



# *Il Popolamento dell'Europa*

Julie Arnaud  
[julie.arnaud@unife.it](mailto:julie.arnaud@unife.it)

# Origine





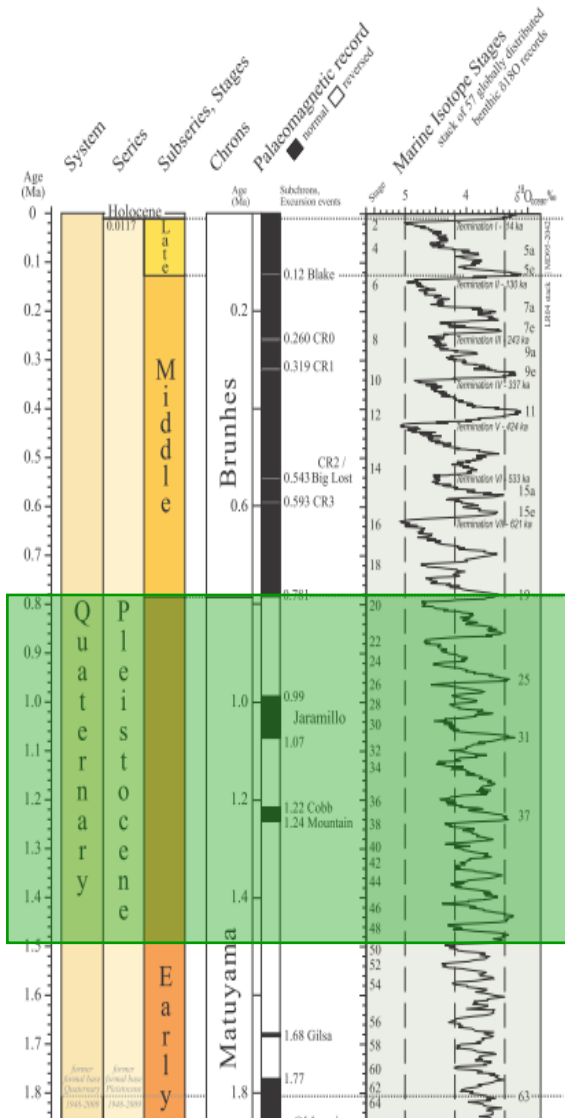


(Cavalli Sforza & Pievani, 2012)

profilo delle antiche coste durante le fasi glaciali



# Origine : Prime testimonianze del popolamento europeo



(Cohen & Cibbard, 2010)







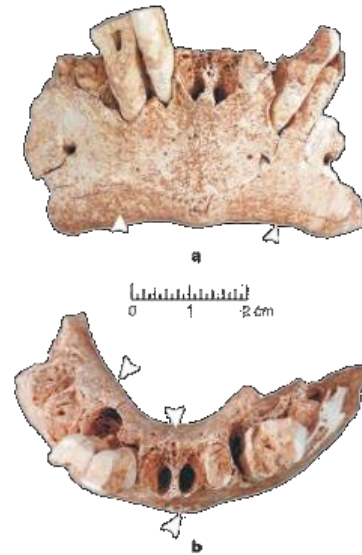


# Le prime testimonianze

Anteneandertaliani : non hanno acquisito nessuna delle apomorfie dei neandertaliani

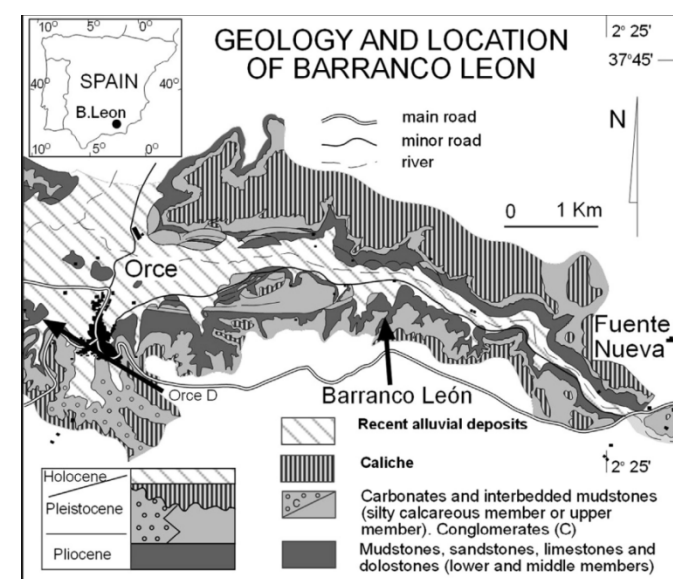
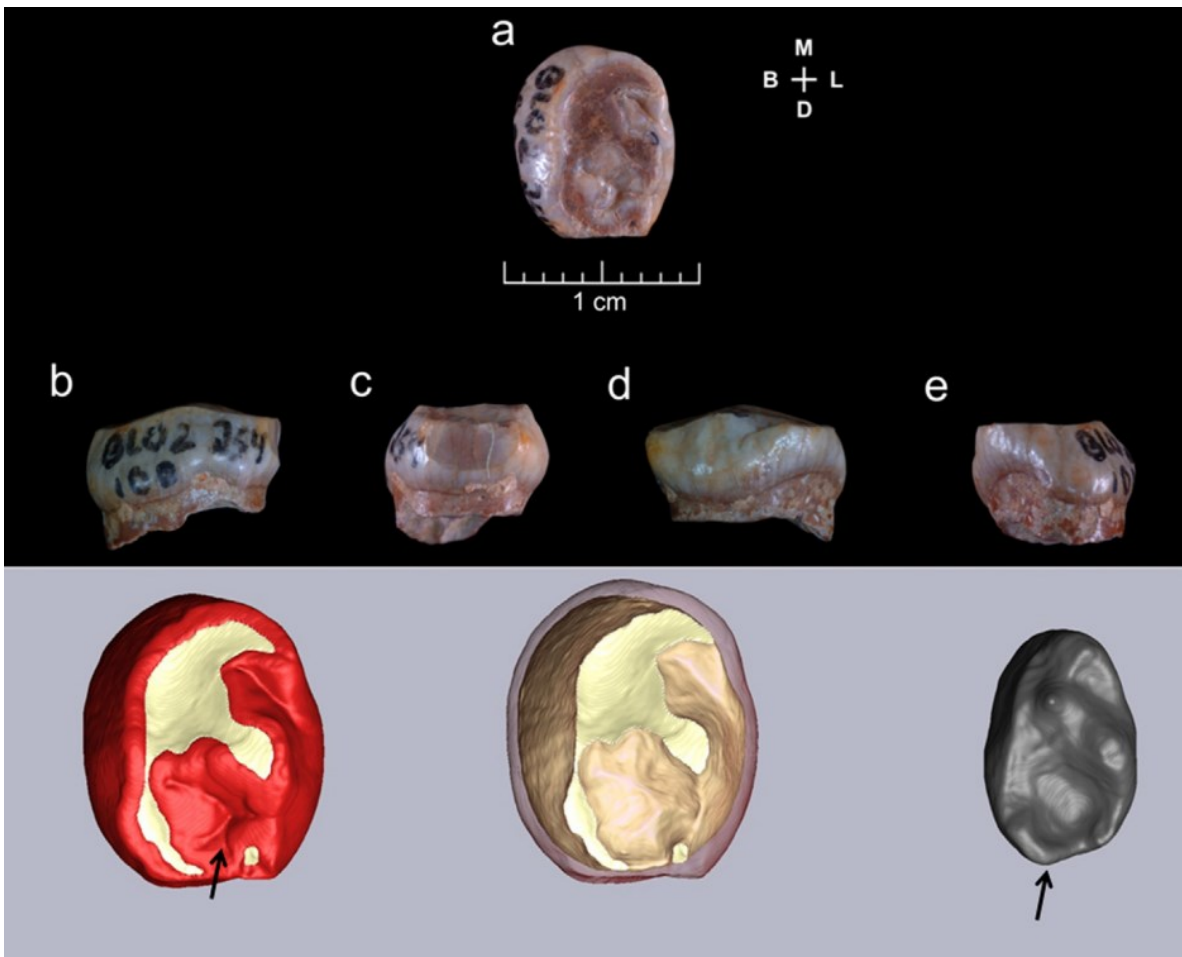


Gran Dolina  
*Homo antecessor* 0,8  
Myr (TD6)



Sima del Elefante  
*Homo sp.*  
1,3 Myr (Mandible ATE9-1)





dm1 di Barranco León BL02-J54-100  
 ESR: 1.02 e 1.73 Ma  
 Paleomagnetismo: 1.07 – 1.77 Ma  
 Biocronologia: 1.4 Ma

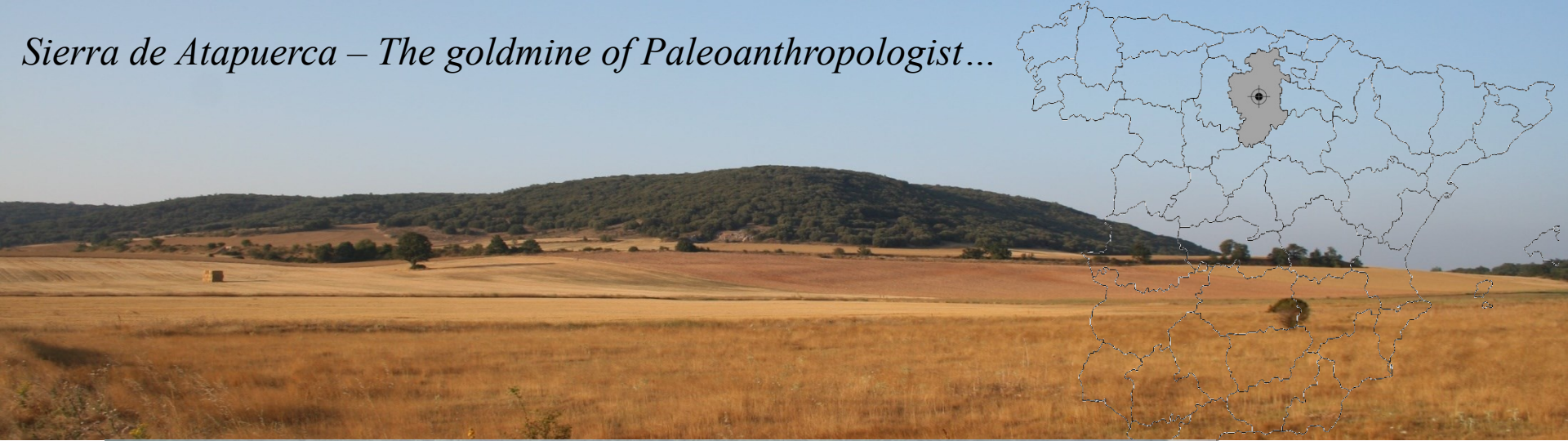
Questo ritrovamento associato ad un importante insieme litico conferma che l'Europe occidentale è stata colonizzata poco dopo la prima espansione out of Africa, documentata da Dmanisi.

*This discovery associated to an important lithic assemblage confirms that Western Europe was colonized soon after the first out of Africa documented in the site of Dmanisi.*





*Sierra de Atapuerca – The goldmine of Paleoanthropologist...*

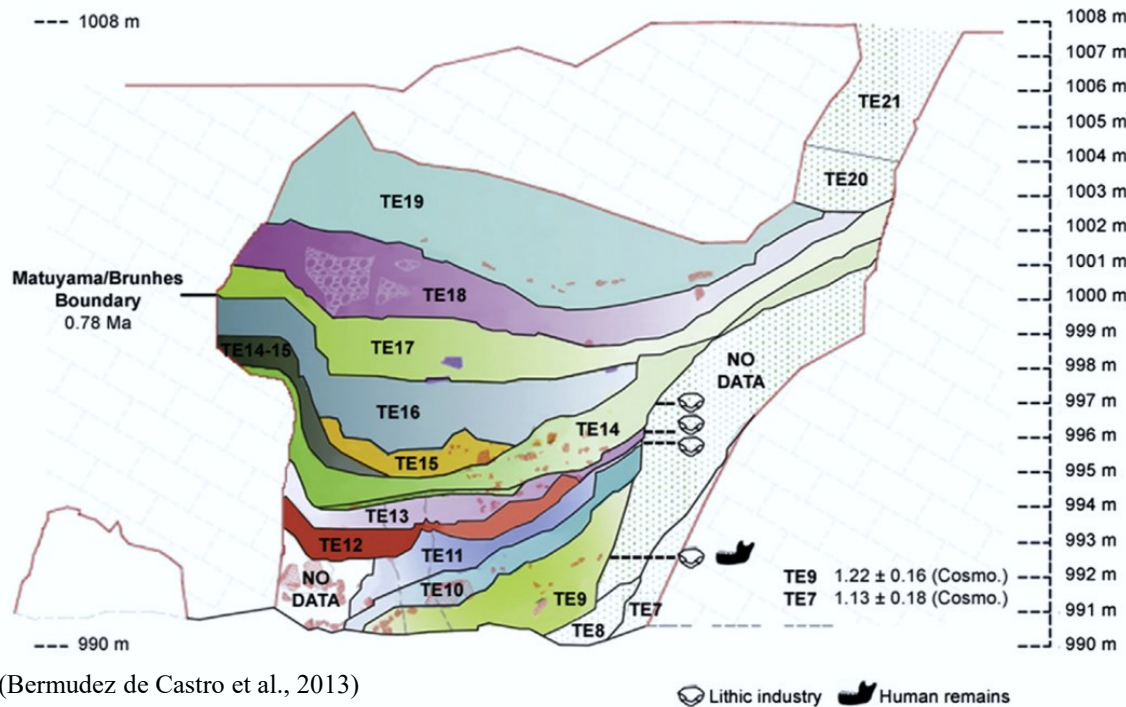


Javier Trueba / Madrid Scientific Films

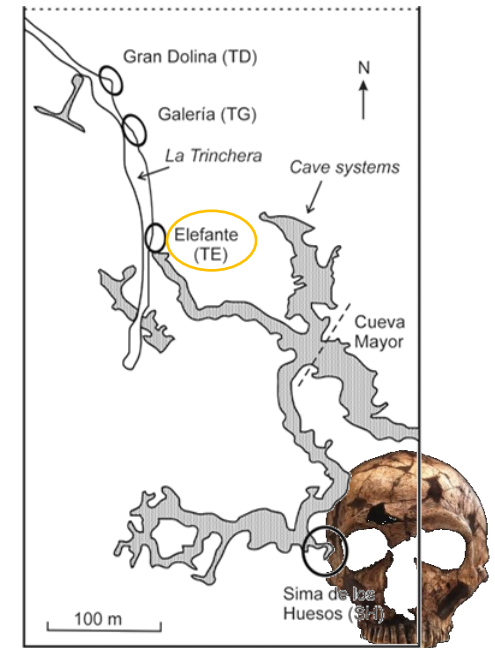




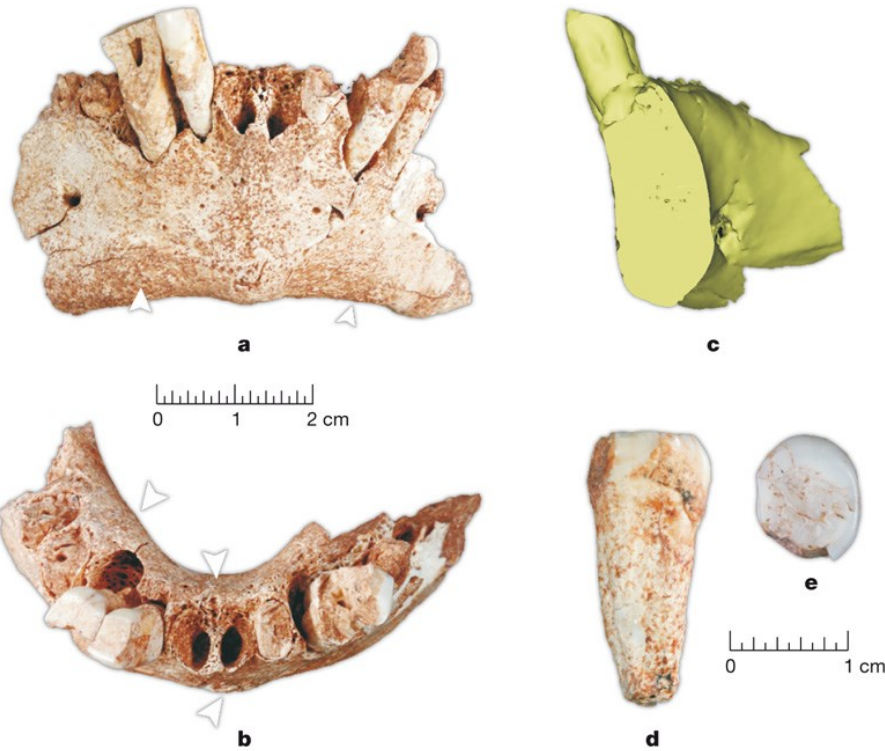
# Sima del Elefante



(Bermudez de Castro et al., 2013)







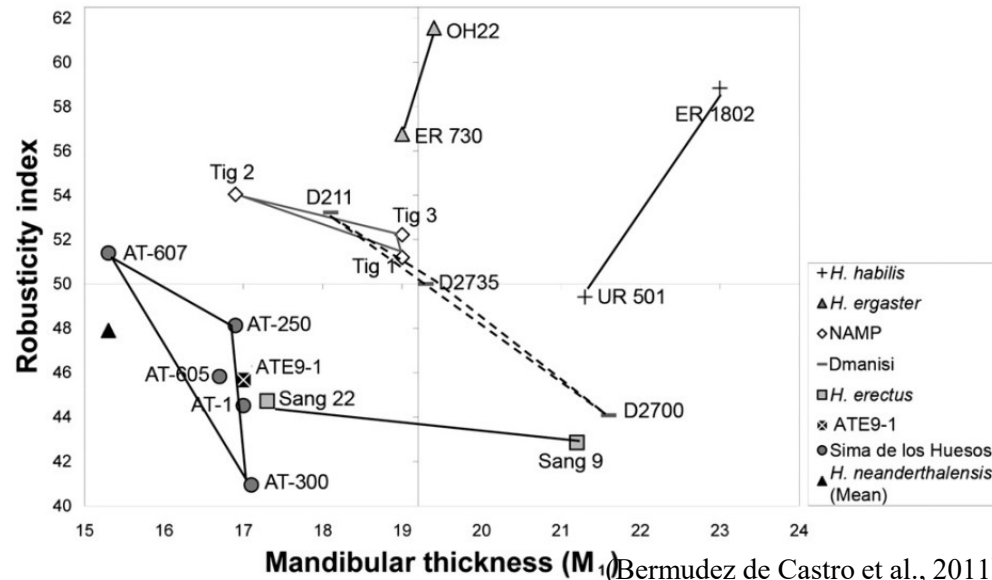
- Caratteri primitive per il genere *Homo*:
- Tubercolo marginale anteriore sotto C/P3
  - *Mentum osseum* poco marcato
  - Trigono mentoniero distinto
  - Presenza di una *incisura submentalis*
  - Morfologia dei premolari

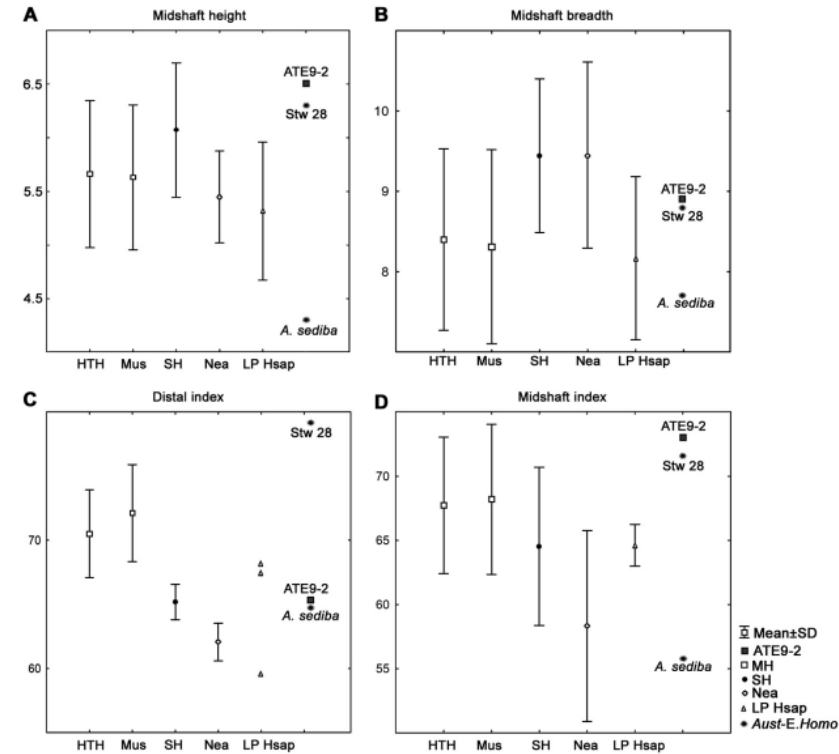
Caratteri derivati rispetto ai primi *Homo* africani:

- Planum alveolare poco inclinato
- Assenza di un toro trasverso superiore
- Corpo mandibolare poco spesso

(Carbonell et al., 2008)

ATE9-1 presenta alcuni caratteri morfologici che dimostrano una discrepanza con la variabilità osservata nei fossili di Dmanisi e del Pleistocene africano, implicando una comparsa precoce di un "identità europea" nei gruppi di ominini che hanno popolato il continente europeo.



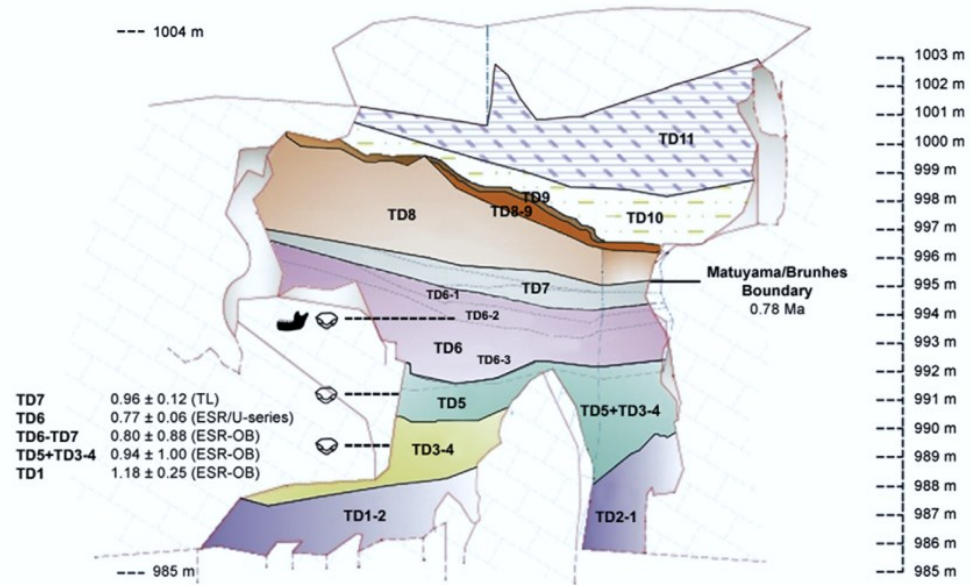


La falange ATE9-2, attribuita a *Homo* sp. non presenta particolare differenze con la collezione di confronto. Questo suggerisce che la morfologia della mano nel genere *Homo* è rimasta invariata da 1.2-1.3 Ma (Lorenzo et al., 2014).



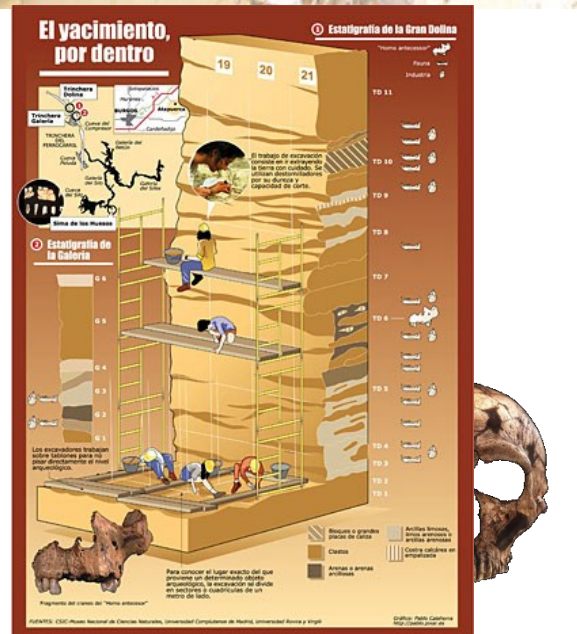


# Gran Dolina and the *Homo antecessor* hypodigm



(Bermudez de Castro et al., 2013)

Lithic industry Human remains





Livello TD6 – c. 800 ka BP

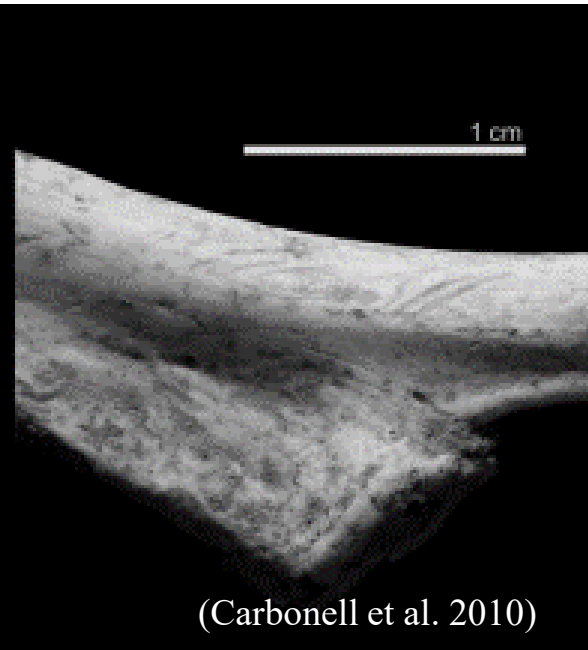
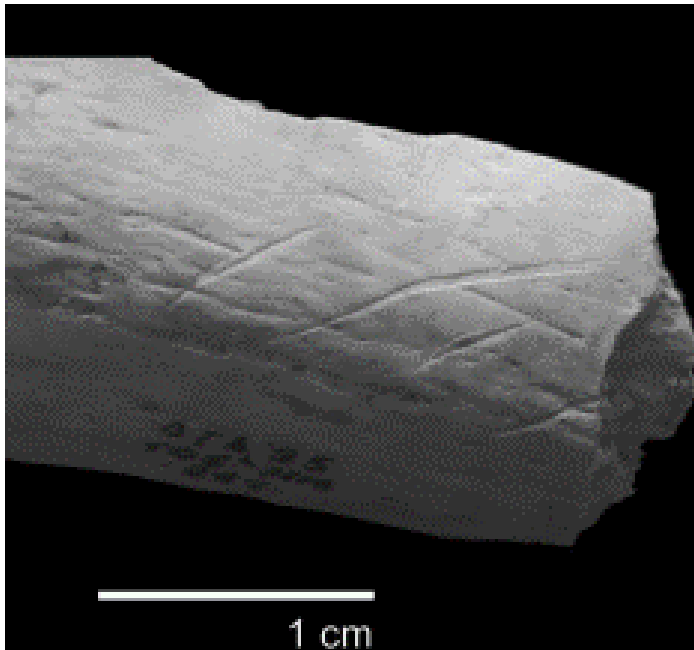
NMI: 2 adulti, 3 adolescenti, 6 bambini

Interpretazione

- cannibalismo gastronomico (Fernandez-Jalvo et al. 1999)
- Cannibalismo culturale (Carbonell et al., 2010)
- Violenza e cannibalismo intergruppo; excocannibalismo (Saladié et al., 2012)

Tracce di macellazione su la diafisi  
di una tibia, interpretate come  
tracce di scarnificazione

Costola umana con  
incisione



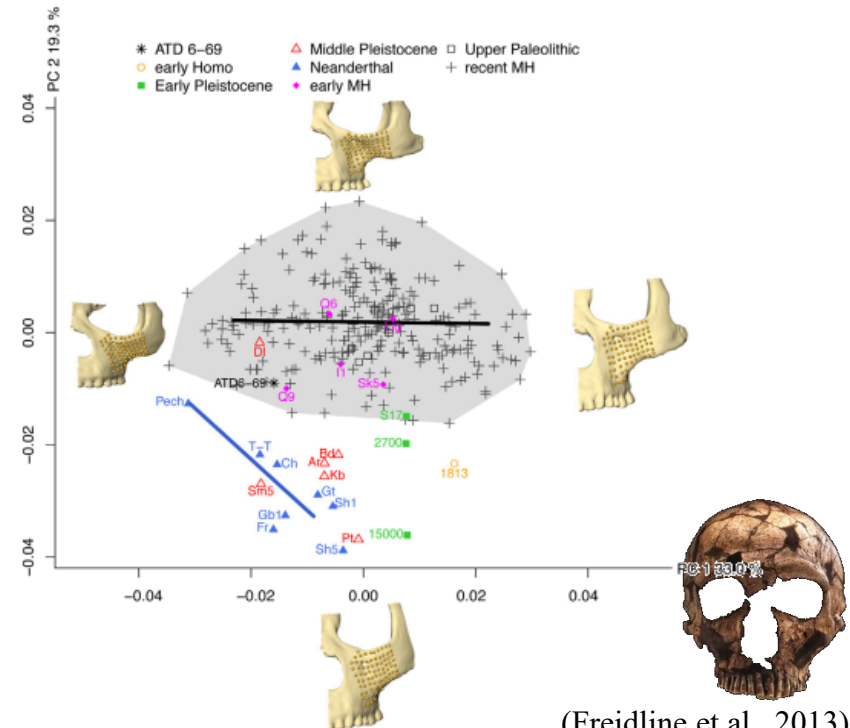
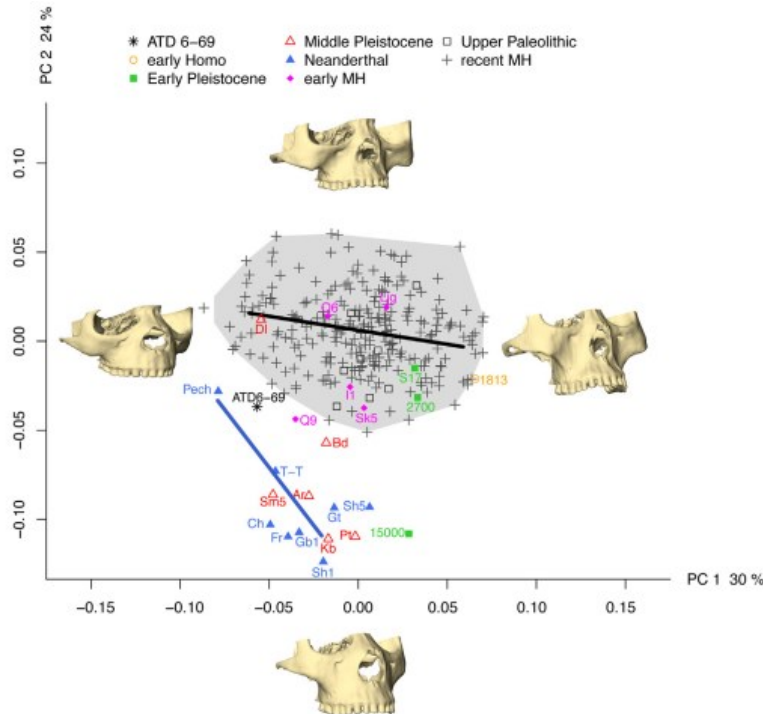
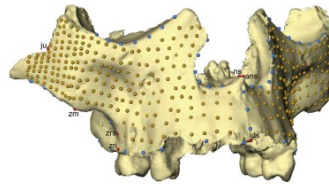
(Carbonell et al. 2010)







The fossil ATD6-69 has been suggested to mark the earliest appearance of modern human facial features. However, this specimen is a subadult and the interpretation of its morphology remains controversial, because it is unclear how developmental shape changes would affect the features that link ATD6-69 to modern humans.



(Freidline et al., 2013)

**ARTICLE**

WILEY

# Twentieth anniversary of *Homo antecessor* (1997-2017): a review

José María Bermúdez de Castro<sup>1,2\*</sup> | María Martín-Torres<sup>2,3\*</sup> |  
Juan Luis Arsuaga<sup>4</sup> | Eudald Carbonell<sup>5,6</sup>





**TABLE 1** List of some of the features observed in *Homo antecessor*

|                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| • Plesiomorphic (primitive) features for the Homo clade                                                                                                                                                                 |
| -Fusion of the styloid process to the basicranium                                                                                                                                                                       |
| -Nasal floor showing a level and sloping configuration                                                                                                                                                                  |
| -Position of the mental foramen at the level of mandibular P <sub>3</sub> -P <sub>4</sub>                                                                                                                               |
| -Low position of the mylohyoid line in relation to the alveolar margin at the mandibular M <sub>3</sub> level                                                                                                           |
| -Parallel trajectory of the mylohyoid line in relation to the alveolar margin                                                                                                                                           |
| -Shallow relief of the pterygoid fossa                                                                                                                                                                                  |
| -Lateral intersection between the mandibular notch and the condyle                                                                                                                                                      |
| -Absence of retromolar space                                                                                                                                                                                            |
| -M <sub>3</sub> partially covered by the mandibular ramus                                                                                                                                                               |
| -Strong tuberculum molare on the deciduous dm <sup>1</sup>                                                                                                                                                              |
| -Presence of mesial and lingual styles on the deciduous upper canine                                                                                                                                                    |
| -Buccal faces of the mandibular premolars showing mesial and distal marginal ridges and grooves, which connect with the shelf-like cingulum                                                                             |
| -Crown shape of the mandibular P <sub>3</sub> is strongly asymmetrical, with a remarkable talonid and a large occlusal polygon                                                                                          |
| -Mandibular P <sub>4</sub> showing an asymmetrical outline, with a mesially displaced metaconid extended talonid, and a broad occlusal polygon                                                                          |
| -Mandibular P <sub>3</sub> and P <sub>4</sub> showing a complex root system (2R: MB+DL) <sup>1</sup> formed by a mesiobuccal (MB) plate-like root with two pulp canals and a distolingual (DL) root with a single canal |
| -M1<M2 for both upper and lower molar series.                                                                                                                                                                           |
| -Mandibular M <sub>1</sub> and M <sub>2</sub> exhibiting a Y-pattern of the buccal and lingual grooves separating the five principal cusps                                                                              |
| -Enamel of the occlusal surface of the postcanine teeth is moderately or remarkably crenulated                                                                                                                          |
| -Absolutely and relatively long radial neck                                                                                                                                                                             |



- Apomorphic (derived features), shared with later hominins

-Doubled arched supraorbital torus

-Parietals showing parasagittal flattening of the upper surfaces

-Position of the lateral prominence at the level of the talonid of mandibular M<sub>2</sub>

-Absence of alveolar prominence

-Oblique inclination of the trigonum postmolare

-Shallow relief of the masseteric fossa

-Moderately hollowed posterior subalveolar fossa

-Regular gonion profile

-Length/width index of the mandibular alveolar arcade clearly below 100 (following Rosas and Bermúdez de Castro<sup>47</sup>)

-Permanent mandibular incisors buccolingually expanded with respect to *H. habilis* s.s. and other African and Eurasian Early Pleistocene hominins such as KNM ER 992 or Dmanisi

-P<sub>3</sub>>P<sub>4</sub> size sequence for the crown area of the maxillary and mandibular premolars

-Postcanine teeth smaller than those of *H. habilis* s.s. and within the range of *H. ergaster* (or African *H. erectus*), *H. erectus* s.l., and European Middle Pleistocene hominins.

-Mandibular M<sub>3</sub> noticeably reduced with respect to M<sub>1</sub> and M<sub>2</sub>

-Antero-medially facing radial tuberosities





• *Derived features, shared with Neandertals and modern humans*

- Convex superior border of the temporal squama<sup>2</sup>
- Anterior position of the incisive canal, which is nearly vertical
- Absence (or weak) planum alveolare

• *Derived features shared with modern humans*

- Modern-like mid-facial topography: infraorbital surface coronally oriented and sloping downward and backward (true canine fossa) with a horizontal and high rooted inferior border
- Medial position of the deepest point of the mandibular notch
- Relatively narrow patellae with high patellar indices

• *Derived features shared with Neandertals and the SH hominins*

- Presence of a medial pterygoid tubercle
- Rhomboidal and compressed occlusal polygon and a skewed external outline of the permanent M<sup>1</sup> with a bulging protrusion of the hypocone
- Permanent upper incisors showing a shovel shape,<sup>3</sup> particularly marked in I<sup>2</sup>
- Large olecranon fossa and very thin medial and lateral pillars
- Clavicle absolutely very long (maximum length), relatively slender (low robusticity index), with pronounced shaft curvature and relatively small ephiphyses<sup>4</sup>
- Relatively narrower trochlea of the talus<sup>4</sup>
- Presence of middle trigonid crest

All these features have been studied by some authors.<sup>1,5,23,27,34,35,40,45,46,48,49,54,57,59,63,65,67,123</sup> In these studies, more detailed descriptions and discussions of the polarity of the TD6 features can be found.

1. According to the Wood et al.<sup>124</sup> classification.<sup>124</sup>

2 This feature as also present in African and later Asian Middle Pleistocene fossils.<sup>27</sup>

3. This feature is also common in other Middle Pleistocene Eurasian hominins.

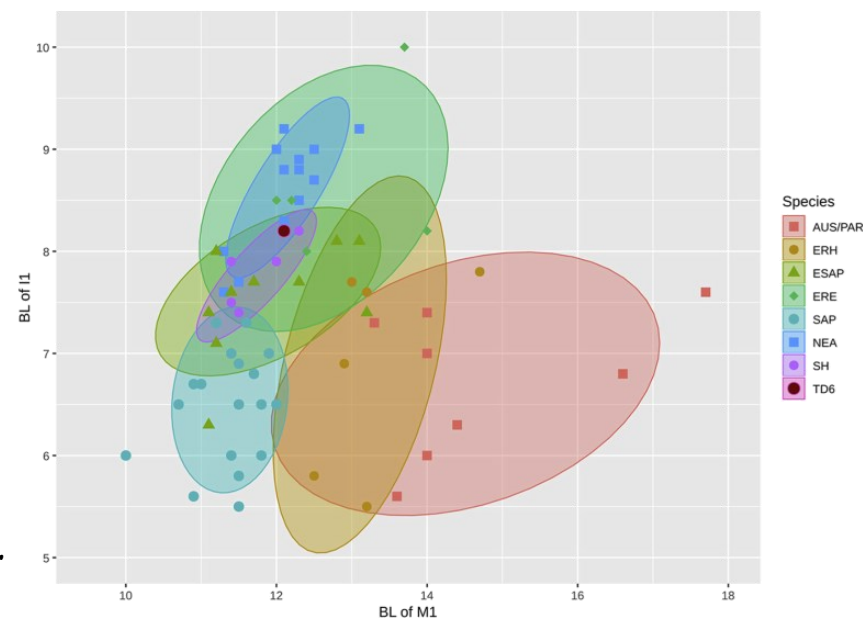
4. These features are found in Neandertals, but not in the SH hominins.<sup>67</sup>





New permanent teeth from Gran Dolina-TD6 (Sierra de Atapuerca).  
The bearing of *Homo antecessor* on the evolutionary scenario of Early and Middle Pleistocene Europe

María Martín-Torres <sup>a, b, \*, 1</sup>, José María Bermúdez de Castro <sup>a, b, \*, 1</sup>,  
Marina Martínez de Pinillos <sup>a</sup>, Mario Modesto-Mata <sup>a, b</sup>, Song Xing <sup>c, d</sup>,  
Laura Martín-Francés <sup>e, a</sup>, Cecilia García-Campos <sup>a</sup>, Xiujie Wu <sup>c</sup>, Wu Liu <sup>c</sup>

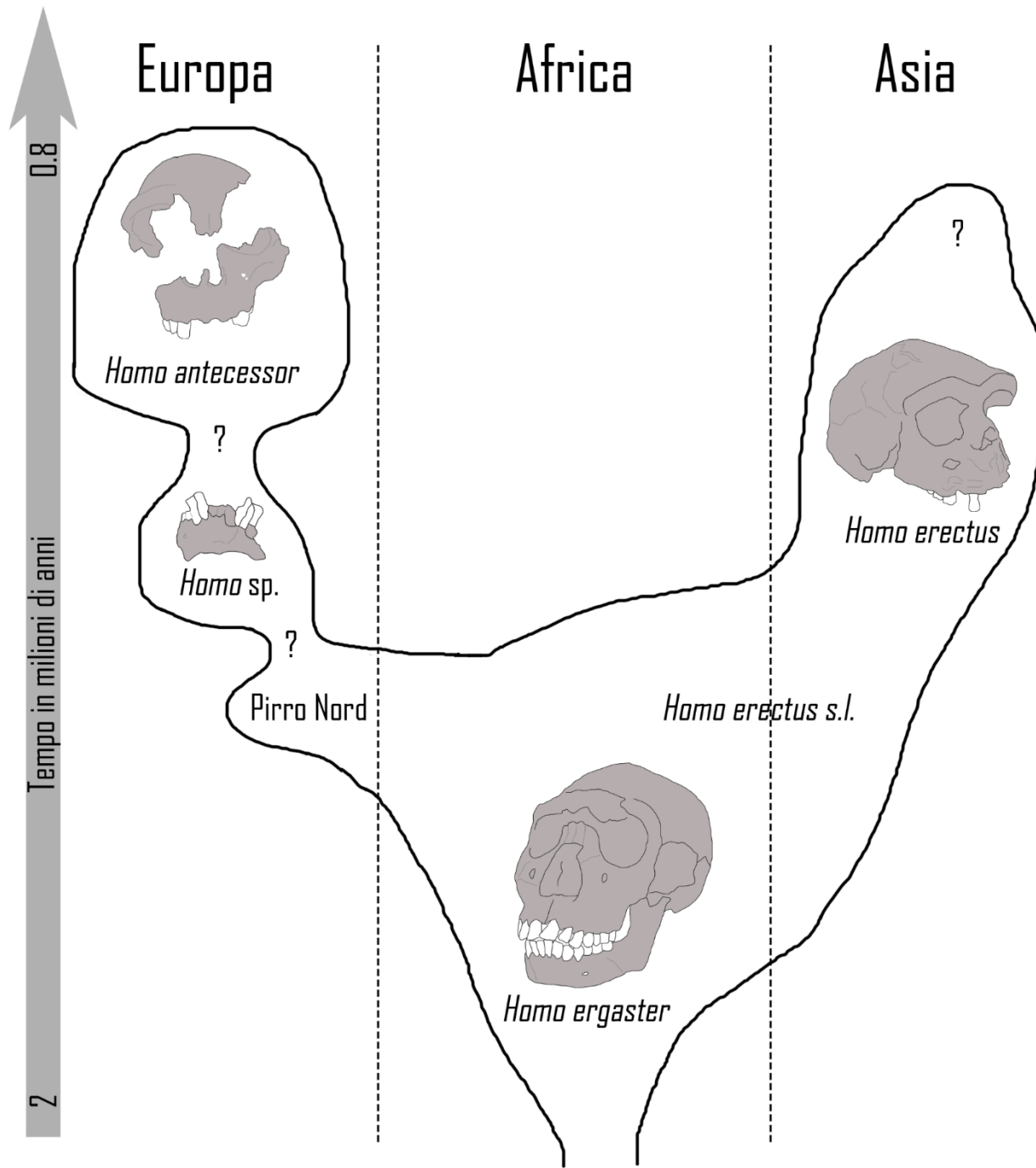


- Support the **taxonomic validity** of the *Homo antecessor*
- Unic mosaic of features:
  - Presence of **primitive traits** for the genus *Homo*
  - Presence of features **exclusively shared** with Early and Middle Pleistocene Eurasian hominins.
  - Some of these traits were retained by the MP hominins of Europe and became **the typical condition** of the Neanderthal lineage.
  - Teeth do not show **any synapomorphy** of modern humans and are **different** from Asian *Homo erectus*.



Compatible with the hypothesis about *H. antecessor* belonging to the **basal population** from which *H. sapiens*, *H. neanderthalensis*, and Denisovans emerged.







# I « Preneandertaliani »

I Preneandertaliani : Si cominciano ad individuare alcune apomorfie.

Le prime caratteristiche morfologiche di tale popolazione si osservano attorno a 350-400.000 anni fa, sui fossili dell'Arago (Francia) e di Sima de los Huesos (Spagna).

*Some apomorphies start to be individualized. The first morphological features of this kind of population are observed around 350-400 000 years.*



Arago 21



Atapuerca 5

*L' Homo heidelbergensis* presenta un mosaico di caratteri.

I caratteri derivati compaiono in un modo discontinuo, ma sono sistematicamente rappresentati negli ultimi Neanderthal.

*The Homo heidelbergensis presents a mosaic of features.*

*The derived features appeared in an discontinued mode, but they are systematically represented in the last neandertal.*



Principali siti con resti umani attribuiti ad *Homo heidelbergensis*





# I PRIMI INSEDIAMENTI UMANI IN EUROPA



## PRIME "INCURSIONI" DEL GENERE HOMO IN EUROPA.

© DE AGOSTINI LIBRI - NOVARA 2011

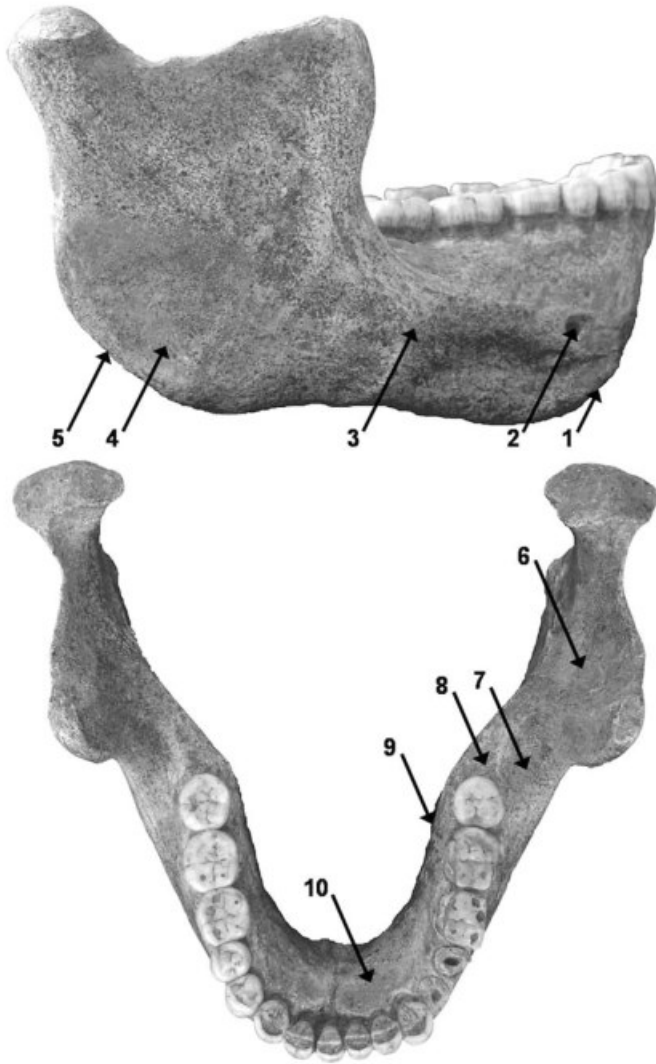
E N4STUDIO

- 1 Atapuerca Gran Dolina (1 200 000-780 000 anni fa)  
*Homo antecessor*
- 2 Atapuerca Sima de los Huesos (500 000 anni fa)  
*Homo heidelbergensis*
- 3 Arago (300 000-200 000 anni fa)  
*Homo heidelbergensis*
- 4 Terra Amata (400 000 anni fa - le prime capanne)  
*Homo heidelbergensis*
- 5 Mauer (600 000-500 000 anni fa)  
*Homo heidelbergensis*
- 6 Steinheim (350 000-250 000 anni fa)  
*Homo heidelbergensis*
- 7 Bilzingsleben (370 000 anni fa)  
*Homo heidelbergensis*
- 8 Boxgrove (524 000-478 000 anni fa)  
*Homo heidelbergensis*
- 9 Pakefield (700 000 anni fa)  
*Homo heidelbergensis*
- 10 Swanscombe (300 000-200 000 anni fa)  
*Homo heidelbergensis*
- 11 Petralona (350 000-200 000 anni fa)  
*Homo heidelbergensis*
- 12 Vértesszöllös (350 000 anni fa)  
*Homo heidelbergensis*
- 13 Ceprano (430 000-385 000 anni fa)  
*Homo heidelbergensis*

\* Norfolk (UK) Happisburgh prints (850 ka)



## Mauer – Olotipo della specie *Homo heidelbergensis* (600 ka)



### Derived Neandertal-like traits

- foramina mentale posteriorly positionned (2)
- prominencia lateralis posteriorly positionned (3)
- truncated gonion (5)
- horizontal retromolar area (8)

### Plesiomorphies

- incisura submentalis (1)
- deep fossa masseterica (4)
- strongly developed planum triangulare (6)
- gutterlike extramolar sulcus (7)
- parallel mylohyoid line (9)
- extensive planum alveolare (10)



# Sima de los Huesos: 430 ka

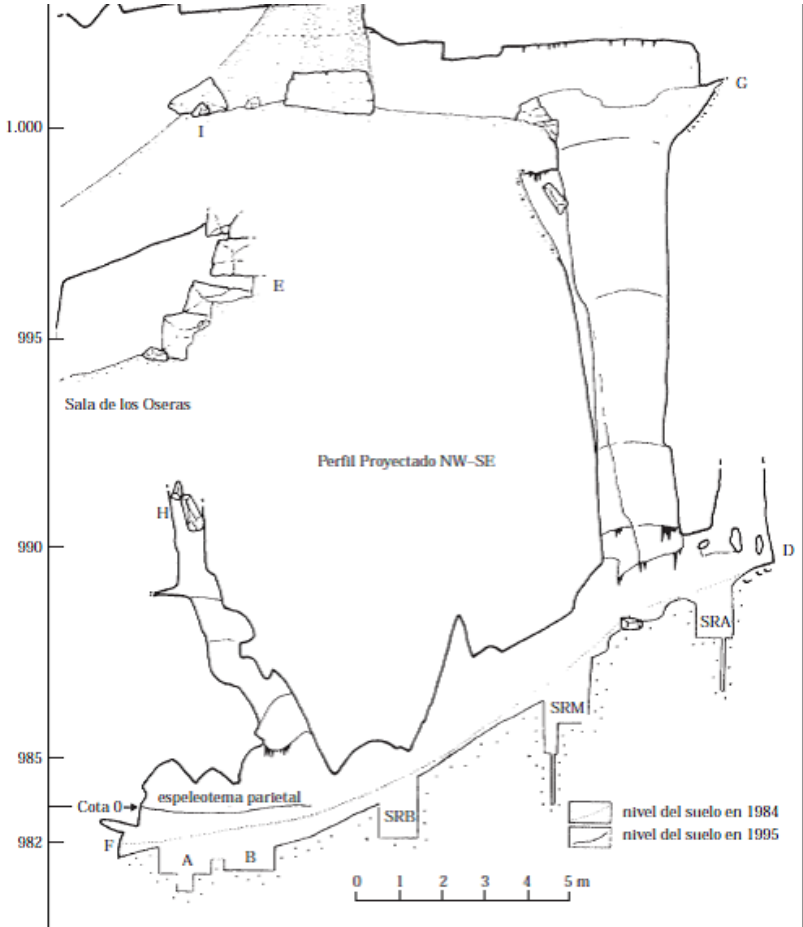
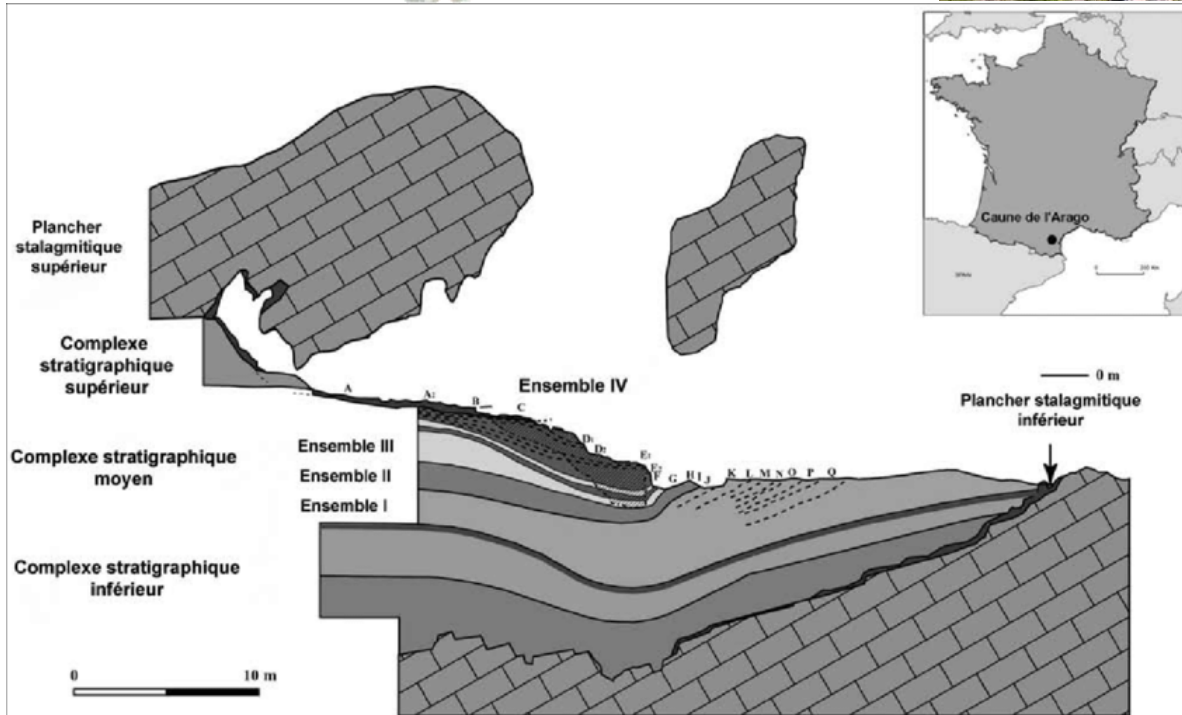


Figure 9. Sima de los Huesos profile (by G. E. Edelweiss, 1992-1996). Projection as in Figure 5. "Tapón de margas" indicates a cone of Neogene white marl coming from the outside. The levels of 1984 and 1995 floors are indicated, as well as a wall speleothem. The blind chimney in Sima de los Huesos behind (to the right of) the shaft, has not been completely drawn.





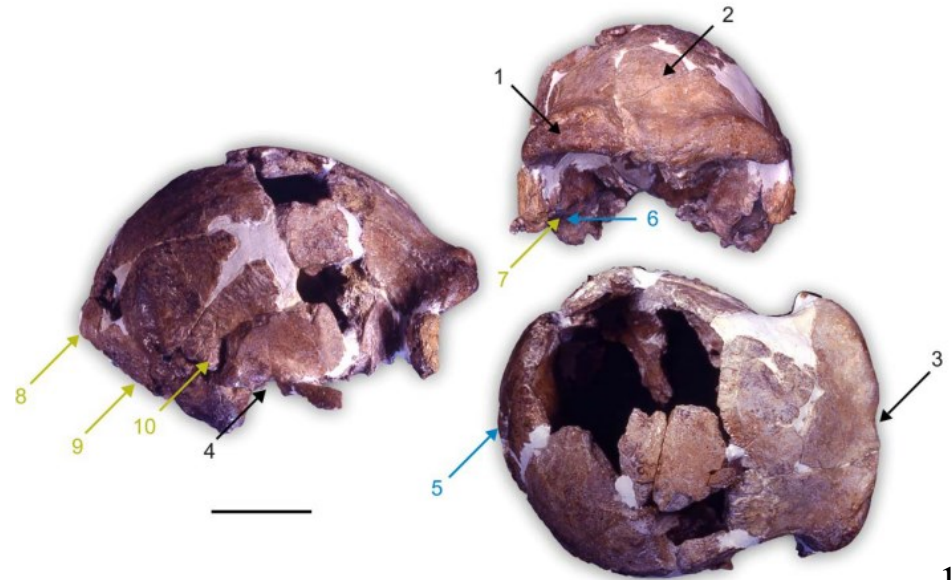
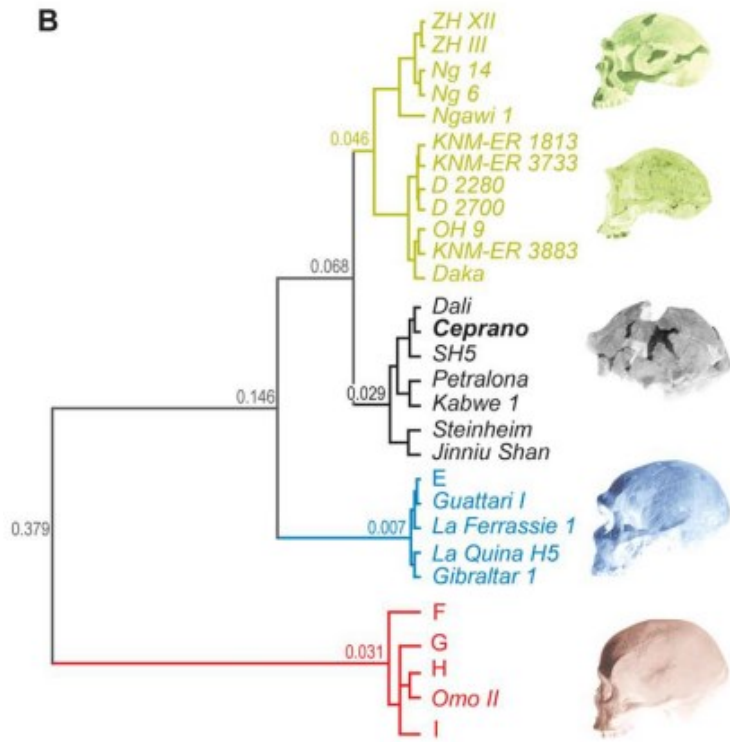
# Caune de l'Arago – Tautavel (France) – 450 ka





# Ceprano : 430 - 385 ka

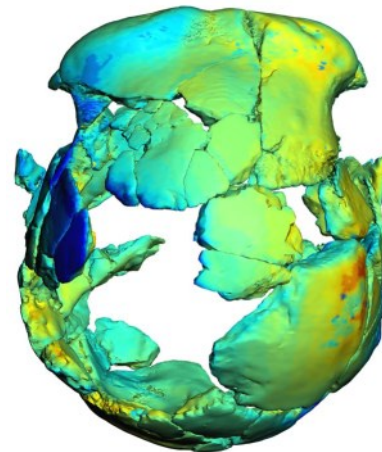
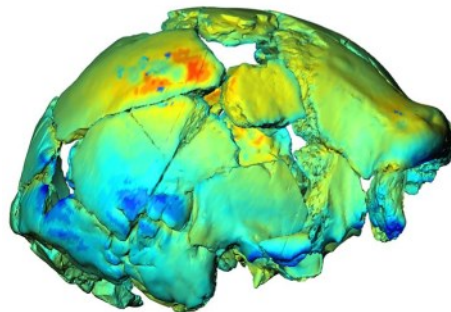
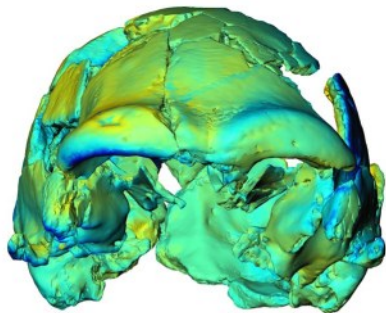
(Mounier, 2012)



1 a 4  
Tratti esclusivamente trovati nei specimen del P. medio

5 & 6  
Tratti derivati

7 a 10  
Tratti primitivi



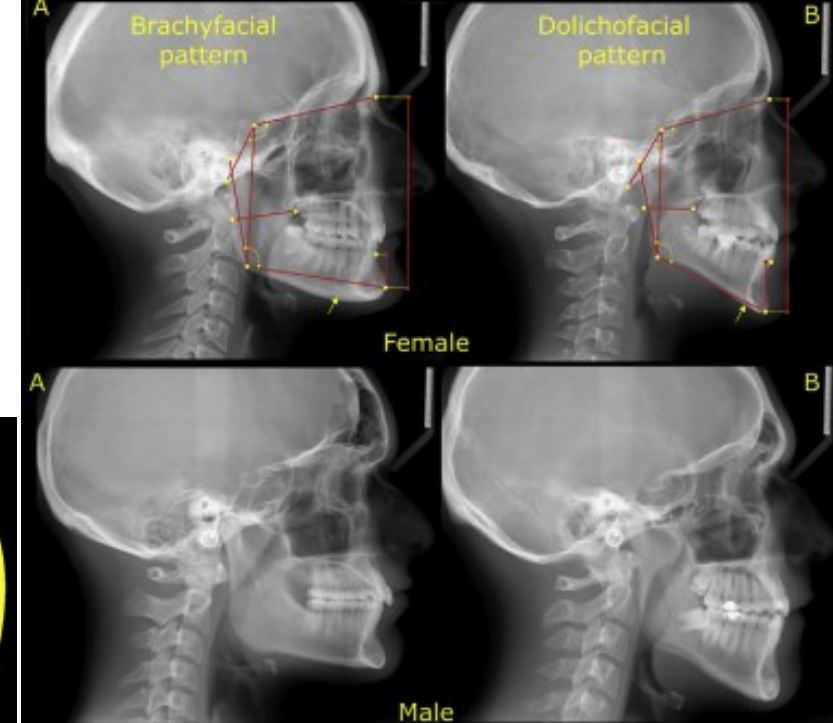
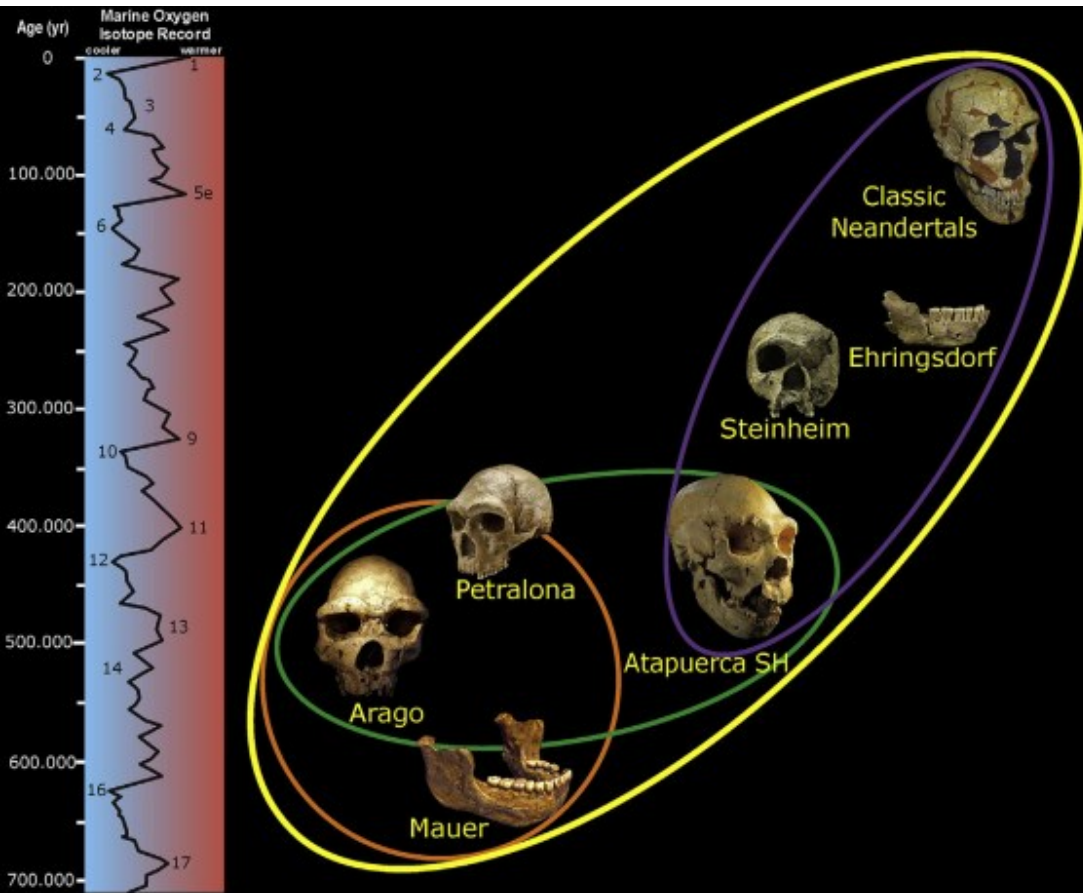
(Di Vincenzo et al, 2017)



## Tempo and mode in the Neandertal evolutionary lineage: A structuralist approach to mandible variation

Antonio Rosas <sup>a,\*</sup>, Markus Bastir <sup>a</sup>, Jose Antonio Alarcón <sup>b</sup>

<sup>a</sup> Paleanthropology Group, Department of Paleobiology, Museo Nacional de Ciencias Naturales, CSIC, Madrid, Spain  
<sup>b</sup> Department of Stomatology, Section of Orthodontics, Faculty of Odontology, University of Granada, Granada, Spain

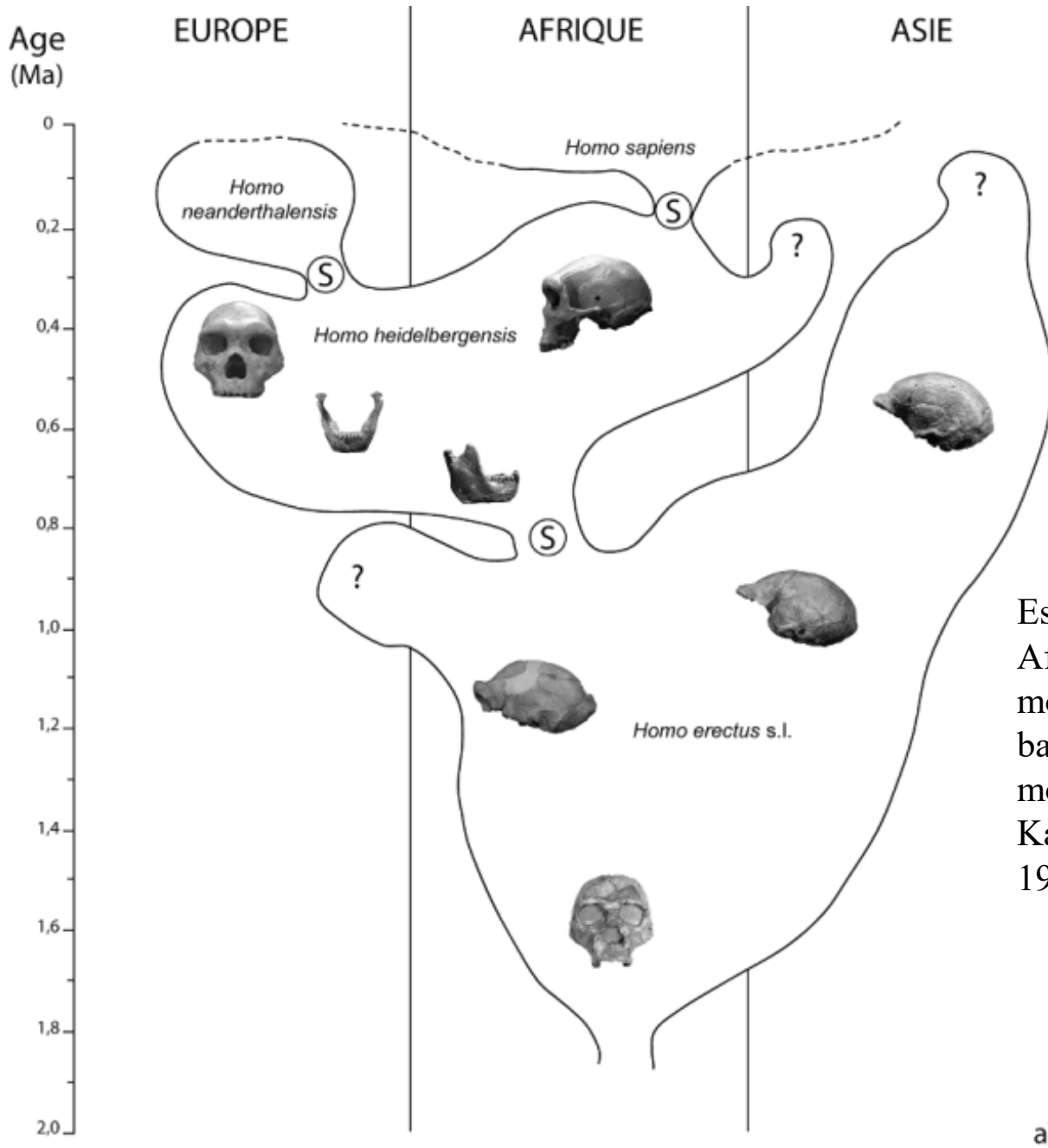


Mauer and Arago = single deme and the presence of Neandertal derived traits represent the beginning of their evolutionary process.

Atapuerca-SH have similarities with Mauer and Arago which allows linking of them to this group. Then Atapuerca-SH are considered members of Neandertal lineage.



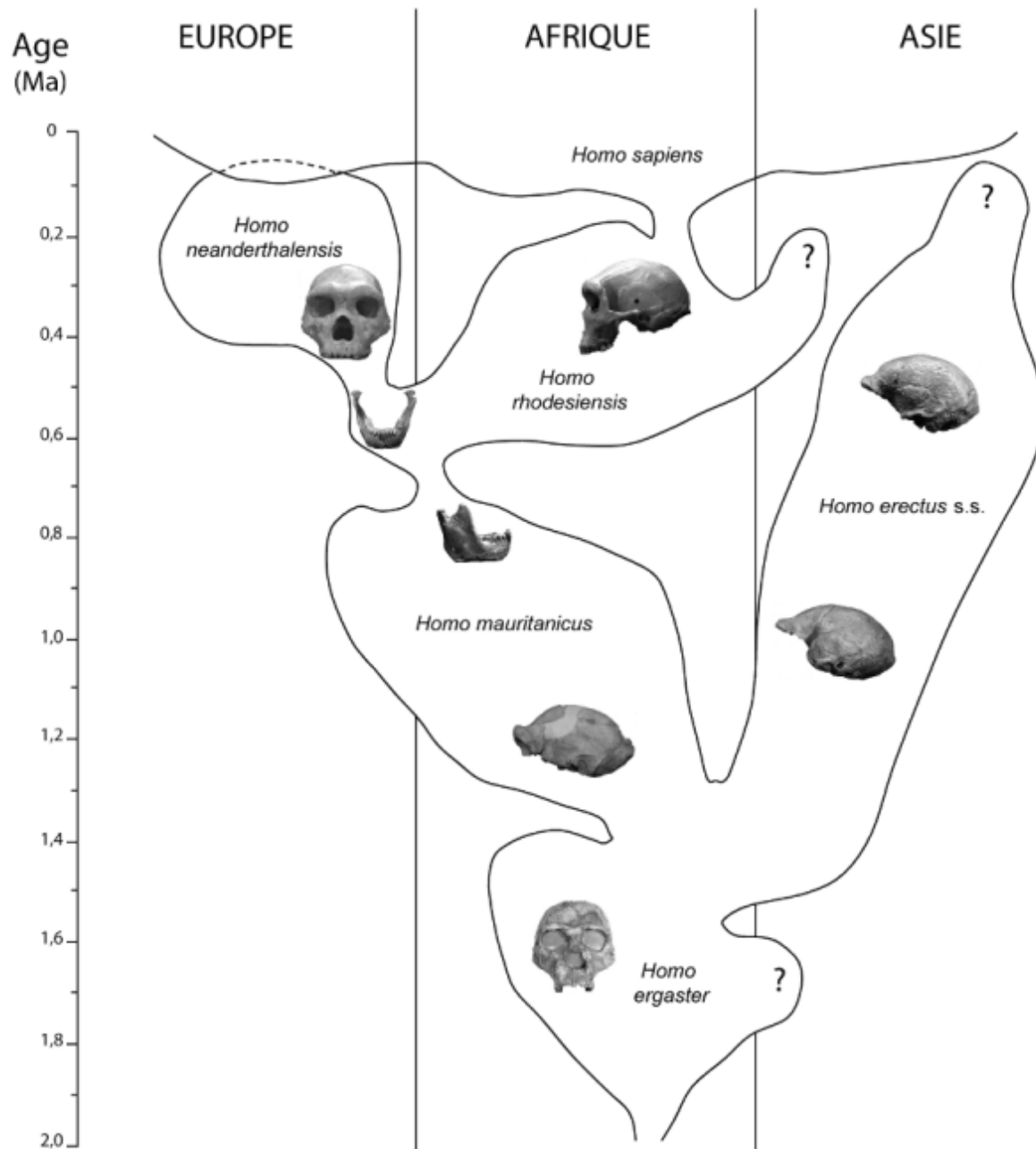
## Ipotesi Evolutive: Origine Afro-europea



Esistenza nel P. medio di un taxa  
Afro-europeo ancestrali ai uomini  
moderni e ai Neandertaliani =  
basato sulle assomiglianze  
morfologiche tra Petralona  
Kabwe e Mauer. (Rightmire,  
1998)



# Ipotesi Evolutive: Origine Afro-europea



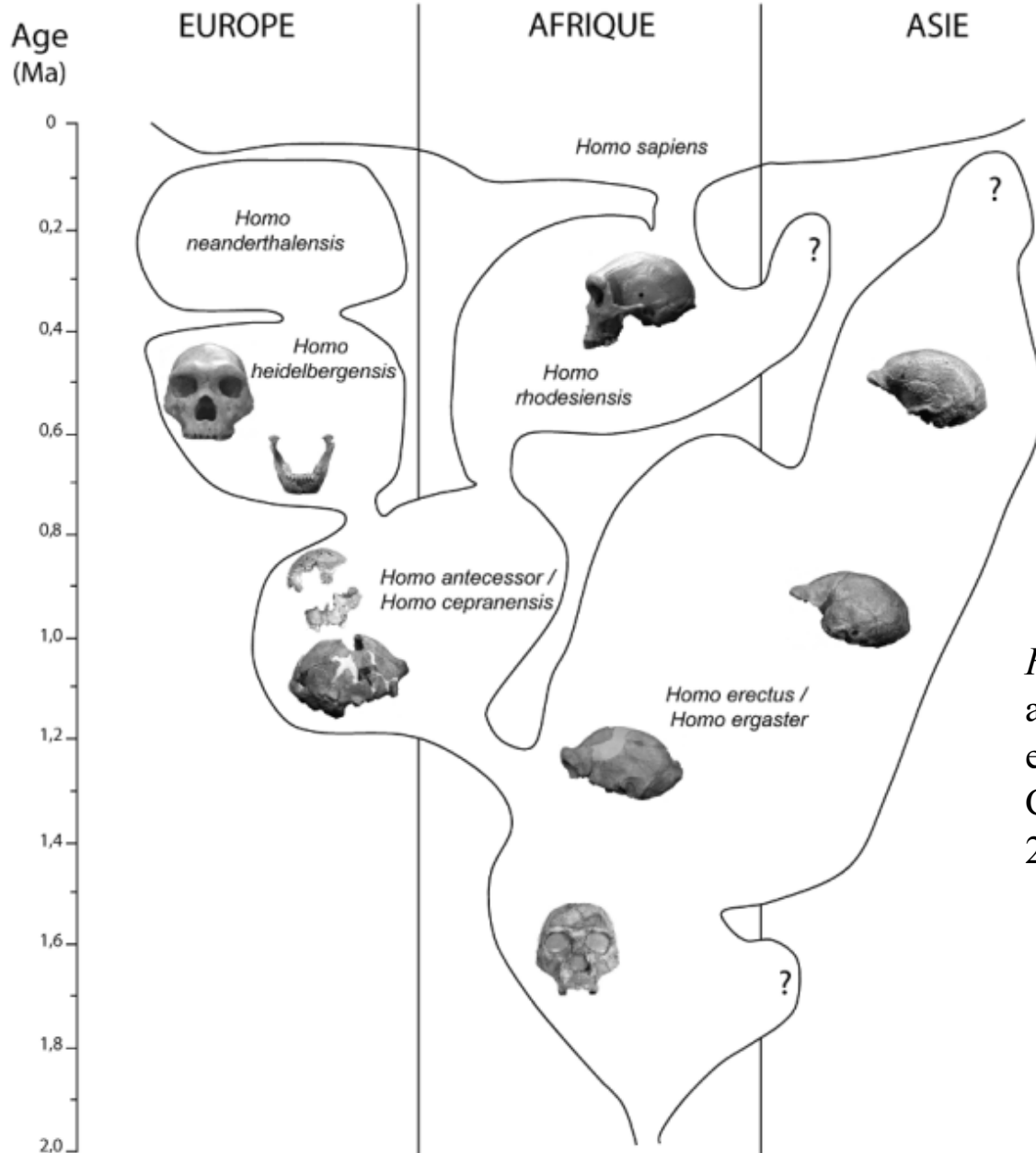
La presenza di caratteri Neandertaliani nella mandibola di Mauer giustifica la sua inclusione nella linea neandertaliana e quindi l'abbandono del nome *H. heidelbergensis* e l'introduzione del *H. mauritanicus* rappresentato dai resti di Tighenif e designato come l'ultimo antenato comune ai neandertaliani e i uomini moderni (Hublin, 2001)



b)



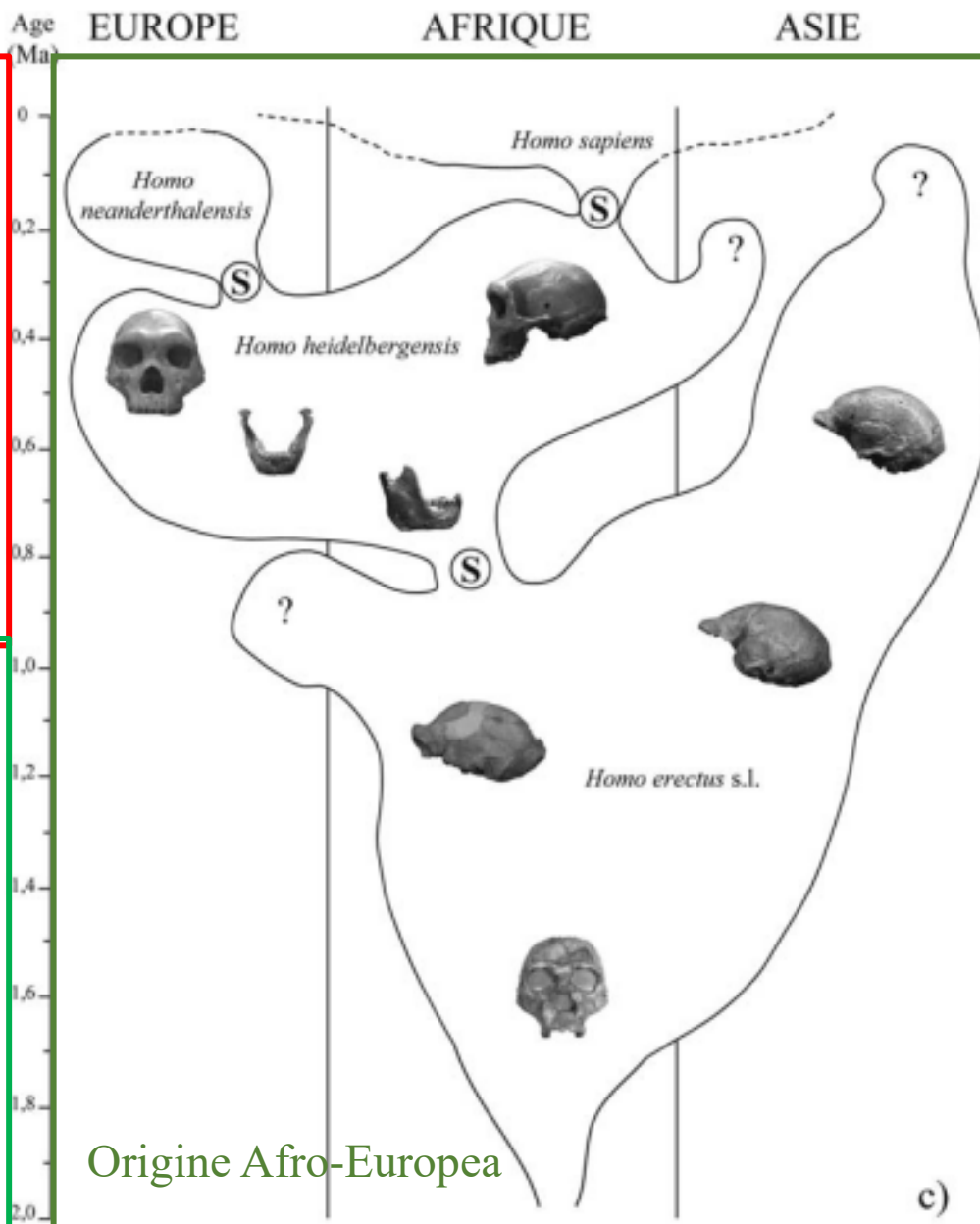
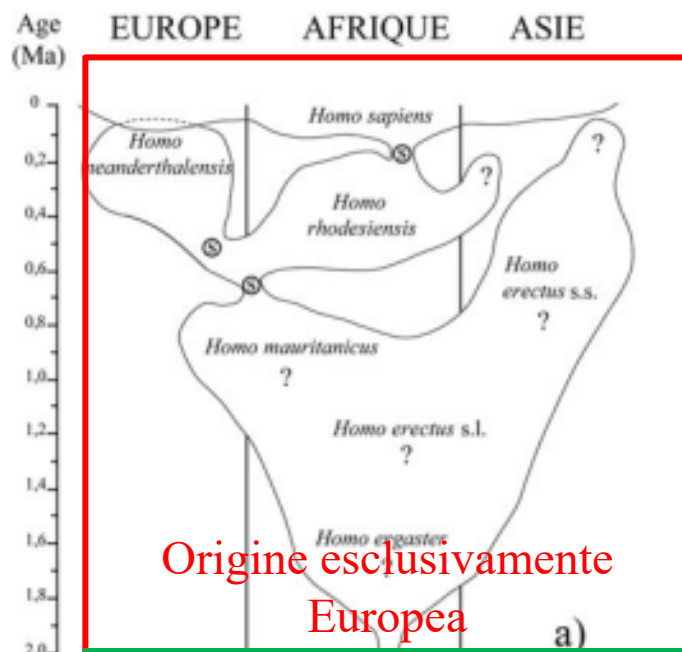
# Ipotesi Evolutive: Origine esclusivamente Europea

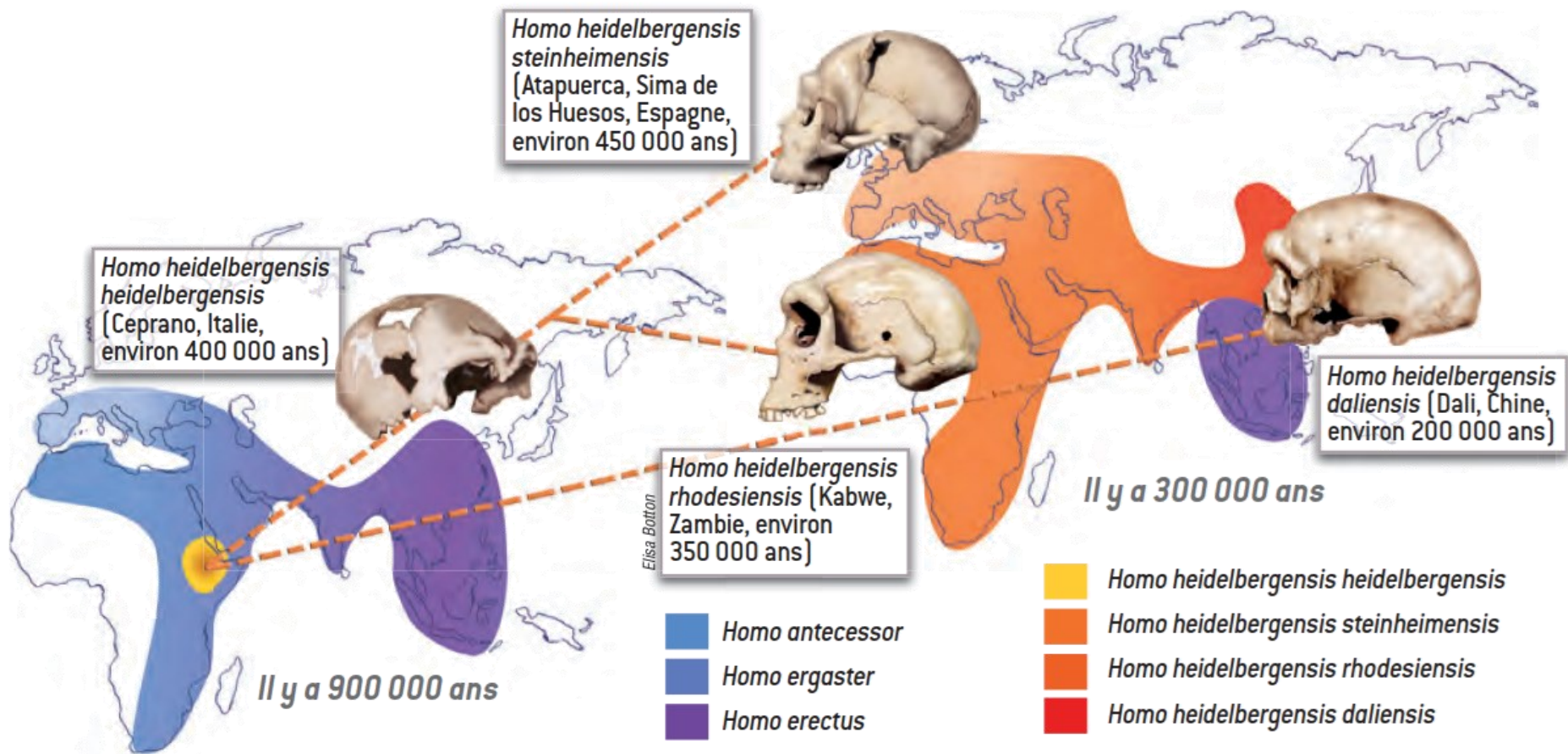


*H. antecessor* sarebbe l'ultimo antenato comune tra i neandertaliani e i uomini moderni (Bermudez de Castro et al., 1997; Mallegni et al., 2003)

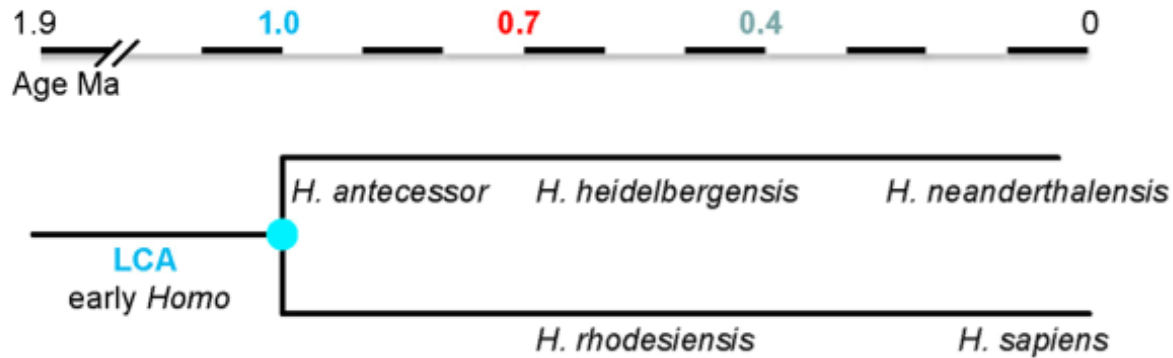
b)



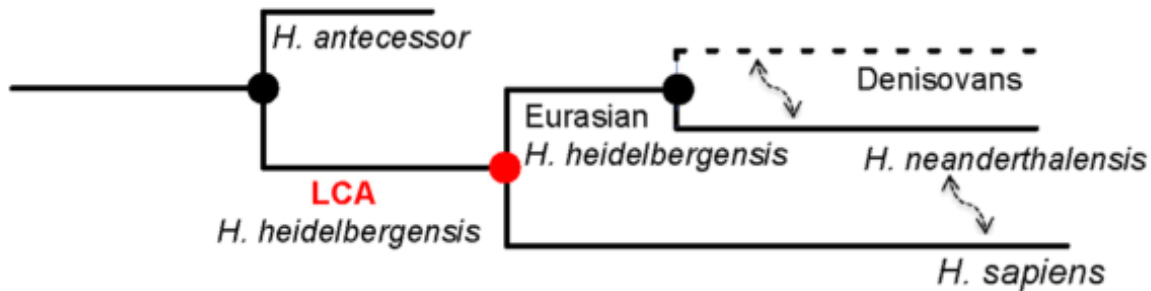




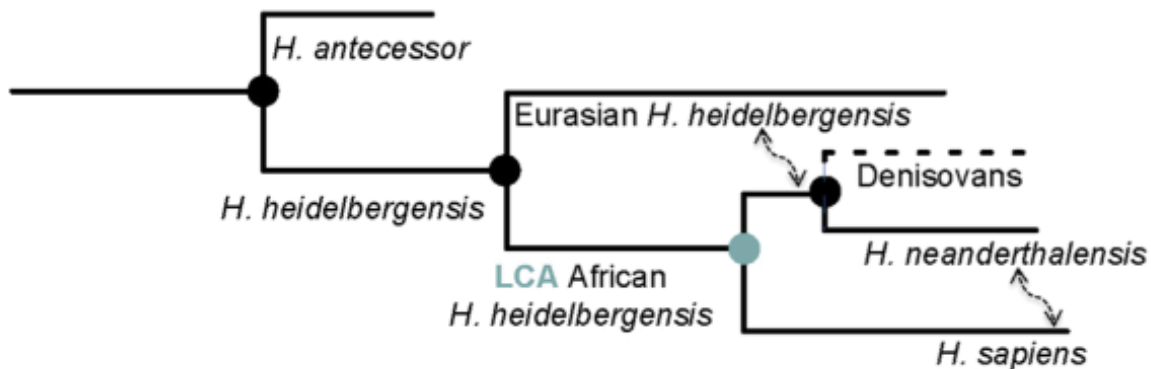




**Model 1: late Lower Pleistocene  
(~1.0 Ma) modern human and  
Neandertal LCA**

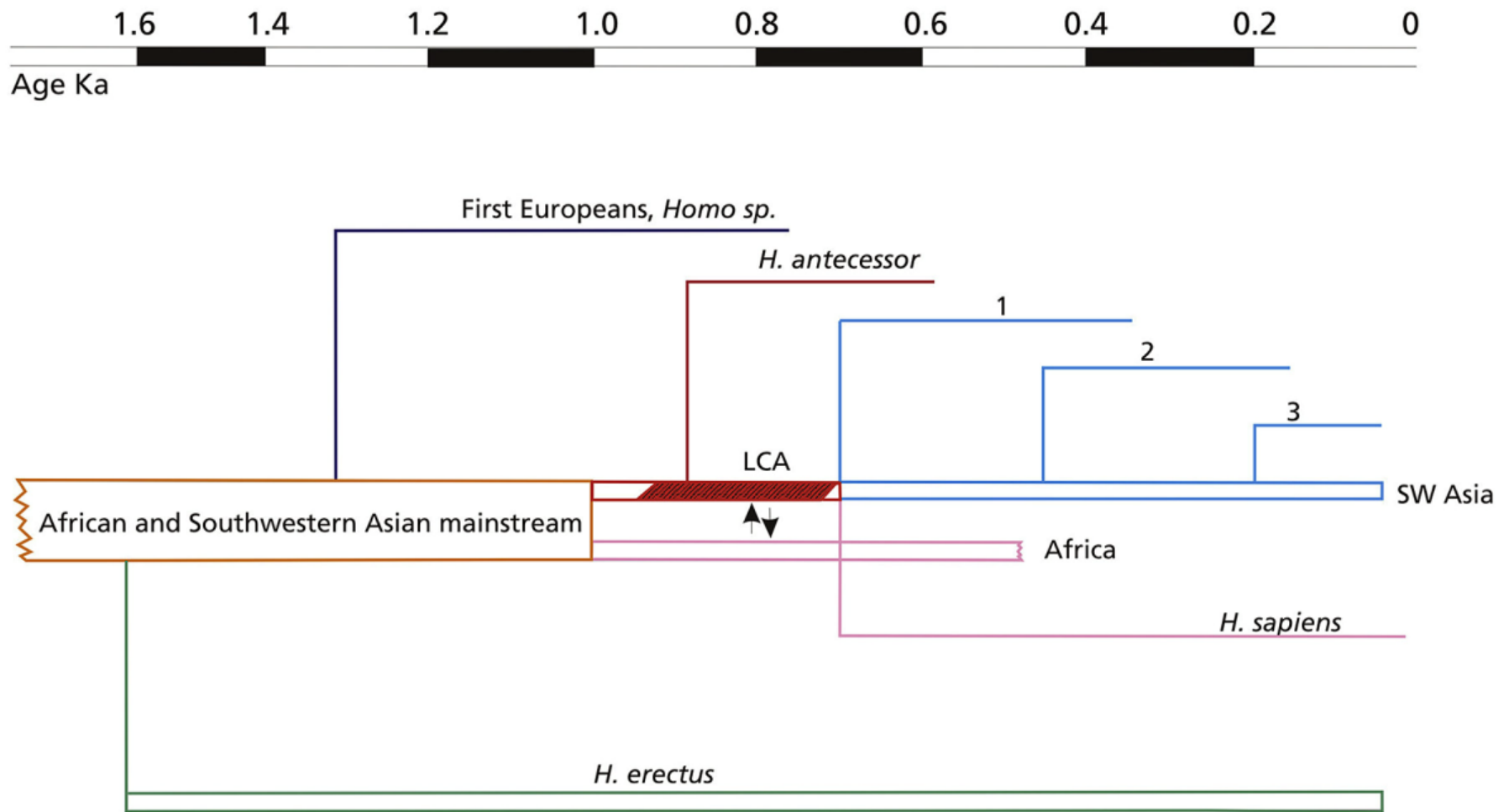


**Model 2: early Middle Pleistocene  
(~0.7 Ma) modern human and  
Neandertal LCA**



**Model 3: mid-Middle Pleistocene  
(~0.4 Ma) modern human and  
Neandertal LCA**





*H. antecessor* = European branch closely related to the LCA Neandertal and MH

*H. heidelbergensis* removed of the hominin phylogeny

European Middle Pleistocene specimens could be included in two or more branches of the Neanderthal clade



# LA SECONDA DIASPORA: ESPANSIONE DI HOMO HEIDELBERGENSIS E DELLE SUE VARIETÀ



OUT OF AFRICA 2. LA SECONDA DIASPORA, COMPIUTA QUESTA VOLTA DA HOMO HEIDELBERGENSIS.  
© DE AGOSTINI LIBRI - NOVARA 2011  
E145TU00

Quaternary Science Reviews 30 (2011) 1511–1524

Contents lists available at ScienceDirect

Quaternary Science Reviews

journal homepage: [www.elsevier.com/locate/quascirev](http://www.elsevier.com/locate/quascirev)



## Hominin variability, climatic instability and population demography in Middle Pleistocene Europe

Robin W. Dennell<sup>a,\*</sup>, María Martín-Torres<sup>b</sup>, José M. Bermúdez de Castro<sup>b</sup>

<sup>a</sup> Department of Archaeology, Northgate House, University of Sheffield, S1 4ET, UK

<sup>b</sup> Centro Nacional de Investigación sobre la Evolución Humana (CENIEH), Avd. La Paz 28 Entreplanta 1, 00904 Burgos, Spain



# *Homo neanderthalensis*



# Definizione dei Neandertaliani S.S.

L'uomo di Neanderthal si caratterizza per la presenza di:

*The Neandertals are characterized by the presence of:*

- **Caratteri arcaici / Plesiomorfie** : dei caratteri ancestrali che non si ritrovano in nessun fossile moderno.

*Archaic features / Plesiomorphies: These are ancestral features which are not found in the modern fossil.*

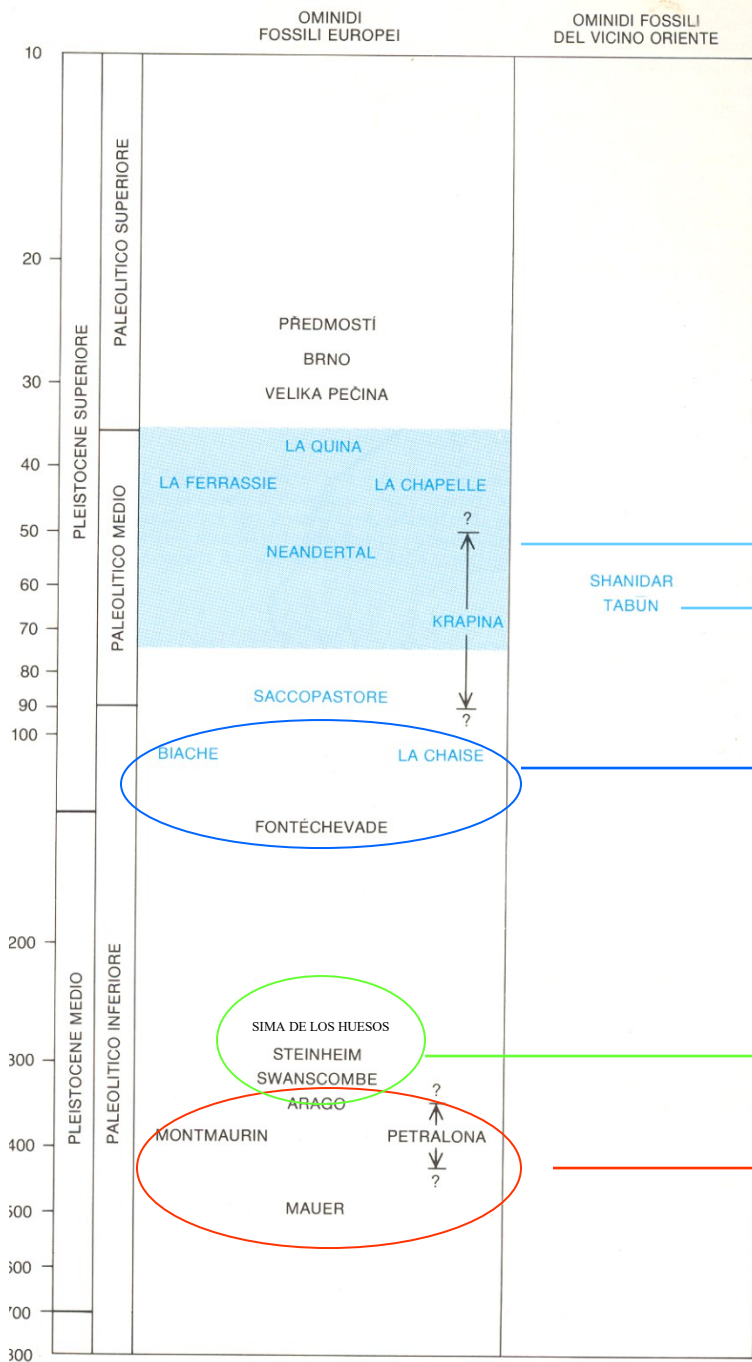
- **Caratteri condivisi** con *Homo sapiens*.

*Feature shared with Homo sapiens*

- **Caratteri derivati / Apomorfie** : presenti solo nei Neandertaliani, peculiari ed identificativi di questa specie.

*Derivated features / Apomorphies: These are present only in the Neanderthals, and allow to identify this species.*





# I Neandertaliani

Neandertaliani classici

Neandertaliani orientali

III fase (250.000-130.000):  
stabilizzazione dei caratteri

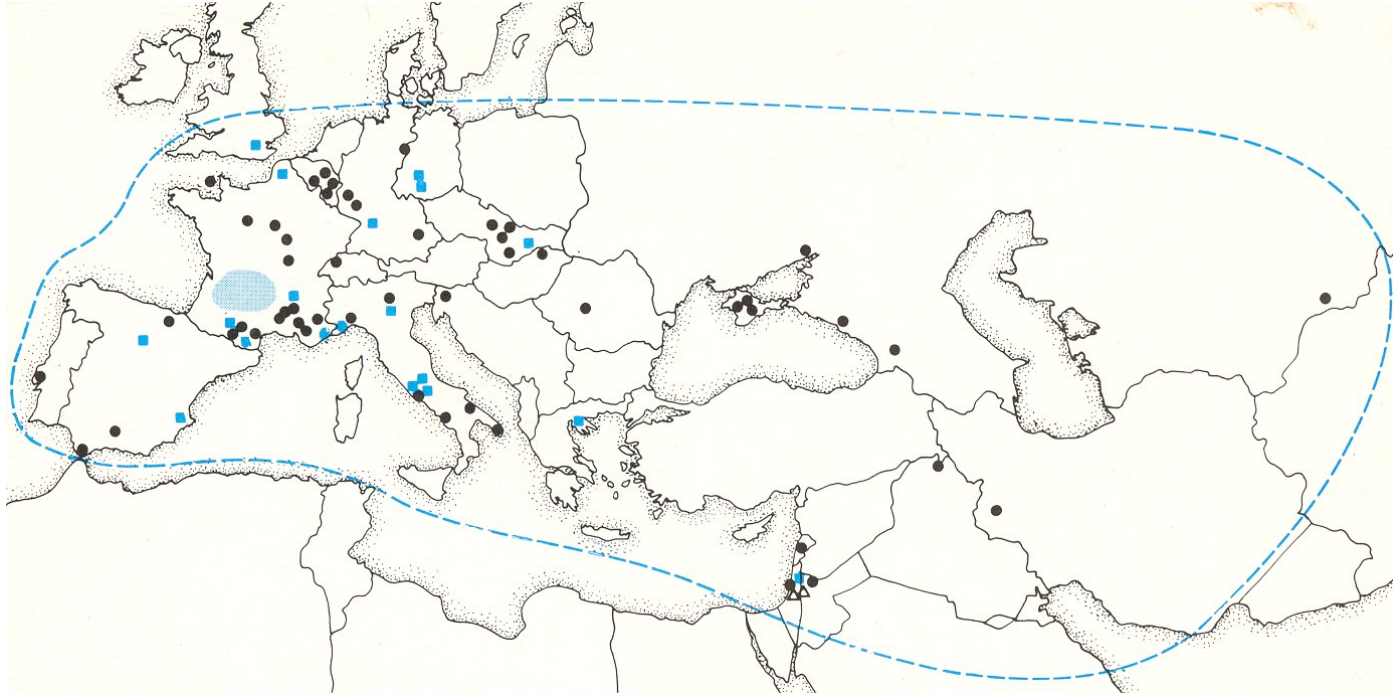
II fase (400.000-250.000): regione  
nucale e facciale

I fase (prima di 400.000): regione  
infraorbitaria e mandibola





# I Neandertaliani



Una speciazione di questi caratteri si osserva nel tempo e nello spazio, infatti i caratteri derivati si mostrano sempre più accentuati man mano che ci si sposta verso Ovest.

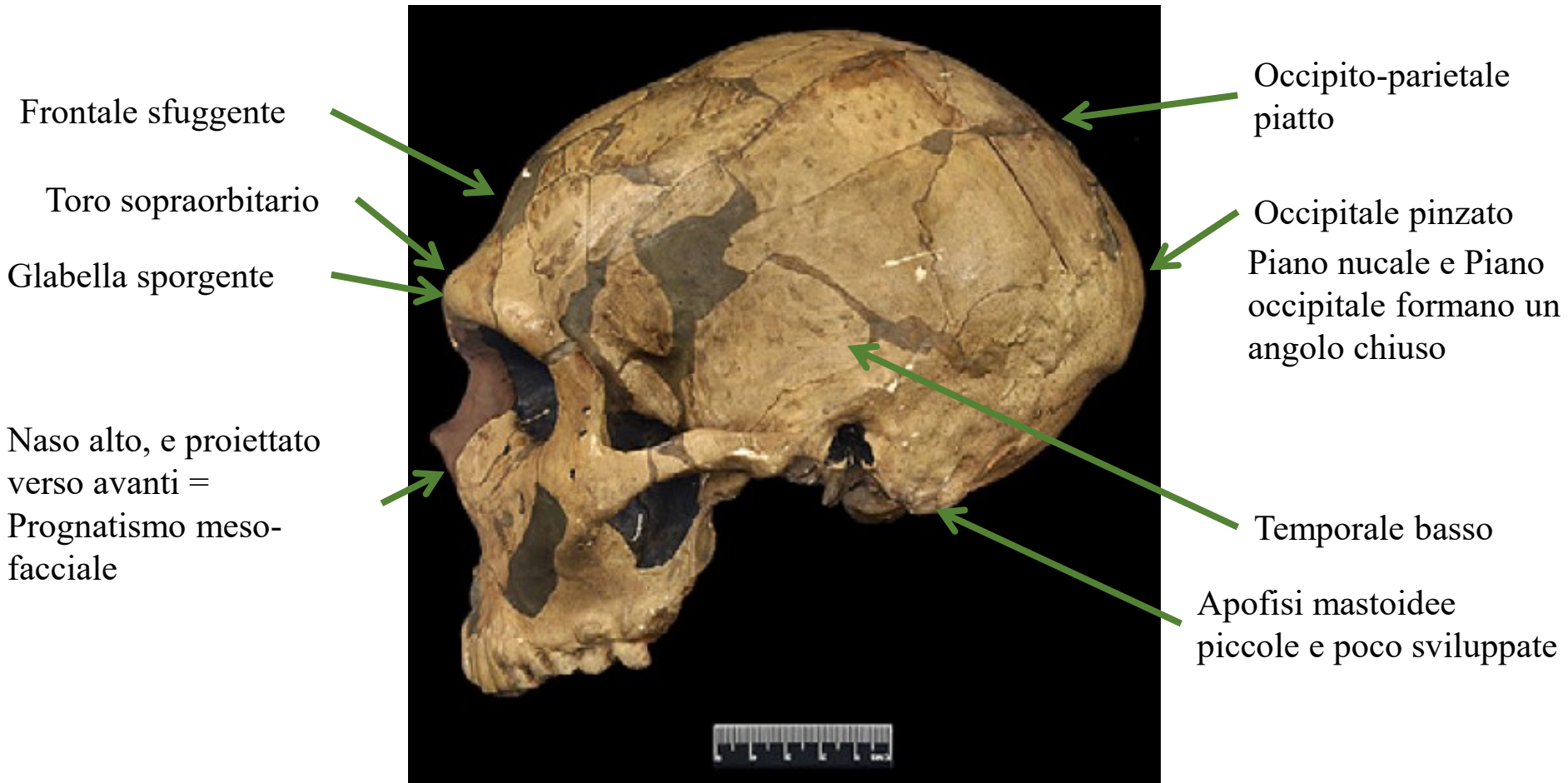
→ attorno a 50000 anni in Europa occidentale, gli individui di Neanderthal presentano dei caratteri derivati più pronunciati rispetto agli individui neandertaliani dell'Europa orientale.

*A speciation of these features can be observed in time and space. In fact the derived features are more accentuated going toward Western Europe.*

*→ around 50 000 years in Western Europe, the neanderthal present derived features more marked compared to the Neanderthal from Eastern Europe.*



Grande capacità cranica 1500-1700 cm<sup>3</sup>



Il cranio cerebrale è allungato per compensare la faccia voluminosa

La Ferrassie 1



*Important cranial capacity 1500-1700 cm<sup>3</sup>*

*Receding frontal bone*

*Supraorbital torus*

*Prominent glabella*

*Meso-facial prognatism*

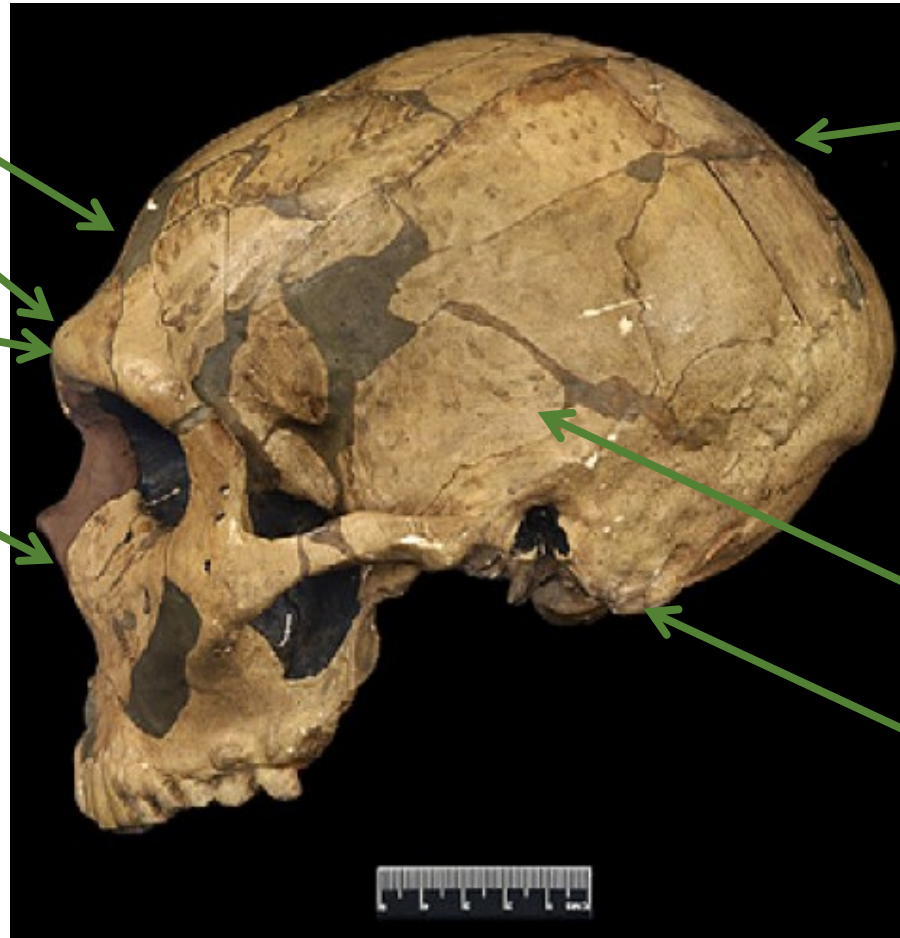
*Flat occipito-parietale region*

*Pinched occipitale pinzato*

*Closed angle between the nuchal and the occipital plans*

*Low temporale*

*Small and reduced mastoideal apophysis*



*Antero-posteriorly elongated cranium*

*La Ferrassie 1*



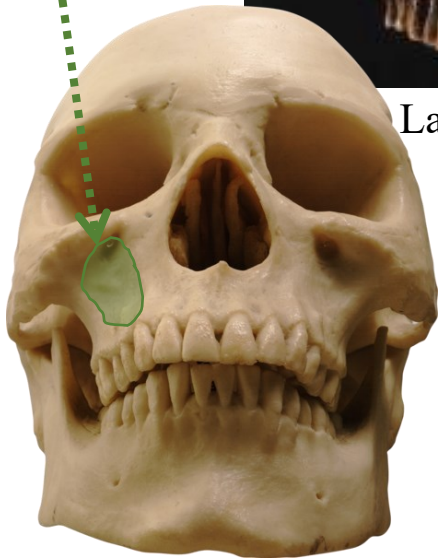


Orbite più large che alte,  
arrotondate e grandi

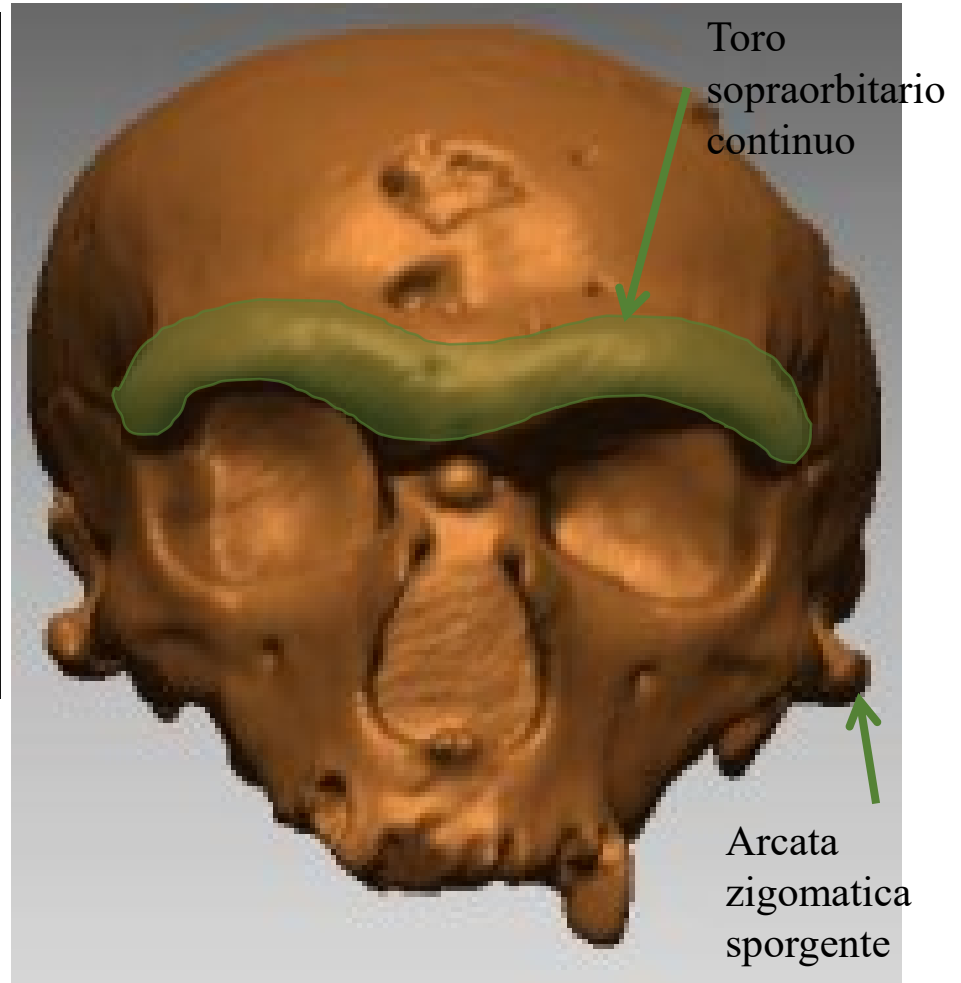


La Ferrassie 1

Assenza di  
fossa canina



Cavità nasale alta e  
voluminosa



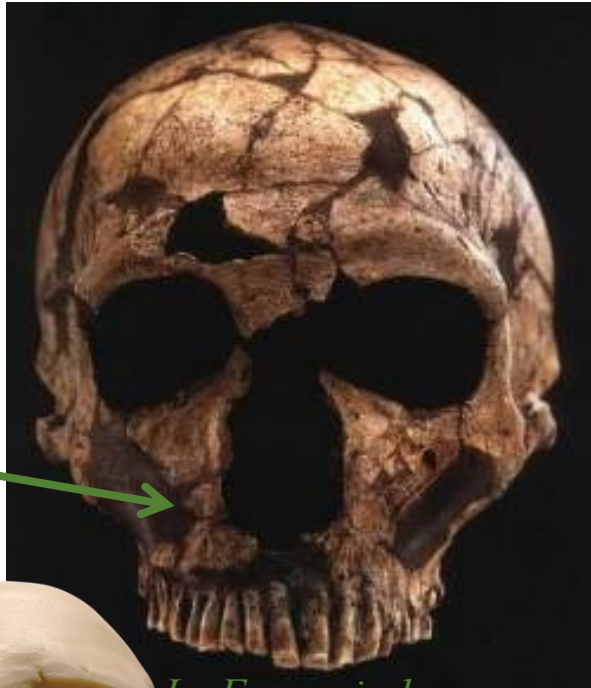
Toro  
sopraorbitario  
continuo

Arcata  
zigomatica  
sporgente

La Chapelle-aux-Saints 1

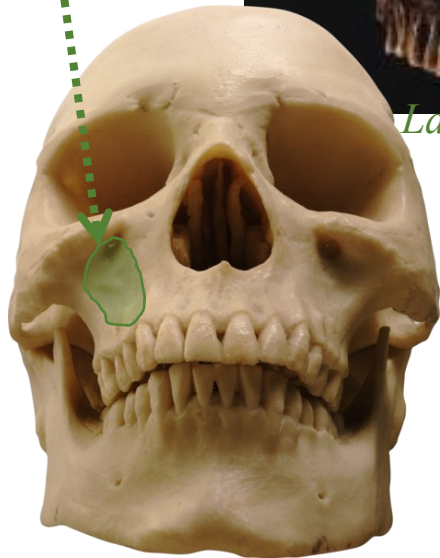


*Rounded orbite larger than wide*



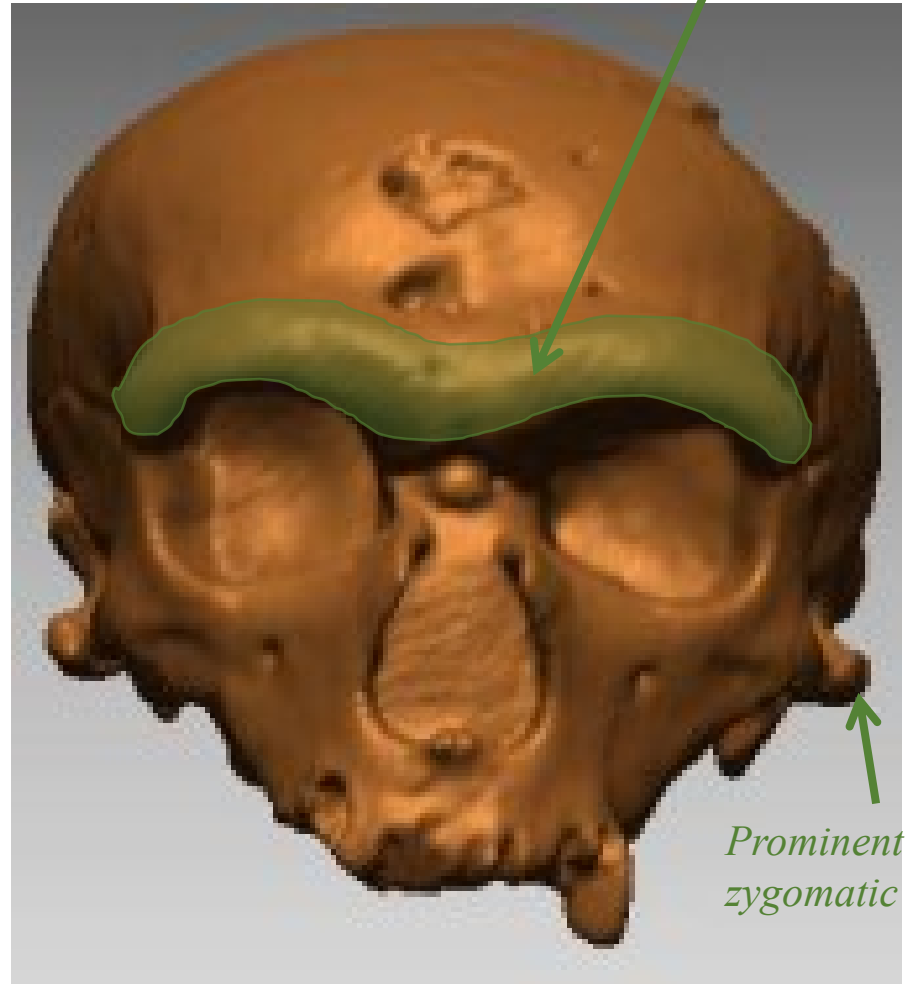
*La Ferrassie 1*

*Fossa  
canina  
absent*



*Nasal cavity high and  
voluminous*

*Continuous  
supraorbital  
torus*

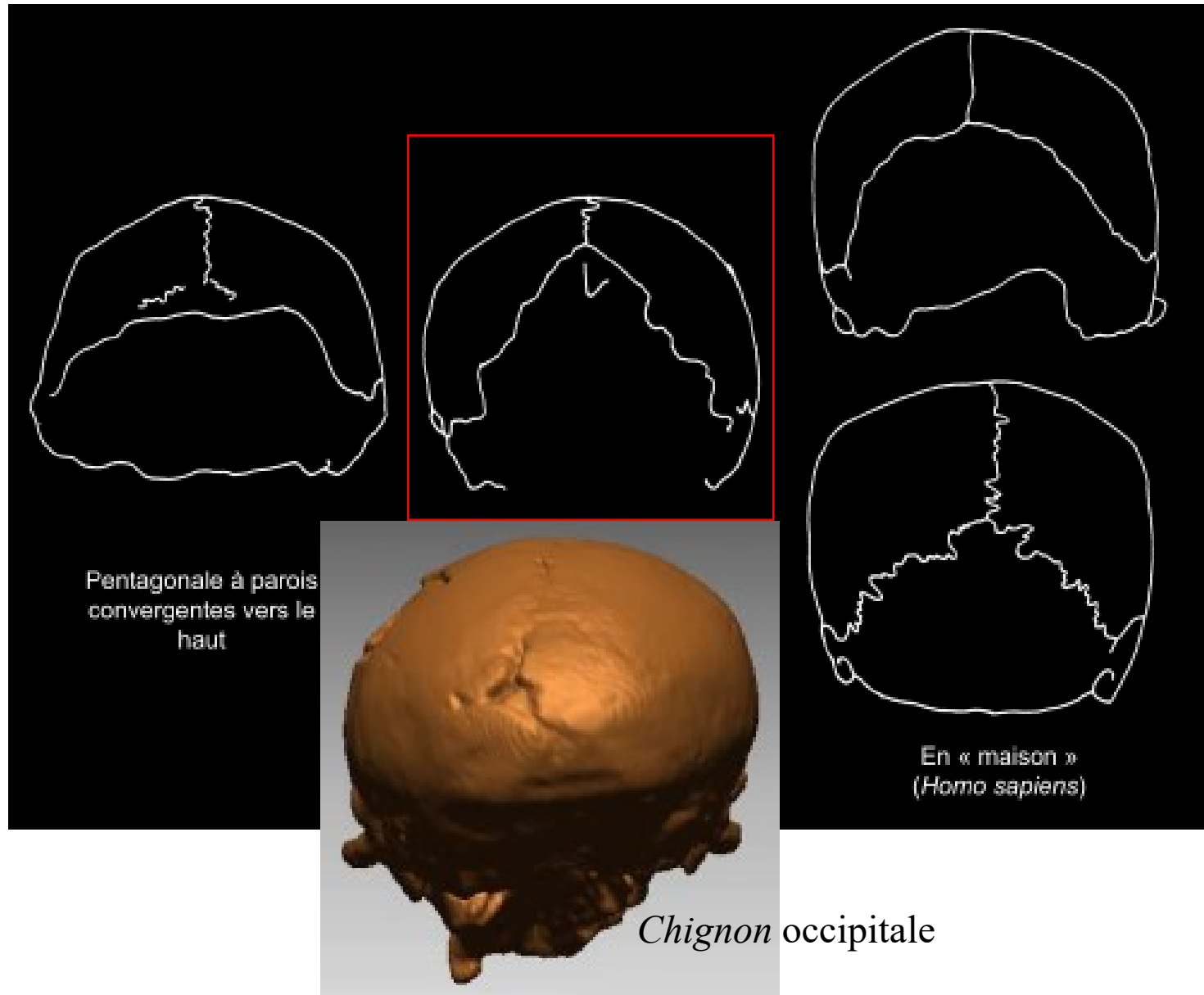


*Prominent  
zygomatic arch*

*La Chapelle-aux-Saints 1*



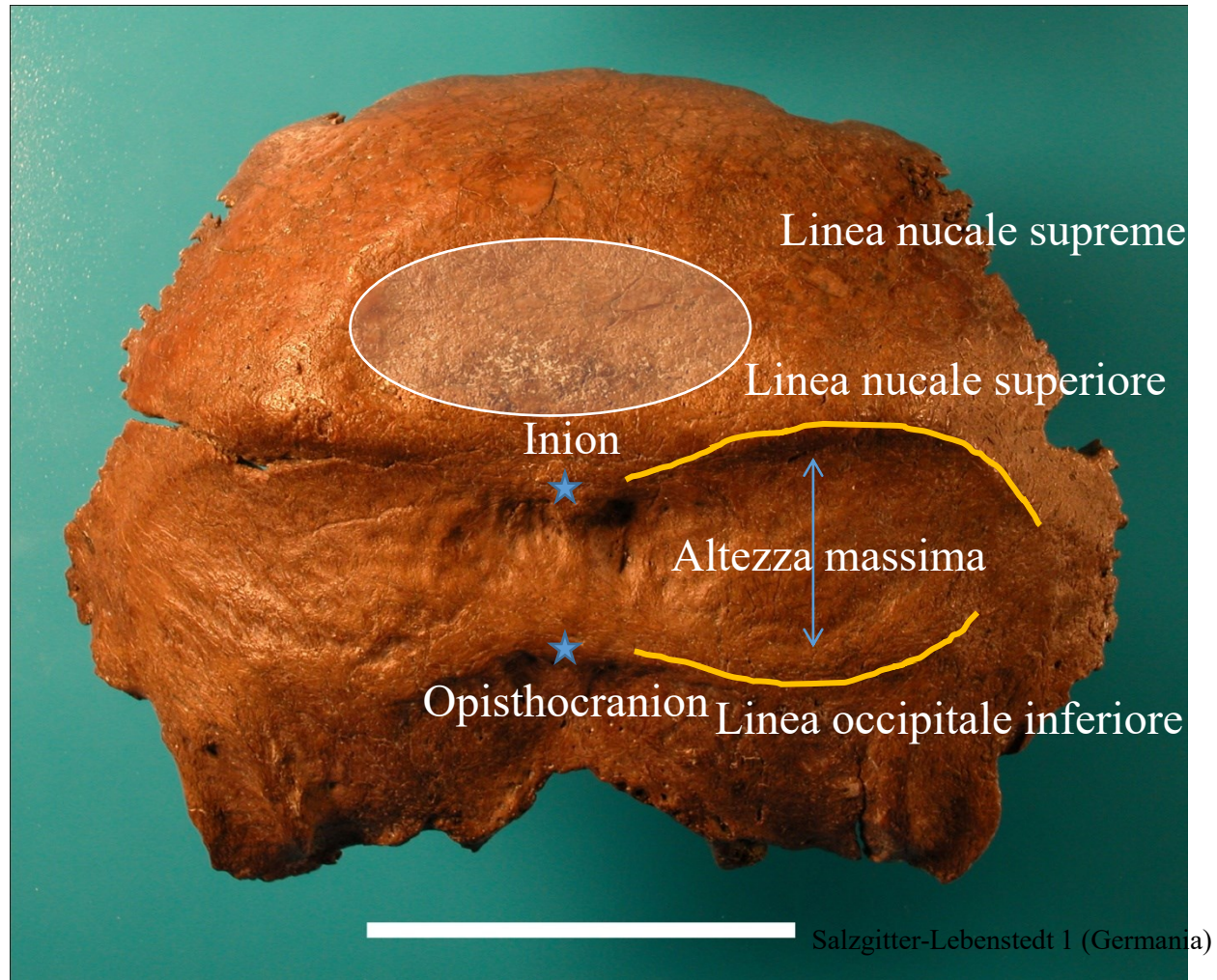
Forma circolare del cranio in vista posteriore  
*Circular shape of the cranium in posterior view*

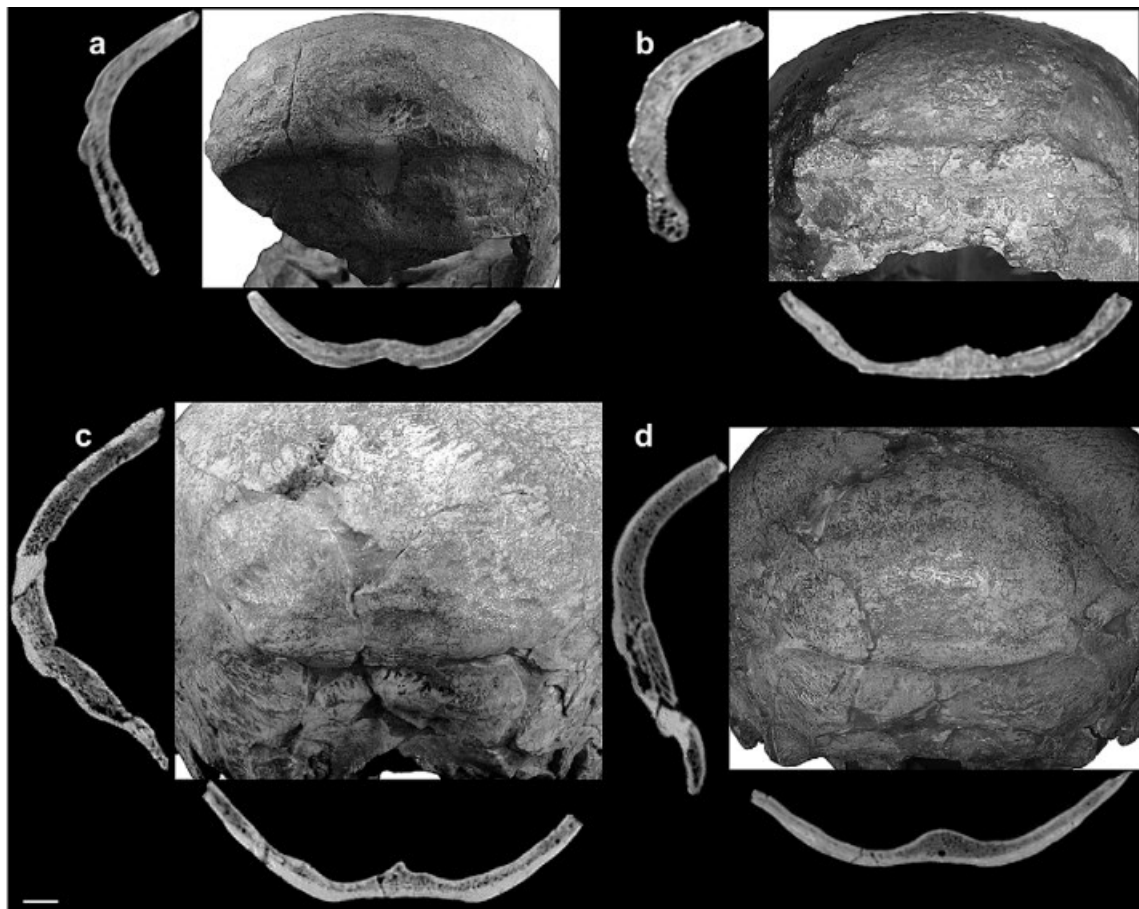


La Chapelle-aux-Saints (Francia)



## Fossa soprainiaca / *suprainiac fossa*





a: Gibraltar 1  
b: Guattari 1  
c: La Chapelle-aux Saints 1  
d: La Ferrassie 1

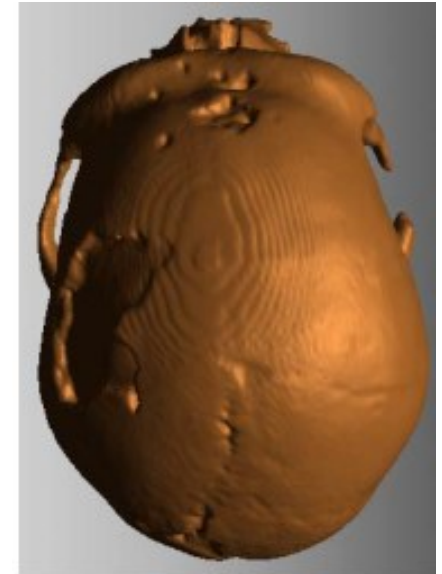
(Balzeau, 2010)

La fossa soprainiaca è un carattere derivato dei neandertaliani che si ritrova in tutti i campioni, si individua già durante i primi stadi di sviluppo ed è presente presto nella differenziazione della linea.

Corrisponde ad un assottigliamento della diploe.

*The suprainiac is a Neandertal derivated feature find in all the sample, it can be individualized early in the individual growth and is present early in the differentiation of the lineage.*





*Homo neanderthalensis*  
(La Chapelle-aux-Saints  
1)

Cranio allungato / *elongated cranium*

Zigomi sporgenti / *prominent zygomatic*

Larghezza massima in posizione bassa /  
*maximum width in a low position*





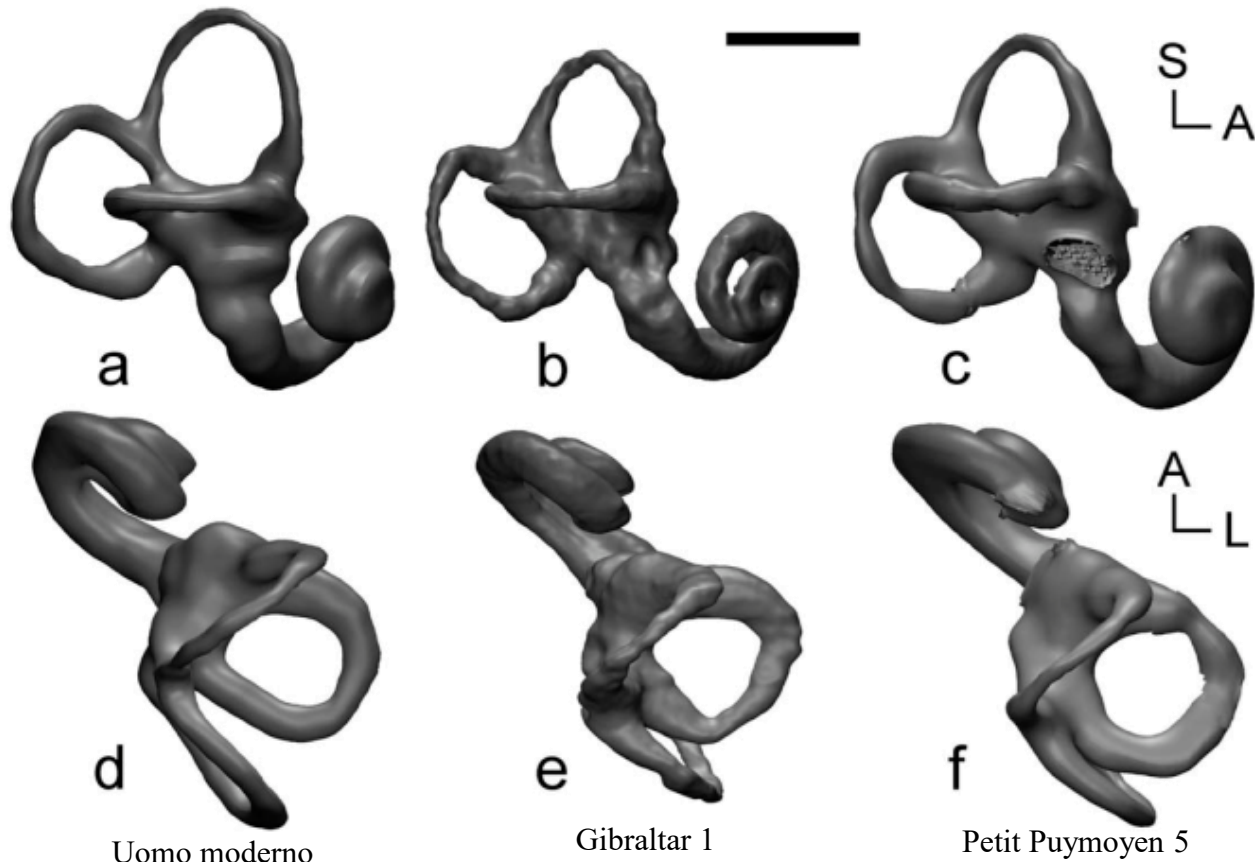


Fig. 2. Lateral (a)–(c) and superior (d)–(f) aspects of the right bony labyrinths of a Holocene human (a), (d), and the Neanderthal specimens Gibraltar 1 (b), (e) and Petit Puymoyen 5 (c), (f), reconstructed from sagittal CT scans. The lateral views are aligned according to the plane of the lateral semicircular canal. S, superior, A, anterior, and L, lateral. Scale bar is 5 mm.

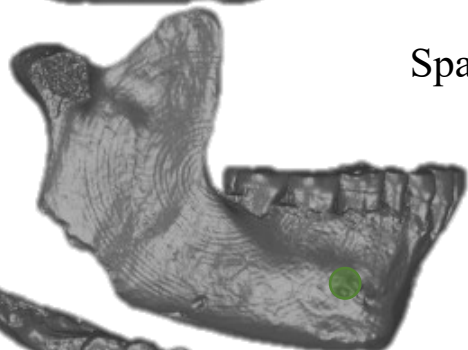
Rispetto all'uomo moderno l'orecchio interno del Neanderthal è caratterizzato da un arco del canale semicircolare anteriore più piccolo nel valore assoluto e relativo, abbastanza appuntito e con più torsioni.

*Compared with Holocene humans the bony labyrinth of Neanderthals can be characterized by an anterior semicircular canal arc which is smaller in absolute and relative size, is relatively narrow, and shows more torsion.*





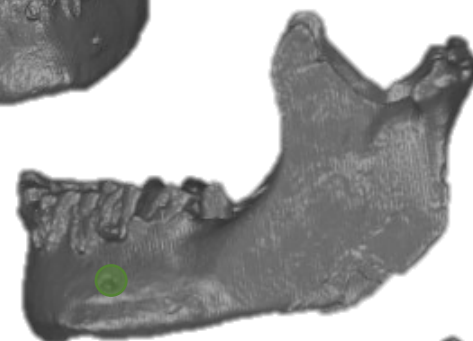
Ramo largo e divergente



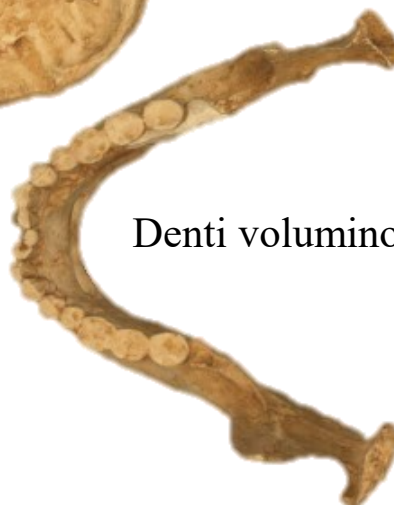
Spazio retro-molare



Assenza di mento



Denti voluminosi

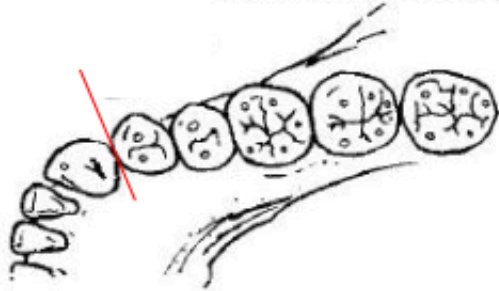


● Foramen mentoniero spostato indietro



## *Australopithecus africanus*

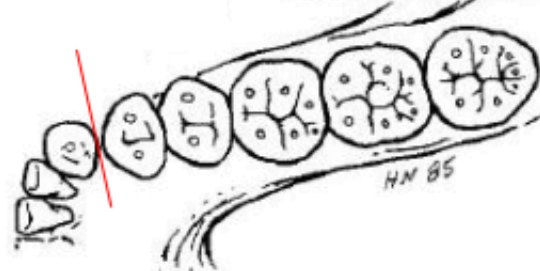
Less Robust Mandible



Relatively Larger Incisors and Canines  
Relatively Smaller Premolars and Molars

## *Paranthropus*

More Robust Mandible



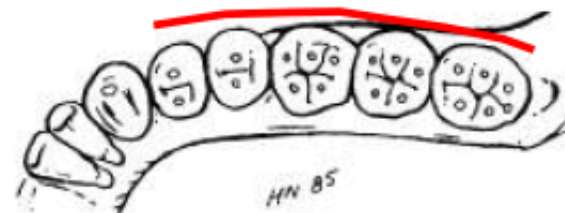
Relatively Smaller Incisors and Canines  
Relatively Larger Premolars and Molars

## *Homo habilis*



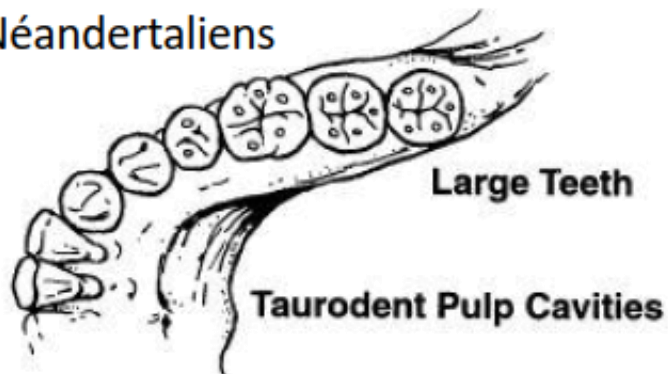
Larger Premolars and Molars

## *Homo erectus*

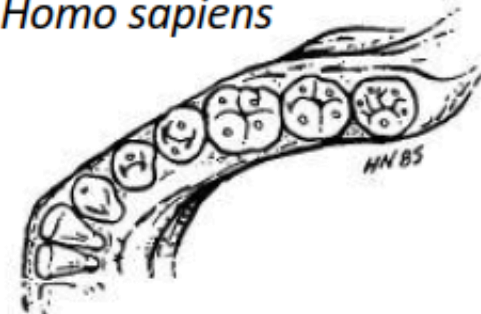


Smaller Premolars and Molars

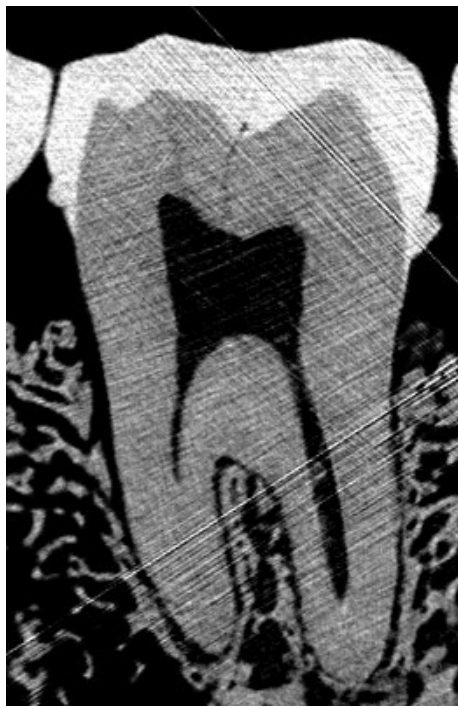
## Néandertaliens



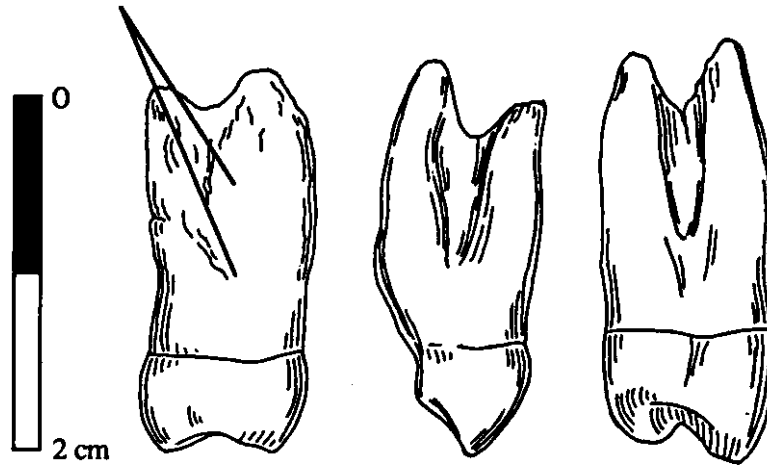
## *Homo sapiens*



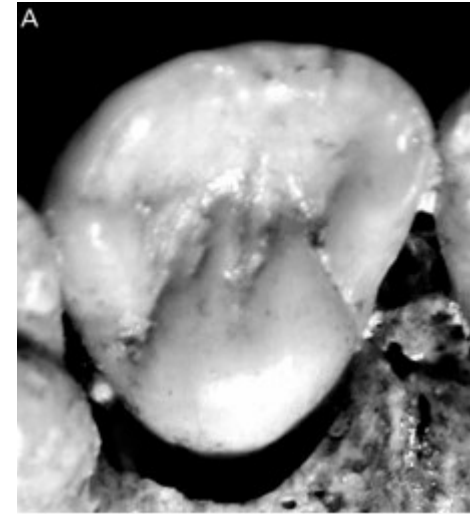




radici fuse  
e cavità pulpare  
ingrandita



Denti premolari e molari taurodonti di Krapina

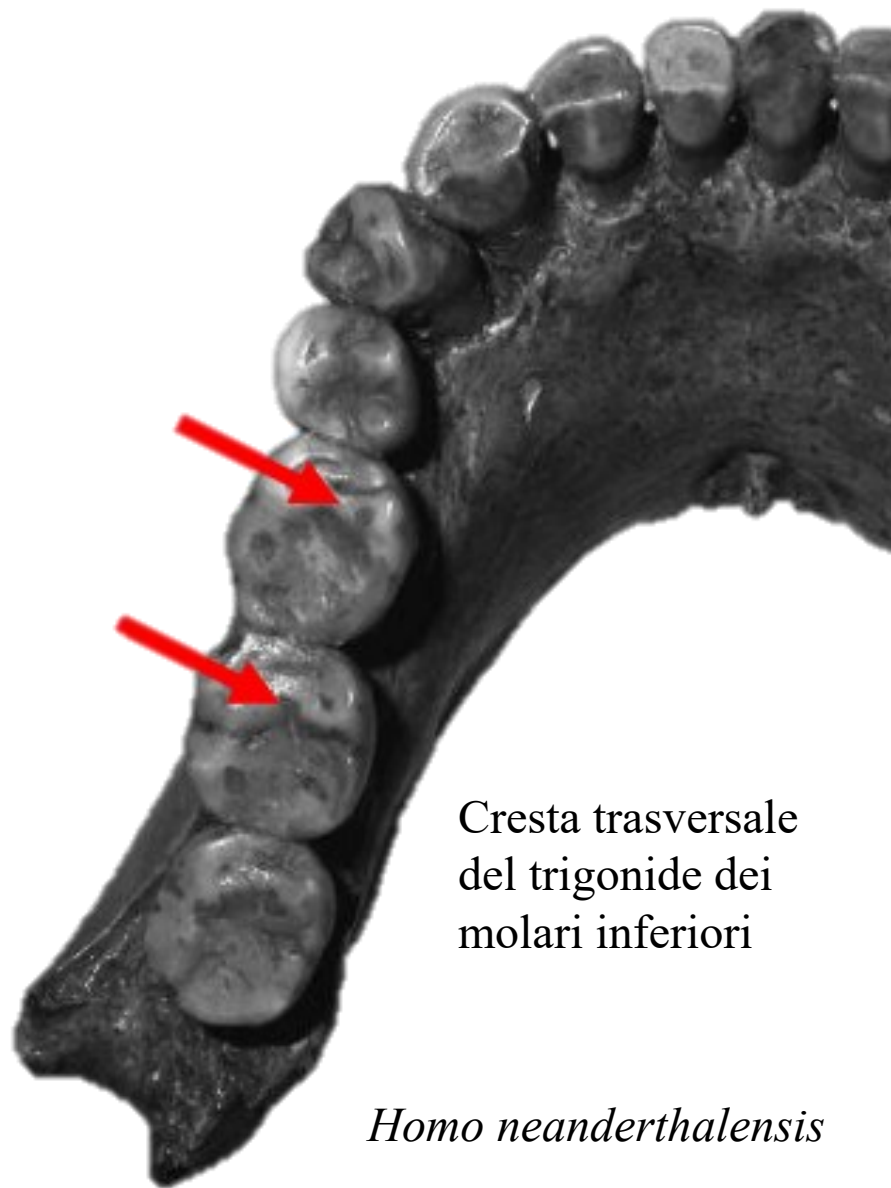


Incisivo con una forma di spatola e con una convessità labiale e un tubercolo linguale

Taurodontismo:  
Grande cavità pulpare

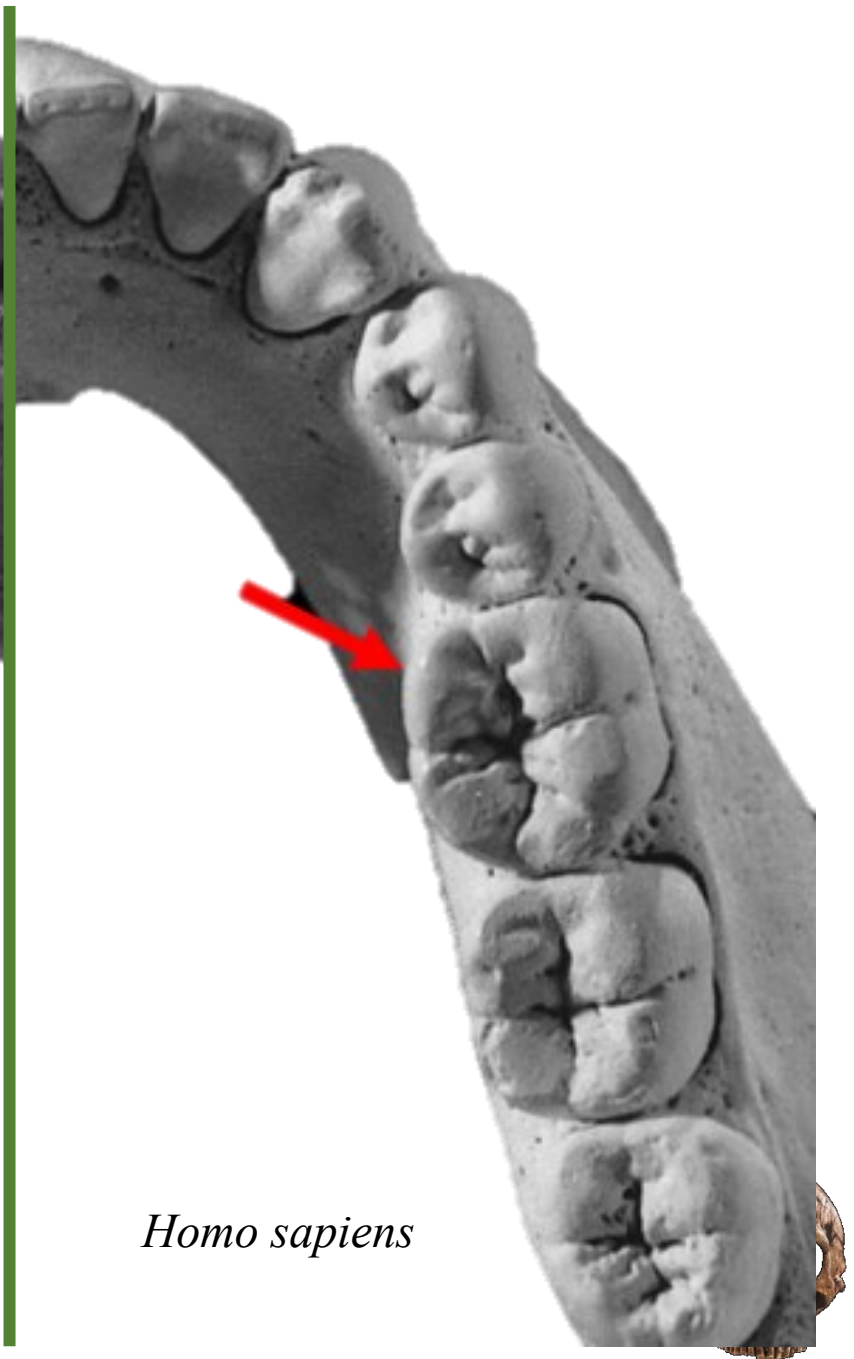
- Dimensione: *Homo* più antico > Neanderthal > *Homo sapiens*
- Incisivi di grandi dimensioni
- Incisivi superiori a forma di spatola
- Usura importante dei incisivi
- Spessore ridotto dello smalto
- Taurodontismo



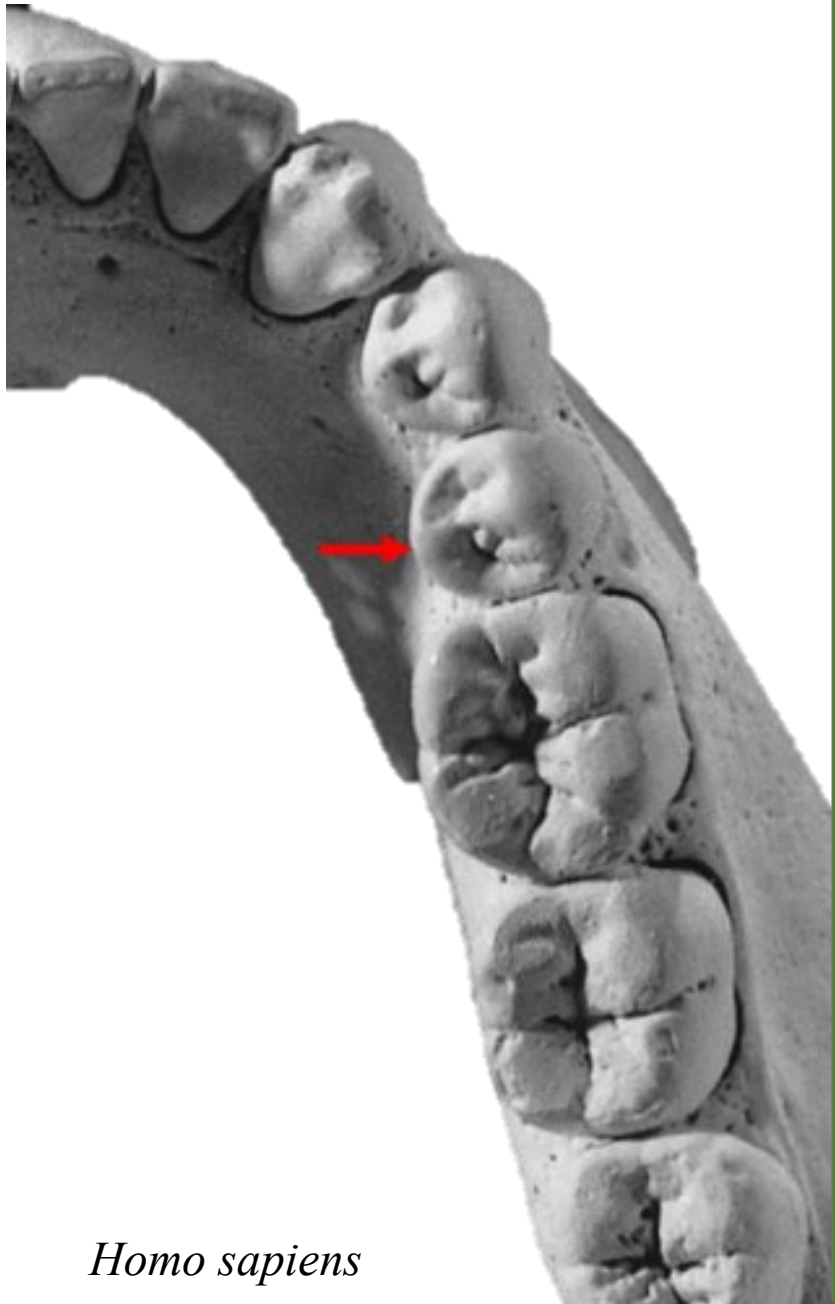


Cresta trasversale  
del trigonide dei  
molari inferiori

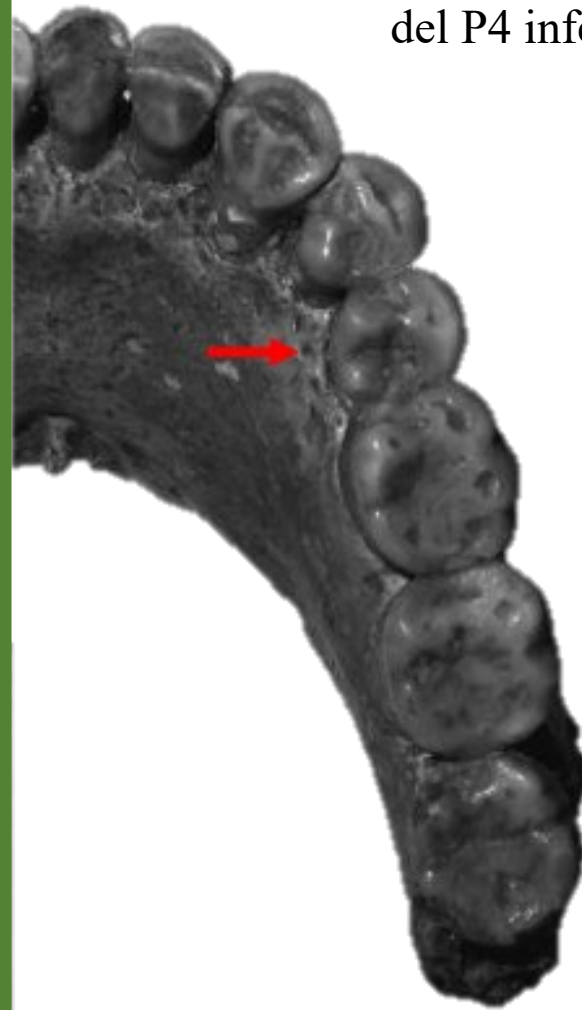
*Homo neanderthalensis*



*Homo sapiens*



*Homo sapiens*



*Homo neanderthalensis*

Asimmetria della  
superficie linguale  
del P4 inferiore





1,65m – 1,55m

Scheletro robusto con inserzioni muscolari robuste.

*Robust skeleton with powerful muscular insertion*

Vertebre cervicali che denotano un collo corto e tozzo

*Cervical vertebra induce a short and squat neck*

Muscolatura dorsale molto sviluppata

*Dorsal musculature well developped*

Torace largo, sviluppato lateralmente e verso l'avanti

*Large thorax, lateraly and frontward developped*

Il radio presenta una curvatura che denota una grande capacità di movimento.

*The radius is curved which indicate an importante mouvement capacity.*

Clavicola grande e gracile

*Large and gracile clavicle*

Mani grandi ma con dita corte: presa potente ed efficace

*Large hand with short finger: powerful and effective handle*



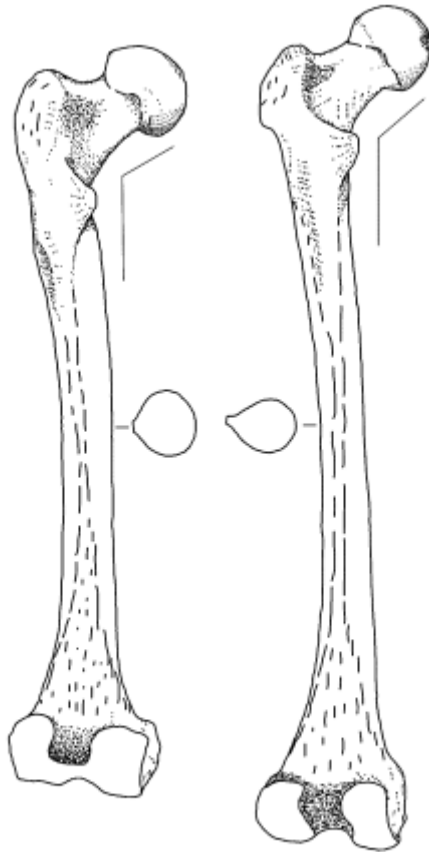
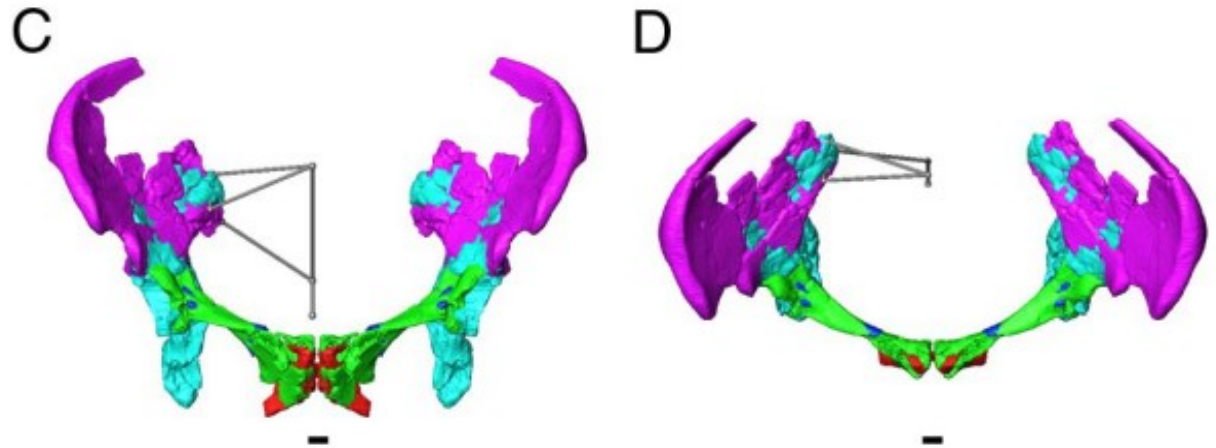


Fig. 1. Distinctive features of the Neanderthal femur. (Left) The Neanderthal 1 (Feldhofer Cave Neanderthal) femur. (Right) The Skhul IV near-modern human femur. Relative to near-modern humans, the Neanderthal femur has larger articulations (head and distal end), a thicker and rounder shaft, and a lower neck-shaft angle. Adapted from McCown and Keith (9).

(Weaver, 2003)

Allungamento mesio-laterale della branca orizzontale dell'osso pubico. Il pube risulta molto alto e gracile.

*Extension meso-lateral of the horyzontal crest of the pubic bone. This bone is high and gracile.*



Ricostruzione virtuale delle pelvi del neandertal di Tabun (Weaver & Hublin)

Femore corto e curvo. L'epifisi è voluminosa e la diafisi presenta una sezione cilindrica.

L'angolo tra la testa e la diafisi è piccolo.

*The femur short and curved. The epiphysis is voluminous and the diaphysis present a cylindrical section.*

*The angle between the femoral head and the diaphysis is small.*



# Significato della morfologia





## Evoluzione della linea neandertaliana

Il modello di evoluzione dei Neanderthal è detto ad accrezione: questo gruppo di ominidi si è sviluppato in un parziale o completo isolamento dal resto dell'umanità.

Questo sviluppo è il risultato di un'accumulazione graduale di tratti morfologici distintivi delle popolazioni Europee.

Alcuni studiosi hanno ipotizzato che i tratti neandertaliani si siano sviluppati seguendo un adattamento a delle condizioni climatiche fredde :

Larga cavità nasale

Robustezza

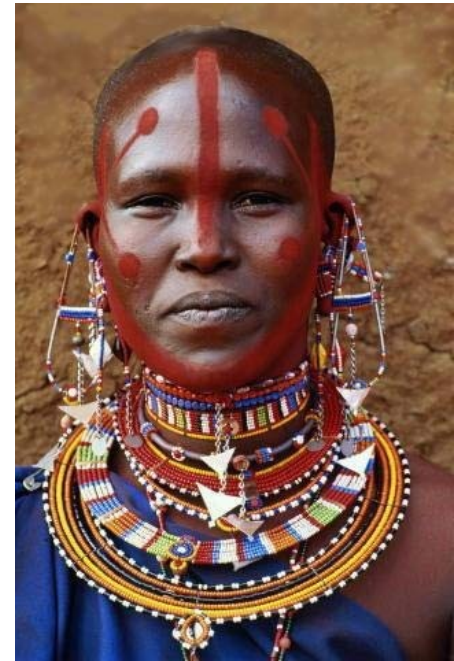
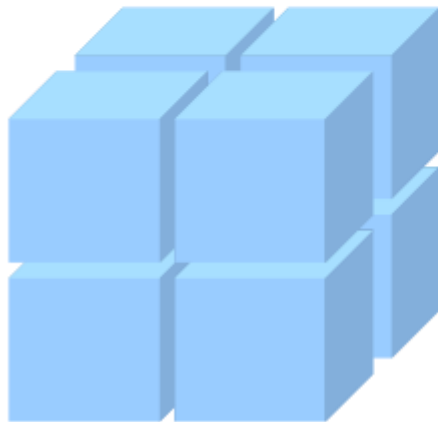
Morfologia tarchiata



# Adattamento al freddo

Regola di Allen : In un clima freddo, gli individui tendono ad essere più larghi e ad avere degli arti più corti rispetto a quelli che vivono in un clima temperato, poiché in questo modo la ritenzione del calore è più efficace (rapporto massa corporea/superficie esposta)

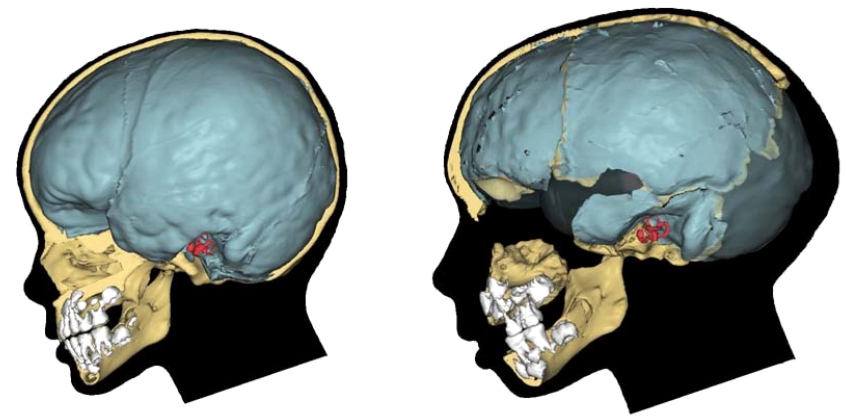
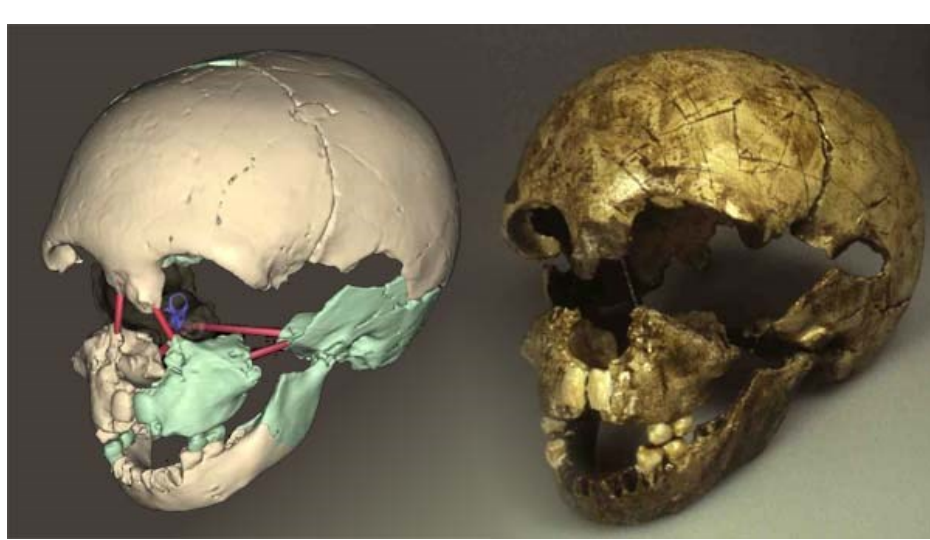
*In cold climat, individuals tends to have shorter limbs than the one from warmer climates, in this way the heat rentention is more effective (ratio corporeal mass/exposed surface)*



# Ontogenesi



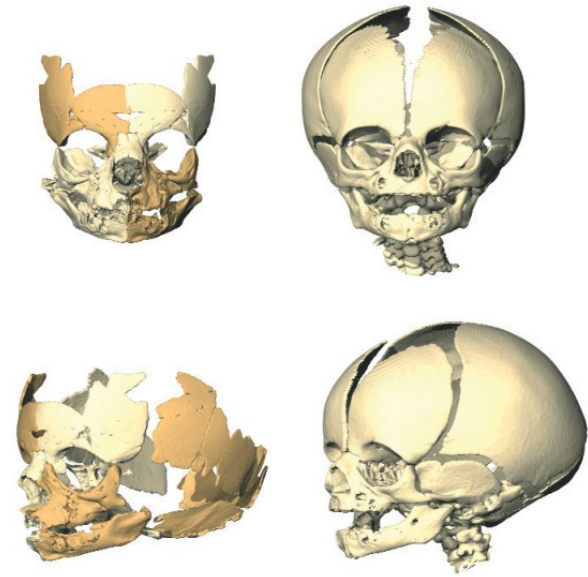




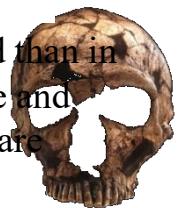
Gibraltar 2, Devil's Tower



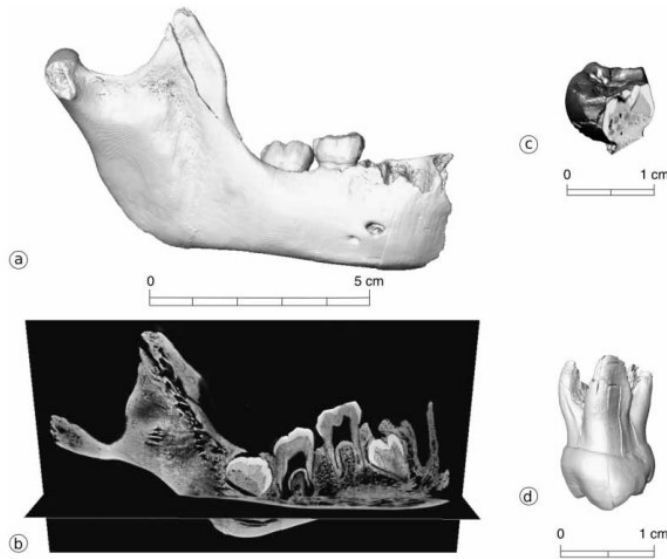
Dederiyeh, Syria



Le Moustier 2 is larger and more projected than in the modern human. Orbital, nasal shape and infraorbital surface of Le Moustier 2 are characteristic for Neanderthals



## Eruzione dei denti in *Homo sapiens*



(a and b) Right hemi-mandible from Scladina (Scla 4A-1).  
 (c) Probable Neandertal deciduous molar from Couvin. (d)  
 deciduous second upper molar from Engis 2

### PRIMARY DENTITION

| Upper Teeth     |  | Erupt        | Exfoliate   |
|-----------------|--|--------------|-------------|
| Central incisor |  | 8-12 months  | 6-7 years   |
| Lateral incisor |  | 9-13 months  | 7-8 years   |
| Canine (cuspid) |  | 16-22 months | 10-12 years |
| First molar     |  | 13-19 months | 9-11 years  |
| Second molar    |  | 25-33 months | 10-12 years |

| Lower Teeth     |  | Erupt        | Exfoliate   |
|-----------------|--|--------------|-------------|
| Second molar    |  | 23-31 months | 10-12 years |
| First molar     |  | 14-18 months | 9-11 years  |
| Canine (cuspid) |  | 17-23 months | 9-12 years  |
| Lateral incisor |  | 10-16 months | 7-8 years   |
| Central incisor |  | 6-10 months  | 6-7 years   |

### PERMANENT DENTITION

| Upper Teeth                       |  | Erupt       |
|-----------------------------------|--|-------------|
| Central incisor                   |  | 7-8 years   |
| Lateral incisor                   |  | 8-9 years   |
| Canine (cuspid)                   |  | 11-12 years |
| First premolar (first bicuspid)   |  | 10-11 years |
| Second premolar (second bicuspid) |  | 10-12 years |
| First molar                       |  | 6-7 years   |
| Second molar                      |  | 12-13 years |
| Third molar (wisdom tooth)        |  | 17-21 years |

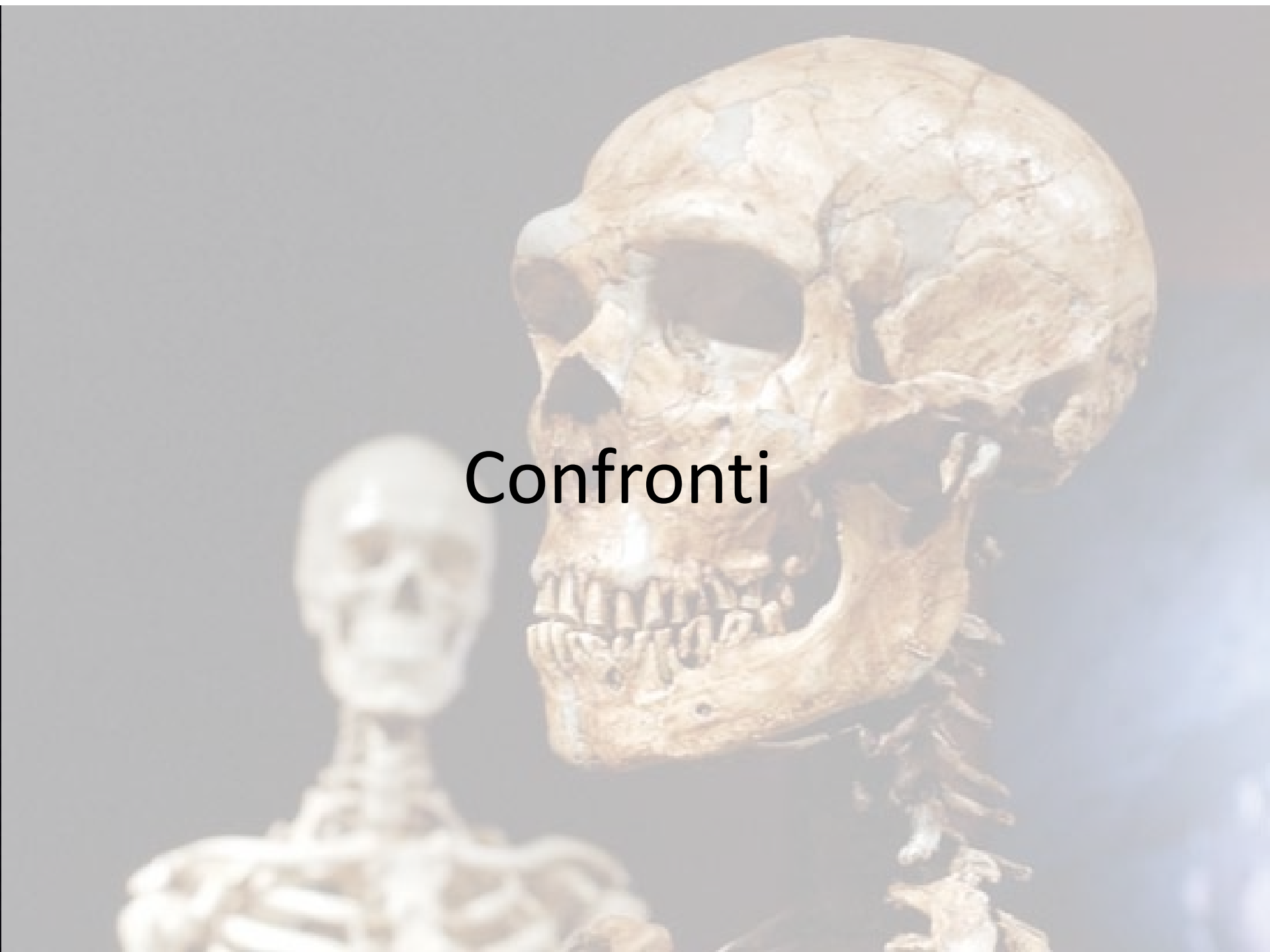
  

| Lower Teeth                       |  | Erupt       |
|-----------------------------------|--|-------------|
| Third molar (wisdom tooth)        |  | 17-21 years |
| Second molar                      |  | 12-13 years |
| First molar                       |  | 6-7 years   |
| Second premolar (second bicuspid) |  | 10-12 years |
| First premolar (first bicuspid)   |  | 10-11 years |
| Canine (cuspid)                   |  | 11-12 years |
| Lateral incisor                   |  | 8-9 years   |
| Central incisor                   |  | 7-8 years   |

Sequenze d'eruzione dei denti permanenti: differenze  
 tra *sapiens* e *Neanderthal*

*Homo sapiens*: M1 – I1- I2 – P1 – C-P2-M2-M3

*Homo neanderthalensis*: M1-I1-I2-C-M2-P1-P2-M3

The image features two human skulls against a blurred background. The skull on the right is a large, adult human skull shown in profile, facing left. It has a prominent brow ridge, a large braincase, and a full set of teeth. The skull on the left is a smaller, more delicate skull, also in profile and facing left. It appears to be a juvenile or a smaller individual. The word "Confronti" is centered between the two skulls.

Confronti



# Definizione dei Neandertaliani s.s.

L'uomo di Neanderthal si caratterizza per la presenza di:

*The Neandertals are characterized by the presence of:*

- **Caratteri arcaici / Plesiomorfie** : dei caratteri ancestrali che non si ritrovano in nessun fossile moderno.

*Arcaic features / Plesiomorphies: These are ancestral features which are not found in the modern fossil.*

- **Caratteri condivisi** con *Homo sapiens*.

*Feature shared with Homo sapiens*

- **Caratteri derivati / Apomorfie** : presenti solo nei Neandertaliani, peculiari ed identificativi di questa specie.

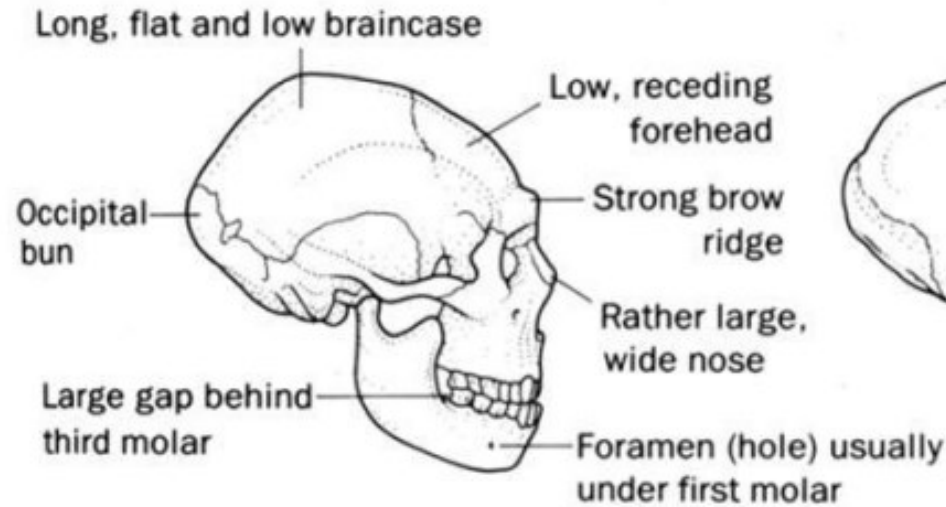
*Derivated features / Apomorphies: These are present only in the Neanderthals, and allow to identify this species.*



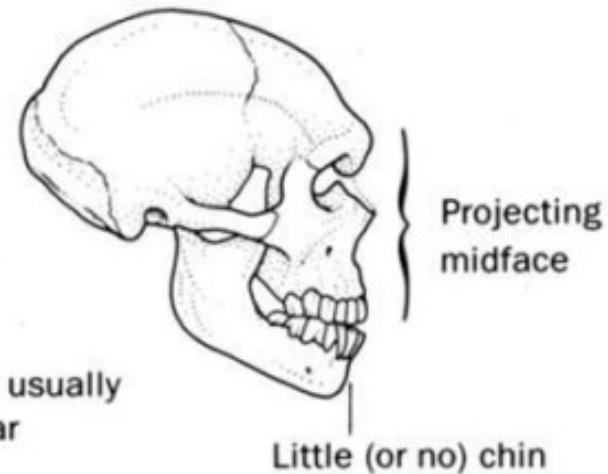
# *Homo neanderthalensis* VS *Homo erectus*



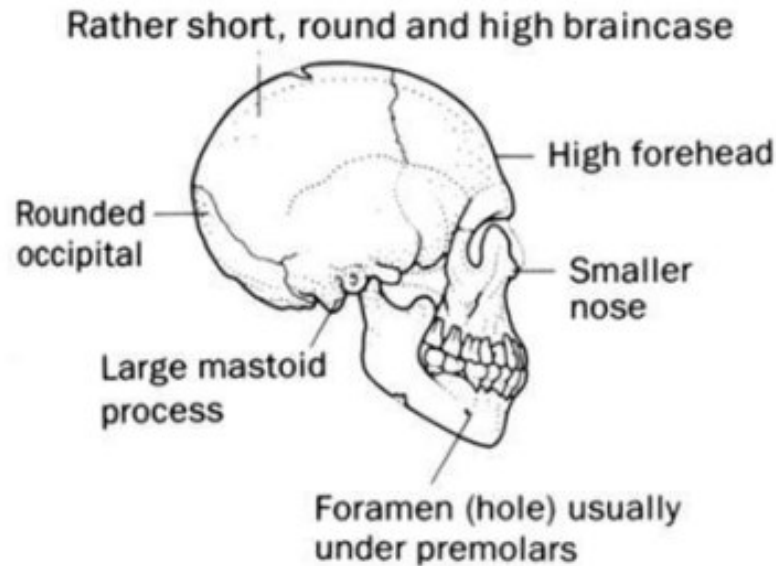
# *Homo neanderthalensis* VS *Homo sapiens*



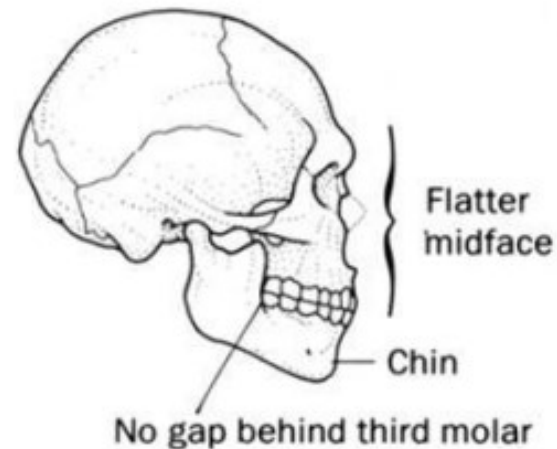
**Shanidar 1**



**La Ferrassie 1**



**Qafzeh 9**

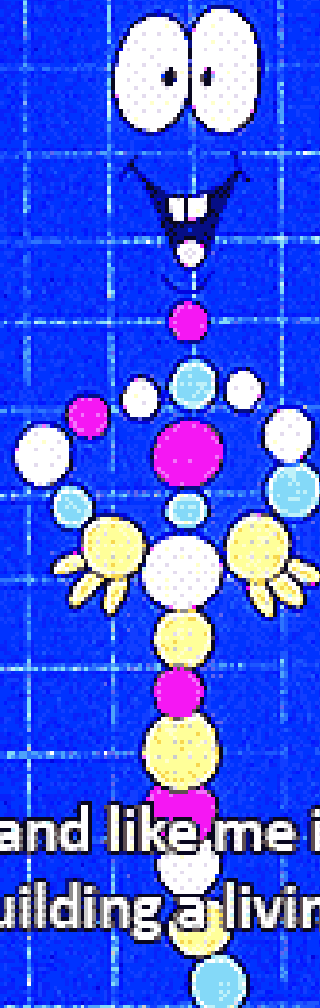


**Předmostí 3**



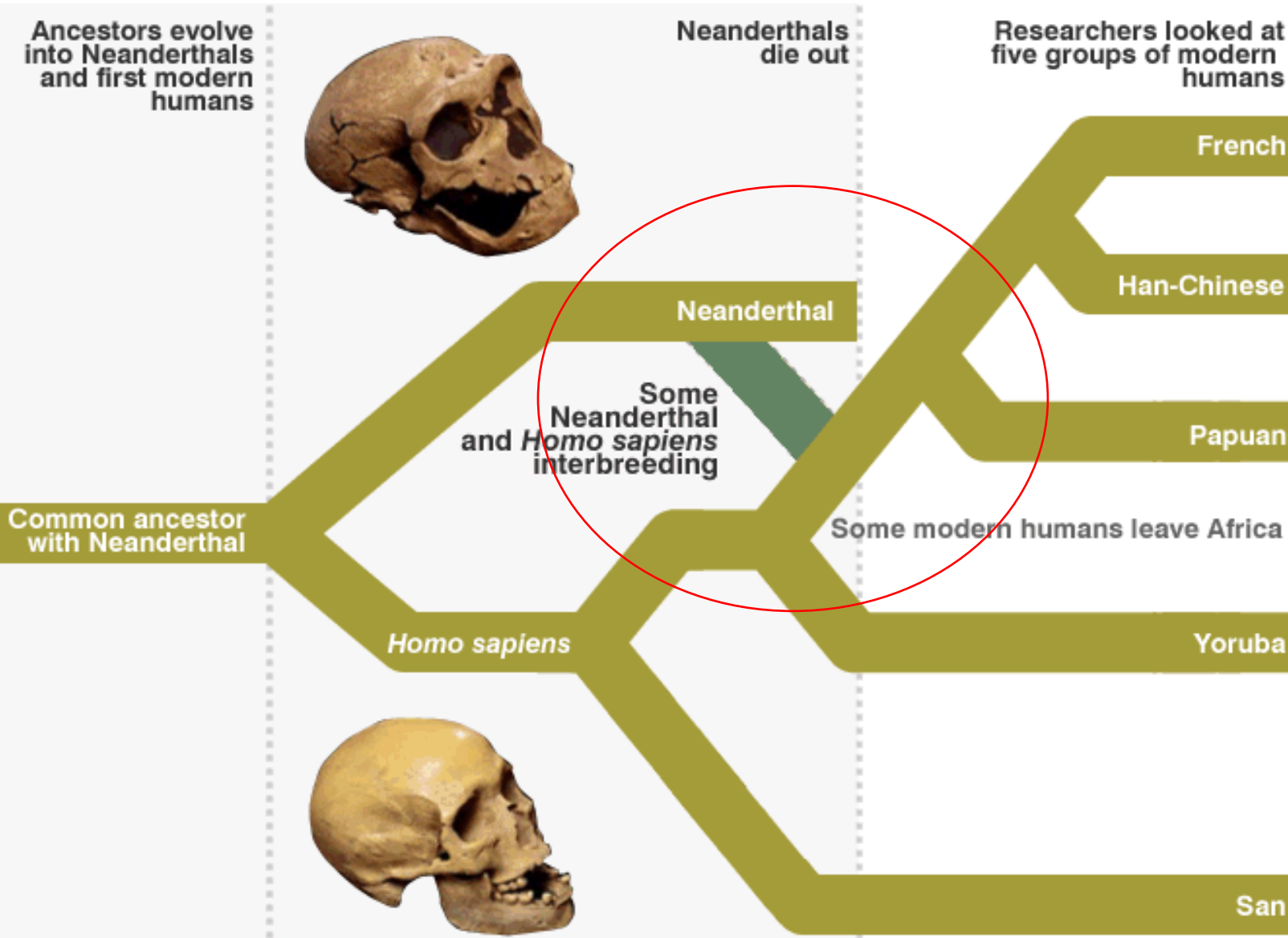


# Genetica



**A DNA strand like me is a blueprint  
for building a living thing!**

# Uno di noi?



*Green et al. (2010)*

- Quando le popolazioni ancestrali Neandertaliane e umane moderne hanno subito una divergenza evolutiva? *Divergence time between the ancestral Neandertal population and the modern human :*

tra 270,000 e 440,000 anni fa

- Da 1 a 4 % del genoma della popolazione Euroasiatica è derivato dai Neandertaliani. Il flusso genetico tra uomini moderni e Neandertaliani è avvenuto prima della divergenza tra gli europei , gli asiatici, e i papuani, tra 50,000 e 80,000 anni fa, in concordanza con i ritrovamenti archeologici.

*From 1 to 4 % of the Eurasiatic population's genoma derives from the Neandertal. The genetic flow between modern human and Neandertal occurred before the divergence between European, Asiatic and Papuan populations, between 50,000 and 80,000 years, in correspondence with the archeological discoveries.*

- L'incontro è stato puntuale da un punto di visto cronologico e localizzato solo nel Vicino Oriente.

*The encounter was punctual in a chronological point of view and localized only in a the Nearest.*





## L'incontro in Europa



Peștera cu Oase, Romania  
40 000 anni BP



(Fu et al., 2015)

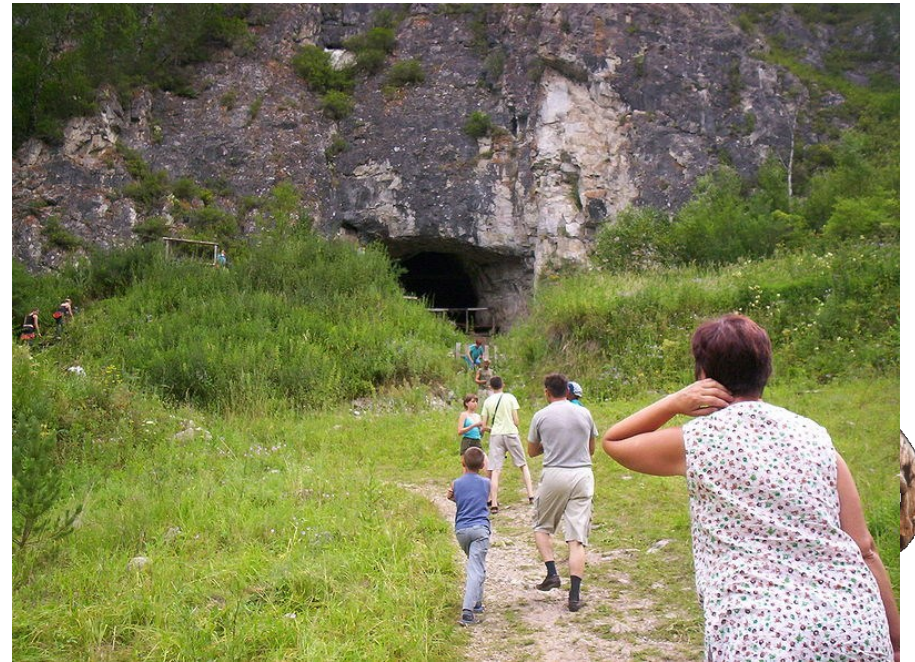


Denisova

---

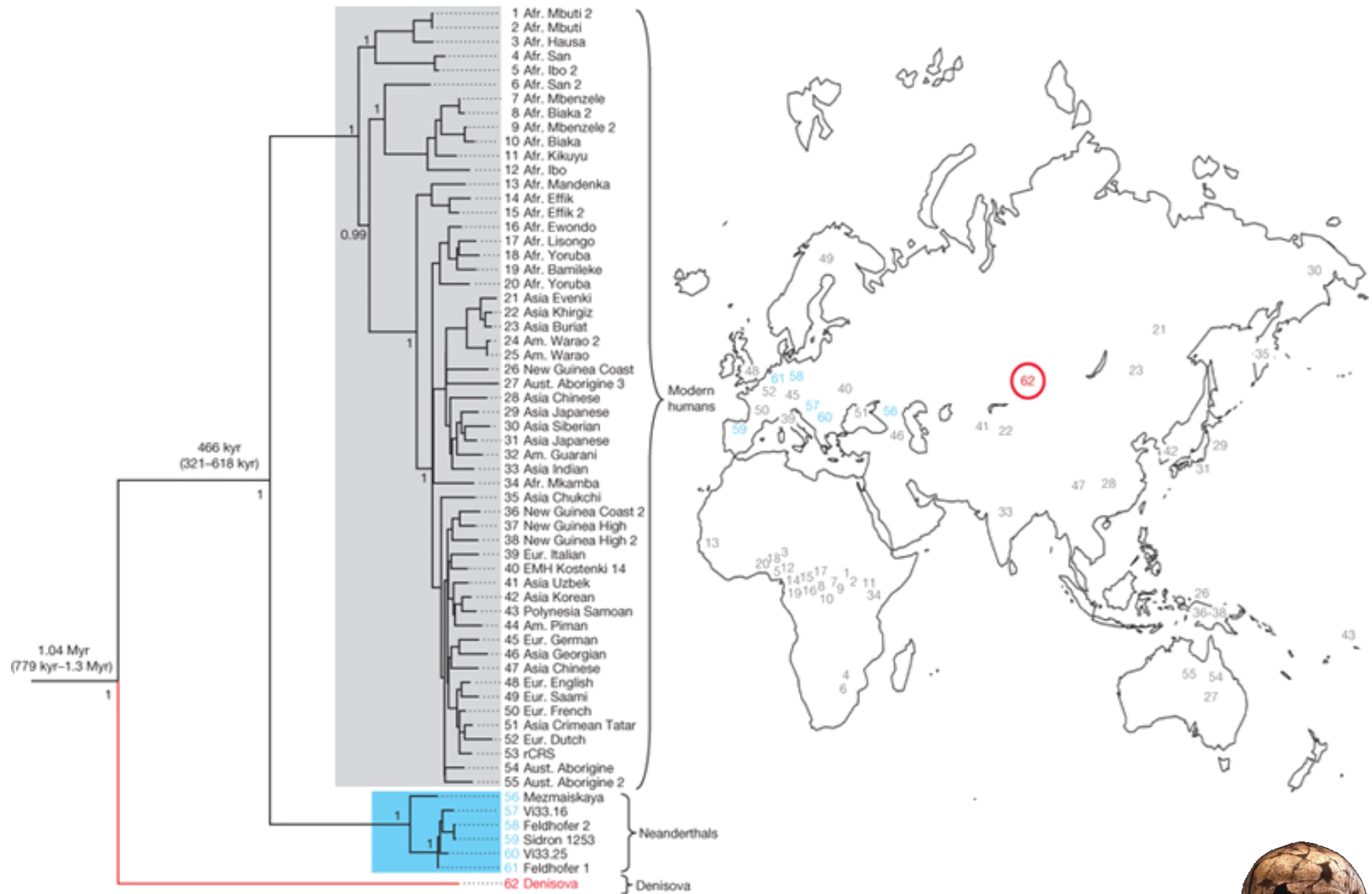


Replica of the finger bone fragment from the ancient Denisovan human who lived about 30-50 000 years ago. Scientists have obtained its complete genome. © Max Planck Institute for Evolutionary Anthropology

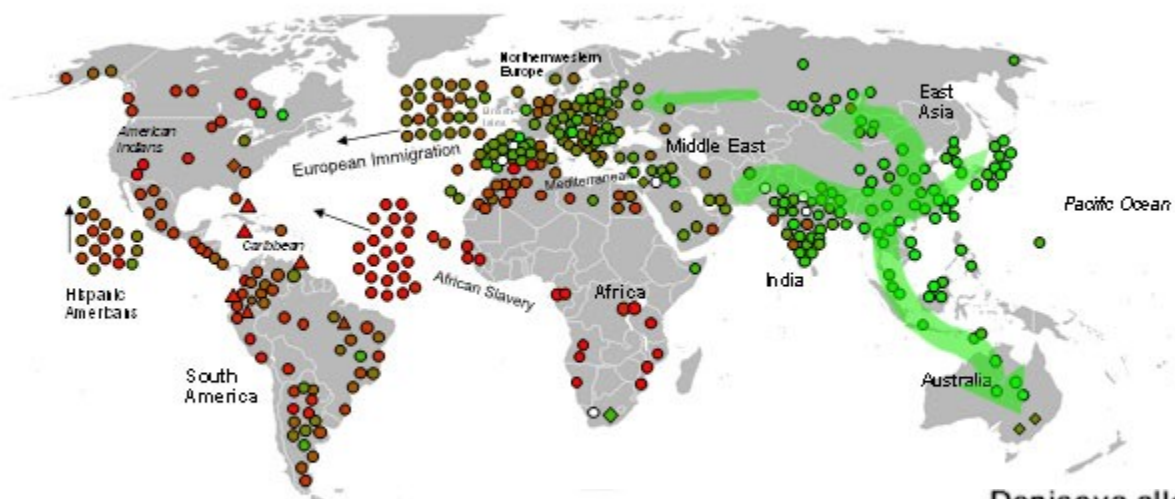




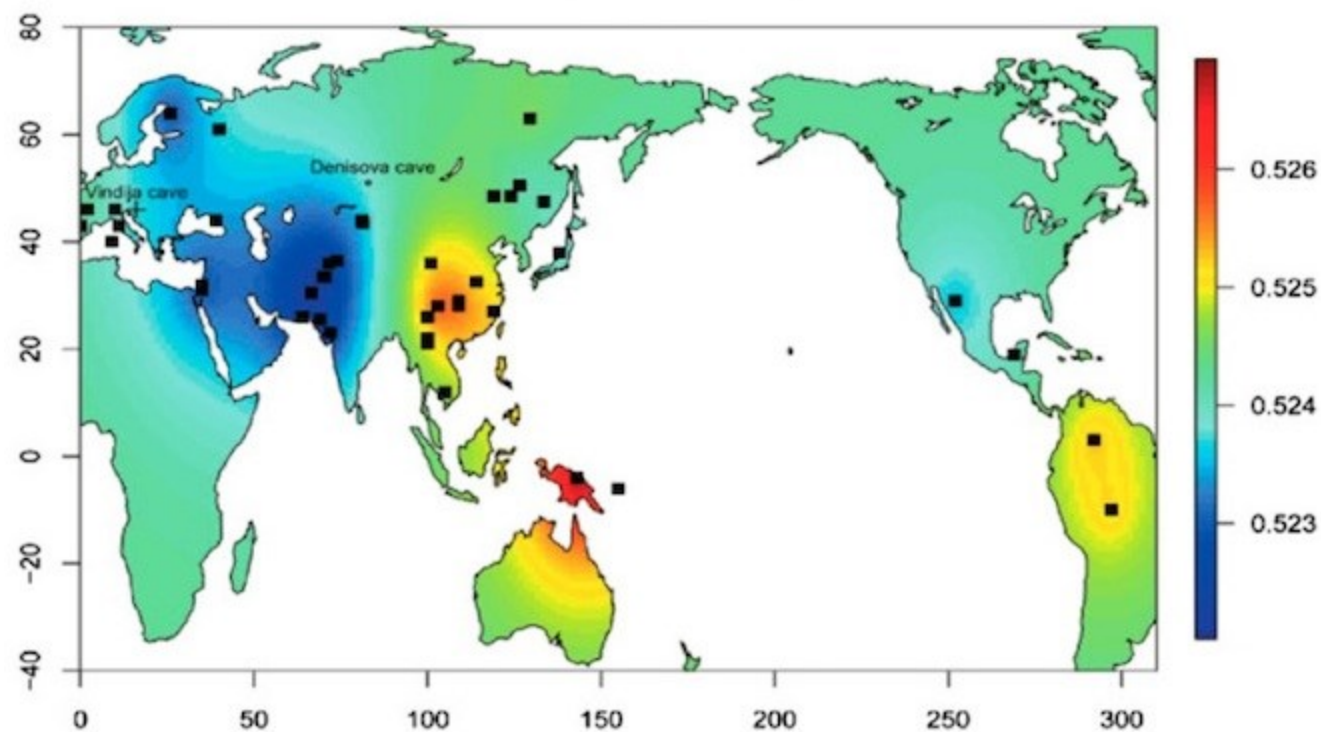
# Phylogenetic tree of complete mtDNAs.

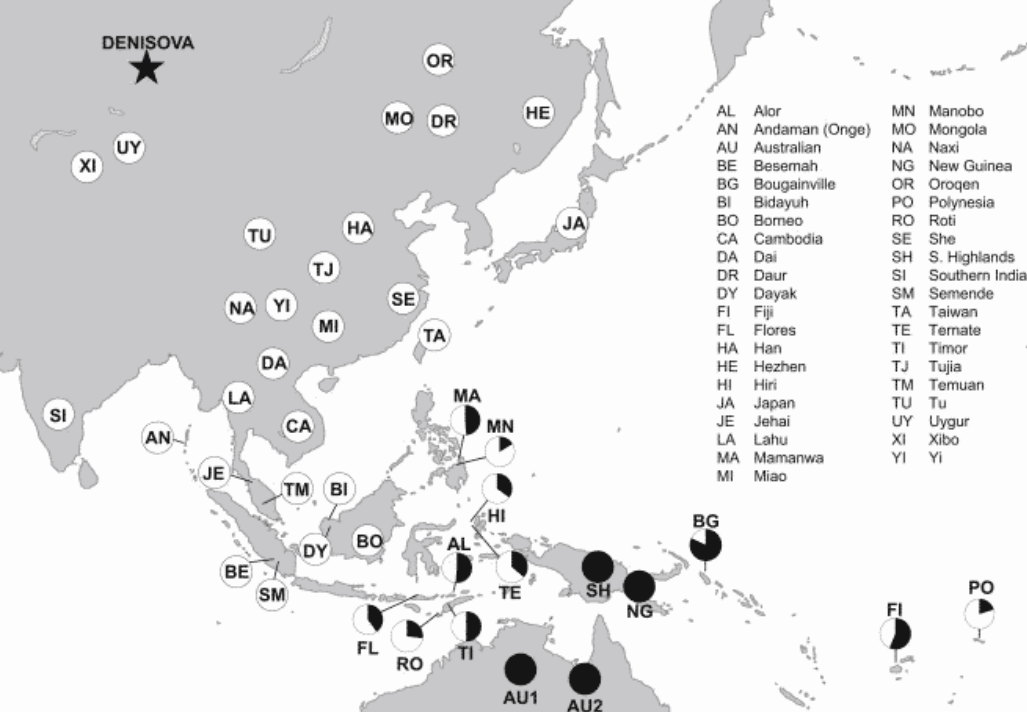


## World Ancestry of the Denisovan Gene

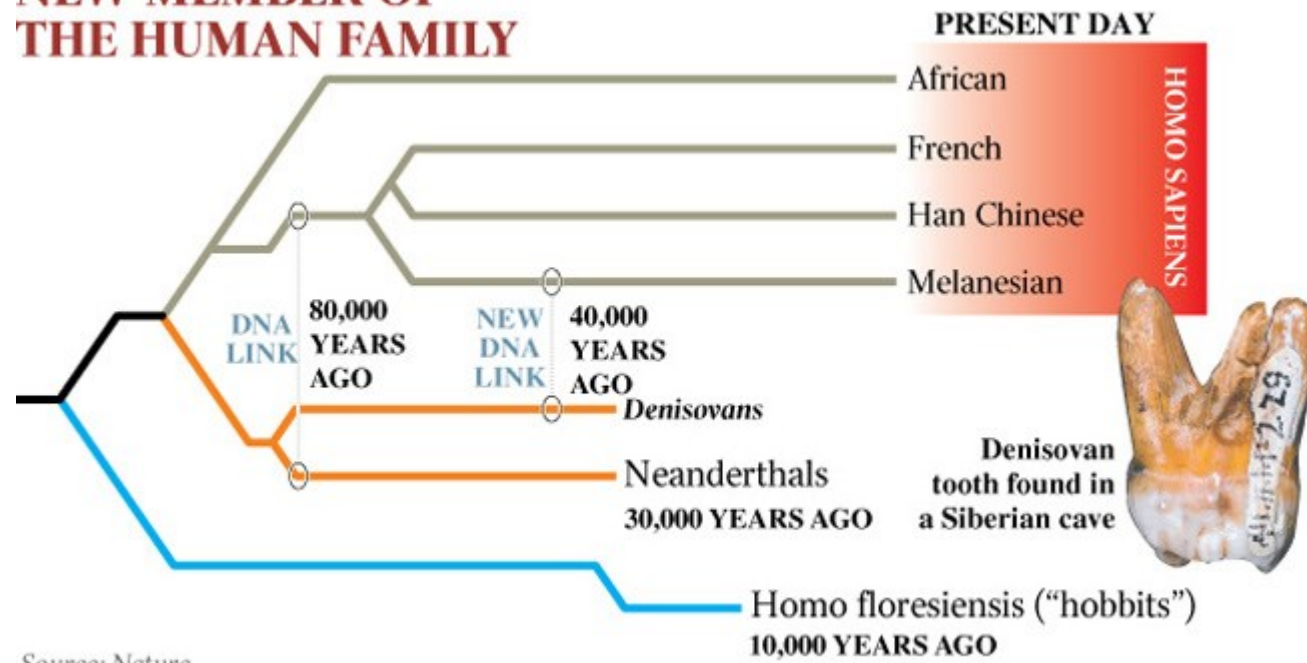


Denisova allele frequency





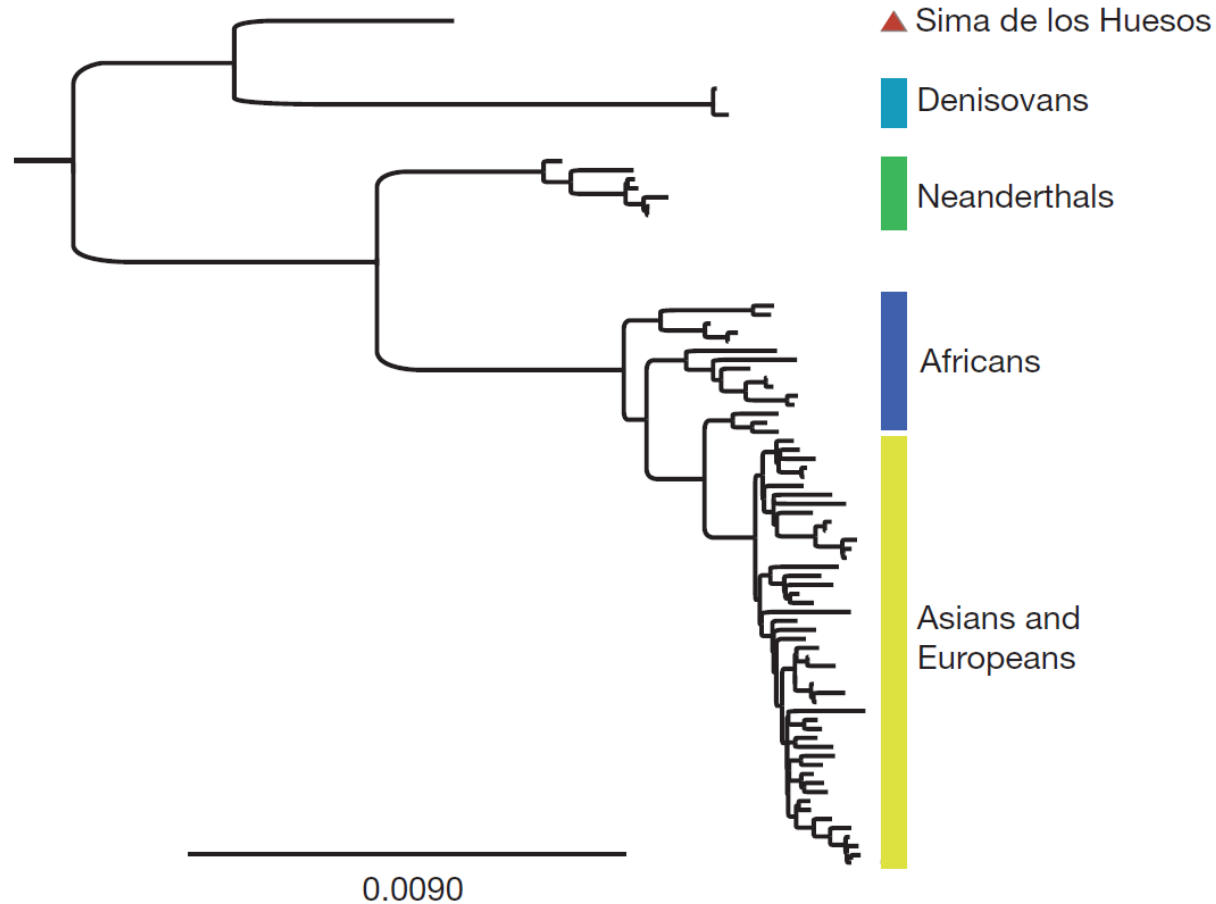
## NEW MEMBER OF THE HUMAN FAMILY



Source: Nature



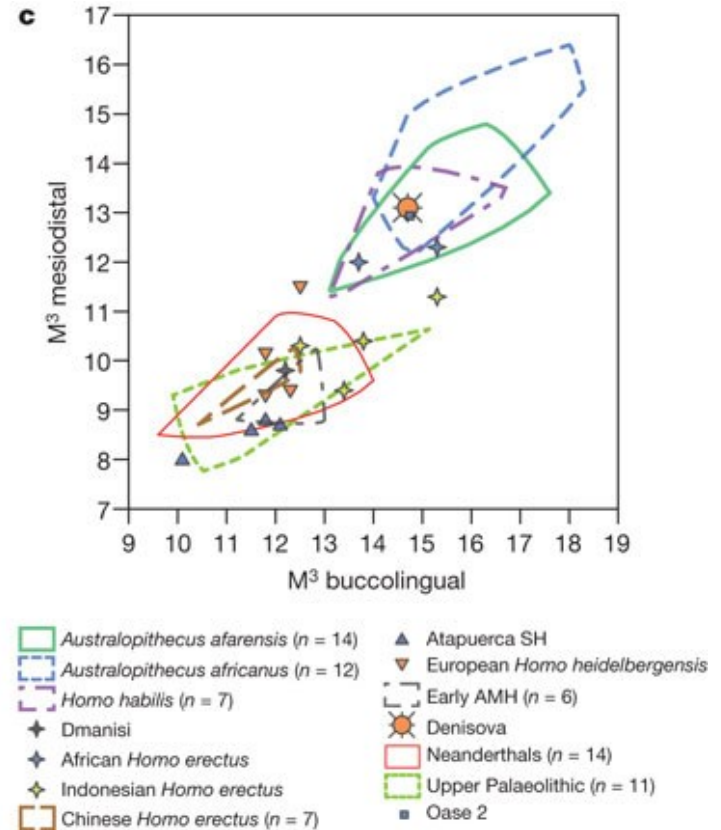
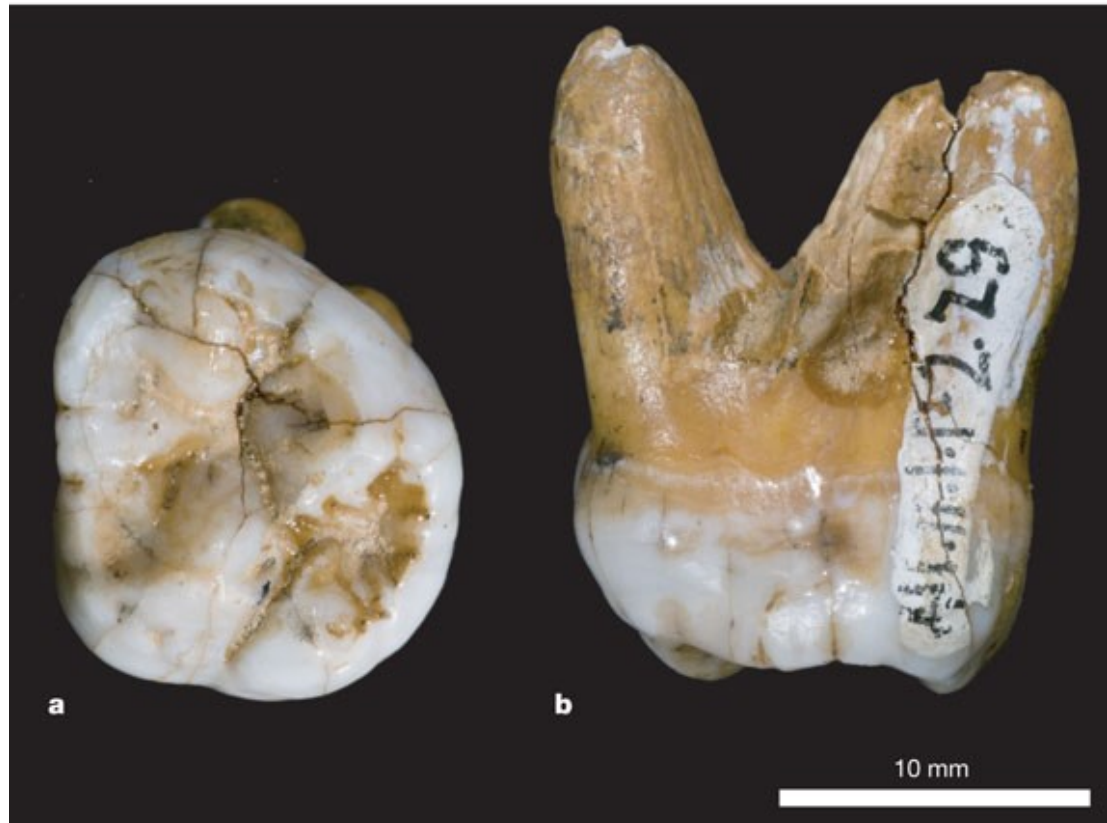
# Sima de los Huesos: 430 ka



**Figure 4 | Bayesian phylogenetic tree of hominin mitochondrial relationships based on the Sima de los Huesos mtDNA sequence determined using the inclusive filtering criteria.** All nodes connecting the denoted hominin groups are supported with posterior probability of 1. The tree was rooted using chimpanzee and bonobo mtDNA genomes. The scale bar denotes substitutions per site.

Matthias Meyer et al. in Nature (2013)





D Reich *et al.* *Nature* **468**, 1053-1060 (2010) doi:10.1038/nature09710

Il M3 o M2 ritrovato a Denisova presenta delle dimensioni al di fuori della variabilità dei taxa del genere *Homo* ed entra in quella dei *Australopithecine*.

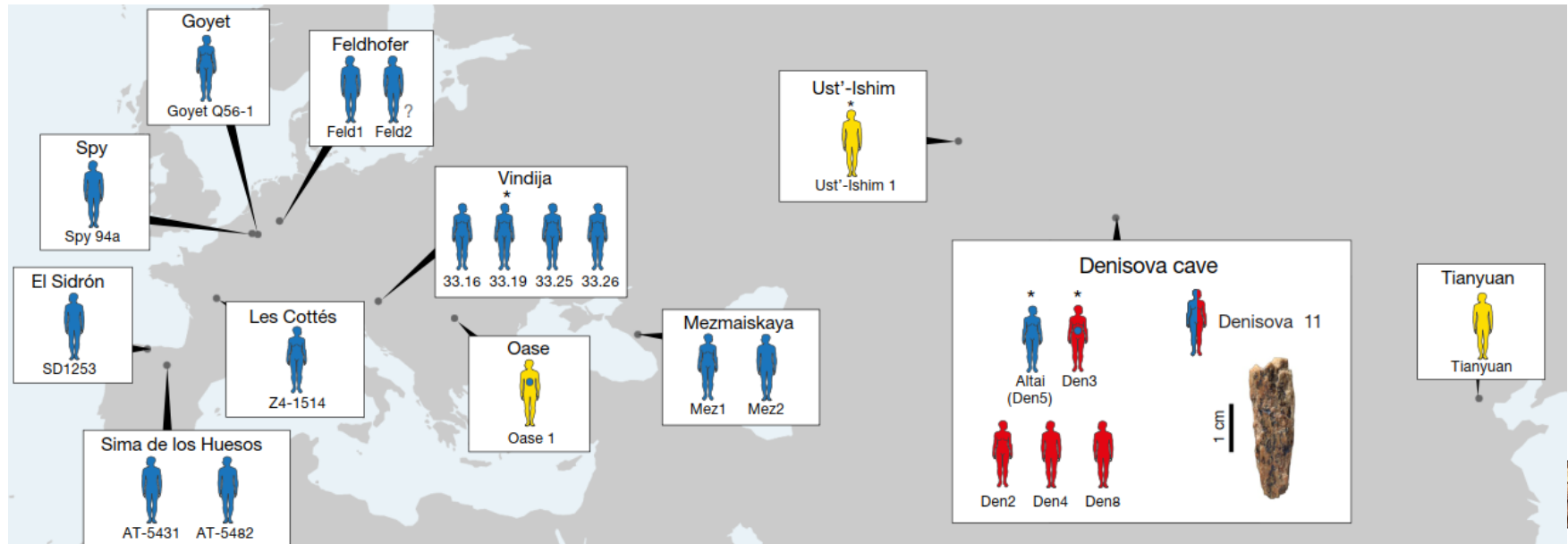
Questo molare appoggia le evidenze del DNA: La popolazione di Denisova era distinta dei Neandertaliani tardivi e dei uomini moderni. In effetti, i tratti primitivi del dente suggeriscono che i Denisoviani potrebbero essersi separati dalla linea neandertaliana prima dei dati che abbiamo sui tratti dentari Neandertaliani in Europa occidentale (>300 ka). Non escludiamo però la possibilità che questa morfologia sia dovuta ad una regressione.



# The genome of the offspring of a Neanderthal mother and a Denisovan father

Viviane Slon<sup>1,7\*</sup>, Fabrizio Mafessoni<sup>1,7</sup>, Benjamin Vernot<sup>1,7</sup>, Cesare de Filippo<sup>1</sup>, Steffi Grote<sup>1</sup>, Bence Viola<sup>2,3</sup>, Mateja Hajdinjak<sup>1</sup>, Stéphane Peyrégne<sup>1</sup>, Sarah Nagel<sup>1</sup>, Samantha Brown<sup>4</sup>, Katerina Douka<sup>4,5</sup>, Tom Higham<sup>5</sup>, Maxim B. Kozlikin<sup>3</sup>, Michael V. Shunkov<sup>3,6</sup>, Anatoly P. Derevianko<sup>3</sup>, Janet Kelso<sup>1</sup>, Matthias Meyer<sup>1</sup>, Kay Prüfer<sup>1</sup> & Svante Pääbo<sup>1\*</sup>

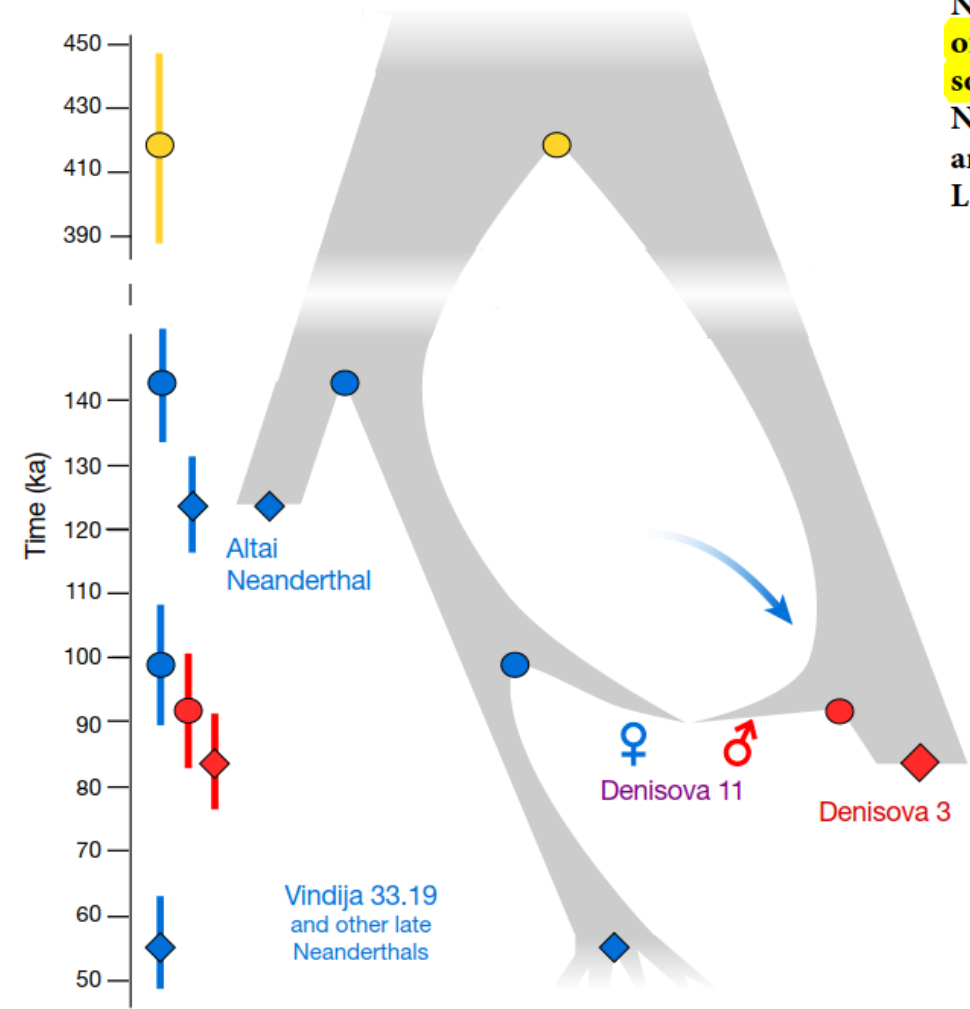
Neanderthals and Denisovans are extinct groups of hominins that separated from each other more than 390,000 years ago<sup>1,2</sup>. Here we present the genome of ‘Denisova 11’, a bone fragment from Denisova Cave (Russia)<sup>3</sup> and show that it comes from an individual who had a Neanderthal mother and a Denisovan father. The father, whose genome bears traces of Neanderthal ancestry, came from a population related to a later Denisovan found in the cave<sup>4–6</sup>. The mother came from a population more closely related to Neanderthals who lived later in Europe<sup>2,7</sup> than to an earlier Neanderthal found in Denisova Cave<sup>8</sup>, suggesting that migrations of Neanderthals between eastern and western Eurasia occurred sometime after 120,000 years ago. The finding of a first-generation Neanderthal–Denisovan offspring among the small number of archaic specimens sequenced to date suggests that mixing between Late Pleistocene hominin groups was common when they met.





The genome of the offspring of a Neanderthal mother and a Denisovan father

Viviane Slon<sup>1,7\*</sup>, Fabrizio Mafessoni<sup>1,7</sup>, Benjamin Vernot<sup>1,7</sup>, Cesare de Filippo<sup>1</sup>, Steffi Grote<sup>1</sup>, Bence Viola<sup>2,3</sup>, Mateja Hajdinjak<sup>1</sup>, Stéphane Peyrégne<sup>1</sup>, Sarah Nagel<sup>1</sup>, Samantha Brown<sup>4</sup>, Katerina Douka<sup>4,5</sup>, Tom Higham<sup>5</sup>, Maxim B. Kozlikin<sup>3</sup>, Michael V. Shunkov<sup>3,6</sup>, Anatoly P. Derevianko<sup>3</sup>, Janet Kelso<sup>1</sup>, Matthias Meyer<sup>1</sup>, Kay Prüfer<sup>1</sup> & Svante Pääbo<sup>1\*</sup>

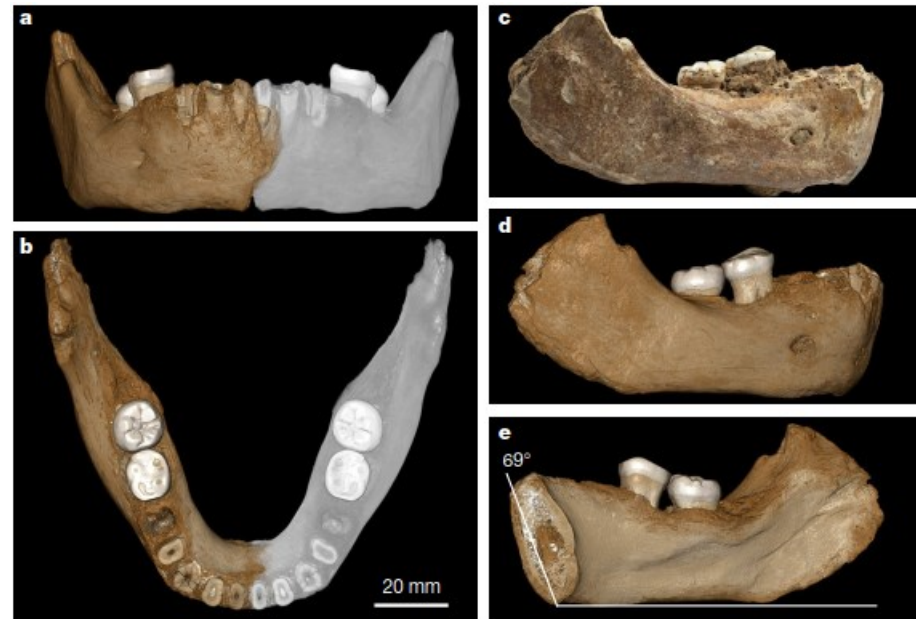
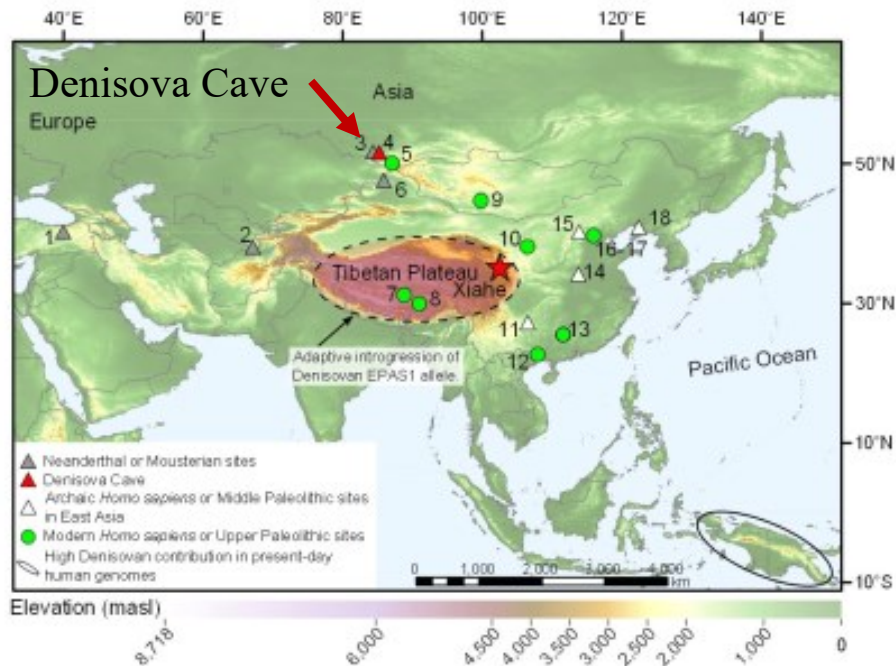


Neanderthals and Denisovans are extinct groups of hominins that separated from each other more than 390,000 years ago<sup>1,2</sup>. Here we present the genome of ‘Denisova 11’, a bone fragment from Denisova Cave (Russia)<sup>3</sup> and show that it comes from an individual who had a Neanderthal mother and a Denisovan father. The father, whose genome bears traces of Neanderthal ancestry, came from a population related to a later Denisovan found in the cave<sup>4–6</sup>. The mother came from a population more closely related to Neanderthals who lived later in Europe<sup>2,7</sup> than to an earlier Neanderthal found in Denisova Cave<sup>8</sup>, suggesting that migrations of Neanderthals between eastern and western Eurasia occurred sometime after 120,000 years ago. The finding of a first-generation Neanderthal–Denisovan offspring among the small number of archaic specimens sequenced to date suggests that mixing between Late Pleistocene hominin groups was common when they met.



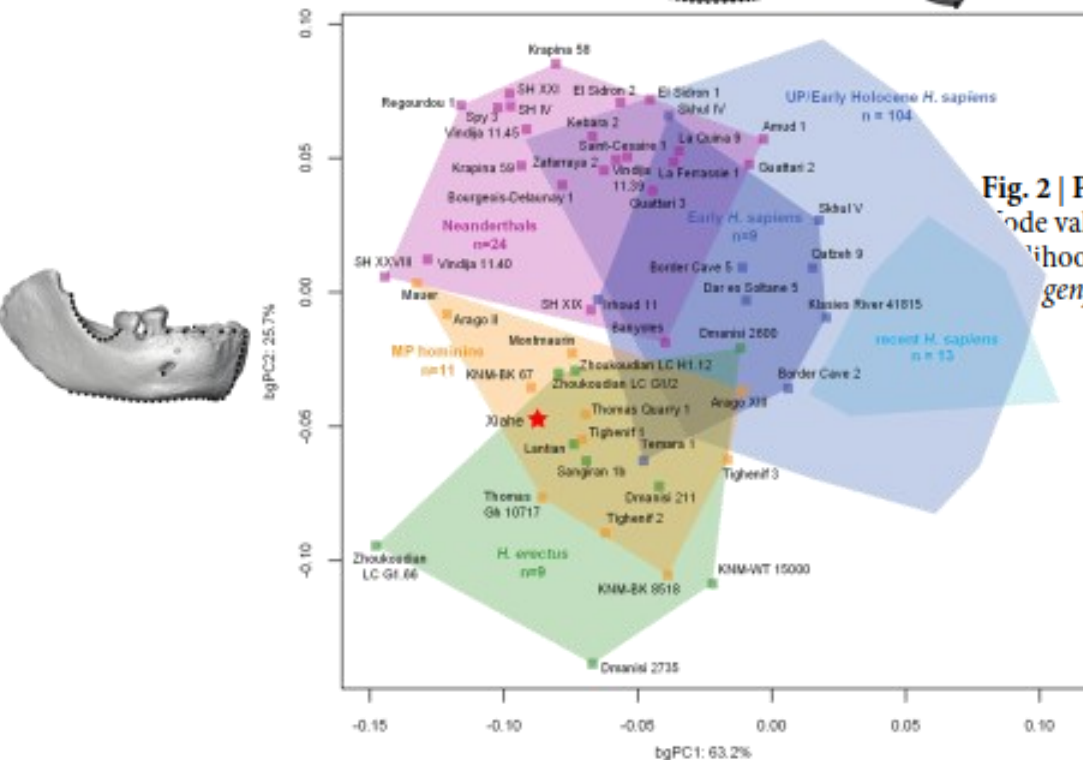
## A late Middle Pleistocene Denisovan mandible from the Tibetan Plateau

Fahu Chen<sup>1,2,15\*</sup>, Frido Welker<sup>2,3,4,15</sup>, Chuan-Chou Shen<sup>5,6,15</sup>, Shara E. Bailey<sup>3,7</sup>, Inga Bergmann<sup>3</sup>, Simon Davis<sup>8</sup>, Huan Xia<sup>2</sup>, Hui Wang<sup>9,10</sup>, Roman Fischer<sup>8</sup>, Sarah E. Freidline<sup>3</sup>, Tsai-Luen Yu<sup>5,6</sup>, Matthew M. Skinner<sup>3,11</sup>, Stefanie Stelzer<sup>3,12</sup>, Guangrong Dong<sup>2</sup>, Qiamei Fu<sup>13</sup>, Guanghui Dong<sup>2</sup>, Jian Wang<sup>2</sup>, Dongju Zhang<sup>2\*</sup> & Jean-Jacques Hublin<sup>3,14\*</sup>



## A late Middle Pleistocene Denisovan mandible from the Tibetan Plateau

Fahu Chen<sup>1,2,15\*</sup>, Frido Welker<sup>2,3,4,15</sup>, Chuan-Chou Shen<sup>5,6,15</sup>, Shara E.<sup>7</sup>, Inga Bergmann<sup>3</sup>, Simon Davis<sup>8</sup>, Xia<sup>2</sup>, Hui Wang<sup>9,10</sup>, Roman Fischer<sup>8</sup>, Sarah E. Freidline<sup>3</sup>, Tsai-Luen Yu<sup>5,6</sup>, M. Skir<sup>11</sup>, Stefanie Stelzer<sup>3,12</sup>, Guangrong Dong<sup>2</sup>, Qiomei Fu<sup>13</sup>, Guanghui Dong<sup>2</sup>, Jian Wang<sup>2</sup>, Dongju<sup>14</sup>, Lin<sup>3,14\*</sup>



**Fig. 2 | Phylogenetic position of the Xiahe proteome within Hominidae.** Node values indicate Bayesian probability (0–1)/RAxML maximum likelihood (0–100%), respectively. *Macaca mulatta* and *Nomascus* are used as outgroups (data not shown).



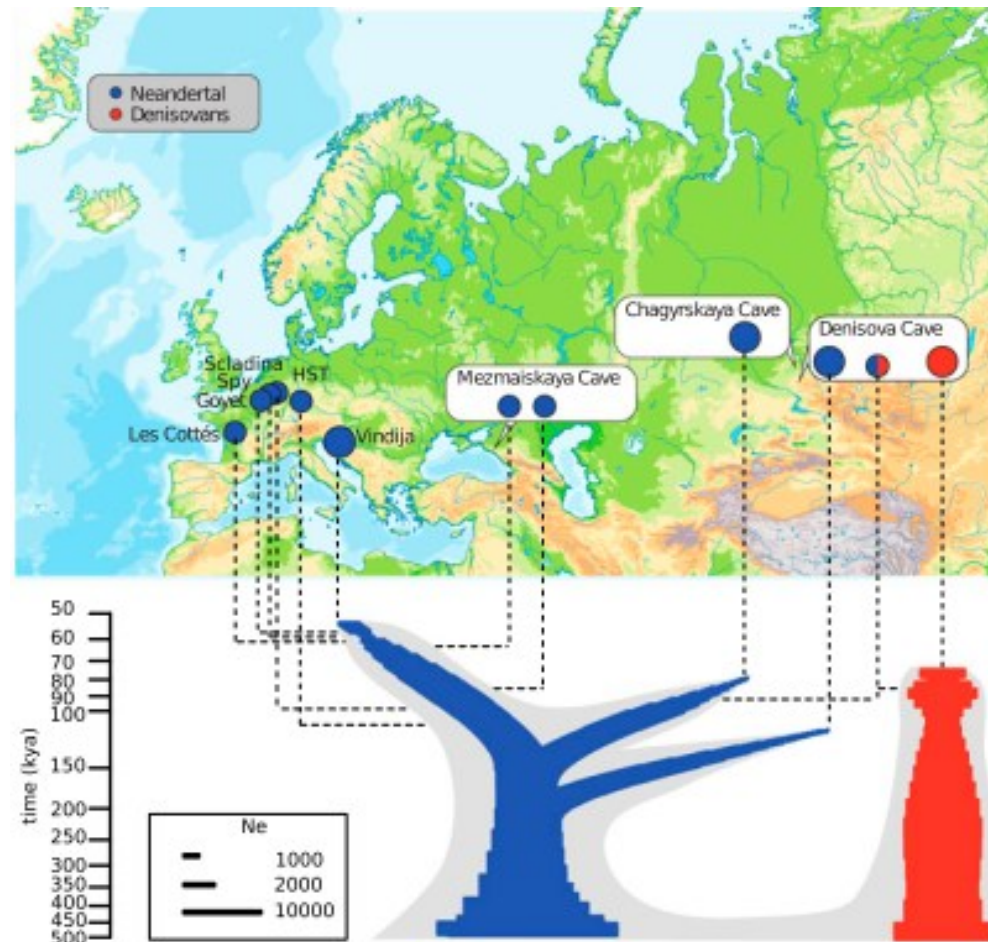


# A high-coverage Neandertal genome from Chagyrskaya Cave

Fabrizio Mafessoni<sup>a</sup>, Steffi Grote<sup>a</sup>, Cesare de Filippo<sup>a</sup>, Viviane Slon<sup>a</sup>, Kseniya A. Kolobova<sup>b</sup>, Bence Viola<sup>c</sup>, Sergey V. Markin<sup>b</sup>, Manjusha Chintalapati<sup>a</sup>, Stephane Peyrégne<sup>a</sup>, Laurits Skov<sup>a</sup>, Pontus Skoglund<sup>d</sup>, Andrey I. Krivoschapkin<sup>b</sup>, Anatoly P. Derevianko<sup>b</sup>, Matthias Meyer<sup>a</sup>, Janet Kelso<sup>a</sup>, Benjamin Peter<sup>a</sup>, Kay Prüfer<sup>a</sup>, and Svante Pääbo<sup>a,e,1</sup>

<sup>a</sup>Department of Evolutionary Genetics, Max Planck Institute for Evolutionary Anthropology, D-04103 Leipzig, Germany; <sup>b</sup>Institute of Archaeology and Ethnography, Russian Academy of Sciences, 630090 Novosibirsk, Russia; <sup>c</sup>Department of Anthropology, University of Toronto, Toronto, ON M5S 2S2, Canada; <sup>d</sup>Ancient Genomics Laboratory, Francis Crick Institute, NW1 1AT London, United Kingdom; and <sup>e</sup>Human Evolutionary Genomics Unit, Okinawa Institute of Science and Technology, Onna-son, 904-0495 Okinawa, Japan

Chagyrskaya 8 is more closely related to Vindija 33.19 and other late Neandertals in western Eurasia than to the Denisova 5 Neandertal who lived earlier in the Altai Mountains (Fig. 2). Chagyrskaya 8 is thus related to Neandertal populations that moved east sometime between 120 and 80 kya (13). Interestingly, the artifacts found in Chagyrskaya Cave show similarities to artifact assemblages in central and eastern Europe (10 and SI Appendix 1), suggesting that Neandertal populations coming from western Eurasia to Siberia may have brought their material culture with them (10, 34). Some of these incoming Neandertals encountered local Denisovan populations, as shown by Denisova 11, who had a Denisovan father and a Neandertal mother related to the population in which Chagyrskaya 8 lived.





# Siti attribuiti a Neanderthal

# La scoperta



Il primo fossile considerato come Neanderthal è stato scoperto nel 1856 nella valle di Neander, nella grotta di Feldhofer.

*The first fossil considered as a Neanderthal was discovered in 1856 in the Neander Valle, in Feldhofer cave.*

Al momento della scoperta gli operai trovarono sul suolo un cranio robusto, delle ossa lunghe, delle coste, un frammento di bacino e di scapola. Queste ossa, considerate dagli operai come i resti ossei di un orso delle caverne, furono portate a J.C. Fuhlrott, il maestro della regione appassionato naturalista. Fin dall'inizio Fuhlrott considerò queste ossa come quelle di un « nuovo » uomo.

*When the site was discovered, the workers found a robust skull and some bones. First these bones were considered as bears bones. Later, J.C.Fuhlrott did some study and found that they were bones from a « new » Homo.*





# La scoperta

Questo fossile non fu il primo Neandertaliano portato alla luce. Altri due fossili erano già stati trovati : uno a Engis in Belgio in 1929 e uno in Spagna a Gibraltar in 1848. Ma il fossile scoperto nella valle di Neander ha confermato l'esistenza di un Uomo fossile.

*This fossil weren't the first Neanderthal highlight. Two other fossil were already found: One in Engis (Belgium) in 1929 and one at Gibraltar (Spain) in 1848. But with the discovery of the Neander Valle, the existance of a human fossil was confirmed.*

Altre scoperte di altri fossili in Belgio a la Naulette e a Spy nel 1966 e 1886 confermarono la presenza dei Neandertaliani in Europa.

*Other discoveries in Belgium at La Naulette e a Spy in 1966 e 1886 has confirmed the presence of Neanderthal in Europa.*

*H. neandertalensis*  
(Spy, Belgio)



Mandibola  
*H. neandertalensis*  
(La naulette, Belgio)



# Biache-Saint-Vaast (Francia) 250 ka BP

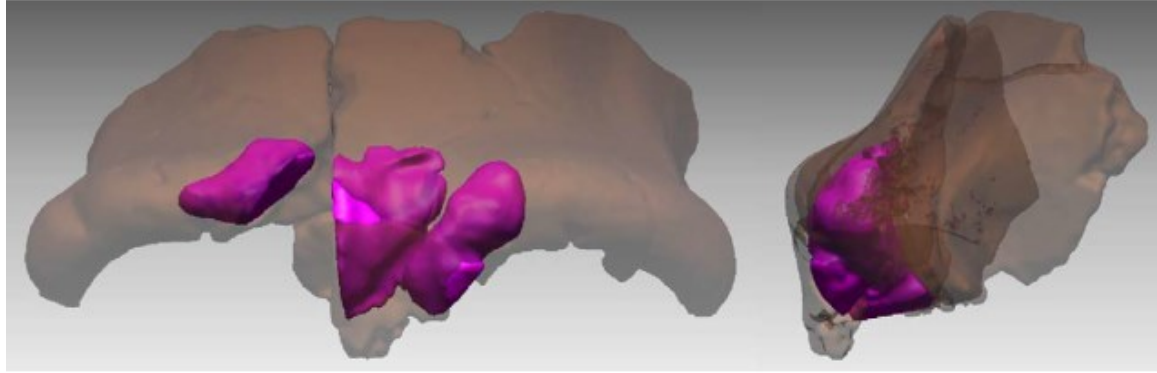


Fig. 4. Frontal sinuses of Biache-Saint-Vaast 2 after virtual reconstruction.

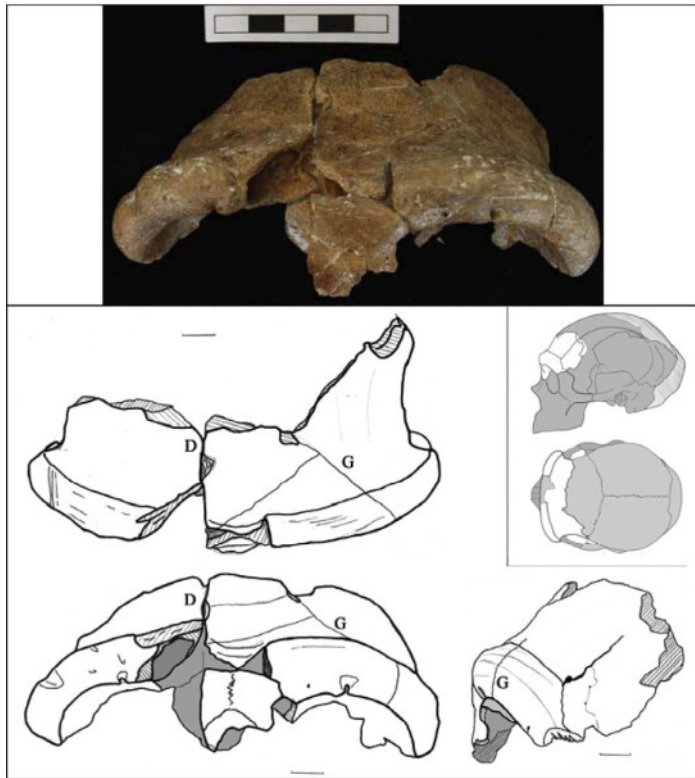
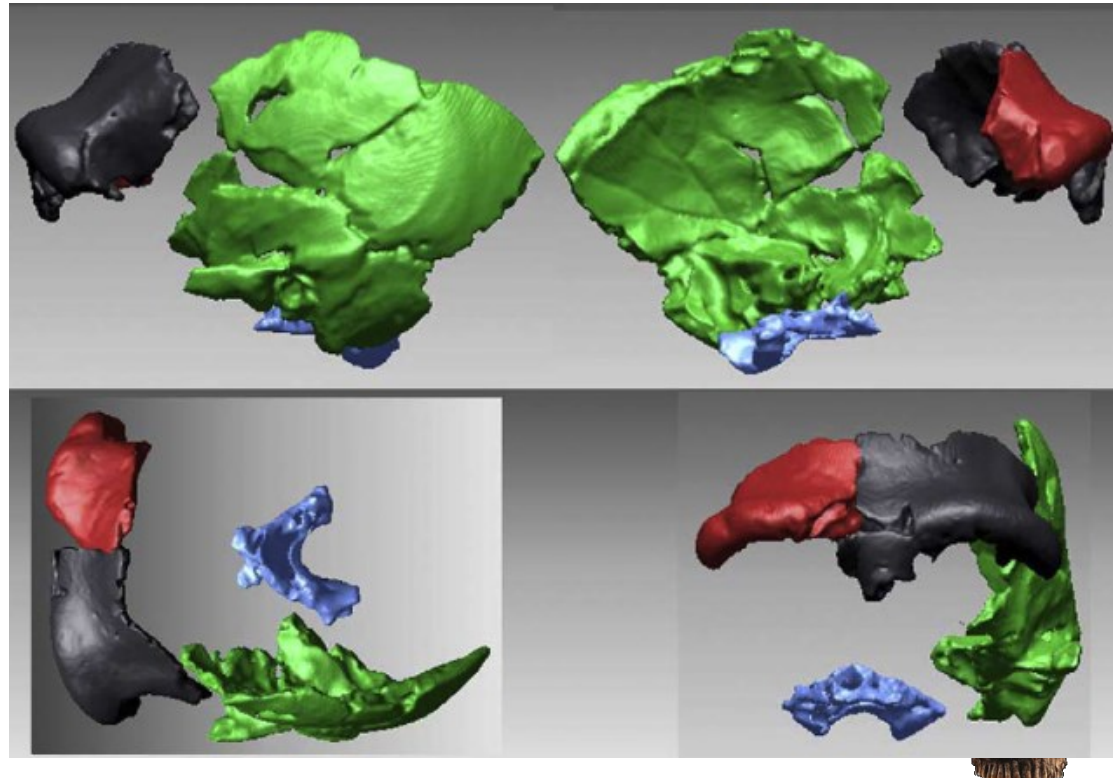


Fig. 1. Frontal bone of the Biache-Saint-Vaast 2 skull. Scale bar is 1 cm.

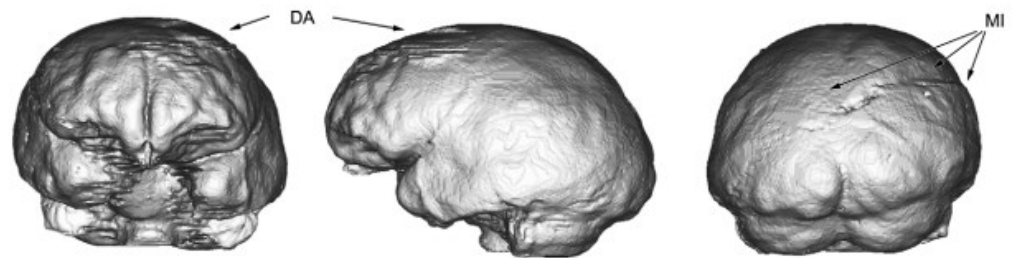


(Guipert et al. 2011)

# Italia : Saccopastore 250 ka BP



Saccopastore 1



Replica digitale dell'endocranio di SCP1

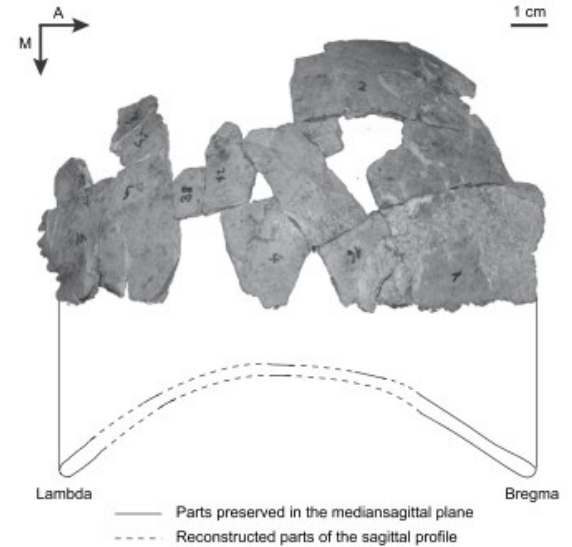




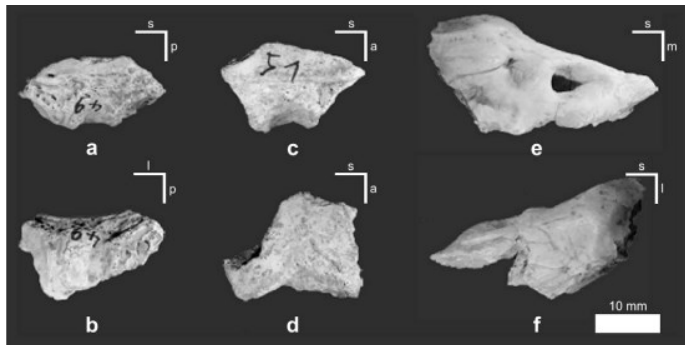
# Uzbekistan: Grotta Obi-Rakhmat 60-90 ka BP



OR 1 : Denti  
permanenti superiori  
sinistri



Ricostruzione del parietale di OR 1.



Frammenti di temporale

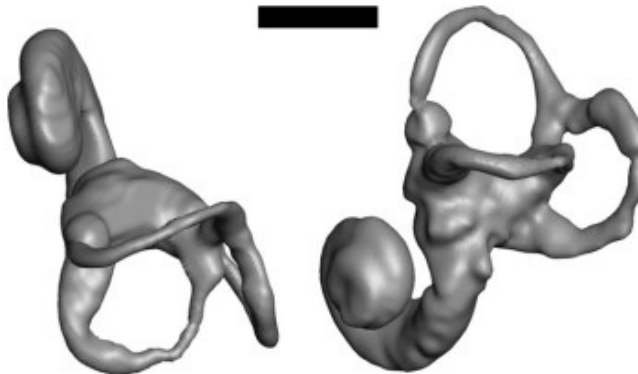
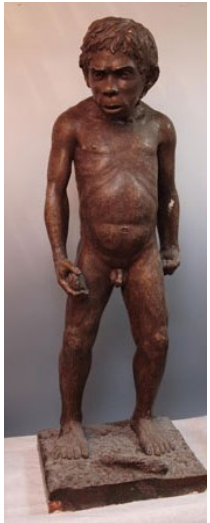


Fig. 9. Left semicircular canal of OR-1.

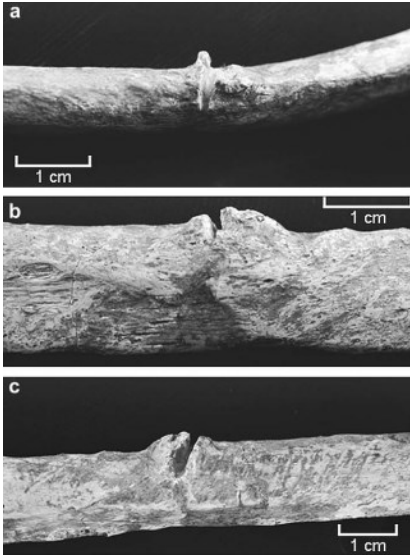


# Uzbekistan: Teshik Tash 70 ka





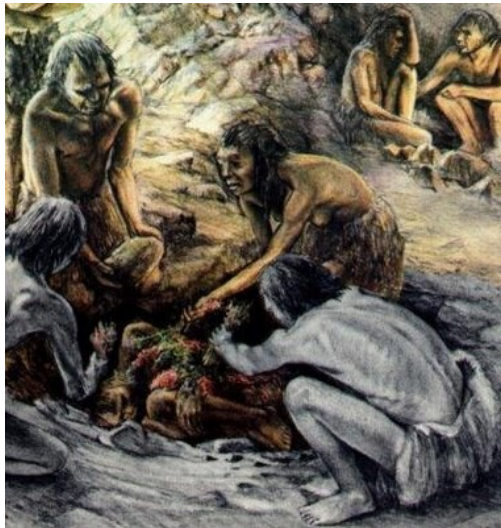
# Iraq : Shanidar 50 ka BP



Shanidar 3: Lesione sulla 9 costa.



Shanidar 1

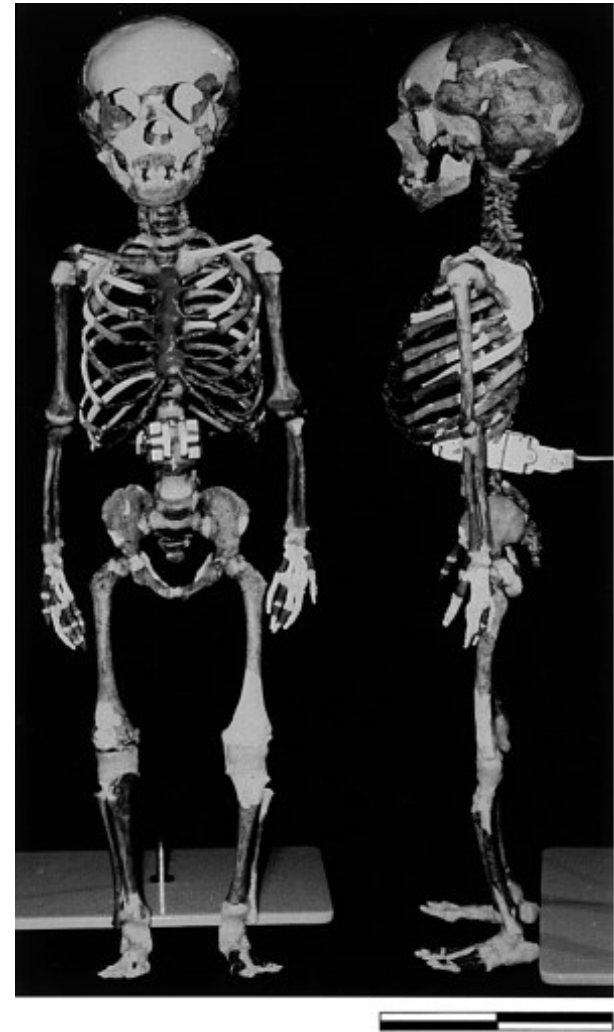




# Syria : Dederyheh 50-60 ka BP



Prima sepoltura di bambini



Ricostruzione dello scheletro immaturo di 2<sup>o</sup> anni.





# Israël: Kebara 48-60 ka BP



Sepulture Kebara II *Moshe*



Osso ioide di Kebara II



Ricostruzione dello scheletro di Kebara II



# Israël: Amud 47 ka BP



Amud 1 circa 47.000 anni, il Neandertaliano più alto (174 cm) e con maggiore cc (1640 cm<sup>3</sup>)





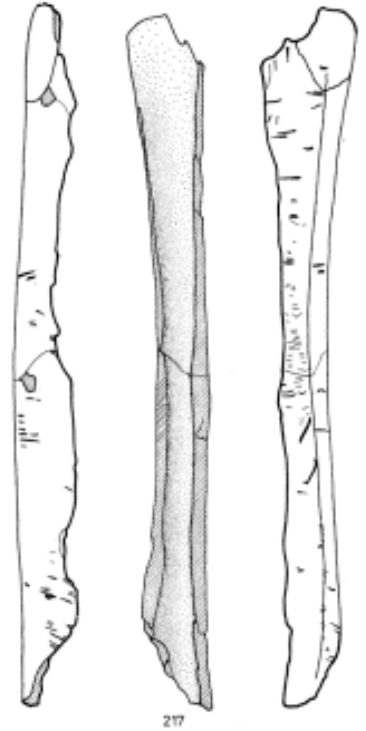
# Croazia: Krapina 130 ka BP



Krapina 12 : Frammento di osso occipitale giovanile



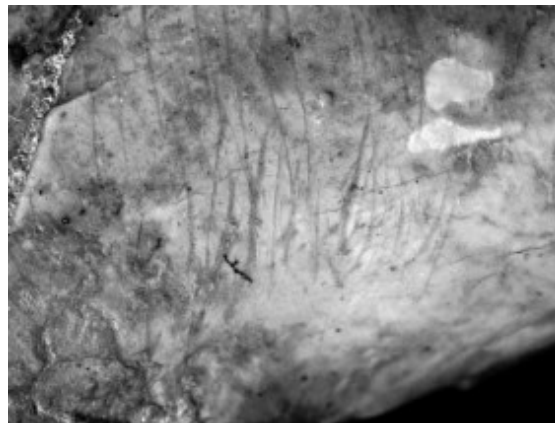
Krapina 59 : Mandibola



Tibia spaccata in 2 con tante cut marks.



emi-endocranio destro di Krapina 3



Cut marks nella sinfisi interna di K53.



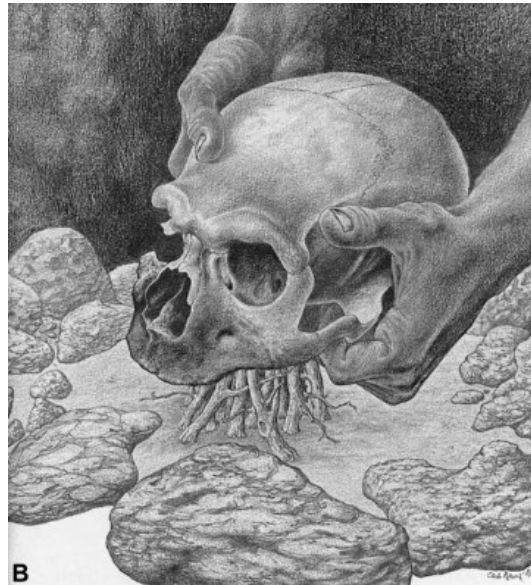
# Italia : Guattari 51-57 ka BP



Guattari 1



Guattari 2



Ricostruzione ipotetica del  
culto del cranio





Belgio : Spy 40 ka BP



Engis 70 ka BP

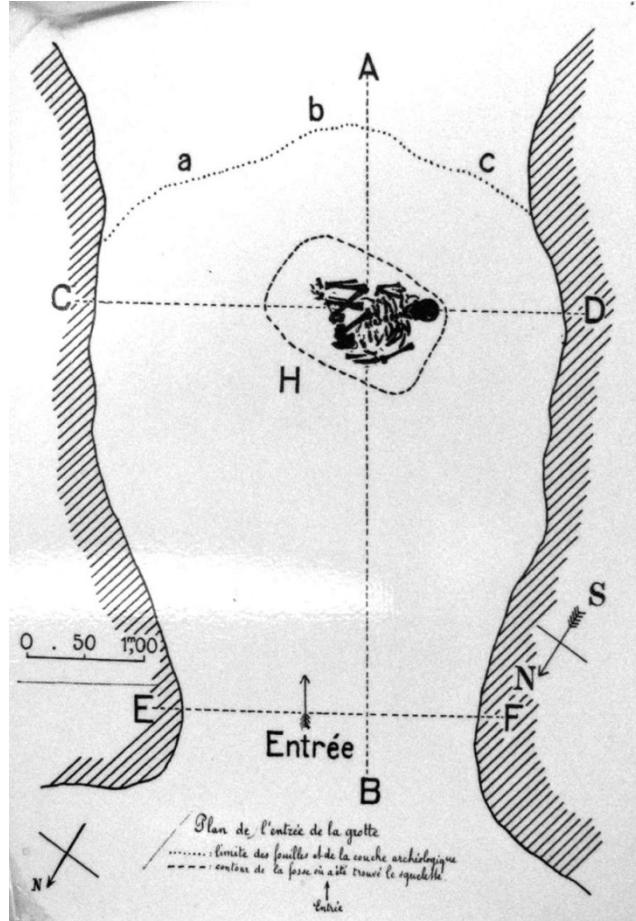


Engis 2



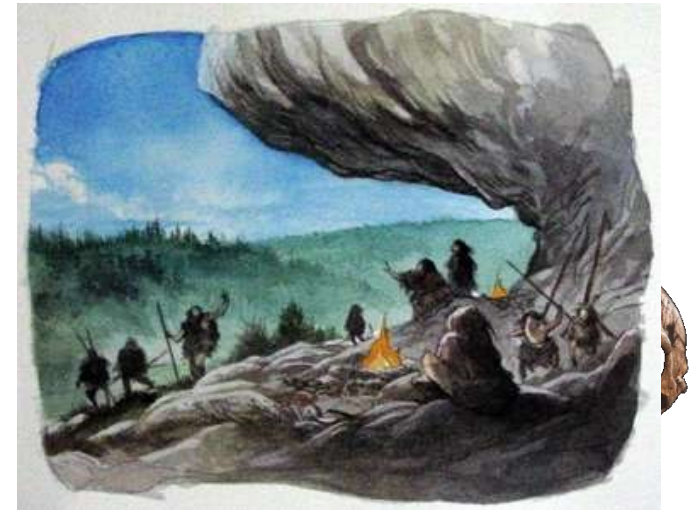
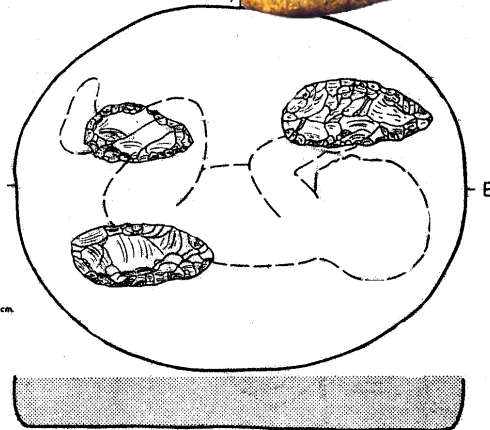
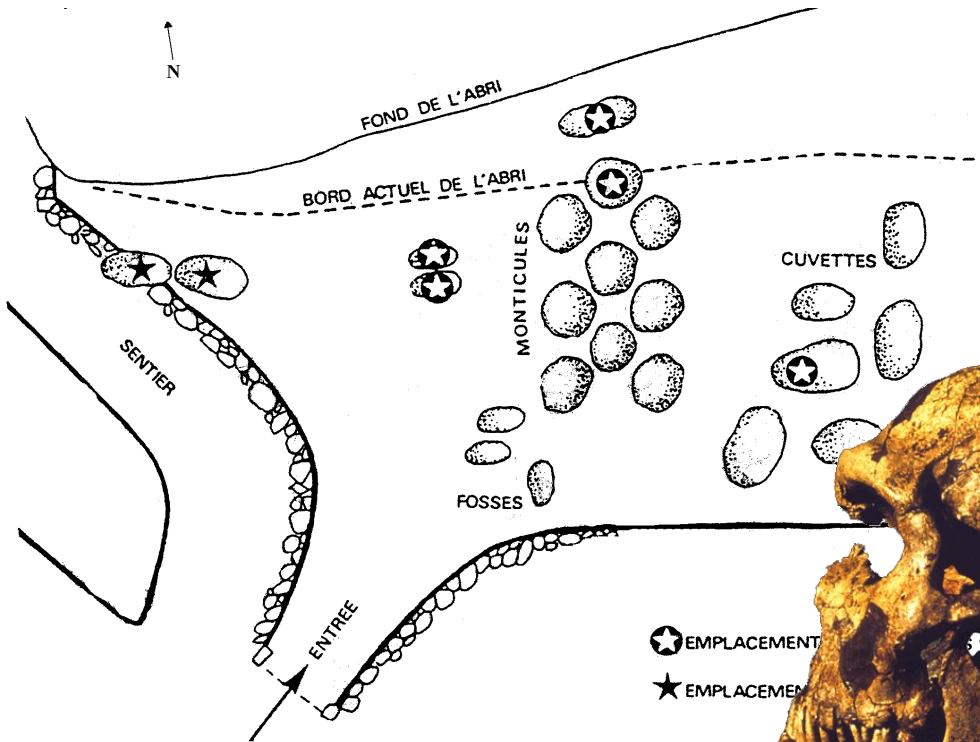


# La Chapelle-aux-Saints (50 ka BP, Francia)



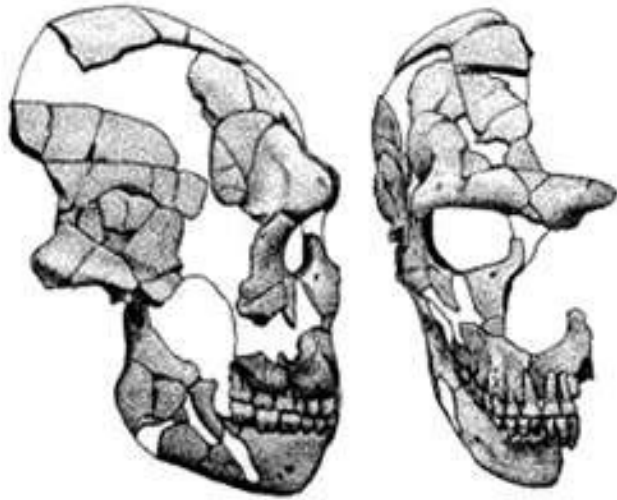


# La Ferrassie (55 ka anni, Francia) – « Necropoli » di 8 scheletri





# Francia : Saint-Césaire 36 ka BP

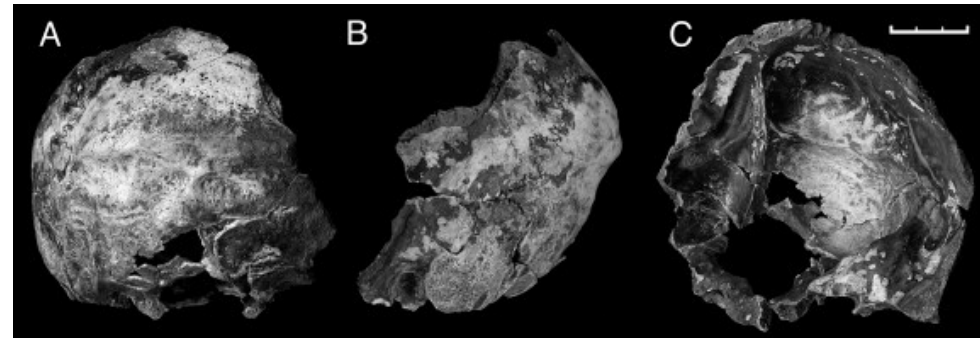
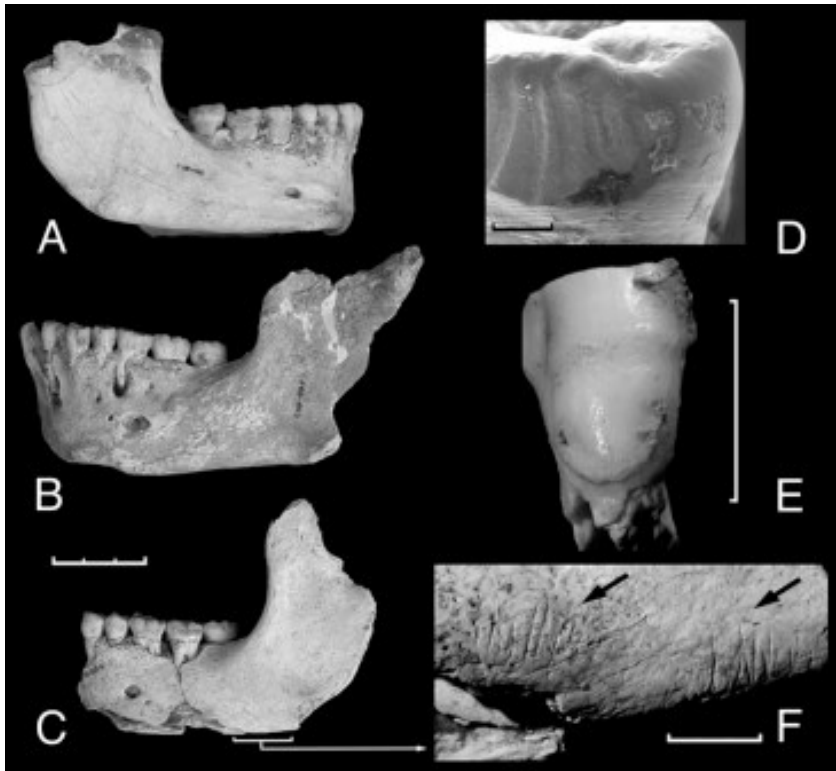
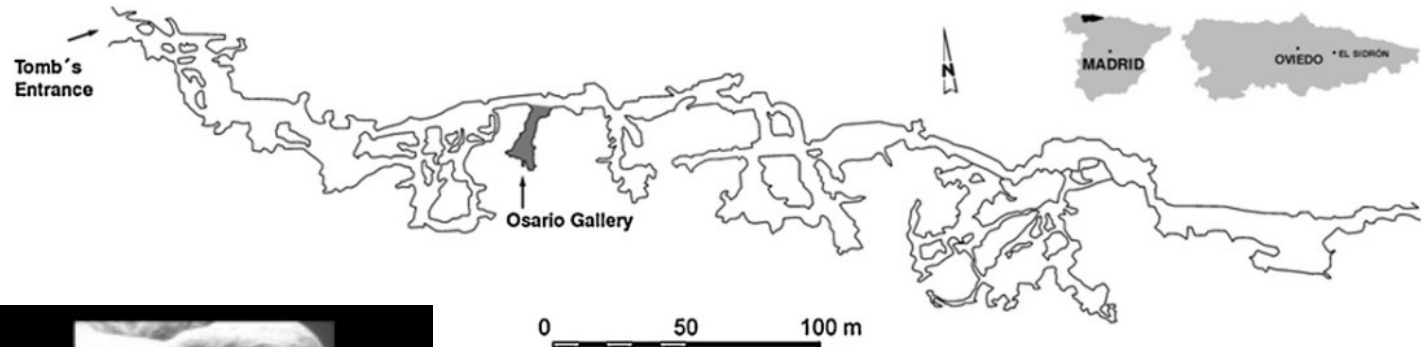


Cranio di Saint-Césaire 1





# Spagna : El Sidron 43 ka BP

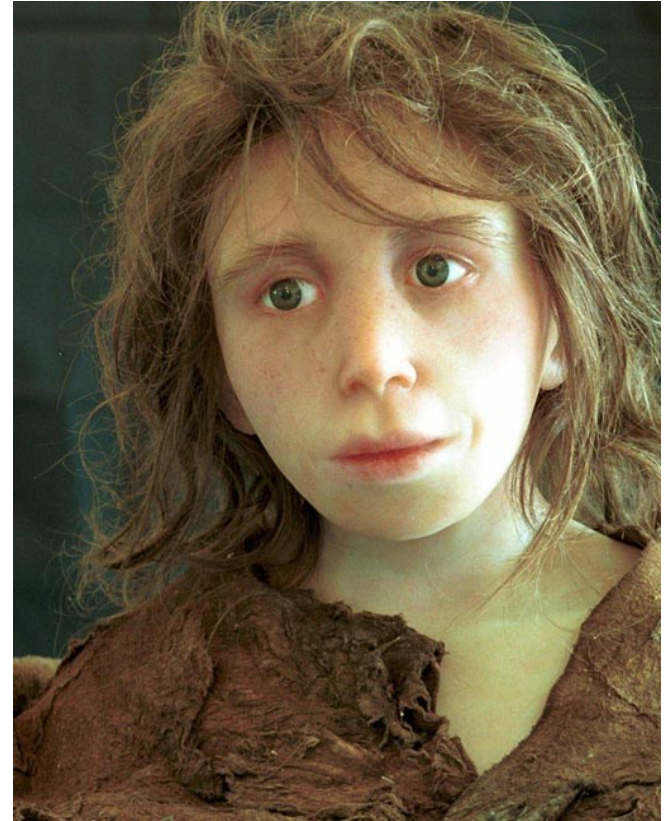
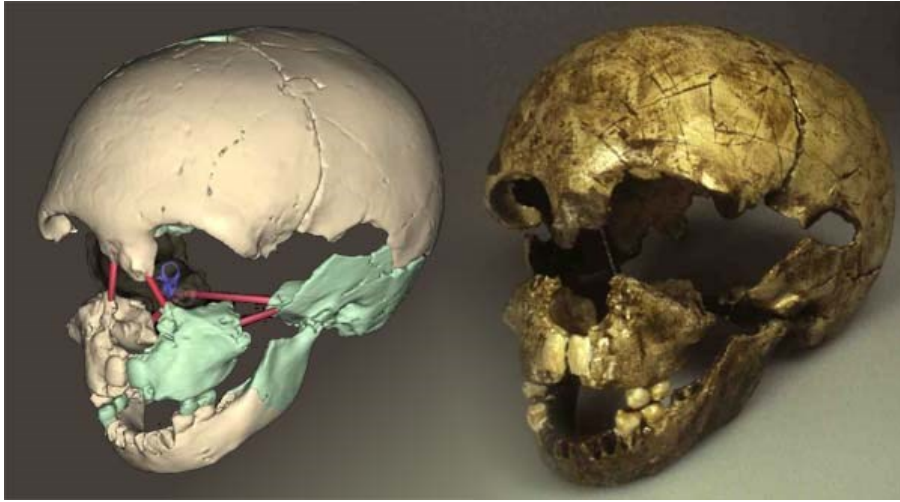


SD-1219. Regione Occipitomastoide

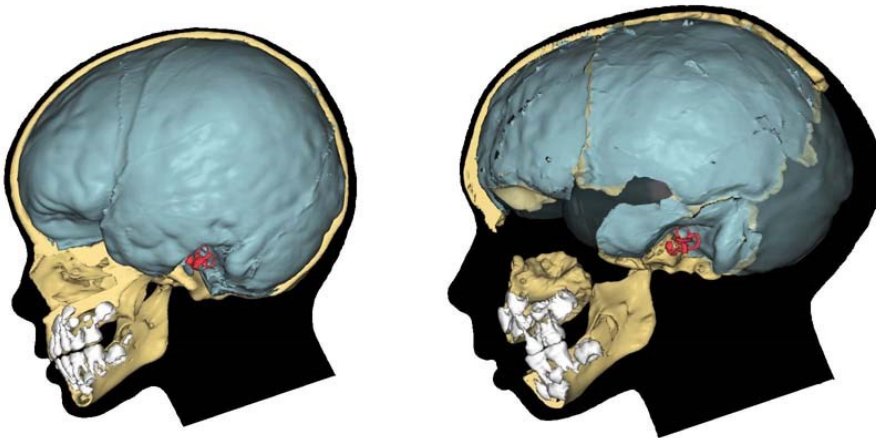
Mandibole con un'ipoplasia dello smalto e delle cut marks sul bordo basale (F)



# Spagna : Gibralatar Devil's Tower 30 ka BP



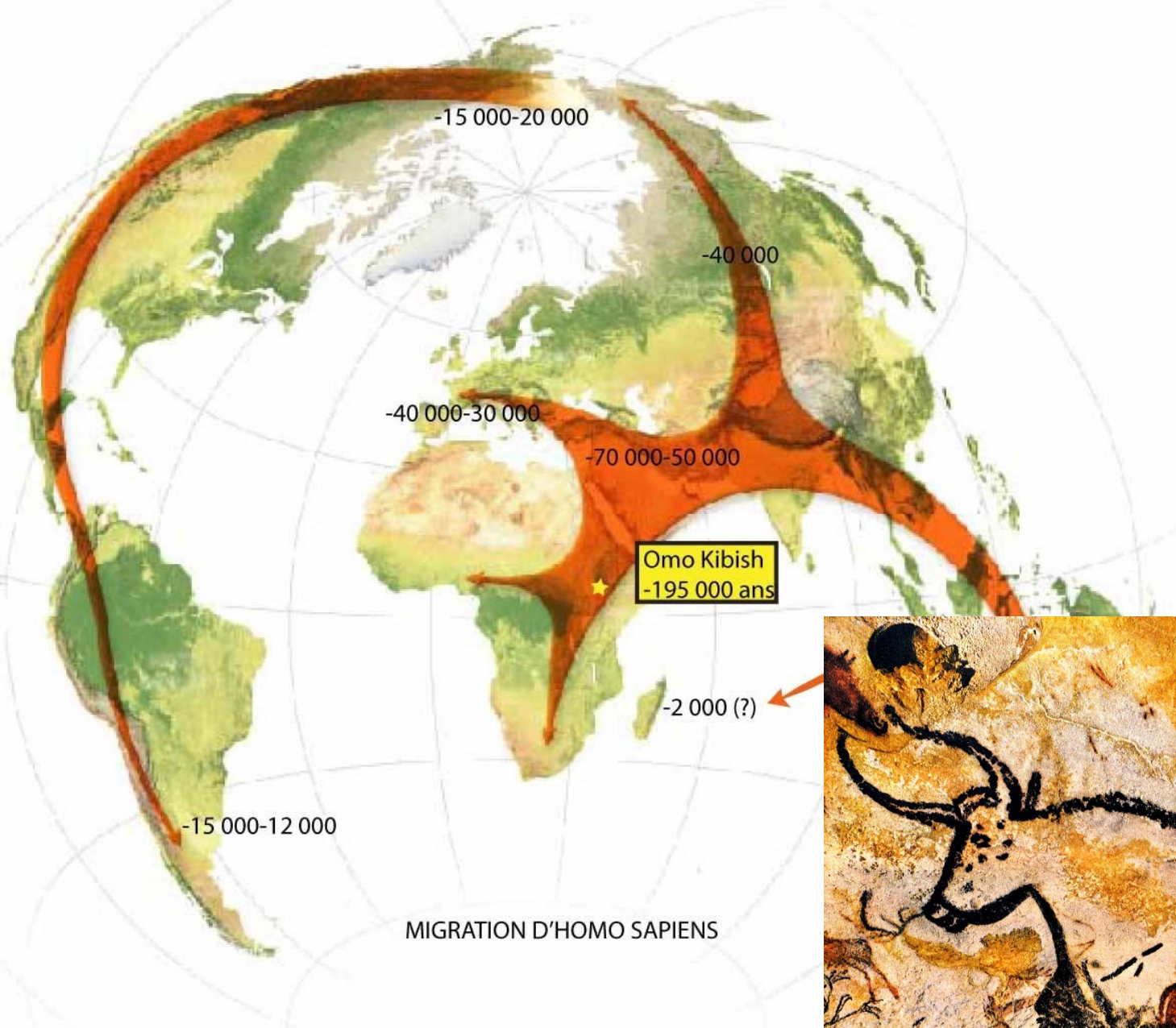
Gibraltar 2 : Cranio e  
ricostruzione



# Estinzione

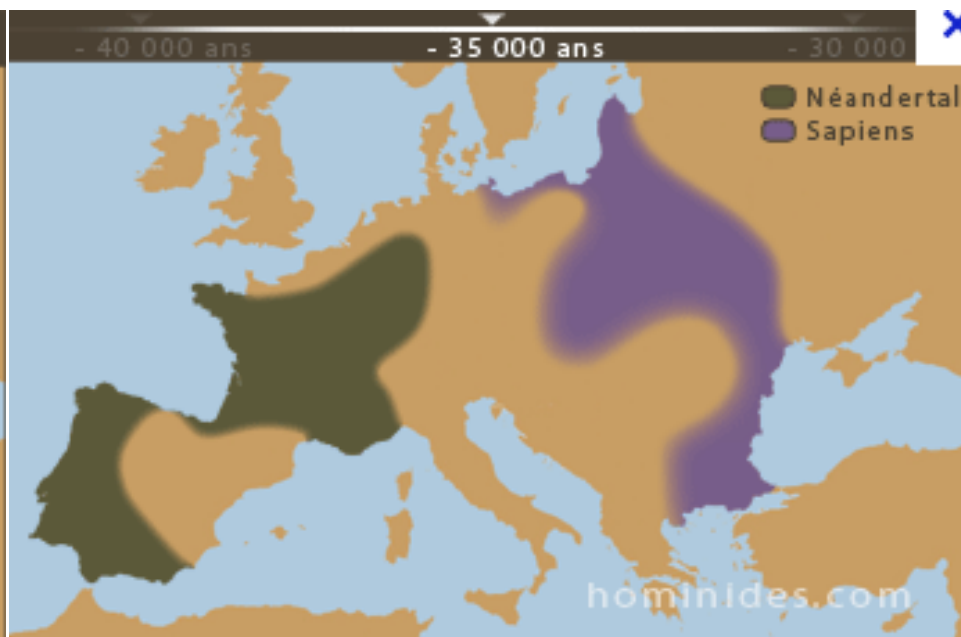




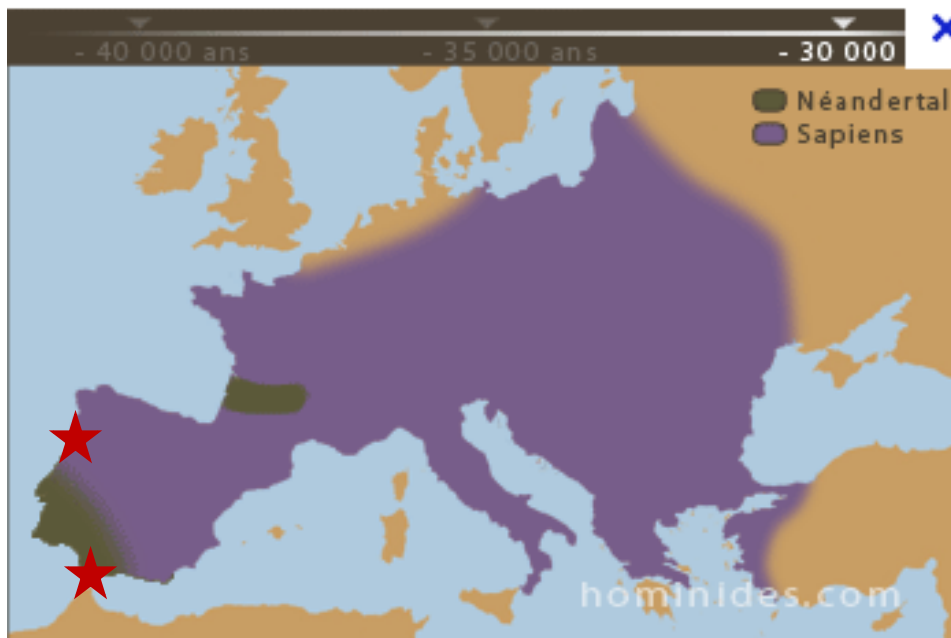




Répartition Néandertaliens et Sapiens



Répartition Néandertaliens et Sapiens



Répartition Néandertaliens et Sapiens



Neanderthal's Cave  
(30,000 years old,  
Cataluña, Spain)



# Ipotesi...

Concorrenza con *Homo sapiens* che ha conquistato tutte le nicchie ecologiche.  
*The competition with Homo sapiens who has colonized all the ecological niche.*

*Homo sapiens* è riuscito a estendere la caccia a vari tipi di prede  
*Homo sapiens was able to extend the hunting to various types of prey..*

Combattimento tra *H.sapiens* e *H.neandertalensis* che si indeboliva.  
*Fight between H. sapiens and H.neanderthalensis who get weaker.*

Genocidi dei Neandertaliani da parte dei *sapiens*.  
*Genocide of the Neandertal from the sapiens.*

Fuga dei Neandertaliani che rifiutavano il confronto con i Cro-Magnon. Questa cultura pacifica e la mortalità infantile elevata sarebbe all'origine della loro scomparsa.  
*Escape of the Neandertal who refused the confrontation with the Cro-Magnon. This pacific culture and the child mortality could have been the reason to their extinction.*

Malattie *Deseases*





# Bibliografia

Carbonell E., J. M. Bermudez de Castro, et al. (2008). "The first hominin of Europe." Nature **452: 465-470.**

Facchini F. and Belcastro M.G. (2009). La lunga storia di Neandertal: Biologia e comportamento. Milano.

Green R.E. et al. (2010) – “A draft sequence of the Neandertal genome.” Science 328

Hodgson, J. A., C. M. Bergey, et al. (2010). "Neandertal Genome: The Ins and Outs of African Genetic Diversity." Current Biology **20(12): R517-R519.**

Hublin J.J (2009). "The origin of Neandertals." PNAS **106(38): 16022-16027.**

Vandermeersch B. and Hublin J.J (2007). Les derniers néandertaliens. Les Néandertaliens. Biologie et cultures. CTHS. Paris, Documents préhistoriques. 23: 109-115.

Weaver T.D. (2009). "The meaning of Neandertal skeletal morphology." PNAS **106(38): 16028-16033.**

