

**LE**  
**SCIENZE**  
*live*



**LE SCIENZE *live***

# Prima colonizzazione umana del continente europeo

G. Muttoni

Università degli Studi di Milano



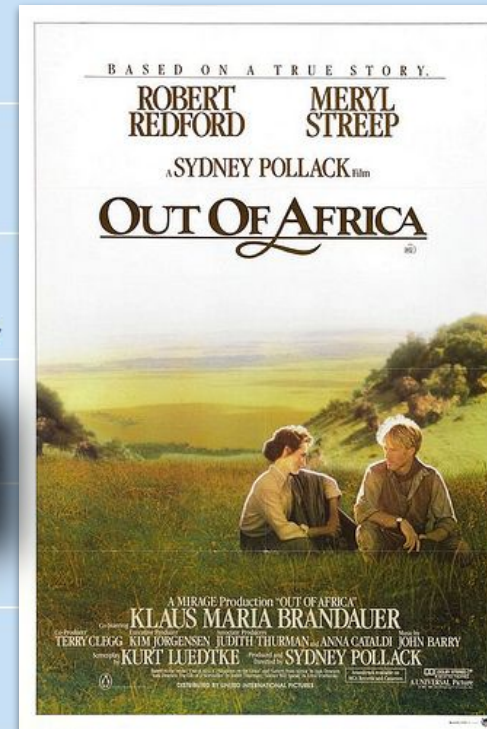
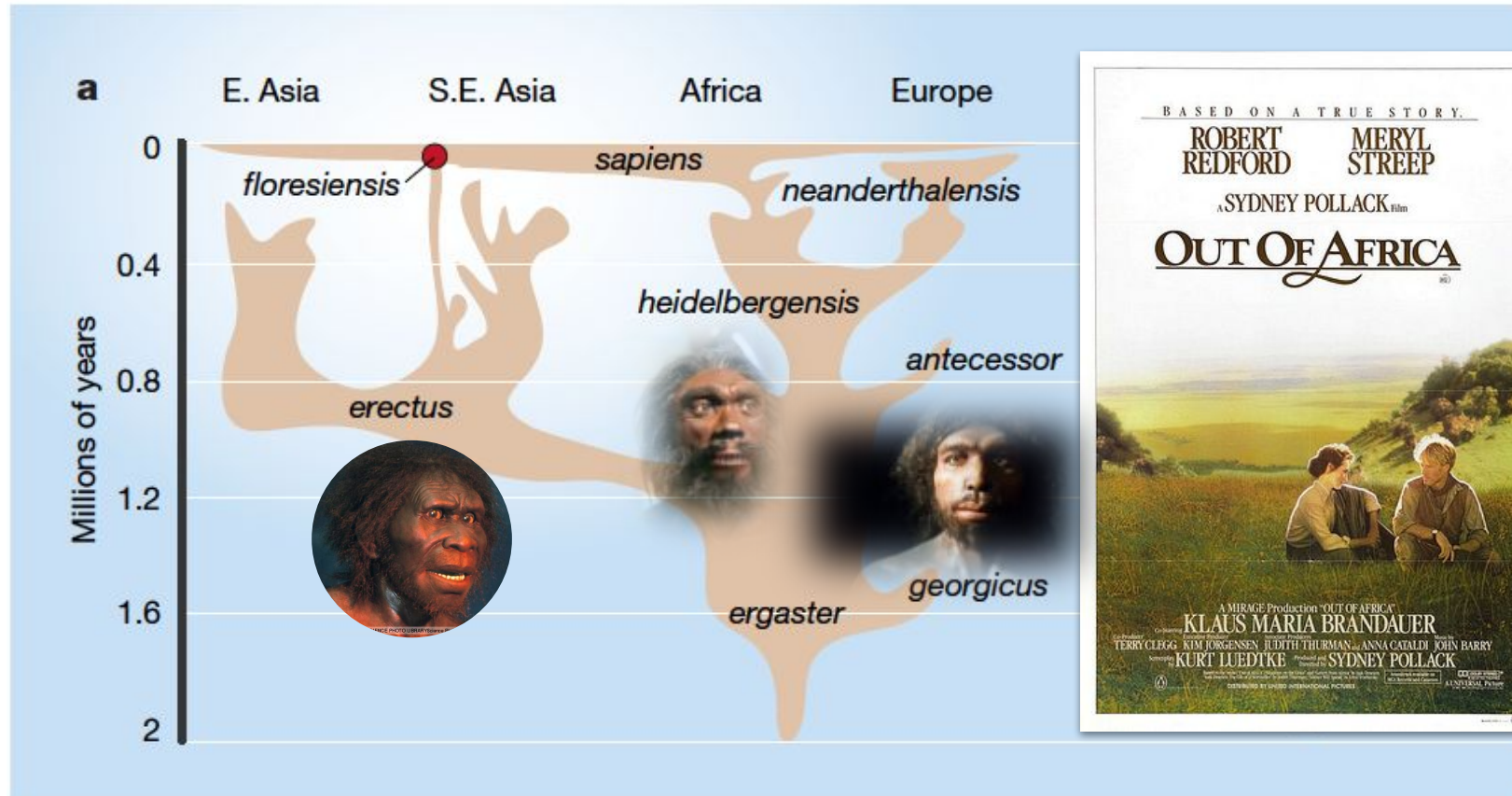
*Aldo Segre*

*Antonio Ascenzi*

# Out of Africa (and into Europe)

## Homo erectus

*Il primo uomo ad uscire dall'Africa -> H. antecessor in Europa*



Mirazon and Foley 2004

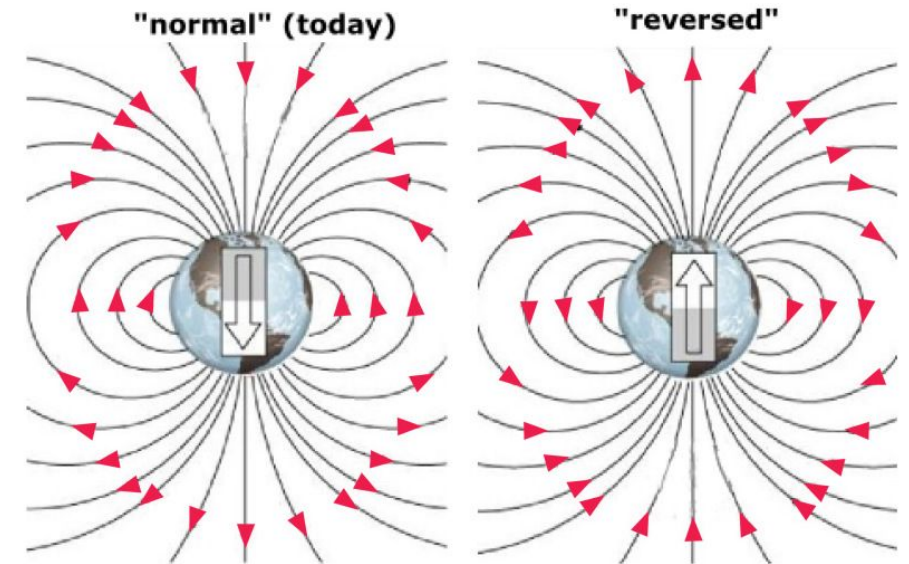
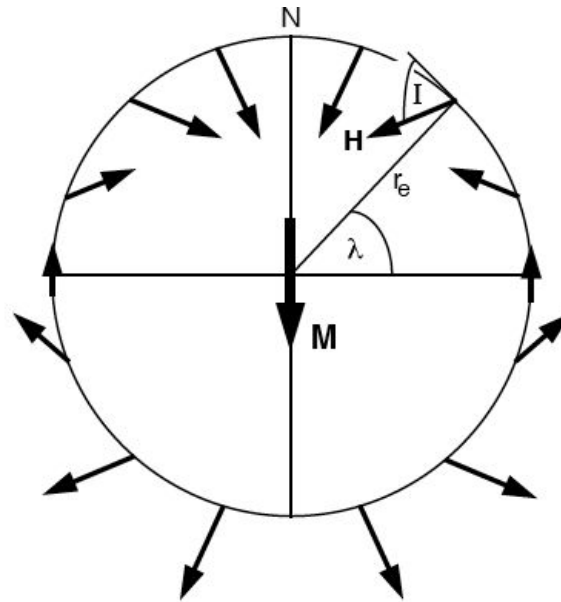
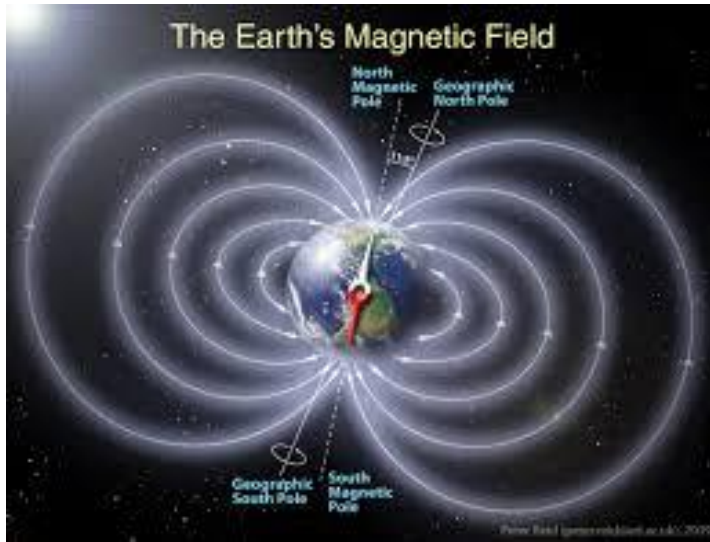


Come ricostruiamo il  
Come-Quando-Perché  
di **Out of Africa**  
**(and into Europe)?**  
Il segreto è nei sedimenti

**Ma come  
datarli?**



# Campo Magnetico Terrestre

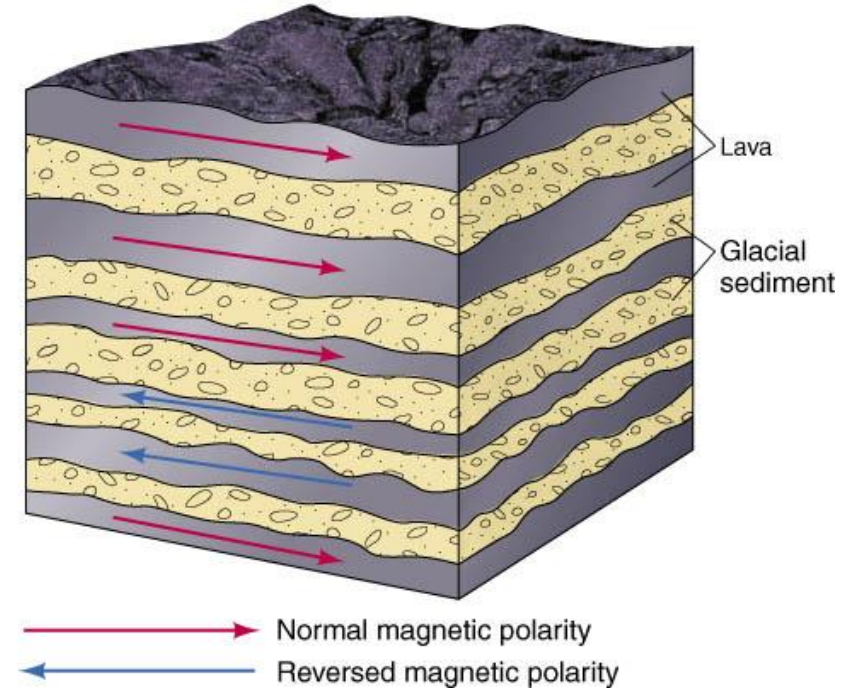
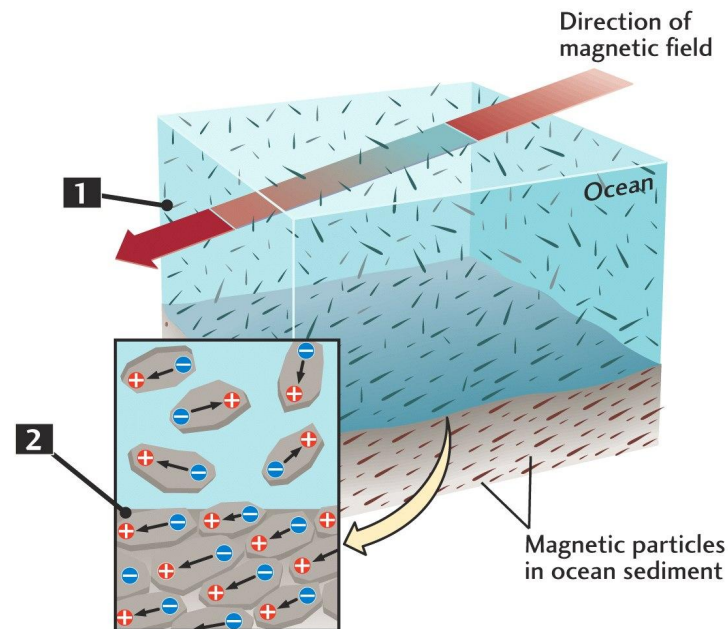


---

## Acquisition of natural remanence in sediments:

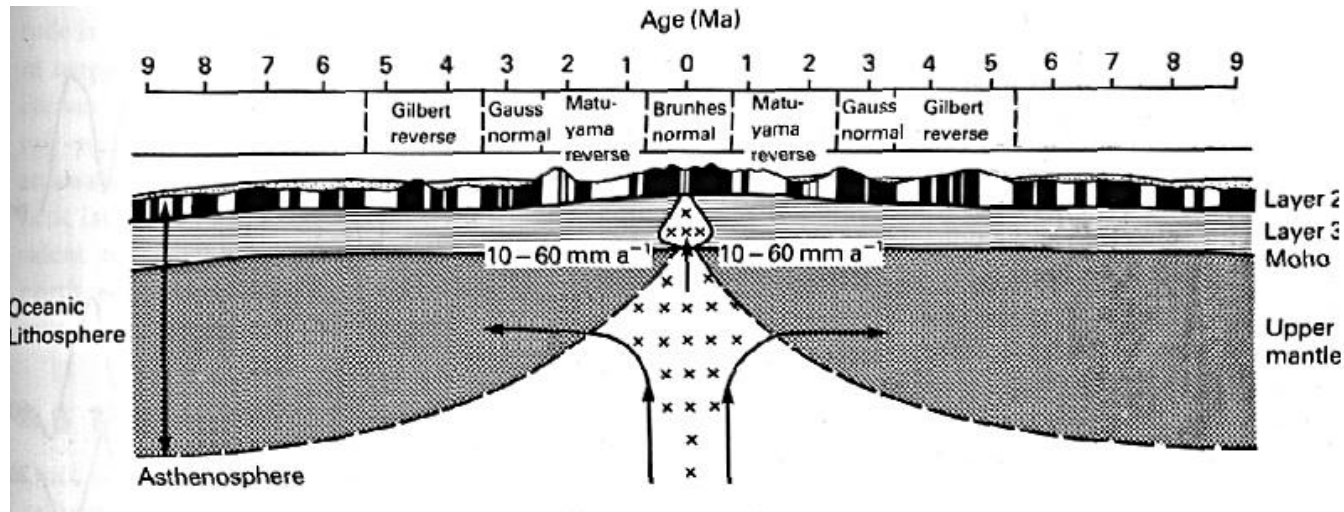
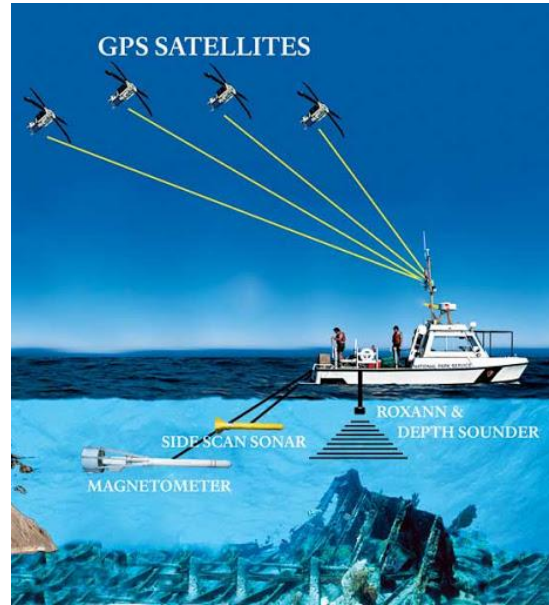
Tiny ferromagnetic grains (e.g. magnetite) depositing on the sea-floor with their magnetic moments oriented parallel to the ambient geomagnetic field lines.

---





Marine magnetic anomalies provide the most complete record of magnetic polarity reversals of the last ~170 Myr



## Geomagnetic Polarity Timescale (GPTS):

Sequence of magnetic polarity reversals from dated marine magnetic anomalies.

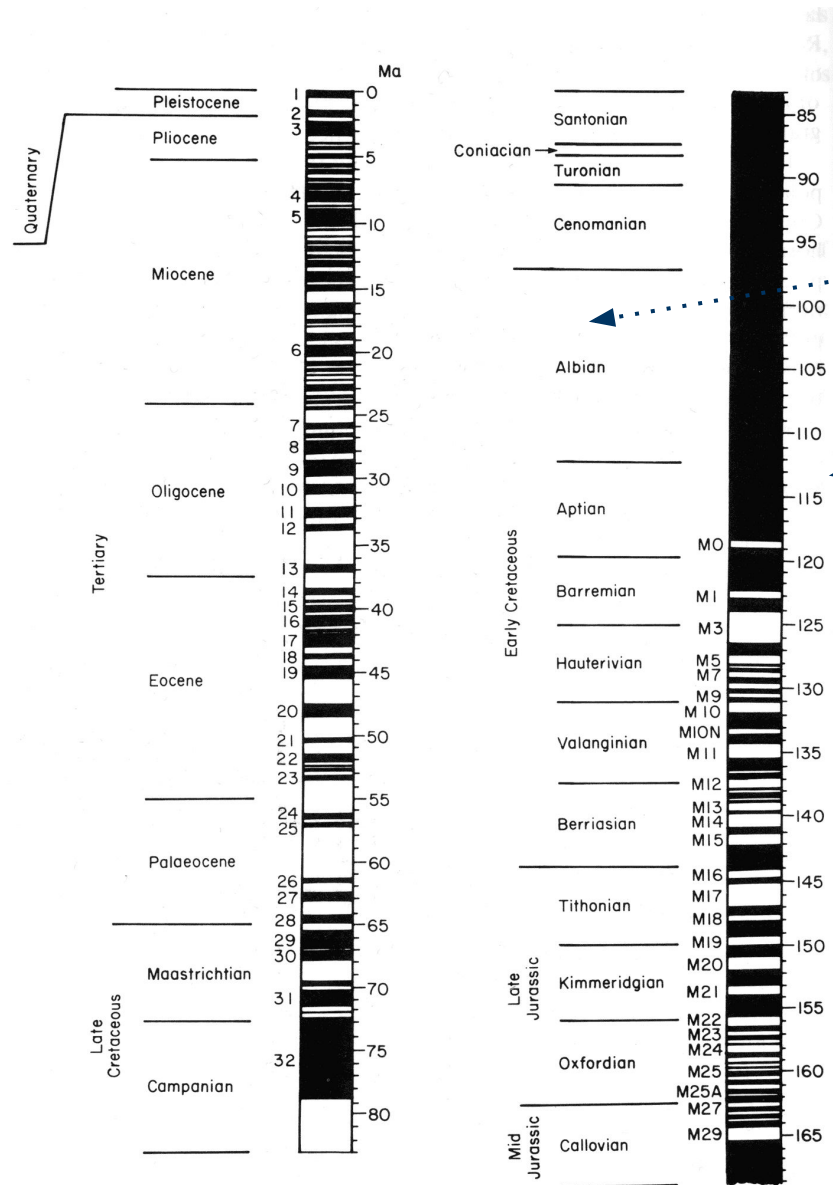
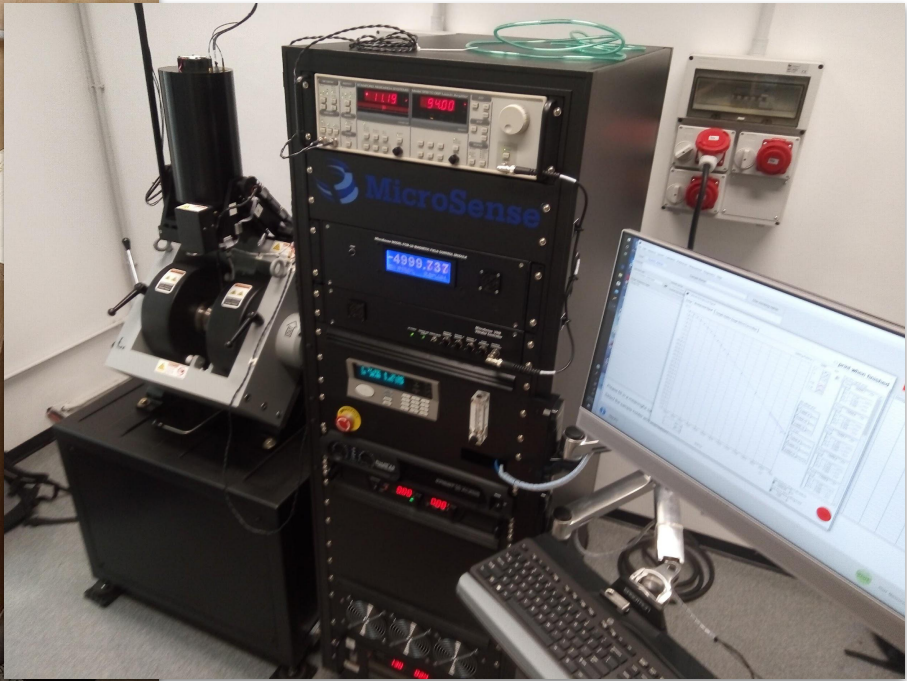


Fig. 5.9. Reversal time-scale for the past 170 Ma (after Cox, 1982).

Età relativa e numerica dalle datazioni biostratigrafiche e radiometriche



# Homo erectus homeland: Turkana, Olduvai Gorge, etc..

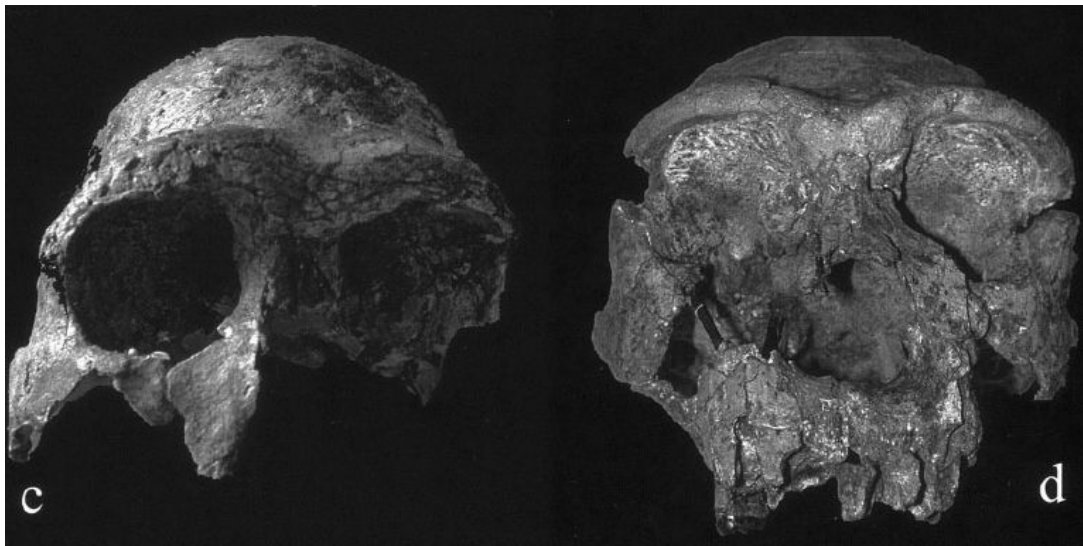


Fig. 6. *H. erectus* faces from Africa and Georgia. a: KNM WT 15000 (cast), b: Dmanisi D2282, c: KNM ER 3883, d: KNM ER 3733. a and b to same scale in centimeters. c and d not to scale.

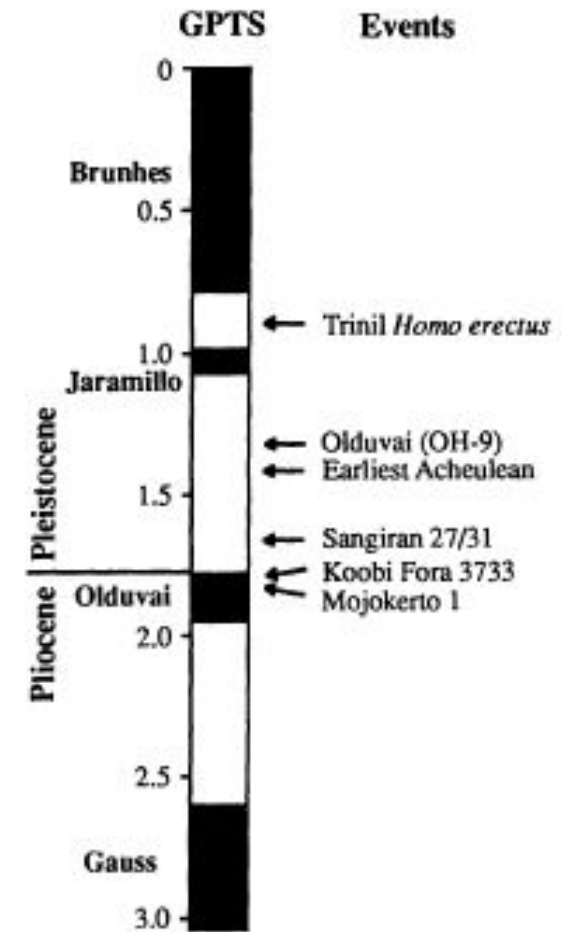



Fig. 2. Chronology of hominid fossils and events in Java, Indonesia, and East Africa discussed in the text, plotted on the geomagnetic polarity time scale (GPTS) (31).

A wide-angle landscape photograph of Lake Turkana in Kenya. The lake's deep blue water fills the middle ground, with several large, rounded volcanic islands in the distance under a clear sky. In the foreground, a dry, brownish plain is visible, featuring a single acacia tree on the left side.

Homo erectus visse  
sulle rive del Lago Turkana  
in Kenya un milione  
e settecentomila anni fa

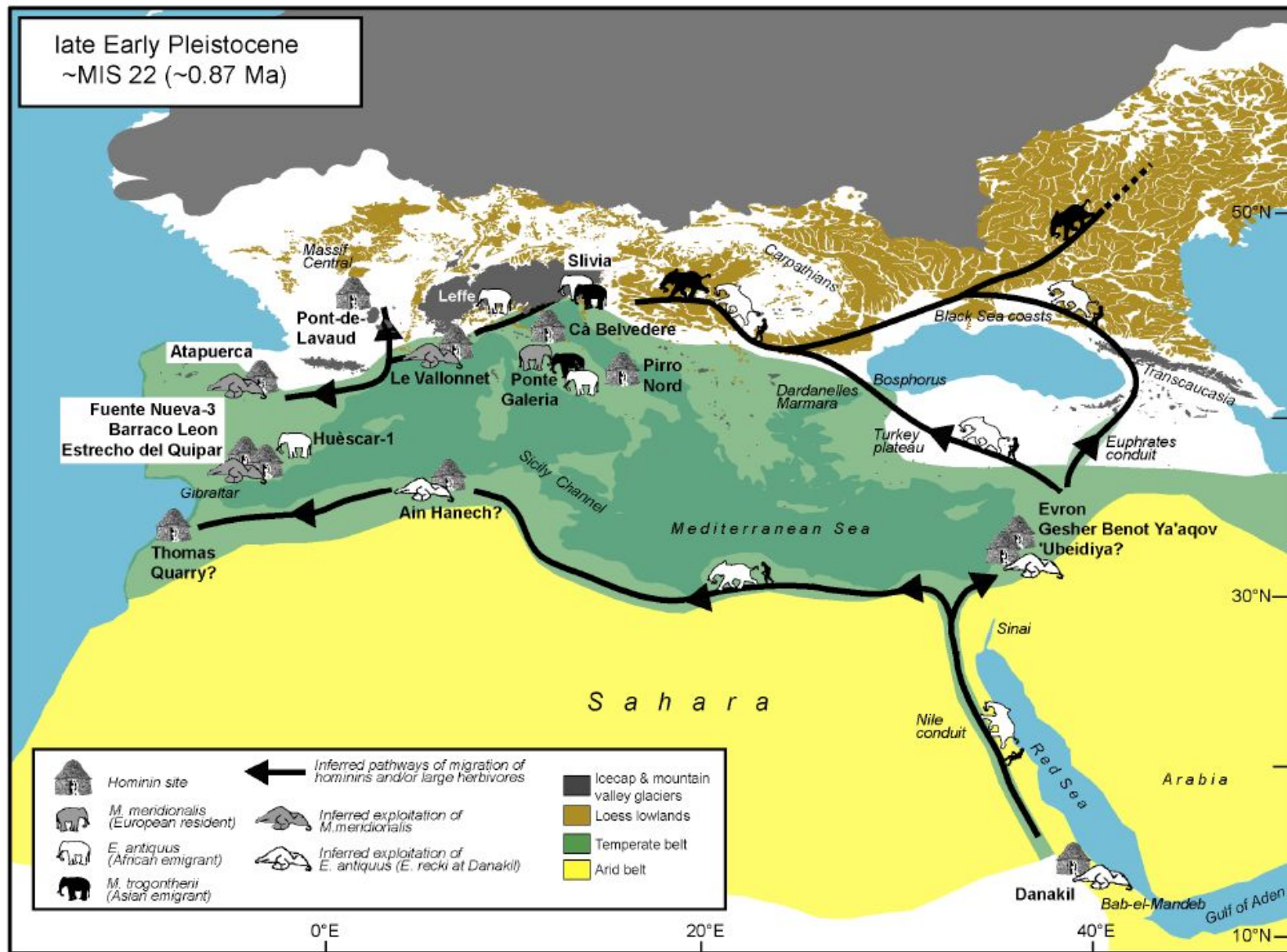


...e nella Gola dell'Olduvai  
vicino a Ngorongoro,  
Tanzania

A photograph showing two men at an archaeological site. The man on the left, wearing a tan cap and glasses, is holding out two fossilized jawbone fragments to the man on the right. The man on the right, wearing a blue polo shirt, is looking at a smartphone in his hand. They are sitting on stone steps in a sunlit, sandy environment with a stone wall in the background.

...e a Thomas Quarry  
vicino a Casablanca,  
Marocco...  
e altrove in Africa...

# Out of Africa (and into Europe)





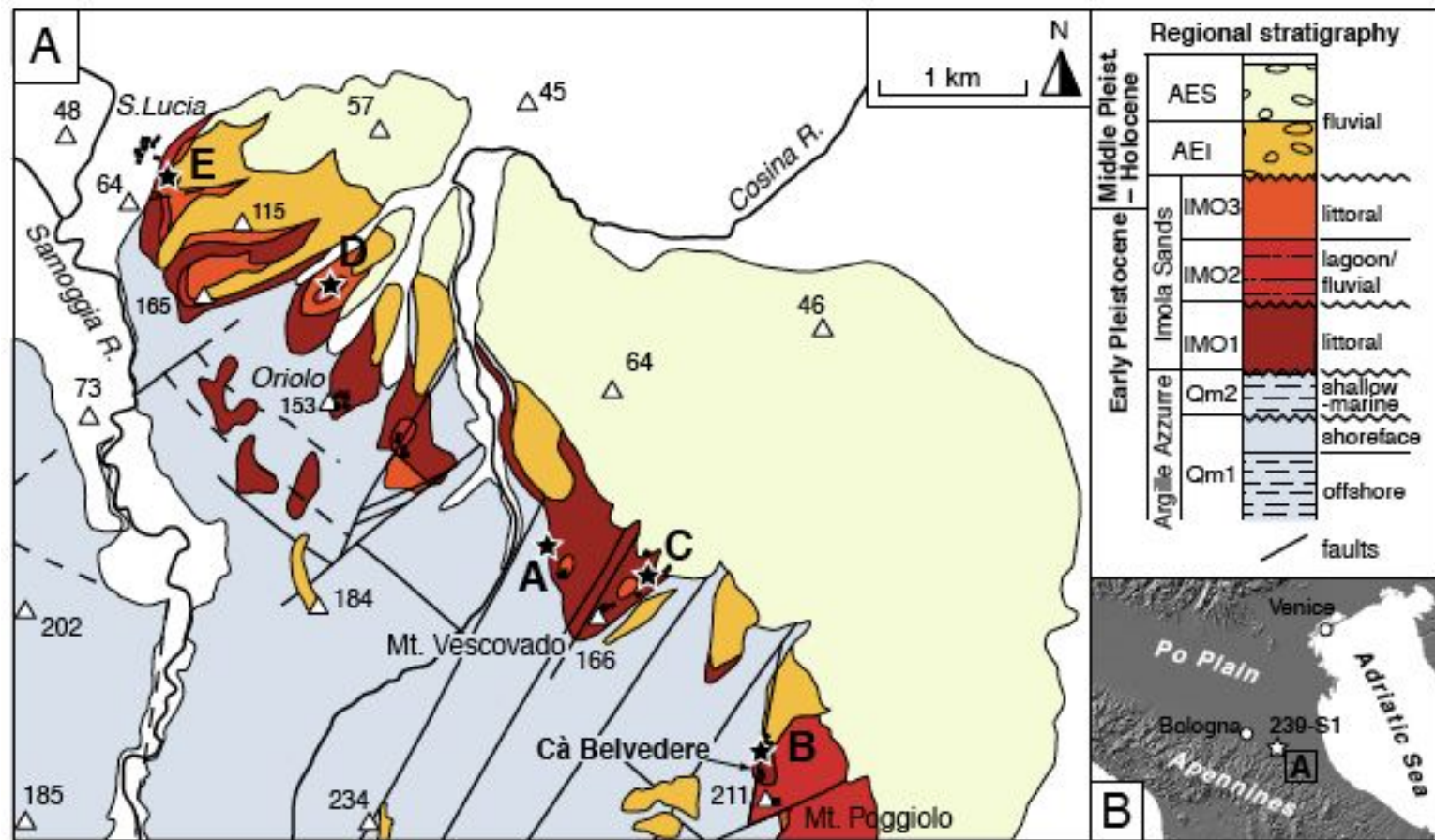
# Monte Poggiolo (Forlì)



# First dated human occupation of Italy at ~0.85 Ma during the late Early Pleistocene climate transition

Earth and Planetary Science Letters xxx (2011) xxx-xxx

Giovanni Muttoni <sup>a,\*</sup>, Giancarlo Scardia <sup>b</sup>, Dennis V. Kent <sup>c,d</sup>, Enrico Morsiani <sup>a</sup>, Fabrizio Tremolada <sup>e</sup>, Mauro Cremaschi <sup>a</sup>, Carlo Peretto <sup>f</sup>





# Atapuerca, Spagna

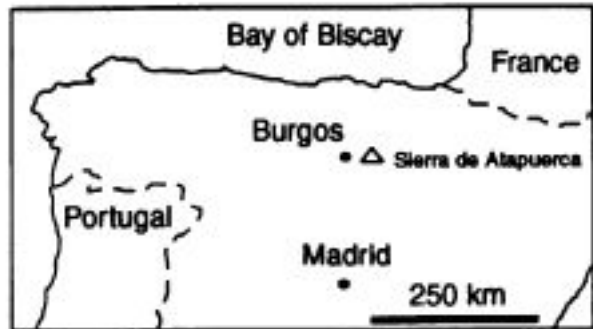


Fig. 1. Location of Sierra de Atapuerca, Spain.

# Paleomagnetic Age for Hominid Fossils at Atapuerca Archaeological Site, Spain

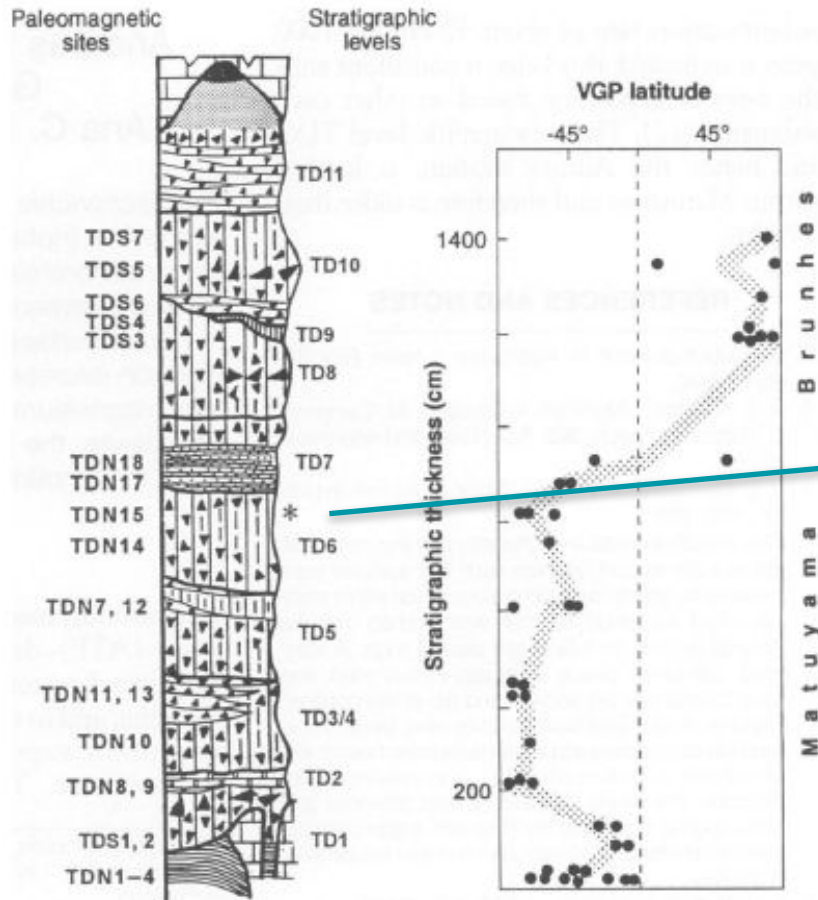
Josep M. Parés\* and Alfredo Pérez-González

SCIENCE • VOL. 269 • 11 AUGUST 1995

# An Early Pleistocene hominin mandible from Atapuerca-TD6, Spain

E. Carbonell\*, J. M. Bermúdez de Castro<sup>†‡§</sup>, J. L. Arsuaga<sup>¶</sup>, E. Allue\*, M. Bastir<sup>†</sup>, A. Benito<sup>†</sup>, I. Cáceres\*, T. Canals\*, J. C. Díez<sup>\*\*</sup>, J. van der Made<sup>†</sup>, M. Mosquera\*, A. Ollé\*, A. Pérez-González<sup>†</sup>, J. Rodríguez<sup>†</sup>, X. P. Rodríguez\*, A. Rosas<sup>†‡</sup>, J. Rosell\*, R. Sala\*, J. Valverdú\*, and J. M. Vergés\*

5674–5678 | PNAS | April 19, 2005 | vol. 102 | no. 16



**Gran Dolina**



Fig. 1. Lateral view of ATD6-96.

**Homo antecessor**



**LE SCIENZE *live***

# Kozarnika, Bulgaria

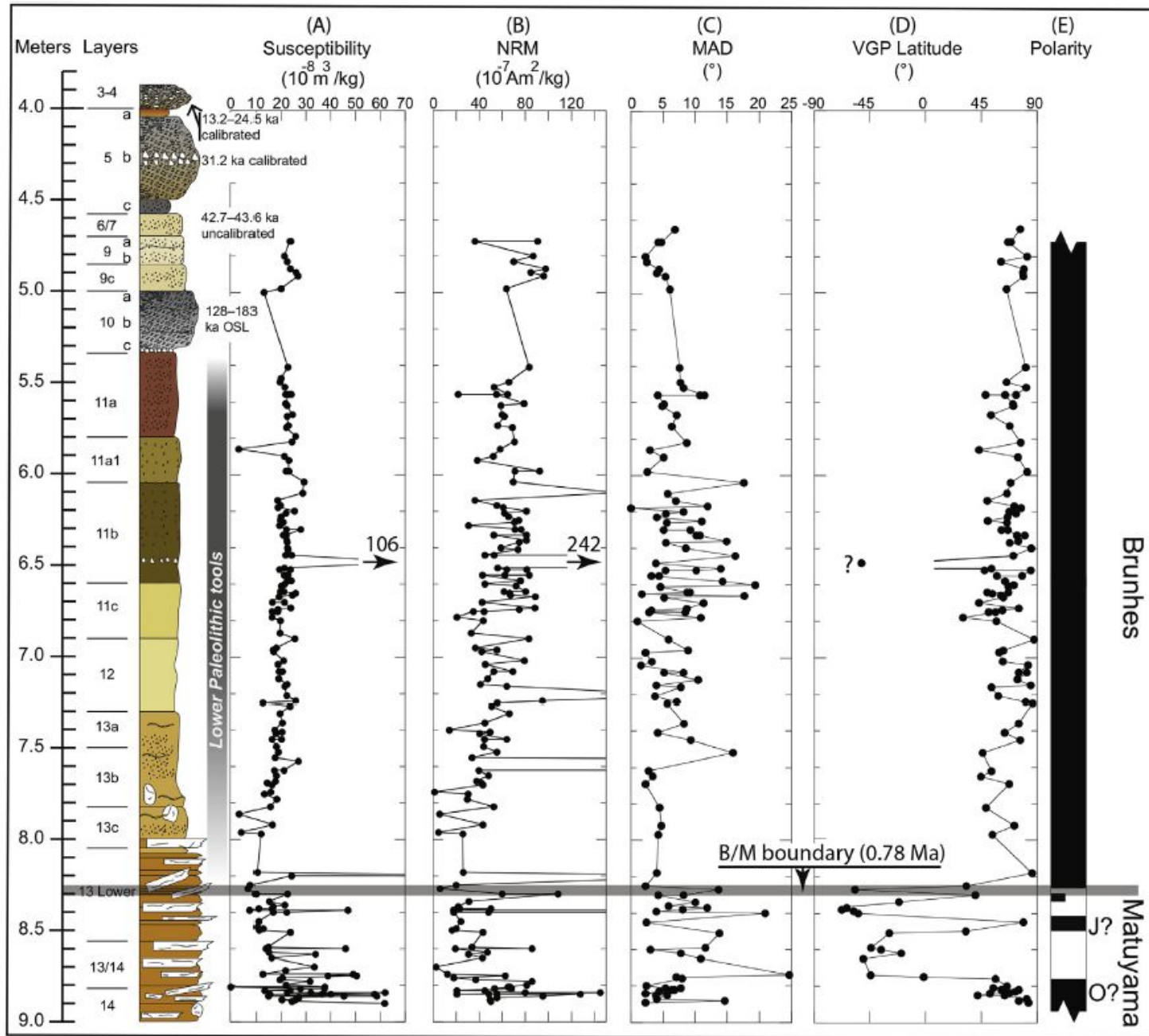


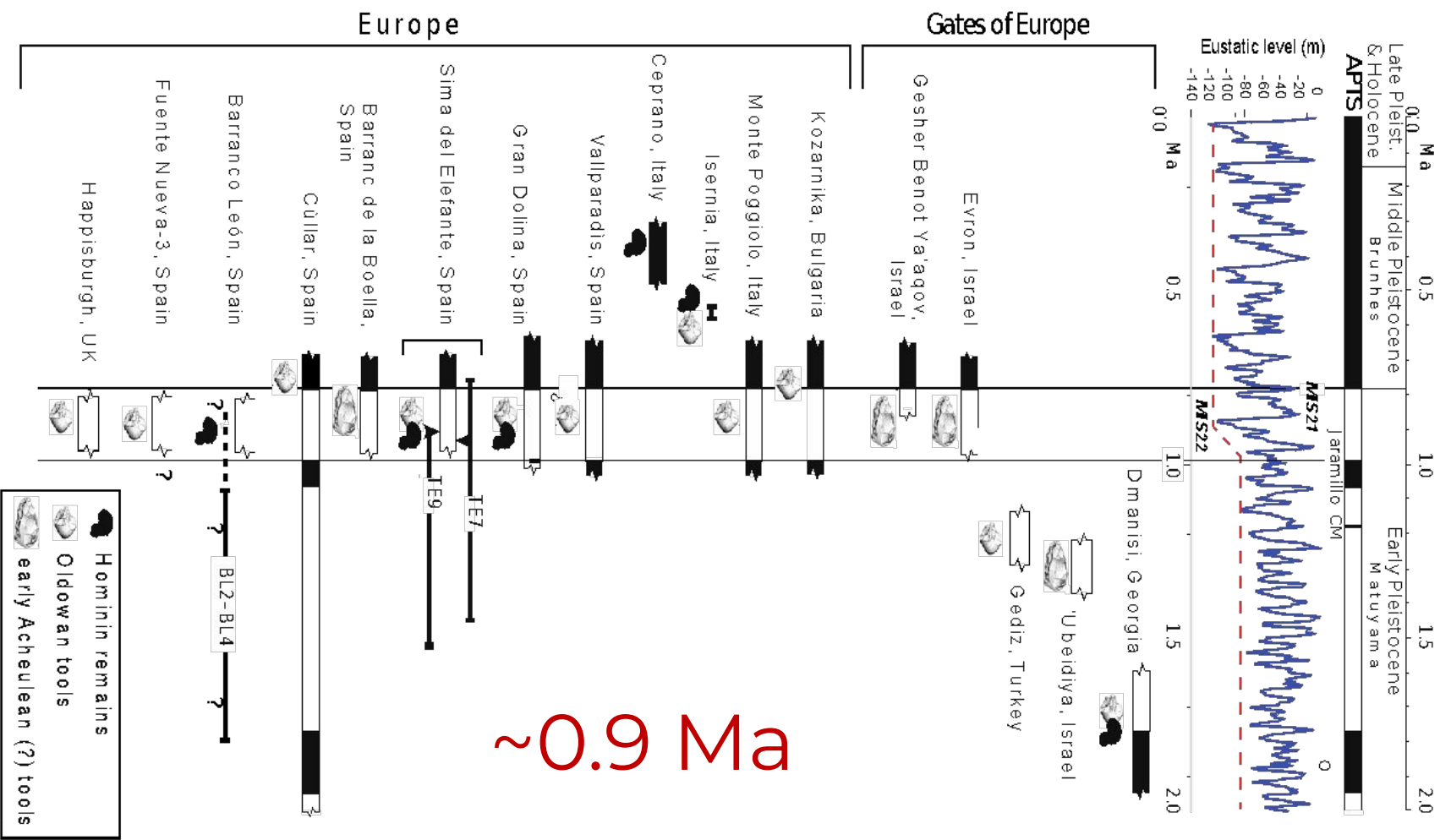
An early Brunhes (<0.78 Ma) age for the Lower Paleolithic tool-bearing Kozarnika cave sediments, Bulgaria

Giovanni Muttoni <sup>a, b, \*</sup>, Nikolas Sirakov <sup>c</sup>, Jean-Luc Guadelli <sup>d</sup>, Dennis V. Kent <sup>e, f</sup>, Giancarlo Scardia <sup>g</sup>, Edoardo Monesi <sup>a, b</sup>, Andrea Zerboni <sup>a, b</sup>, Enzo Ferrara <sup>h</sup>

Quaternary Science Reviews 178 (2017) 1–13

**LE SCIENZE** *live*

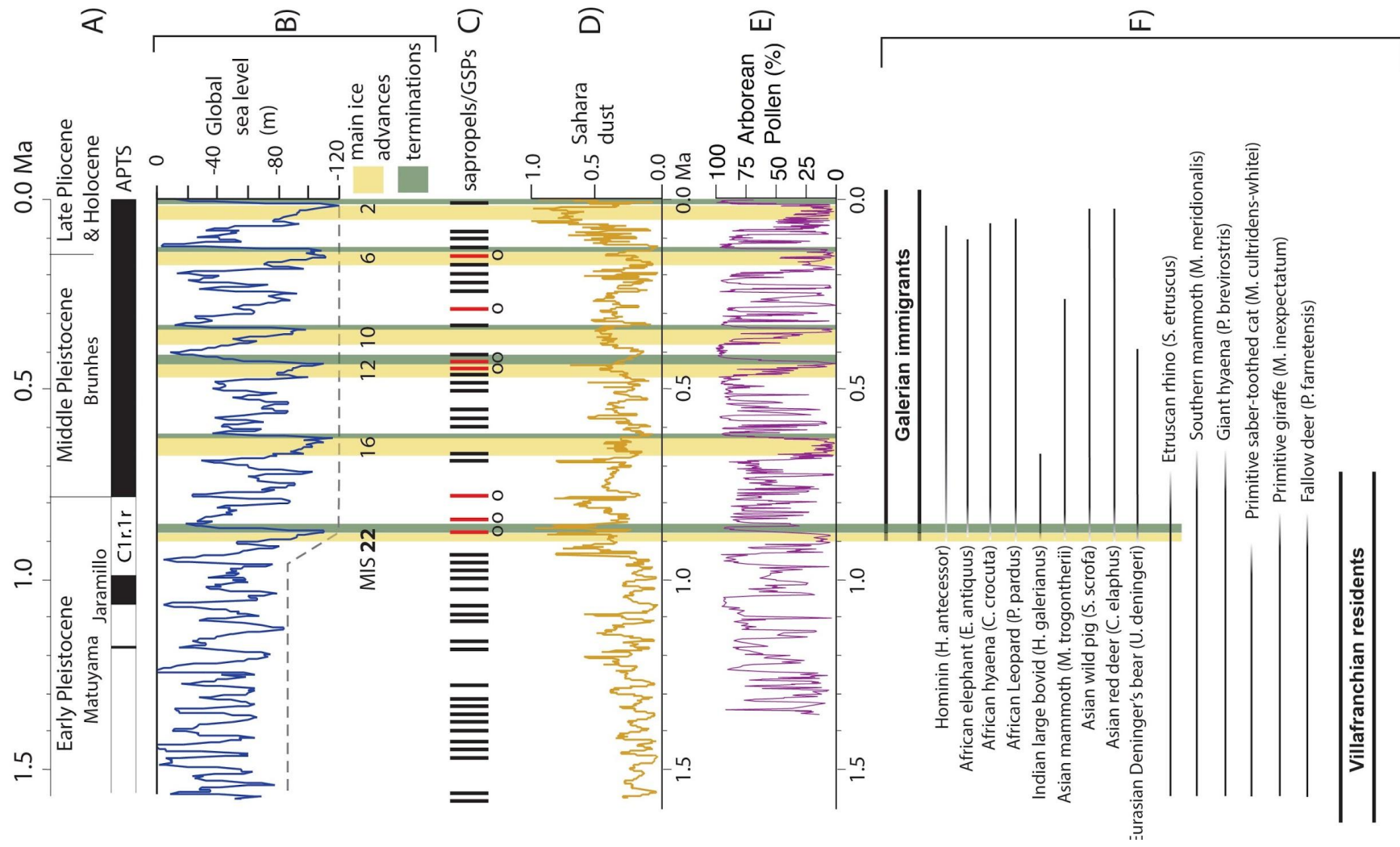




Current European magnetochronology of early hominin sites

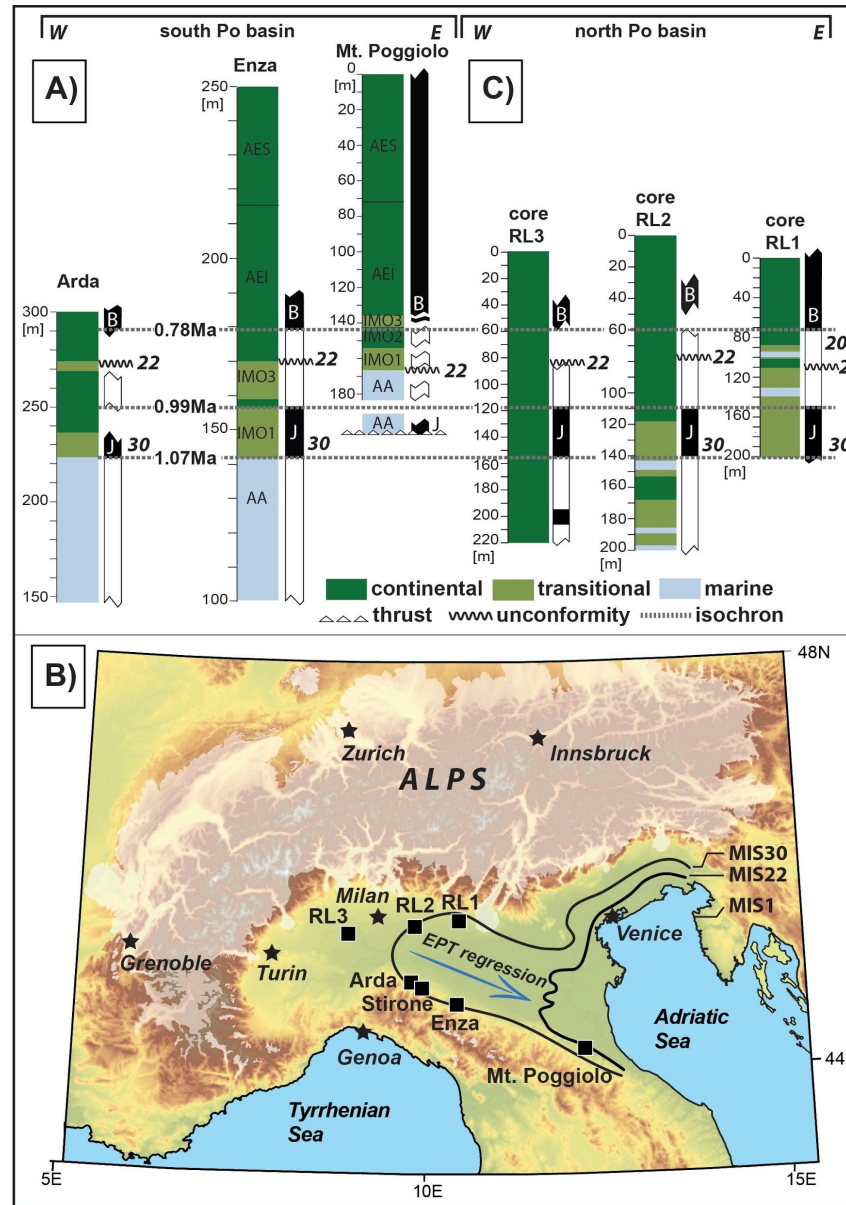


# The Climatic context of hominin migration to Europe at ~0.9 Ma

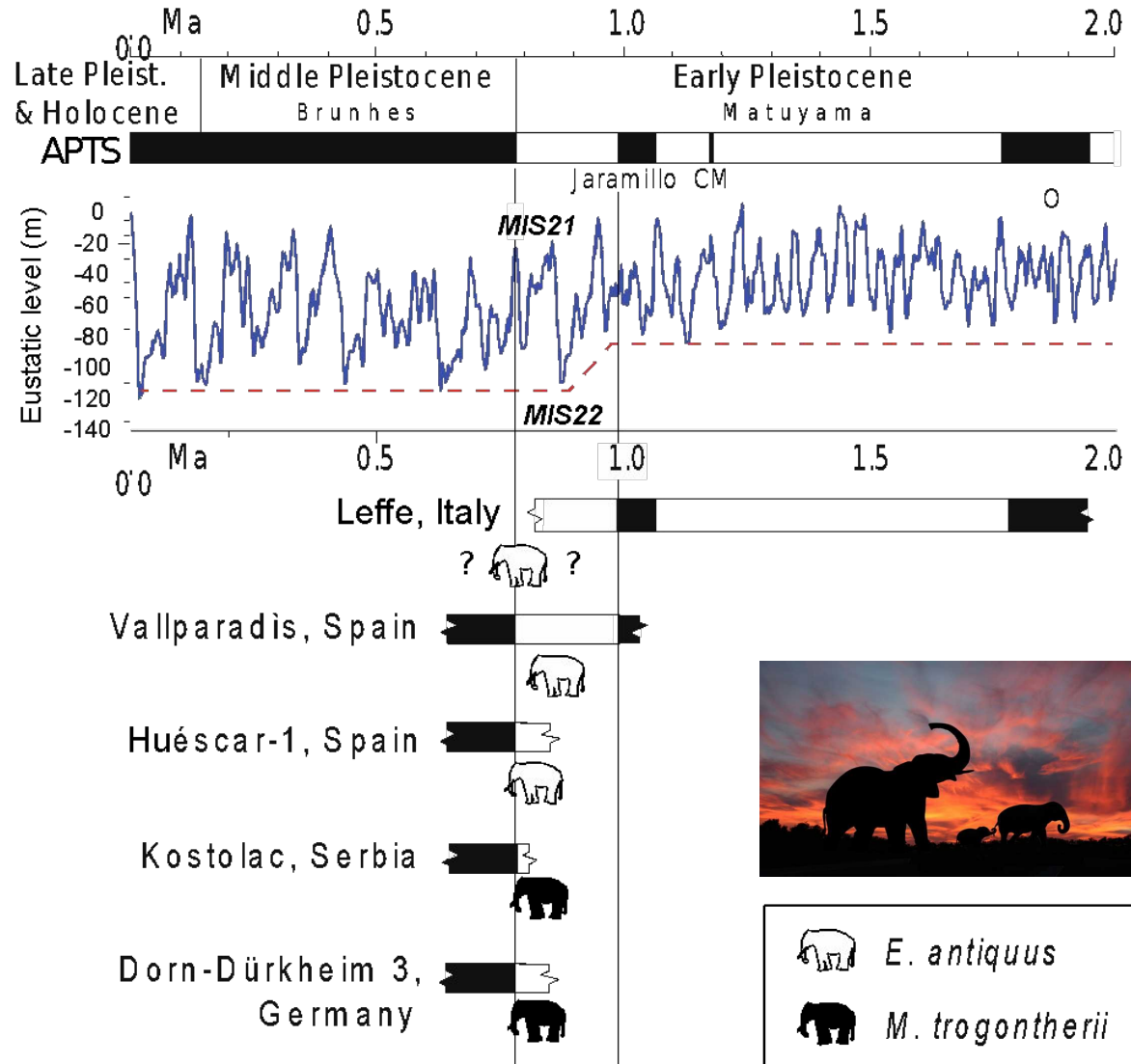


# Opening of sustainable migration Corridors at ~0.9 Ma

# The Po- Danube gateway



# Fellow Mammal Travelers Chronology



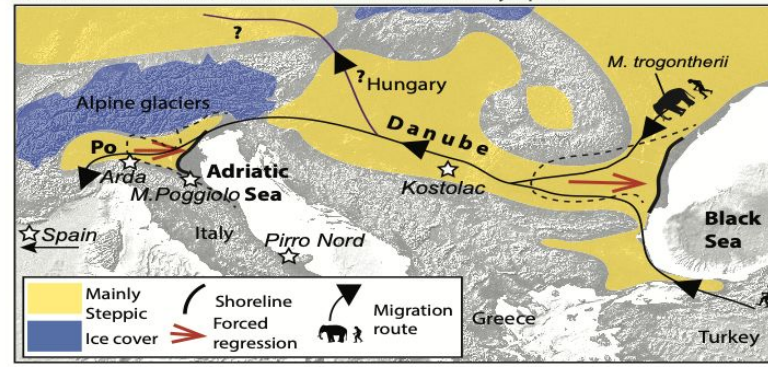
Muttoni et al., 2015; 2018

# The Galerian Migration Hypothesis

A) Pre-MIS22 low-stands (>~0.9 Ma): Danube-Po Gateway closed



B) MIS22 low-stand (~0.9 Ma): Danube-Po Gateway open



C) MIS22/21 transition (~0.85 Ma): Danube-Po Gateway open

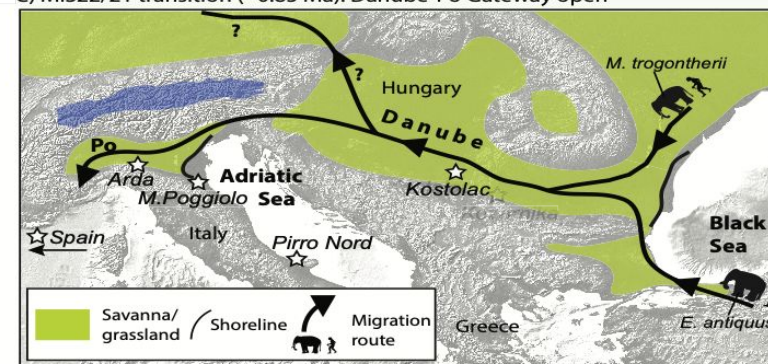


Figure 13

Muttoni et al., 2018

# A Complete Neandertal Mitochondrial Genome Sequence Determined by High-Throughput Sequencing

Richard E. Green,<sup>1,\*</sup> Anna-Sapfo Malaspinas,<sup>2</sup> Johannes Krause,<sup>1</sup> Adrian W. Briggs,<sup>1</sup> Philip L.F. Johnson,<sup>3</sup> Caroline Uhler,<sup>4</sup> Matthias Meyer,<sup>1</sup> Jeffrey M. Good,<sup>1</sup> Tomislav Maricic,<sup>1</sup> Udo Stenzel,<sup>1</sup> Kay Prüfer,<sup>1</sup> Michael Siebauer,<sup>1</sup> Hernán A. Burbano,<sup>1</sup> Michael Ronan,<sup>5</sup> Jonathan M. Rothberg,<sup>6</sup> Michael Egholm,<sup>5</sup> Pavao Rudan,<sup>7</sup> Dejana Brajković,<sup>8</sup> Željko Kućan,<sup>7</sup> Ivan Gušić,<sup>7</sup> Mårten Wikström,<sup>9</sup> Liisa Laakkonen,<sup>10</sup> Janet Kelso,<sup>1</sup> Montgomery Slatkin,<sup>2</sup> and Svante Pääbo<sup>1</sup>

Recent DNA analyses would push back the divergence of the Neandertals from the human lineage to around 800,000 years ago (Green *et alii*, 2008; Pennisi, 2009). This divergence may be due to a hominin population that remained largely isolated from a parental African (or Asian?) stock after migrating to Europe at ~0.95–0.87 Ma where it evolved into a new species.

## SUMMARY

A complete mitochondrial (mt) genome sequence was reconstructed from a 38,000 year-old Neandertal individual with 8341 mtDNA sequences identified among 4.8 Gb of DNA generated from ~0.3 g of bone. Analysis of the assembled sequence unequivocally establishes that the Neandertal mtDNA falls outside the variation of extant human mtDNAs, and allows an estimate of the divergence date between the two mtDNA lineages of 660,000 ± 140,000 years. Of the 13 proteins encoded in the mtDNA, subunit 2 of cytochrome c oxidase of the mitochondrial electron transport chain has experienced the largest number of amino acid substitutions in human ancestors since the separation from Neandertals. There is evidence that purifying selection in the Neandertal mtDNA was reduced compared with other primate lineages, suggesting that the effective population size of Neandertals was small.

---

Ma noi chi siamo?  
Il più vecchio homo  
sapiens visse 195 mila  
anni fa a Omo in Etiopia,  
vicino al Lago Turkana

---



**LE SCIENZE** *live*



Grazie per l'attenzione



 **MONDADORI**  
EDUCATION

**Rizzoli**  
EDUCATION



# FORMAZIONE SU MISURA



[WWW.FORMAZIONESUMISURA.IT](http://WWW.FORMAZIONESUMISURA.IT)



Rizzoli  
EDUCATION