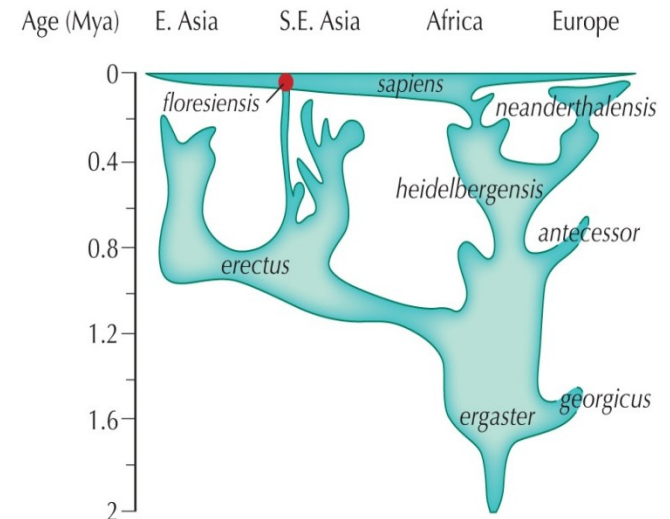
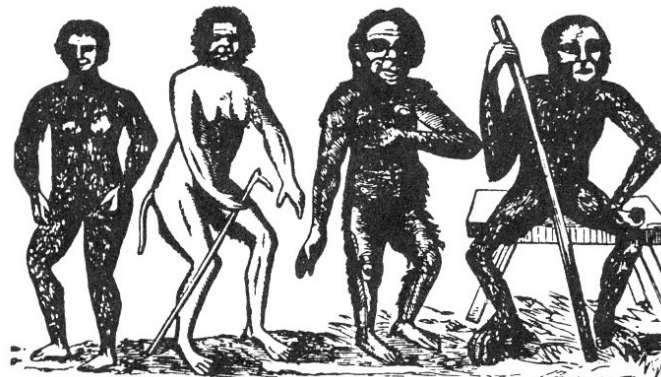
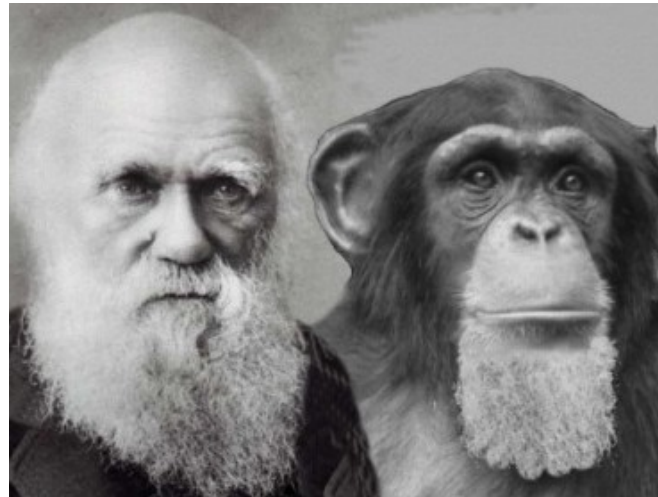
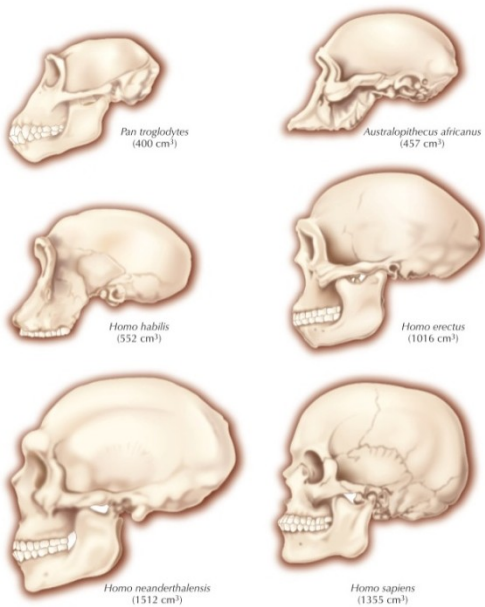
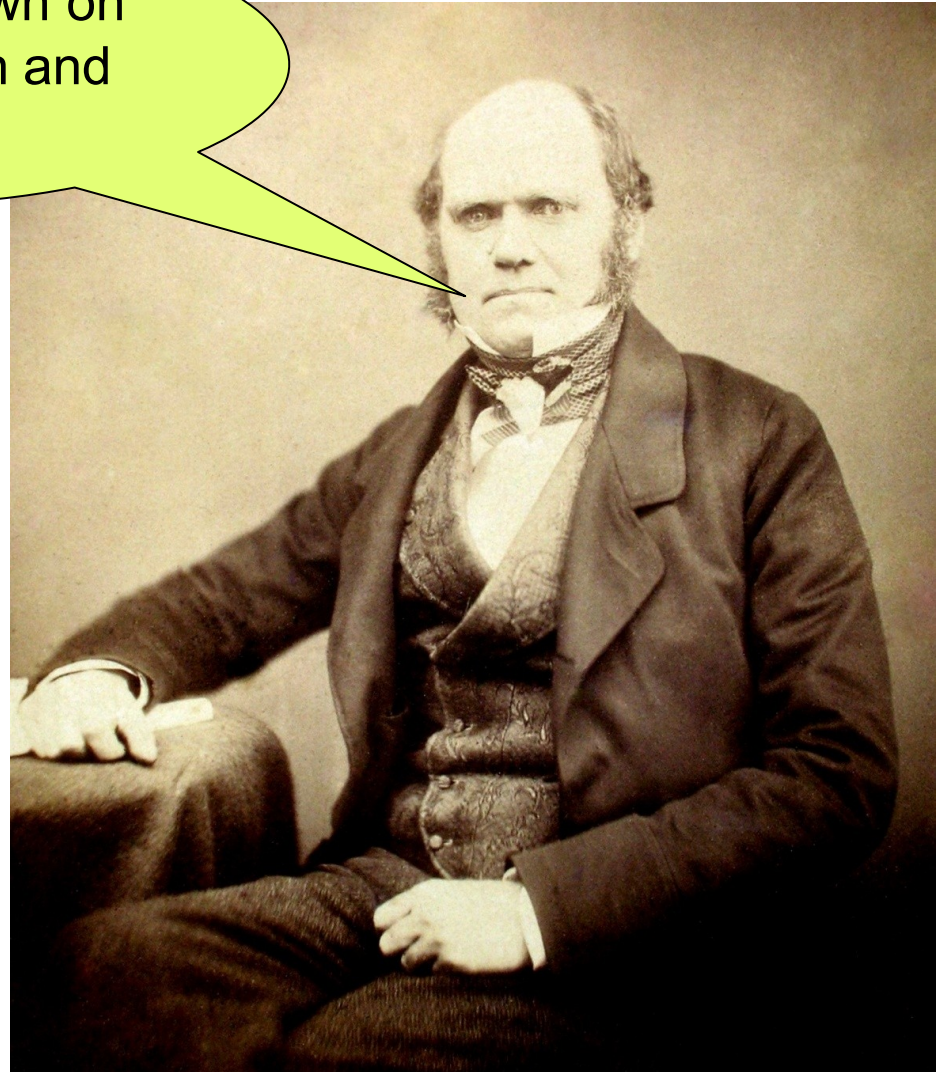
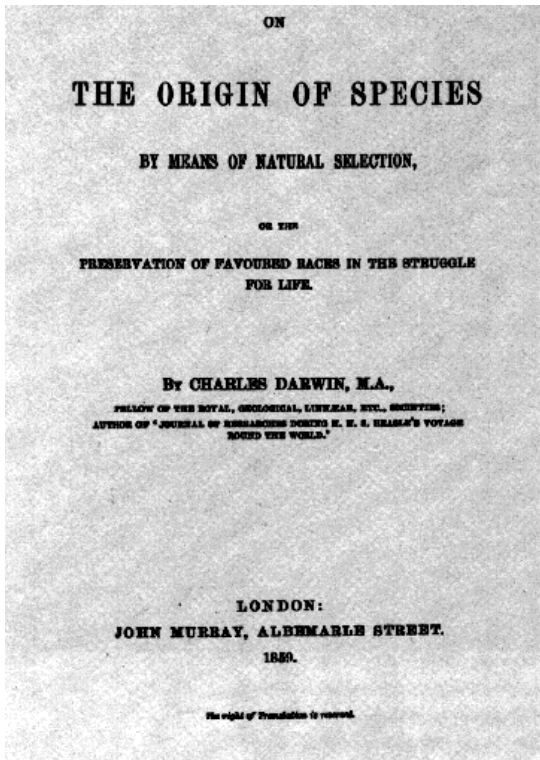
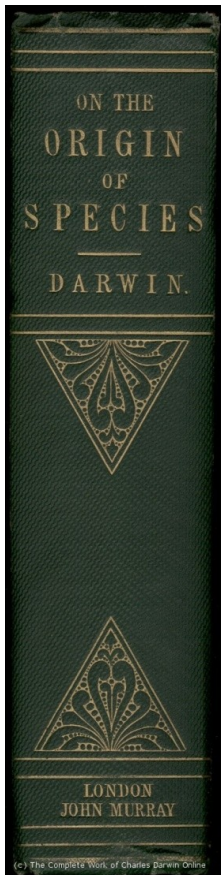


# EVOLUCE ČLOVĚKA

## KULTURNÍ EVOLUCE



Light will be thrown on  
the origin of man and  
his history.

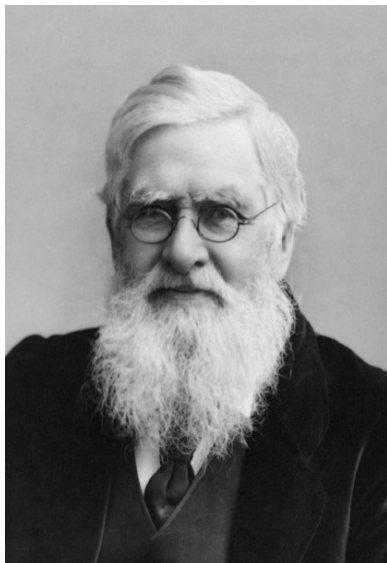




T. H. Huxley (1863):

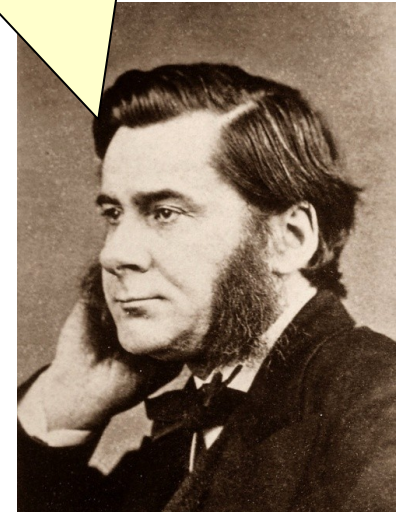
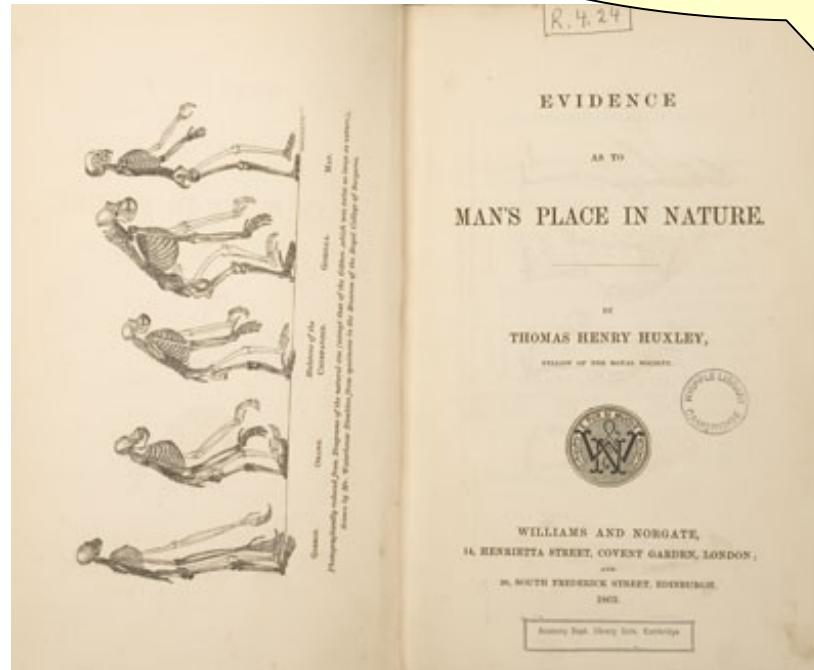
*Evidence as to Man's place in Nature*  
(*Důkazy o místě člověka v přírodě*)

Člověk se ve všech  
částech svého těla odlišuje  
od lidoopů méně než lidoopi  
od nižších primátů.

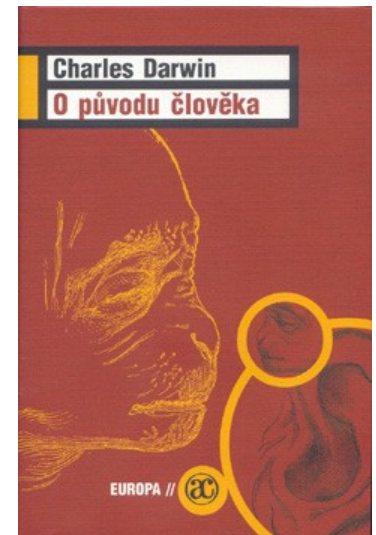
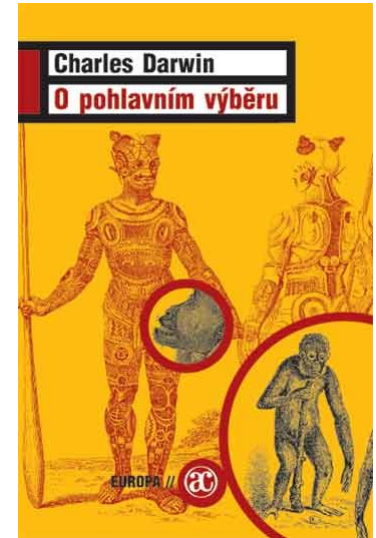
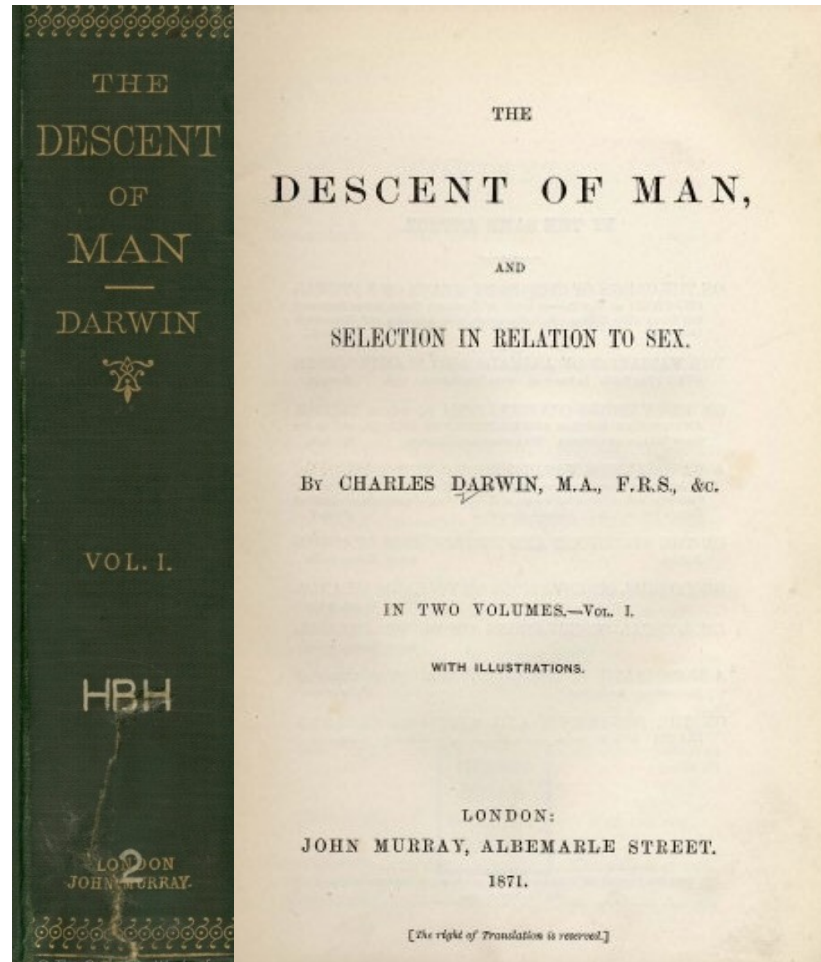
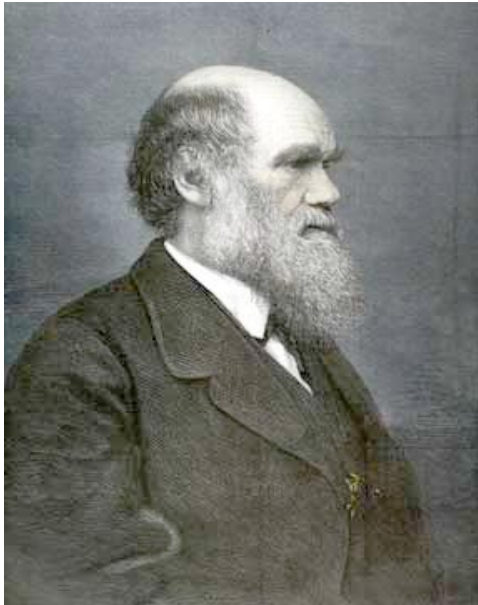


A. R. Wallace (1864):

*The origin of human races and the antiquity of Man deduced from the theory of 'Natural Selection'* (*Původ lidských ras a starobylost člověka vyvozená z teorie přírodního výběru*)

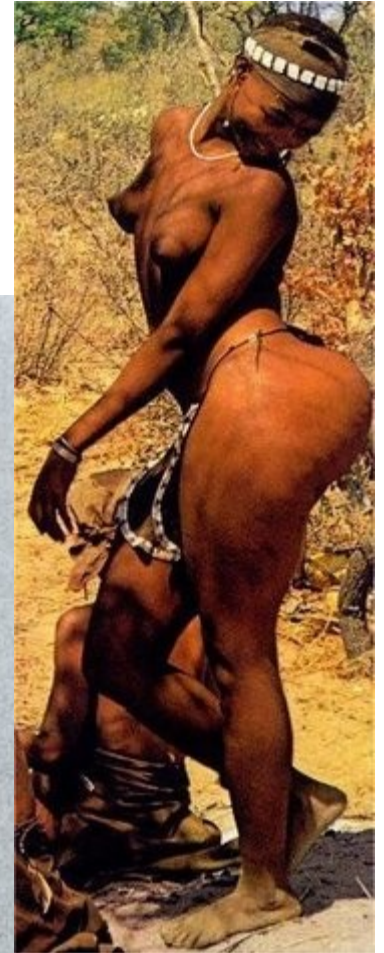
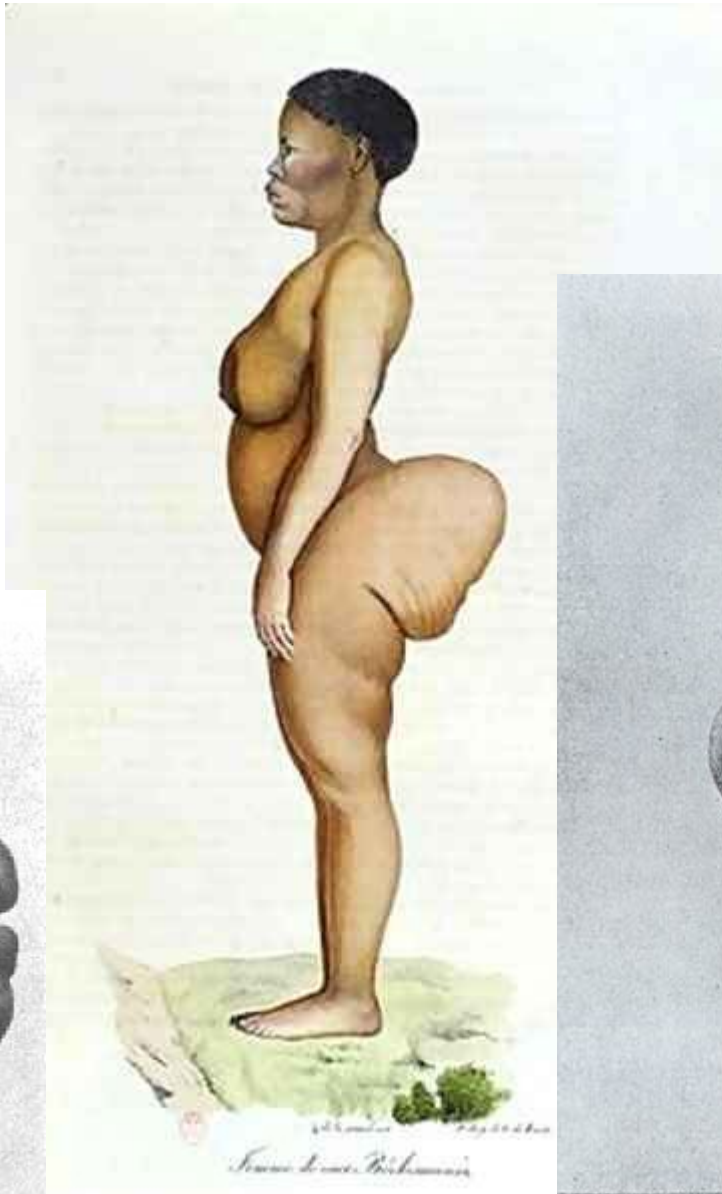


1871: *The descent of man, and selection in relation to sex* (*Původ člověka a pohlavní výběr*)



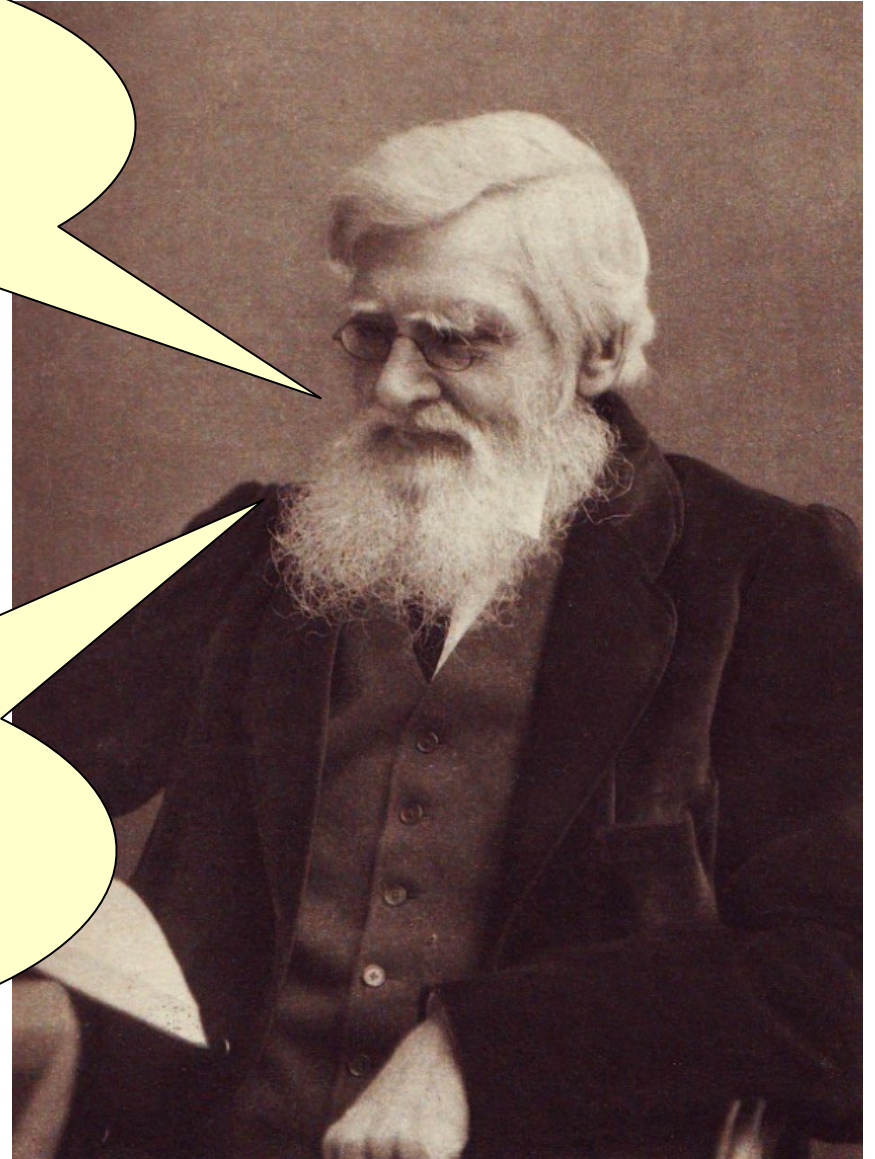


# Khoi San

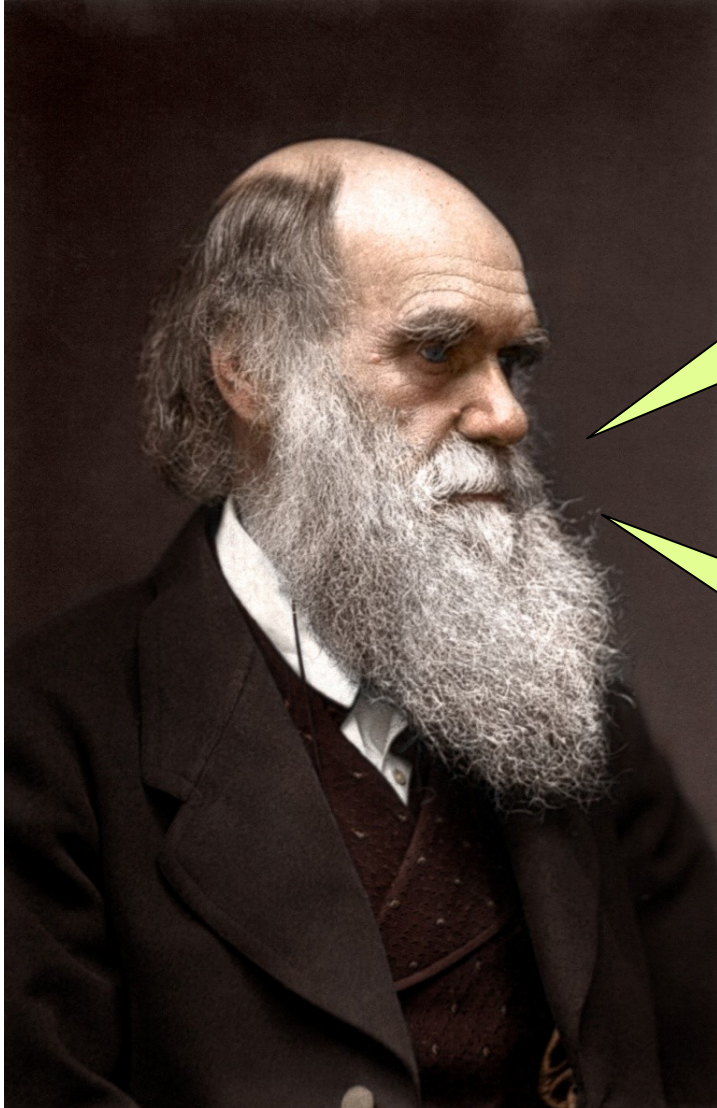


Mezera mezi lidoppy a  
člověkem je příliš velká,  
„divoši“ ji ani zdaleka  
nevyplňují.

Selekce nemůže vysvětlit  
smysl pro humor, důvtip,  
nadání pro matematiku,  
filozofii, umění nebo hudbu.







Rozdíl mezi živočichy a člověkem je pouze kvantitativní. Existence morálky, soucitu, smyslu pro krásu u zvířat.

U zvířat existuje chování analogické lásce, laskavosti, náboženství nebo altruismu.

neandertálci: 1829 Engis (Liège), 1848 Gibraltar, 1856 Neandertal

hledání chybějícího článku:

1891 Eugène Dubois: *Pithecanthropus erectus*, Trinil, Jáva

1924 Raymond Dart: *Australopithecus africanus*, Taung, J Afrika





neandertálci: 1829 Engis (Liège), 1848 Gibraltar, 1856 Neandertal

hledání chybějícího článku:

1891 Eugène Dubois: *Pithecanthropus erectus*, Trinil, Jáva

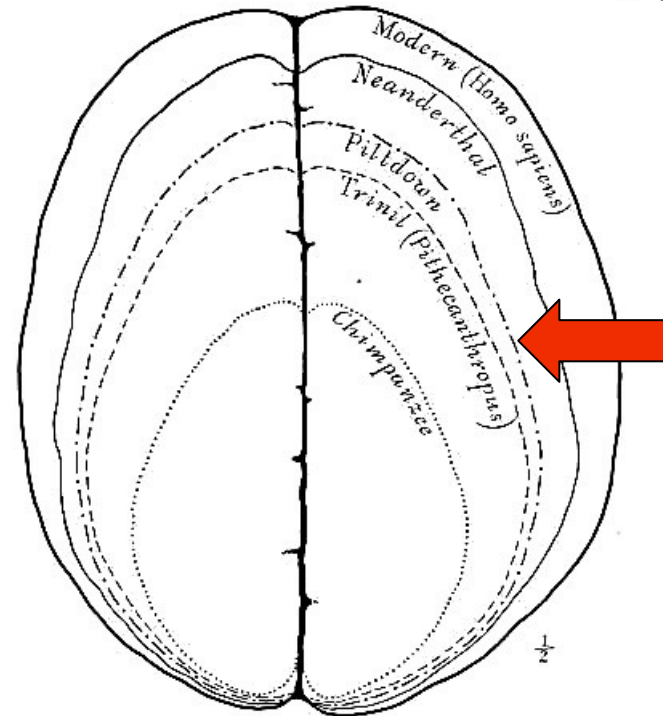
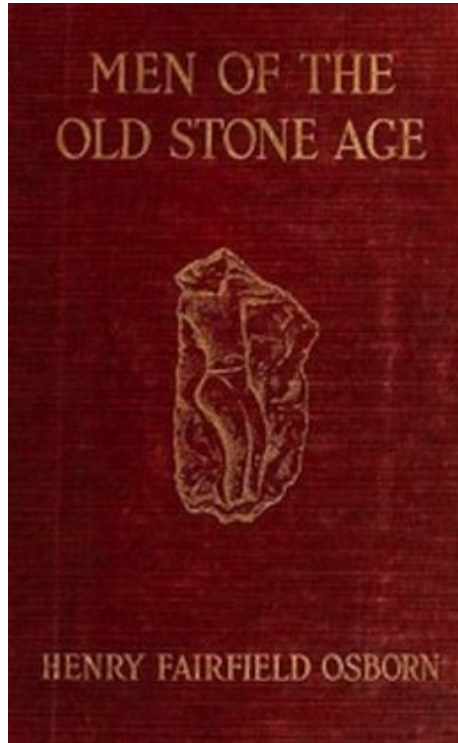
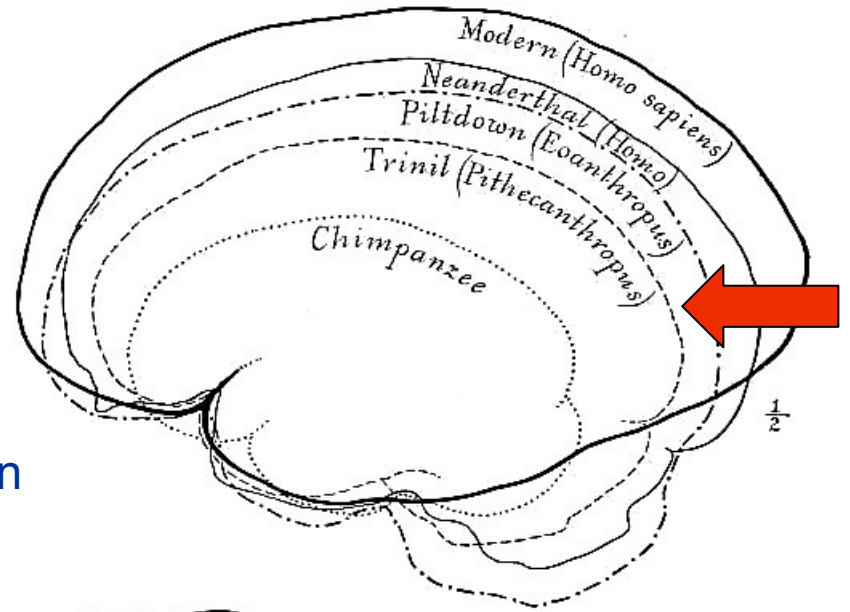
1924 Raymond Dart: *Australopithecus africanus*, Taung, J Afrika

1912: Piltdown – *Eoanthropus dawsoni* („piltdownský člověk“)

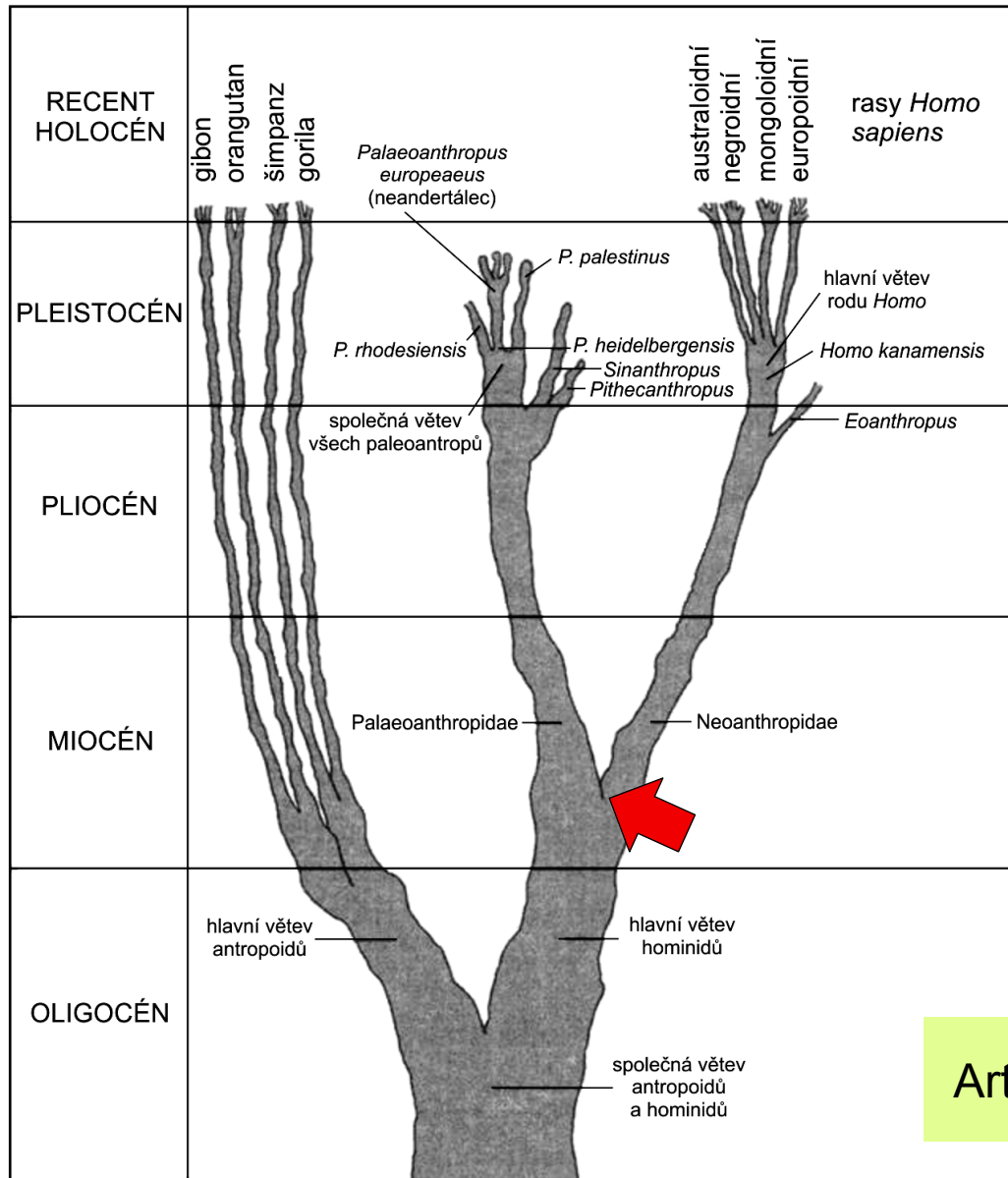




Henry Fairfield Osborn







Arthur Keith (1935)

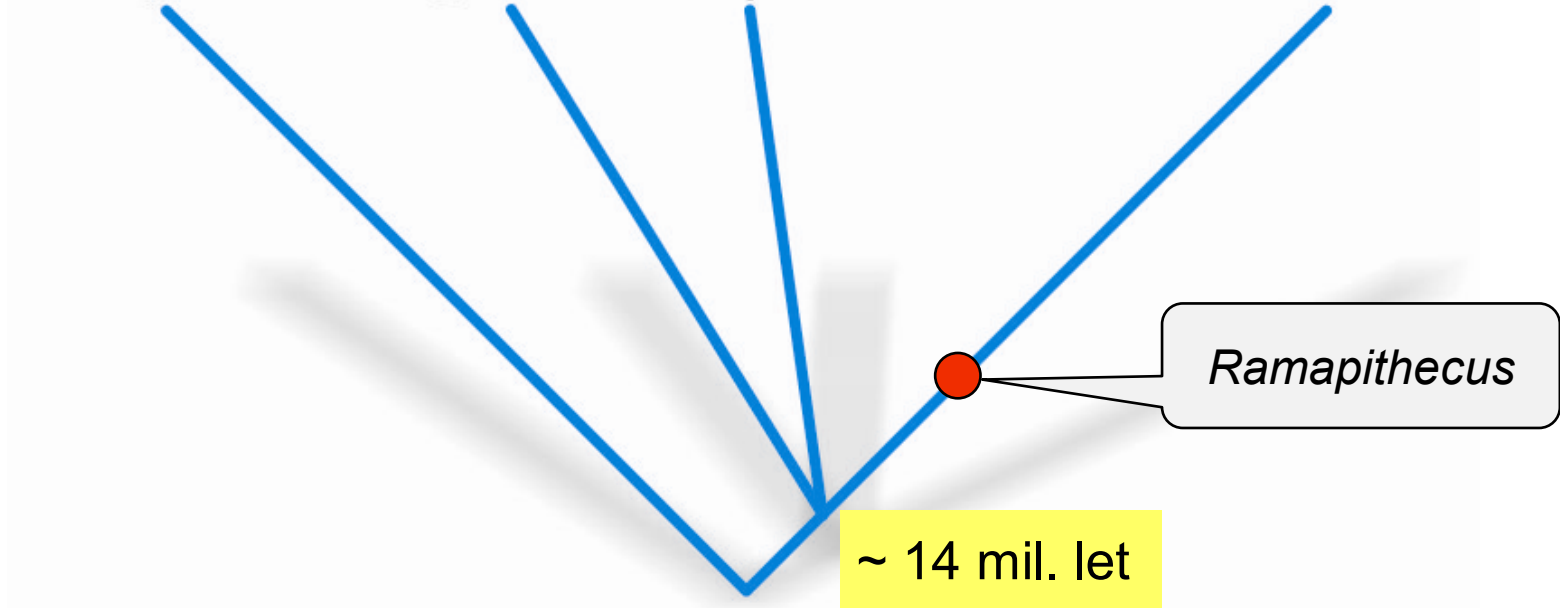
divergence člověka a ostatních fosilních homininů velmi starobylá

orangutan

gorila

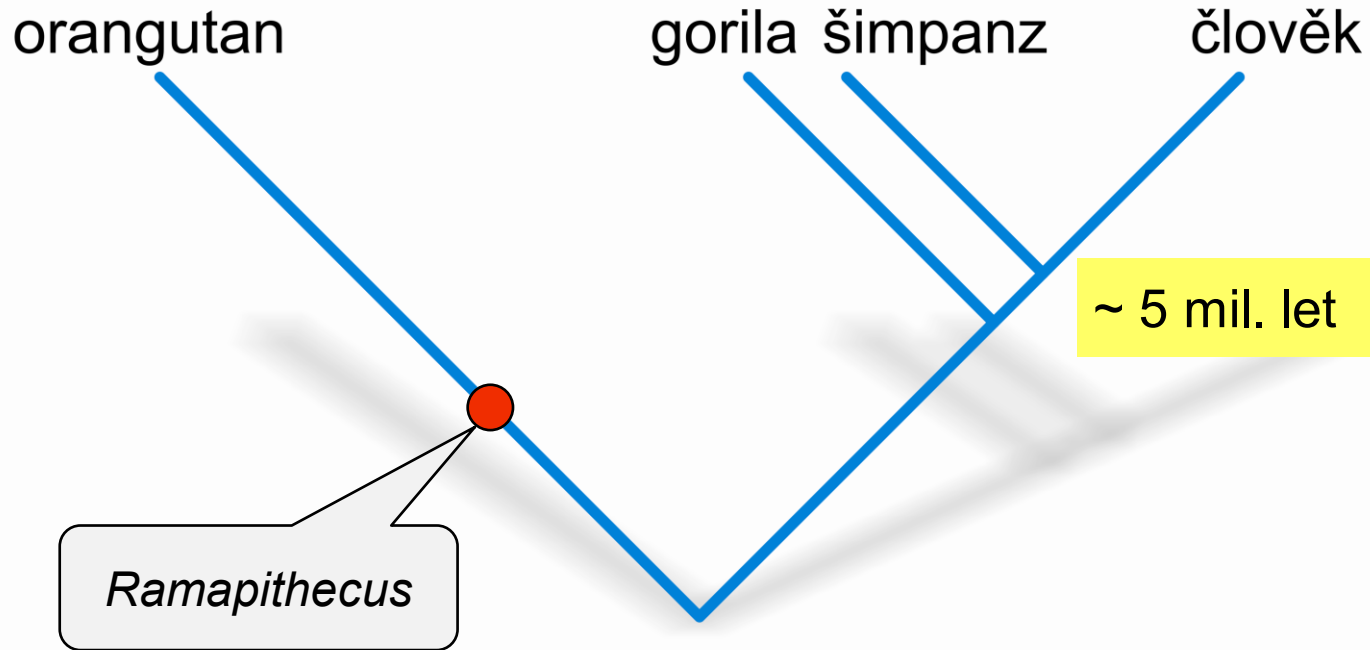
šimpanz

člověk



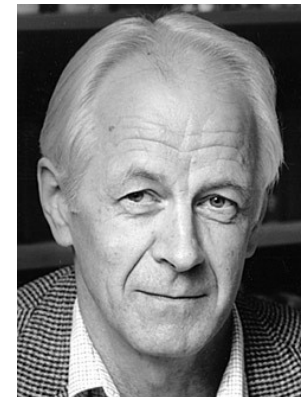
~ 14 mil. let

*Ramapithecus*

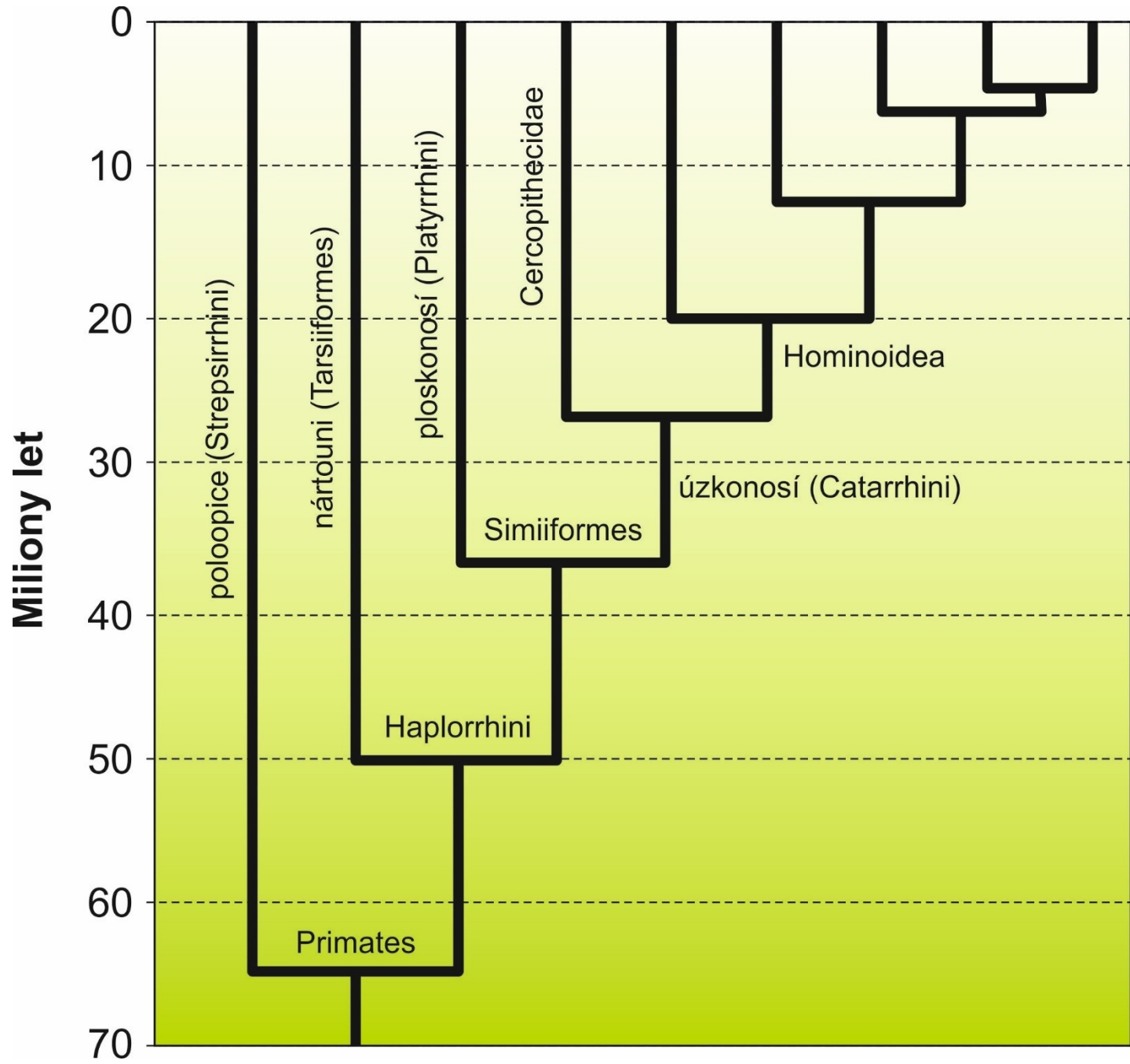


1967: Vincent Sarich, Allan C. Wilson  
 sérový albumin, imunologické distance  
 člověk-šimpanz  $\approx$  4-5 mil.

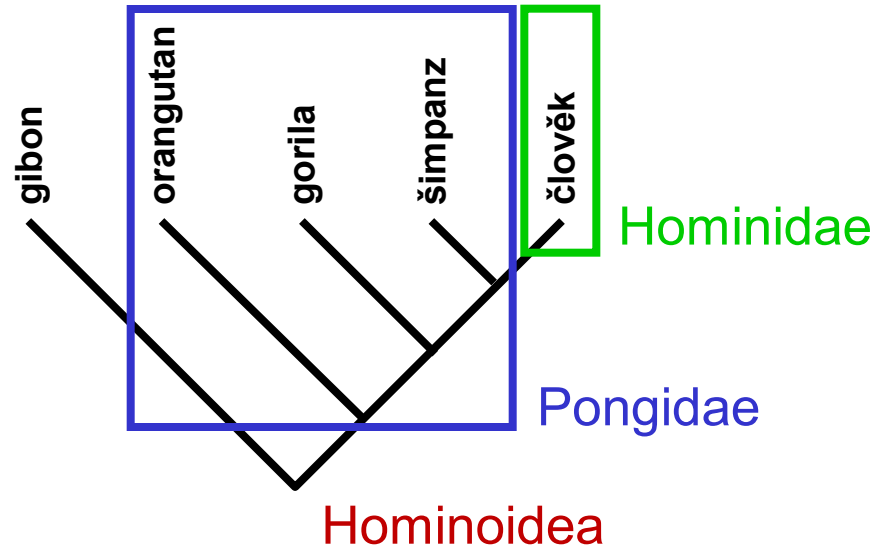
dnes: *Ramapithecus* předkem orangutana  
 člověk-šimpanz  $\approx$  7,5 M

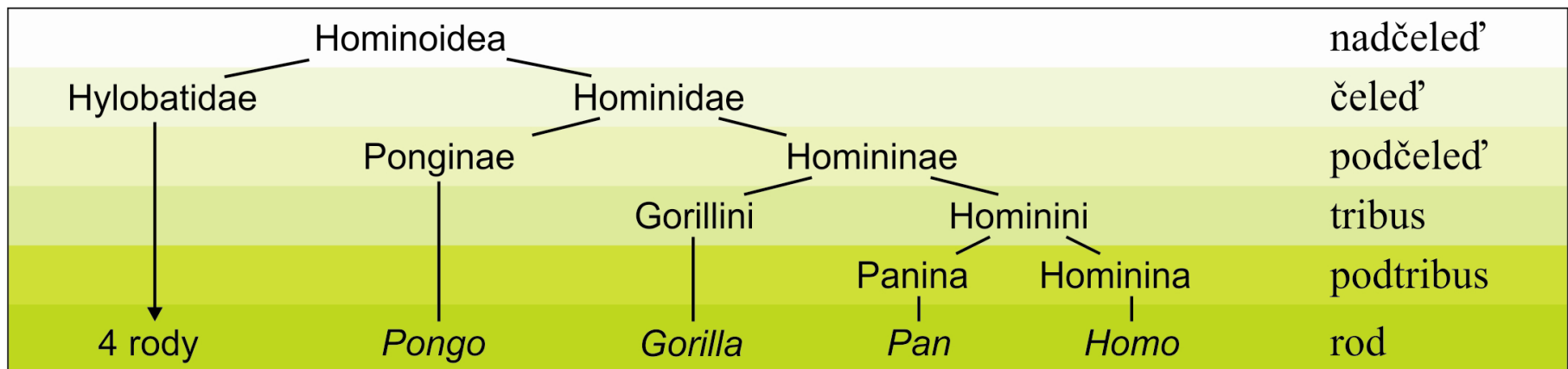
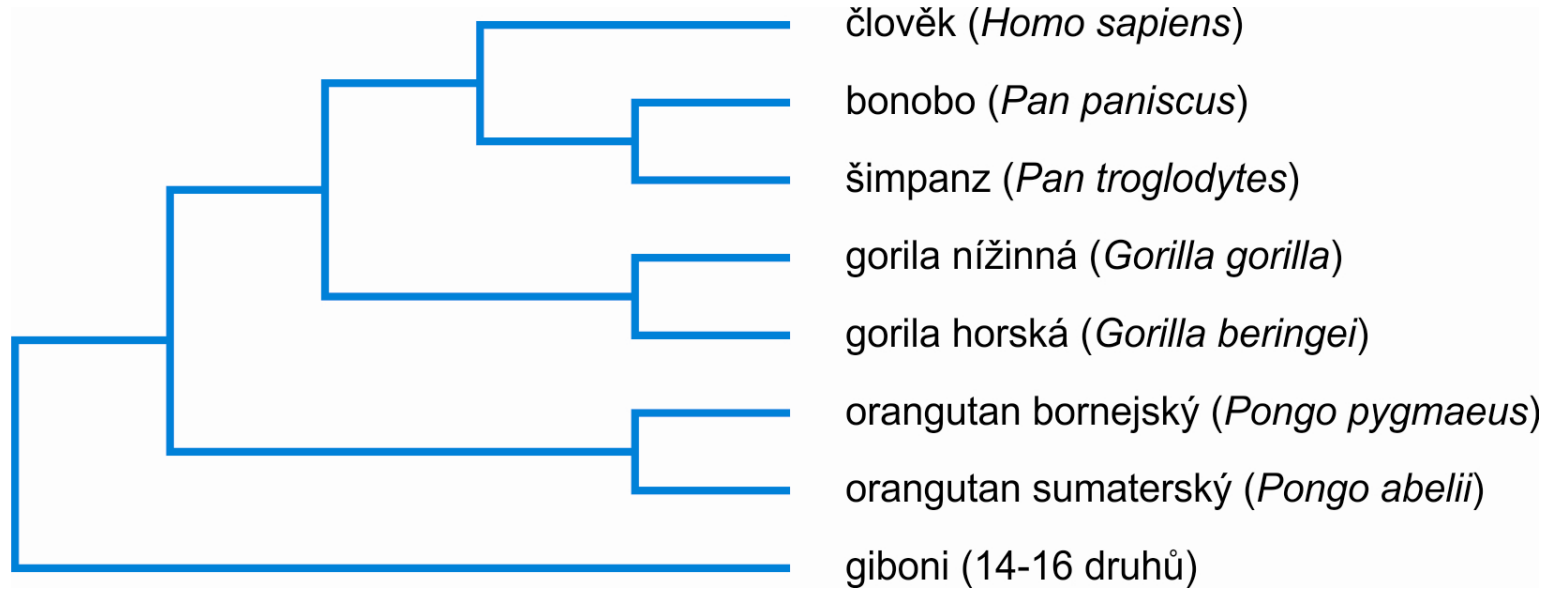






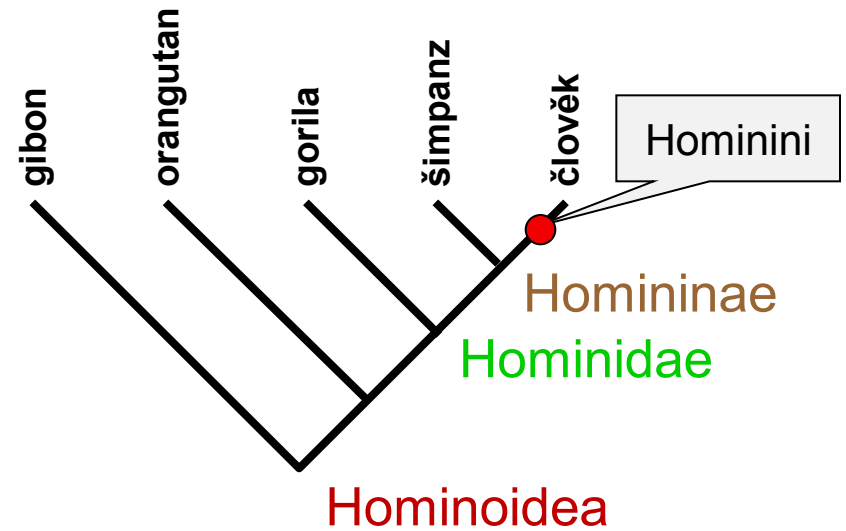
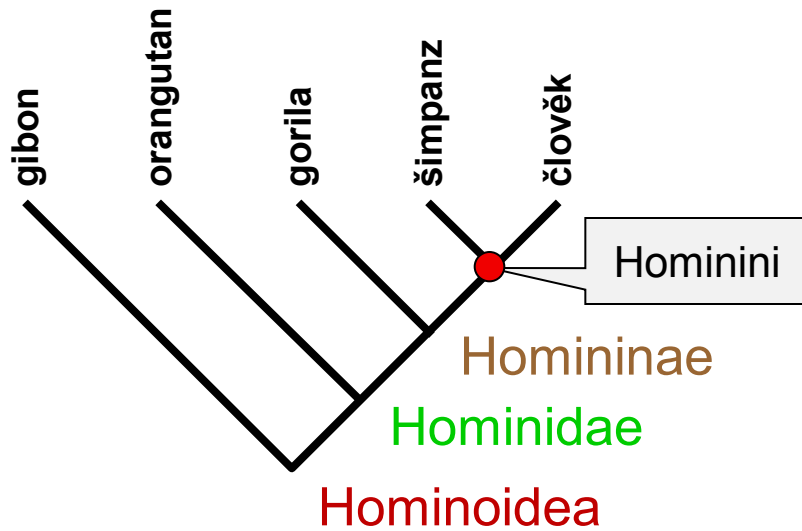
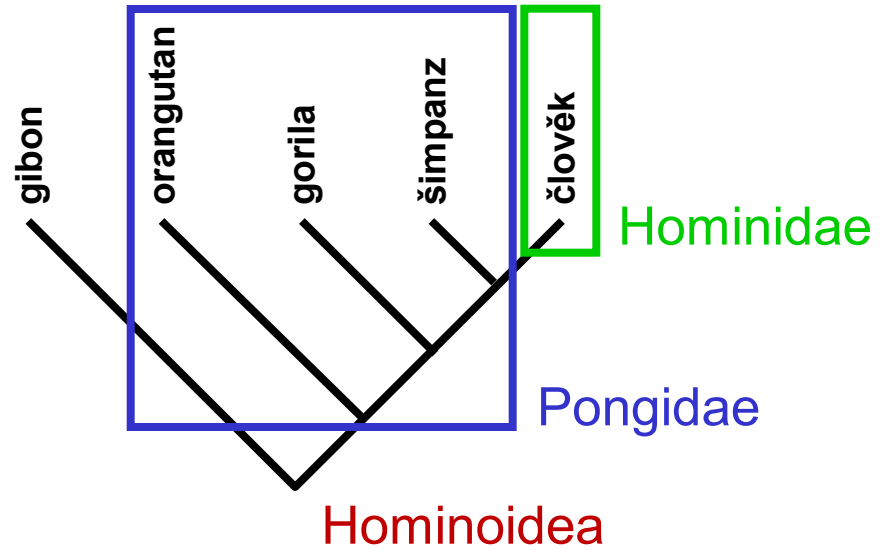
# 3 pohledy na systém lidoopů a člověka







# 3 pohledy na systém lidoopů a člověka



## Fosilní nálezy:

1924 **Raymond Dart**: Taung, J Afrika  
*A. africanus* („dítě z Taungu“)



1959 **Louis S.B. Leakey, Mary Leakey**:  
Olduvai, Tanzanie, V Afrika –  
*Australopithecus (Paranthropus) boisei*



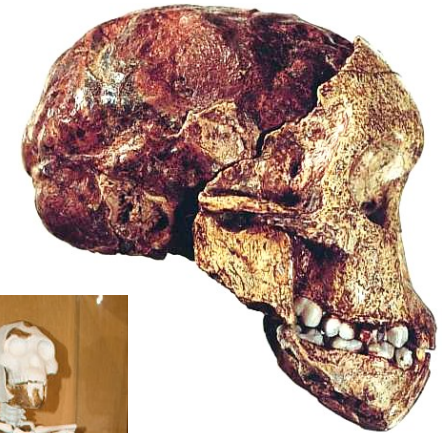
*P. boisei*

1974 **Donald Johanson**:  
Hadar, Awaš, Afarská proláklina, Etiopie  
*Australopithecus afarensis* (Lucy)



Lucy

*A. africanus*



hledání nejstaršího předka:

1994: *Ardipithecus ramidus* („Ardi“), Awaš, Etiopie – 4,4 mil. (2004: *Ar. kadabba* – 5,6 mil.)

2001: *Orrorin tugenensis*, Tugen Hills, Keňa – 6 mil.

2002: *Sahelanthropus tchadensis* („Toumai“), J Čad – 6-7 mil.



*Ar. ramidus*



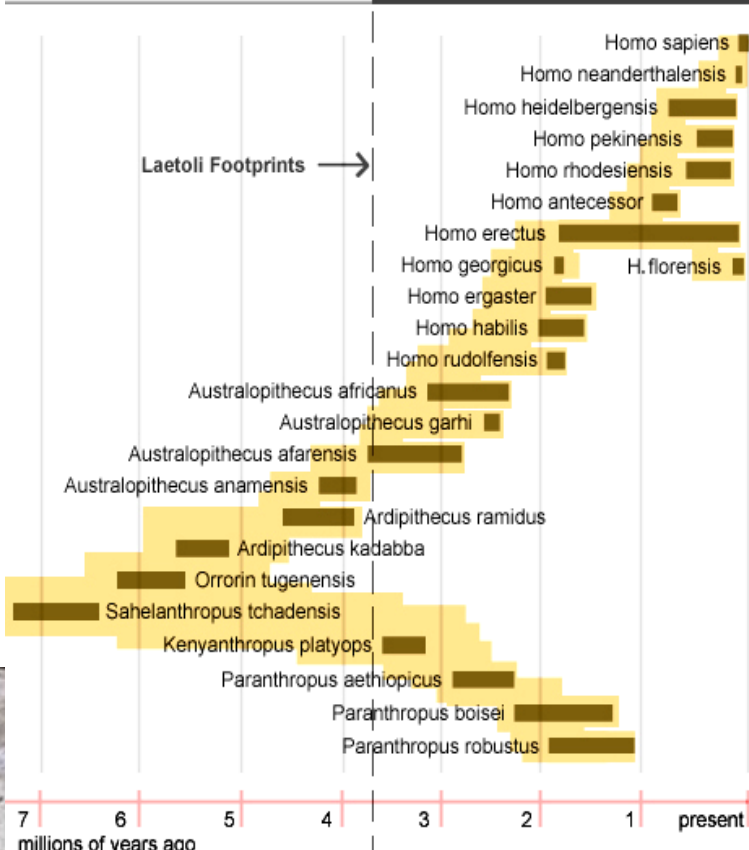
*Orrorin tugenensis*



*Sahelanthropus tchadensis*



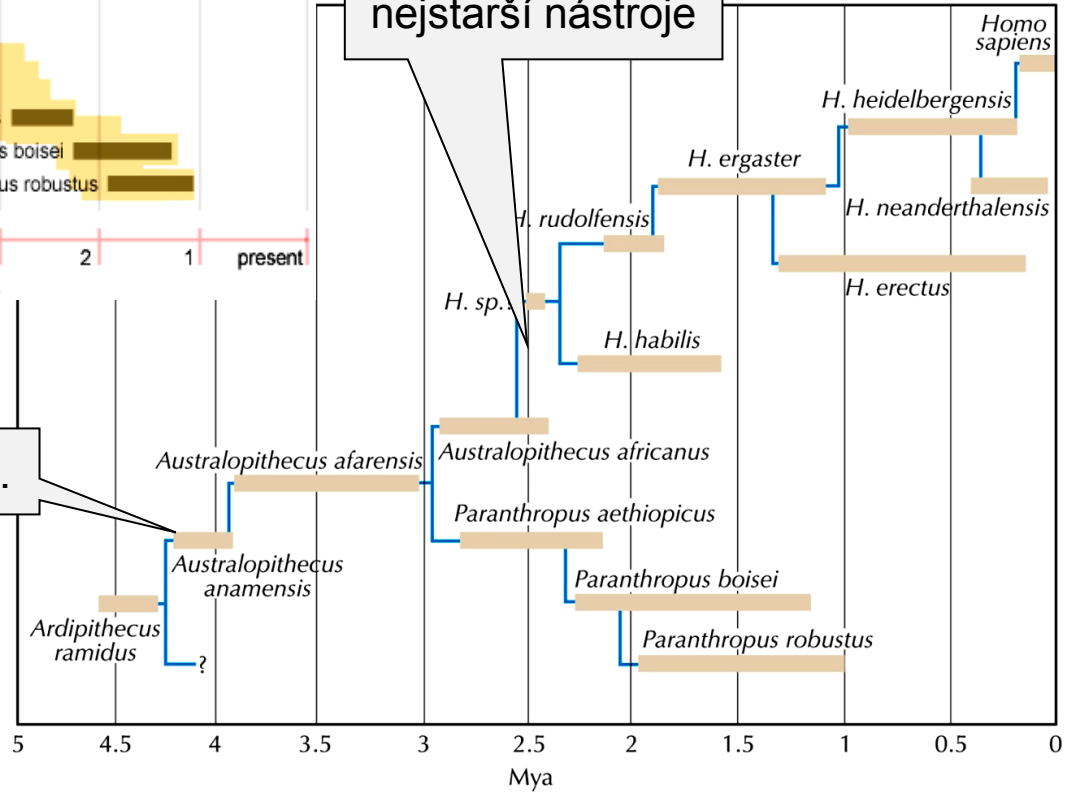
Possible Bipedal Locomotion      Bipedal Locomotion



stopy *A. afarensis*  
Laetoli, Tanzánie, 3,6 M

2,5 mil.  
nejstarší nástroje

4,2 mil.



Mya

# Komplikace: Dmanisi

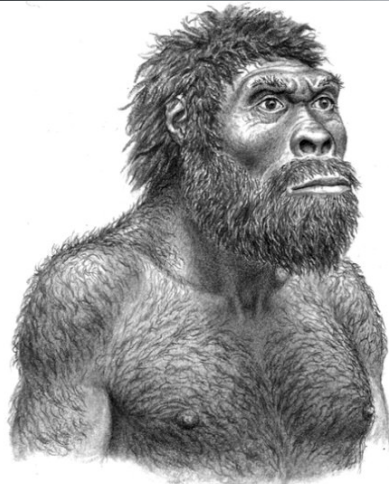
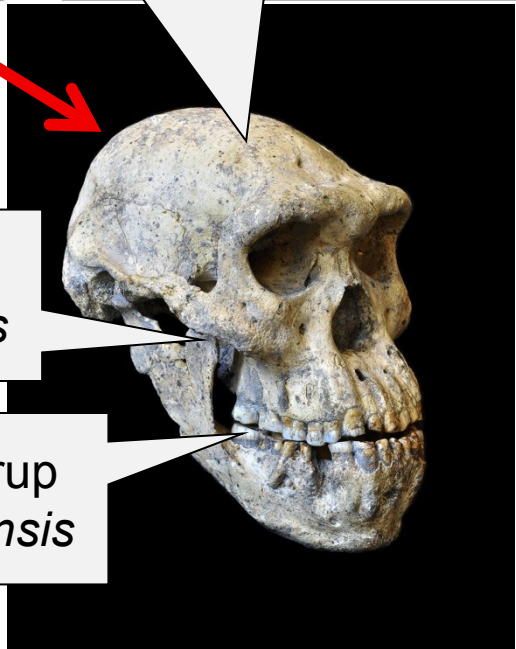
„*Homo georgicus*“  
~ 1,8 mil.  
~ raný *H. erectus*  
velká variabilita  
jedinec D4500



mozková 546 cm<sup>3</sup>  
~ *H. habilis*

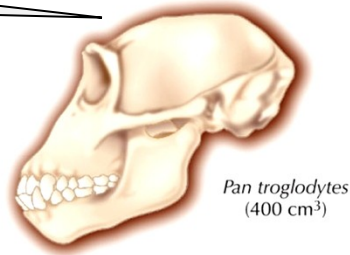
obličej  
~ *H. erectus*

masivní chrup  
~ *H. rudolfensis*

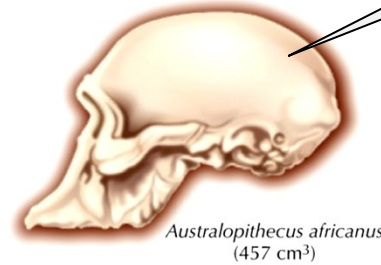


# Růst velikosti mozkovny:

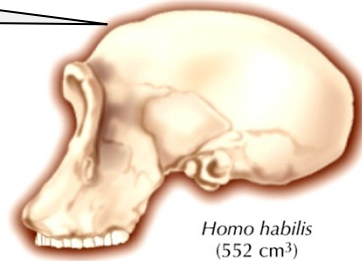
400 cm<sup>3</sup>



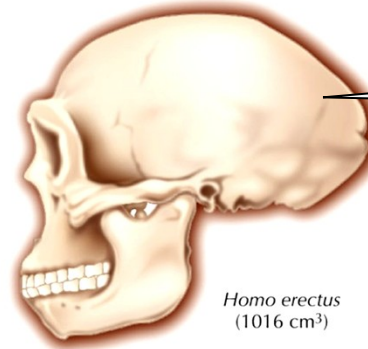
457 cm<sup>3</sup>



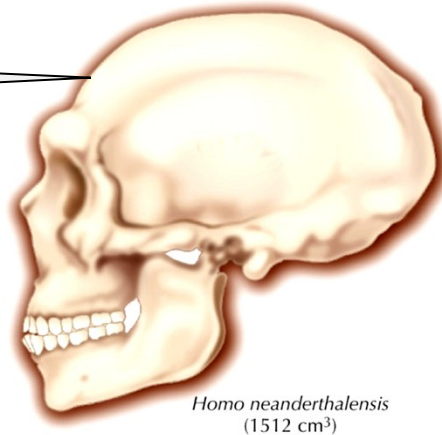
552 cm<sup>3</sup>



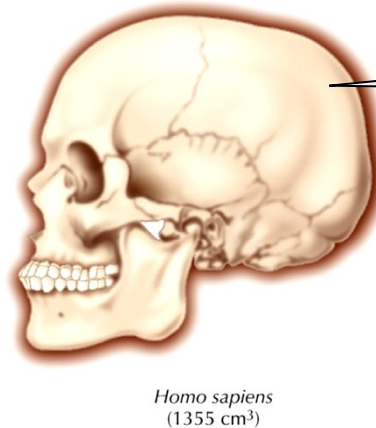
1016 cm<sup>3</sup>



1512 cm<sup>3</sup>

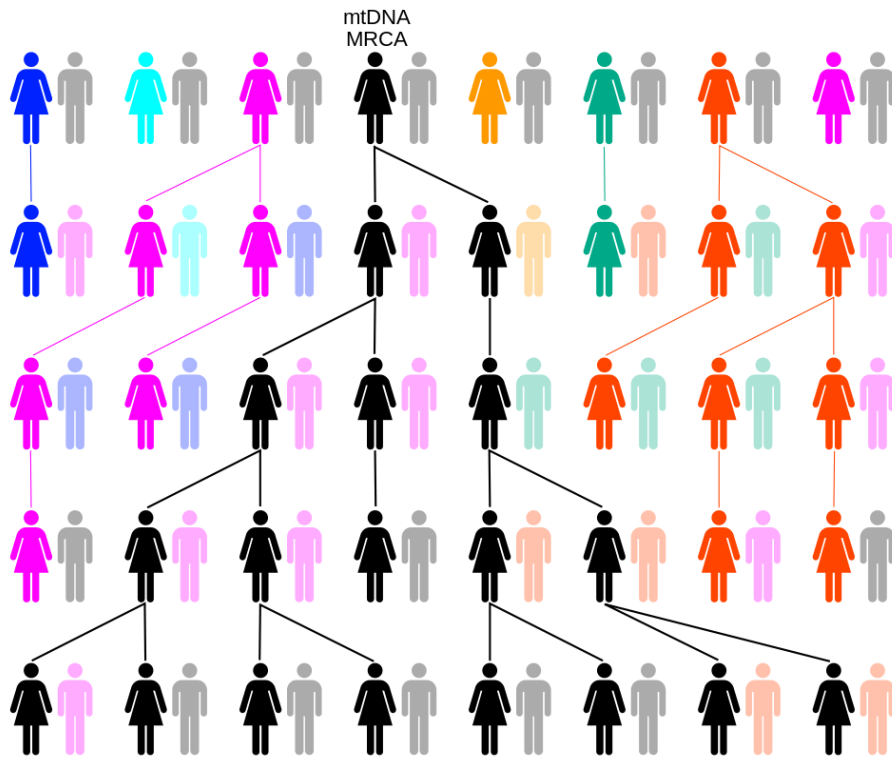


1355 cm<sup>3</sup>

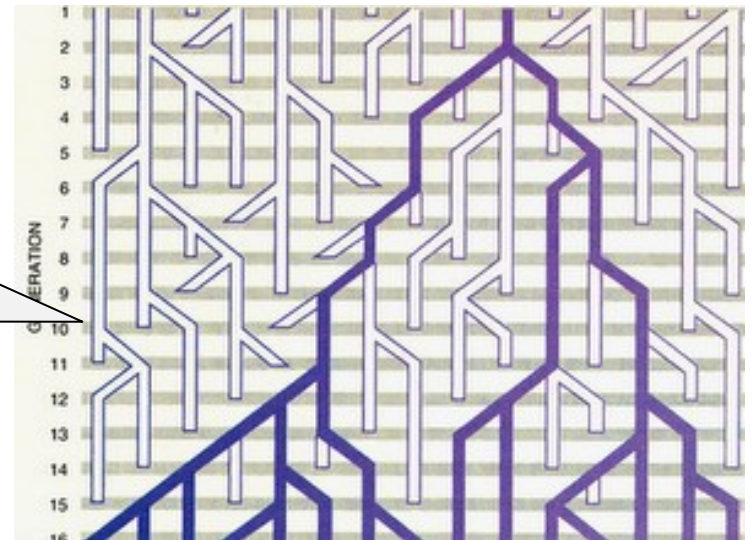




# 1987: Rebecca Cann, Mark Stoneking, A. C. Wilson



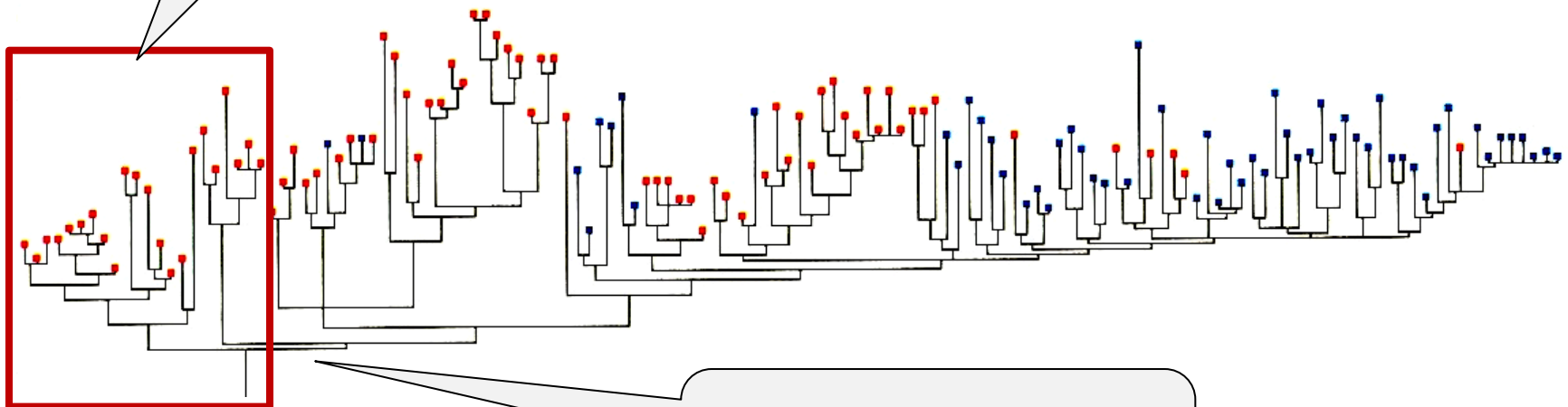
náhodné třídění  
mitochondriálních  
linií



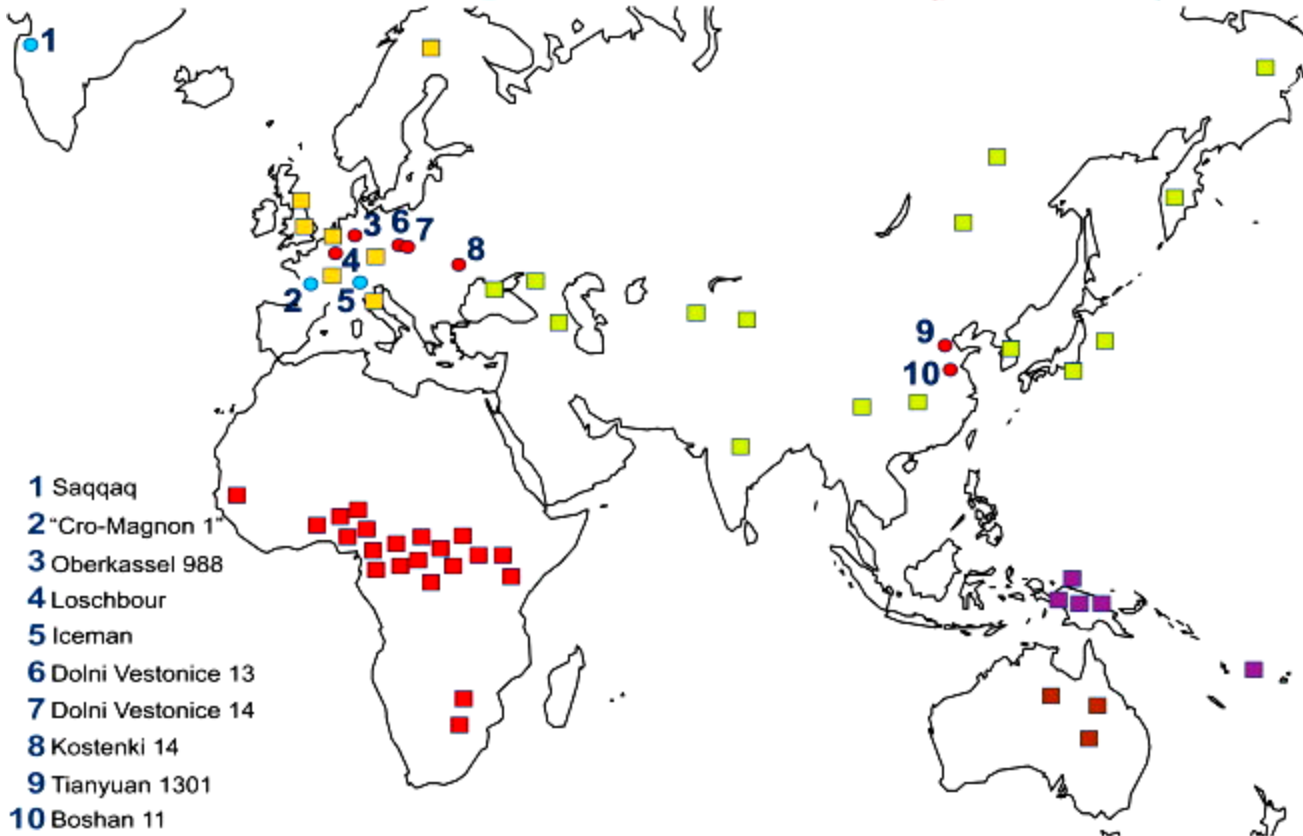
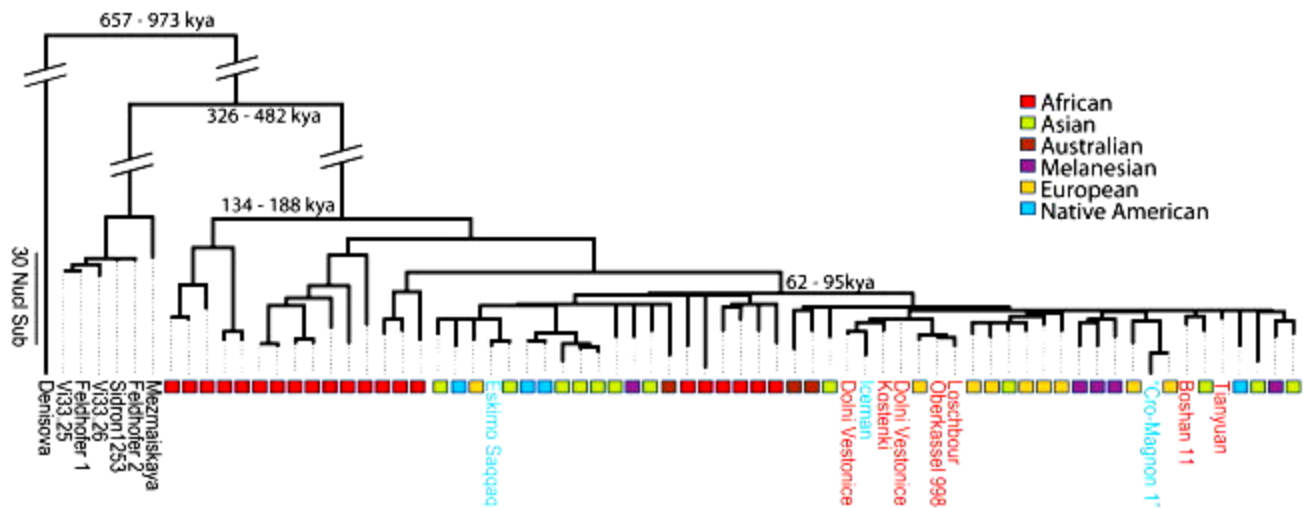
1987: Rebecca Cann, Mark Stoneking, A. C. Wilson

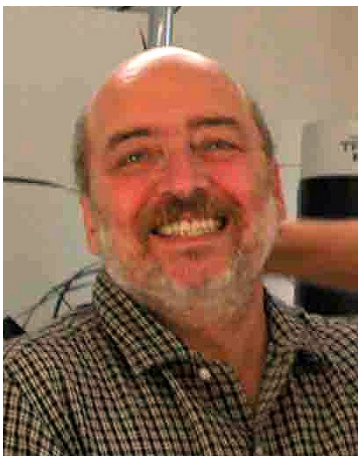


nejstarší linie mají  
africký původ



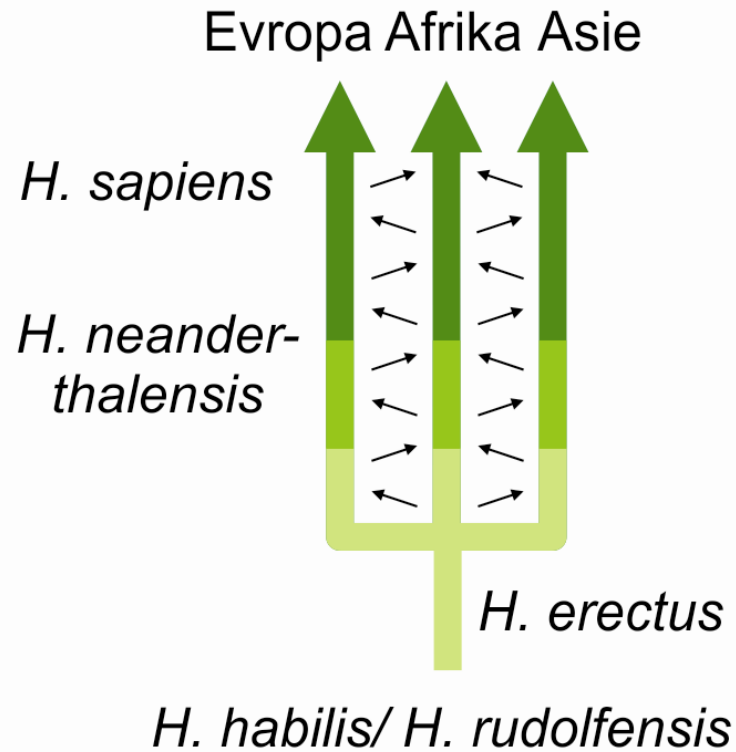
„Mitochondriální Eva“:  
~ 200 000 let





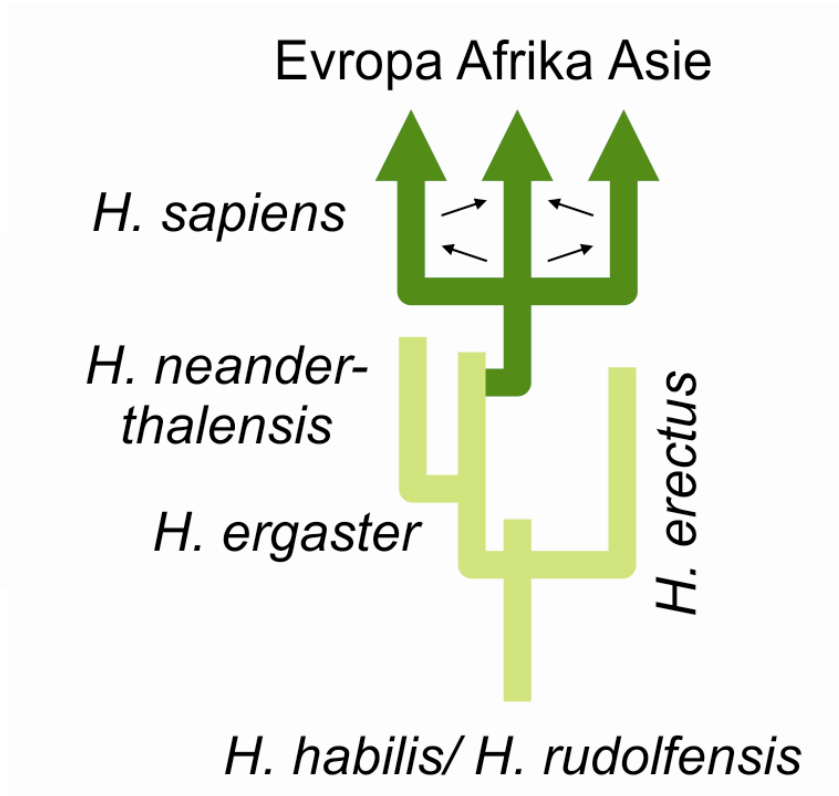
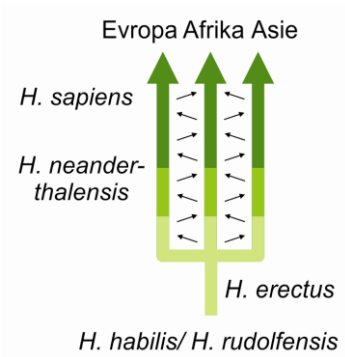
Milford H. Wolpoff

## multiregionální model

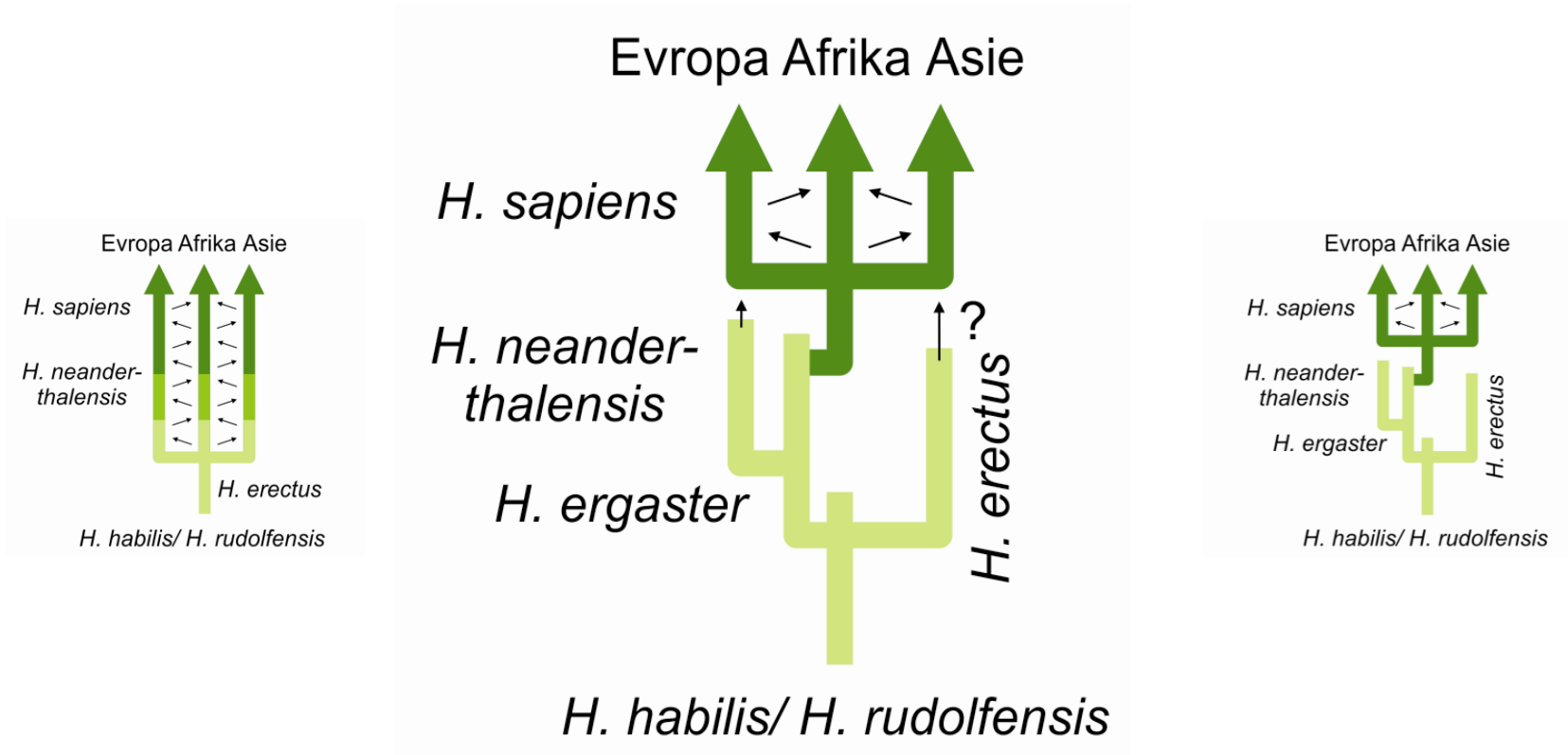




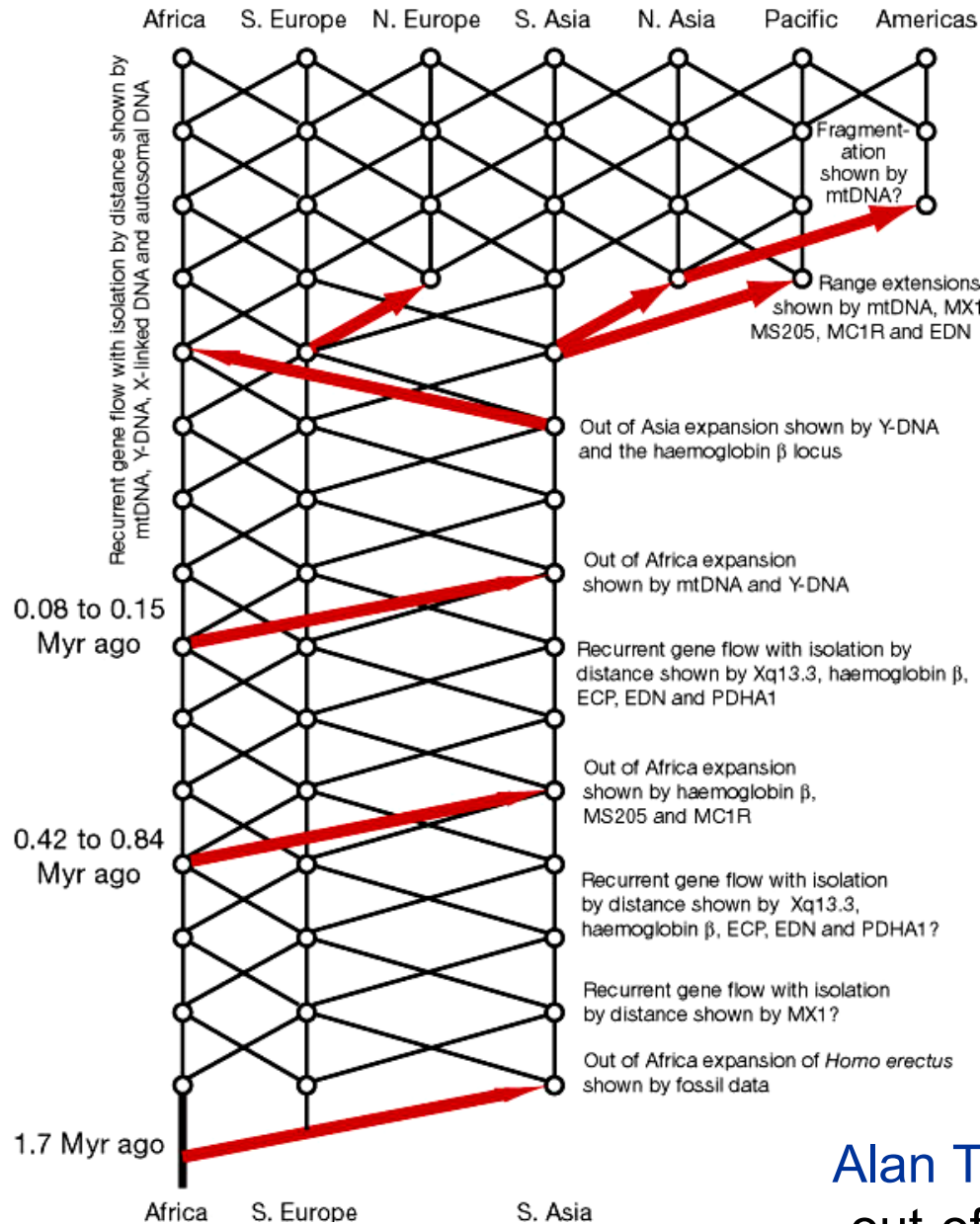
# „out-of-Africa“



# „out-of-Africa“ s křížením

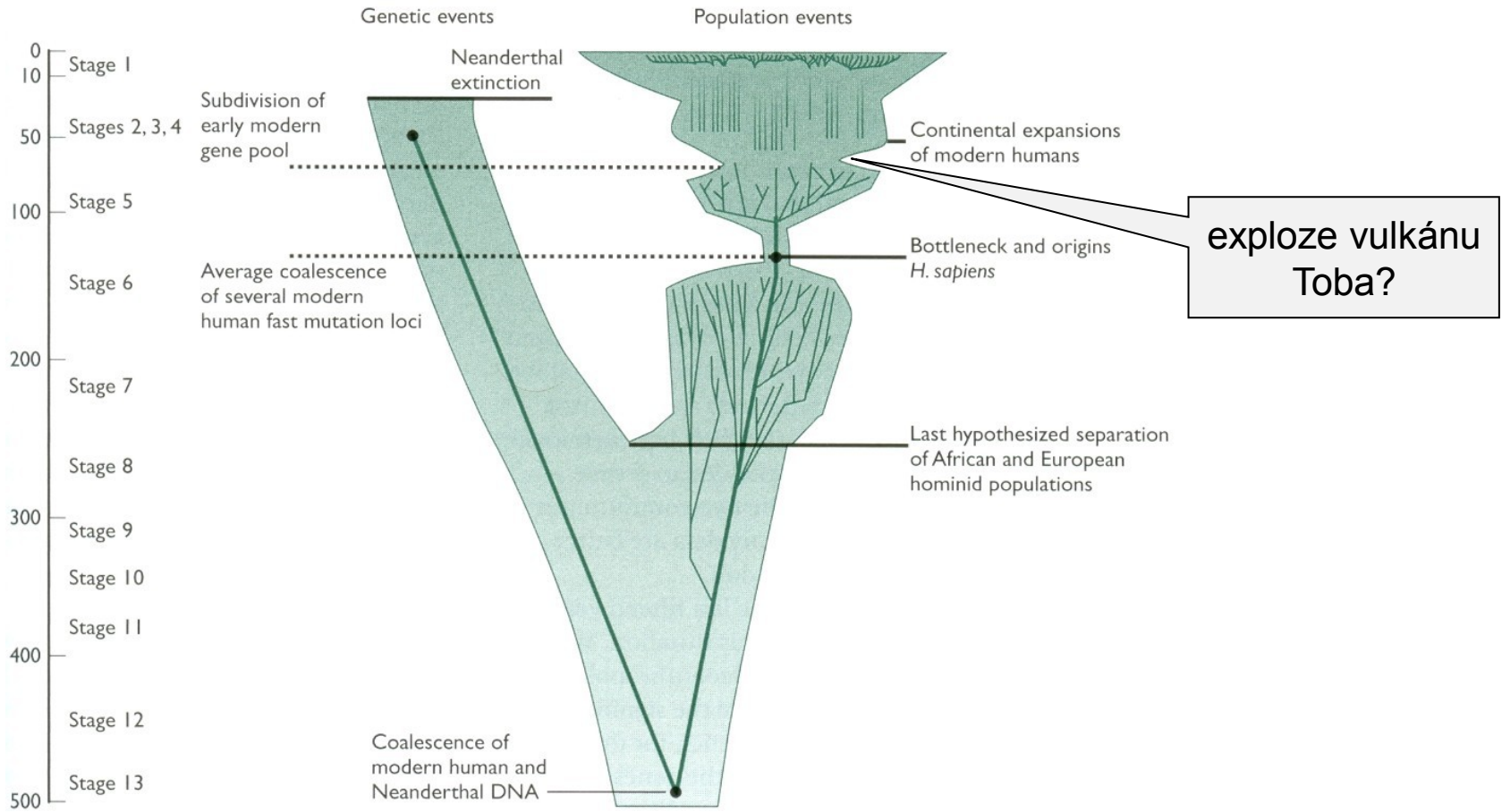


Problém: i multiregionální hyp. předpokládá africký původ



Alan Templeton (2002):  
 „out-of-Africa again and again“

# Expanze a bottlenecky:





**'JOURNEY OF MANKIND' INTERACTIVE TRAIL ADAPTED FROM 'OUT OF EDEN' / 'THE REAL EVE',  
STEPHEN OPPENHEIMER © 2003**



**135,000 - 115,000**

A group travelled across a green Sahara 125,000 years ago, through the open northern gate, up the Nile to the Levant.

**1st EXIT**

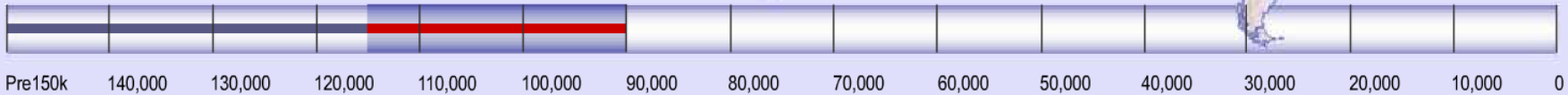


Journey of Mankind  
iLecture Film  
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**'JOURNEY OF MANKIND' INTERACTIVE TRAIL ADAPTED FROM 'OUT OF EDEN' / 'THE REAL EVE',  
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**90,000 - 85,000**

85,000 years ago a group crossed the mouth of the Red Sea - the Gates of Grief - prior to travelling as beach-combers along the southern coast of the Arabian Peninsula toward India. All non-African people are descended from this group.



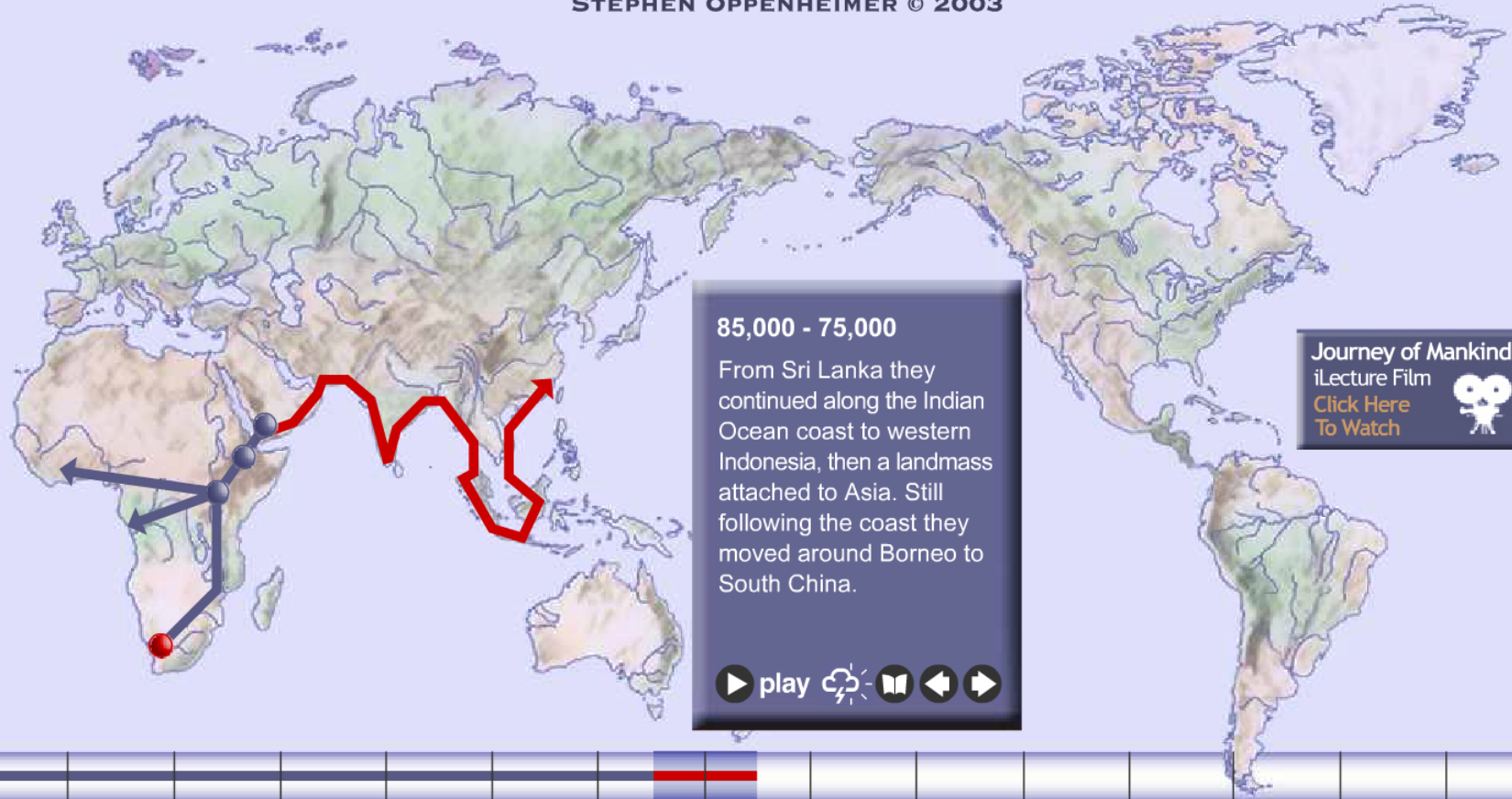
Journey of Mankind  
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**85,000 - 75,000**

From Sri Lanka they continued along the Indian Ocean coast to western Indonesia, then a landmass attached to Asia. Still following the coast they moved around Borneo to South China.

Journey of Mankind  
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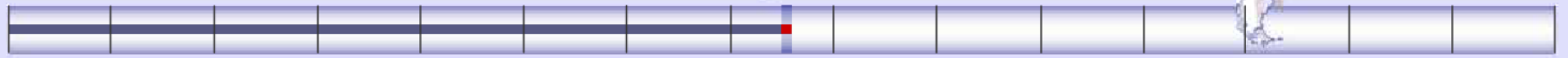


**74,000 Mt Toba**

Super-eruption of Mt. Toba, Sumatra, causing a 6 year nuclear winter and instant 1000 year ice-age with a dramatic population crash, to less than **10,000 adults**. Volcanic ash from the eruption up to 5m deep covered India & Pakistan.



Journey of Mankind  
iLecture Film  
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Pre150k 140,000 130,000 120,000 110,000 100,000 90,000 80,000 70,000 60,000 50,000 40,000 30,000 20,000 10,000 0

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# Expanze a bottlenecky:

Toba:

sever Sumatry

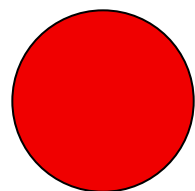
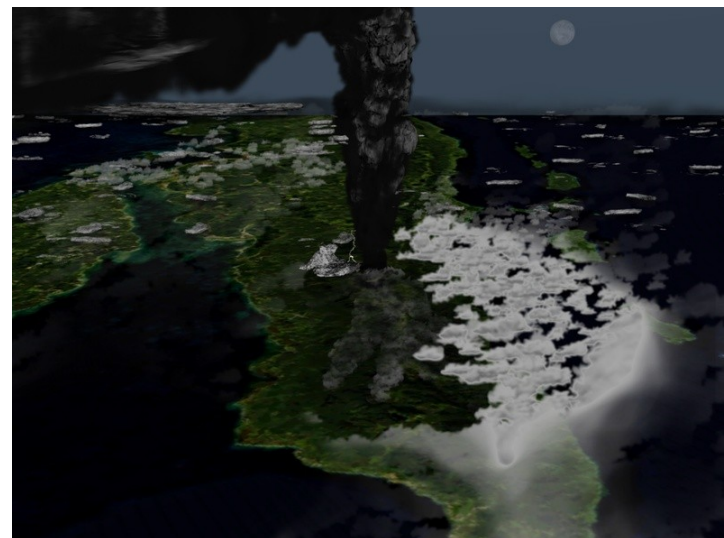
~74 000 let

75% živých jedinců

2800 km<sup>3</sup> horniny

pokles teploty o 16°C

ztráta variability



Toba



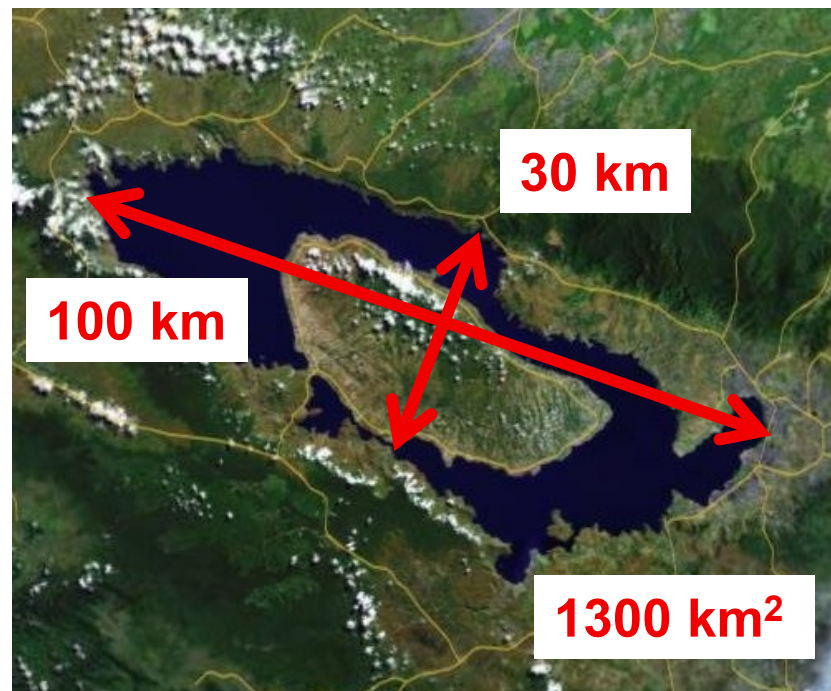
Tambora



Thera

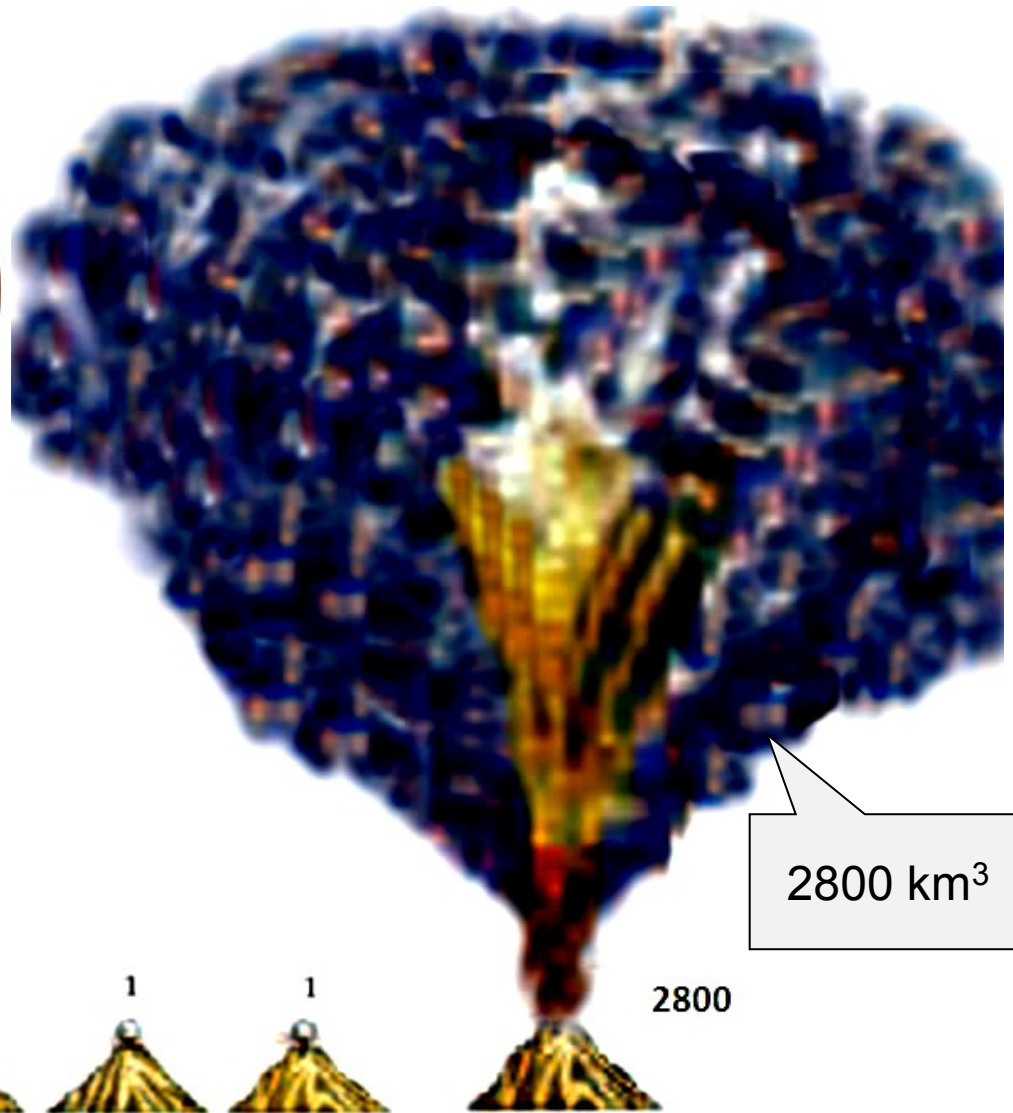
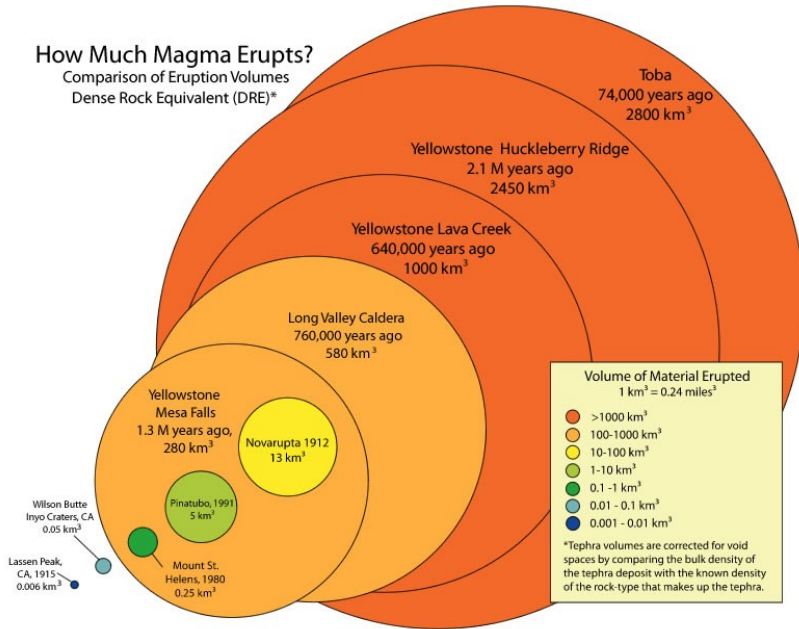


Krakatoa

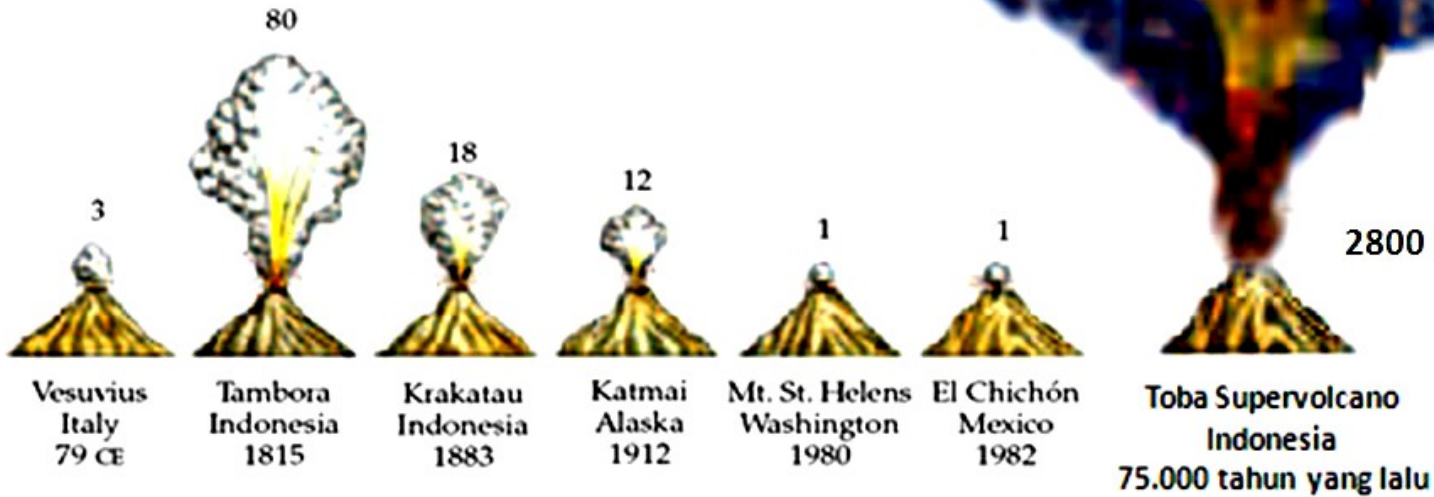


# How Much Magma Erupts?

Comparison of Eruption Volumes  
Dense Rock Equivalent (DRE)\*

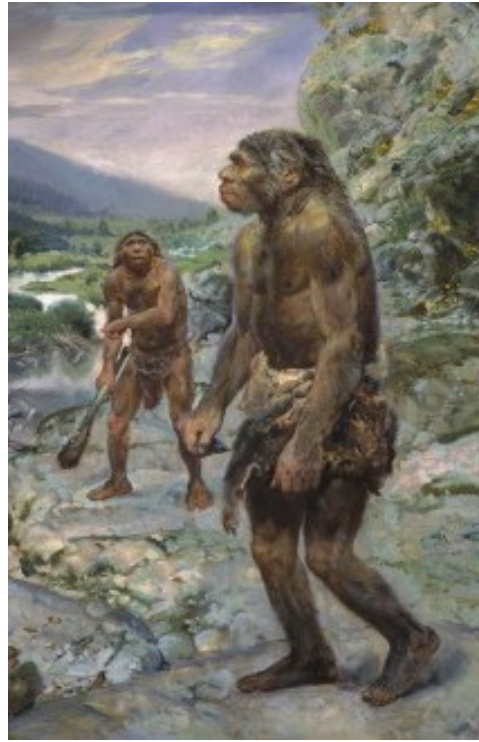


2800 km<sup>3</sup>

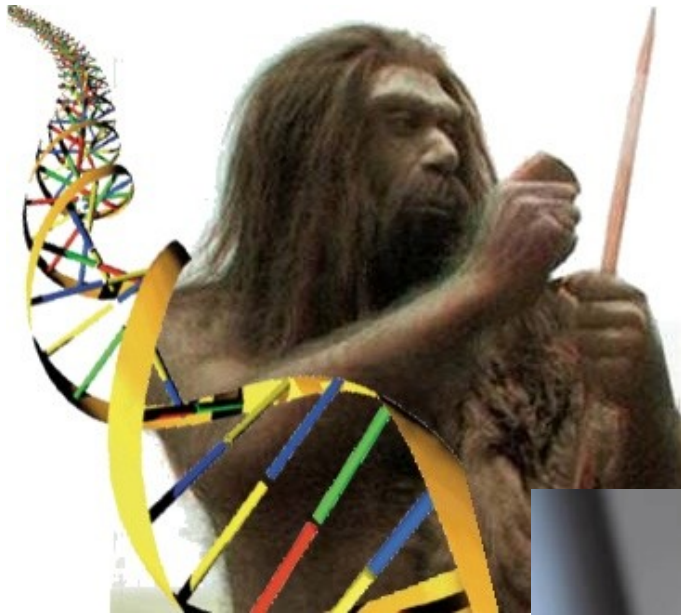


D-094









sekvence neandertálské mtDNA:  
mimo variabilitu současných lidí  
není bližší současným než archaickým  
lidem



Svante Pääbo

~1-4 % neandertálských sekvencí v genomu člověka

Evropa, Asie (asi o 20 % víc)

ne subsaharská Afrika



neandertálský keratin (adaptace na chladné podnebí?)

interleukin 18 (cytokiny)

gen *MC1R*: El Sidrón, Španělsko (43 tis.), Monti Lessini, Itálie (50 tis.)

→ „keltský typ“ min. u 1 % (u člověka 1-2 %)



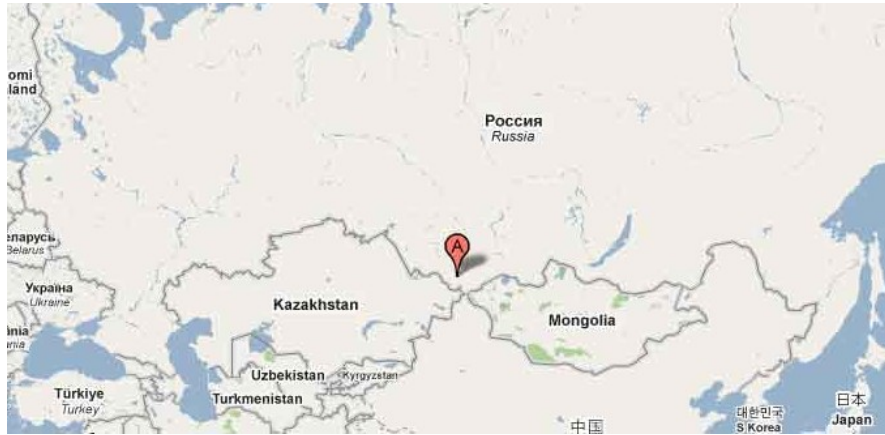
systémový lupus erythematoses, primární biliární cirhóza,

Crohnova nemoc, cukrovka II. typu

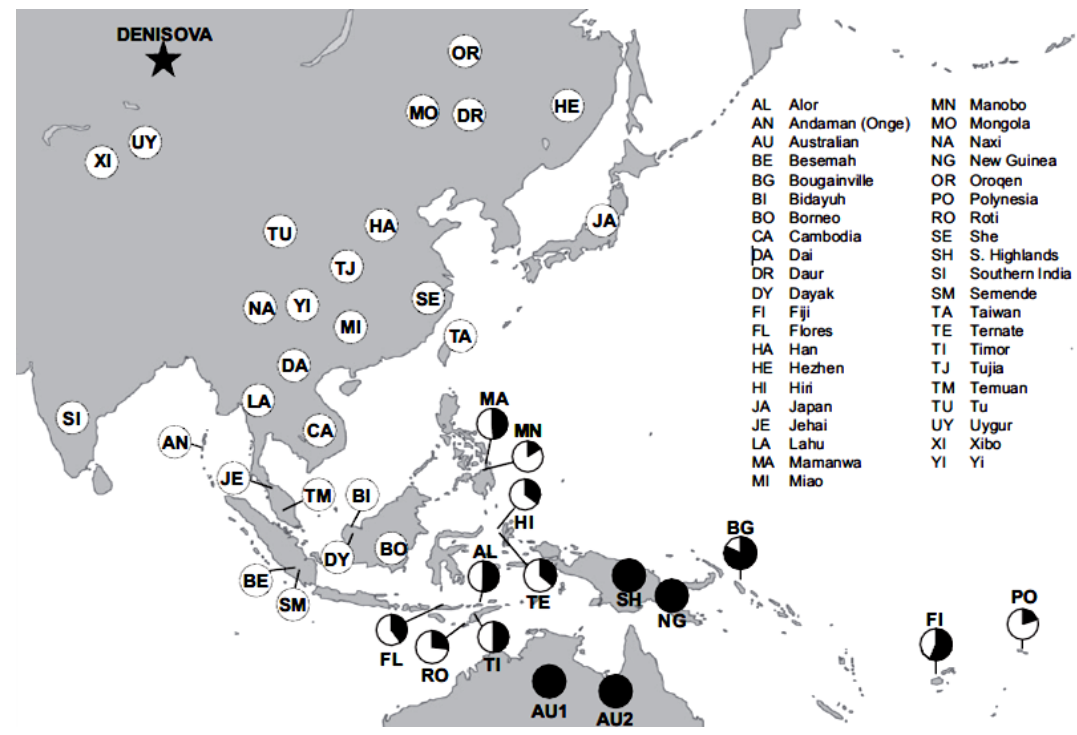
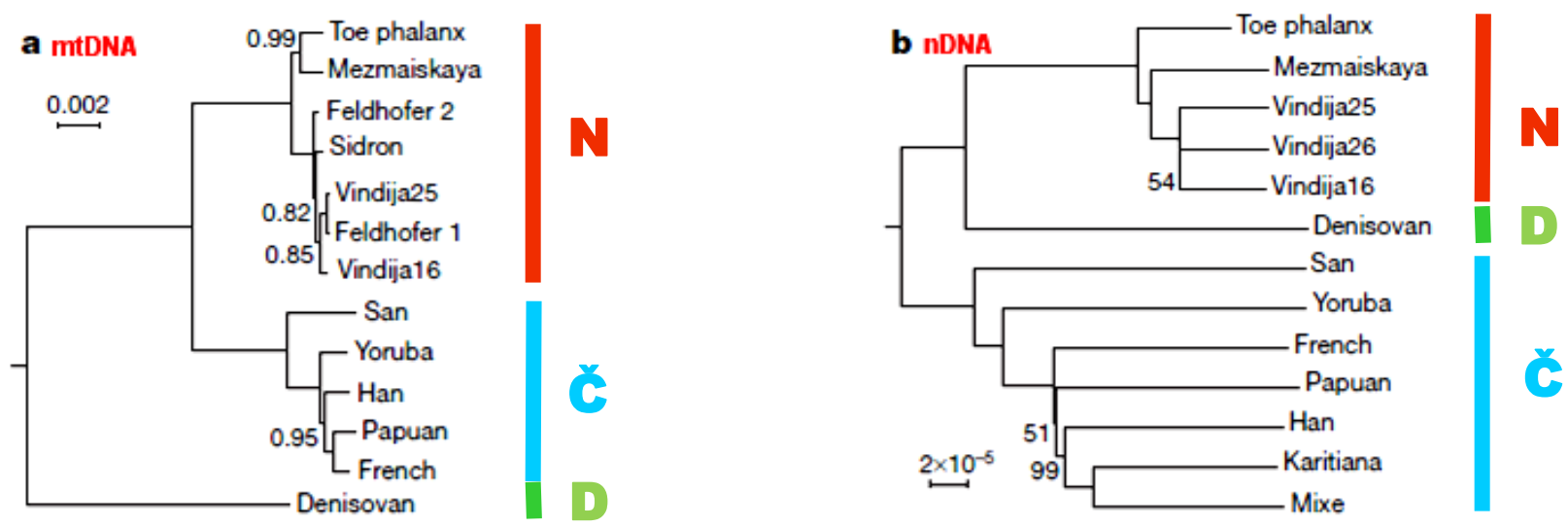
závislost na nikotinu

absence genů na chromozomu X → Haldaneovo pravidlo

# Denisova jeskyně

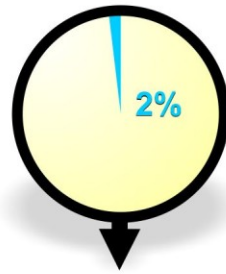








- Afrika
- neznámý archaický africký zdroj
- neandertálci
- děnisovci



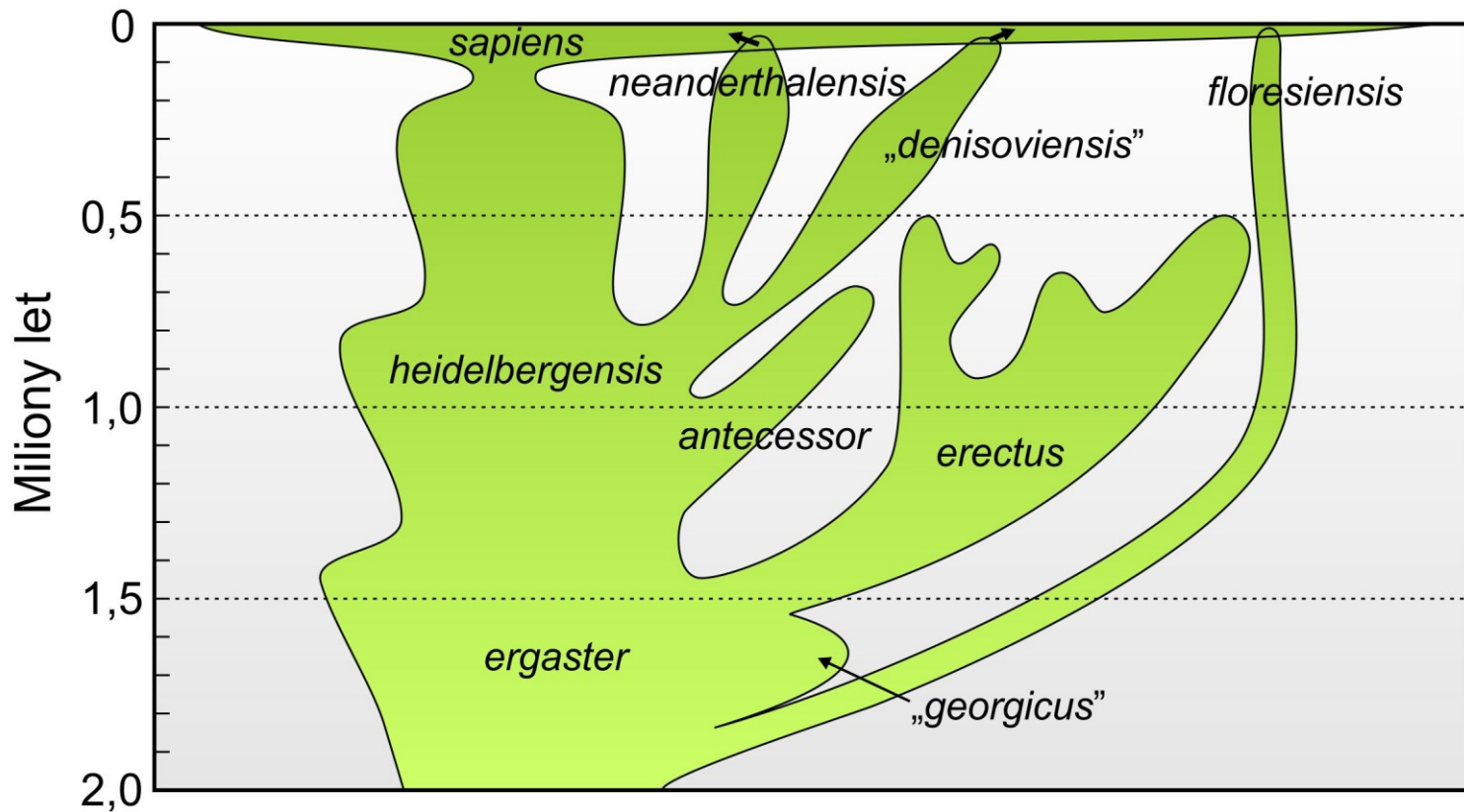
Afrika

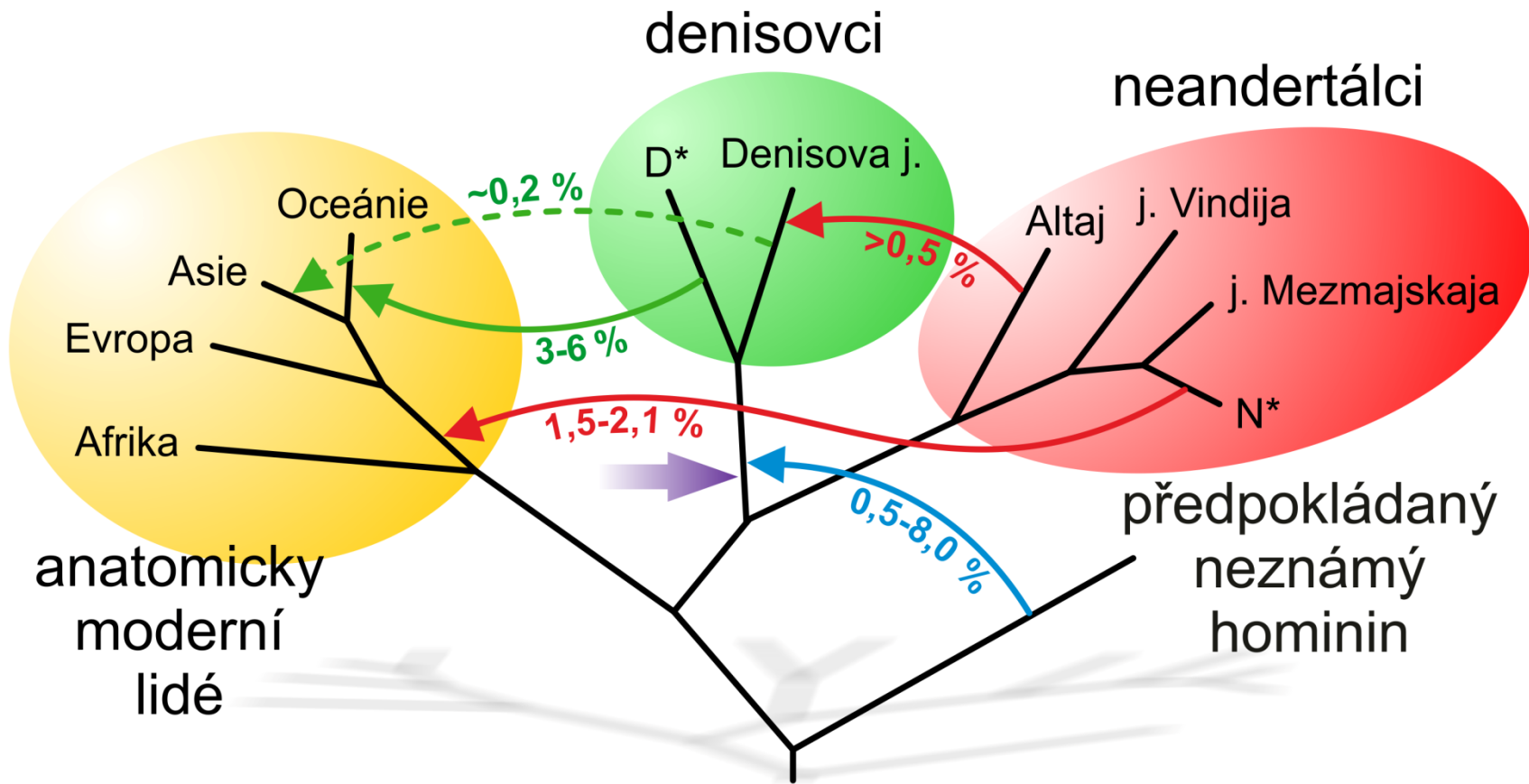


Eurasie



Austrálie  
Oceánie



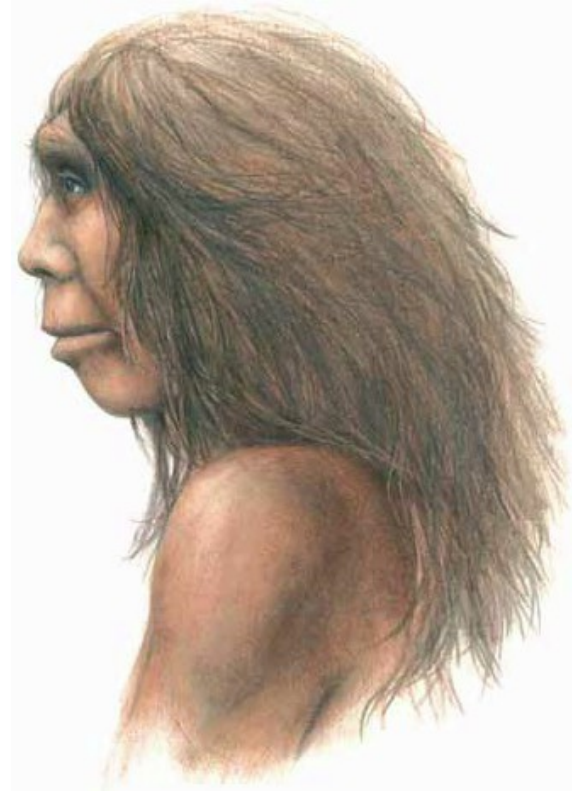


# Sima de los Huesos, Cueva Mayor (Atapuerca, S Španělsko)



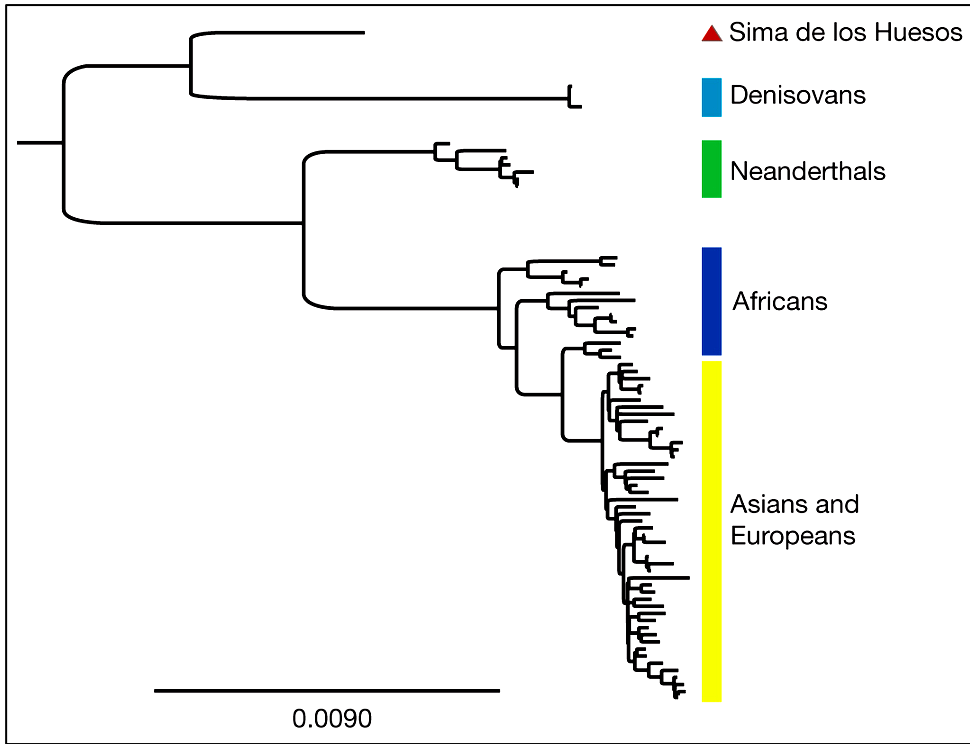
„Miguelón“

*Homo heidelbergensis*



300 – 530 tis.





~ 400 000 let

oddělení cca. 800 tis.





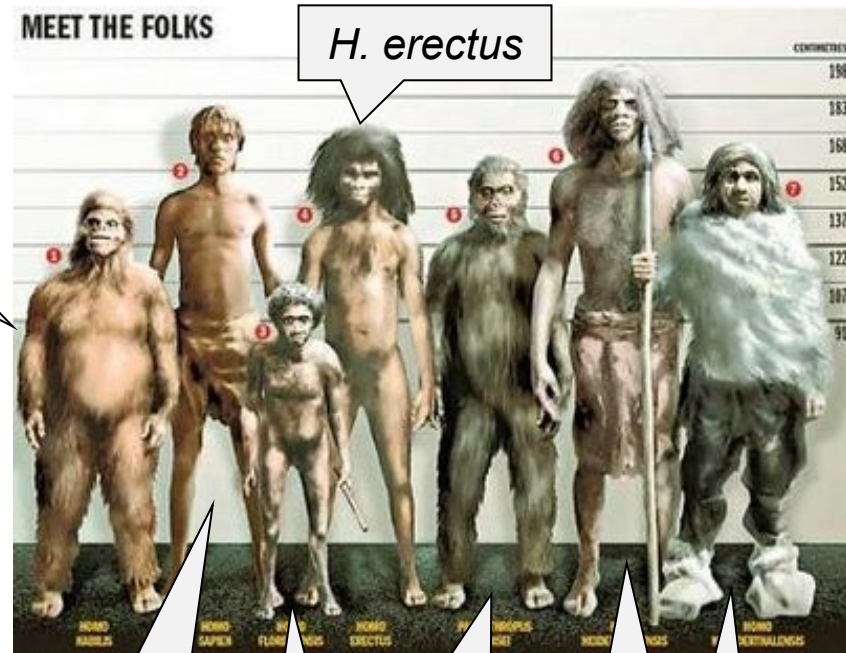
# „Hobit“ z ostrova Flores



*H. habilis*

= Ebu Gogo („pramáti, která všechno sní“)?

Sumatra: Orang Pendek („malý člověk“)



*H. sapiens*

*P. boisei*

*H. floresiensis*

*H. heidelbergensis*

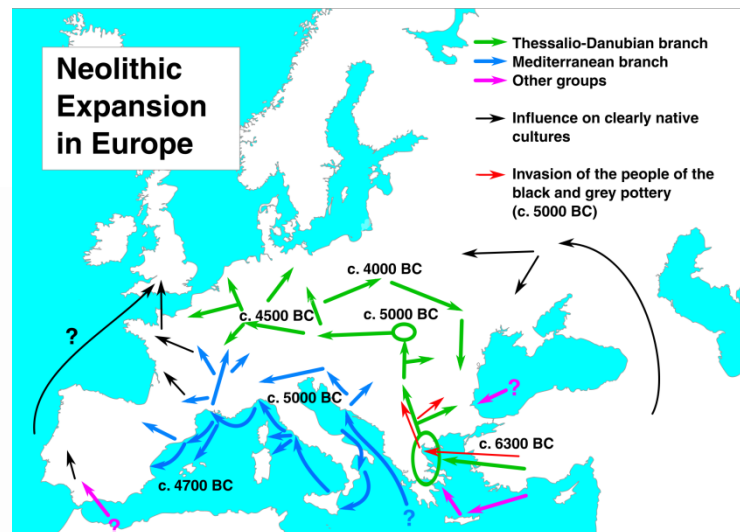
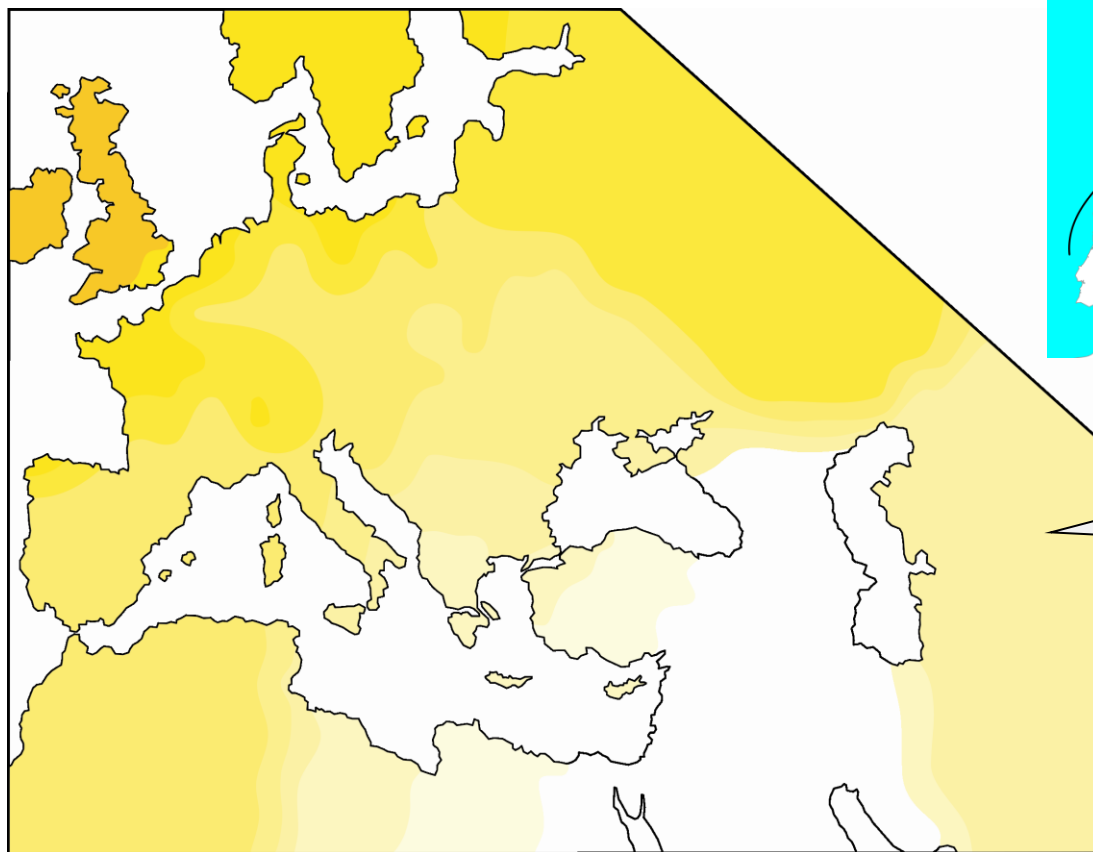
*H. neanderthalensis*



# Příchod neolitiků do Evropy – akulturace vs. démická difuze

Minimálně 8 center:

Úrodný půlměsíc, S a J Čína, Sahel, Papua-Nová Guinea, střední Mexiko, peruánské Andy a V Severní Ameriky

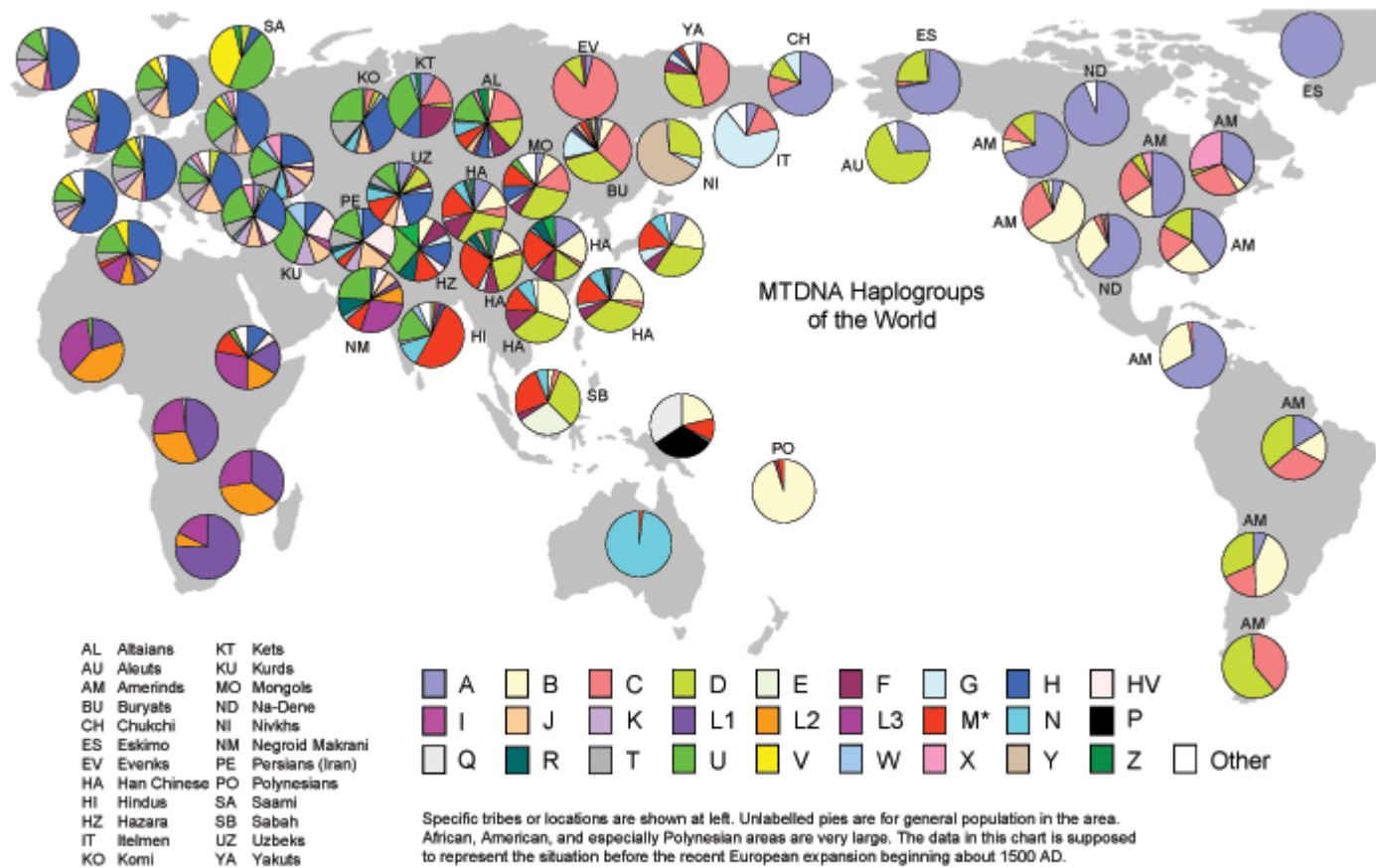


L.-L. Cavalli-Sforza:  
démická difuze

# mtDNA

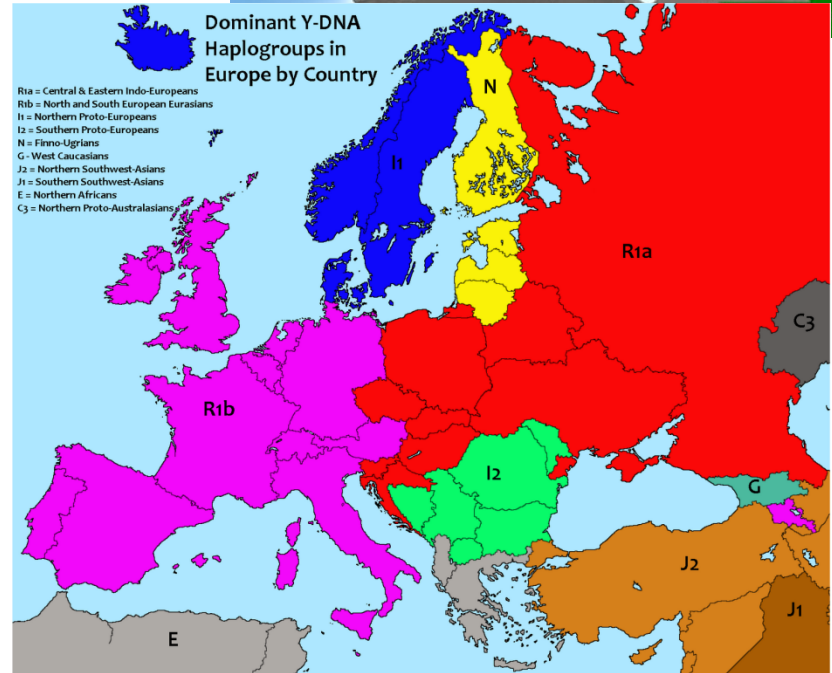
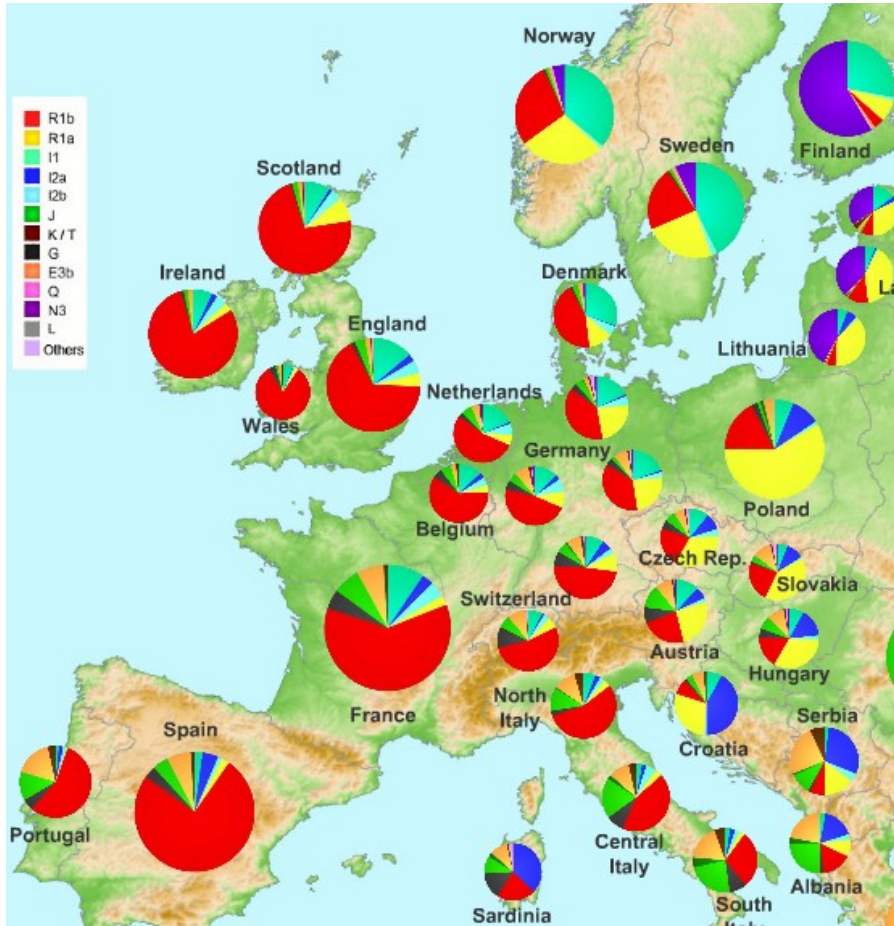
Haplogroup	Possible time of origin	Possible place of origin
N	75,000 ago	India or South Asia
R	70,000 ago	India or South Asia
U	60,000 ago	North-East Africa or South-West Asia
pre-JT	55,000 ago	Middle East
JT	50,000 ago	Middle East
U5	50,000 ago	Western Asia
U6	50,000 ago	North Africa
U8	50,000 ago	Western Asia
pre-HV	50,000 ago	Near East
J	45,000 ago	Near East or Caucasus
HV	40,000 ago	Near East
H	> 35,000 ago	Western Asia
X	> 30,000 ago	north-east Europe
U5a1	30,000 ago	Europe
I	30,000 ago	Caucasus or north-east Europe
J1a	27,000 ago	Near East
W	25,000 ago	north-east Europe or north-west Asia
U4	25,000 ago	Central Asia
J1b	23,000 ago	Near East
T	17,000 ago	Mesopotamia
K	16,000 ago	Near East
V	15,000 ago	Iberia and moved to Scandinavia
H1b	13,000 ago	Europe
K1	12,000 ago	Near East
H3	10,000 ago	Western Europe (Spain)

# mtDNA





# chr. Y

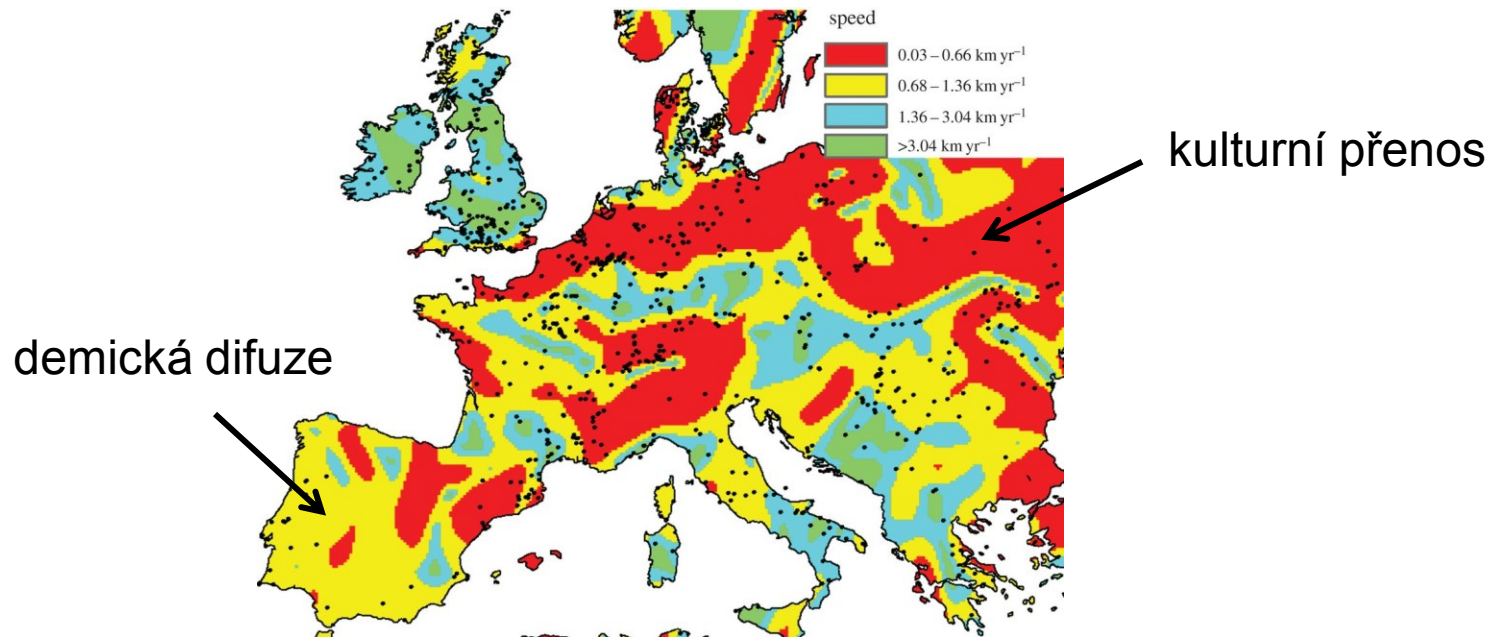


mtDNA: ~ 20 % paleolitického původu → spíše akulturace?

kraniometrie, jaderné geny (*NR4*): demická difuze

→ odpovídá modelu samčí migrace

způsob pronikání zemědělství byl zřejmě lokálně specifický



**Problém: odhady minulých dějů mohou být velmi variabilní – pouze jediná realizace evolučního procesu!**

Co definuje člověka?

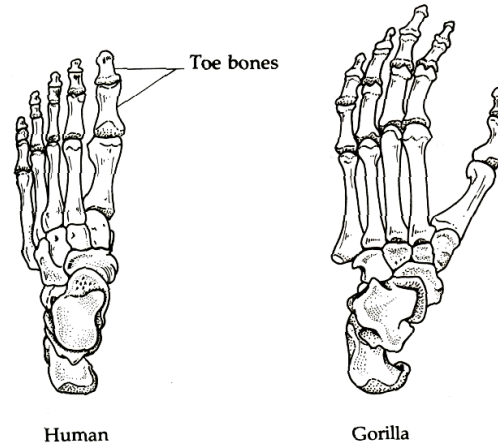
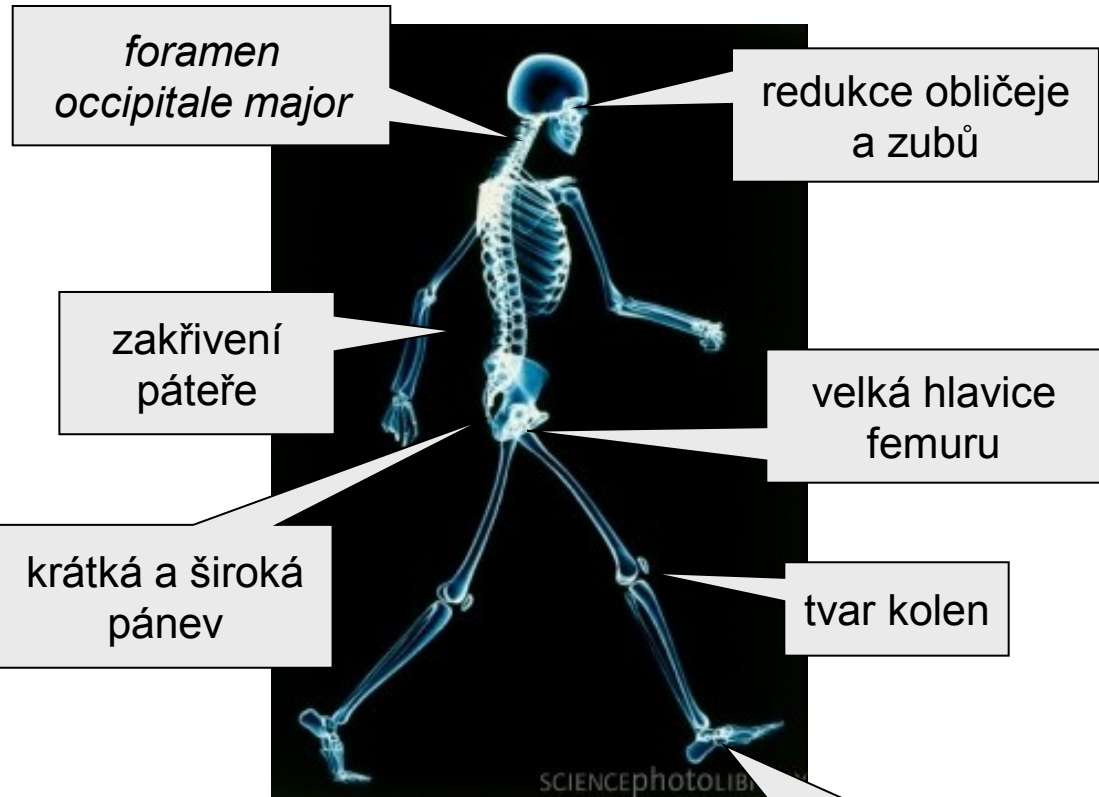
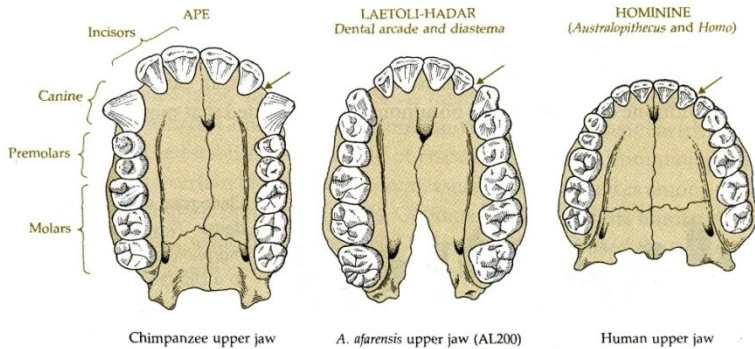
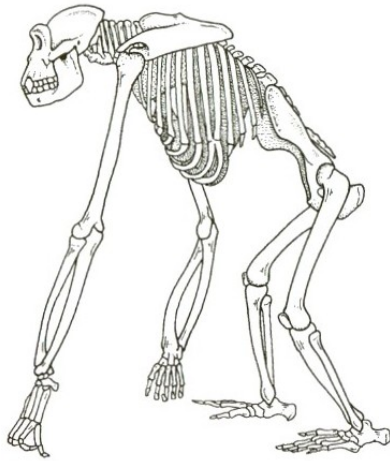
vzpřímená chůze?

nástroje?

mozek?

řeč?

# Typické znaky na kostře:





## Nevýhody vzpřímené postavy:

bolestivý porod

bolesti páteře

kýla

křečové žíly, oběhové problémy

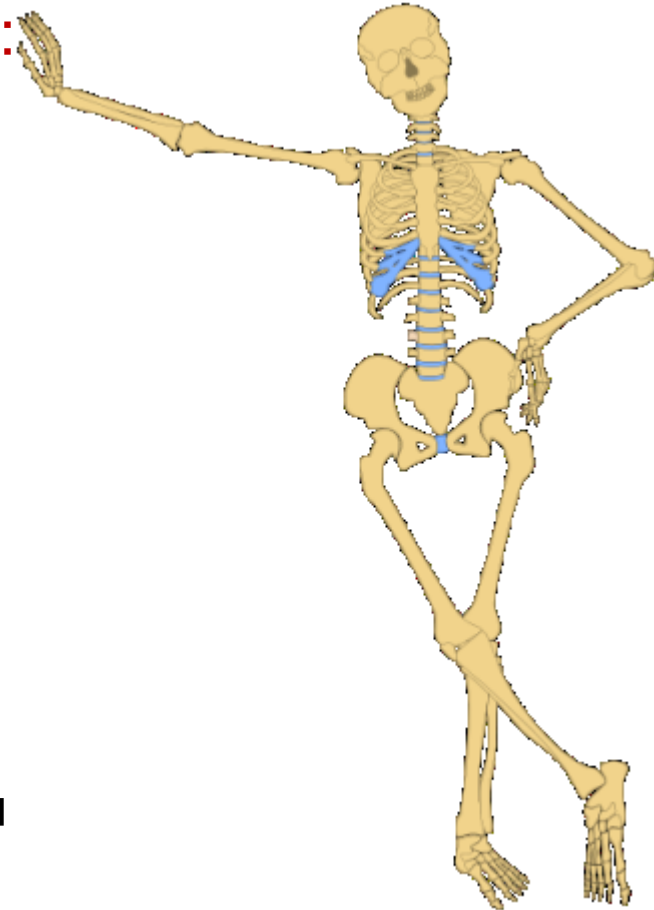
hemoroidy

nadýmání během těhotenství

ploché nohy, kuří oka, bolesti nohou

nutnost učit se chodit

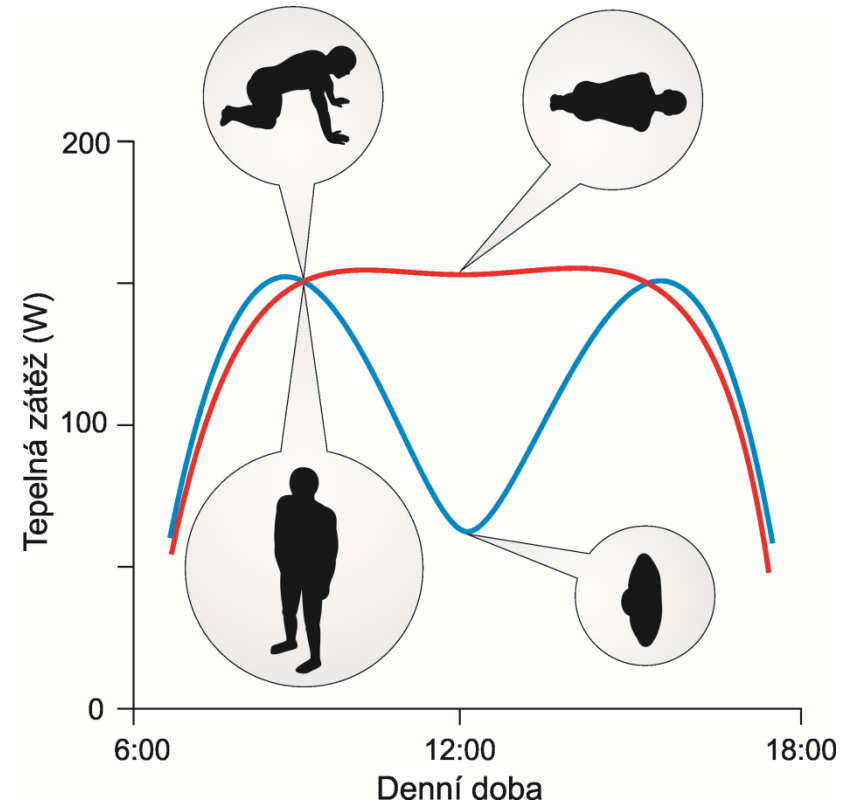
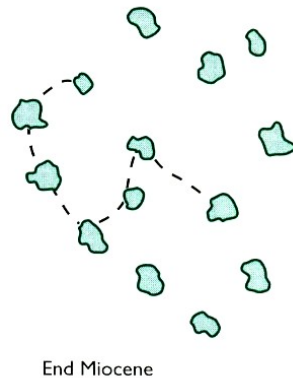
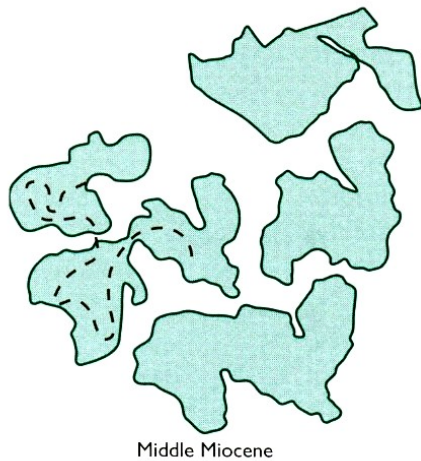
(+ zkrácená čelist → zuby moudrosti)



# konec miocénu: klimatické změny les → savana

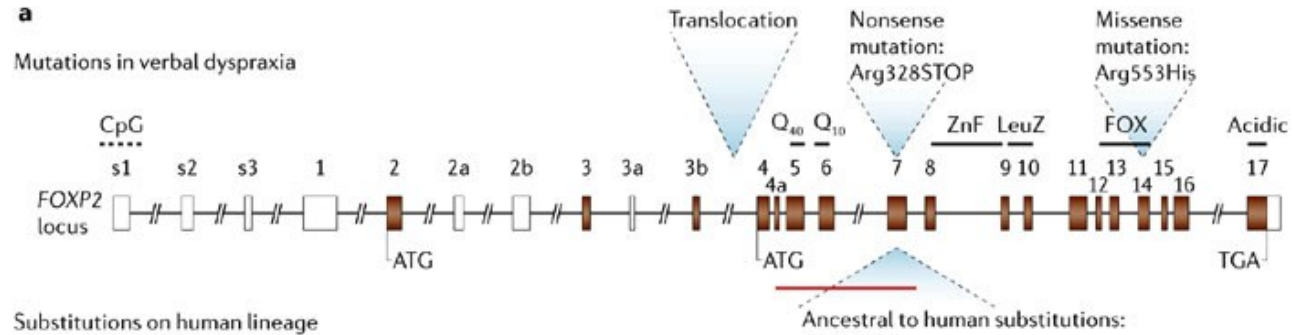
vzpřímení:

rozhled?, sběr potravy?, nástroje?, přehled o kořisti a predátorech?,  
termoregulace?, migrace za potravou?



# Co definuje člověka?

vzpřímená chůze?  
nástroje?  
mozek?  
řeč?



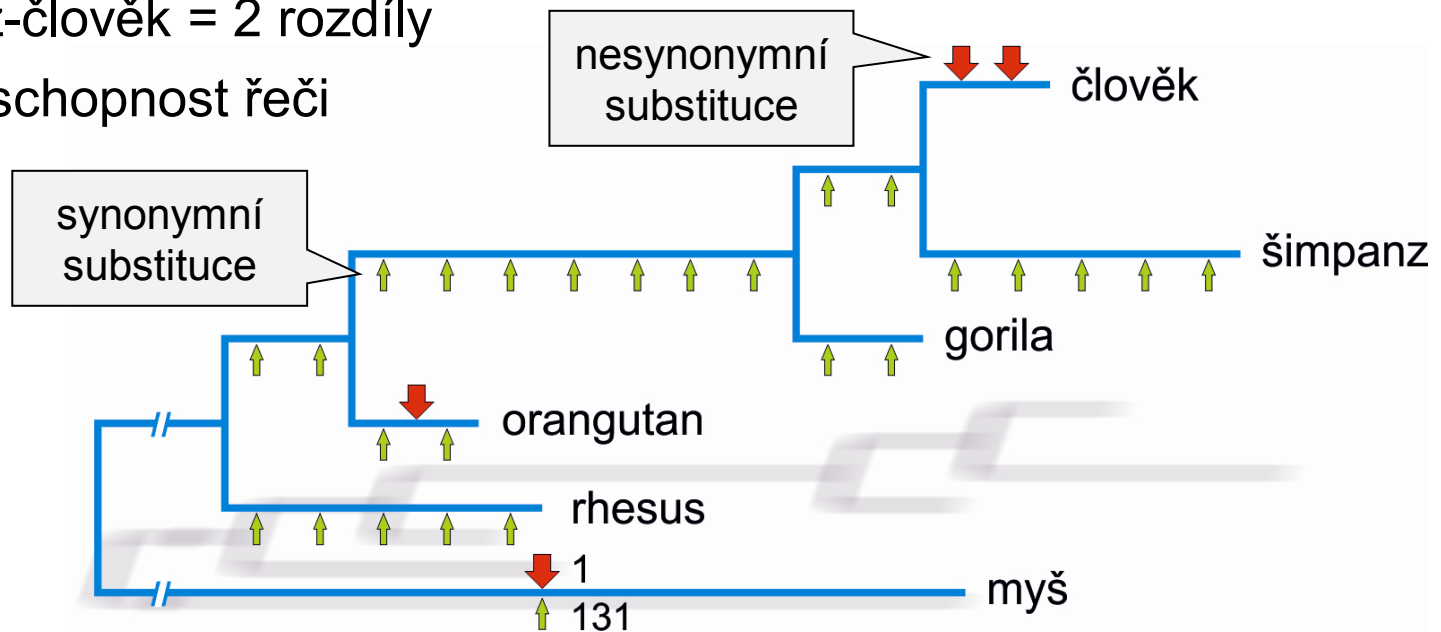
gen *FOXP2* (Forkhead box 2):

velmi konzervativní

člověk-myš = 3 AA rozdíly; orangutan-myš = 2; orangutan-člověk = 3;

šimpanz-člověk = 2 rozdíly

u člověka schopnost řeči



# Unikátnost evoluce člověka

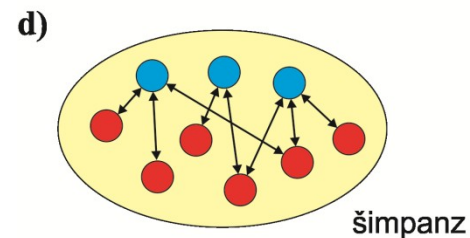
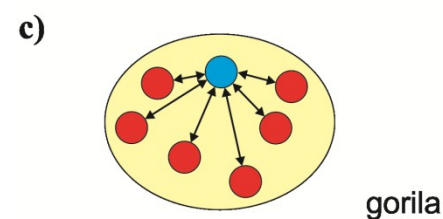
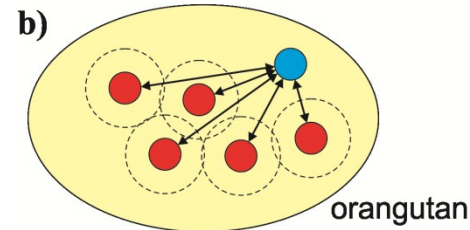
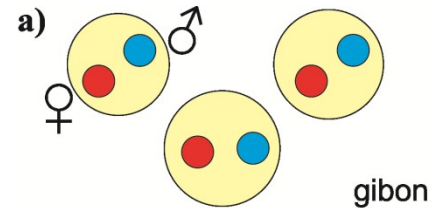
sociální systém: život ve skupině,  
monogamie se sklonem k polygamii

paradox: rychlá evoluce, ale pouze  
jeden druh

typické 2 procesy:

ekologická dominance: vnější prostředí  
→ lidská společnost (člověk sám sobě  
„nepřátelskou silou přírody“)

kooperativní kompetice: kooperace  
kvůli kompetici (*runaway social  
selection*)





## Rasové a etnické skupiny:

3-60 ras

genetická variabilita se nekryje s morfologickou

genetická variabilita uvnitř „ras“ vyšší než mezi nimi (80 % vs. 8 %)

např. i při vyměření všech lidí kromě kmene Kikujů ve V Africe by se zachovalo ~ 80 % variability

## Proč menopauza?

skupinová selekce – nerodit defektní děti a nezhoršovat kvalitu genofondu?

zvyšování věku, menopauza jako projev senescence?

dnes: pomoc dřívějším potomkům

## Proč skrytá ovulace?

vytěžování komodit („prostituce“)?

zasetí pochybností a prevence infanticidy?

stálá sexualita, otcovská péče?

## Proč „bezsrstost“?

pohlavní výběr?

obrana proti parazitaci?

šaty, oheň a přístřeší (zbytečnost srsti)?

druhová identifikace?

neotenie?

akvatický život předků (Alistair Hardy, Elaine Morganová)?

termoregulace

# KULTURNÍ EVOLUCE

šimpanzi, koňadra, potkan, makak červenolící (*Macaca fuscata*)





# Vlastnosti kulturní evoluce:

vertikální i horizontální

lamarckovská

rychlá

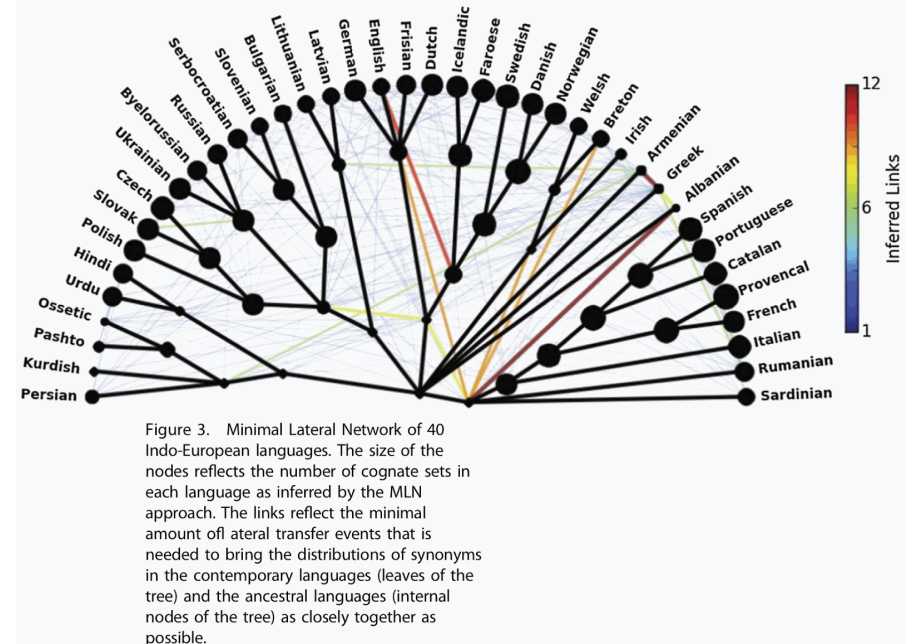
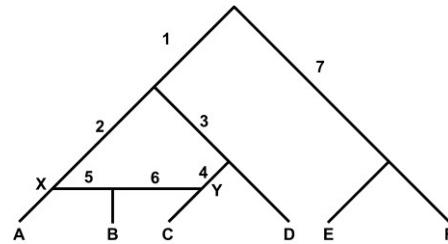
retikulátní

selekce kulturních znaků (memy)

skupinová selekce

nejen kulturní přenos, ale i růst populace (demová difúze)

ovlivnění genetických faktorů kulturou



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