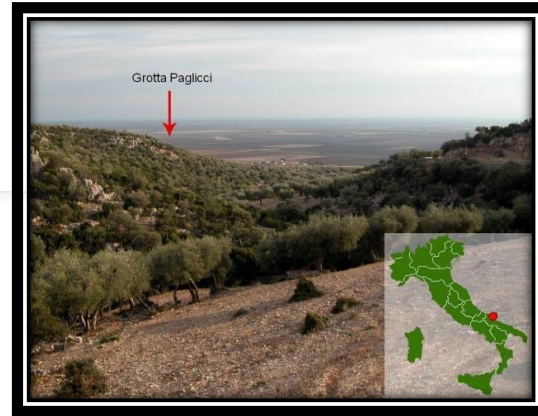


Up to 35,000 YBP



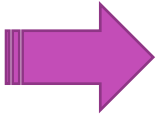
Up to 30,000 YBP

Cro-Magnons in Italy

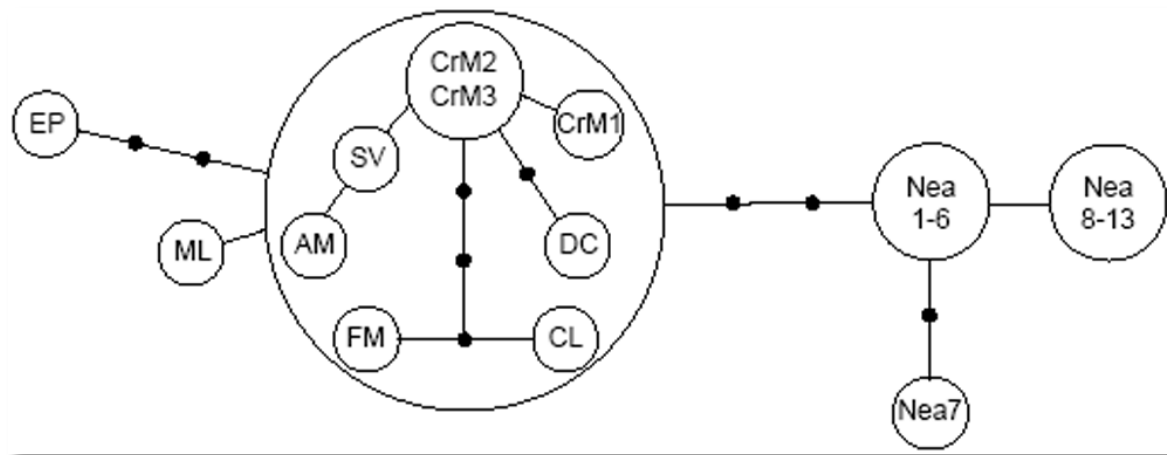


A mitochondrial DNA sequence

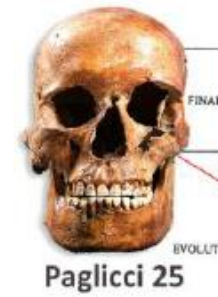
- ❑ two Cro-Magnons from the Paglicci Cave
- ❑ dated to 23,000 & 24,000 years old



Its DNA is identical to the DNA sequences of certain modern Europeans (Haplogroup N)

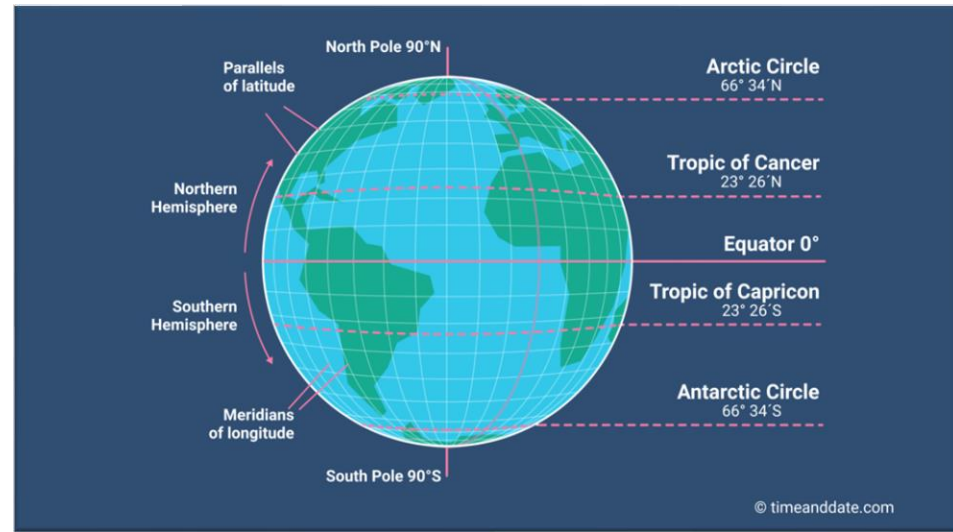


Fasi culturali	Livelli	Anni da oggi	Clima
EPICRAVESTIANO	1		
	2	15.440	
	3		Temperato caldo
	4	11.990	Temperato
	5	13.000	Temperato caldo
	6	14.270	Temperato
	7	14.820	Freddo
	8		Freddo moderato
	8	15.270	Freddo
	10	15.320	
	11		
	12		Freddo moderato
	ANTICO	13	15.480
14		15.830	
15		16.260	
16		16.450	Freddo intenso (Marmotta)
17		17.900	
18		19.600	
18a			
18b			
18bx		20.200	
18ba			Freddo moderato
19a		20.730	
19b			
20a			
20b	21.260		
20c	22.110		
20d		Freddo intenso (Marmotta)	
20e	22.630		
21a	23.040		
21b	23.470		
21c	24.210		
21d	24.720	Freddo umido	
22	25.800	Freddo moderato e umido	
22a	28.100	Freddo	
22b			
22c			
GRACRAVESTIANO	24a		
	24aa		
	24ab		
	24ac		
	24d		
	24e		
	24f		
	24g		
	24h	34.300	Temperato asciutto
	24i		
AURIGNAZIANO	25a		
	25b		
	25c		
	25d		
PALEOLITICO INTERIORE	26		
	26-28		Temperato umido
	29		



1. Europe

- ❑ An important difference between Europe & other parts of the inhabited world was the **northern latitude**
- ❑ Archaeological evidence suggests humans (whether Neanderthal or Cro-Magnon) reached sites in Arctic Russia by **40,000 years ago**



West of the Urals

Faced with adaptive **challenges**;

1. winter temperatures averaged from -20 to -30 °C
2. fuel & shelter scarce
3. travelled on foot
4. relied on hunting highly mobile herds for food



West of the Urals

These challenges → technological **innovations**:

1. tailored clothing from the pelts of fur-bearing animals
2. construction of shelters with hearths using bones as fuel
3. digging "ice cellars" into the permafrost to store meat and bones

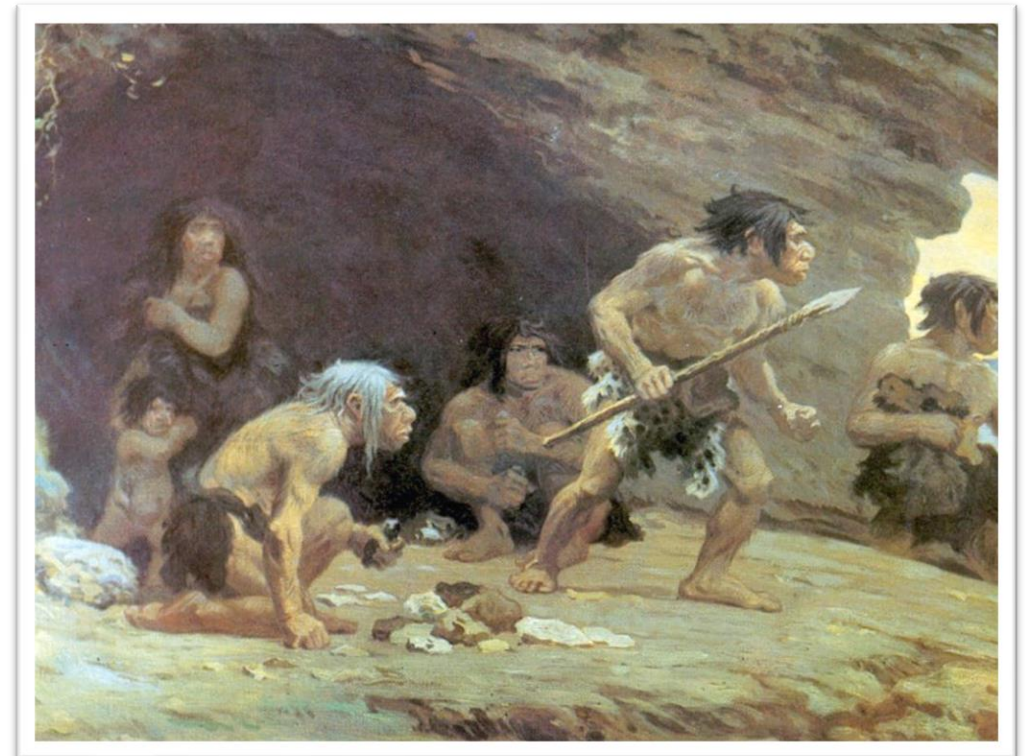
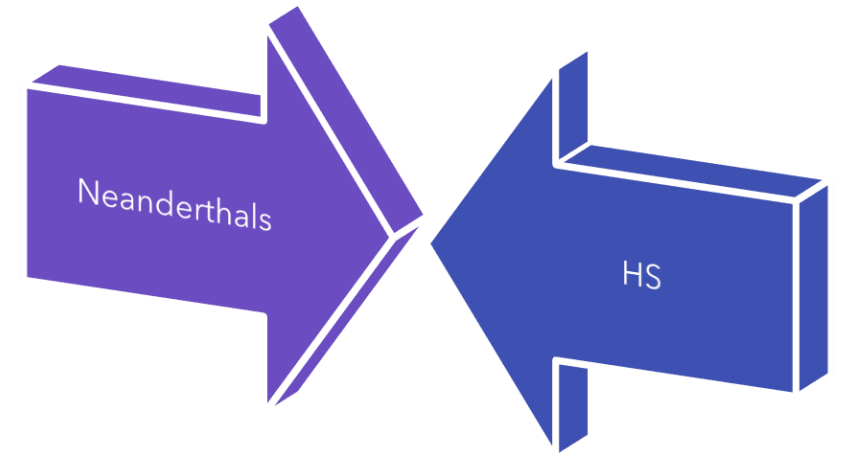


Modern human remains dating to:
43,000–45,000 years ago in Italy and Britain
40,000 years ago in the European Russian Arctic

15,000–20,000 yrs for Europe to be colonized

During this time,

- ❑ N were slowly being displaced
- ❑ Because it took so long for Europe to be occupied → H & N compete for territory
- ❑ The N (larger brains, larger overall, more robust or heavily built frame) which suggests that they were physically stronger than modern *HS*
- ❑ Having lived in Europe for 200,000 years, N would have been better adapted to the cold weather?

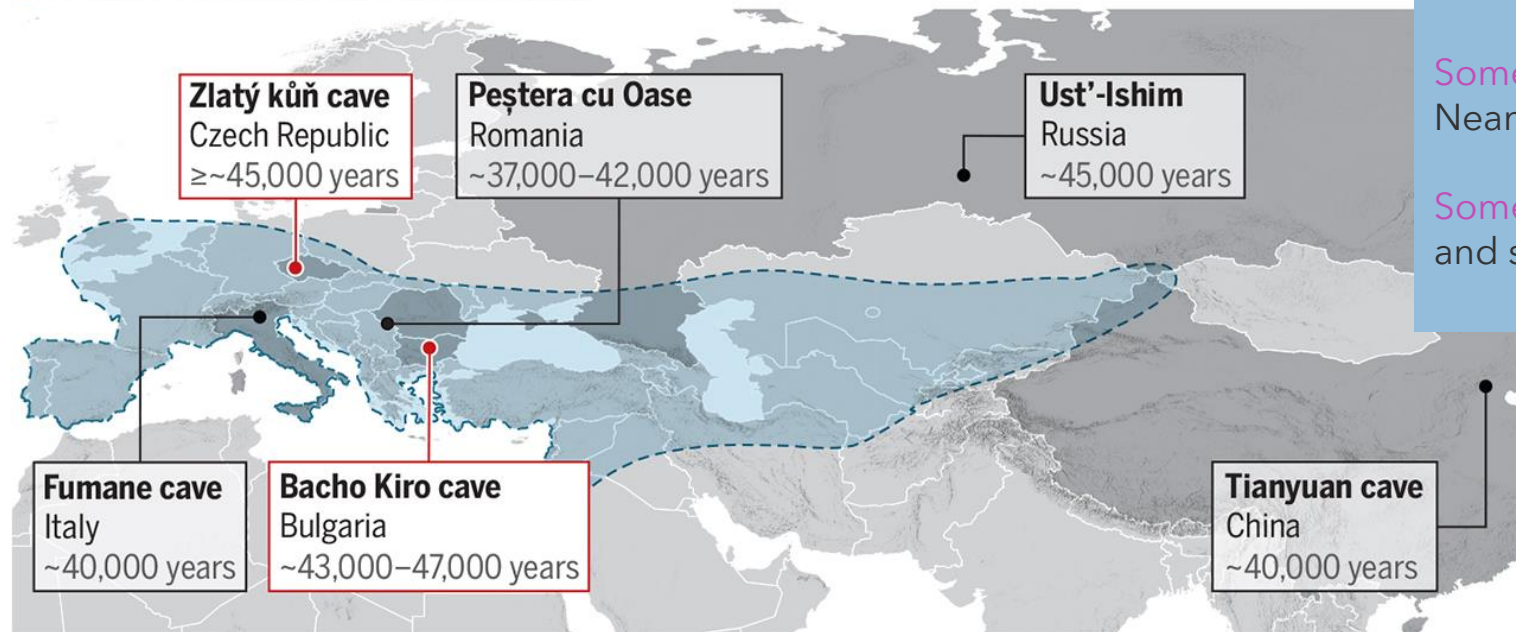


these genomic snapshots offer a glimpse into the identities of the mysterious modern humans who first set foot in Europe and their relationship to Neanderthals, who vanished about 40,000 years ago.

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



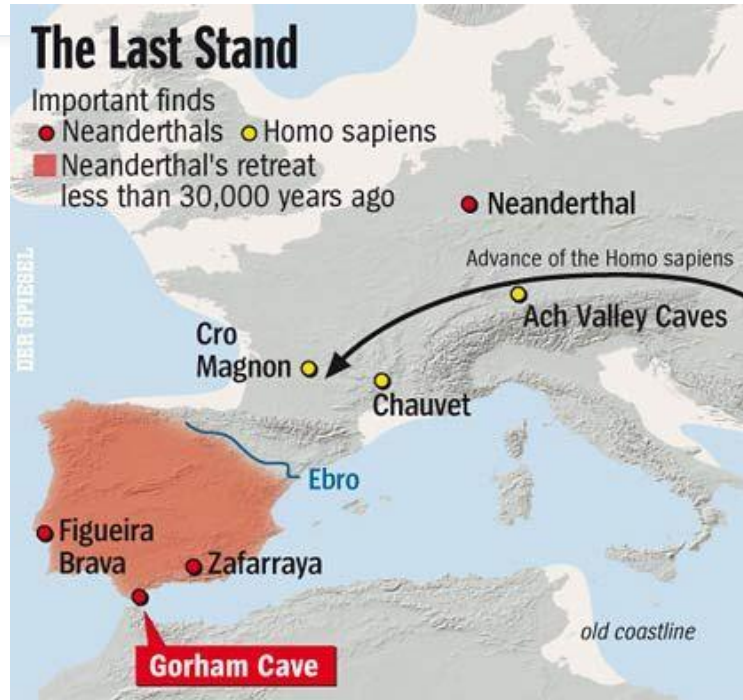
multiple waves of modern humans

Some groups mixed with Neanderthals, and some didn't

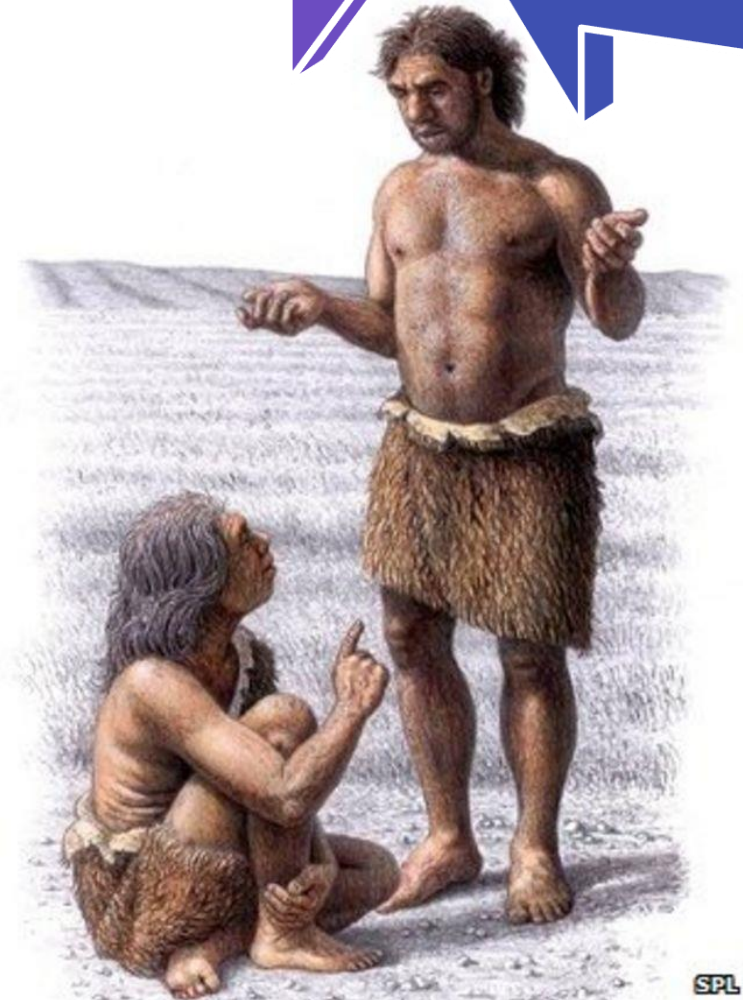
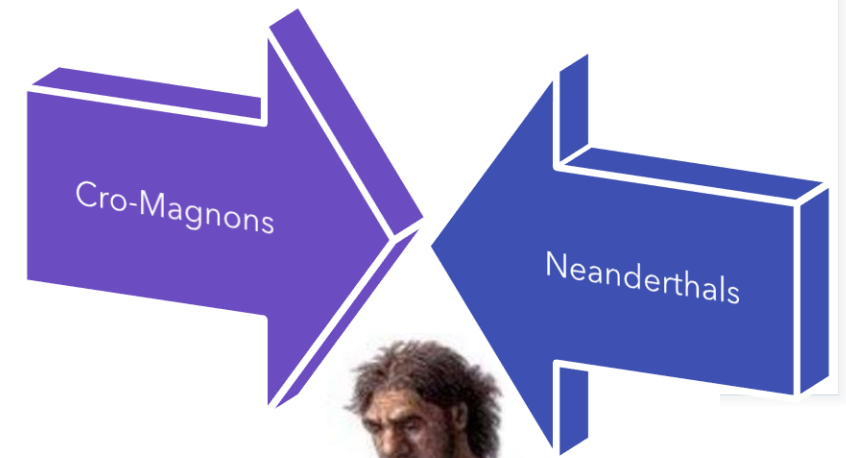
Some are related to later humans and some are not

During this time,

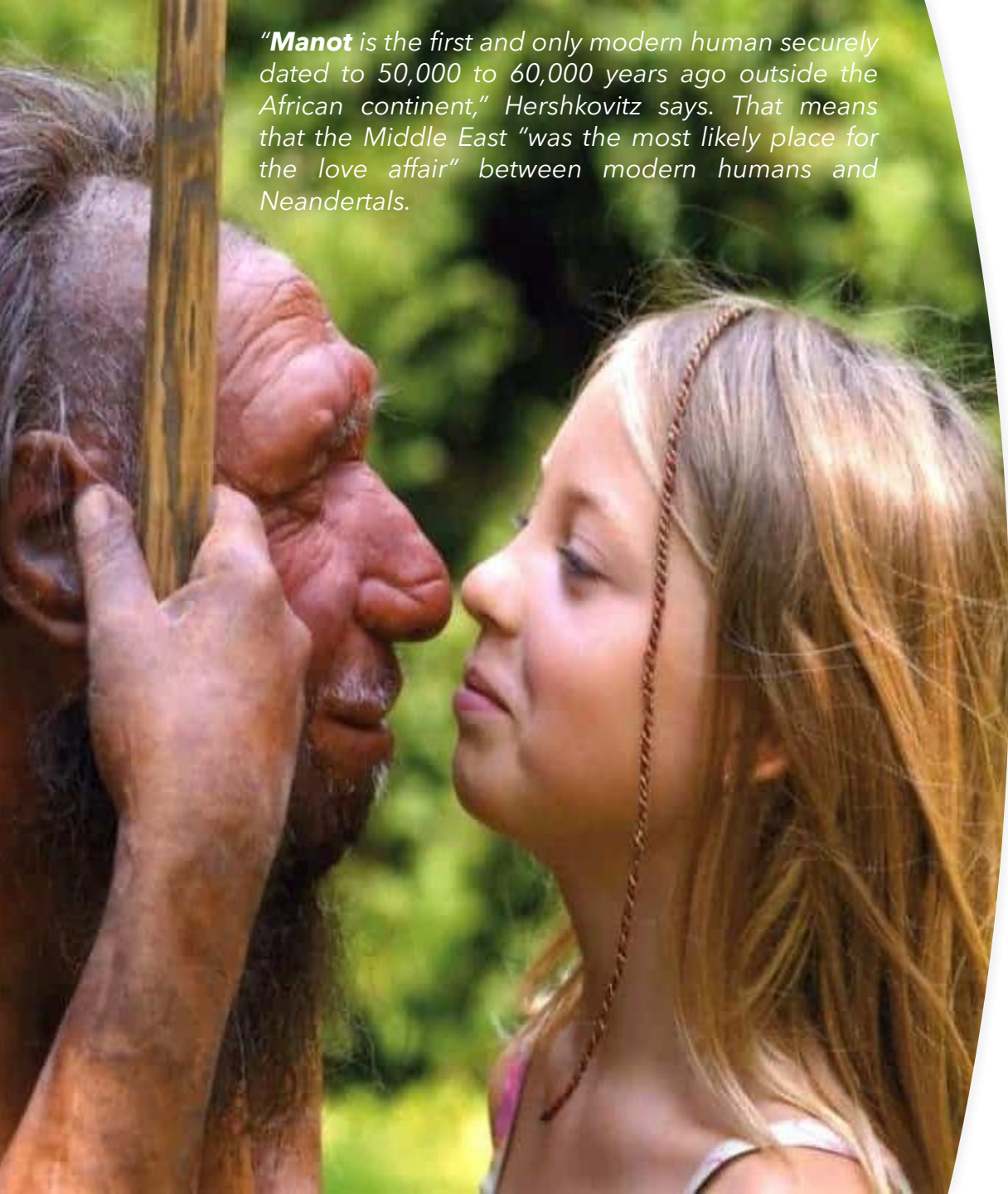
- ❑ The Cro-Magnons, with widespread trade networks, superior technology & bodies likely better, would eventually completely displace the Neanderthals, whose last refuge was in the Iberian peninsula



- ❑ After about 25,000 years ago the fossil record of the Neanderthals ends, indicating **extinction**
- ❑ The last known population lived around a cave system on the remote south-facing coast of Gibraltar from 30,000 to 24,000 years ago



"Manot is the first and only modern human securely dated to 50,000 to 60,000 years ago outside the African continent," Hershkovitz says. That means that the Middle East "was the most likely place for the love affair" between modern humans and Neandertals.



From the extent of linkage disequilibrium

- ❑ It was estimated that the last Neanderthal gene flow into early ancestors of Europeans occurred 47,000-65,000 years BP
- ❑ archaeological & fossil evidence → interbreeding occurred somewhere in Western Eurasia



An aerial photograph of a river delta, showing a complex network of channels and islands. The water is a deep blue, and the land is a rich, reddish-brown color. A large white circular cutout is positioned on the left side of the image, containing the title and list of points.

From the extent of linkage disequilibrium

- ❑ Studies show a higher Neanderthal admixture in East Asians than in Europeans
- ❑ North African groups share a similar excess of derived alleles with Neanderthals as non-African populations
- ❑ whereas Sub-Saharan African groups are the only modern human populations with no substantial Neanderthal admixture



From the extent of linkage disequilibrium

- ❑ The Neanderthal-linked **haplotype B006** of the dystrophin gene has also been found among **nomadic pastoralist groups** in the Sahel & Horn of Africa, who are associated with northern populations

➔ presence of this **B006** haplotype on the northern & northeastern perimeter of Sub-Saharan Africa is attributed to gene flow from a **non-African** point of origin

2. East, Southeast & North Asia



2. East, Southeast & North Asia

- A 2017 study of the ancient DNA of Tianyuan Man found that the individual is related to modern Asian & Native American populations

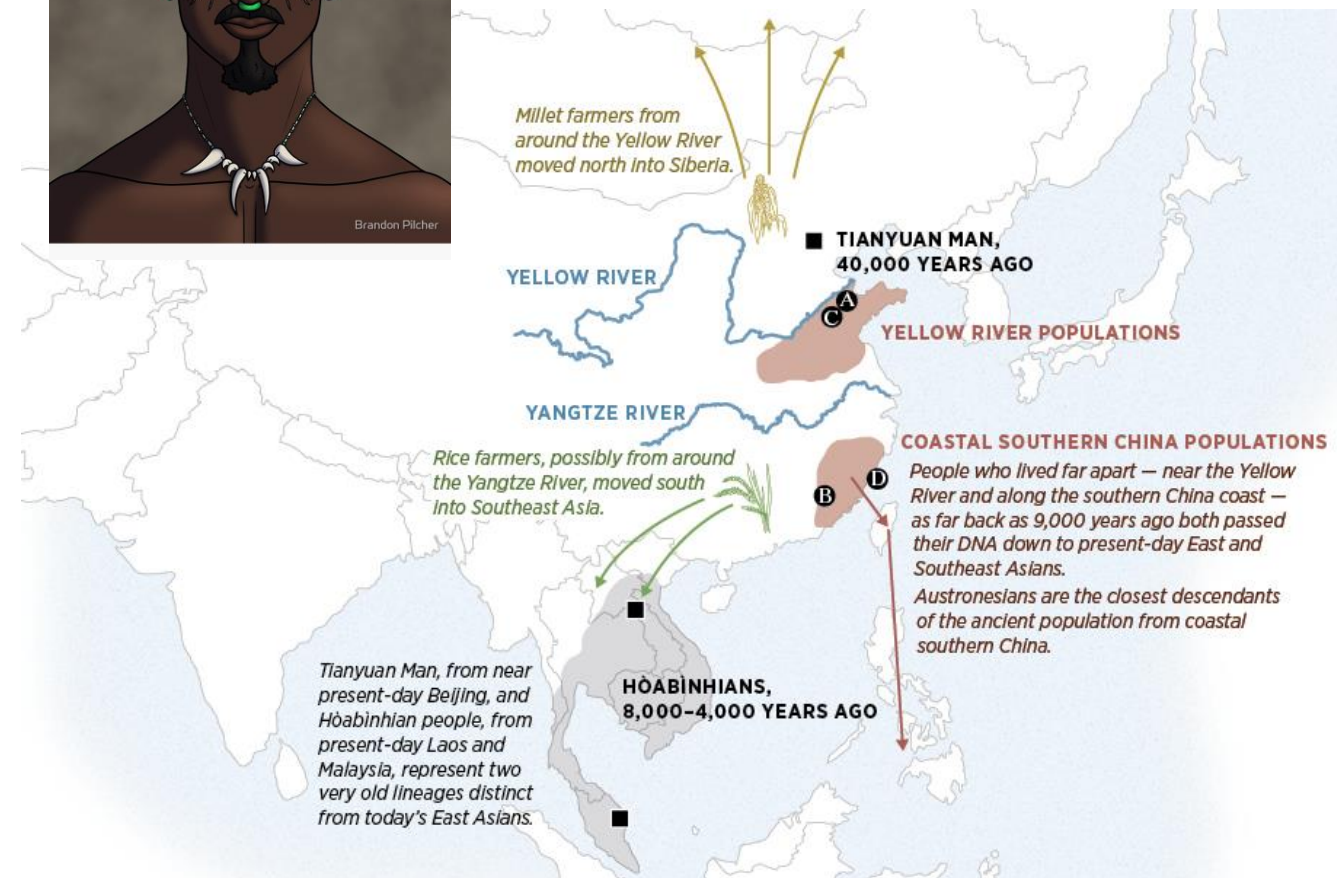


"Tianyuan Man" China c. 40,000 yrs ago
showed substantial Neanderthal admixture



2. East, Southeast & North Asia

- ❑ A 2013 study found Neanderthal introgression of 18 genes within the chromosome 3p21.31 region (HYAL region) of East Asians.
- ❑ The introgressive haplotypes were positively selected in only **East Asian populations**, rising steadily from 45,000 years ago until a sudden increase of growth rate around 5,000 to 3,500 years ago.
- ❑ They occur at very high frequencies among East Asian populations in contrast to other Eurasian populations (e.g. European and South Asian populations).
- ❑ The findings also suggest that this Neanderthal introgression occurred within the ancestral population shared by East Asians & Native Americans



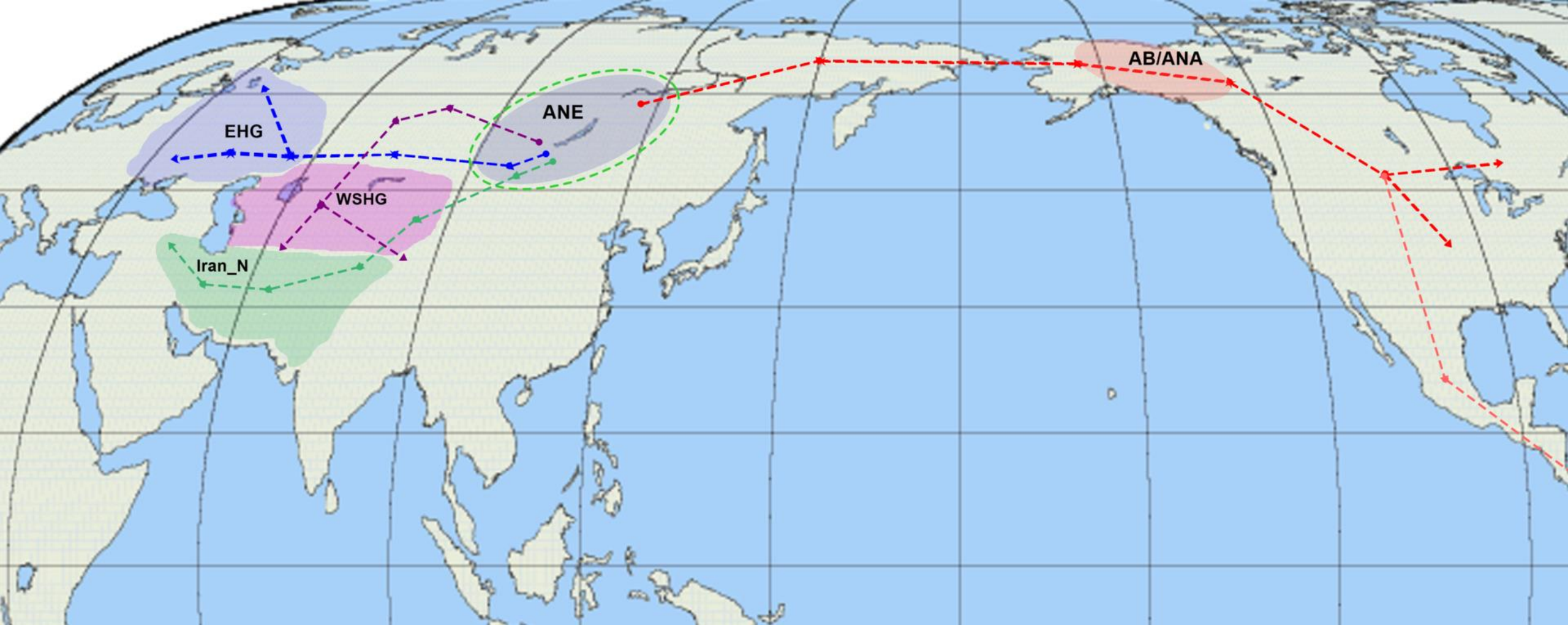


The Ainu are an indigenous people who primarily inhabit the island of Hokkaido in Japan, but also live in the north of Honshu, Japan's main island, and Sakhalin island in Russia. There are more than 24,000 Ainu in Japan.

A 2016 genetic study

- ❑ The Ainu were found to represent a more basal branch than the modern farming populations of East Asia → an ancient (pre-Neolithic) connection with northeast Siberians

Ancient North Eurasian populations from Siberia were an important genetic contributor to Ancient Native Americans and Eastern European Hunter-Gatherers. Neolithic Iranian farmers and Jōmon people (ancestors of the Ainu people) also received geneflow from ANE-related populations



❑ Mitochondrial haplogroups A, B and G originated about 50,000 years ago, and bearers subsequently colonized Siberia, Korea and Japan, by about 35,000 years ago

❑ Parts of these populations migrated to North America during the Last Glacial Maximum.

A genetic history of migration, diversification, and admixture in Asia

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Abstract

L.L. Cavalli-Sforza spearheaded early efforts to study the genetic history of humans, recognizing the importance of sampling diverse populations worldwide. He supported research on human evolutionary genetics in Asia, with research on human dispersal into Asia and genetic distances between present-day East Asians in the late 20th century. Since then, great strides have been made in understanding the genetic history of humans in Asia, through large-scale genomic sequencing of present-day humans and targeted sequencing of DNA from ancient humans. In this review, I survey the genetic prehistory of humans in Asia, based on research using sequence data from humans who lived in Asia as early as 45,000 years ago. Genetic studies comparing present-day Australasians and Asians show that they likely derived from a single dispersal out of Africa, rapidly differentiating into three main lineages: one that persists partially in South Asia, one that is primarily found today in Australasia, and one that is widely represented across Siberia, East Asia, and Southeast Asia. Studies of ancient DNA from human remains in Asia dating from as far back as 45,000 years has greatly increased our understanding of the population dynamics leading to the current Asian populations.

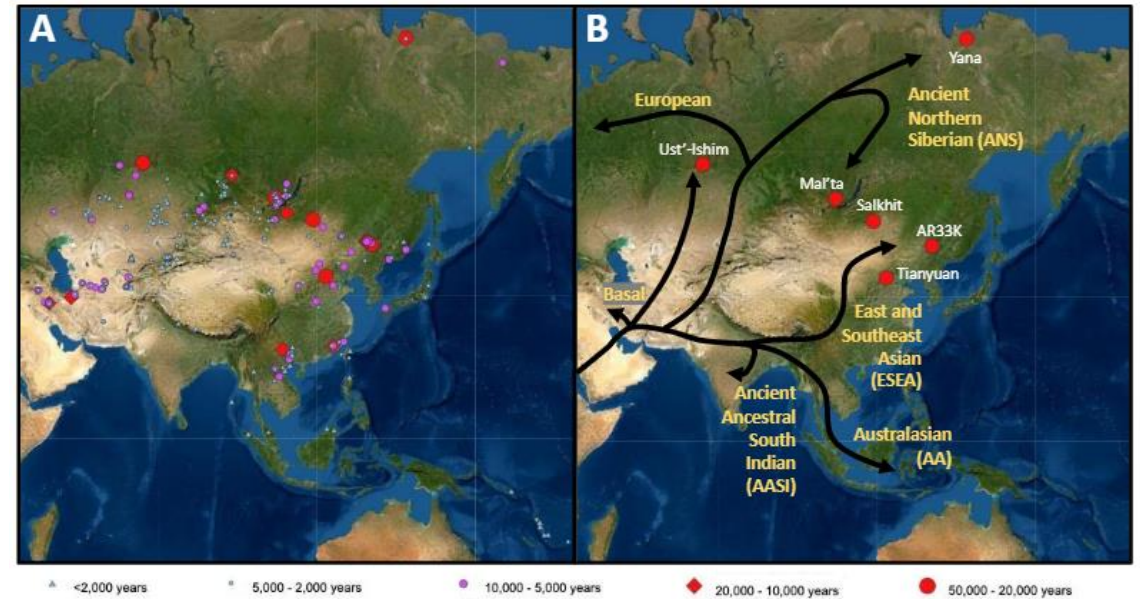
Based on "Jin L, Underhill PA, Doornik V, Davis RW, Shen P, Cavalli-Sforza LL, Oefner PJ. Distribution of haplotypes from a chromosome 21 region distinguishes multiple prehistoric human migrations. Proc Natl Acad Sci U S A. 1999;96(7):3796-3800".

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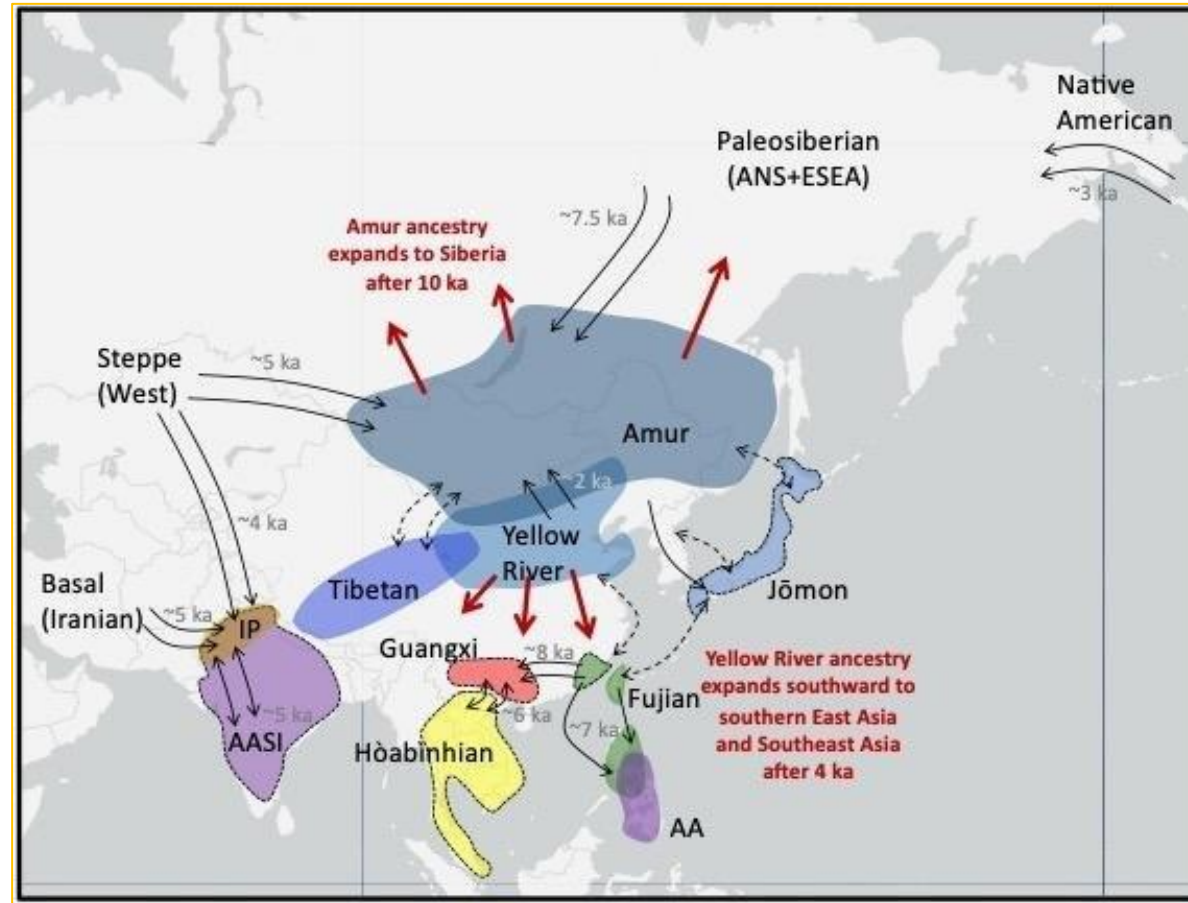


summarized & concluded that:

- a distinctive "Basal-East Asian population" referred to as '*East- & Southeast Asian lineage*' (ESEA); which is ancestral to modern East Asians, Southeast Asians, Polynesians, & Siberians, originated in Mainland Southeast Asia at ~50,000BC, and expanded through multiple migration waves southwards and northwards respectively

This lineage:

1. gave rise to various sublineages,
2. **is** also ancestral to the Hoabinhian hunter-gatherers of Southeast Asia and the ~40,000 year old Tianyuan lineage found in Northern China,
3. **but** distinct from European-related & Australasian-related lineages (found in other regions of prehistoric Eurasia)
4. **it** trifurcated from an earlier East-Eurasian or "eastern non-African" (ENA) meta-population, which also contributed to the formation of Ancient Ancestral South Indians (AASI) as well as to Australasians





• Eurasia

• Americas

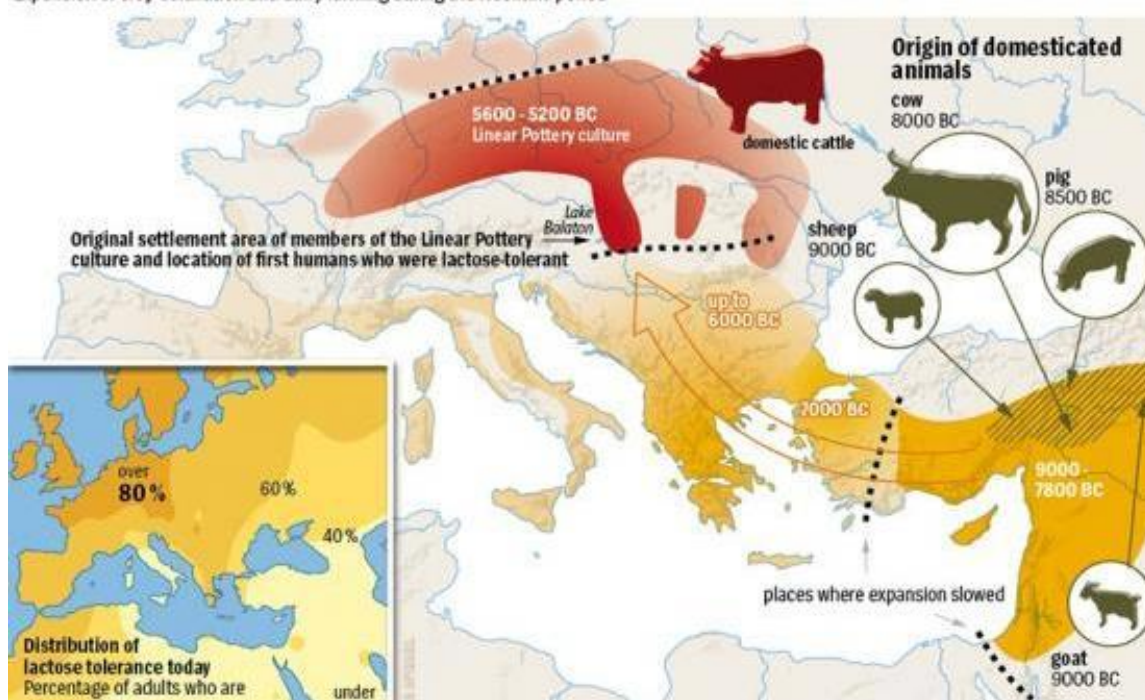
II. Last Glacial Maximum





1. Eurasia

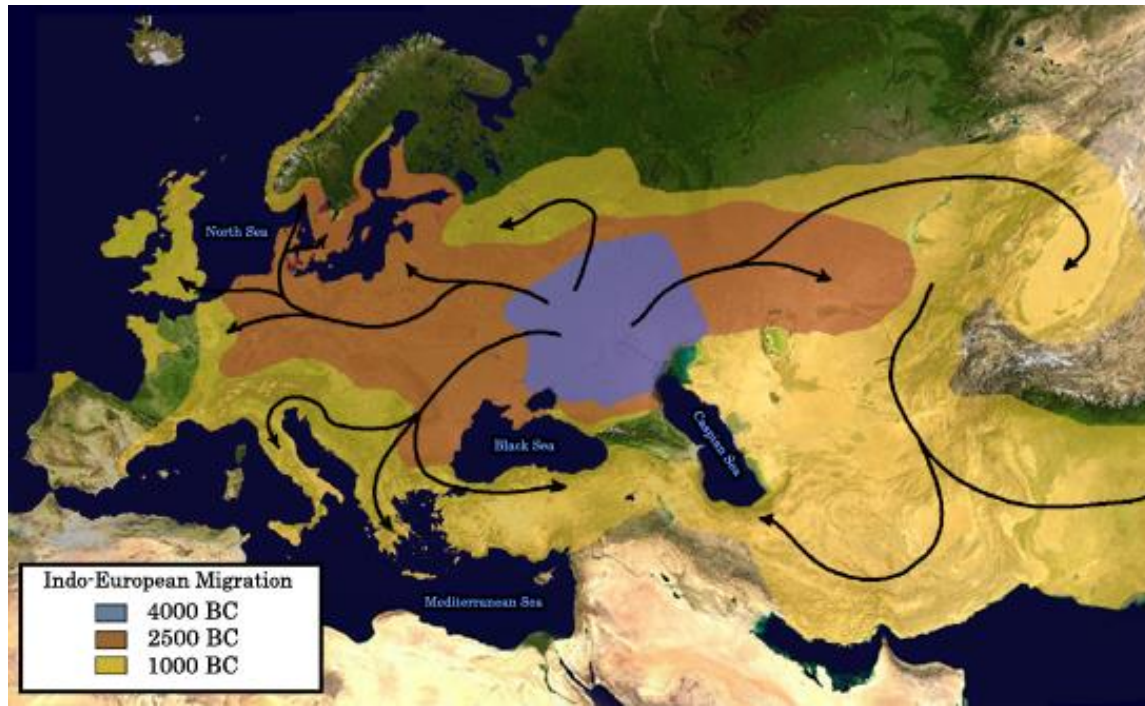
- ❑ Around 20,000 years ago, approximately 5,000 years after the Neanderthal extinction, the Last Glacial Maximum forced northern hemisphere inhabitants to migrate to several shelters (refugia) until the end of this period
- ❑ The resulting populations are presumed to have resided in such refuges during the LGM to ultimately reoccupy Europe



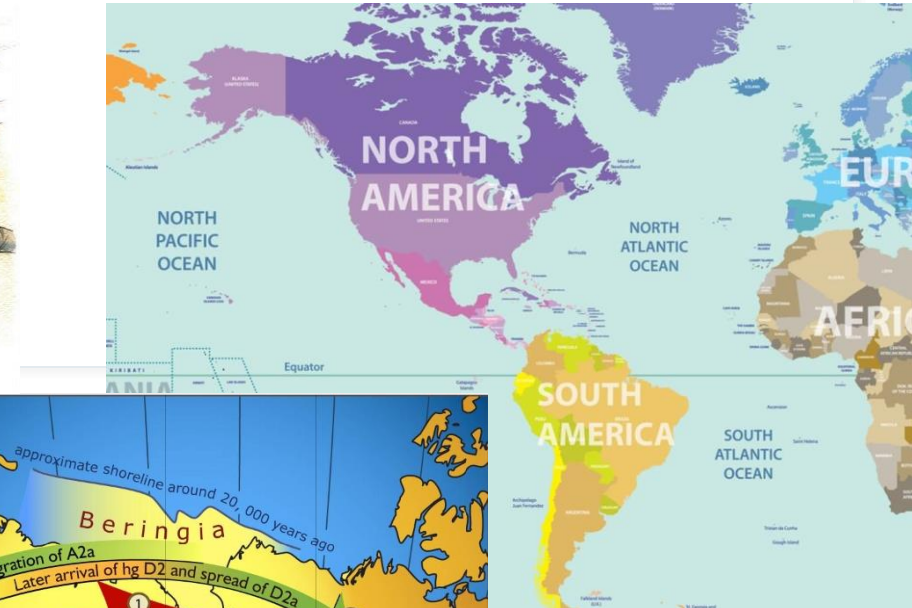
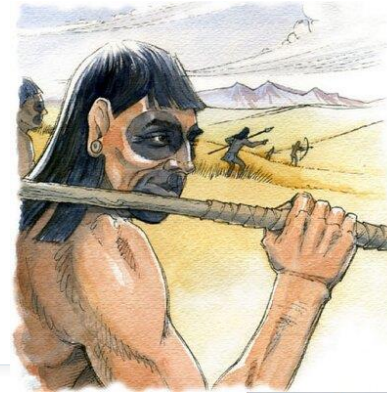
1. Eurasia

The composition of European populations was later altered by further migrations, notably:

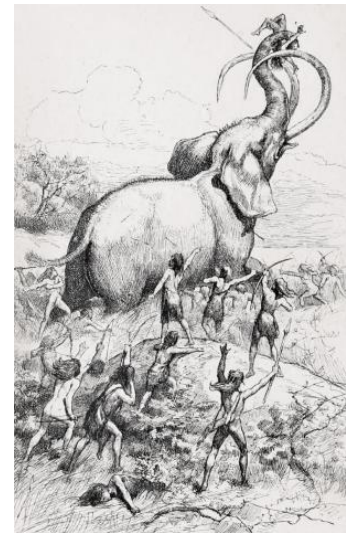
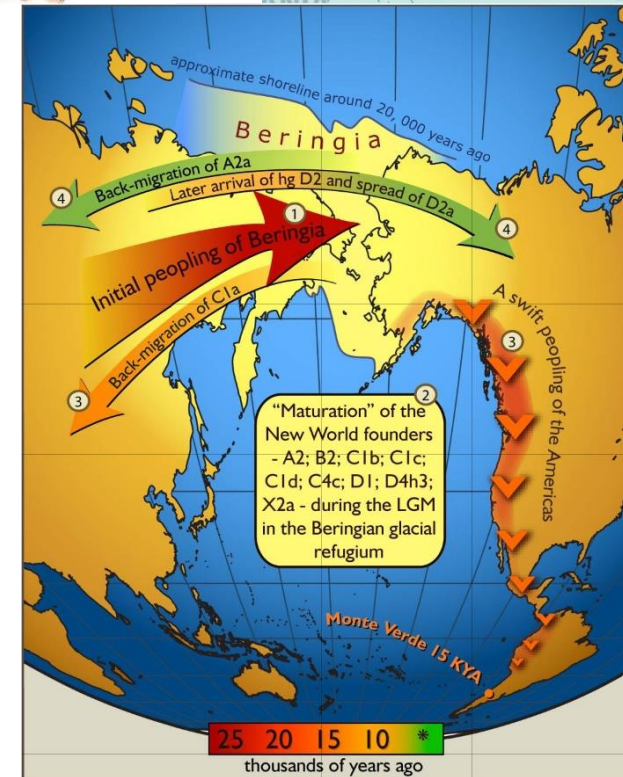
1. Neolithic expansion from the 'Near East'
2. Chalcolithic population movements associated with Indo-European expansion



2. Americas



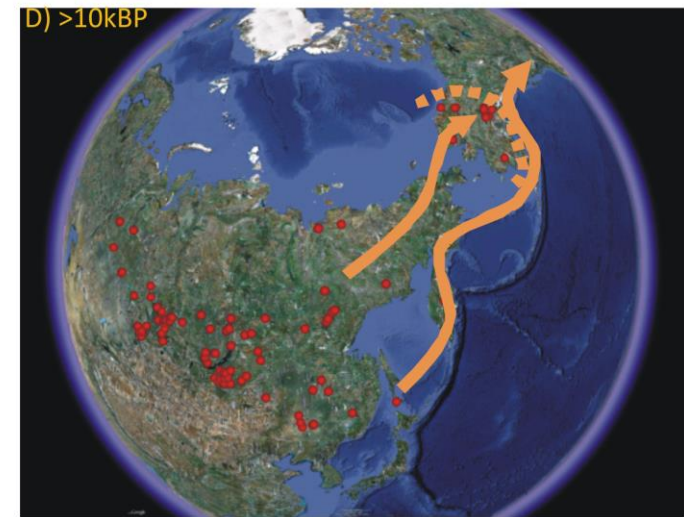
- ❑ Paleo-Indians originated from Central Asia, crossing the Beringia land bridge between eastern Siberia & present-day Alaska
- ❑ Details of Paleo-Indian migration to and throughout the American continent, including the dates and the routes traveled, are subject to ongoing research and discussion



2. Americas

Conventional estimates have it that humans reached North America at some point between 15,000 and 20,000 years ago.

1. The traditional theory is that these early migrants moved when sea levels were significantly lowered due to the Quaternary glaciation, following herds of now-extinct pleistocene megafauna along *ice-free corridors* that stretched between the Laurentide and Cordilleran ice sheets.
2. Another route proposed is that, either on foot or using primitive boats, they migrated down the Pacific coast to South America as far as Chile.




Proposed alternative timings and trajectories of colonization routes into the Americas.




2. Americas

The recent finding of indigenous Australasian genetic markers in Amazonia supports that a coastal route and subsequent isolation did occur with some migrants


A herd of horses of various colors (black, brown, and tan) is running across a grassy field. The horses are in motion, and the background shows a hazy, open landscape. A white horizontal line is positioned above the text.

Humans Used Northern Migration Routes to Reach Eastern Asia



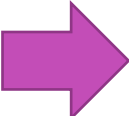
New article suggests wetter climates may have allowed Homo sapiens to expand across the deserts of Central Asia by 50-30,000 years ago

- ❑ Northern & Central Asia neglected in studies of early human migration
- ❑ deserts & mountains considered uncompromising barriers



However, a new study argues that *humans may have moved through these extreme settings in the past under wetter conditions.*

We must now reconsider where we look for the:

- 
- earliest traces of our species in northern Asia,
 - zones of potential interaction with other hominins (Neanderthals & Denisovans)

Humans Used Northern Migration Routes to Reach Eastern Asia

- Increasing interest in discovering the environments facing *Homo sapiens*, as it moved into new parts of Eurasia in the Late Pleistocene (125,000-12,000 years ago)

focused on a 'coastal' route from Africa to Australia, skirting around India & Southeast Asia

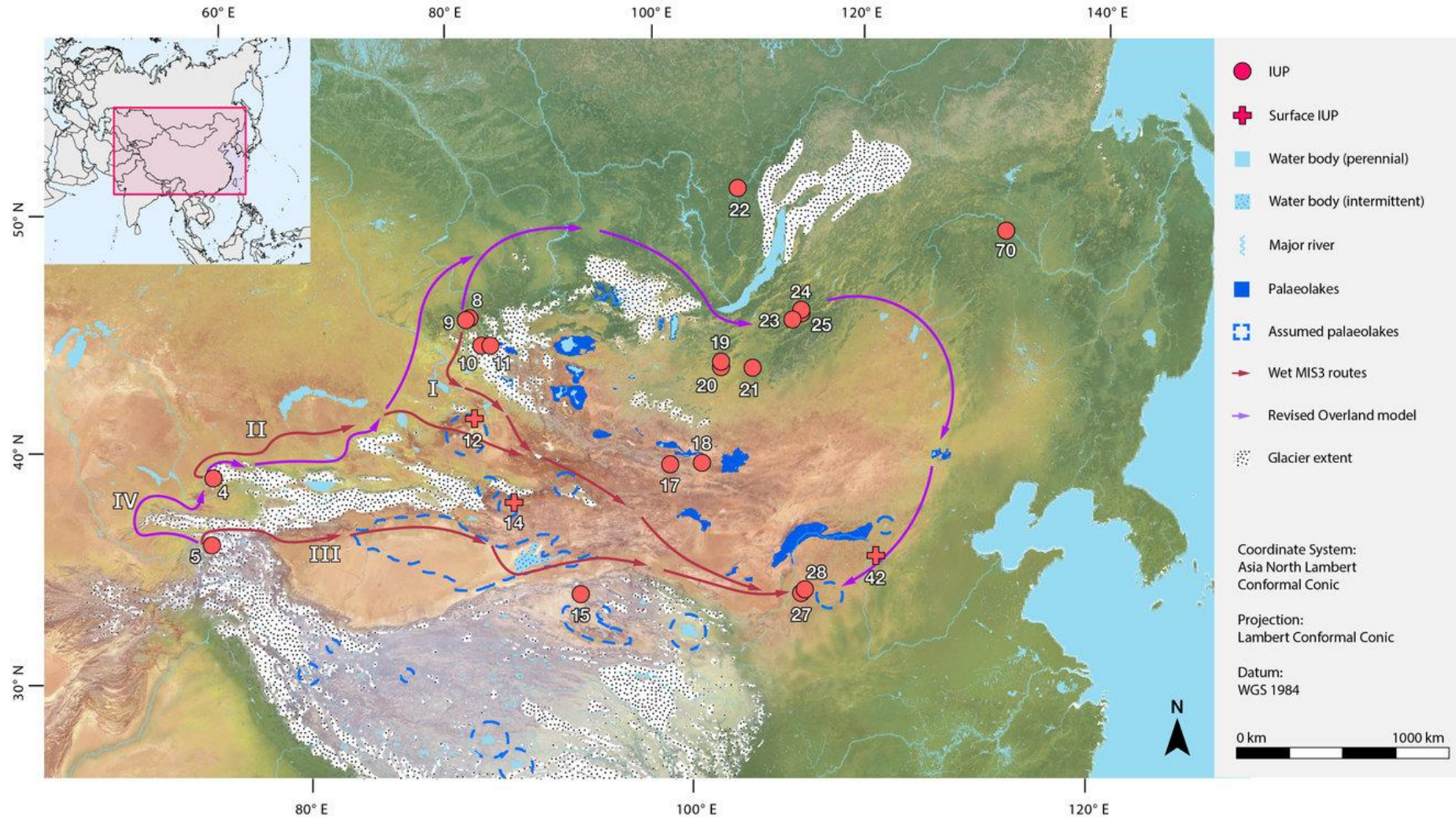
Much attention has focused on a **'southern' route around the Indian Ocean**

Northern & Central Asia being somewhat neglected

a route into Siberia has been preferred, avoiding deserts such as the Gobi

- However, a new *PLOS ONE* argues that climate change may have made this a particularly dynamic region of hominin dispersal, interaction, and adaptation, and a crucial corridor for movement

Yet over the past ten years, a variety of evidence has emerged that has suggested that areas considered inhospitable today might not have always been so in the past.



Illustrated dispersal routes from the results of the Least Cost Path analysis. The three routes from the "wet" simulations and the single route from the "dry" simulation are presented together in conjunction with palaeoclimatic extents (glaciers and palaeolakes). © Nils Vanwezer and Hans Sell



- ❑ Previous work in Saudi Arabia, and Thar Desert of India, has been key in highlighting that survey work in previously neglected regions can yield new insights into human routes and adaptations
- ❑ Indeed, if *Homo sapiens* could cross what is now the Arabian Deserts then what would have stopped it crossing other currently arid regions (the Gobi Desert, the Junggar Basin, & the Taklamakan Desert) at different points in the past?

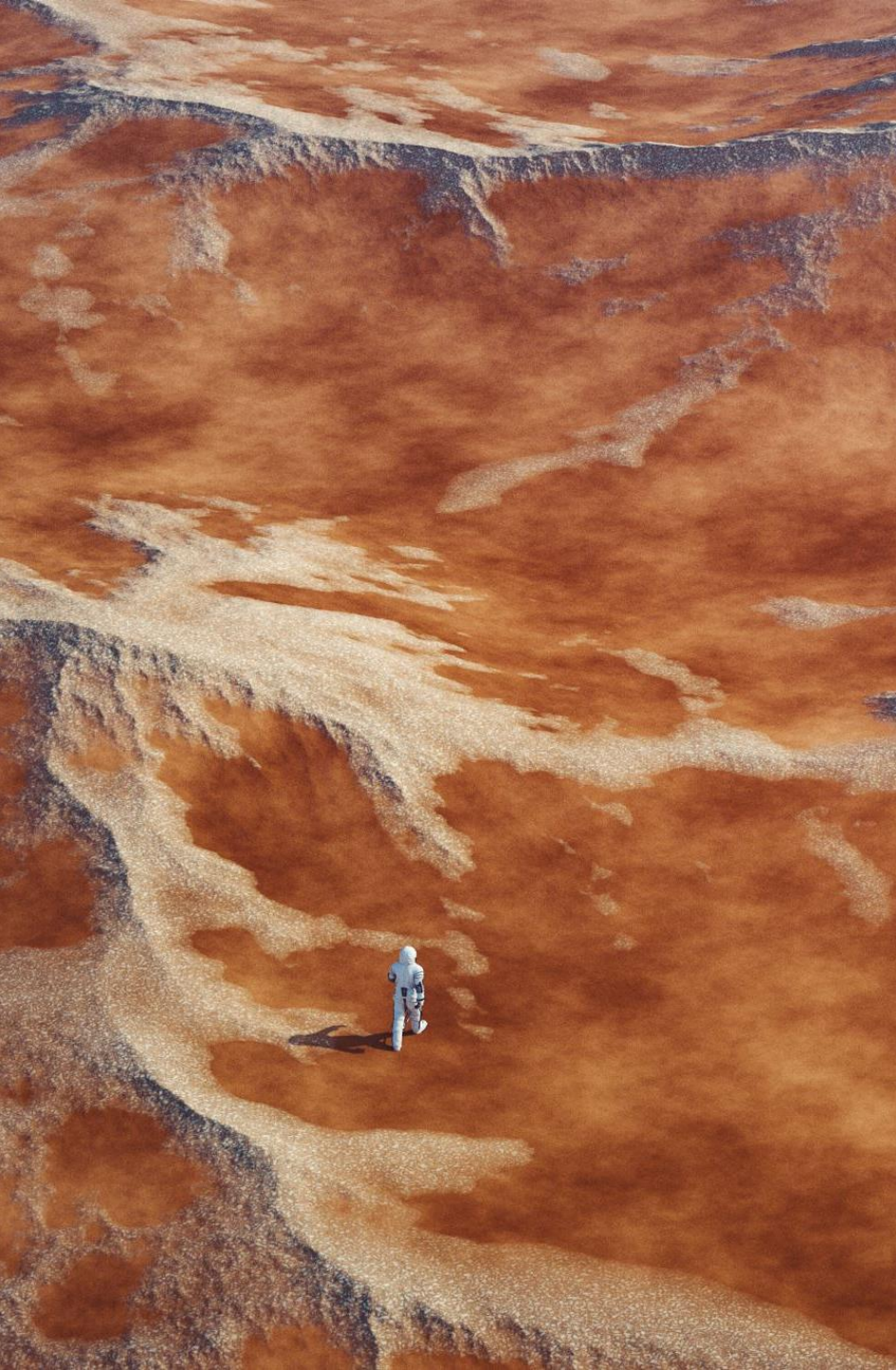
- Similarly, the Altai Mountains, the Tien Shan & the Tibetan Plateau represent a potentially new high altitude window into human evolution, especially given the recent Denisovan findings from Denisova Cave in Russia & at the Baishiya Karst Cave in China.





Nevertheless

1. traditional research areas
 2. a density of archaeological sites
 3. assumptions about the persistence of environmental 'extremes' in the past
- to focus on Siberia, rather than the potential for interior routes of human movement across northern Asia
-



A “Green Gobi”?

Palaeoclimatic research in Central Asia has increasingly accumulated evidence of past lake extents, past records of changing precipitation amounts, and changing glacial extents in mountain regions



suggest that environments could have varied dramatically in this part of the world over the course of the Pleistocene.

However,

1. the dating of many of these environmental transitions remained broad in scale,
2. these records have not yet been incorporated into archaeological discussions of human arrival in northern and Central Asia

A "Green Gobi"?

"We factored in climate records and geographical features into GIS models for glacials & interstadials to test whether the direction of past human movement would vary, based on the presence of these environmental barriers,"

"We found that while during 'glacial' conditions humans would indeed likely have been forced to travel via a northern arc through southern Siberia, during wetter conditions a number of alternative pathways would have been possible, including across a 'green' Gobi Desert,"

"Comparisons with the available palaeoenvironmental records confirm that local and regional conditions would have been very different in these parts of Asia in the past, making these 'route' models a definite possibility for human movement."





Where did you come from?

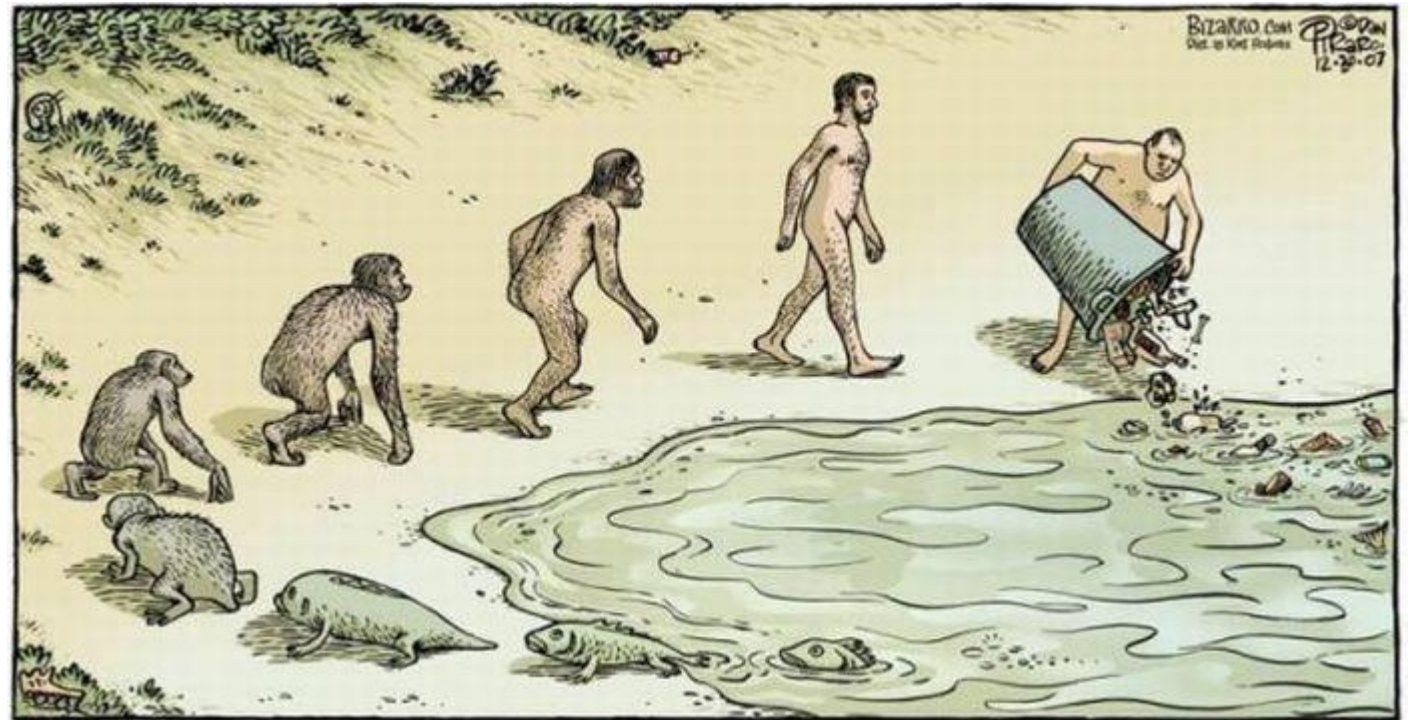
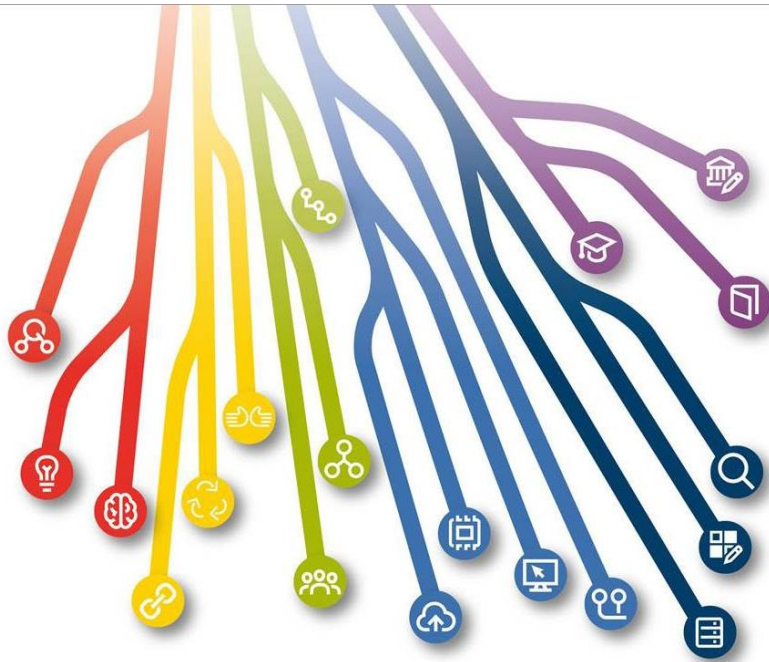
these routes are not 'real', definite pathways of Pleistocene human movement.

"Given what we are increasingly discovering about the flexibility of our species, it would be of no surprise if we were to find early Homo sapiens in the middle of modern deserts or mountainous glacial sheets."

Where did you go?

"These models will stimulate new survey and fieldwork in previously forgotten regions of northern and Central Asia,"

"Our next task is to undertake this work, which we will be doing in the next few years with an aim to test these new potential models of human arrival in these parts of Asia."



Thank you/Děkuji/Merci/ شكراً

